South Carolina Department of Health and Environmental Control

Environmental Surveillance Oversight Program
Data Report for 2008

D H E C
PROMOTE PROTECT PROSPER
South Carolina Department of Health and Environmental Control

Region 5
Environmental Quality Control
Serving: Aiken, Allendale, Bamberg, Barnwell, Calhoun, and Orangeburg Counties
Promoting Health, Protecting the Environment

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Introduction

The South Carolina Department of Health and Environmental Control's (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) supports and complements SCDHEC's comprehensive regulatory program at the Savannah River Site (SRS) by focusing on those activities not supported or covered through our normal regulatory framework. The primary function of the ESOP is to evaluate the effectiveness of SRS monitoring activities. To accomplish this function, the ESOP conducts non regulatory monitoring activities on and around the SRS, conducts evaluations of the SRS monitoring program and provides an independent source of information to the public pertaining to levels of contaminants in the environment from historical and current SRS operations.

This report includes a description of the ESOP's multi-media monitoring network and activities along with a summary of the findings of the ESOP from the 2008 calendar year monitoring period.

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List of Acronyms

8HLE	Eight half-lives elapsed
AEI	Average Exposed Individual
AGMN	Ambient Groundwater Monitoring Network
AGQMP	Ambient Groundwater Quality Monitoring Project
ANL	Argonne National Laboratory
APW	Atmospheric Pathway
ASD	Analytical Services Division
ATSDR	Agency for Toxic Substances and Disease Registry
Avg	Average
“B”	Background samples (>50 miles from SRS center point)
BDC	Beaver Dam Creek
BNA	Base neutral/ acid extractable organics
BOD	Biochemical Oxygen Demand
CDC	Centers for Disease Control
DER	Duplicate Error Ratio
DNRGW	Department of Natural Resources Groundwater Wells
DO	Dissolved Oxygen
DOE	Department of Energy
DOE-SR	Department of Energy - Savannah River
DW	Drinking Water
“E”	Perimeter samples (<50 miles from SRS center point, but outside SRS boundary)
EMS	Environmental Monitoring Section
EPA	Environmental Protection Agency
EQC	Environmental Quality Control
ESOP	Environmental Surveillance and Oversight Program
ESV	Ecological Screening Value
ETF	Effluent Treatment Facility
FGR	Federal Guidance Report
FMB	Fourmile Branch
FT AMSL	Feet Above Mean Sea Level
FT BGS	Feet Below Ground Surface
GA	Georgia
GOR	Gordon
GW	Groundwater
Hwy. 17	United States Highway 17
Hwy. 301	United States Highway 301
ICRP	International Commission on Radionuclide Protection
LLD	Lower Limit of Detection
LN	Lognormal
LPW	Liquid Pathway
LTR	Lower Three Runs Creek
MAX	Single highest maximum detection
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDL	Minimum Detection Level
MEI	Maximum Exposed Individual
MFFF	Mixed Oxide Fuel Fabrication Facility
MSRP #2	Miscellaneous Rubble Pile #2
N/A	Not Applicable
NaI	Sodium Iodide
NAS	National Academy of Science
NFEC	Naval Facilities Engineering Command
NORM	Naturally Occurring Radioactive Material
NSBLD	New Savannah Bluff Lock & Dam
NTAC	National Technical Advisory Committee

List of Acronyms

PCB	Polychlorinated Biphenyl
PRG	Preliminary Remediation Goals
PWS	Public Water System
PWSGW	Public Water System Groundwater Wells
PWSRW	Public Water System River Water
QA/QC	Quality Assurance/Quality Control
R	dry/wet weight ratio
RAC	Radiological Assessments Corporation
REMD	Radiological Environmental Monitoring Division
RW	River Water
SAS	Trademark Name of SAS Institute Inc., Cary, North Carolina
SC	South Carolina
SCDHEC	South Carolina Department of Health and Environmental Control
SCDNR	South Carolina Department of Natural Resources
SD	Standard Deviation
SE	Site Evaluation
SMSV	Sediment from Savannah River Study area
SOP	Standard Operating Procedure
SRNS	Savannah River Nuclear Solutions
SRS	Savannah River Site
SS	Surface Soil
STC	Steel Creek
STEVENS	Stevens Creek
STOKES	Stokes Bluff Landing
SW	Surface Water
TAL	Target Analyte List (metals)
TCL	Target Compound List
TEF	Tritium Extraction Facility
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TKN	Total Kjeldahl Nitrogen
TLD	Thermoluminescent Dosimeter
TOC	Total Organic Carbon
TSP	Total Suspended Particulates
TSS	Total Suspended Solid
UNK	Unknown
US	United States
USDOE	United States Department of Energy
USDOI	United States Department of Interior
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
UTR	Upper Three Runs
VEGP	Vogtle Electric Generating Plant
VOC	Volatile Organic Carbon
WRS	Wilcoxon Rank Sum
WSRC	Washington Savannah River Company (formerly Westinghouse Savannah River Company)

List of Acronyms

UNITS OF MEASURE

Bq	becquerel. A unit of measure of radioactivity. A becquerel is one disintegration per second.
Bq/kg	becquerel per kilogram
C	temperature in Celsius
cm	centimeter
cps	**c**ounts per second
d	days
g/cm^3	grams per cubic centimeter
h	hours
hr/day	hours per day
hr/yr	hours per year
kg/yr	kilograms per year
L	Liter
L/hr	Liters per hour
L/yr	Liters per year
m	minutes or when attached to radionuclide identification means metastable
m^3/yr	cubic meters per year
mg/day	milligrams per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
mrem	millirem
mrem/yr	millirem per year
ntu	nephelometric turbidity units
pCi	picocurie: one-millionth of a microcurie (3.7 X 10-2 disintegrations per second or 2.2 disintegrations per minute).
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
pCi/m^3	Picocuries per cubic meter
person-rem/y	Person-roentgen equivalent man per year
su	standard units
umhos/cm	specific conductance
±	Plus or minus. Refers to one standard deviation unless otherwise stated.
±**2**	Plus or minus two standard deviations, represents uncertainty in single detects.

List of Acronyms

Radionuclides and Associated Half-Lives

Ac-228	**Actinium-228**	**6.1 hours (h)**
Am-241	**Americium-241**	**432 years (y)**
Be-7	**Beryllium**	**53.4 days (d)**
Ce-144	**Cerium-144**	**284 d**
Cs-134	**Cesium-134**	**2.06 y**
Cs-137	**Cesium-137**	**30.1 y**
Cm-244	**Curium-244**	**18.1 y**
Co-58	**Cobalt-58**	**70.8 d**
Co-60	**Cobalt-60**	**5.27 y**
Eu-152	**Europium-152**	**13.6 y**
Eu-154	**Europium-154**	**8.8 y**
Eu-155	**Europium-155**	**4.96 y**
H-3	**Hydrogen-3 (tritium)**	**12.3 y**
I-129	**Iodine-129**	**1.57E7 y**
I-131	**Iodine-131**	**8.04 d**
K-40	**Potassium-40**	**1.27E9 y**
Mn-54	**Manganese-54**	**312.7 d**
Na-22	**Sodium-22**	**2.6 y**
Pb-212	**Lead-212**	**10.64 h**
Pb-214	**Lead-214**	**27 m**
Pu-238	**Plutonium-238**	**87.8 y**
Pu-239	**Plutonium-239**	**2.4E4 y**
Pu-240	**Plutonium-240**	**6.5E3 y**
Ra-226	**Radium-226**	**1.6E3 y**
Ra-228	**Radium-228**	**5.75 y**
Ru-103	**Ruthenium-103**	**39 d**
Sb-125	**Antimony-125**	**2.77 y**
Sr-89	**Strontium-89**	**50.6 d**
Sr-90	**Strontium-90**	**28.6 y**
Tc-99	**Technetium-99**	**2.13E5 y**
Th-238	**Thorium-238**	**1.9 y**
Th-234	**Thorium-234**	**24.1 d**
U-234	**Uranium-234**	**2.44E5 y**
U-235	**Uranium-235**	**7.03E8 y**
U-238	**Uranium-238**	**4.47E9 y**
Zn-65	**Zinc-65**	**244 d**
Zr-95	**Zirconium-95**	**64.0 d**

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Sampling Location Information

Random Quadrant Locations for Environmental Perimeter Samples Collected from 2004 - 2008

DOE-SR Environmental Perimeter Random Quadrants Within SRS Perimeter or "E" Quadrants Quad	 7.5' Quad Name	Quadrant (Quad) Limits Latitude by Lat and Longitude by Long	 Geological Region
E1X&B2X	Furman (50mi.)	3237.5 by 3245 and -8107.5 by -8115	LCP
E2	Barnwell	3307.5 by 3315 and -8115 by -8122.5	UCP
E3X	New Ellenton, SE (SRSX)	3315 by 3322.5 and -8130 by -8137.5	UCP
E4	Aiken	3330 by 3337.5 and -8137.5 by -8145	UCP
E5	Ehrhardt	3300 by 3307.5 and -8100 by -8107.5	LCP
E6	Foxtown	3337.5 by 3345 and -8130 by -8137.5	UCP
E7X&B24X	Emory (50mi.)	3352.5 by 3400 and -8137.5 by -8145	PM
E8	HarleysMillPond	3330 by 3337.5 and -8107.5 by -8115	UCP
E9	Monetta	3345 by 3352.5 and -8130 by -8137.5	UCP
E10	Norway West	3322.5 by 3330 and -8107.5 by -8115	UCP
E11	North	3330 by 3337.5 and -8100 by -8107.5	UCP
E12	Colliers	3337.5 by 3345 and -8200 by -8207.5	PM
E13	Norway East	3325.5 by 3330 and -8100 by -8107.5	UCP
E14X	Jackson (NRX/SRS)	3315 by 3322.5 and -8145 by -8152.5	UCP
E15X	Evans (GAX)	3330 by 3337.5 and -8207.5 by -8215	PM
E16	Denmark	3315 by 3322.5 and -8107.5 by -8115	UCP
E17X&B25X	Orangeburg S. (50mi.)	3322.5 by 3330 and -8045 by -8052.5	UCP
E18	Midway	3315 by 3322.5 and -8052.5 by -8100	LCP
E19X	Mechanics Hill (GAX)	3315 by 3322.5 and -8152.5 by -8200	UCP
E20	Kitchens Mill	3330 by 3337.5 and -8122.5 by -8130	UCP
E21	Clear Pond	3307.5 by 3315and -8100 by -8107.5	LCP
E22X&B26X	Grays (50mi.)	3237.5 by 3245 and -8100 by -8107.5	LCP
E23X	Kildaire(GAX)	3230 by 3237.5 and -8122.5 by -8130	LCP
E24X	Long Branch(SRS)	3315 by 3322.5 and -8122.5 by -8130	UCP
E25X&B53X	Clarks Hill(GAX)	3337.5 by 3345 and -8207.5 by -8215	PM
E26X&B27X	Parksville (50mi.)	3345 by 3352.5 and -8207.5 by -8215	PM
E27	Roper's Crossroads	3337.5 by 3345 and -8152.5 by -8200	PM
E28	Salley	3330 by 3337.5 and -8115 by -8122.5	UCP
E29	Allendale	3300 by 3307.5 and -8115 by -8122.5	LCP
E30	Graniteville	3330 by 3337.5 and -8145 by -8152.5	UCP
E31	Oakwood	3330 by 3337.5 and -8130 by -8137.5	UCP
E32X	Martinez(GAX)	3330 by 3337.5 and -8200 by -8207.5	PM
E33X	Snellings (SRS)	3307.5 by 3315 and -8122.5 by -8130	UCP
E34X&B41X	Gilbert (50mi.)	3352.5 by 3400 and -8122.5 by -8130	PM
E35	Steedman	3345 by 3352.5 and -8122.5 by -8130	UCP
E36	Springfield	3322.5 by 3330 and -8115 by -8122.5	UCP
E37	Sycamore	3300 by 3307.5 and -8107.5 by -8115	LCP
E38X	Brier Creek Island(GAX)	3245 by 3252.5.5 and -8122.5 by -8130	LCP
E39X	Bull Pond(GAX)	3252.5 by 3300 and -8122.5 by -8130	LCP
E40	Blackville	3315 by 3322.5 and -8115 by -8122.5	UCP
E41	Windsor	3322.5 by 3330 and -8130 by -8137.5	UCP
E42X&B32X	Saluda South (50mi.)	3352.5 by 3400 and -8145 by -8152.5	PM
E43	Olar	3307.5 by 3315 and -8107.5 by -8115	LCP

Sampling Location Information

Random Quadrant Locations for Environmental Perimeter Samples Collected from 2004 - 2008

DOE-SR Environmental Perimeter Random Quadrants Within SRS Perimeter or "E" Quadrants Quad	 7.5' Quad Name	Quadrant (Quad) Limits Latitude by Lat and Longitude by Long	 Geological Region
E44	Girard NE	3307.5 by 3315 and -8130 by -8137.5	UCP
E45	Gifford	3245 by 3252.5 and -8107.5 by -8115	LCP
E46	Cordova	3322.5 by 3330 and -8052.5 by -8100	UCP
E47X&B71	Barr Lake	3352.5 by 3400 and -8115 by -8122.5	UCP
E48X&B72X	Orangeburg N.(50mi.)	3330 by 3337.5 and -8045 by -8052.5	UCP
E49X	Millett (GAX)(NRX)	3300 by 3307.5 and -8030 by -8037.5	UCP
E50X&B75X	Batesburg(50mi.)	3352.5 by 3400 and -8130 by -8137.5	PM
E51	Crocketville	3252.5 by 3300 and -8100 by -8107.5	LCP
E52X	Girard NW(GAX)	3307.5 by 3315 and -8137.5 and -8145	UCP
E53	New Ellenton	3322.5 by 3330 and -8137.5 by -8145	UCP
E54X&B80X	Wolfton(50mi.)	3330 by 3337.5 and -8052.5 by -8100	UCP
E55	Bamburg	3315 by 3322.5 and -8100 by -8107.5	UCP
E56X&B85X	Branchville North(50mi.)	3315 by 3322.5 and -8045 by -8052.5	LCP
E57	North Augusta	3330 by 3337.5 and -8152.5 by -8200	UCP
E58	Tony Hill Bay	3307.5 by 3315 and -8052.5 by -8100	LCP
E59	Williston	3322.5 by 3330 and -8122.5 by -8130	UCP
E60X	Shell Bluff Landing(GAX)	3307.5 by 3315 and -8145 by -8152.5	UCP
E61	Shirley	3237.5 by 3245 and -8115 by -8122.5	LCP
E62	New Ellenton SW	3315 by 3322.5 and -8137.5 by -8145	UCP
E63X&B86X	Owdoms(50mi.)	3352.5 by 3400 and -8152.5 by -8200	PM
E64	Martin	3300 by 3307.5 and -8122.5 by -8130	LCP
E65	Ridge Spring	3345 by 3352.5 and -8137.5 by -8145	UCP
E66X	Blue Springs Landing(GAX)	3237.5 by 3245 and -8122.5 by -8130	LCP
E67X&B87X	Pelion East(50mi.)	3345 by 3352.5 and -8107.5 by -8115	UCP
E68X	Burtons Ferry Landing(GAX)	3252.5 by 3300 and -8130 by -8137.5	LCP
E69	Pond Branch	3337.5 by 3345 and -8107.5 by -8115	UCP
E70	Hollow Creek	3322.5 by 3330 and -8145 by -8152.5	UCP
E71	Barton	3252.5 by 3300 and -8115 by -8122.5	LCP
E72	Aiken NW	3337.5 by 3345 and -8137.5 by -8145	UCP
E73X&B88X	Williams(50mi.)	3300 by 3307.5 and -8045 by -8052.5	LCP
E74	Fairfax	3252.5 by 3300 and -8107.5 by -9115	LCP
E75X&B89X	Hampton(50mi.)	3245 by 3252.5 and -8100 by -8107.5	LCP
E76	Lodge	3300 by 3307.5 and -8052.5 by -8100	LCP
E77	Solomons Crossroads	3245 by 3252.5 and -8115 by -8122.5	LCP
E78X	Augusta East(GAX)	3322.5 by 3330 and -8152.5 by -8200	UCP
E79X&B90X	Brighton (50mi.)	3230 by 3237.5 and -8115 by -8122.5	LCP
E80X&B91X	Swansea(50mi.)	3337.5 by 3345 and -8100 by -8107.5	UCP
E81X&B92X	Cummings (50mi.)	3245 by 3252.5 and -8052.5 by -8100	LCP
E82X&B93X	Islandton (50mi.)	3252.5 by 3300 and -8052.5 by -8100	LCP
E83X&B94X	Branchville South (50mi.)	3307.5 by 3315 and -8045 by -8052.5	LCP
E84	Pelion West	3345 by 3352.5 and -8115 by -8122.5	UCP
E85	Johnston	3345 by 3352.5 and -8145 by -8152.5	PM
E86	Wagener	3337.5 by 3345 and -8115 by -8122.5	UCP

Sampling Location Information

Random Quadrant Locations for SC Background Samples Collected from 2004 - 2008

South Carolina Background Random Random Quadrants Outside the 50-mile SRS Perimeter or "B" Quadrants. Quad	**7.5' Quad Name**	**Quadrant (Quad) Limits Latitude by Lat and Longitude by Long**	**Geological Region**
B1X	Cashiers (NCX)	3500 by 3507.5 and -8300 by -8307.5	BR
B2X&E1X	Furman (50mi.)	3237.5 by 3245 and -8107.5 by -8115	LCP
B3	Felderville	3322.5 by 3330 and -8030 by -8037.5	LCP
B4	James Is.	3237.5 by 3245 and -7952.5 by -8000	PM
B5	Carlisle	3430 by 3437.5 and -8122.5 by -8130	LCP
B6	Antreville	3415 by 3422.5 and -8230 by -8237.5	PM
B7X	Saluda (NCX)	3507.5 by 3515 and -8215 by -8222.5	BR
B8	Bingham	3422.5 by 3430 and -7930 by -7937.5	UCP
B9	Alvin	3315 by 3322.5 and -7945 by -7952.5	LCP
B10	Jamestown	3315 by 3322.5 and -7937.5 by -7945	LCP
B11	North Is.	3315 by 3322.5 and -7907.5 by -7915	LCP
B12	Summerton	3330 by 3337.5 and -8015 by -8022.5	LCP
B13	Sharon	3452.5 by 3500 and -8115 by -8122.5	PM
B14X	Lake Murray E (NRX)	3400 by 3407.5 and -8115 by -8122.5	PM
B15	Spring Is.	3215 by 3222.5 and -8045 by -8052.5	LCP
B16X	Westminster (NRX)	3437.5 by 3445 and -8300 by -8307.5	PM
B17X	Hartwell Dam (GAX)	3415 by 3422.5 and -8245 by -8252.5	PM
B18X	Hartsville South (NRX)	3415 by 3422.5 and -8000 by -8007.5	UCP
B19	Salters	3330 by 3337.5 and -7945 by -7952.5	LCP
B20X	Pineland(GAX)	3230 by 3237.5 and -8107.5 by -8115	LCP
B21	Mayesville	3352.5 by 3400 and -8007.5 by -8015	LCP
B22	Carlisle SE	3430 by 3437.5 and -8115 by -8122.5	PM
B23	Outland	3337.5 by 3345 and -7915 by -7922.5	LCP
B24X&E7X	Emory (50mi.)	3352.5 by 3400 and -8137.5 by -8145	PM
B25X&E17X	Orangeburg S. (50mi.)	3322.5 by 3330 and -8045 by -8052.5	LCP
B26X&E22X	Grays (50mi.)	3237.5 by 3245 and -8100 by -8107.5	LCP
B27X&E26X	Parksville (50mi.)	3345 by 3352.5 and -8207.5 by -8215	PM
B28	Lake City West	3345 by 3352.5 and -7945 by -7952.5	LCP
B29	Neyles	3245 by 3252.5 and -8030 by -8037.5	LCP
B30	Oak Grove	3415 by 3422.5 and -7930 by -7937.5	LCP
B31X	Hardeeville(GAX)	3215 by 3222.5 and -8100 by -8107.5	LCP
B32X&E42X	Saluda South (50mi.)	3352.5 by 3400 and -8145 by -8152.5	PM
B33	Bradley	3400 by 3407.5 and -8207.5 by -8215	PM
B34	Greenwood	3407.5 by 3415 and -8207.5 by -8215	PM
B35	Limestone	3352.5.5 by 3400 and -8200 by -8207.5	PM
B36	Abbeville East	3407.5 by 3415 and -8215 by -8222.5	PM
B37	Calhoun Creek	3400 by 3407.5 and -8222.5 by -8230	PM
B38	Laurens North	3430 by 3437.5 and -8200 by -8207.5	PM
B39	Saluda North	3400 by 3407.5 and -8145 by -8152.5	PM
B40	Waterloo	3415 by 3422.5 and -8200 by -8207.5	PM
B41X&E34X	Gilbert (50mi.)	3352.5 by 3400 and -8122.5 by -8130	PM
B42	Reevesville	3307.5 by 3315 and -8037.5 by -8045	LCP
B43	Saint Paul	3330 by 3337.5 and -8022.5 by -8030	LCP
B44	Sandridge	3315 by 3322.5 and -8015 by -8022.5	LCP
B45	La France	3430 by 3437.5 and -8245 by -8252.5	PM
B46X	Walhalla(50mi.)	3445 by 3452.5 and -8300 by -8307.5	BR
B47	Clinton	3422.5 by 3430 and -8152.5 by -8200	PM

Sampling Location Information

Random Quadrant Locations for SC Background Samples Collected from 2004 - 2008

South Carolina Background Random Random Quadrants Outside the 50-mile SRS Perimeter or "B" Quadrants. Quad	 7.5' Quad Name	Quadrant (Quad) Limits Latitude by Lat and Longitude by Long	 Geological Region
B48	Pringletown	3307.5 by 3315 and -8015 by -8022.5	LCP
B49	Elloree	3330 by 3337.5 and -8030 by -8037.5	LCP
B50X	Belmont(NCX)	3507.5 by 3515 and -8100 by -8107.5	PM
B51	Stallsville	3252.5 by 3300 and -8007.5 by -8015	LCP
B52X	Tabor City East(NCX)	3407.5 by 3415 and -7945 by -7952.5	LCP
B53X&E25X	Clarks Hill(GAX)	3337.5 by 3345 and -8207.5 by -8215	PM
B54	Stover	3430 by 3437.5 and -8100 by -8107.5	PM
B55	Ware Shoals East	3422.5 by 3430 and -8207.5 by -8015	PM
B56	Chicora	3315 by 3322.5 and -8000 by -8007.5	LCP
B57	Ninety Six	3407.5 by 3415 and -8200 by -8207.5	PM
B58	Anderson North	3430 by 3437.5 and -8237.5 by -8245	PM
B59	Parris Island	3215 by 3222.5 and -8037.5 by -8045	LCP
B60	Winnsboro Mills	3415 by 3422.5 and -8100 by -8107.5	PM
B61	Bennetts Point	3230 by 3237.5 and -8022.5 by -8030	LCP
B62	Butlers Sav	3330 by 3337.5 and -8000 by -8007.5	LCP
B63	Gadsden	3345 by 3352.5 and -8045 by -8052.5	UCP
B64	Edisto Island	3230 by 3237.5 and -8015 by -8022.5	LCP
B65	Sardinia	3345 by 3352.5 and -8000 by -8007.5	LCP
B66X	Avalon(GAX)	3430 by 3437.5 and -8307.5 by -8315	PM
B67	Camden South	3407.5 by 3415 and -8030 by -8037.5	UCP
B68	Winnsboro	3422.5 by n3430 and -8100 by -8107.5	PM
B69	Lake Murray West	3400 by 3407.5 and -8122.5 by -8130	PM
B70X	Lincolnton(GAX)	3345 by 3352.5 and -8222.5 by -8230	PM
B71X&E47X	Barr Lake (50mi.)	3352.5 by 3400 and -8115 by -8122.5	UCP
B72X&E48X	Orangeburg N.(50mi.)	3330 by 3337.5 and -8045 by -8052.5	UCP
B73	Union East	3437.5 by 3445 and -8130 by -8137.5	PM
B74	Delmar	3400 by 3407.5 and -8130 by -8137.5	PM
B75X&E50X	Batesburg	3352.5 by 3400 and -8130 by -8137.5	PM
B76	Sheldon	3230 by 3237.5 and -8045 by -8052.5	LCP
B77	Kirksey	3400 by 3407.5 and -8200 by -8207.5	PM
B78	Calfpen Bay	3230 by 3237.5 and -8100 by -8107.5	LCP
B79	Blair	3422.5 by 3430 and -8122.5 by -8130	PM
B80X&E54X	Wolfton	3330 by 3337.5 and -8052.5 by -8100	UCP
B81	Silverstreet	3407.5 by 3415 and -8137.5 by -8145	PM
B82	Chapin	3407.5 by 3415 and -8115 by -8122.5	PM
B83	Hickory Tavern	3430 by 3437.5 and -8207.5 by -8215	PM
B84	Denny	3400 by 3407.5 and -8137.5 by -8145	PM
B85X&E56X	Branchville North	3315 by 3322.5 and -8045 by -8052.5	LCP
B86X&E63X	Owdoms	3352.5 by 3400 and -8152.5 by -8200	PM
B87X&E67X	Pelion East	3345 by 3352.5 and -8107.5 by -8115	UCP
B88X&E73X	Williams	3300 by 3307.5 and -8045 by -8052.5	LCP
B89X&E75X	Hampton	3245 by 3252.5 and -8100 by -8107.5	LCP
B90X&E79X	Brighton (50mi.)(GAX)	3230 by 3237.5 and -8115 by -8122.5	LCP
B91X&E80X	Swansea(50mi.)	3337.5 by 3345 and -8100 by -8107.5	UCP
B92X&E81X	Cummings (50mi.)	3245 by 3252.5 and -8052.5 by -8100	LCP
B93X&E82X	Islandton (50mi.)	3252.5 by 3300 and -8052.5 by -8100	LCP
B94X&E83X	Branchville South (50mi.)	3307.5 by 3315 and -8045 by -8052.5	LCP

Sampling Location Information

Random Quadrant Information for Samples Collected from 2004 - 2008

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" samples.
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.
5. Parenthesis info by quad name identifies type of exclusion (NCX is North Carolina, GAX is Georgia, NRX is nuclear reactor, SRS is Savannah River Site exclusion zone border).
6. Purpose of random sampling is to compare public dose within 50 miles of SRS to a S. C. background.
7. Geological Regions are Blue Ridge (BR), Piedmont (PM), Upper Coastal Plain (UCP), and Lower Coastal Plain (LCP).
8. Quadrants split by geological regions are assigned to the upper most region in the quadrant.

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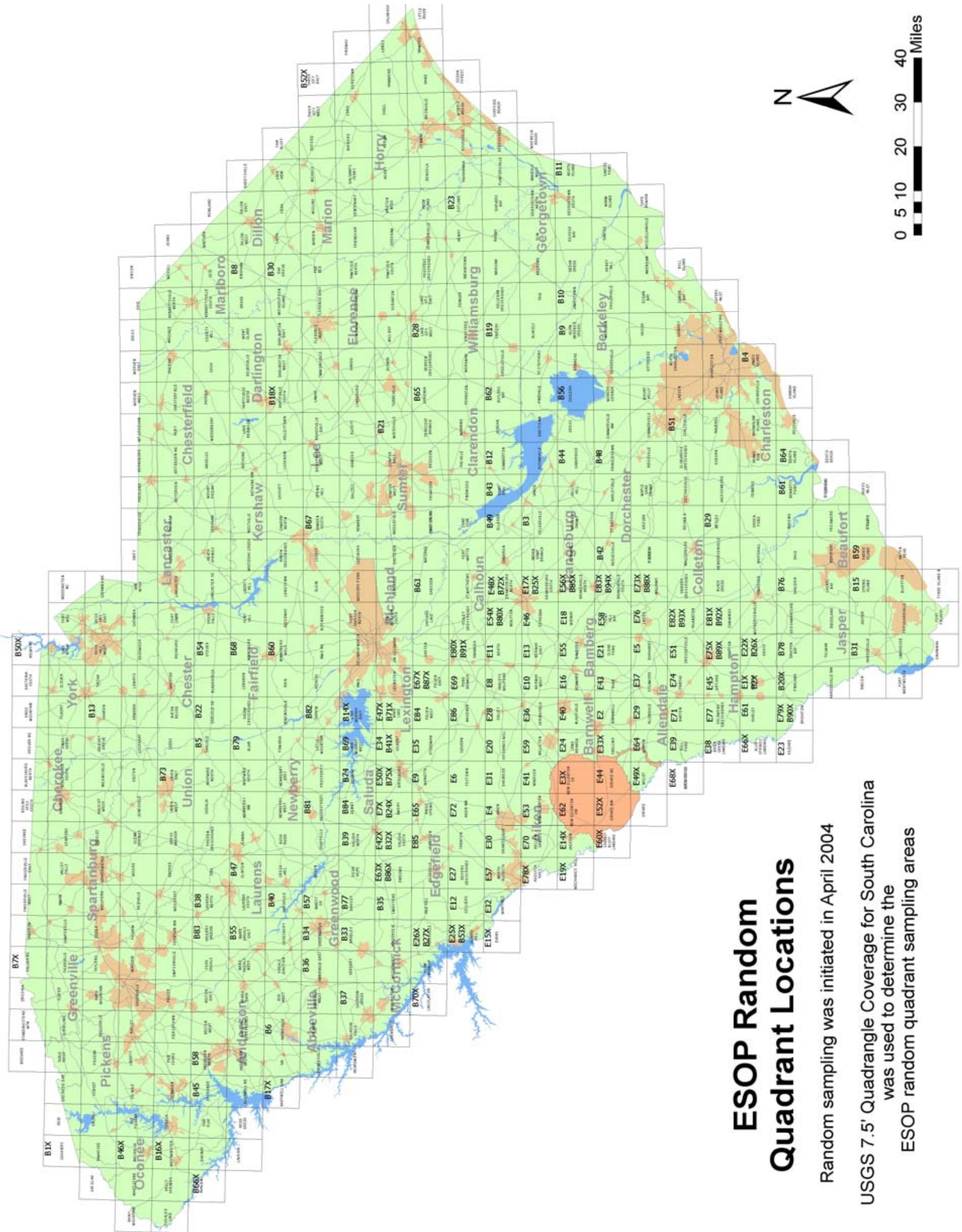
Sampling Location Information

Map 1. Savannah River Site perimeter and South Carolina background random sampling locations chosen to date. Not all locations have been sampled.



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1.1 Radiological Atmospheric Monitoring

1.1.1 Summary

Atmospheric transport has the greatest potential to impact the citizens of South Carolina from releases associated with activities at the Savannah River Site (SRS). This project provides independent quantitative monitoring of atmospheric radionuclide releases associated with SRS. It also provides monitoring of atmospheric media on a routine basis to measure radionuclide concentrations in the surrounding environment and to identify trends that may require further investigation. Radiological atmospheric monitoring sites were established to provide spatial coverage of the project area.

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) air monitoring capabilities in 2008 included nine air-monitoring stations with the capacity for sample collection using glass fiber filters, rain collection pans, silica gel columns, and 19 thermoluminescent dosimeters (TLDs). Five of the air-monitoring stations are on or within two miles of the SRS perimeter (NEL, JAK, ABR, SCT, and DKH), one at the center of the site (BGN), two are within 25 miles of the site (AIK and ALN), and one is a background location (BEU). Twelve of the TLDs are on or near the site perimeter, one is in the center of the site, five are within 25 miles of the site and one is a background location. Only perimeter air monitoring stations and TLDs are used for summary statistics. Refer to the Map 2 in Section 1.1.2 for specific monitoring locations.

The air station in Beaufort, South Carolina, was put in place so that SCDHEC would have a background monitoring location. This monitoring location is far enough away from SRS so that the samples collected there would not be affected by SRS activities and could be used to compare against samples taken closer to SRS. This station was removed in August because the data collected was not substantial enough to continue to monitor at this location. The data collected at the Allendale location will now provide background data.

The glass fiber filters were used to collect total suspended particulates (TSP). Particulates were screened weekly for gross alpha and gross beta-emitting activity. Precipitation, when present, was sampled and analyzed monthly for tritium. Silica gel distillates of atmospheric moisture were analyzed monthly for tritium. TLDs were collected and analyzed every quarter for ambient beta/gamma levels. SCDHEC emphasizes monitoring for radionuclides in atmospheric media around the SRS at potential public exposure locations.

SCDHEC data substantiated historically reported Department of Energy-Savannah River (DOE-SR) values for radionuclides in the ambient environment at or near the SRS boundary. Average DOE-SR atmospheric radiological monitoring results for gross alpha/beta in air, ambient beta/gamma, and tritium in precipitation at the SRS boundary were within one standard deviation of the SCDHEC reported average values, with the exception of tritium in air, which was within eight standard deviations. Variations in atmospheric radiological monitoring results between SCDHEC and DOE-SR are likely a result of differences in monitoring locations, local meteorological conditions, frequency of sampling, and number of locations.

In summary no United States Environmental Protection Agency (USEPA) air standards were exceeded at the monitored locations and there were no elevations of radiological pollutant concentrations associated with SRS operations. Sampling results by SCDHEC indicate that SRS activities had a measurable but negligible impact on local air quality.

Results and Discussion

Total Suspended Particulates

Gross Alpha

During the 2008 sampling period, gross alpha activity ranged from 0.0010 to 0.0277 picoCuries per cubic meter (pCi/m^3) at the site perimeter (NEL, JAK, ABR, SCT, and DKH). The maximum was collected on March 25 at the Allendale, South Carolina air station (ALN). Values in this range are typically associated with naturally occurring alpha-emitting radionuclides, primarily as decay products of radon (Kathren 1984), and are considered normal. According to the USEPA (Rhonda Sears telephone conversation, September 17, 2005) if gross alpha counts are above 0.7 pCi/m^3 the filters are analyzed for specific radioisotopes. The SCDHEC average gross alpha radionuclide concentration in 2008 was 0.0039 (± 0.0027) pCi/m^3. The DOE-SR gross alpha average of 0.0010 (± 0.0004) pCi/m^3 is within one standard deviation of the SCDHEC gross alpha activity average (SRNS 2009). Section 1.1.3, Figure 1 shows average gross alpha activity for SRS perimeter locations and illustrates trending of gross alpha values for SCDHEC and DOE-SR.

Gross Beta

During the 2008 sampling period, the site perimeter (NEL, JAK, ABR, SCT, and DKH) gross beta concentrations ranged from 0.0026 to 0.0843 pCi/m^3. The maximum was collected on January 2 at the Allendale Barricade (ABR) air station. The average gross beta concentration reported by SCDHEC in 2008 was 0.0291(± 0.0096) pCi/m^3. Values in this range are typically associated with naturally occurring beta-emitting radionuclides, primarily as decay products of radon (Kathren 1984). Small seasonal variations at each monitoring location have been consistent with historically reported SCDHEC values (SCDHEC 2007). The USEPA Office of Radiation and Indoor Air uses gross beta counts as an indicator to determine if additional analyses will be performed. A gamma scan is conducted if the gross beta activity exceeds 1 pCi/m^3. This is the tiering of definitive analyses that is used for all total suspended particulate sampling associated with RadNet. RadNet is comprised of a nationwide network of sampling stations that identify trends in the accumulation of long-lived radionuclides in the environment (USEPA 2005). Over the past six years, SCDHEC has seen a slight increase in gross beta while DOE-SR activities have remained stable. Section 1.1.3, Figure 2 shows average gross beta activity for the SRS perimeter locations and illustrates trending of gross beta values for SCDHEC and DOE-SR. The DOE-SR gross beta average of 0.0157 (±0.0034) pCi/m^3 is within one standard deviation of the SCDHEC gross beta activity average (SRNS 2009). Section 1.1.3, Figures 6-14 show trending for 2008 for both gross alpha and gross beta.

Ambient Beta/Gamma

SCDHEC conducts ambient beta/gamma monitoring through the deployment of Thermoluminescent Dosimeters (TLD's) around the perimeter of the SRS. Ambient beta/gamma levels measured with TLDs are provided for all quarters of 2008. It should be noted that 4 mrem are subtracted from the reported result for each TLD to account for the transcontinental flight from South Carolina to California and back (Walter 1995). The SCDHEC average ambient beta/gamma activity for perimeter TLDs in 2008 was 90.38 (±11.82) mrem. The DOE-SR average ambient beta/gamma activity was 81.92 (±10.41) mrem for 2008. The DOE-SR ambient/beta gamma average was within one standard deviation of the SCDHEC average. During the sampling period, SCDHEC external radiation levels at monitored locations were higher than levels reported by DOE-SR. Over the past six years, there have been no major increases or decreases in the average ambient beta/gamma activity reported by DOE-SR or SCDHEC. Section 1.1.3, Figure 3 shows trends at the SRS perimeter for averaged ambient beta/gamma values for DOE-SR and SCDHEC.

Tritium

Tritium continues to be the predominant radionuclide detected in the perimeter samples. During 2008, DOE-SR released approximately 34594 Ci of tritium from SRS (SRNS 2009). Most of the tritium detected in SCDHEC perimeter samples may be attributed to the release of tritium from tritium facilities, separation areas, and from diffuse and fugitive sources (SRNS 2009).

Tritium In Air

Tritium in air values reported by SCDHEC are the result of using the historical means of calculating an air concentration of tritium based on the upper limit value of absolute humidity (11.5 grams of atmospheric moisture per cubic meter) in the region (NCRP 1984). SCDHEC tritium results greater than the lower limit of detection (LLD) are converted from picocuries per liter (pCi/L) to pCi/m^3. Average DOE-SR tritium in air activity was higher than the SCDHEC measured activity but well within the same order-of-magnitude. These variations could be caused by different sampling locations or sample frequency.

Average tritium in air activity at the SRS perimeter reported by SCDHEC for 2008 was slightly lower than reported in 2007 and has fluctuated over the last six years. DOE-SR reported an increase from 2007 to 2008. Section 1.1.3, Figure 4 illustrates trending of atmospheric tritium activity for SCDHEC and DOE-SR as measured and calculated at the SRS perimeter. Section 1.1.3, Figures 15-23 show trending for 2008 for SCDHEC.

The DOE-SR average measured value for tritium activity in air at the SRS perimeter was 13.01 (±25.90) pCi/m^3 (SRNS 2009). The SCDHEC average measured activity for tritium was 4.30 (± 1.15) pCi/m^3. The maximum tritium in air activity of 6.92(±1.27) pCi/m^3 was collected at the Darkhorse air station, inside the Williston barricade, for the month of August 2008. The SCDHEC average for tritium activity was well below the USEPA equivalent standard of 21,000 pCi/m^3 for airborne tritium activity (ANL 2007). DOE-SR average measured values for tritium in atmospheric moisture were higher than SCDHEC averaged measured values for the SRS perimeter (SRNS 2009). The DOE-SR average measured activity for tritium was within eight standard deviations of the SCDHEC measured average, although within the same order of magnitude. This difference may be attributed to a dilution that occurs when desiccants are used for collecting atmospheric moisture for tritium analysis. Tritium concentrations in air, as determined using desiccants, can result in under-reporting of air tritium concentrations by factors of 1.4 to 2.6 (Rosson 2000). Prior to deployment in the field, silica-gel desiccant is dried to remove any moisture. However, a small percentage of water remains in the desiccant. This results in a slight dilution of the collected sample, which is reflected in the distillate. DOE-SR has implemented a correction factor for tritium-in-air measurements using silica-gel (SRNS 2009). Another factor that may contribute to the lower SCDHEC air tritium values is that only two of the monitoring stations are exactly on the SRS perimeter (property line), while the other three points used for this comparison are located approximately two miles from the SRS property line.

Tritium In Precipitation

The maximum reported value for SCDHEC perimeter locations was 561 (±102) pCi/L, collected in New Ellenton, South Carolina for the collection period of July 2008. The DOE-SR average measured value for tritium activity in precipitation at the SRS perimeter was 118.30 (±202.85) pCi/L (SRNS 2009). The SCDHEC average measured activity for tritium in precipitation was 310.3 (±101.06) pCi/L. The SCDHEC and DOE-SR averages for tritium activity were well below the EPA standard of 20,000 pCi/L in drinking water (USEPA 2002). The DOE-SR averages for tritium activity were within one standard deviation of the SCDHEC average. Section 5.0, Figure 5 shows average tritium in precipitation activity for SRS perimeter locations and illustrates trending tritium in precipitation values for SCDHEC and DOE-SR. Section 1.1.3, Figures 24-32 show trending for 2008 for SCDHEC.

Conclusions/Recommendations

All SCDHEC data collected in 2008 confirmed historically reported DOE-SR values for gross alpha/beta, ambient beta/gamma and tritium in the environment at the SRS boundary with no anomalous data noted for any monitored parameters.

Due to the variability of environmental data and the frequency of collecting samples, DOE-SR air and tritium data averages were within one standard deviation of SCDHEC measured averages, with the exception on tritium in air, which was within eight standard deviations. DOE-SR tritium in air and precipitation data was consistently within the same order of magnitude as the SCDHEC measured values.

The background location in Beaufort, South Carolina, had one detection of tritium in air, 6.72 pCi/m3 and no detections for precipitation. This station was removed in August because the data collected was not significant enough to continue to monitor at this location. The data collected at the Allendale location will now provide background data.

No EPA air standards were exceeded at the monitored locations and there were no elevations of radiological pollutant concentrations associated with SRS operations. Sampling results by SCDHEC indicate that SRS activities did have a measurable but negligible impact on local air quality.

SCDHEC will continue to collect weekly TSP for gross alpha/beta, monthly for atmospheric and precipitation tritium, and quarterly ambient beta/gamma samples.

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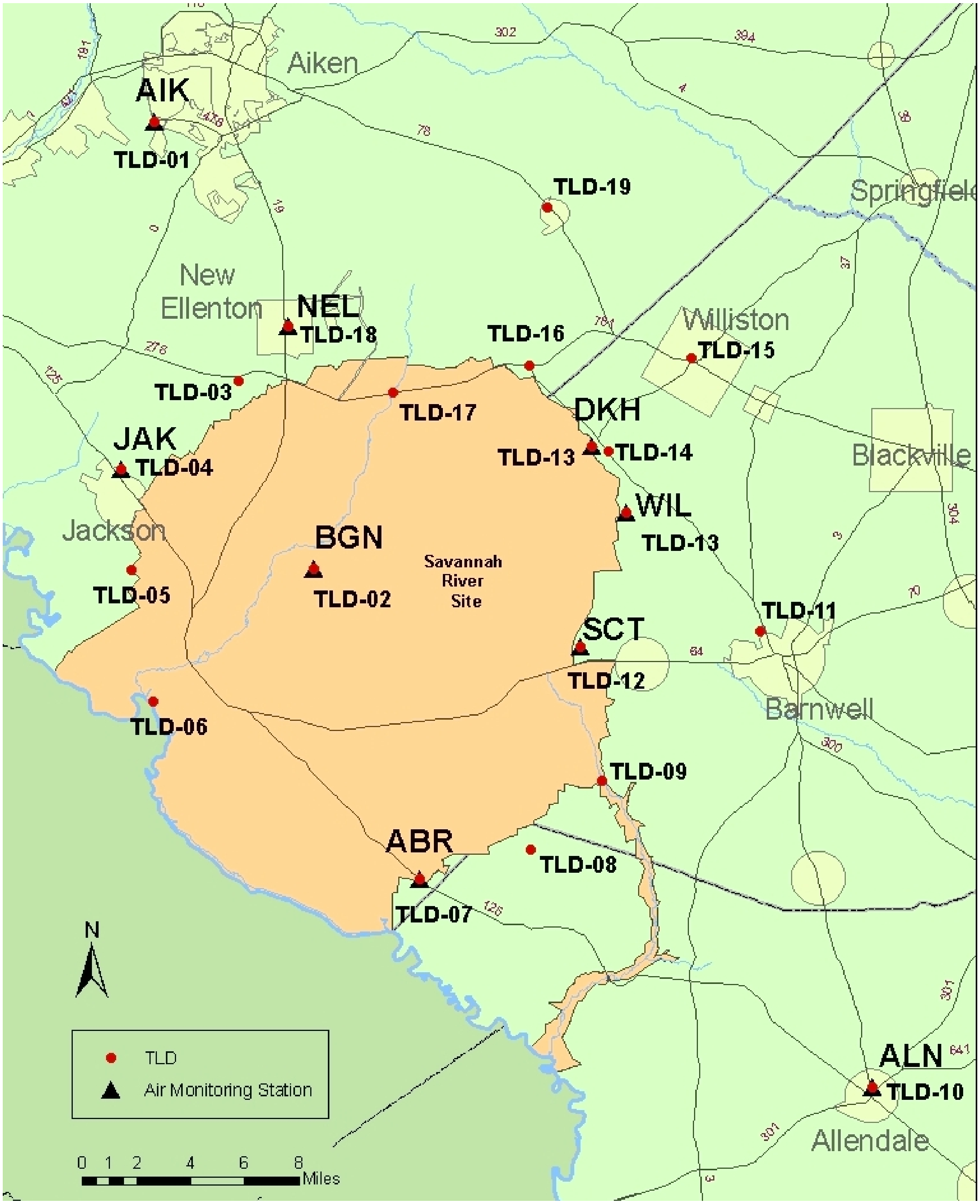
1.1.2

Map 2. Radiological Atmospheric Monitoring Locations



Note: Location in Beaufort, SC not shown on map.

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1.1.3 Tables and Figures

Radiological Atmospheric Monitoring

Figure 1. DOE-SR and SCDHEC Comparison of Average Gross Alpha For Total Suspended Particulates at the SRS Perimeter

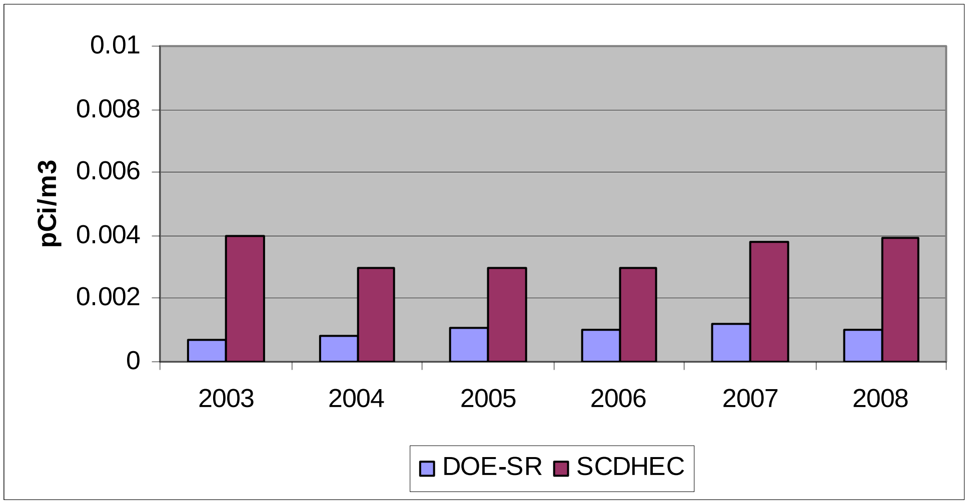


Figure 2. DOE-SR and SCDHEC Comparison of Average Gross Beta For Total Suspended Particulates at the SRS Perimeter

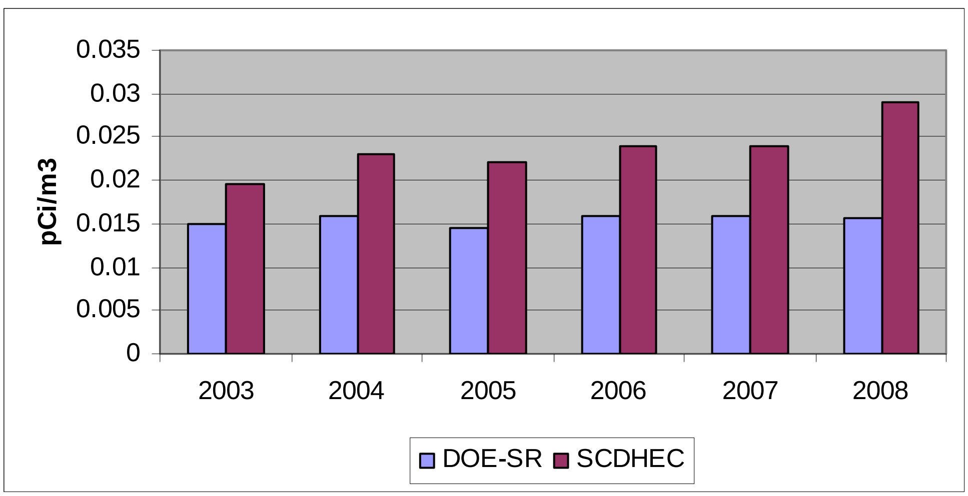


Figure 3. DOE-SR and SCDHEC Comparison of Ambient Beta/Gamma at the SRS Perimeter 2008

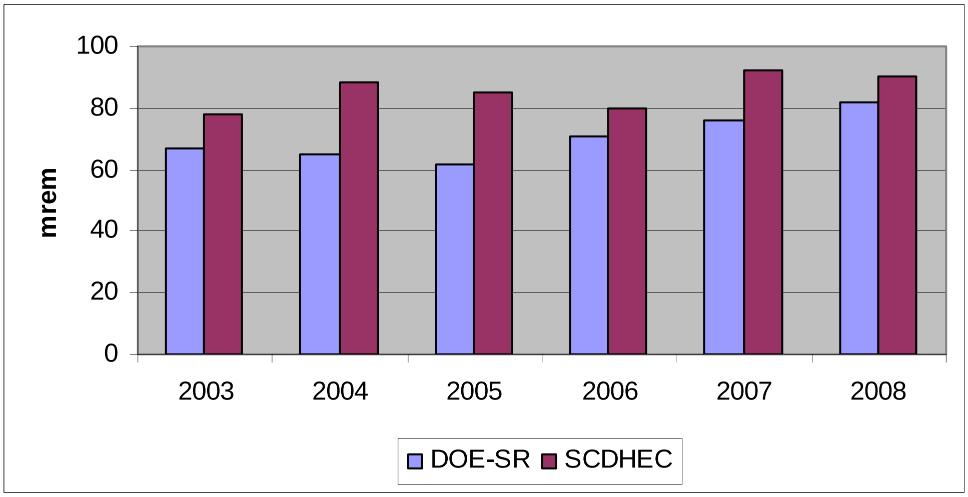


Figure 4. DOE-SR and SCDHEC Comparison of Average Tritium in Air at the SRS Perimeter

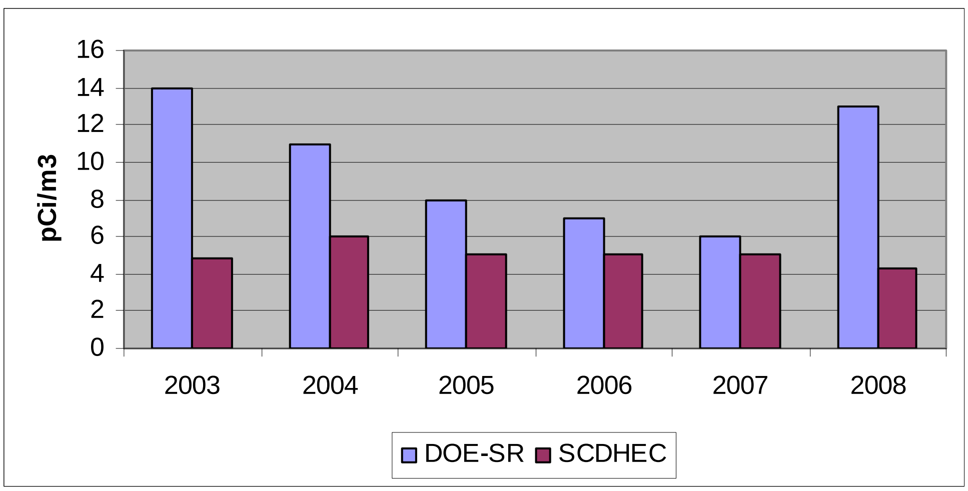


Figure 5. DOE-SR and SCDHEC Comparison of Average Tritium in Precipitation at the SRS Perimeter

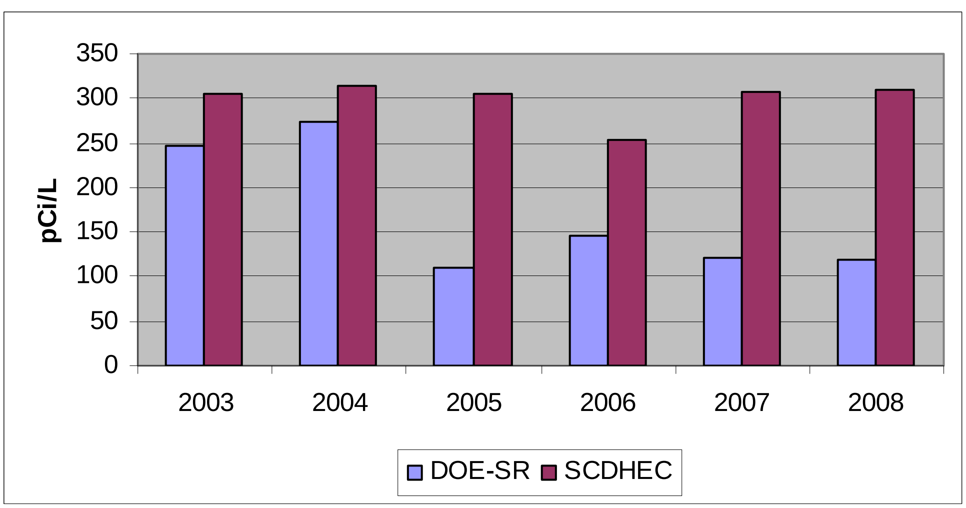


Figure 6. AIK Weekly Gross Alpha/Beta 2008

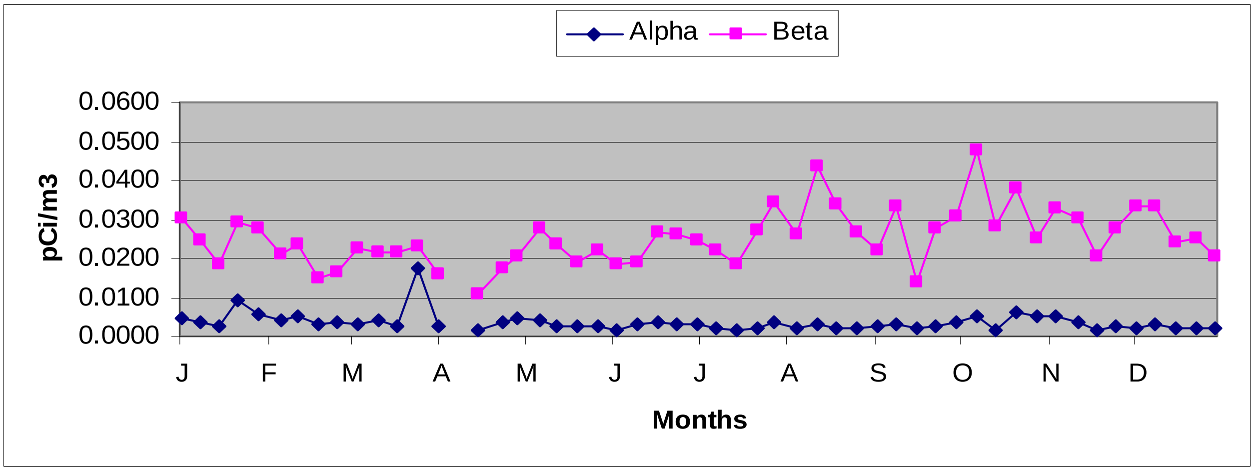


Figure 7. NEL Weekly Gross Alpha/Beta 2008

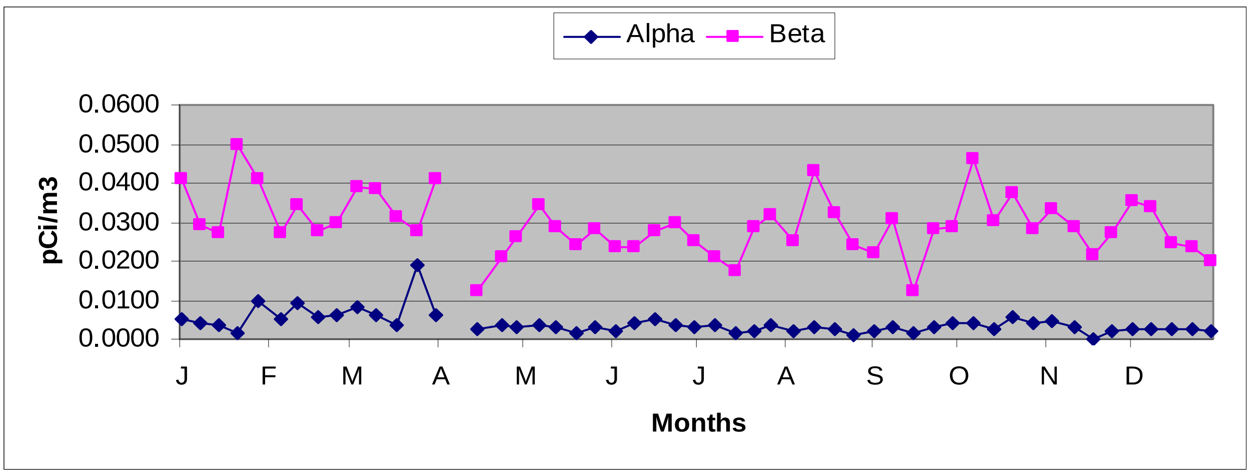
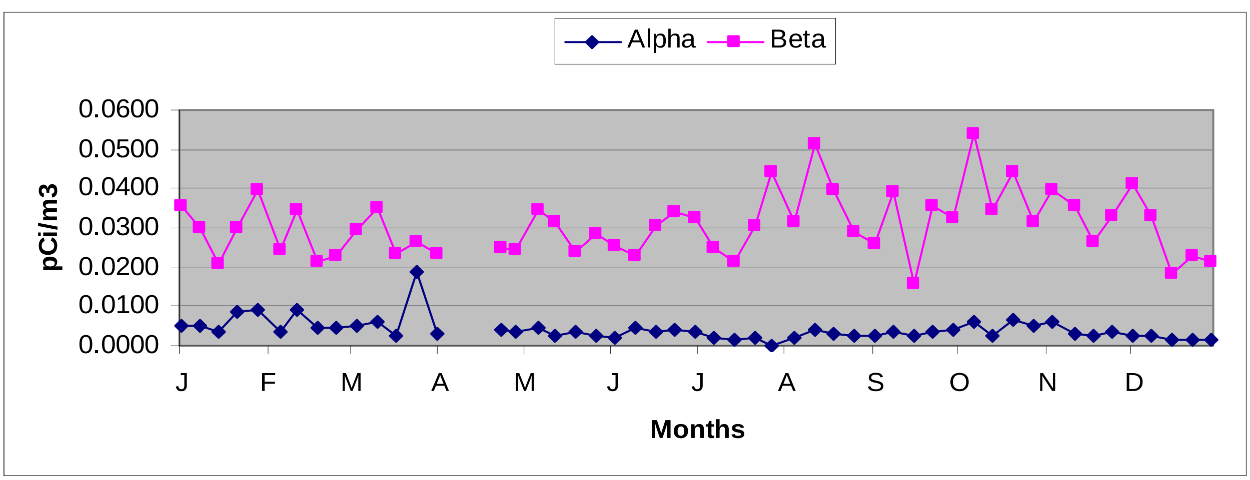


Figure 8. JAK Weekly Gross Alpha/Beta 2008



Note: Gaps in data indicate where no sample was available

Figure 9. BGN Weekly Gross Alpha/Beta 2008

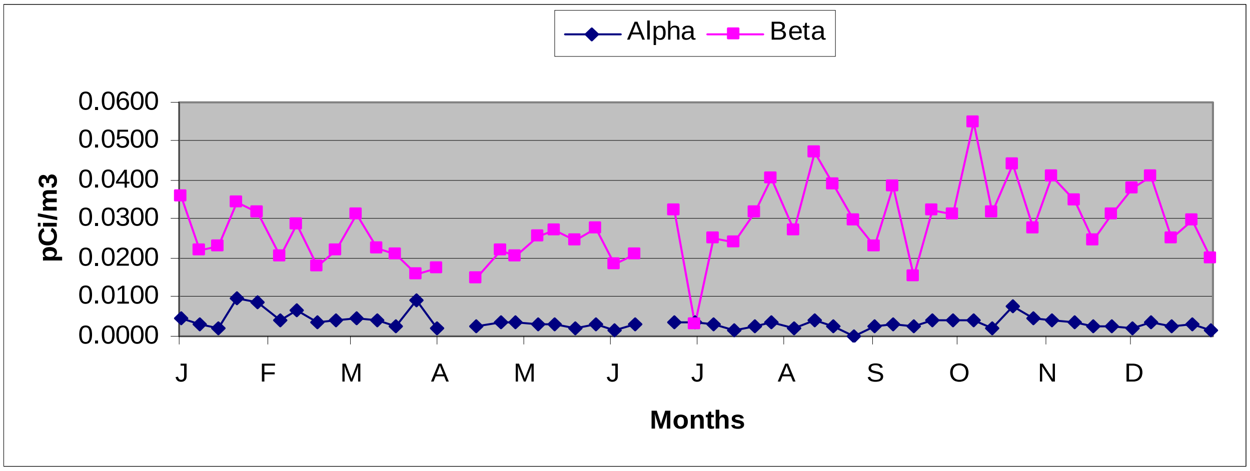


Figure 10. ABR Weekly Gross Alpha/Beta 2008

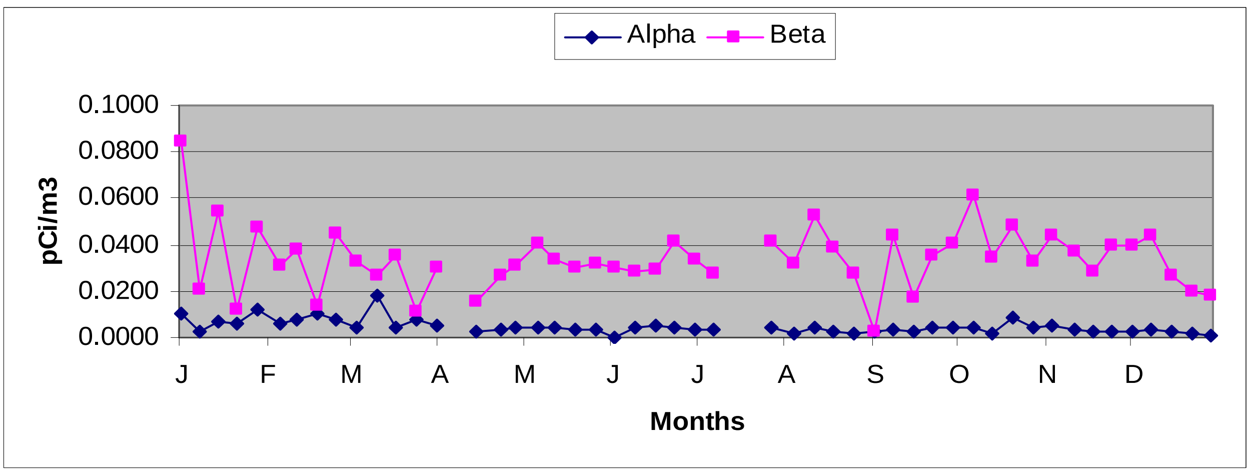
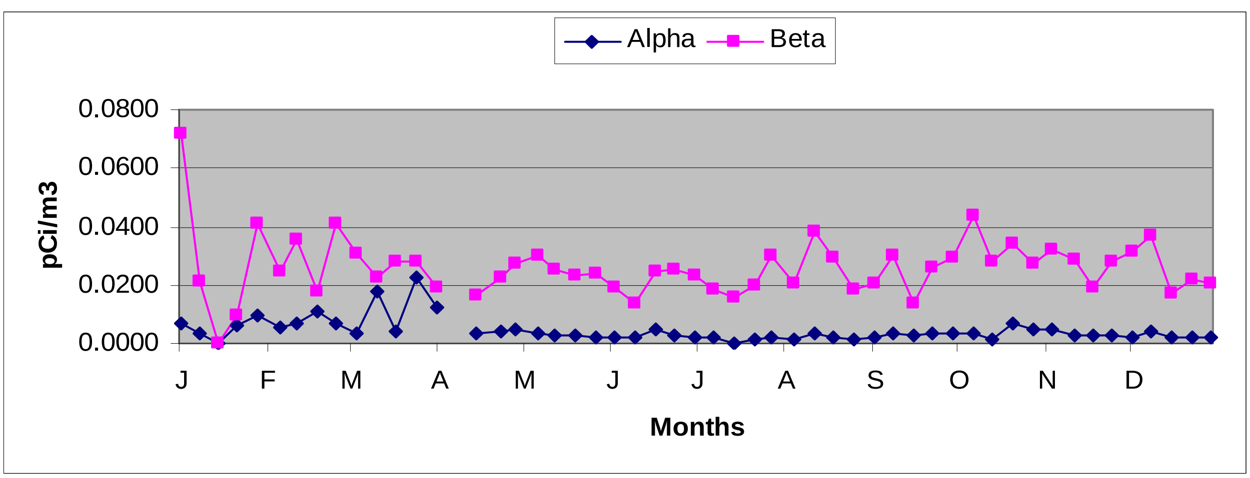


Figure 11. ALN Weekly Gross Alpha/Beta 2008



Note: Gaps in data indicate where no sample was available.

Figure 12. SCT Weekly Gross Alpha/Beta Beta 2008

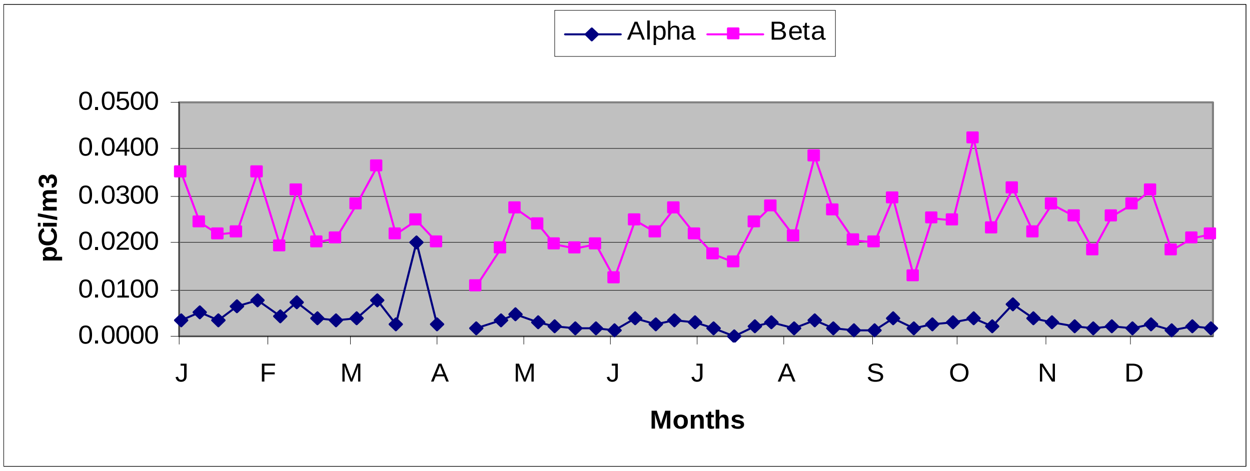


Figure 13. WIL/DKH Weekly Gross Alpha/Beta 2008

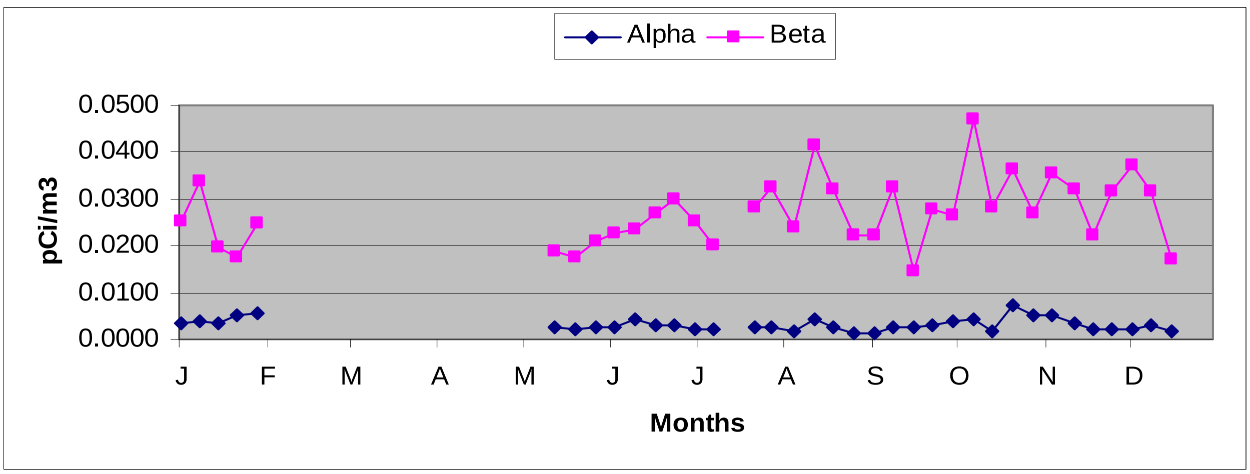
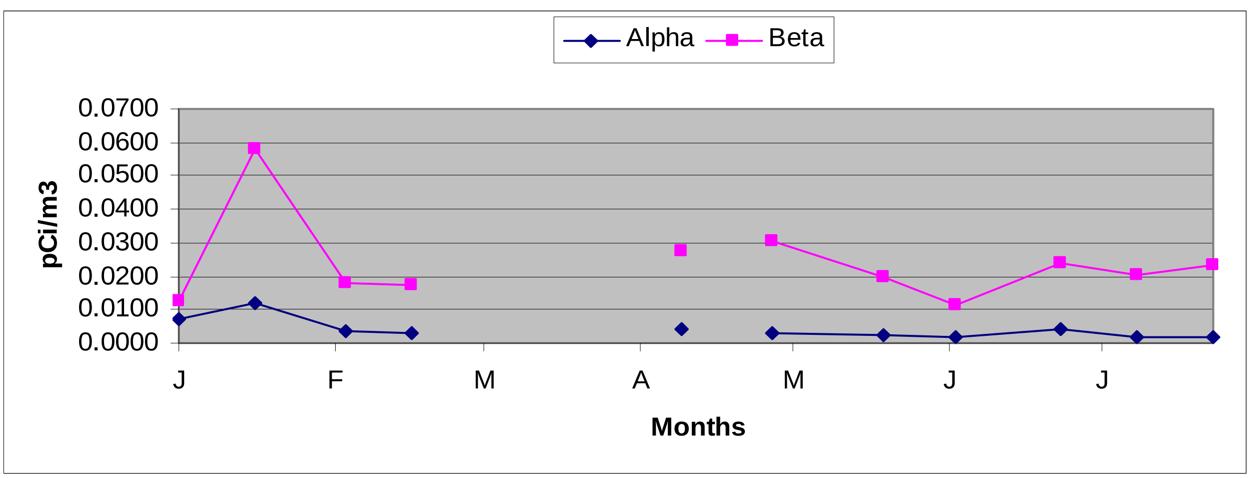


Figure 14. BEU Weekly Gross Alpha/Beta 2008



Note: Gaps in data indicate where no sample was available.

Figure 15. AIK Monthly Tritium in Air 2008

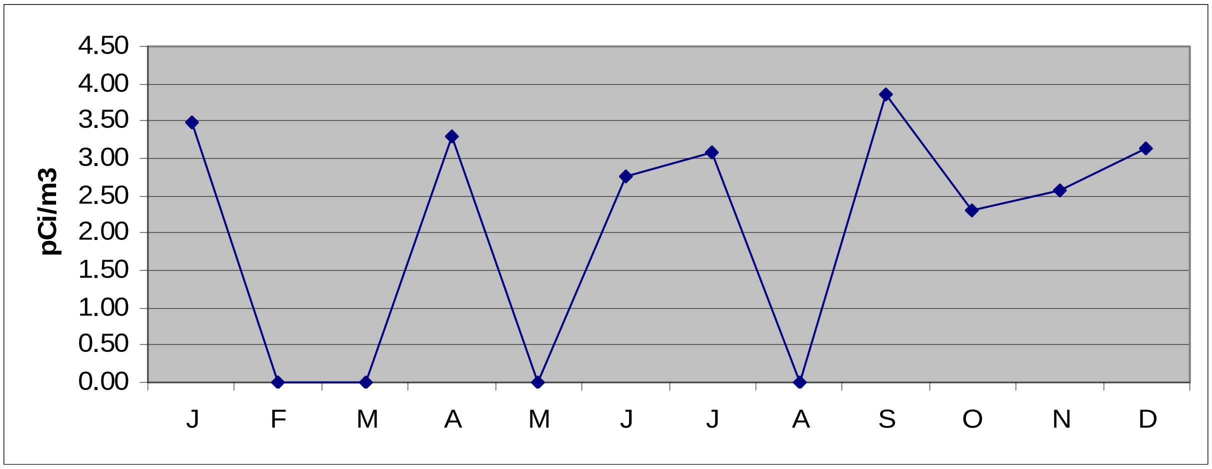


Figure 16. NEL Monthly Tritium in Air 2008

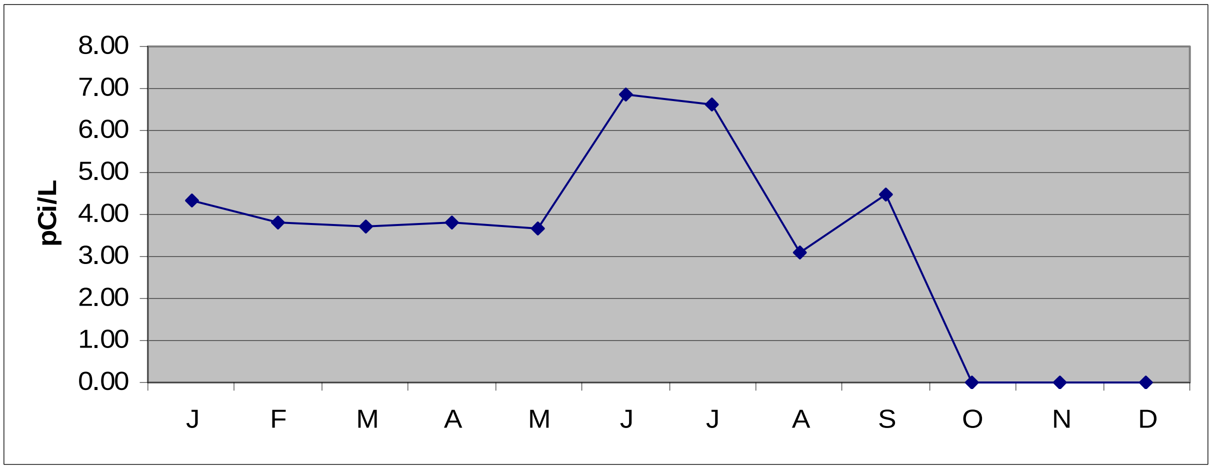
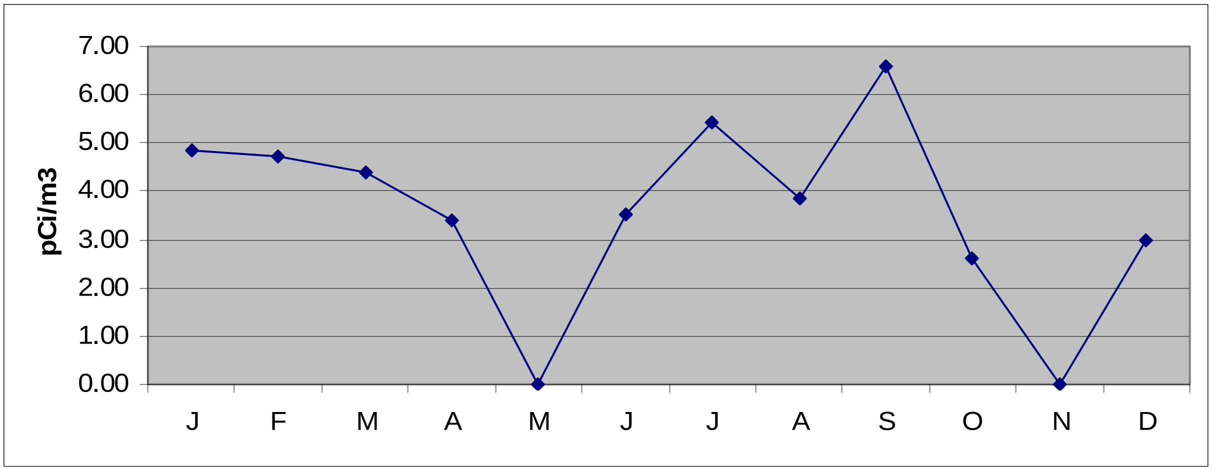


Figure 17. JAK Monthly Tritium in Air 2008



Note: Gaps in data indicate where no sample was available.

Figure 18. BGN Monthly Tritium in Air 2008

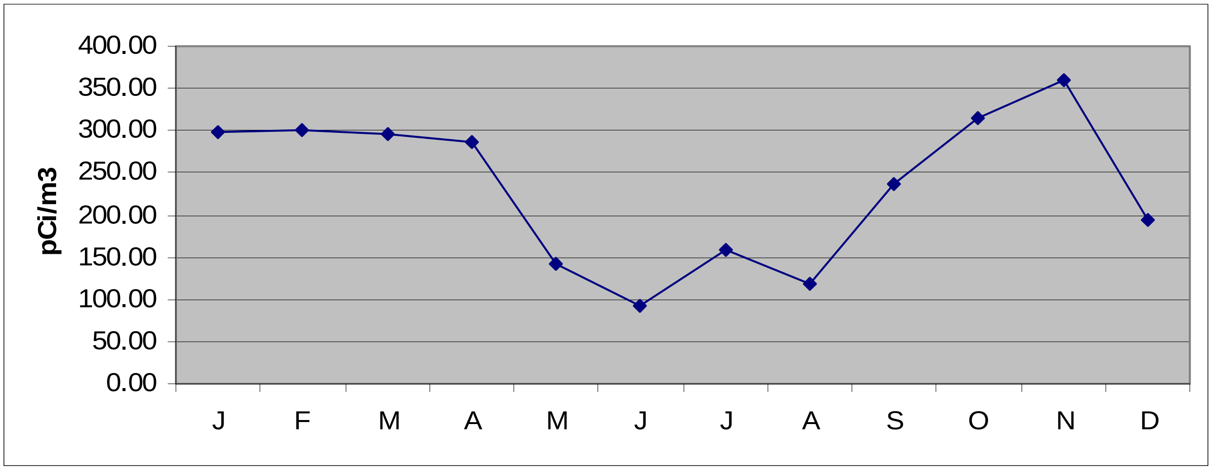


Figure 19. ABR Monthly Tritium in Air 2008

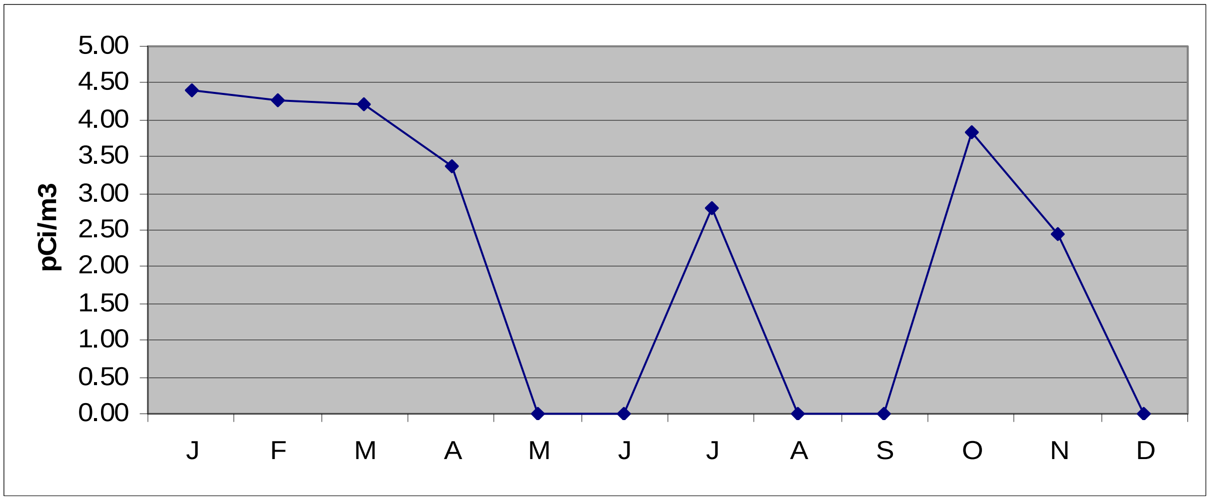
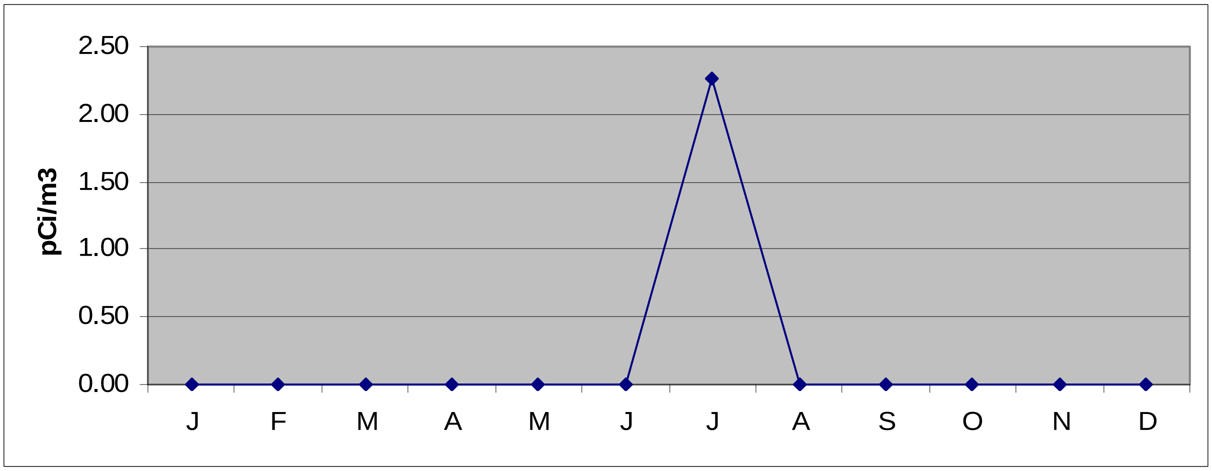


Figure 20. ALN Monthly Tritium in Air 2008



Note: Gaps in data indicate where no sample was available.

Figure 21. SCT Monthly Tritium in Air 2008

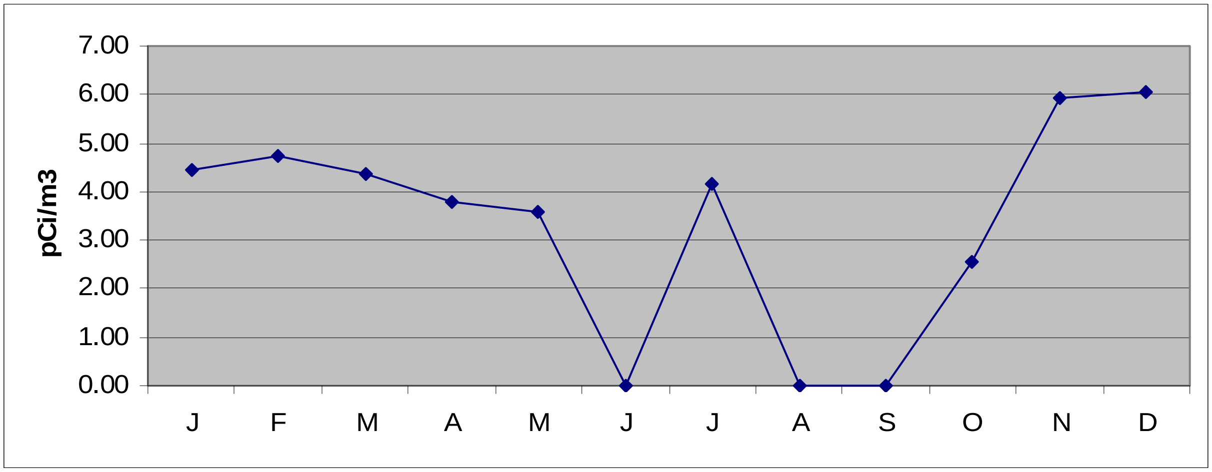


Figure 22. WIL/DKH Monthly Tritium in Air 2008

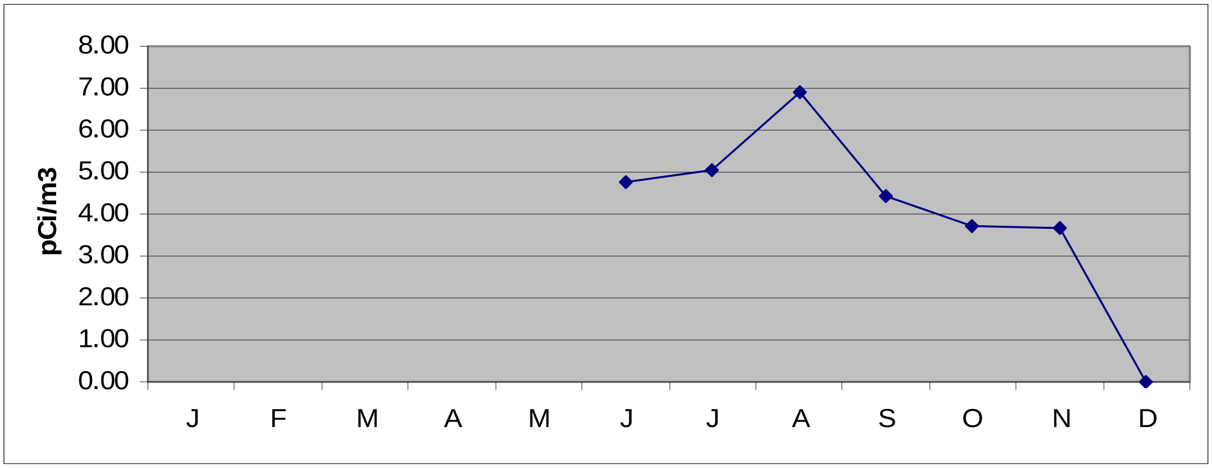
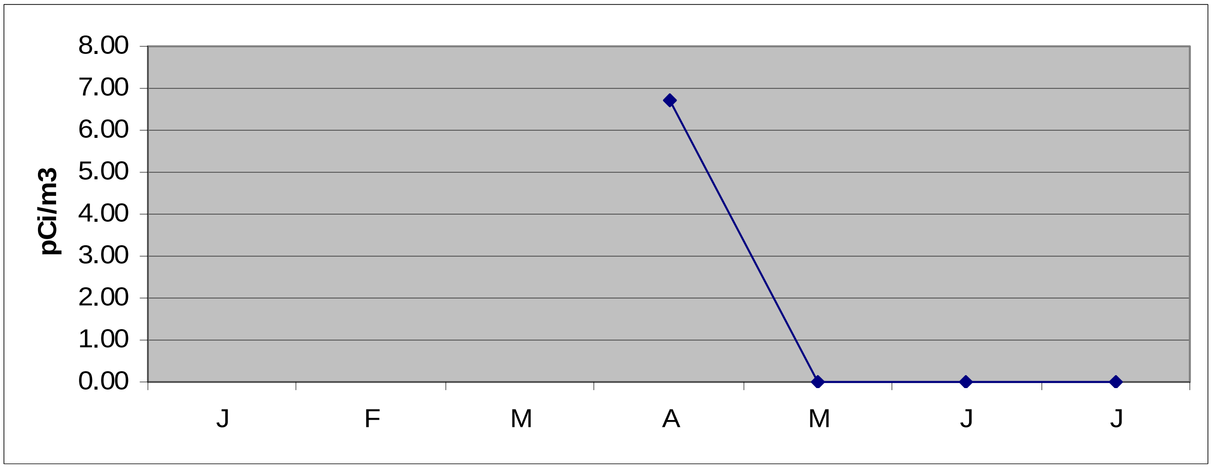


Figure 23. BEU Monthly Tritium in Air 2008



Note: Gaps in data indicate where no sample was available.

Figure 24. AIK Monthly Tritium in Precipitation 2008

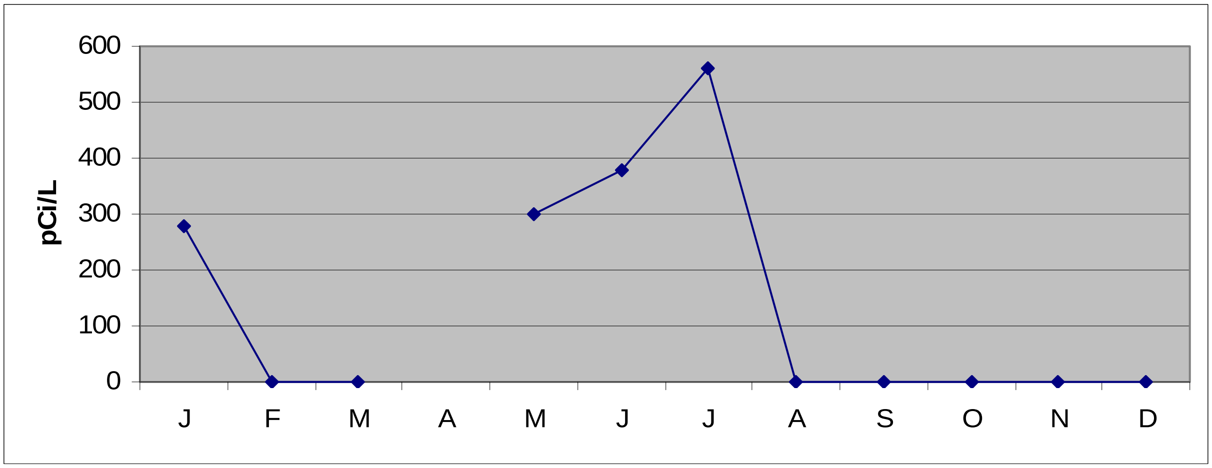


Figure 25. NEL Monthly Tritium in Precipitation 2008

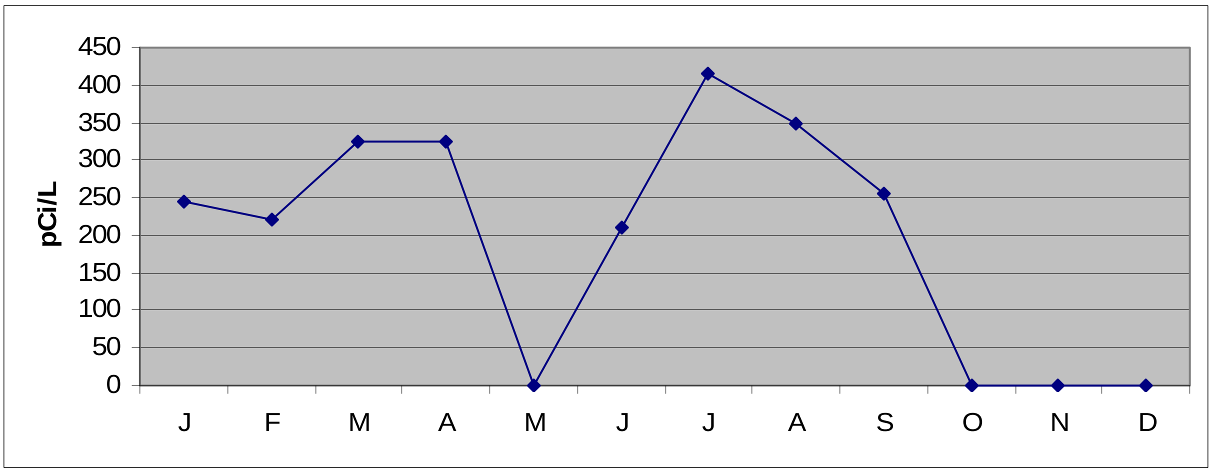
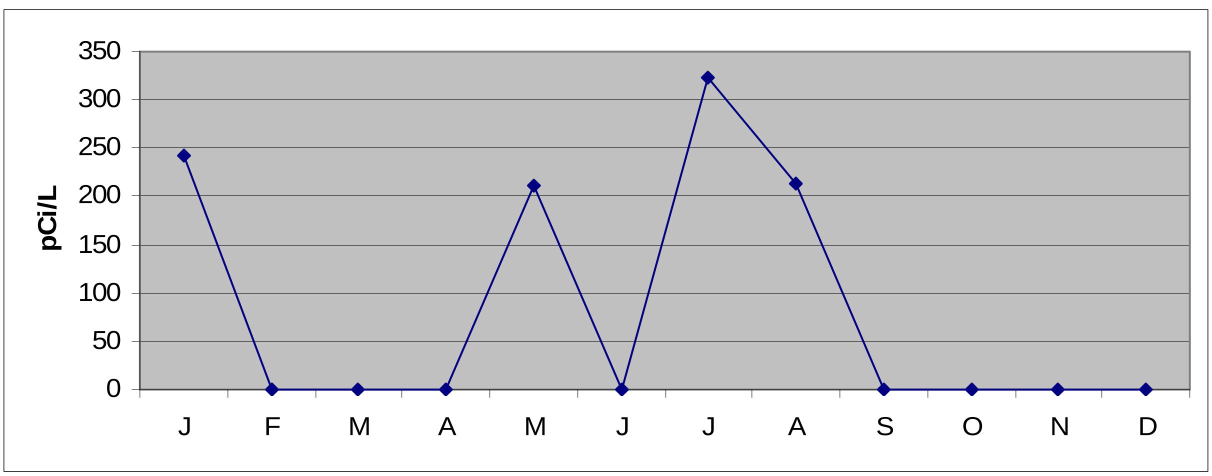


Figure 26. JAK Monthly Tritium in Precipitation 2008



. Note: Gaps in data indicate where no sample was available

Figure 27. BGN Monthly Tritium in Precipitation

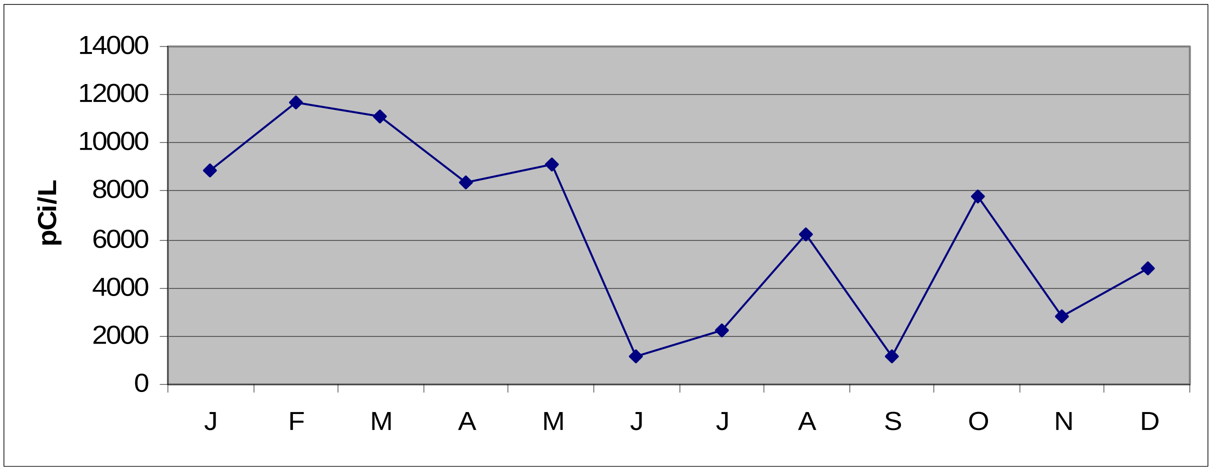


Figure 28. ABR Monthly Tritium in Precipitation

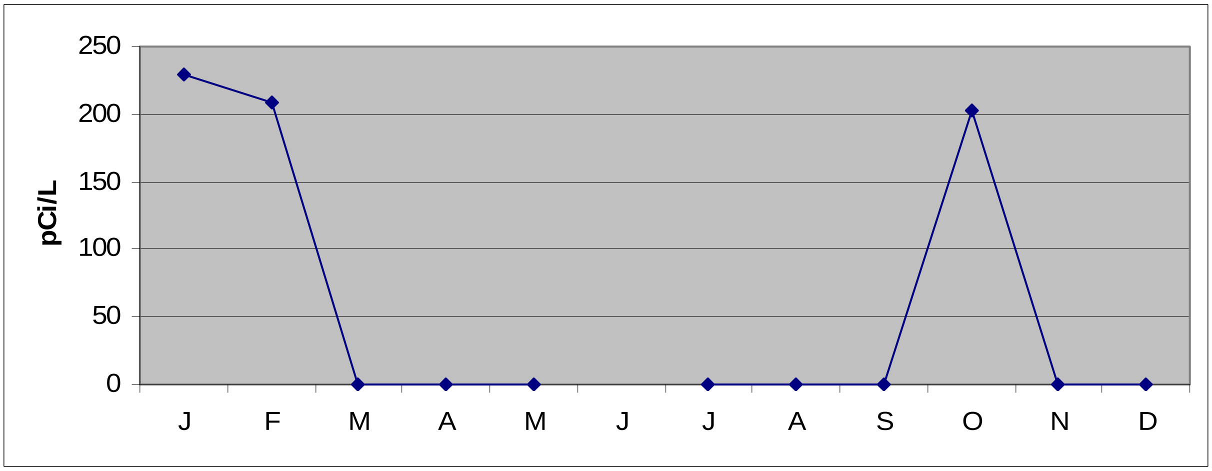
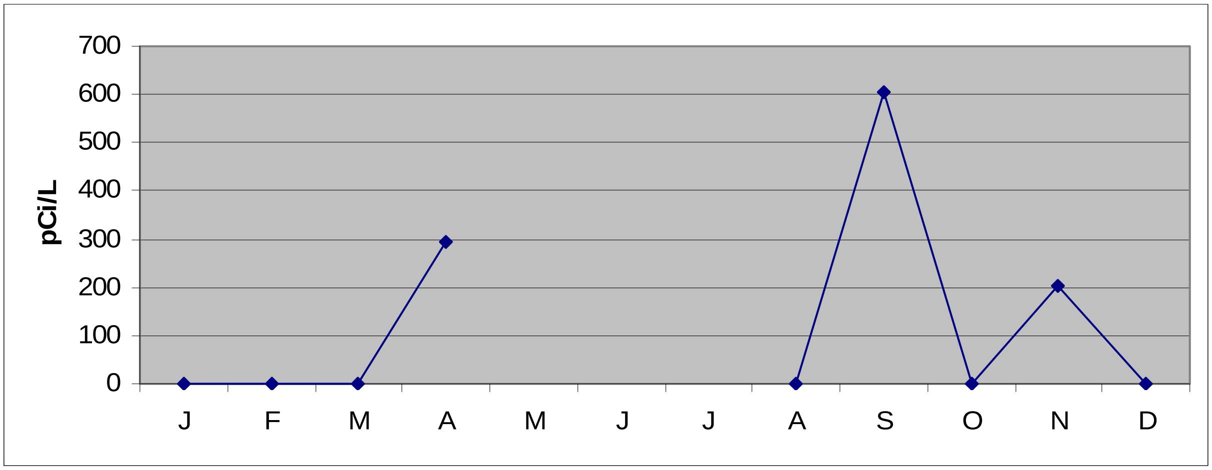


Figure 29. ALN Monthly Tritium in Precipitation



Note: Gaps in data indicate where no sample was available.

Figure 30. SCT Monthly Tritium in Precipitation

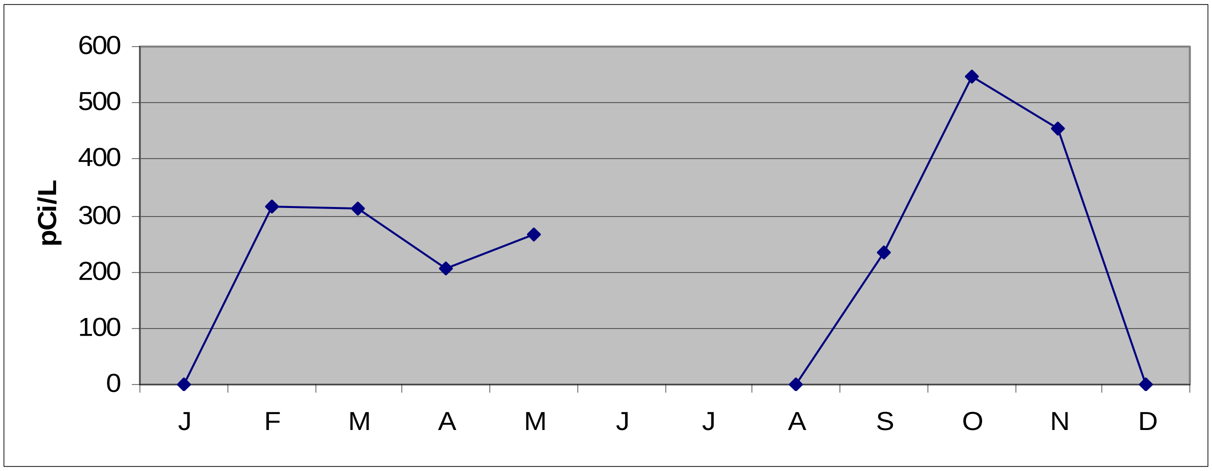


Figure 31. WIL/DKH Monthly Tritium in Precipitation

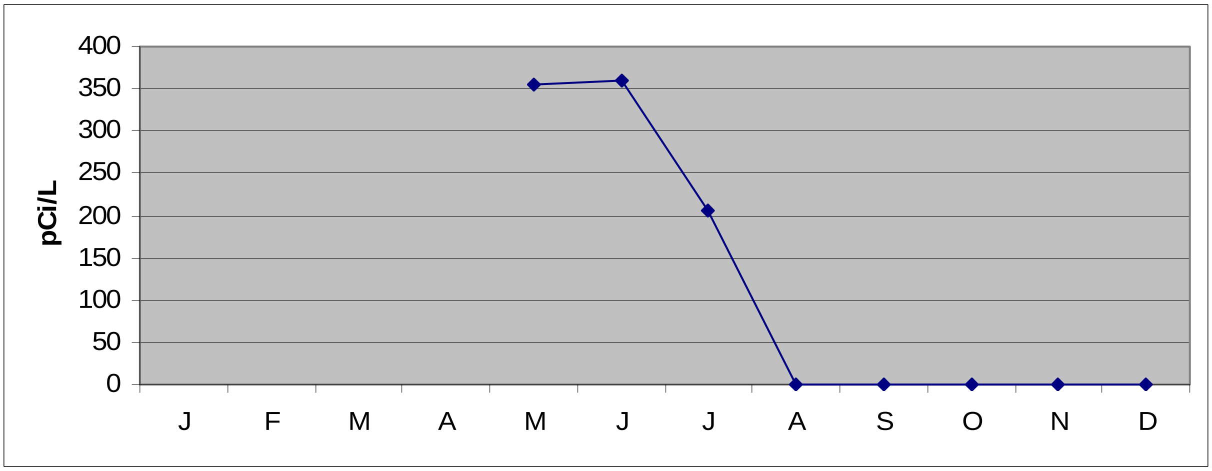
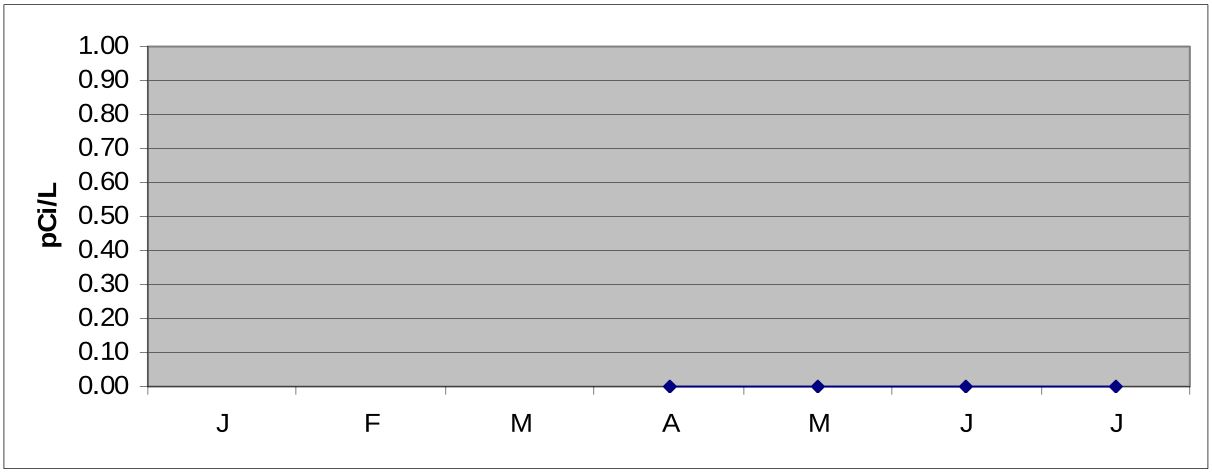


Figure 32. BEU Monthly Tritium in Precipitation



Note: Gaps in data indicate where no sample was available.

TOC

1.1.4 Data

Radiological Atmospheric Monitoring

Notes:
1. Blank Spaces -- No Sample Available
2. N/A -- Not Applicable
3. LLD -- Lower Limit of Detection
4. < -- Less Than LLD
5. Large blank are in WIL/DKH occurred due to the relocation of the air station

Quarterly TLD Beta/Gamma Summary 2008

Sample Location	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year
	mrem	mrem	mrem	mrem	mrem
Co-located with Aiken Air Station	23.00	17.00	20.00	17.00	77.00
E Area	35.00	32.00	32.00	34.00	133.00
Green Pond	26.00	22.00	24.00	24.00	96.00
Co-located with Jackson Air Station	24.00	20.00	18.00	19.00	81.00
Crackerneck Gate	27.00	23.00	20.00	26.00	96.00
TNX Boat Ramp	20.00	26.00	27.00	29.00	102.00
Co-located with Allendale Barricade	23.00	15.00	16.00	17.00	71.00
Junction of Millet Road and Round Tree Road	27.00	23.00	24.00	22.00	96.00
Patterson Mill road At Lower Three Runs Creek	30.00	24.00	26.00	28.00	108.00
Co-located with Allendale Air station	24.00	20.00	21.00	23.00	88.00
Barnwell Airport	26.00	21.00	20.00	23.00	90.00
Co-located with Snelling Air station	28.00	21.00	22.00	25.00	96.00
Co-located with Williston Air station	25.00		22.00	22.00	69.00
Bates cemetery	23.00	18.00	21.00	23.00	85.00
Williston Police Department	28.00	23.00	23.00	27.00	101.00
Junction of US 278 and SC 781	27.00	21.00	21.00	21.00	90.00
US 278 near Upper Three Runs Creek	21.00	26.00	28.00	26.00	101.00
Co-located with New Ellenton Air Station	17.00	21.00	20.00	26.00	84.00
Winsor Post Office	25.00	22.00	23.00	20.00	90.00
Beaufort	28.00	23.00		20.00	71.00

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Aiken Elementary Water Tower (AIK)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0048	0.0012	0.0303	0.0024				
01/09/08	0.0038	0.0010	0.0245	0.0020				
01/15/08	0.0027	0.0009	0.0183	0.0020				
01/22/08	0.0094	0.0014	0.0291	0.0021				
01/29/08	0.0055	0.0011	0.0279	0.0020	3.48	1.09	243	91
02/06/08	0.0043	0.0009	0.0208	0.0017				
02/12/08	0.0053	0.0012	0.0236	0.0021				
02/19/08	0.0033	0.0009	0.0148	0.0015				
02/26/08	0.0037	0.0009	0.0163	0.0016	<2.26	N/A	<197	N/A
03/04/08	0.0029	0.0008	0.0225	0.0018				
03/11/08	0.0039	0.0009	0.0213	0.0018				
03/18/08	0.0024	0.0008	0.0216	0.0018				
03/25/08	0.0176	0.0018	0.0233	0.0019	<2.22	N/A	<203	N/A
04/01/08	0.0024	0.0009	0.0160	0.0017				
04/08/08								
04/15/08	0.0016	0.0004	0.0107	0.0009				
04/24/08	0.0034	0.0008	0.0174	0.0015				
04/29/08	0.0047	0.0014	0.0207	0.0024	3.30	1.05	< 188	N/A
05/07/08	0.0043	0.0010	0.0278	0.0020				
05/13/08	0.0026	0.0011	0.0234	0.0023				
05/20/08	0.0025	0.0009	0.0191	0.0019				
05/27/08	0.0026	0.0010	0.0223	0.0020	<2.09	N/A	211	86
06/03/08	0.0017	0.0009	0.0186	0.0019				
06/10/08	0.0031	0.0011	0.0189	0.0019				
06/17/08	0.0038	0.0010	0.0268	0.0021				
06/24/08	0.0033	0.0010	0.0259	0.0021				
07/01/08	0.0031	0.0011	0.0248	0.0021	2.76	1.01	<184	N/A
07/08/08	0.0022	0.0009	0.0218	0.0020				
07/15/08	0.0017	0.0009	0.0184	0.0019				
07/22/08	0.0021	0.0009	0.0272	0.0022				
07/28/08	0.0037	0.0013	0.0343	0.0026	3.08	1.02	323	91
08/05/08	0.0023	0.0009	0.0259	0.0019				
08/12/08	0.0032	0.0009	0.0435	0.0026				
08/19/08	0.0022	0.0009	0.0337	0.0024				
08/26/08	0.0020	0.0009	0.0268	0.0022	<2.31	N/A	213	94
09/02/08	0.0024	0.0009	0.0223	0.0020				
09/09/08	0.0030	0.0010	0.0335	0.0023				
09/16/08	0.0020	0.0008	0.0140	0.0017				
09/23/08	0.0027	0.0009	0.0277	0.0021				
09/30/08	0.0034	0.0010	0.0307	0.0023	3.86	1.10	<193	N/A
10/07/08	0.0049	0.0012	0.0478	0.0027				
10/14/08	0.0017	0.0009	0.0280	0.0022				
10/21/08	0.0062	0.0012	0.0377	0.0025				
10/28/08	0.0050	0.0011	0.0253	0.0021	2.30	1.00	<187	N/A
11/04/08	0.0050	0.0011	0.0329	0.0023				
11/12/08	0.0037	0.0010	0.0303	0.0021				
11/18/08	0.0013	0.0008	0.0207	0.0021				
11/25/08	0.0024	0.0009	0.0278	0.0021	2.56	1.03	<188	N/A
12/02/08	0.0020	0.0010	0.0331	0.0024				
12/09/08	0.0032	0.0009	0.0332	0.0023				
12/16/08	0.0020	0.0009	0.0241	0.0020				
12/23/08	0.0022	0.0008	0.0252	0.0021				
12/30/08	0.0021	0.0007	0.0206	0.0017	3.14	1.13	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	New Ellenton, SC (NEL)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0049	0.0014	0.0408	0.0030				
01/09/08	0.0041	0.0011	0.0291	0.0024				
01/15/08	0.0035	0.0012	0.0273	0.0026				
01/22/08	0.0013	0.0018	0.0498	0.0030				
01/29/08	0.0098	0.0014	0.0408	0.0024	4.32	1.12	277	91
02/06/08	0.0052	0.0010	0.0271	0.0019				
02/12/08	0.0091	0.0015	0.0346	0.0025				
02/19/08	0.0054	0.0011	0.0275	0.0020				
02/26/08	0.0060	0.0012	0.0300	0.0022	3.81	1.12	<197	N/A
03/04/08	0.0082	0.0014	0.0391	0.0026				
03/11/08	0.0061	0.0012	0.0384	0.0025				
03/18/08	0.0037	0.0010	0.0312	0.0023				
03/25/08	0.0190	0.0021	0.0276	0.0023	3.73	1.10	<203	N/A
04/01/08	0.0063	0.0017	0.0411	0.0032				
04/08/08								
04/15/08	0.0024	0.0005	0.0121	0.0009				
04/24/08	0.0038	0.0008	0.0212	0.0015				
04/29/08	0.0031	0.0012	0.0259	0.0027	3.81	1.07		
05/07/08	0.0033	0.0010	0.0344	0.0023				
05/13/08	0.0031	0.0012	0.0285	0.0025				
05/20/08	0.0017	0.0009	0.0242	0.0021				
05/27/08	0.0033	0.0011	0.0280	0.0023	3.68	1.05	299	92
06/03/08	0.0018	0.0010	0.0235	0.0022				
06/10/08	0.0041	0.0012	0.0236	0.0021				
06/17/08	0.0050	0.0011	0.0275	0.0021				
06/24/08	0.0035	0.0010	0.0295	0.0022				
07/01/08	0.0029	0.0010	0.0249	0.0020	6.84	1.18	379	95
07/08/08	0.0035	0.0010	0.0210	0.0020				
07/15/08	0.0015	0.0009	0.0175	0.0018				
07/22/08	0.0021	0.0009	0.0288	0.0022				
07/28/08	0.0037	0.0012	0.0318	0.0024	6.63	1.17	561	102
08/05/08	0.0019	0.0009	0.0250	0.0019				
08/12/08	0.0033	0.0009	0.0432	0.0026				
08/19/08	0.0026	0.0010	0.0321	0.0023				
08/26/08	0.0012	0.0008	0.0241	0.0021	3.11	1.10	<201	N/A
09/02/08	0.0018	0.0008	0.0221	0.0020				
09/09/08	0.0029	0.0009	0.0306	0.0022				
09/16/08	0.0017	0.0008	0.0125	0.0016				
09/23/08	0.0030	0.0009	0.0280	0.0212				
09/30/08	0.0041	0.0010	0.0287	0.0022	4.45	1.12	<193	N/A
10/07/08	0.0042	0.0011	0.0459	0.0026				
10/14/08	0.0027	0.0010	0.0305	0.0022				
10/21/08	0.0056	0.0011	0.0376	0.0024				
10/28/08	0.0041	0.0010	0.0284	0.0021	<2.15	N/A	<187	N/A
11/04/08	0.0045	0.0010	0.0333	0.0022				
11/12/08	0.0030	0.0009	0.0285	0.0020				
11/18/08	<0.0012	N/A	0.0215	0.0021				
11/25/08	0.0022	0.0008	0.0274	0.0021	<2.16	N/A	<188	N/A
12/02/08	0.0025	0.0010	0.0352	0.0024				
12/09/08	0.0024	0.0008	0.0340	0.0022				
12/16/08	0.0026	0.0009	0.0248	0.0020				
12/23/08	0.0025	0.0010	0.0237	0.0022				
12/30/08	0.0019	0.0008	0.0202	0.0020	<2.29	N/A	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Jackson, SC (JAK)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0051	0.0014	0.0355	0.0028				
01/09/08	0.0053	0.0012	0.0299	0.0024				
01/15/08	0.0034	0.0012	0.0211	0.0025				
01/22/08	0.0085	0.0015	0.0299	0.0024				
01/29/08	0.0092	0.0016	0.0397	0.0028	4.83	1.14	244	91
02/06/08	0.0038	0.0011	0.0243	0.0021				
02/12/08	0.0091	0.0015	0.0346	0.0025				
02/19/08	0.0045	0.0012	0.0215	0.0021				
02/26/08	0.0046	0.0011	0.0230	0.0021	4.74	1.17	221	90
03/04/08	0.0051	0.0012	0.0295	0.0024				
03/11/08	0.0061	0.0013	0.0352	0.0025				
03/18/08	0.0026	0.0009	0.0234	0.0021				
03/25/08	0.0186	0.0021	0.0263	0.0022	4.38	1.17	324	97
04/01/08	0.0029	0.0011	0.0235	0.0022				
04/08/08								
04/15/08								
04/24/08	0.0043	0.0012	0.0247	0.0023				
04/29/08	0.0037	0.0013	0.0244	0.0027	3.38	1.06	324	98
05/07/08	0.0044	0.0011	0.0347	0.0024				
05/13/08	0.0028	0.0012	0.0316	0.0027				
05/20/08	0.0036	0.0011	0.0241	0.0022				
05/27/08	0.0024	0.0011	0.0285	0.0024	<2.09	N/A	<182	N/A
06/03/08	0.0020	0.0011	0.0253	0.0023				
06/10/08	0.0045	0.0013	0.0230	0.0022				
06/17/08	0.0038	0.0011	0.0307	0.0024				
06/24/08	0.0039	0.0011	0.0343	0.0025				
07/01/08	0.0036	0.0012	0.0326	0.0025	3.53	1.04	212	87
07/08/08	0.0021	0.0009	0.0251	0.0022				
07/15/08	0.0014	0.0009	0.0212	0.0021				
07/22/08	0.0021	0.0009	0.0307	0.0023				
07/28/08	<0.0007	N/A	0.0444	0.0074	5.42	1.13	415	95
08/05/08	0.0018	0.0009	0.0314	0.0022				
08/12/08	0.0039	0.0010	0.0512	0.0029				
08/19/08	0.0031	0.0011	0.0397	0.0027				
08/26/08	0.0025	0.0010	0.0292	0.0023	3.86	1.15	348	101
09/02/08	0.0025	0.0009	0.0257	0.0021				
09/09/08	0.0036	0.0011	0.0389	0.0025				
09/16/08	0.0023	0.0009	0.0159	0.0018				
09/23/08	0.0036	0.0010	0.0356	0.0024				
09/30/08	0.0043	0.0011	0.0324	0.0024	6.58	1.20	255	91
10/07/08	0.0060	0.0013	0.0541	0.0029				
10/14/08	0.0027	0.0010	0.0346	0.0024				
10/21/08	0.0067	0.0013	0.0442	0.0027				
10/28/08	0.0053	0.0012	0.0315	0.0023	2.59	1.02	<187	N/A
11/04/08	0.0061	0.0012	0.0396	0.0025				
11/12/08	0.0032	0.0010	0.0354	0.0023				
11/18/08	0.0026	0.0010	0.0266	0.0024				
11/25/08	0.0034	0.0010	0.0331	0.0023	<2.16	N/A	<188	N/A
12/02/08	0.0023	0.0010	0.0414	0.0027				
12/09/08	0.0024	0.0008	0.0330	0.0022				
12/16/08	0.0013	0.0007	0.0181	0.0016				
12/23/08	0.0017	0.0007	0.0231	0.0018				
12/30/08	0.0017	0.0007	0.0212	0.0018	2.99	1.08	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Burial Grounds North (BGN)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0048	0.0014	0.0357	0.0029				
01/09/08	0.0033	0.0010	0.0222	0.0021				
01/15/08	0.0022	0.0010	0.0229	0.0025				
01/22/08	0.0099	0.0016	0.0344	0.0025				
01/29/08	0.0089	0.0016	0.0317	0.0026	298.41	5.15	8843	276
02/06/08	0.0040	0.0012	0.0205	0.0021				
02/12/08	0.0067	0.0016	0.0287	0.0027				
02/19/08	0.0037	0.0010	0.0177	0.0019				
02/26/08	0.0043	0.0011	0.0222	0.0021	300.99	5.20	11674	405
03/04/08	0.0045	0.0011	0.0313	0.0024				
03/11/08	0.0041	0.0011	0.0228	0.0021				
03/18/08	0.0027	0.0009	0.0209	0.0020				
03/25/08	0.0094	0.0016	0.0161	0.0019	296.47	5.15	11066	394
04/01/08	0.0021	0.0009	0.0173	0.0017				
04/08/08								
04/15/08	0.0026	0.0006	0.0149	0.0012				
04/24/08	0.0036	0.0009	0.0219	0.0017				
04/29/08	0.0038	0.0011	0.0204	0.0020	285.99	5.11	8396	267
05/07/08	0.0030	0.0008	0.0256	0.0018				
05/13/08	0.0031	0.0011	0.0271	0.0024				
05/20/08	0.0022	0.0009	0.0247	0.0020				
05/27/08	0.0029	0.0010	0.0277	0.0021	141.94	3.66	9072	283
06/03/08	0.0014	0.0008	0.0185	0.0018				
06/10/08	0.0031	0.0010	0.0210	0.0018				
06/17/08								
06/24/08	0.0035	0.0010	0.0324	0.0023				
07/01/08	0.0038	0.0011	0.0031	0.0022	91.32	2.97	1120	122
07/08/08	0.0032	0.0009	0.0250	0.0021				
07/15/08	0.0014	0.0009	0.0241	0.0021				
07/22/08	0.0025	0.0009	0.0320	0.0023				
07/28/08	0.0036	0.0012	0.0406	0.0027	158.35	3.86	2260	155
08/05/08	0.0021	0.0009	0.0270	0.0019				
08/12/08	0.0041	0.0010	0.0471	0.0027				
08/19/08	0.0023	0.0009	0.0391	0.0025				
08/26/08	<0.0012	N/A	0.0295	0.0022	118.97	3.41	6182	241
09/02/08	0.0026	0.0009	0.0231	0.0020				
09/09/08	0.0032	0.0010	0.0384	0.0024				
09/16/08	0.0024	0.0008	0.0154	0.0017				
09/23/08	0.0039	0.0010	0.0323	0.0022				
09/30/08	0.0041	0.0010	0.0311	0.0022	236.98	4.68	1133	123
10/07/08	0.0041	0.0011	0.0550	0.0028				
10/14/08	0.0022	0.0009	0.0317	0.0022				
10/21/08	0.0079	0.0013	0.0441	0.0026				
10/28/08	0.0048	0.0011	0.0278	0.0021	315.69	5.49	7749	259
11/04/08	0.0041	0.0010	0.0410	0.0024				
11/12/08	0.0035	0.0009	0.0351	0.0021				
11/18/08	0.0027	0.0010	0.0244	0.0022				
11/25/08	0.0028	0.0009	0.0313	0.0022	359.65	5.77	2790	167
12/02/08	0.0018	0.0009	0.0382	0.0024				
12/09/08	0.0034	0.0009	0.0408	0.0024				
12/16/08	0.0025	0.0009	0.0253	0.0020				
12/23/08	0.0029	0.0009	0.0298	0.0022				
12/30/08	0.0013	0.0007	0.0200	0.0018	193.92	4.25	4801	210

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Allendale Barricade (ABR)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0104	0.0018	0.0843	0.0042				
01/09/08	0.0026	0.0009	0.0210	0.0021				
01/15/08	0.0069	0.0016	0.0547	0.0036				
01/22/08	0.0063	0.0013	0.0125	0.0018				
01/29/08	0.0120	0.0016	0.0471	0.0027	4.39	1.12	229	97
02/06/08	0.0062	0.0012	0.0307	0.0021				
02/12/08	0.0081	0.0015	0.0377	0.0028				
02/19/08	0.0106	0.0015	0.0137	0.0017				
02/26/08	0.0076	0.0014	0.0444	0.0028	4.26	1.10	209	93
03/04/08	0.0043	0.0011	0.0330	0.0024				
03/11/08	0.0181	0.0020	0.0265	0.0022				
03/18/08	0.0042	0.0011	0.0355	0.0025				
03/25/08	0.0075	0.0015	0.0108	0.0017	4.22	1.13	<203	N/A
04/01/08	0.0053	0.0013	0.0304	0.0024				
04/08/08								
04/15/08	0.0024	0.0006	0.0159	0.0011				
04/24/08	0.0037	0.0008	0.0263	0.0018				
04/29/08	0.0040	0.0016	0.0310	0.0034	3.38	1.06	< 188	N/A
05/07/08	0.0041	0.0013	0.0409	0.0029				
05/13/08	0.0039	0.0016	0.0336	0.0032				
05/20/08	0.0036	0.0013	0.0298	0.0027				
05/27/08	0.0034	0.0014	0.0321	0.0028	<2.09	N/A	<182	N/A
06/03/08	<0.0019	N/A	0.0304	0.0028				
06/10/08	0.0040	0.0014	0.0288	0.0027				
06/17/08	0.0048	0.0013	0.0290	0.0025				
06/24/08	0.0045	0.0013	0.0415	0.0029				
07/01/08	0.0037	0.0013	0.0340	0.0026	<2.12	N/A		
07/08/08	0.0036	0.0018	0.0276	0.0039				
07/15/08								
07/22/08								
07/28/08	0.0047	0.0015	0.0413	0.0030	2.80	1.01	<178	N/A
08/05/08	0.0021	0.0010	0.0320	0.0023				
08/12/08	0.0041	0.0011	0.0529	0.0031				
08/19/08	0.0026	0.0011	0.0390	0.0027				
08/26/08	0.0018	0.0010	0.0280	0.0024	<2.31	N/A	<201	N/A
09/02/08	0.0029	0.0010	0.0026	0.0023				
09/09/08	0.0037	0.0011	0.0442	0.0028				
09/16/08	0.0029	0.0010	0.0171	0.0019				
09/23/08	0.0046	0.0012	0.0350	0.0025				
09/30/08	0.0043	0.0011	0.0404	0.0027	<2.22	N/A	<193	N/A
10/07/08	0.0041	0.0012	0.0615	0.0032				
10/14/08	0.0018	0.0009	0.0342	0.0025				
10/21/08	0.0083	0.0015	0.0481	0.0029				
10/28/08	0.0045	0.0011	0.0324	0.0024	3.84	1.07	203	89
11/04/08	0.0052	0.0012	0.0436	0.0027				
11/12/08	0.0034	0.0010	0.0373	0.0024				
11/18/08	0.0025	0.0011	0.0285	0.0026				
11/25/08	0.0024	0.0009	0.0394	0.0026	2.45	1.02	<188	N/A
12/02/08	0.0029	0.0011	0.0400	0.0027				
12/09/08	0.0033	0.0010	0.0443	0.0027				
12/16/08	0.0024	0.0009	0.0271	0.0207				
12/23/08	0.0021	0.0007	0.0198	0.0016				
12/30/08	0.0010	0.0006	0.0181	0.0017	<2.29	N/A	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Allendale, SC (ALN)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0071	0.0016	0.0720	0.0040				
01/09/08	0.0031	0.0010	0.0214	0.0021				
01/15/08	<0.0013	N/A	<0.0024	N/A				
01/22/08	0.0063	0.0013	0.0099	0.0016				
01/29/08	0.0094	0.0016	0.0413	0.0027	<2.25	N/A	<196	N/A
02/06/08	0.0052	0.0012	0.0249	0.0021				
02/12/08	0.0069	0.0015	0.0358	0.0029				
02/19/08	0.0110	0.0016	0.0176	0.0019				
02/26/08	0.0071	0.0013	0.0411	0.0027	<2.27	N/A	<197	N/A
03/04/08	0.0036	0.0010	0.0310	0.0023				
03/11/08	0.0176	0.0020	0.0223	0.0021				
03/18/08	0.0040	0.0011	0.0278	0.0022				
03/25/08	0.0227	0.0023	0.0278	0.0023	<2.33	N/A	<203	N/A
04/01/08	0.0122	0.0018	0.0190	0.0020				
04/08/08								
04/15/08	0.0035	0.0007	0.0162	0.0012				
04/24/08	0.0039	0.0009	0.0225	0.0018				
04/29/08	0.0047	0.0013	0.0275	0.0025	< 2.16	N/A	293	98
05/07/08	0.0037	0.0009	0.0301	0.0020				
05/13/08	0.0030	0.0011	0.0253	0.0022				
05/20/08	0.0025	0.0009	0.0232	0.0019				
05/27/08	0.0021	0.0009	0.0239	0.0020	<2.09	N/A		
06/03/08	0.0019	0.0009	0.0189	0.0018				
06/10/08	0.0021	0.0009	0.0137	0.0016				
06/17/08	0.0046	0.0011	0.0246	0.0020				
06/24/08	0.0030	0.0009	0.0252	0.0020				
07/01/08	0.0024	0.0009	0.0230	0.0019	<2.15	N/A		
07/08/08	0.0023	0.0008	0.0183	0.0018				
07/15/08	< 0.0012	N/A	0.0156	0.0017				
07/22/08	0.0015	0.0008	0.0200	0.0018				
07/28/08	0.0021	0.0010	0.0302	0.0023	2.27	0.99		
08/05/08	0.0016	0.0008	0.0202	0.0016				
08/12/08	0.0034	0.0009	0.0382	0.0023				
08/19/08	0.0018	0.0008	0.0293	0.0021				
08/26/08	0.0015	0.0008	0.0183	0.0018	<2.31	N/A	<201	N/A
09/02/08	0.0021	0.0008	0.0205	0.0018				
09/09/08	0.0034	0.0010	0.0301	0.0021				
09/16/08	0.0025	0.0008	0.0138	0.0015				
09/23/08	0.0035	0.0009	0.0258	0.0020				
09/30/08	0.0034	0.0009	0.0295	0.0021	<2.22	N/A	606	127
10/07/08	0.0035	0.0010	0.0440	0.0025				
10/14/08	0.0017	0.0008	0.0281	0.0021				
10/21/08	0.0066	0.0012	0.0340	0.0022				
10/28/08	0.0049	0.0011	0.0276	0.0022	<2.15	N/A	<187	N/A
11/04/08	0.0047	0.0011	0.0322	0.0023				
11/12/08	0.0027	0.0009	0.0289	0.0021				
11/18/08	0.0026	0.0010	0.0192	0.0021				
11/25/08	0.0029	0.0009	0.0282	0.0022	<2.16	N/A	202	92
12/02/08	0.0019	0.0010	0.0315	0.0023				
12/09/08	0.0043	0.0011	0.0367	0.0024				
12/16/08	0.0020	0.0007	0.0168	0.0016				
12/23/08	0.0020	0.0007	0.0217	0.0017				
12/30/08	0.0020	0.0007	0.0207	0.0017	<2.29	N/A	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Snelling, SC South Carolina Advanced Technology Park (SCT)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0035	0.0012	0.0350	0.0028				
01/09/08	0.0051	0.0012	0.0244	0.0022				
01/15/08	0.0034	0.0012	0.0217	0.0024				
01/22/08	0.0065	0.0012	0.0221	0.0020				
01/29/08	0.0078	0.0014	0.0350	0.0024	4.46	1.14	<196	N/A
02/06/08	0.0043	0.0010	0.0193	0.0017				
02/12/08	0.0073	0.0015	0.0310	0.0027				
02/19/08	0.0041	0.0010	0.0200	0.0019				
02/26/08	0.0036	0.0009	0.0209	0.0019	4.74	1.13	317	96
03/04/08	0.0040	0.0010	0.0280	0.0022				
03/11/08	0.0076	0.0013	0.0365	0.0024				
03/18/08	0.0027	0.0009	0.0220	0.0020				
03/25/08	0.0201	0.0021	0.0249	0.0022	4.38	1.14	311	98
04/01/08	0.0025	0.0009	0.0200	0.0018				
04/08/08								
04/15/08	0.0015	0.0004	0.0108	0.0009				
04/24/08	0.0033	0.0008	0.0187	0.0015				
04/29/08	0.0047	0.0013	0.0275	0.0025	3.81	1.07	206	89
05/07/08	0.0030	0.0008	0.0239	0.0017				
05/13/08	0.0022	0.0009	0.0198	0.0019				
05/20/08	0.0016	0.0007	0.0190	0.0017				
05/27/08	0.0018	0.0008	0.0196	0.0017	3.57	1.04	268	89
06/03/08	0.0013	0.0007	0.0123	0.0014				
06/10/08	0.0037	0.0010	0.0248	0.0018				
06/17/08	0.0026	0.0008	0.0224	0.0018				
06/24/08	0.0034	0.0009	0.0275	0.0019				
07/01/08	0.0029	0.0009	0.0220	0.0018	<2.15	N/A		
07/08/08	0.0018	0.0007	0.0176	0.0017				
07/15/08	< 0.0012	N/A	0.0156	0.0017				
07/22/08	0.0023	0.0008	0.0245	0.0019				
07/28/08	0.0030	0.0010	0.0276	0.0021	4.15	1.06		
08/05/08	0.0016	0.0007	0.0215	0.0016				
08/12/08	0.0033	0.0008	0.0384	0.0023				
08/19/08	0.0018	0.0008	0.0268	0.0019				
08/26/08	0.0015	0.0007	0.0207	0.0017	<2.31	N/A	<201	N/A
09/02/08	0.0011	0.0006	0.0200	0.0017				
09/09/08	0.0037	0.0009	0.0295	0.0020				
09/16/08	0.0017	0.0007	0.0130	0.0014				
09/23/08	0.0024	0.0007	0.0253	0.0018				
09/30/08	0.0029	0.0008	0.0246	0.0018	<2.22	NA	235	92
10/07/08	0.0040	0.0010	0.0422	0.0023				
10/14/08	0.0020	0.0008	0.0232	0.0018				
10/21/08	0.0068	0.0021	0.0316	0.0021				
10/28/08	0.0037	0.0009	0.0223	0.0018	2.54	1.02	545	103
11/04/08	0.0030	0.0009	0.0283	0.0021				
11/12/08	0.0022	0.0008	0.0257	0.0019				
11/18/08	0.0016	0.0009	0.0182	0.0020				
11/25/08	0.0022	0.0008	0.0257	0.0020	5.93	1.16	456	103
12/02/08	0.0016	0.0009	0.0282	0.0022				
12/09/08	0.0027	0.0010	0.0311	0.0024				
12/16/08	0.0015	0.0007	0.0184	0.0017				
12/23/08	0.0022	0.0008	0.0208	0.0018				
12/30/08	0.0017	0.0007	0.0217	0.0018	6.07	1.20	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Williston, SC (WIL), Willsiton Barricade (DKH)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/m^3	+- 2 sigma	pCi/L	+- 2 sigma
01/02/08	0.0034	0.0012	0.0253	0.0025				
01/09/08	0.0039	0.0011	0.0338	0.0025				
01/15/08	0.0036	0.0012	0.0198	0.0024				
01/22/08	0.0051	0.0012	0.0176	0.0019				
01/29/08	0.0055	0.0012	0.0246	0.0021				
02/06/08								
02/12/08								
02/19/08								
02/26/08								
03/04/08								
03/11/08								
03/18/08								
03/25/08								
04/01/08								
04/08/08								
04/15/08								
04/24/08								
04/29/08								
05/07/08								
05/13/08	0.0024	0.0012	0.0189	0.0023				
05/20/08	0.0021	0.0010	0.0175	0.0021				
05/27/08	0.0028	0.0012	0.0211	0.0023			355	92
06/03/08	0.0025	0.0012	0.0227	0.0023				
06/10/08	0.0044	0.0013	0.0234	0.0023				
06/17/08	0.0031	0.0009	0.0270	0.0020				
06/24/08	0.0032	0.0009	0.0298	0.0021				
07/01/08	0.0022	0.0009	0.0251	0.0020	4.77	1.10	359	95
07/08/08	0.0023	0.0008	0.0199	0.0018				
07/15/08								
07/22/08	0.0026	0.0009	0.0280	0.0021				
07/28/08	0.0025	0.0010	0.0324	0.0023	5.03	1.10	206	85
08/05/08	0.0015	0.0007	0.0238	0.0017				
08/12/08	0.0041	0.0009	0.0415	0.0024				
08/19/08	0.0024	0.0008	0.0320	0.0021				
08/26/08	0.0013	0.0007	0.0223	0.0018	6.92	1.27	<201	N/A
09/02/08	0.0014	0.0007	0.0221	0.0018				
09/09/08	0.0028	0.0008	0.0325	0.0021				
09/16/08	0.0024	0.0008	0.0145	0.0015				
09/23/08	0.0030	0.0008	0.0278	0.0019				
09/30/08	0.0037	0.0009	0.0267	0.0019	4.44	1.11	<193	N/A
10/07/08	0.0045	0.0010	0.0468	0.0024				
10/14/08	0.0019	0.0008	0.0284	0.0019				
10/21/08	0.0072	0.0012	0.0363	0.0022				
10/28/08	0.0051	0.0011	0.0270	0.0021	3.71	1.07	<187	N/A
11/04/08	0.0051	0.0011	0.0353	0.0023				
11/12/08	0.0036	0.0010	0.0321	0.0021				
11/18/08	0.0020	0.0009	0.0222	0.0022				
11/25/08	0.0023	0.0008	0.0316	0.0022	3.66	1.07	<188	N/A
12/02/08	0.0019	0.0009	0.0373	0.0024				
12/09/08	0.0028	0.0008	0.0316	0.0021				
12/16/08	0.0018	0.0008	0.0171	0.0016				
12/23/08								
12/30/08					<2.29	N/A	<199	N/A

Routine Radiological Atmospheric Monitoring Data, 2008

Sample Location:	Beaufort, SC (BEU)							
Date	Gross Alpha in Air		Gross Beta in Air		Tritium in Air		Tritium in Rain	
	pCi/m3	+- 2 sigma	pCi/m3	+- 2 sigma	pCi/m3	+- 2 sigma	pCi/L	+- 2 sigma
01/10/08	0.0072	0.0009	0.0127	0.0011				
01/25/08	0.0120	0.0011	0.0583	0.0020				
02/12/08	0.0036	0.0006	0.0177	0.0011				
02/25/08	0.0032	0.0006	0.0174	0.0012				
03/12/08								
03/26/08								
04/18/08	0.0039	0.0004	0.0276	0.0010				
04/29/08					6.72	1.18	< 188	N/A
05/06/08	0.0032	0.0006	0.0305	0.0015				
05/28/08	0.0023	0.0005	0.0198	0.0011	<2.09	N/A	<182	N/A
06/11/08	0.0016	0.0006	0.0111	0.0011				
07/02/08	0.0042	0.0014	0.0242	0.0025	<2.12	N/A	<184	N/A
07/17/08	0.0016	0.0005	0.0202	0.0013				
08/01/08	0.0020	0.0005	0.0233	0.0012	<2.05	N/A	<178	N/A

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1.1.5 Summary Statistics

Radiological Atmospheric Monitoring

Note:

1. Avg—Average
2. Std Dev—Standard Deviation
3. Min—Minimum
4. Max—Maximum
5. N—Number of Samples
6. LLD—Lower Limit of Detection
7. ( )—Number of Samples Below LLD

Yearly Average of Ambient TLD Beta/Gamma Summary 2008

Sample Location	Quarterly Avg	Std Dev	Min	Max	Median
	mrem	mrem	mrem	mrem	
Co-located with Aiken Air Station	19.25	2.87	17.00	23.00	18.50
E Area	33.25	1.50	32.00	35.00	33.00
Green Pond	24.00	1.63	22.00	26.00	24.00
Co-located with Jackson Air Station	20.25	2.63	18.00	24.00	19.50
Crackerneck Gate	24.00	3.16	20.00	27.00	24.50
TNX Boat Ramp	25.50	3.87	20.00	29.00	26.50
Co-located with Allendale Barricade	17.75	3.59	15.00	23.00	16.50
Junction of Millet Road and Round Tree Road	24.00	2.16	22.00	27.00	23.50
Patterson Mill road At Lower Three Runs Creek	27.00	2.58	24.00	30.00	27.00
Co-located with Allendale Air station	22.00	1.83	20.00	24.00	22.00
Barnwell Airport	22.50	2.65	20.00	26.00	22.00
Co-located with Snelling Air station	24.00	3.16	21.00	28.00	23.50
Co-located with Williston Air station	23.00	1.73	22.00	25.00	22.00
Bates cemetery	21.25	2.36	18.00	23.00	22.00
Williston Police Department	25.25	2.63	23.00	28.00	25.00
Junction of US 278 and SC 781	22.50	3.00	21.00	27.00	21.00
US 278 near Upper Three Runs Creek	25.25	2.99	21.00	28.00	26.00
Co-located with New Ellenton Air Station	21.00	3.74	17.00	26.00	20.50
Winsor Post Office	22.50	2.08	20.00	25.00	22.50
Beaufort	23.67	4.04	20.00	28.00	23.00

Summary Statistics

Statistical Review Of Radiological Monitoring at Aiken Elementary Water Tower (AIK)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52(0)	52(0)	12(4)	12(8)
Average	0.0035	0.0253	3.06	247.44
Std Dev	0.0025	0.0071	0.51	52.16
Median	0.0030	0.0247	3.11	228.10
Min	0.0013	0.0107	2.30	211.00
Max	0.0176	0.0478	3.86	322.55

Statisical Review Of Radiological Monitoring at Jackson, SC (JAK)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	51(1)	51(0)	12(2)	12(4)
Average	0.0041	0.0308	4.23	292.83
Std Dev	0.0028	0.0080	1.21	71.22
Median	0.0036	0.0307	4.12	289.45
Min	0.0013	0.0159	2.59	211.53
Max	0.0186	0.0541	6.58	414.86

Statistical Review Of Radiological Monitoring at New Ellenton, SC (NEL)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52(1)	52(0)	12(3)	11(7)
Average	0.0040	0.0293	4.49	379.06
Std Dev	0.0028	0.0076	1.33	128.89
Median	0.0033	0.0285	3.81	339.25
Min	0.0012	0.0121	3.11	277.00
Max	0.0190	0.0498	6.84	560.75

Statisical Review Of Radiological Monitoring at Burial Grounds North, SRS (BGN)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	51(1)	51(0)	12(0)	12(0)
Average	0.0037	0.0281	233.23	6257.09
Std Dev	0.0019	0.0094	88.98	3773.76
Median	0.0033	0.0271	261.49	6965.47
Min	0.0013	0.0031	91.32	1120.13
Max	0.0099	0.0550	359.65	11674.00

Statistical Review Of Radiological Monitoring at Allendale Barricade (ABR)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	50(1)	50(0)	12(5)	11(8)
Average	0.0048	0.0338	3.62	213.52
Std Dev	0.0031	0.0137	0.76	13.79
Median	0.0040	0.0327	3.84	209.00
Min	0.0010	0.0026	2.45	202.56
Max	0.0181	0.0843	4.39	229.00

Summary Statistics

Statistical Review Of Radiological Monitoring at Allendale, SC (ALN)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52(2)	52(1)	12(11)	9(6)
Average	0.0045	0.0264	One detect of 2.27	367.04
Std Dev	0.0040	0.0099	N/A	211.52
Median	0.0034	0.0252	N/A	293.00
Min	0.0015	0.0099	N/A	202.49
Max	0.0227	0.0720	N/A	605.62

Statistical Review Of Raiological Monitoring at Snelling, SC (SCT)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	52(1)	52(0)	12(3)	10(3)
Average	0.0035	0.0241	4.41	334.00
Std Dev	0.0029	0.0064	1.11	123.05
Median	0.0029	0.0228	4.38	311.00
Min	0.0011	0.0108	2.54	206.00
Max	0.0201	0.0422	6.07	545.36

Statistical Review Of Radiological Monitoring at Williston, SC (WIL), Dark Horse (DKH)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	36(0)	36(0)	7(1)	8(5)
Average	0.0031	0.0271	4.75	306.72
Std Dev	0.0013	0.0072	1.20	86.99
Median	0.0028	0.0269	4.61	355.00
Min	0.0013	0.0145	3.66	206.29
Max	0.0072	0.0468	6.92	358.86

Statistical Review Of Radiological Monitoring at Beaufort, SC (BEU)				
Analyte	Gross Alpha	Gross Beta	Tritium in Air	Tritium in Rain
Units	pCi/m3	pCi/m3	pCi/m3	pCi/L
N	11(0)	11(0)	4(3)	4(4)
Average	0.0041	0.0239	One detect of 6.72	<LLD
Std Dev	0.0031	0.0128	N/A	N/A
Median	0.0032	0.0202	N/A	N/A
Min	0.0016	0.0111	N/A	N/A
Max	0.0120	0.0583	N/A	N/A

TOC

2.1 Ambient Groundwater Monitoring Adjacent to SRS

2.1.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) samples an ambient groundwater monitoring network adjacent to the Savannah River Site (SRS) to characterize groundwater quality in the area. Radiological and non-radiological contaminants have historically been detected in some network, random background and random perimeter groundwater wells. ESOP provides this project report annually as an independent source of information concerning Department of Energy-Savannah River (DOE-SR) activities and the potential impacts of those activities to public health and the environment.

DOE-SR currently utilizes a regional monitoring network of groundwater monitoring wells. These wells, which are not routinely sampled, are maintained and sampled by various agencies. These agencies include DOE-SR, SCDHEC, South Carolina Department of Natural Resources (SCDNR), and the United States Geological Survey (USGS). ESOP has identified and considered wells in this network for inclusion in the ESOP Ambient Groundwater Monitoring Network (AGMN). For a more detailed review of background information, please refer to "A Determination of Ambient Groundwater Quality Adjacent to Savannah River Site, Annual Report 1997" (SCDHEC 1999).

The ESOP Ambient Groundwater Quality Monitoring Project (AGQMP) evaluates ambient groundwater quality adjacent to SRS. This annual evaluation is conducted to determine possible offsite groundwater impacts due to operations conducted at SRS. The following items outline the objectives of the project, as well as the importance of sampling for radionuclides throughout the groundwater well network:

- Evaluate groundwater quality adjacent to SRS
- Determine any SRS contaminant migration offsite
- Expand current ambient water quality databases
- Provide the public with independently generated, region specific, groundwater quality information.
- The study area is composed of a 10-mile perimeter extending from the SRS boundary, as well as random background and random perimeter locations found throughout the state of South Carolina.

The SCDHEC analytical laboratory data from the 2008 groundwater sampling event revealed limited contaminants present in the groundwater wells sampled and the immediate surrounding area. These groundwater wells, along with the extent of contaminants, will be detailed in Section 2.1.4 of this report. Due to the low concentrations and limited extent of the contaminants identified in these groundwater wells, it is likely the sources of these contaminants are a result of naturally occurring processes in the subsurface.

Results and Discussion

The 2008 groundwater sampling event was comprised of 27 wells. Sixteen of these wells (Section 2.1.2, Map 3) are designated as C wells and the remaining 11 are classified as random background and random perimeter wells (Map 1). Based on a review of the wet chemistry, metals, tritium, alpha-, beta-, and gamma-emitting radioisotope analytical data provided by the

SCDHEC analytical and radiological laboratories, various contaminants were detected in all of the 27 groundwater wells sampled.

Alpha activity was detected at six monitoring well locations, two of which exceeded the Environmental Protection Agency (EPA) established maximum contaminant level (MCL) for drinking water of 15 picocuries per liter (pCi/L). These wells are identified as M02305 and GWB5. The wells revealed alpha activity of 22.70 pCi/L and 29.20 pCi/L, respectively. Beta activity was detected at six monitoring well locations, two of which exceeded the MCL of 8 pCi/L. Potassium-40 was detected in 12 monitoring well locations. At this time, the EPA has not published an MCL for Potassium-40 in the drinking water standards. Tritium was detected at two random perimeter well locations. These locations are identified as GWE3X (New Ellenton) and GWE4 (Aiken). These two slightly elevated detections did not exceed the MCL drinking water standard of 20,000 pCi/L.

The 2008 groundwater sampling event revealed additional contamination in other groundwater well locations. Lead was detected at a concentration of 0.0180 milligrams per liter (mg/L) at groundwater well M02203. The concentration of lead (0.0180 mg/L) found in this well is slightly elevated over the 0.015 mg/L MCL established by the EPA. Aluminum and iron were detected in nine monitoring well locations. The EPA secondary drinking water standard for aluminum and iron is (0.05 to 0.20 mg/l) and (0.30 mg/l), respectively. Although the concentrations of aluminum and iron found in these samples indicate an exceedance of the EPA secondary drinking water standard, the EPA has not established a primary drinking water standard for aluminum and iron, as they are not considered to be a known health risk to humans.

ESOP is currently involved in an ongoing statistical study, where random background (B locations) and random perimeter (E locations) are sampled around the perimeter of the SRS as well as throughout the state of South Carolina. These sample locations are selected at random using a designated quadrant system that extends over the state of South Carolina. These samples are collected from private residential groundwater wells. This study provides ESOP an opportunity to determine if there has been any impact to the environment as a result of SRS activities. Section 2.1.2, Map 3 depicts the network groundwater well locations and the approximate extent of the study area from 2005 through 2009. The wells sampled in 2008 are depicted. ESOP evaluates five aquifer zones from the water table to confined aquifers more than 1400 feet deep (Section 2.1.3, Table 2).

Radiological Parameter Results

Samples for alpha-emitting, beta-emitting, gamma-emitting, and tritium radioisotopes were collected. Gross alpha was detected in eight of the 27 groundwater wells analyzed (Section 2.1.3, Table 3). These wells are from the network and also include random background and random perimeter locations. Two of the eight gross alpha detections exceeded the MCL. These concentrations of 22.70 pCi/L and 29.20 pCi/L were detected at groundwater wells M02305 and GWB5, respectively. The duplicate samples collected at M02305 and GWB5 also yielded exceedances of 39.80 pCi/L and 41.10 pCi/L respectively.

The presence of naturally occurring radionuclides has been well documented in the groundwater regime across the state of South Carolina. Groundwater investigations performed by state and federal agencies such as SCDHEC, SCDNR and the US Geological Survey have confirmed the presence of these radionuclides. The concentrations of gross alpha in M02305 and GWB5 are most likely due to the natural decay process of uranium deposits within the subsurface. Calculation of summary statistics revealed a gross alpha average of 35.15 pCi/L for the background population (5 groundwater wells) and an average of 6.70 pCi/L for the 16 groundwater network wells sampled during the 2008 event. These calculations reveal a gross alpha average for the network wells that is less than the average background concentration.

Non-volatile beta was detected in six of the 27 groundwater wells that were analyzed. These detections were found in 5 C-wells and 1 random background well. As the presence of naturally occurring radionuclides has been well documented in the groundwater regime across the state of South Carolina, the concentration of non-volatile beta in this well is likely due to the natural decay process of uranium deposits within the subsurface. A calculated average for gross non-volatile beta yielded an activity of 7.71 pCi/L. This activity is well below the average non-volatile beta random background of 13.59 pCi/L.

Tritium was detected in two perimeter groundwater monitoring wells. These two wells are identified as GWE3X (New Ellenton) and GWE4 (Aiken) and yielded activity of 298 pCi/L and 321 pCi/L, respectively. Neither of these wells exceeded the 20,000 pCi/L MCL for tritium. As stakeholder interests in tritium levels continue to rise (DOE 2006), tritium sampling will continue and be addressed in future project reports.

During the 2008 random groundwater sampling event, 11 groundwater wells were sampled. Of the 11 wells sampled, five of the wells are classified as random background wells and the remaining six wells are classified as random perimeter wells. These wells are located on private property (either a private residence or a church) situated around the perimeter of the SRS as well as various locations throughout the state of South Carolina. Laboratory analytical data revealed a background alpha average of 35.15 pCi/L (± 8.41) and a beta average of 13.59 (± 9.28). This average exceeds the EPA MCL of 15 pCi/L for alpha and 8 pCi/L for beta. The primary contributor to this elevated average is due to the sample collected at GWB5. The gross alpha and beta concentrations found in this sample were 29.20 pCi/L and 19.30 pCi/L, respectively. Due to the elevated concentrations found at this location, additional repeat sampling was conducted to determine if the initial concentrations are accurate. The results of the follow-up sampling indicate the gross alpha and non-volatile beta activities were below the MCL. The property owner has been informed of the latest results. The reason for the discrepancy in the two samples collected is unknown, as a result, the initial results will be used for the purposes of this report.

Statistical results from the perimeter sampling revealed an alpha average of 5.15 pCi/L. This average reflects a single detection of all of the samples collected.
Two perimeter locations (GWE3X, New Ellenton) and (GWE4, Aiken) revealed tritium activity of 298 pCi/L and 321 pCi/L respectively. Although these samples are slightly above the LLD, they do not exceed the 20,000 pCi/L MCL established by the EPA. As a result, these concentrations are not considered immediate concerns to human health.

Nonradiological Parameter Results

The presence of metals in the environment can be attributed to man-made processes such as industrial manufacturing and/or the natural decay of deposits. A review of the following metal contaminants detected indicates their presence is most likely due to the erosion of natural deposits.

Aluminum was detected in six groundwater monitoring wells. The calculated average for aluminum in these wells is 0.33 mg/L. Although the concentrations of aluminum in these wells are elevated, there is currently no primary drinking water standard for aluminum established by the EPA. The EPA secondary drinking water standard for aluminum is currently set between 0.05 and 0.20 mg/L.

Beryllium was detected in a trip blank sample at a concentration of 0.004 mg/L. This sample was collected in the South Carolina DHEC Region 5 EQC laboratory using deionized water, and was transported in the same cooler as the other samples collected during the course of the day. The EPA has established an MCL for Beryllium of 0.004 mg/L. Although the beryllium concentration found in this trip blank sample is slightly elevated, this concentration meets the MCL, but does not exceed it.

Cadmium was detected in four groundwater monitoring wells. The calculated average for cadmium in these wells is 0.000285 mg/L. The EPA has established the MCL for cadmium at 0.005 mg/L. Although the cadmium concentration found in these groundwater wells is slightly elevated, these concentrations do not exceed the MCL. There is no immediate threat to public health as these wells are used strictly for monitoring purposes and are not intended for human consumption.

Iron was detected in three groundwater monitoring wells. The calculated average for iron in these wells is 1.29 mg/L. Although iron was detected in these wells, there is currently no primary drinking water standard for iron established by the EPA. The EPA secondary drinking water standard for iron is currently set at 0.30 mg/L.

Lead was detected in five groundwater monitoring wells. The calculated average for lead in these wells is 0.009 mg/L. The EPA has established an MCL for lead at 0.015 mg/L. Although the lead concentration found in these wells is slightly elevated, there is no immediate threat to public health as these wells are used strictly for monitoring purposes and are not intended for human consumption.

Zinc was detected in 15 groundwater monitoring wells. The calculated average for zinc in these wells is 1.12 mg/L. Although zinc was detected in these wells, there is currently no primary drinking water standard for zinc established by the EPA. The EPA secondary drinking water standard for zinc is currently set at 5.0 mg/L.

Nitrate/Nitrite was detected at concentrations well below the 10 mg/L MCL in six groundwater monitoring wells. The presence of nitrate/nitrite is most likely due to the erosion of natural deposits and/or runoff from fertilizer use. Once in the soil, nitrate is mobile due to its water solubility characteristic, and therefore moves easily through the soil matrix at a speed comparable to groundwater flow velocity. Calculation revealed a nitrate/nitrite average of 0.24 mg/L of these six groundwater well locations.

ESOP and DOE-SR Data Comparison

Because DOE-SR collects groundwater samples from a separate monitoring well network, direct comparisons could not be made between ESOP and the 2008 SRS Environmental Report. However, the 2008 SRS report identifies numerous areas of groundwater contamination throughout the SRS property. These areas of impacted groundwater include: A Area, C Area, D Area, E Area, F Area, H Area, K Area, L Area, M Area, P Area, Sanitary Landfill, TNX and CMP Pits. The extent of the contamination varies and the contaminants include: trichloroethylene (TCE), perchloroethylene (PCE), tritium, gross alpha, beta, and vinyl chloride. Due to the presence of TCE, PCE and vinyl chloride in the groundwater on SRS, the ESOP groundwater project will begin sampling for these contaminants beginning in 2009.

Conclusions and Recommendations

A review of the 2008 analytical data revealed various but limited nonradiological and/or radiological constituents in all 27 groundwater wells sampled. Although several of the groundwater wells sampled during the 2008 sampling event revealed elevated concentrations and exceedances, the data suggests the extent of the contaminants is isolated and likely the result of dissolved metals and radionuclides from naturally occurring geologic formations.

The AGQMP attempted to determine if constituents, other than naturally occurring, have impacted groundwater within the AGMN. The results of the 2008 groundwater sampling event indicate several non-radiological constituents and naturally occurring radioisotopes are impacting groundwater quality in isolated regions throughout the groundwater monitoring well network. Independent monitoring of basic water quality parameters, metals, tritium, gross alpha, non-volatile beta, and gamma-emitting radioisotopes will continue throughout future annual groundwater investigations. In addition, statistical analysis of perimeter and background data along with evaluating DOE-SR groundwater monitoring data will be performed. Continued groundwater monitoring will provide a better understanding of actual groundwater quality parameters, their extent, and trends. As a result, comparisons with historical data can be made. In addition, ESOP will provide SCDHEC's Bureau of Water with groundwater data to assist in their evaluation of the extent of naturally occurring radioisotopes in the region.

During future DOE-SR groundwater sampling events, SCDHEC will request the opportunity to conduct split QA/QC (Quality Assurance/Quality Control) sampling. Split sampling at random well locations throughout the SRS groundwater well network will help provide SCDHEC further annual confirmation.

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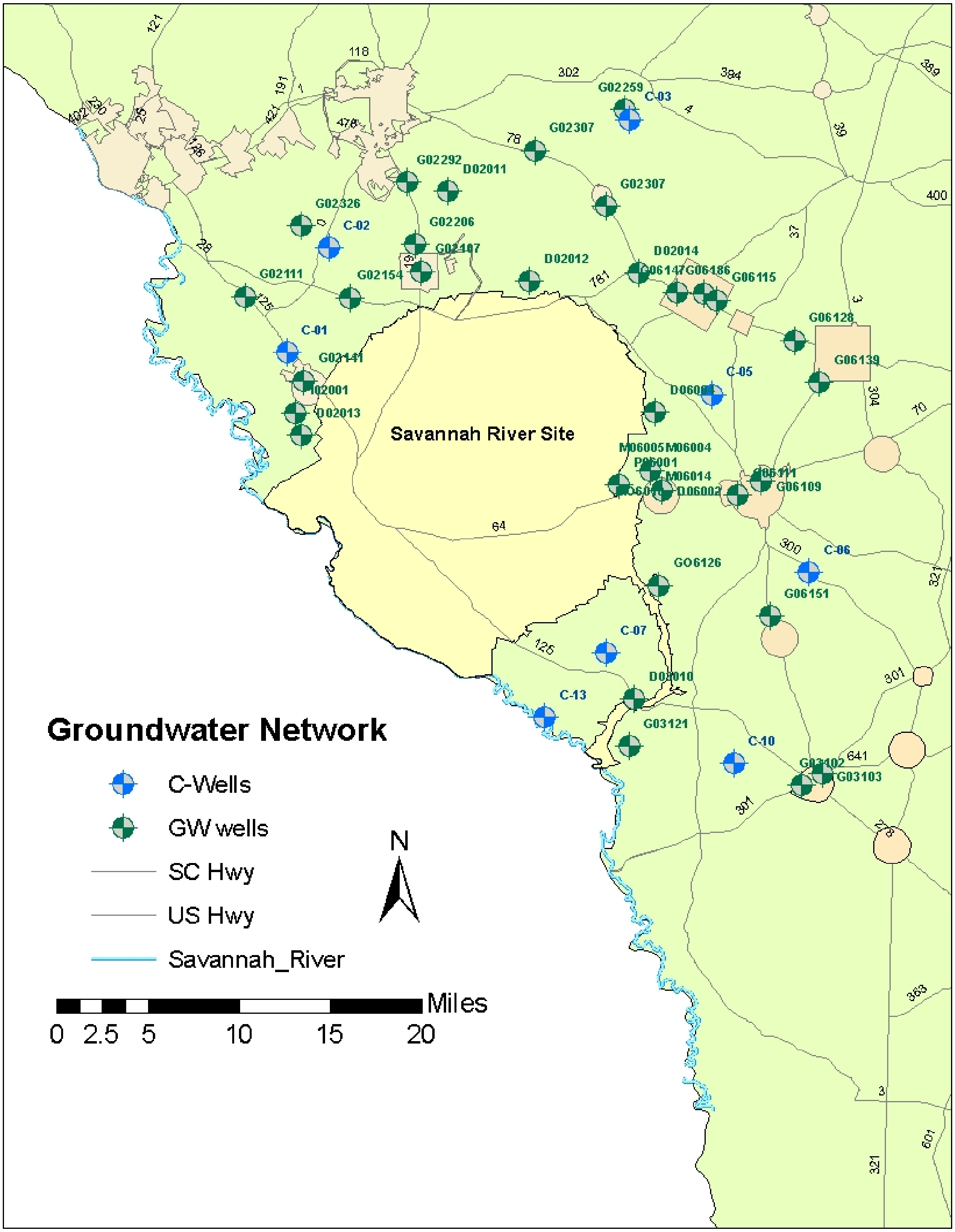
2.1.2 Maps

Map 3. Ambient Groundwater Quality Monitoring Well Network



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2.1.3 Tables and Figures

Ambient Groundwater Monitoring

Table 1. 2008 ESOP Groundwater Monitoring Well Data

Well No.	Well Name	Sample Year	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Aquifer
G02292	Hunter's Glen	2005	unknown	210	SP
G02206	Oak Hill Subdivision	2005	445	240	SP
G02107	New Ellenton	2005	421	425	CB
G06163	Mitchum MHP	2005	365	117	SP
G02259	Aiken State Park	2005	262	*	SP
G02154	Talatha Water District	2005	250	185	CB
G02141	Jackson	2005	225	105	SP
G02111	Beech Island Water District	2005	380	360	CB
G02326	ORA Site	2005	300	397	MB
D02014	Messer Well	2005	unknown	144	SP
G02307	Oakwood School	2005	428	404	CB
D02013	Cowden Plantation, Well 2	2005	124	*	SP
I02001	Cowden Plantation, Well 1	2005	132	*	CB
D02011	Mettlen Well	2005	400	180	SP
D02012	Windsome Plantation, House Well	2005	260	*	SP
G06109	Barnwell, Hwy. 3	2006	230	146	UTR
G06111	Barnwell, Rose St.	2006	220	166	UTR
G06128	Edisto Station	2006	322	360	GOR
G06147	Williston, Halford St.	2006	352	530	CB
G06113	Williston, Dewey Ct.	2006	353	125	UTR
G06115	Williston, Industrial Park	2006	360	685	MB
G06139	Barnwell State Park	2006	248	163	UTR
D06002	Moore Well	2006	240	*	UTR
P06001	Allied General Nuclear, Well 1	2006	250	*	MB
D06004	J. Williams Well	2006	245	76.15	UTR
M06004	Chem Nuclear WO0061	2006	254.52	401	CB
M06014	Chem Nuclear WO0071	2006	255.33	250	GOR
M06005	Chem Nuclear WO0067	2006	254.76	46.79	UTR
M06010	Chem Nuclear WO0069	2006	254.28	145	UTR
D03010	Martin Post Office	2007	108	105	UTR
I03002	Williams Grocery	2007	138	*	UTR
G03102	Allendale, Water St.	2007	201	343	UTR
G03103	Allendale, Googe St.	2007	180	347	UTR
G03112	Allendale Welcome Center	2007	143	100	UTR
G06151	Chappels Labor Camp	2007	250	260	UTR
G03121	Clariant	2007	180	812	CB
G03115	Whitlock Combing	2007	166	800	CB
G06126	Starmet (Carolina Metals)	2007	200	323	GOR

Tables and Figures

Ambient Groundwater Monitoring

Table 1. (continued) 2008 ESOP Groundwater Monitoring Well Data

Well No.	Well Name	Sample Year	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Aquifer
M02101	SCDNR Cluster C-01, AIK-2378	**2008**	220.3	185	CB
M02102	SCDNR Cluster C-01, AIK-2379	**2008**	224.2	266	CB
M02103	SCDNR Cluster C-01, AIK-2380	**2008**	228.9	385	MB
M02104	SCDNR Cluster C-01, AIK-902	**2008**	231.9	511	MB
M02202	SCDNR Cluster C-02, AIK-825	**2008**	418.8	231	CB
M02203	SCDNR Cluster C-02, AIK-824	**2008**	418.6	365	CB
M02204	SCDNR Cluster C-02, AIK-818	**2008**	418.3	425	MB
M02205	SCDNR Cluster C-02, AIK-817	**2008**	418.9	535	MB
M02301	SCDNR Cluster C-03, AIK-849	**2008**	301.6	97	SP
M02302	SCDNR Cluster C-03, AIK-848	**2008**	299.7	131	CB
M02303	SCDNR Cluster C-03, AIK-847	**2008**	299.0	193	CB
M02304	SCDNR Cluster C-03, AIK-846	**2008**	297.8	255	CB
M02305	SCDNR Cluster C-03, AIK-845	**2008**	296.9	356	MB
M02306	SCDNR Cluster C-03, AIK-826	**2008**	294.9	500	MB
M06501	SCDNR Cluster C-05, BRN-360	**2008**	264.3	140	UTR
M06502	SCDNR Cluster C-05, BRN-359	**2008**	265.5	214	GOR
M06503	SCDNR Cluster C-05, BRN-367	**2008**	263.8	285	GOR
M06504	SCDNR Cluster C-05, BRN-368	**2008**	265.1	443	CB
M06505	SCDNR Cluster C-05, BRN-365	**2008**	263.5	539	CB
M06506	SCDNR Cluster C-05, BRN-366	**2008**	266.7	715	MB
M06507	SCDNR Cluster C-05, BRN-358	**2008**	265.6	847	MB
M03706	SCDNR Cluster C-07, ALL-368	2009	246.6	691	CB
M03707	SCDNR Cluster C-07, ALL-369	2009	242.1	800	CB
M03708	SCDNR Cluster C-07, ALL-370	2009	245.1	975	MB
M03709	SCDNR Cluster C-07, ALL-358	2009	243.1	1123	MB
M03131	SCDNR Cluster C-13, Artesian	2009	80	*	GOR
M03132	SCDNR Cluster C-13, ALL-378	2009	90	1060	MB
M03701	SCDNR Cluster C-07, ALL-363	2009	246.1	105	UTR
M03702	SCDNR Cluster C-07, ALL-364	2009	245.2	225	UTR
M03703	SCDNR Cluster C-07, ALL-365	2009	244.3	333	GOR
M03704	SCDNR Cluster C-07, ALL-366	2009	243.5	400	GOR
M03705	SCDNR Cluster C-07, ALL-367	2009	245.7	566	CB
M06601	SCDNR Cluster C-06, BRN-351	2009	207.3	95	UTR
M06602	SCDNR Cluster C-06, BRN-350	2009	207.4	170	UTR
M06603	SCDNR Cluster C-06, BRN-352	2009	207.1	293	GOR

Tables and Figures

Ambient Groundwater Monitoring

Table 1. (continued) 2008 ESOP Groundwater Monitoring Well Data

Well No.	Well Name	Sample Year	Top of Casing Elevation (ft amsl)	Total Depth (ft bgs)	Aquifer
M06604	SCDNR Cluster C-06, BRN-354	2009	207.6	411	GOR
M06605	SCDNR Cluster C-06, BRN-353	2009	207.7	588	CB
M06608	SCDNR Cluster C-06, BRN-349	2009	208.6	1045	MB
M03101	SCDNR Cluster C-10, ALL-347	2009	281.6	1423	MB
M03102	SCDNR Cluster C-10, ALL-372	2009	282.0	155	UTR
M03103	SCDNR Cluster C-10, ALL-371	2009	282.2	217	UTR
M03104	SCDNR Cluster C-10, ALL-374	2009	280.9	580	GOR

Notes: * - Total depth unknown, Aquifer assigned based on owner information
ft amsl – feet above mean sea level
ft bgs – feet below ground surface
UTR – Upper Three Runs
CB – Crouch Branch
SP – Steeds Pond
GOR – Gordon
MB- McQueen Branch

Tables and Figures

Ambient Groundwater Monitoring

Table 2. Summary of the Stratigraphy and Hydrostratigraphy of the Study Area

<table>
<tr><th>PERIOD/EPOCH</th><th>GROUP</th><th>FORMATION</th><th colspan="2">HYDROLOGIC UNIT</th></tr>
<tr><td>Middle Miocene</td><td>Cooper</td><td>Upland Unit</td><td colspan="2">Unsaturated Zone</td></tr>
<tr><td rowspan="6">Tertiary /
Eocene</td><td rowspan="2">Barnwell</td><td>Tobacco Road</td><td rowspan="6">Steed Pond Aquifer (SP)</td><td rowspan="3">Upper Three Runs Aquifer (UTR)</td></tr>
<tr><td>Dry Branch/Clinchfield</td></tr>
<tr><td rowspan="3">Orangeburg</td><td>Tinker/Santee</td></tr>
<tr><td>Warley Hill</td><td>Gordon Confining Unit</td></tr>
<tr><td>Congaree</td><td rowspan="2">Gordon Aquifer (GOR)</td></tr>
<tr><td rowspan="3">Black Mingo</td><td>Fourmile</td></tr>
<tr><td rowspan="2">Tertiary /
Paleocene</td><td>Snapp</td><td colspan="2" rowspan="2">Crouch Branch Confining Unit</td></tr>
<tr><td>Lang Syne/Sawdust Landing</td></tr>
<tr><td rowspan="3">Late
Cretaceous</td><td rowspan="3">Lumbee</td><td>Steel Creek</td><td colspan="2">Crouch Branch Aquifer (CB)</td></tr>
<tr><td>Black Creek</td><td colspan="2">McQueen Branch Confining Unit</td></tr>
<tr><td>Middendorf</td><td colspan="2">McQueen Branch Aquifer (MB)</td></tr>
<tr><td rowspan="2">Paleozoic or Precambrian</td><td rowspan="2"></td><td>Cape Fear</td><td colspan="2">Appleton Confining System</td></tr>
<tr><td>Crystalline Basement</td><td colspan="2">Piedmont Hydrogeologic Province</td></tr>
</table>

Tables and Figures

Ambient Groundwater Monitoring

Table 3. Summary of Contaminants Detected Above an Established Drinking Water MCL in 2008

Well No.	Well Name	Analyte	MCL	Activity/ Concentration	Aquifer
M02302	N/A	Aluminum	0.05 to 0.20 mg/L*	0.270 mg/L	CB
M02203	N/A	Lead	0.015 mg/L	0.0180 mg/L	CB
M02305	N/A	Aluminum	0.05 to 0.20 mg/L*	0.21 mg/L	MB
M06507	N/A	Aluminum	0.05 to 0.20 mg/L*	0.12 mg/L	MB
M06506	N/A	Aluminum	0.05 to 0.20 mg/L*	0.17 mg/L	MB
M06501	N/A	Aluminum	0.05 to 0.20 mg/L*	1.00 mg/L	UTR
M06502	N/A	Aluminum	0.05 to 0.20 mg/L*	0.20 mg/L	GOR
M06507	N/A	Iron	0.3 mg/L*	0.440 mg/L	MB
M06506	N/A	Iron	0.3 mg/L*	0.540 mg/L	MB
M06501	N/A	Iron	0.3 mg/L*	2.90 mg/L	UTR
M02305	N/A	Gross Alpha	15 pCi/L	22.70 pCi/L	MB
GWB5	N/A	Gross Alpha	15 pCi/L	29.20 pCi/L	Unknown
M02305	N/A	Beta	8 pCi/L	11.10 pCi/L	MB
GWB5	N/A	Beta	8 pCi/L	19.30 pCi/L	Unknown
GWE3X	New Ellenton	Tritium	20,000 pCi/L	298 pCi/L	Unknown
GWE4	Aiken	Tritium	20,000 pCi/L	321 pCi/L	Unknown

Notes: * - Indicates USEPA secondary drinking water standard
N/A – Not applicable

Tables and Figures

Ambient Groundwater Monitoring

Figure 1. Gross Alpha Activity

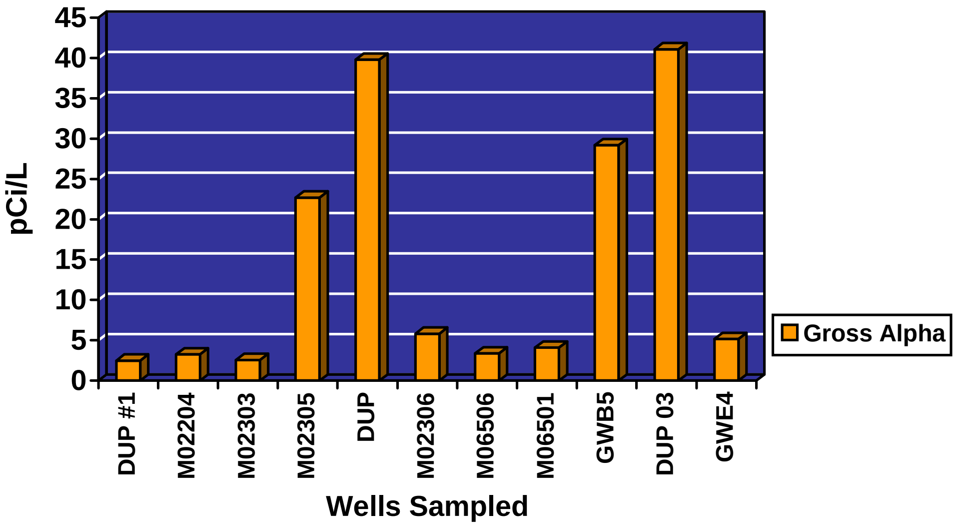
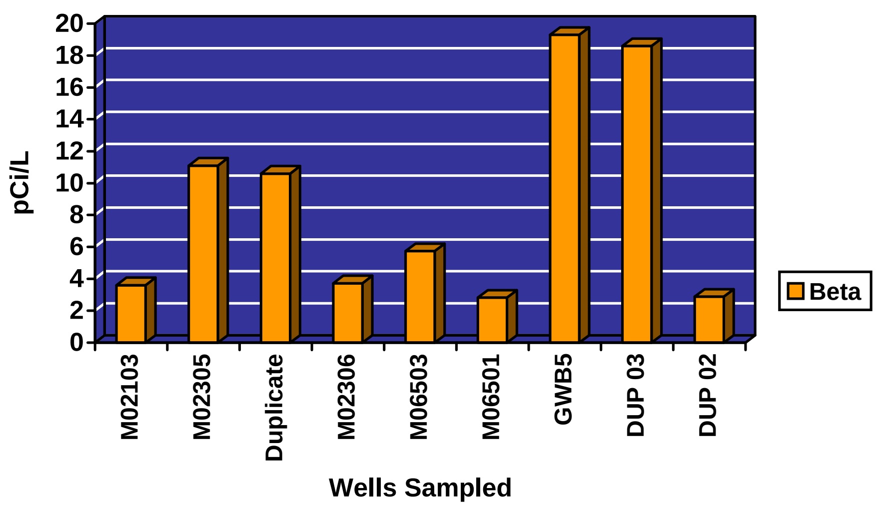


Figure 2. Beta Activity



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2.1.4 Data

Ambient Groundwater Monitoring

Notes:
1. Bold numbering denote a detection
2. A blank field following ±2 SIGMA occurs when the sample is <LLD.
3. LLD= Lower Limit of Detection
4. MDA= Minimum Detectable Activity
5. Dark shaded boxes indicate exceedance of the MCL
6. Source: http://www.epa.gov/safewater/contaminants/index.html

2.1.4 Data

Ambient Groundwater Data

2008 Radiological Data

Location Description	M02101	M02102	Trip Blank 01	Duplicate #1	M02103	M02104	M02202	M02204	M02203	M02302
Collection Date	4/21/2008	4/21/2008	4/21/2008	4/21/2008	4/22/2008	4/22/2008	4/23/2008	4/23/2008	4/24/2008	5/5/2008
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Be-7 MDA	24.70	24.10	26.85	27.48	26.80	25.51	25.89	24.93	25.84	20.77
Na-22 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Na-22 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Na-22 MDA	1.92	2.25	2.15	1.73	2.35	2.02	1.98	2.06	1.99	1.79
K-40 Activity	**129.80**	**122.00**	**123.30**	**108.10**	**126.20**	**116.70**	**127.70**	**118.70**	<MDA	**115.80**
K-40 Confidence Interval	28.25	29.50	30.90	27.08	28.97	30.89	26.82	29.35	NA	24.14
K-40 MDA	17.88	17.40	20.79	17.14	16.89	19.28	18.36	19.05	41.39	18.82
Mn-54 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Mn-54 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mn-54 MDA	2.45	2.27	2.27	2.27	2.39	2.29	2.02	2.15	2.23	2.07
Co-58 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Co-58 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Co-58 MDA	2.32	2.34	2.67	2.34	2.58	2.48	2.59	2.55	2.62	2.28
Co-60 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Co-60 MDA	2.40	1.92	1.85	1.85	1.57	2.00	2.00	1.99	2.10	1.78
Zn-65 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zn-65 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn-65 MDA	4.67	4.61	4.82	4.24	4.12	4.38	4.37	4.48	4.58	4.18
Y-88 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Y-88 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Y-88 MDA	2.36	2.20	2.29	2.30	2.32	1.98	2.28	2.24	2.48	1.84
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zr-95 MDA	4.52	5.32	5.35	4.33	4.92	4.98	4.82	4.28	5.15	4.16
Ru-103 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ru-103 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ru-103 MDA	3.51	3.38	3.75	3.27	3.57	3.65	3.53	3.40	3.53	2.90
Sb-125 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Sb-125 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sb-125 MDA	6.78	6.86	6.69	6.15	7.17	6.36	6.96	6.41	6.51	6.17
I-131 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-131 MDA	20.09	21.00	27.74	24.56	24.23	26.65	24.65	25.16	23.52	15.43
Cs-134 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-134 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cs-134 MDA	2.17	2.20	2.14	2.06	2.16	2.40	2.25	2.10	2.31	1.84
Cs-137 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cs-137 MDA	2.44	2.32	2.35	2.13	2.34	2.31	2.06	2.22	2.15	2.06
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ce-144 MDA	24.48	23.90	24.82	22.87	24.15	25.70	24.18	24.21	25.04	22.75
Eu-152 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-152 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eu-152 MDA	7.21	7.29	7.47	7.10	7.82	7.91	7.39	7.50	7.30	7.35
Eu-154 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-154 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eu-154 MDA	5.35	6.28	5.96	4.73	6.11	5.59	5.48	5.70	5.53	4.98
Eu-155 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-155 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eu-155 MDA	11.98	11.60	12.00	10.95	12.08	12.04	12.09	11.59	12.13	11.20
Pb-212 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-212 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pb-212 MDA	5.77	5.62	5.49	5.00	5.46	5.67	5.57	5.77	5.84	5.32
Pb-214 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-214 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pb-214 MDA	5.97	5.77	6.17	5.11	5.57	6.29	5.91	5.72	6.22	5.58
Ra-226 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ra-226 MDA	72.79	75.00	76.00	68.54	72.88	71.91	74.84	75.73	73.52	69.26
Ac-228 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ac-228 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ac-228 MDA	9.78	9.93	10.16	9.25	10.24	10.12	9.49	9.81	9.88	9.09
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	75.51	76.30	73.77	66.61	75.67	73.78	73.13	73.87	74.63	70.62
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Am-241 MDA	23.35	23.00	22.93	21.19	22.22	22.57	21.89	23.27	23.71	21.02

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Location Description	M02303	M02305	Duplicate	M02306	M06507	M06506	M06503	M06501	M06502	Trip Blank 02
Collection Date	5/5/2008	5/6/2008	5/6/2008	5/7/2008	6/3/2008	6/3/2008	6/4/2008	6/4/2008	6/9/2008	6/9/2008
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Be-7 MDA	20.11	24.15	25.60	23.72	32.78	32.09	34.33	35.66	32.11	32.75
Na-22 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Na-22 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Na-22 MDA	1.57	1.98	2.44	2.11	2.11	2.16	1.85	2.05	2.15	2.28
K-40 Activity	**75.62**	**99.91**	**142.90**	**111.60**	**122.90**	<MDA	<MDA	<MDA	<MDA	<MDA
K-40 Confidence Interval	19.02	26.65	29.43	28.85	27.48	NA	NA	NA	NA	NA
K-40 MDA	14.55	19.72	15.83	18.59	18.82	45.34	19.50	43.37	43.36	43.65
Mn-54 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Mn-54 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mn-54 MDA	1.58	2.15	2.37	2.06	2.12	2.17	2.25	2.27	2.07	2.17
Co-58 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Co-58 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Co-58 MDA	1.88	2.43	2.52	2.56	2.95	3.01	2.92	2.91	2.85	3.10
Co-60 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Co-60 MDA	1.38	2.01	1.80	2.05	1.88	1.76	2.04	2.03	1.82	1.94
Zn-65 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zn-65 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zn-65 MDA	3.29	4.15	4.05	4.34	3.73	4.42	4.82	4.52	4.20	4.86
Y-88 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Y-88 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Y-88 MDA	1.61	2.08	2.30	2.09	2.22	2.21	1.84	2.71	2.05	2.32
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zr-95 MDA	3.84	4.63	5.00	4.53	5.64	6.08	5.53	5.80	6.19	5.13
Ru-103 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ru-103 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ru-103 MDA	2.43	3.07	3.35	3.27	4.80	5.13	4.92	5.06	4.87	4.35
Sb-125 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Sb-125 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sb-125 MDA	5.72	6.94	6.62	6.95	7.09	6.28	7.07	7.20	7.08	6.87
I-131 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-131 MDA	12.59	15.64	16.71	15.01	99.65	121.30	103.10	130.20	88.47	89.92
Cs-134 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-134 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cs-134 MDA	1.86	2.08	2.00	2.17	2.21	2.08	2.16	2.16	2.13	2.04
Cs-137 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cs-137 MDA	1.89	2.42	2.68	2.14	2.43	2.20	2.33	2.27	2.23	2.31
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ce-144 MDA	19.93	24.06	24.59	24.70	26.05	25.08	25.15	26.30	25.86	24.95
Eu-152 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-152 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eu-152 MDA	5.84	7.34	7.48	7.44	7.21	7.43	7.83	7.16	7.01	7.14
Eu-154 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-154 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eu-154 MDA	4.34	5.51	6.56	5.89	5.74	5.92	5.08	5.65	5.94	6.26
Eu-155 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-155 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Eu-155 MDA	9.87	12.02	12.53	11.56	11.61	12.61	11.95	12.01	11.54	12.00
Pb-212 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-212 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pb-212 MDA	4.36	5.57	5.83	5.33	5.77	5.84	5.62	5.95	5.51	5.35
Pb-214 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-214 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pb-214 MDA	4.75	6.23	6.80	6.07	6.08	5.79	5.70	5.60	5.96	6.31
Ra-226 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ra-226 MDA	57.65	65.77	66.10	71.51	72.77	74.42	72.96	75.37	74.61	72.72
Ac-228 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ac-228 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ac-228 MDA	8.39	11.26	11.23	11.05	10.69	10.26	10.06	10.13	9.50	9.43
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	61.83	73.14	76.11	75.94	74.07	76.65	74.82	73.42	76.11	73.62
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Am-241 MDA	18.95	23.45	22.87	22.09	22.47	22.29	23.91	23.50	23.19	23.41

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Location Description	GWB2X	GWB3	GWB4	GWB5	GWB6
Collection Date	8/6/2008	8/25/2008	8/14/2008	9/9/2008	10/28/2008
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval	NA	NA	NA	NA	NA
Be-7 MDA	38.19	30.95	39.18	35.91	22.06
Na-22 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Na-22 Confidence Interval	NA	NA	NA	NA	NA
Na-22 MDA	2.01	1.83	2.35	2.03	1.75
K-40 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
K-40 Confidence Interval	NA	NA	NA	NA	NA
K-40 MDA	41.70	42.55	40.47	29.32	27.09
Mn-54 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Mn-54 Confidence Interval	NA	NA	NA	NA	NA
Mn-54 MDA	2.20	2.32	2.04	2.00	1.52
Co-58 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Co-58 Confidence Interval	NA	NA	NA	NA	NA
Co-58 MDA	3.37	2.98	3.38	3.57	2.19
Co-60 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Co-60 Confidence Interval	NA	NA	NA	NA	NA
Co-60 MDA	1.75	1.78	2.14	1.58	1.65
Zn-65 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Zn-65 Confidence Interval	NA	NA	NA	NA	NA
Zn-65 MDA	4.78	4.21	5.08	3.90	3.61
Y-88 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Y-88 Confidence Interval	NA	NA	NA	NA	NA
Y-88 MDA	2.81	2.37	2.46	2.30	1.79
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval	NA	NA	NA	NA	NA
Zr-95 MDA	7.04	6.12	6.39	6.74	4.41
Ru-103 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Ru-103 Confidence Interval	NA	NA	NA	NA	NA
Ru-103 MDA	6.20	4.87	5.72	7.12	3.12
Sb-125 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Sb-125 Confidence Interval	NA	NA	NA	NA	NA
Sb-125 MDA	6.16	6.89	6.33	5.13	5.37
I-131 Activity	<MDA	<MDA	<MDA	Lab Error	<MDA
I-131 Confidence Interval	NA	NA	NA	NA	NA
I-131 MDA	449.30	115.30	435.60	NA	37.79
Cs-134 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-134 Confidence Interval	NA	NA	NA	NA	NA
Cs-134 MDA	2.27	2.28	2.19	1.82	1.69
Cs-137 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-137 Confidence Interval	NA	NA	NA	NA	NA
Cs-137 MDA	2.11	2.22	2.05	1.83	1.67
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval	NA	NA	NA	NA	NA
Ce-144 MDA	26.08	25.67	26.33	18.07	15.91
Eu-152 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-152 Confidence Interval	NA	NA	NA	NA	NA
Eu-152 MDA	7.07	7.56	7.67	5.49	5.21
Eu-154 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-154 Confidence Interval	NA	NA	NA	NA	NA
Eu-154 MDA	5.51	5.05	6.26	3.94	4.28
Eu-155 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-155 Confidence Interval	NA	NA	NA	NA	NA
Eu-155 MDA	12.04	12.08	11.79	7.08	6.55
Pb-212 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-212 Confidence Interval	NA	NA	NA	NA	NA
Pb-212 MDA	5.40	5.67	5.90	3.80	3.80
Pb-214 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-214 Confidence Interval	NA	NA	NA	NA	NA
Pb-214 MDA	5.52	5.58	6.00	4.98	4.59
Ra-226 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Ra-226 Confidence Interval	NA	NA	NA	NA	NA
Ra-226 MDA	73.00	73.87	73.00	57.49	54.56
Ac-228 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Ac-228 Confidence Interval	NA	NA	NA	NA	NA
Ac-228 MDA	9.61	9.27	10.08	8.40	8.42
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA
U/Th-238 MDA	75.94	74.79	72.74	50.41	51.73
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval	NA	NA	NA	NA	NA
Am-241 MDA	22.81	22.75	22.32	12.63	12.51

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Location Description	GWE1X	GWE2	GWE3X	GWE4	GWE5	GWE6
Collection Date	8/6/2008	8/11/2008	8/12/2008	8/12/2008	8/11/2008	8/18/2008
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval	NA	NA	NA	NA	NA	NA
Be-7 MDA	40.40	38.97	35.80	35.66	41.62	35.06
Na-22 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Na-22 Confidence Interval	NA	NA	NA	NA	NA	NA
Na-22 MDA	2.25	1.91	2.21	1.77	2.09	2.01
K-40 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
K-40 Confidence Interval	NA	NA	NA	NA	NA	NA
K-40 MDA	44.10	43.59	17.39	42.97	45.11	44.56
Mn-54 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Mn-54 Confidence Interval	NA	NA	NA	NA	NA	NA
Mn-54 MDA	2.32	2.08	2.29	2.14	2.31	2.32
Co-58 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Co-58 Confidence Interval	NA	NA	NA	NA	NA	NA
Co-58 MDA	3.09	3.59	3.48	3.32	3.06	3.27
Co-60 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA
Co-60 MDA	1.93	1.82	2.02	1.92	1.90	2.04
Zn-65 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zn-65 Confidence Interval	NA	NA	NA	NA	NA	NA
Zn-65 MDA	4.47	4.96	4.76	4.59	5.49	4.76
Y-88 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Y-88 Confidence Interval	NA	NA	NA	NA	NA	NA
Y-88 MDA	2.31	3.08	2.45	2.59	3.03	2.34
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval	NA	NA	NA	NA	NA	NA
Zr-95 MDA	6.60	7.25	6.53	6.78	6.40	5.94
Ru-103 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ru-103 Confidence Interval	NA	NA	NA	NA	NA	NA
Ru-103 MDA	6.96	6.11	5.51	5.62	5.85	5.13
Sb-125 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Sb-125 Confidence Interval	NA	NA	NA	NA	NA	NA
Sb-125 MDA	6.58	6.70	6.65	6.46	6.80	6.66
I-131 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA
I-131 MDA	492.80	552.60	323.50	271.80	364.50	174.50
Cs-134 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-134 Confidence Interval	NA	NA	NA	NA	NA	NA
Cs-134 MDA	2.03	2.36	2.11	2.10	2.21	2.25
Cs-137 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA
Cs-137 MDA	2.22	2.35	2.35	1.97	2.44	2.39
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval	NA	NA	NA	NA	NA	NA
Ce-144 MDA	27.24	26.71	25.60	26.12	26.51	26.03
Eu-152 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-152 Confidence Interval	NA	NA	NA	NA	NA	NA
Eu-152 MDA	7.56	7.16	7.23	7.15	6.82	7.23
Eu-154 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-154 Confidence Interval	NA	NA	NA	NA	NA	NA
Eu-154 MDA	6.17	5.20	6.05	4.84	5.72	5.52
Eu-155 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Eu-155 Confidence Interval	NA	NA	NA	NA	NA	NA
Eu-155 MDA	11.75	12.35	11.82	11.82	12.05	12.02
Pb-212 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-212 Confidence Interval	NA	NA	NA	NA	NA	NA
Pb-212 MDA	5.71	5.61	5.59	5.60	5.66	5.79
Pb-214 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-214 Confidence Interval	NA	NA	NA	NA	NA	NA
Pb-214 MDA	6.13	5.62	5.72	5.88	5.56	5.83
Ra-226 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA
Ra-226 MDA	75.23	72.11	73.75	71.58	70.43	75.83
Ac-228 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ac-228 Confidence Interval	NA	NA	NA	NA	NA	NA
Ac-228 MDA	9.66	9.63	9.87	9.63	9.31	10.09
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	73.15	72.84	74.30	72.75	76.28	78.23
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA
Am-241 MDA	23.11	22.45	22.19	23.38	23.37	23.14

Ambient Groundwater Data

2008 Radiological Data

Location Description	M02101	M02102	Trip Blank 01	Duplicate #1	M02103	M02104	M02202
Collection Date	4/21/2008	4/21/2008	4/21/2008	4/21/2008	4/22/2008	4/22/2008	4/23/2008
Alpha Activity	<LLD	<LLD	<LLD	**2.48**	<LLD	<LLD	<LLD
Alpha Confidence Interval	NA	NA	NA	1.45	NA	NA	NA
Alpha LLD	2.05	2.12	2.03	2.20	2.16	2.14	2.15
Beta Activity	<LLD	<LLD	<LLD	<LLD	**3.60**	<LLD	<LLD
Beta Confidence Interval	NA	NA	NA	NA	1.30	NA	NA
Beta LLD	2.01	2.02	2.01	2.03	2.03	2.02	2.02

Network Wells

Location Description	M02203	M02204	M02302	M02303	M02305	Duplicate	M02306
Collection Date	4/24/2008	4/23/2008	5/5/2008	5/5/2008	7/30/2008	5/6/2008	5/7/2008
Alpha Activity	<LLD	**3.26**	<LLD	**2.56**	**22.70**	**39.80**	**5.82**
Alpha Confidence Interval	NA	1.49	NA	1.52	3.28	3.87	1.86
Alpha LLD	2.17	2.11	2.90	2.41	2.64	2.45	2.45
Beta Activity	<LLD	<LLD	<LLD	<LLD	**11.10**	**10.60**	**3.72**
Beta Confidence Interval	NA	NA	NA	NA	2.62	2.00	1.52
Beta LLD	2.03	2.02	2.58	2.51	4.24	2.52	2.52

Network Wells

Location Description	M06507	M06506	M06503	M06501	M06502	Trip Blank 02
Collection Date	6/3/2008	6/3/2008	6/4/2008	6/4/2008	6/9/2008	6/9/2008
Alpha Activity	<LLD	**3.36**	<LLD	4.08	<LLD	<LLD
Alpha Confidence Interval	NA	1.58	NA	1.97	NA	NA
Alpha LLD	2.44	2.32	2.98	2.92	4.00	2.52
Beta Activity	<LLD	<LLD	**5.74**	**2.82**	<LLD	<LLD
Beta Confidence Interval	NA	NA	1.66	1.52	NA	NA
Beta LLD	2.57	2.55	2.63	2.63	2.70	2.58

Network Wells

Location Description	GWB2X	GWB3	GWB4	GWB5	Duplicate 03	GWB6	Duplicate 02	Trip Blank 03
Collection Date	8/6/2008	8/25/2008	8/14/2008	9/9/2008	9/9/2008	10/28/2008	10/28/2008	10/28/2008
Alpha Activity	<LLD	<LLD	<LLD	**29.20**	**41.10**	<LLD	<LLD	<LLD
Alpha Confidence Interval	NA	NA	NA	3.71	4.49	NA	NA	NA
Alpha LLD	5.71	4.30	9.37E+00	2.78	2.99	2.75	2.76	2.33
Beta Activity	<LLD	<LLD	<LLD	**19.30**	**18.60**	<LLD	**2.88**	<LLD
Beta Confidence Interval	NA	NA	NA	2.36	2.39	NA	1.40	NA
Beta LLD	2.82	2.77	6.94	2.46	2.49	2.34	2.35	2.29

Background Wells

Location Description	GWE1X	GWE2	GWE3X	GWE4	GWE5	GWE6
Collection Date	8/6/2008	8/11/2008	8/12/2008	8/12/2008	8/11/2008	8/18/2008
Alpha Activity	<LLD	<LLD	<LLD	**5.15**	<LLD	<LLD
Alpha Confidence Interval	NA	NA	NA	1.76	NA	NA
Alpha LLD	4.15	2.37	2.29	2.37	4.09	2.31
Beta Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Beta Confidence Interval	NA	NA	NA	NA	NA	NA
Beta LLD	2.76	2.60	2.58	2.60	2.76	2.59

Perimeter Wells

Ambient Groundwater Data

2008 Radiological Data

Location Description	M02101	M02102	Trip Blank 01	Duplicate #1	M02103	M02104	M02202
Collection Date	4/21/2008	4/21/2008	4/21/2008	4/21/2008	4/22/2008	4/22/2008	4/23/2008
Tritium Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tritium Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Tritium LLD	191	191	191	198	191	191	191

Network Wells

Location Description	M02204	M02203	M02302	M02303	M02305	Duplicate	M02306
Collection Date	4/23/2008	4/24/2008	5/5/2008	5/5/2008	5/6/2008	5/6/2008	5/7/2008
Tritium Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tritium Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Tritium LLD	191	191	198	198	198	198	198

Network Wells

Location Description	M06507	M06506	M06503	M06501	M06502	Trip Blank 02
Collection Date	6/3/2008	6/3/2008	6/4/2008	6/4/2008	6/9/2008	6/9/2008
Tritium Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tritium Confidence Interval	NA	NA	NA	NA	NA	NA
Tritium LLD	188	188	188	188	188	188

Network Wells

Location Description	GWB2X (Furman)	GWB3 (Felderville)	GWB4 (James Is.)	GWB5 (Carlisle)
Collection Date	8/6/2008	8/25/2008	8/14/2008	9/9/2008
Tritium Activity	<LLD	<LLD	<LLD	<LLD
Tritium Confidence Interval	NA	NA	NA	NA
Tritium LLD	200	200	200	200

Background Wells

Location Description	GWB6 (Antreville)	Duplicate 02	Duplicate 03
Collection Date	10/28/2008	10/28/2008	9/9/2008
Tritium Activity	<LLD	<LLD	<LLD
Tritium Confidence Interval	NA	NA	NA
Tritium LLD	200	200	200

Background Wells

Location Description	GWE4 (Aiken)	GWE5 (Ehrhardt)	GWE6 (Foxtown)
Collection Date	8/12/2008	8/11/2008	8/18/2008
Tritium Activity	**321**	<LLD	<LLD
Tritium Confidence Interval	94	NA	NA
Tritium LLD	187	187	187

Perimeter Wells

Location Description	GWE1X (Furman)	GWE2 (Barnwell)	GWE3X (New Ellenton)
Collection Date	8/6/2008	8/11/2008	4/21/2008
Tritium Activity	<LLD	<LLD	**268**
Tritium Confidence Interval	NA	NA	93
Tritium LLD	187	187	187

Perimeter Wells

Ambient Groundwater Monitoring

2008 Nonradiological Data

Location Description	M02101	M02102	Trip Blank 01	Duplicate #1	M02103	M02104	M02202
Collection Date	4/21/2008	4/21/2008	4/21/2008	4/21/2008	4/22/2008	4/22/2008	4/23/2008
Field Water Quality Data							
pH	4.81	5.36		5.36	5.51	5.40	4.83
Conductivity	0.020	0.015		0.015	0.018	0.018	0.022
Turbitity	0.00	2.00		2.00	0.00	0.00	0.00
Dissolved Oxygen	4.03	6.70		6.70	7.03	6.18	5.67
Temperature ©	19.40	19.50		19.50	19.70	19.60	18.70
Analyte							
Ammonia (mg/L)	<0.050	0.1	0.1	0.1	<0.050	<0.050	<0.050
Nitrate/Nitrite (mg/L)	0.110	0.110	<0.020	0.110	<0.020	0.033	1.100
Total Organic Carbon (mg/L)	2.8	2.0	<2.0	3.1	2.4	<2.0	<2.0
Ortho Phosphate (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chloride (mg/L)	1.8	1.7	<1.0	1.8	1.8	1.7	1.9
Sulfate, Turbidimetric (mg/L)	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Aluminum (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Barium (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Beryllium (mg/L)	<0.0030	<0.0030	0.004	<0.0030	<0.0030	<0.0030	<0.0030
Boron (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium (mg/L)	1.80	0.87	0.09	1.80	1.30	0.40	1.50
Chromium (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Copper (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010
Iron (mg/L)	0.046	0.030	<0.020	0.033	<0.020	0.250	0.110
Magnesium (mg/L)	0.220	0.140	<0.050	0.230	0.200	0.160	0.320
Manganese (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Mercury (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	0.025	<0.020
Silver (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Vanadium (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc (mg/L)	0.350	0.390	<0.010	0.570	0.710	2.900	0.013
Silicon (mg/L)	5.1	3.8	<0.050	5.1	4.0	4.2	3.2
Hardness (mg/L)	5.4	2.7	<1.0	5.4	4.1	1.6	5.1
Alkalinity (mg/L)	5.0	2.8	<1.0	5.5	6.3	6.2	3.6
pH (SU)	5.6	5.6	5.7	5.8	5.8	5.9	6.9
Specific Conductivity (UMHOS)	25.0	16.0	1.3	25.0	20.0	20.0	24.0
Arsenic (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (mg/L)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00038	<0.00010
Fluoride (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium (mg/L)	0.3	0.2	<1.0	<1.0	<1.0	<1.0	<1.0
Sodium (mg/L)	1.30	1.80	<0.10	1.30	1.30	1.20	1.80
Phenolphthalein Alkalinity (mg/L)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lead (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0066	0.0065
Antimony (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total Kjeldahl Nitrogen (mg/L)	<0.10	0.7	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrite (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020

Ambient Groundwater Monitoring

2008 Nonradiological Data

Location Description	M02204	M02203	M02302	M02303	M02305	Duplicate	M02306
Collection Date	4/23/2008	4/24/2008	5/5/2008	5/5/2008	5/6/2008	5/6/2008	5/7/2008
Field Water Quality Data							
pH	4.21	5.51	9.54	4.75	4.90	4.90	5.03
Conductivity	0.013	0.023	0.409	0.017	0.03	0.03	0.02
Turbidity	0.00	0.00	0.00	0.00	0.00	0.00	2.00
Dissolved Oxygen	6.30	4.56	4.16	1.95	0.32	0.32	5.13
Temperature ©	19.60	20.30	19.50	19.70	19.90	19.90	20.80
Analyte							
Ammonia (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate/Nitrite (mg/L)	<0.020	<0.020	0.027	<0.020	<0.020	<0.020	<0.020
Total Organic Carbon (mg/L)	<2.0	<2.0	2.5	<2.0	3.50	3.80	3.00
Ortho Phosphate (mg/L)	<0.020	Lab Error	<0.020	<0.020	<0.020	<0.020	<0.020
Chloride (mg/L)	1.6	1.7	<1.0	<1.0	<1.0	1.00	1.00
Sulfate, Turbidimetric (mg/L)	<5.0	<5.0	<5.0	<5.0	<5.0	5.30	<5.0
Aluminum (mg/L)	<0.10	<0.10	**0.270**	<0.10	**0.21**	**0.20**	<0.10
Barium (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Beryllium (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Boron (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium (mg/L)	0.34	1.10	14.00	0.48	1.70	2.00	1.00
Chromium (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Copper (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Iron (mg/L)	0.200	0.090	0.160	0.086	0.190	0.160	0.100
Magnesium (mg/L)	0.150	0.230	0.075	0.170	0.22	0.22	0.26
Manganese (mg/L)	<0.010	<0.010	<0.010	<0.010	0.016	0.016	0.010
Mercury (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Silver (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Vanadium (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc (mg/L)	1.400	2.000	0.013	0.920	1.000	0.980	1.000
Silicon (mg/L)	4.0	4.3	4.6	3.8	4.50	4.60	5.10
Hardness (mg/L)	1.5	3.7	35.0	1.9	5.20	5.90	3.60
Alkalinity (mg/L)	3.2	6.3	39.0	1.6	4.30	4.20	6.10
pH (SU)	6.9	5.8	9.3	5.0	5.20	5.20	5.70
Specific Conductivity (UMHOS)	15.0	24.0	74.0	20.0	30.00	32.00	25.00
Arsenic (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium (mg/L)	<0.00010	<0.00010	<0.00010	0.00044	<0.00010	0.00012	0.00017
Fluoride (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Potassium (mg/L)	<1.0	<1.0	<1.0	<1.0	<1.0	0.450	<1.0
Sodium (mg/L)	0.97	1.40	1.10	0.93	1.10	1.10	1.50
Phenolphthalein Alkalinity (mg/L)	0.0	0.0	8.2	0.0	0.00	0.00	0.00
Lead (mg/L)	0.0100	0.0180	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Antimony (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total Kjeldahl Nitrogen (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Thallium (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrite (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020

Ambient Groundwater Monitoring

2008 Nonradiological Data

Location Description	M06507	M06506	M06503	M06501	M06502	Trip Blank 02
Collection Date	6/3/2008	6/3/2008	6/4/2008	6/4/2008	6/9/2008	6/9/2008
Field Water Quality Data						
pH	5.41	5.44	6.05	6.17	7.05	
Conductivity	0.05	0.05	0.14	0.06	0.17	
Turbitity	0.00	0.00	0.00	10.00	0.00	
Dissolved Oxygen	-1.20	-0.40	-0.43	6.53	-1.75	
Temperature ©	22.30	22.00	20.10	20.10	20.20	
Analyte						
Ammonia (mg/L)	<0.050	<0.050	<0.050	<0.050	<0.050	0.064
Nitrate/Nitrite (mg/L)	<0.020	<0.020	<0.020	0.05200	<0.020	<0.020
Total Organic Carbon (mg/L)	<2.0	2.70	3.80	3.20	8.40	<2.0
Ortho Phosphate (mg/L)	<0.020	0.020	0.430	0.044	0.150	<0.020
Chloride (mg/L)	3.30	1.70	3.00	3.40	3.20	1.70
Sulfate, Turbidimetric (mg/L)	7.50	7.80	5.40	<5.0	6.30	<5.0
Aluminum (mg/L)	**0.12**	**0.17**	<0.10	**1.00**	**0.20**	<0.10
Barium (mg/L)	<0.050	<0.050	0.065	<0.050	<0.050	<0.050
Beryllium (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Boron (mg/L)	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Calcium (mg/L)	5.90	2.80	15.00	10.00	36.00	0.06
Chromium (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cobalt (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Copper (mg/L)	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Iron (mg/L)	**0.440**	**0.540**	0.180	**2.900**	0.040	0.071
Magnesium (mg/L)	0.38	0.33	0.36	0.78	0.59	<0.050
Manganese (mg/L)	0.023	0.024	<0.010	0.020	<0.010	<0.010
Mercury (mg/L)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Silver (mg/L)	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Vanadium (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Zinc (mg/L)	1.700	4.300	0.050	0.011	<0.010	<0.010
Silicon (mg/L)	4.70	6.40	13.00	7.50	13.00	<0.050
Hardness (mg/L)	16.00	8.40	39.00	28.00	92.00	<1.0
Alkalinity (mg/L)	15.00	7.90	54.00	34.00	90.00	<1.0
pH (SU)	6.40	5.90	7.20	6.60	8.60	5.80
Specific Conductivity (UMHOS)	53.00	48.00	120.00	70.00	190.00	0.93
Arsenic (mg/L)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.050
Cadmium (mg/L)	<0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010
Fluoride (mg/L)	<0.10	<0.10	0.18	<0.10	0.12	<0.10
Potassium (mg/L)	<1.0	<1.0	9.000	<1.0	<1.0	<1.0
Sodium (mg/L)	1.10	1.00	3.80	1.10	1.40	<0.10
Phenolphthalein Alkalinity (mg/L)	0.00	0.00	0.00	0.00	6.80	0.00
Lead (mg/L)	<0.0050	<0.0050	<0.0050	0.0076	<0.0050	<0.0050
Antimony (mg/L)	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Selenium (mg/L)	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total Kjeldahl Nitrogen (mg/L)	<0.10	<0.10	0.11	<0.10	<0.10	<0.10
Thallium (mg/L)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrite (mg/L)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020

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2.1.5 Summary Statistics

Ambient Groundwater Monitoring

Notes:
1. N/A = Not Applicable
2. LLD = Lower Limit of Detection

2.1.5 Summary Statistics

Ambient Groundwater Monitoring

Location Description	Well Designation	Alpha (pCi/L)	Beta (pCi/L)	Tritium (pCi/L)
GWE1X	Random Perimeter	<LLD	<LLD	<LLD
GWE2	Random Perimeter	<LLD	<LLD	<LLD
GWE3X	Random Perimeter	<LLD	<LLD	**268**
GWE4	Random Perimeter	**5.15**	<LLD	**321**
GWE5	Random Perimeter	<LLD	<LLD	<LLD
GWE6	Random Perimeter	<LLD	<LLD	<LLD
GWB2X	Random Background	<LLD	<LLD	<LLD
GWB3	Random Background	<LLD	<LLD	<LLD
GWB4	Random Background	<LLD	<LLD	<LLD
GWB5	Random Background	**29.20**	**19.30**	<LLD
GWB6	Random Background	<LLD	<LLD	<LLD
Duplicate 02	Random Background	<LLD	**2.88**	<LLD
Duplicate 03	Random Background	**41.10**	**18.60**	<LLD
Trip Blank 03	Random Background	<LLD	<LLD	<LLD

Random Background	Mean	Std Dev.	Median
Alpha (pCi/L)	**35.15**	**8.41**	**35.15**
Beta (pCi/L)	**13.59**	**9.28**	**18.60**
Tritium (pCi/L)	N/A	N/A	N/A

Random Perimeter	Mean	Std Dev.	Median
Alpha (pCi/L)	**5.15**	N/A	**5.15**
Beta (pCi/L)	N/A	N/A	N/A
Tritium (pCi/L)	**294.5**	**37.48**	**294.5**

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2.2 Drinking Water Quality Monitoring

2.2.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) Drinking Water Monitoring Project, as part of South Carolina Department of Health and Environmental Control (SCDHEC), evaluates drinking water quality in communities that could be impacted by Savannah River Site (SRS) operations. ESOP provides assurance to the public that radiological constituents have not impacted community drinking water systems adjacent and downstream to the SRS. Additionally, ESOP provides analytical data from this project for comparison to published Department of Energy-Savannah River (DOE-SR) data. The project objectives are to collect monthly composite surface water samples from water treatment plants using the lower portion of the Savannah River, and to collect semi-annual grab samples from selected community drinking water systems within 30 miles of SRS. SCDHEC analyzes samples for gross alpha, non-volatile beta, gamma-emitting radionuclides, and tritium.

The study area was established as a 30-mile radius circle centered in the SRS. Using SCDHEC geographical information system, 18 groundwater fed and four surface water fed community drinking water systems were selected (Section 2.2.2, Map 4). These systems serve approximately 285,000 customers with approximately 109,000 receiving their water from groundwater sources (Section 2.2.3, Table 1). None of the drinking water samples collected, originated from the SRS drinking water system.

Part of the drinking water project includes sampling random background (B locations) and random perimeter (E locations) around the SRS and the state of South Carolina (Map 1). Sample locations are selected at random using a designated quadrant system that extends over the entire state of South Carolina. Samples are collected from private residences connected to public water systems. The data collected provides ESOP an opportunity to help determine if there has been any impact to the environment as a result of SRS activities.

During 2008, DOE-SR collected water samples from four surface water locations (North Augusta, Purrysburg, Beaufort and Savannah) that are colocated with the ESOP surface water fed drinking water systems.

Historically, tritium has been the main environmental release due to operations at the SRS. Tritium was produced as a nuclear weapon enhancement component. The majority of tritium releases came from the production reactors and the separation areas (Till. et al 2001). In addition to SRS activities, tritium can be attributed to releases from nuclear facilities within close proximity of the study area.

Man-made gamma-emitting radionuclides, such as iodine-131, cesium-137, and cobalt-60, were products of SRS activities. These radionuclides were produced by fission in reactor fuels. They were primarily released in surface streams in the 1960s, or into the atmosphere in the separation areas (WSRC 1998). There have been no detections of gamma-emitting radionuclides since ESOP began testing drinking water in 2002. Currently, DOE-SR does not conduct drinking water sampling off-site from groundwater fed wells.

Results and Discussion

Surface Water System Fixed Network Results

Tritium

Tritium oxide, the form of most concern, is generally indistinguishable from normal water and can move rapidly through the environment in the same manner as water. Tritium is naturally present in surface waters at about 10 to 30 picocuries per liter (pCi/L) (ANL 2007). The maximum contaminant level (MCL) developed by the United States Environmental Protection Agency (USEPA) for tritium in drinking water supplies is 20,000 pCi/L (ANL 2007). Tritium continues to be the most abundant radionuclide detected in public drinking water in the study area. Detected in both groundwater and surface water systems, the ESOP tritium detectable average was 224 pCi/L for groundwater systems and 506 pCi/L for surface water systems. The DOE-SR detectable average for surface water systems was 439.50 pCi/L. These tritium activities, however, were quite low when compared to the USEPA drinking water MCL (USEPA 2002).

The primary tritium releases originated from processes associated with the reactors (R, P, K, L, and C), separation facilities (F-Area and H-Area), the heavy water facility (D-Area), and tritium recovery in the tritium facilities. The two main types of tritium releases come from direct releases from site facilities and migration from seepage basins in F-Area and H-Area, the burial ground, and the K-Area containment basin. In the early operational years, almost 100% of the releases to streams were related to direct releases. After the cessation of operational activities, most releases were a result of migration from the seepage basins. Since the mid 1970s, migration and outcropping to streams have accounted for most of the SRS tritium released to surface water (Till et al. 2001).

Based on a review of the surface water data from the Savannah River, tritium was detected above the lower limit of detection (LLD) in all surface water composites. Detectable tritium activity in these samples had an average of 506 (± 200) pCi/L and ranged from 205 to 1097 pCi/L. These tritium activities are measurable but not significant when compared with the 20,000 pCi/L USEPA MCL (USEPA 2002). Of the 12 upstream North Augusta surface water composites, there were three detections above the LLD. Tritium activity in the North Augusta samples ranged from 206 to 217 pCi/L and averaged 211 (± 5.57) pCi/L. Tritium activity in the three downstream intakes, Beaufort/Jasper Chelsea Plant, Beaufort/Jasper Purrysburg Plant, and City of Savannah samples had a range of 205 to 1097 and averaged 604 (± 44.18) pCi/L. Section 2.2.3, Figure 1 illustrates the trending data for surface water fed systems over the past six years.

Gamma-emitting Radionuclides

Gamma-emitting radionuclides of concern (Section 2.2.3, Table 2) were not detected above the MDA and have not been detected for any of the surface water samples collected by ESOP or DOE-SR since 2002.

Gross Alpha and Non-volatile Beta

Gross alpha-emitting radionuclides were released to liquid effluent from the reactor materials area (M-area), separations areas (F- Area and H-area), and the reactor areas. The primary stream affected by the M-area releases was Tims Branch, which ultimately flows into Upper Three Runs. Fourmile Creek is the stream most affected by releases coming from the separation areas.

Releases from the reactor areas affected all streams with the exception of Upper Three Runs (Till et al 2001). Gross beta-emitting radionuclides were released to liquid effluent from the separations areas (F-Area and H-area). The stream primarily affected by these releases was Fourmile Creek (Till et al. 2001). The aforementioned streams ultimately flow directly or indirectly into the Savannah River.

Gross alpha and non-volatile beta were detected in both background (North Augusta) and downstream (City of Savannah and Purrysburg) locations. These locations revealed gross alpha detections that averaged 4.61 (± 4.20) pCi/L and ranged from 1.72 to 13.90 pCi/L. There was only one surface water location where 2.65 pCi/L of gross non-volatile beta was detected for the City of Savannah in September of 2008. Speciation is not conducted for gross alpha or non-volatile beta unless there is detection above the USEPA MCL of 15 pCi/L or 8 pCi/L, respectively (USEPA 2002). Alpha and beta activity is likely attributable to naturally occurring radionuclides.

Section 2.2.3 (Figures 1-3) illustrate the trends in tritium, gross alpha and non-volatile beta concentrations since the year 2004. Although each of these tables indicate increased concentrations (for most years), none of these analytes have exceeded the EPA established MCL for each of these contaminants. As a result, these concentrations are not considered to be known health risks for humans.

As part of the drinking water project, during the 2006–2007 calendar years, random background (B locations) and random perimeter (E locations) samples were collected around the perimeter of the SRS as well as throughout the state of South Carolina. Sample locations are selected at random using a designated quadrant system that extends over the state. These samples were collected to obtain statistical data for an ongoing study within the ESOP program to determine whether or not SRS activities may be impacting the surrounding area. Each location was sampled for gross alpha, non-volatile beta, gamma, and tritium. No samples from any of these locations exceeded the EPA established MCL for any of these analytes.

Random Background & Random Perimeter Results

Tritium

Tritium averaged 506 (± 200.00) pCi/L for water systems in 2008 (Section 2.2.3, Table 3). A table of the drinking water tritium detections over the last five years can be found in Section 2.2.3, Figure 1. Surface water systems continue to have a higher tritium average compared to groundwater systems. These averages, however, have continued to be considerably lower than the USEPA MCL of 20,000 pCi/L (USEPA 2002).

Gamma-emitting Radionuclides

There were no detectable gamma-emitting radionuclides of concern found in surface water systems in 2008.

Gross Alpha and Non-volatile Beta

Gross alpha averaged 4.61 (± 4.20) pCi/L for surface water systems in 2008 (Section 2.2.3, Table 3). The trending data for all ESOP surface water gross alpha detections over the last five years can be found in Section 2.2.3, Figure 2. Detections of gross alpha continue to be far lower than the USEPA MCL of 15 pCi/L (USEPA 2002). The single non-volatile beta detection for surface water systems was 2.65 pCi/L.

Groundwater System Fixed Network Results

Tritium

Based on a review of the analytical data, four of the 18 groundwater fed systems sampled had tritium activities above the LLD. The detected tritium activities ranged from 212 to 240 pCi/L with an average of 224 (± 12.11) pCi/L. These tritium activities are measurable but not significant when compared to the 20,000 pCi/L USEPA MCL (USEPA 2002). Section 2.2.3, Figure 1 shows trending data from the past five years for the samples from groundwater fed systems that showed detections.

Gamma-emitting Radionuclides

Gamma-emitting radionuclides of concern were not detected above the MDA in any groundwater samples tested in the seven years of testing by ESOP. No summary statistics were calculated for gamma-emitting radionuclides.

Gross Alpha and Non-volatile Beta

Gross alpha was detected in five of the 18 groundwater systems tested in 2008. The range for gross alpha detections was 1.91 to 3.88 pCi/L with an average activity of 3.11 (± 0.85) pCi/L. All gross alpha samples were below the USEPA MCL of 15 pCi/L (USEPA 2002). Speciation is not conducted for gross alpha unless there is a detection above the USEPA MCL of 15 pCi/L. Summary statistics for groundwater fed systems are located in Section 2.2.5. There were no detections for non-volatile beta in any of the groundwater systems tested.

Random Background & Random Perimeter Groundwater Results

Tritium

Five of the random background locations revealed detectable concentrations for tritium. The average tritium concentration was 440.60 (± 206.64) pCi/L. Two of the random perimeter locations revealed detectable concentrations for tritium. The average tritium concentration was 271.50 (± 78.48) pCi/L.

Gamma-emitting Radionuclides

None of the random perimeter groundwater sample locations revealed gamma detections.

Gross Alpha and Non-volatile Beta

Random background groundwater sample results (Section 2.2.4) indicated three locations had detectable concentrations for gross alpha. The average concentration was 5.12 (± 4.19) pCi/L. Two of the background samples revealed detectable concentrations of non-volatile beta, which averaged 4.83 (± 0.25) pCi/L. Although these concentrations are slightly elevated, none of these samples exceeded the EPA established MCL. Random perimeter groundwater sample results (Section 2.2.4) indicated four locations had detectable concentrations for gross alpha. The average concentration was 5.82 (± 3.19) pCi/L. Three of the perimeter samples revealed detectable concentrations of non-volatile beta, which averaged 7.26 (± 4.29) pCi/L. Although these concentrations are slightly elevated, none of these samples exceeded the EPA established MCL.

Section 2.2.3, Figure 3 illustrates surface water trending data for all non-volatile beta detections since 2004. Non-volatile beta has continued to stay far below the USEPA MCL of 8 pCi/L (USEPA 2002).

A comparison of the random background and random perimeter results revealed slightly higher concentrations of alpha and non-volatile beta in the perimeter samples collected. The opposite is true for tritium. The tritium concentration was found to be slightly higher for the background average versus the perimeter average. Although there are differences between the values of background versus perimeter samples, these values are within one standard deviation and are not considered to be significant. Additional testing will help determine whether or not SRS activities are a primary contributor to these results.

The SCDHEC Drinking Water Monitoring Project continues to be an important source of essential data for assessing human health exposure pathways. SCDHEC will continue sampling to provide the public with an independent source of radiological data for drinking water systems within the SRS study area.

ESOP and DOE-SR Data Comparison

DOE-SR conducts monthly composite sampling at the four water treatment plants (North Augusta, Purrysburg, Beaufort and Savannah) that use Savannah River surface water to supply drinking water for the local population.

Based on the DOE-SR 2008 annual report, tritium in the three downstream water intakes averaged 552.66 (± 16.10) pCi/L ranging from 505.0 to 578.0 pCi/L while ESOP downstream detections averaged 604.33 (± 44.19) pCi/L ranging from 558 to 646 pCi/L. Section 2.2.3, Figure 4 and Figure 5 illustrate DOE-SR finished water tritium detection averages over a five year time period. DOE-SR had an overall detected tritium average of 439.50 (± 15.73) pCi/L for all surface water samples collected in 2008. This was lower than the ESOP detected tritium average of 506.00 (± 200.00) pCi/L for the same period. The average tritium activity for North Augusta is 211.00 pCi/L. This average is lower than the averages for the other down stream locations due to the fact North Augusta is located up stream from the SRS (Section 2.2.3, Table 3). All samples were within one standard deviation as well as being lower than the USEPA MCL of 20,000 pCi/L (USEPA 2002). Tritium continues to be the most abundant radionuclide in the Savannah River. Although the tritium activity in 2008 is slightly higher than the previous four years, these activity levels are well below the USEPA MCL.

Gamma-emitting radionuclides were not detected in DOE-SR or ESOP samples in 2008. DOE-SR and ESOP detected non-volatile beta in surface water samples. The DOE-SR non-volatile beta average (for all four locations) of 1.96 (± 0.11) pCi/L was slightly less than the single ESOP detection of 2.65 pCi/L located at the city of Savannah. DOE-SR reported an average gross alpha activity (for all four locations) of 0.07 (± 0.11) pCi/L. ESOP had four surface water detections averaging 4.61 (± 4.20) pCi/L. Naturally occurring radionuclides may account for variability in tritium activities. All detections were less than the established USEPA MCL for gross alpha and non-volatile beta in drinking water (USEPA 2002).

Alphas (or betas) are not directly comparable due to the unknown nature (species) of the contributing alphas (or betas) in any two compared samples.

Conclusions and Recommendations

Tritium continues to be the most abundant radionuclide detected in public drinking water supplies potentially impacted by SRS. Tritium was detected in both groundwater and surface water systems. However, these tritium activities were low considering the USEPA 20,000 pCi/L MCL for drinking water. Detections of gross alpha, non-volatile beta and gamma-emitting radionuclides of concern were all below their respective MCL's. Comparative analysis with DOE-SR for groundwater systems cannot be performed because DOE-SR does not sample groundwater systems off of the Savannah River Site.

SCDHEC will continue sampling to provide the public with an independent source of radiological data for surface water and groundwater water systems. Additional background samples will be taken in the future to give a better idea of what ambient radioactivity levels are present in South Carolina. The data from these samples will be used in statistical analysis with the routine samples.

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2.2.2

Map 4. SCDHEC ESOP Drinking Water Network

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2.2.3 Tables and Figures

Drinking Water Quality Monitoring

Table 1. Drinking Water Systems Sampled by ESOP

System Number	System Name	Number of Taps	Population Served
0210001	Aiken	18,443	42,374
0210002	Jackson	1,309	3,602
0210007	New Ellenton	2,231	5,303
0220001	Langley Water District	367	838
0220002	College Acres Public Water District	529	1,350
0220003	Bath Water District	314	1,064
0220004	Beech Island	3,094	7,436
0220005	Talatha Water District	571	1,553
0220006	Breezy Hill Water District	5,080	12,495
0220008	Montmorenci Water District	1,396	3,428
0220012	Valley Public Service Authority	3,409	7,803
0310001	Allendale	1,521	4,052
0610001	Barnwell	2,494	6,727
0610002	Williston	1,650	3,307
0610003	Blackville	1,141	2,973
0610004	Hilda	131	466
0610005	Elko	150	462
0670075	Healing Springs	1	6*
0210003F	North Augusta Surface Water	12,022	31,506
0720003F	Chelsea B/J Plant Surface Water canal intake	44,227	133,353
0720004F	Purrysburg B/J Plant Surface Water SR intake		
SAVF	City of Savannah Surface Water (Industrial)	35	10,619
	TOTAL	100,115	280,717
	Approx. Groundwater	43,831	105,239
	Approx. Surface water	56,284	175,478

*This number is likely higher due to public access to the natural spring.
Information Updated June 2008

Note: Information was updated August 2009. Data was obtained from SC DHEC EFIS database.

Tables and Figures

Radiological Monitoring of Drinking Water Adjacent to the Savannah River Site

Table 2. Gamma Analyte Table

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Tables and Figures

Radiological Monitoring of Drinking Water Adjacent to the Savannah River Site

Table 3. DOE-SR and ESOP Data Comparisons

	ESOP Tritium	DOE-SR Tritium	ESOP Gross Alpha	DOE-SR Gross Alpha	ESOP NV Beta	DOE-SR NV Beta
North Augusta	211.00	100.00	2.68	0.12	<MDA	1.75
Beaufort Jasper	558.00	505.00	<MDA	0.03	<MDA	2.21
Purrysburg	646.00	575.00	1.72	0.00	<MDA	1.74
Savannah	609.00	578.00	9.43	0.13	2.65	2.15
Average	**506.00**	**439.50**	**4.61**	**0.07**	**2.65**	**1.96**

2.2.3 Tables and Figures

Drinking Water Quality Monitoring

Figure 1. ESOP Yearly Tritium Averages in Drinking Water Systems

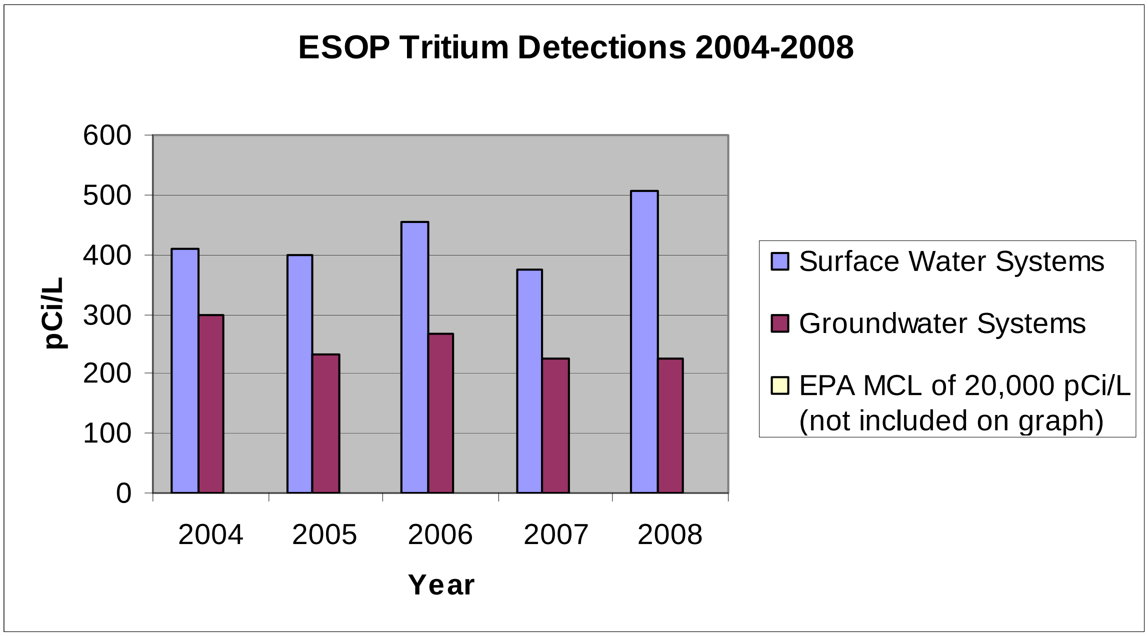
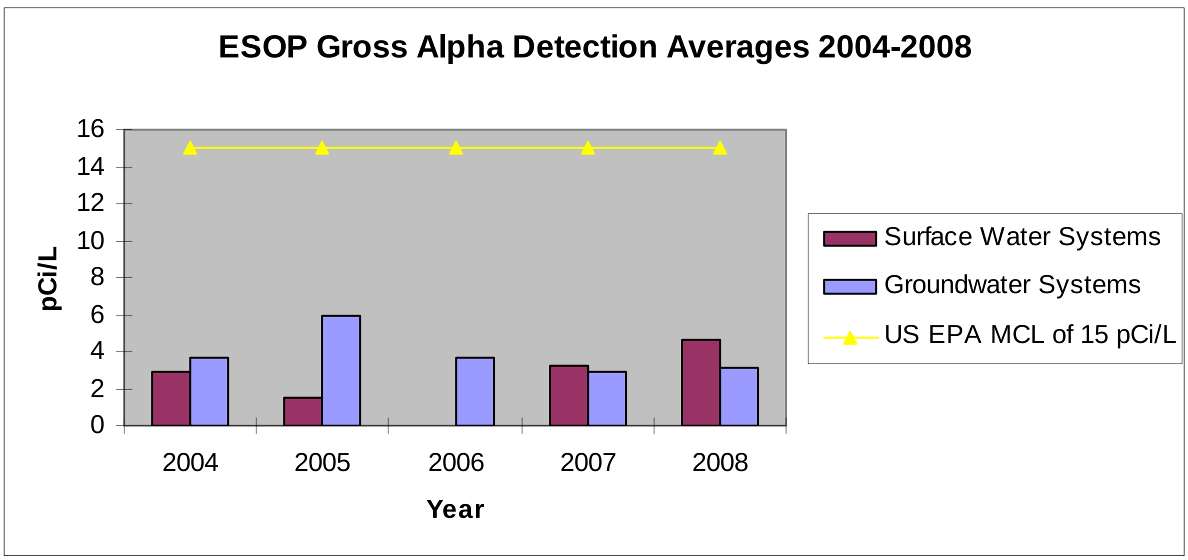


Figure 2. ESOP Yearly Gross Alpha Averages in Drinking Water Systems

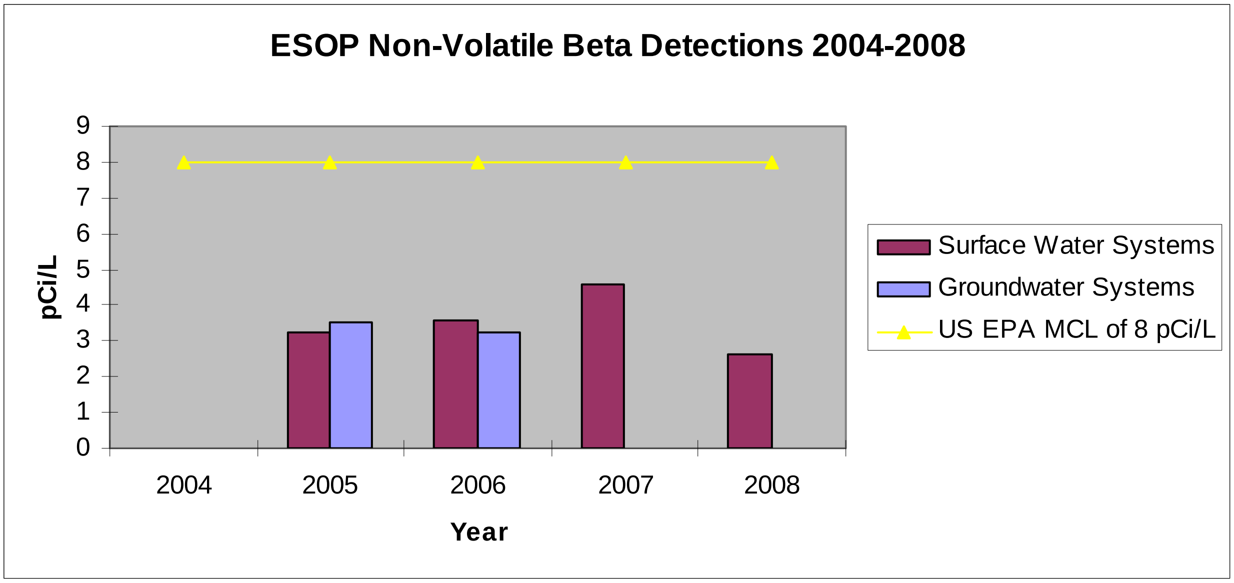


Note: Missing data for 2006 indicates no surface water detections were found for that year.

Tables and Figures

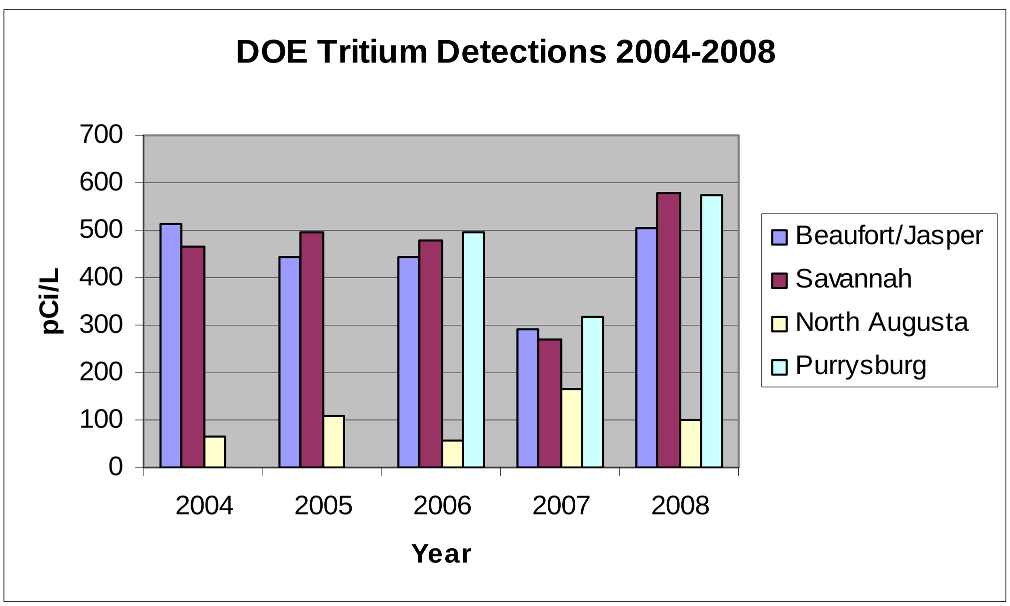
Drinking Water Quality Monitoring

Figure 3. ESOP Yearly Non-Volatile Beta Averages in Drinking Water Systems



Note: Missing data for 2004 indicates no surface or drinking water detections were found for that year. Missing data for 2007 and 2008 indicates no drinking water detections were found for those years.

Figure 4. DOE-SR Yearly Tritium Averages in Drinking Water

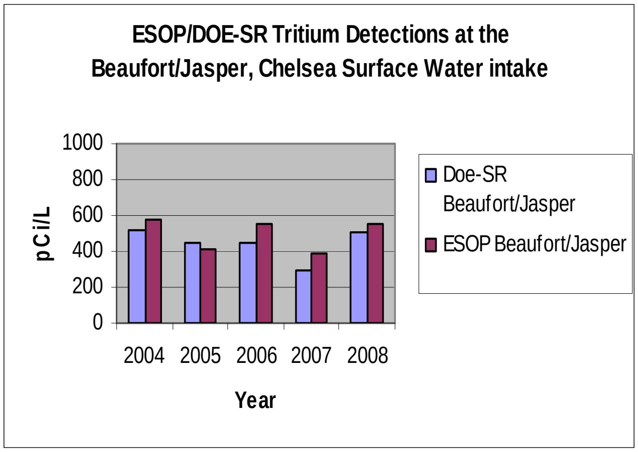


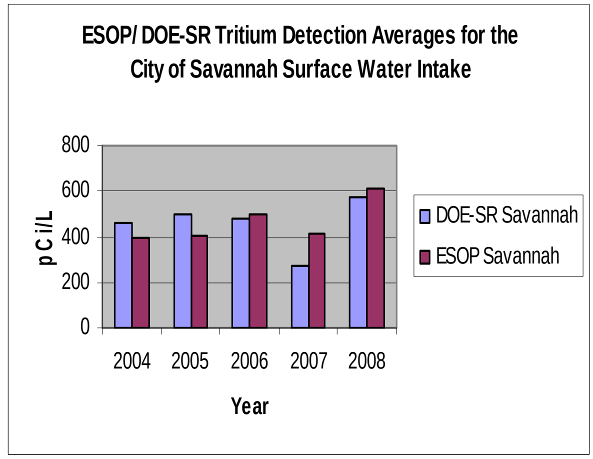
Note: Purrysburg was first collected as a new sampling location in 2006.

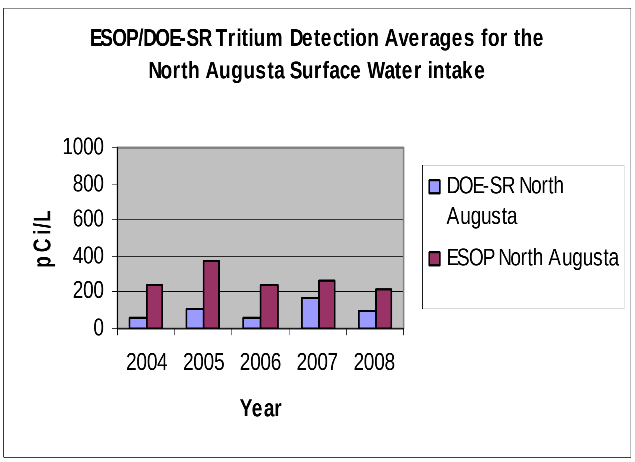
Tables and Figures

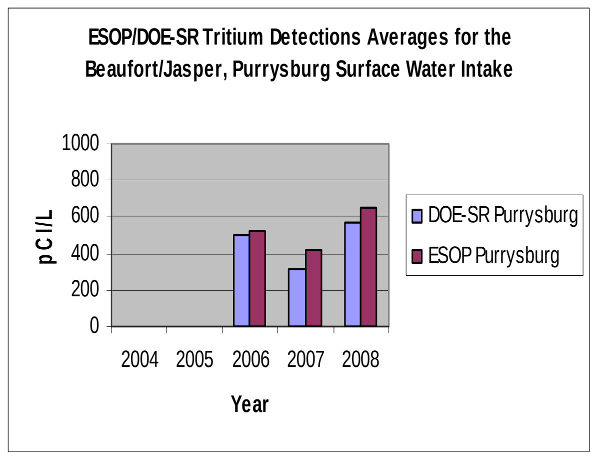
Drinking Water Quality Monitoring

Figure 5. ESOP/DOE-SR Comparison of 2008 Averages of Tritium in Drinking Water









Note: Purrysburg was first collected as a new sampling location in 2006.

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2.2.4 Data

Radiological Monitoring of Drinking Water Adjacent to the Savannah River Site

Notes:
1. Bold numbers denote detection.
2. A blank field following ±2 SIGMA occurs when the sample is <LLD.
3. LLD= Lower Limit of Detection
4. MDA= Minimum Detectable Activity
5. No Media = No Drinking Water Sample was Available in the Quadrant

Drinking Water Data

2008 Radiological Data for Surface Water Systems

Sample Number:		DW0210003F											
Sample Name:		North Augusta Surface Water											
Date:		Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Gross Alpha	(pCi/L)	<LLD	<LLD	<LLD	**2.68**	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	1.35	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.26	2.68	2.34	1.64	3.39	3.35	2.00	2.01	2.71	2.70	3.26	2.19
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	3.79	3.88	3.81	2.61	3.87	3.87	2.62	2.62	2.34	2.34	3.73	2.34
Tritium	(pCi/L)	<LLD	<LLD	<LLD	**206**	**210**	**217**	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	85	88	88	NA	NA	NA	NA	NA	NA
	(LLD)	188	188	188	182	187	187	200	200	200	200	194	194
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	3.966	3.993	3.983	2.040	2.304	2.174	1.737	1.633	1.930	1.775	2.325	2.480

Sample Number:		DW0720003F											
Sample Name:		Chelsea B/J Surface Water Canal Intake											
Date:		Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Gross Alpha	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.39	3.00	3.00	1.61	3.70	3.54	2.28	2.28	3.10	3.02	2.43	2.61
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	3.82	2.59	2.60	2.61	3.91	3.89	2.66	2.66	2.38	2.37	2.37	2.47
Tritium	(pCi/L)	**451**	**675**	**581**	**690**	**528**	**329**	**205**	**1050**	**795**	**633**	**304**	**452**
±2	(sigma)	97	111	104	104	101	93	92	123	115	110	94	101
	(LLD)	188	188	188	182	187	187	200	200	200	200	194	194
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	3.859	3.996	3.993	2.223	2.239	2.167	1.919	1.676	1.864	2.016	2.470	2.459

Sample Number:		DWSAVF											
Sample Name:		City of Savannah Surface Water (Industrial)											
Date:		Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Gross Alpha	(pCi/L)	**4.96**	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	**13.9**	<LLD
±2	(sigma)	1.88	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.44	NA
	(LLD)	2.40	2.19	2.20	1.67	3.48	4.53	2.27	2.30	3.11	4.26	4.14	2.64
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	**2.65**	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	1.38	NA	NA	NA
	(LLD)	3.82	3.77	3.77	2.62	3.89	3.99	2.66	2.67	2.38	3.83	3.82	2.83
Tritium	(pCi/L)	**413**	**595**	**627**	**634**	**363**	**412**	**936**	**857**	**1097**	**329**	<LLD	**438**
±2	(sigma)	97	104	105	103	94	96	120	116	125	93	NA	100
	(LLD)	188	188	188	182	187	187	200	200	200	200	185	194
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	3.999	3.985	3.999	2.276	2.310	2.434	1.845	1.851	1.509	2.129	2.220	2.258

Sample Number:		DW0720004F											
Sample Name:		Purrysburg B/J Plant Surface Water SR Intake											
Date:		Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
Gross Alpha	(pCi/L)	<LLD	<LLD	<LLD	**1.72**	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	1.18	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.30	3.70	2.49	1.63	3.45	3.91	2.33	2.31	3.11	3.12	2.68	3.81
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	3.80	4.37	3.84	2.61	3.88	3.93	2.67	2.67	2.38	2.38	2.47	3.79
Tritium	(pCi/L)	**788**	**689**	**534**	**701**	**545**	**451**	**696**	**867**	**994**	<LLD	**454**	**384**
±2	(sigma)	110	107	102	105	102	98	110	117	122	NA	101	98
	(LLD)	188	188	188	182	187	187	200	200	200	200	194	194
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	3.999	3.966	3.993	2.184	2.279	2.432	1.891	1.648	1.692	1.931	2.448	2.386

Drinking Water Data

2008 Radiological Data for Surface Water Systems

System Number:		DW0210001		DW0210002		DW670075		DW0210007		DW0220001	
System Name:		Aiken		Jackson		Healing Springs		New Ellenton		Langley Water	
Date:		Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08
Gross Alpha	(pCi/L)	**3.88**	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	**1.91**	<LLD
±2	(sigma)	1.44	NA	NA	NA	NA	NA	NA	NA	1.31	NA
	(LLD)	1.50	2.62	2.45	3.39	3.69	5.63	3.40	3.35	1.81	2.67
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.58	2.30	2.57	3.75	2.69	4.32	2.67	3.75	2.64	2.30
Tritium	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	182	188	186	187		187	186	187	182	188
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	2.527	1.865	2.221	3.214	2.085	3.361	2.274	2.689	2.300	1.768

System Number:		DW0220005		DW0220006		DW0220008		DW0220012		DW0310001	
System Name:		Talatha Water		Breezy Hill		Montmorenci		Valley PSA		Allendale	
Date:		Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08
Gross Alpha	(pCi/L)	<LLD	<LLD	**3.60**	<LLD	<LLD	<LLD	**2.53**	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	1.37	NA	NA	NA	1.74	NA	NA	NA
	(LLD)	2.58	3.65	1.44	3.61	2.69	2.87	2.40	3.54	4.73	6.08
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.59	3.78	2.57	3.78	2.60	3.79	2.70	2.37	2.73	3.94
Tritium	(pCi/L)	**218**	215	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	88	89	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	186	187	182	187	186	187	182	188	186	187
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	2.274	3.268	2.229	3.500	2.404	3.138	2.415	1.641	2.239	3.329

System Number:		DW0610004		DW0610001		DW0220003		DW0220002		DW0610002	
System Name:		Hilda		Barnwell		Bath Water Dist.		College Acres		Williston	
Date:		Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08
Gross Alpha	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	**3.61**	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	1.7	NA	NA	NA
	(LLD)	2.67	3.78	2.89	4.02	2.19	2.77	2.49	3.85	3.22	3.90
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.60	4.19	2.62	3.81	2.69	2.31	2.58	3.80	2.65	3.79
Tritium	(pCi/L)	<LLD	<LLD	<LLD	<LLD	**226**	<LLD	**240**	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	86	NA	89	NA	NA	NA
	(LLD)	186	187	186	187	182	188	186	187	186	187
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	2.075	3.688	2.184	3.178	2.263	1.771	2.465	3.073	2.01	3.374

System Number:		DW0610005		DW0610003		DW0220004		Duplicate 01		Duplicate 02	
System Name:		Elko		Blackville		Beech Island					
Date:		Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08	Jun-08	Dec.-08
Gross Alpha	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	**7.55**	<LLD	**2.47**	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	2.04	NA	1.25	NA
	(LLD)	3.52	4.20	4.38	5.35	2.54	3.34	2.43	6.07	1.52	3.41
N-V Beta	(pCi/L)	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	2.68	3.91	2.72	3.98	2.58	3.75	2.57	3.94	2.59	3.76
Tritium	(pCi/L)	<LLD	**212**	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
±2	(sigma)	NA	88	NA	NA	NA	NA	NA	NA	NA	NA
	(LLD)	186	187	186	187	186	187	182	187	182	187
Cesium-137	(pCi/L)	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
±2	(sigma)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	(MDA)	2.152	2.859	2.399	3.260	2.367	3.541	2.277	3.394	2.254	2.657

Drinking Water Data

2008 Random Perimeter and Background Drinking Water Data

		Radionuclides							
		Gross Alpha	±2	N-V Beta	±2	Tritium	±2	Cesium-137	±2
System Number	Date	(pCi/L)	(sigma)	(pCi/L)	(sigma)	(pCi/L)	(sigma)	(pCi/L)	(sigma)
DWB1	NO MEDIA								
DWB2	NO MEDIA								
DWB3	March-06	<4.43		**5.00**	1.85	<187		<3.372	
DWB4	September-06	<2.19		<3.04		<197		<3.141	
DWB5	December-06	<1.93		<3.91		**232**	89	<3.587	
DWB6	April-06	<2.45		<3.94		<196		<3.388	
DWB7	NO MEDIA								
DWB8	August-06	**3.24**	1.55	**4.65**	1.81	<197		<3.246	
DWB9	October-06	<1.61		<2.89		**375**	95	<3.417	
DWB10	October-06	<2.51		<3.03		<188		<3.310	
DWB11	October-06	<2.57		<2.99		<188		<3.168	
DWB12	March-06	<3.66		<3.11		<187		<3.294	
DWB13	December-06	**2.19**	1.41	<3.90		<188		<3.244	
DWB14	December-06	<1.58		<3.86		<188		<3.212	
DWB15	January-07	<1.90		<3.95		**429**	97	<3.489	
DWB16	December-07	**9.92**	2.51	<3.45		**786**	100	<1.726	
DWB17	June-06	<1.59		<2.52		**381**	92	<2.123	
DWB18	December-07	<3.11		<3.47		<184		<1.782	
DWB19	December-07	<3.11		<3.47		<184		<1.993	
DWB20	January-07	<2.92		<4.09		<187		<3.481	

		Radionuclides							
		Gross Alpha	±2	N-V Beta	±2	Tritium	±2	Cesium-137	±2
System Number	Date	(pCi/L)	(sigma)	(pCi/L)	(sigma)	(pCi/L)	(sigma)	(pCi/L)	(sigma)
DWE1	June-07	<4.21		<3.72		<192		<1.662	
DWE2	October-06	<2.04		<2.63		<196		<3.547	
DWE3	NO MEDIA								
DWE4	October-06	<1.97		**3.01**	1.37	<196		<3.809	
DWE5	June-07	**3.99**	2.43	<3.84		<192		<1.640	
DWE6	June-06	**4.48**	1.36	<2.50		<180		<1.985	
DWE7	April-06	<2.58		<3.95		<196		<3.340	
DWE8	March-06	<2.92		<3.08		<187		<3.109	
DWE9	April-06	<3.19		<4.00		<196		<3.604	
DWE10	March-06	<2.53		<3.06		<187		<3.34	
DWE11	March-06	<2.75		<3.07		<187		<3.36	
DWE12	June-06	<3.28		<2.85		<191		<3.230	
DWE13	March-06	<2.64		<3.06		<187		<3.321	
DWE14	October-06	**4.19**	1.50	<2.61		**327.00**	96.00	<3.313	
DWE15	NO MEDIA								
DWE16	January-07	<2.85		<3.82		<182		<3.352	
DWE17	January-07	<2.45		<3.79		<182		<3.408	
DWE18	January-07	<2.91		**7.19**	2.25	<182		<3.335	
DWE19	NO MEDIA								
DWE20	January-07	**10.60**	2.15	**11.60**	2.45	**216.00**	86.00	<3.253	

Note: No Media indicates there is no public water supply in the quadrant.

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2.2.5 Summary Statistics

Radiological Monitoring of Drinking Water Adjacent to the Savannah River Site

Notes:
1. N/A = Not Applicable
2. Min. = Minimum
3. Max. = Maximum
4. Num = Number of Detections
5. N-V = Nonvolatile

Summary Statistics

2008 Random Perimeter Drinking Water Data

Statistical Data for Random Perimeter (E) Locations

	Gross Alpha		N-V Beta		Tritium
Average:	5.82		7.26		271.5
Stand. Deviation:	3.19		4.29		78.48
Median:	4.33		7.19		271.5
Minimum:	3.99		3.01		216.00
Maximum:	10.6		11.6		327.00
Number:	20 (4)		20 (3)		20 (2)

Note: No random perimeter samples were collected in 2008.

Statistical Data for Random Background (B) Locations

	Gross Alpha		N-V Beta		Tritium
Average:	5.12		4.83		440.60
Stand. Deviation:	4.19		0.25		206.64
Median:	3.24		4.83		381.00
Minimum:	2.19		4.65		232.00
Maximum:	9.92		5.00		786.00
Number:	20 (3)		20 (2)		20 (5)

Note: No random background samples were collected in 2008.

Summary Statistics

2008 Surface Water Fed Summary Statistics

Radionuclide:	Gross Alpha (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
North Augusta SW	DW0210003F	2.68	2.68	N/A	2.68	2.68	1
City of Savannah	SAVF	9.43	9.43	6.32	13.9	4.96	2
Purrysburg	DW0720004F	1.72	1.72	N/A	1.72	1.72	1
Yearly Average of Detectable gross alpha			4.61				
Standard Deviation			4.20				

Radionuclide:	Gross NV Beta (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
City of Savannah	DWSAVF	2.65	2.65	N/A	2.65	2.65	1
Yearly Average of Detectable non-volatile (NV) beta			2.65				
Standard Deviation			N/A				

Radionuclide:	Tritium (pCi/L)	Statistical Analysis					
System Name:	System Number:	Median	Avg.	St. Dev.	Max	Min	Num
North Augusta SW	DW0210003F	210	211	5.57	217	206	3
Chelsea B/J SW	DW0720003F	555	558	234	1050	205	12
City of Savannah	DWSAVF	595	609	256	1097	329	11
Purrysburg B/J SW	DW0720004F	689	646	191	994	384	11
Yearly Average of Detectable Tritium			506				
Standard Deviation			200				

Radiological Monitoring of Drinking Water Adjacent to the Savannah River Site

Groundwater Fed Summary Statistics

Radionuclide:	Gross Alpha (pCi/L)	Statistical Analysis					
System Name:	System	Median	Avg.	St. Dev.	Max	Min	Num
Aiken	DW0210001	3.88	3.88	N/A	3.88	3.88	1
Valley PSA	DW0220012	2.53	2.53	N/A	2.53	2.53	1
Breezy Hill	DW0220006	3.60	3.60	N/A	3.60	3.60	1
Langley	DW0220001	1.91	1.91	N/A	1.91	1.91	1
College Acres	DW0220002	3.61	3.61	N/A	3.61	3.61	1
Yearly Average of Detectable gross alpha			3.11				
Standard Deviation			0.85				

Radionuclide:	Tritium (pCi/L)	Statistical Analysis					
System Name:	System	Median	Avg.	St. Dev.	Max	Min	Num
College Acres	DW0220002	240	240	N/A	240	240	1
Talatha Water	DW0220005	218	218	N/A	218	218	1
Bath	DW0220003	226	226	N/A	226	226	1
Elko	DW0610005	212	212	N/A	212	212	1
Yearly Average of Detectable Tritium			224.00				
Standard Deviation			12.11				

TOC

2.3 Radiological Monitoring of Surface Water

2.3.1 Summary

The U.S. Atomic Energy Commission established the Savannah River Site (SRS) in 1950 to produce plutonium, tritium, and other materials for national defense and civilian purposes (Till et al. 2001). Due to the large number of materials that could potentially be released from SRS, the Centers for Disease Control and Prevention (CDC) performed a site assessment to determine the potential health effects of any released radionuclides to the offsite public. In 1992, CDC hired Radiological Assessments Corporation (known as Risk Assessment Corporation as of 1998) to perform screening procedures to determine the key radionuclides released to the environment. These screening methods indicated that the main radionuclides released to surface water were tritium (H3) and cesium-137 (Cs-137). Other radionuclides of interest are strontium-90 (Sr-90), cobalt-60 (Co-60), americium-241 (Am-241), and uranium (U). The five production reactors (R, K, P, L, and C) were the primary sources for these radionuclide releases directly to site streams. Additionally, effluent from the separation areas (F-Area and H-Area) was discharged into storage tanks and seepage basins, but not directly into streams. However, some releases from these areas occurred due to leaks in cooling coils containing water pumped from deep wells into site streams. The fuel fabrication area (M-Area), heavy water reprocessing facility (D-Area), and the administration area (A-Area) also contributed radionuclides to liquid effluent. Onsite streams affected by these releases are Upper Three Runs Creek, Beaver Dam Creek, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek. All of these SRS streams are tributaries to the Savannah River (Till et al. 2001).

Tritium was one of the principle nuclear materials produced at SRS to multiply the firepower of plutonium in nuclear weapons (Till et al. 2001). The primary tritium releases originated from processes associated with the reactors, F-Area and H-Area, D-Area, and tritium recovery in the tritium facilities. The two main types of tritium releases come from direct site facility releases and migration from seepage basins in F-Area and H-Area, the burial ground, and the K-Area containment basin. In the early operational years, almost 100% of the releases to streams were related to direct releases. After the cessation of operational activities, most releases were a result of migration from the seepage basins. Since the mid 1970s, migration and outcropping to streams have accounted for most of the SRS tritium released to surface water (Zeigler et al. 1985, Murphy et al. 1991, Murphy and Carlton 1991). After 1988, the Effluent Treatment Facility (ETF) went into operation and the F-Area and H-Area basins were not used (CDC 2006). The primary purpose of ETF was to process low level radioactive wastewater from the separation areas (SRS 2008). Periodically, ETF has controlled tritium releases to Upper Three Runs Creek. Additionally, tritium occurs naturally from the cosmic interaction of radiation with atmospheric gases (USEPA 2008b) and also as a result of past nuclear testing (Till et al. 2001).

Most of the radiocesium at SRS was formed as a byproduct of the nuclear fuel and targets during operation of the five production reactors. Cesium-137 is an important radionuclide to monitor due to its 30 year half-life. Additionally, the biological behavior of Cs-137 is similar to potassium, which is essential to the function of living cells (USEPA 2008c). Therefore, the potential for Cs-137 uptake into humans is important. The streams that were largely affected by Cs-137 are Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs Creek, with Steel Creek showing the highest activity (Till et al. 2001).

Alpha-emitting radionuclides were released to liquid effluent from M-Area, F- Area and H-Area, and the reactor areas. The primary stream affected by the M-area releases was Tims Branch, which ultimately flows into Upper Three Runs Creek. Fourmile Branch is the stream most affected by releases coming from the separation areas. Releases from the reactor areas affected all streams with the exception of Upper Three Runs Creek (Till et al. 2001).

Beta-emitting radionuclides were released to liquid effluent from F-Area, H-Area and the reactors. Fourmile Branch is the stream primarily affected by releases from the separations areas. Steel Creek, Pen Branch, and Lower Three Runs Creek were mainly affected by releases from the reactors. Strontium-90 is a main contributor of beta activity and came primarily from the reactors (Till et al. 2001).

These SRS surface water bodies, as well as the Savannah River, continue to be the focus for monitoring and surveillance activities of the Radiological Monitoring of Surface Water (RSW) project that is part of the South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP). Since the Savannah River is the primary drinking water source for downstream communities, it is important to ensure radionuclide concentrations in the river are well below limits considered safe for human consumption. Surface water samples are collected and analyzed for radionuclides and the results are compared to Department of Energy-Savannah River (DOE-SR) data. DOE-SR has conducted surveillance and monitoring activities for the following purposes: determining concentrations and migration of radionuclides in the aquatic environment, detecting and verifying accidental releases, characterizing concentration trends, and determining associated impacts on human health and the environment. ESOP supports DOE-SR's objectives to ensure the primary goal of drinking water safety is established and met. Project databases were expanded and data trends for radionuclides in streams are given (Section 2.3.3, 2.3.4, and 2.3.5). These activities will allow the RSW project to generate independent data that can be shared with the public.

Section 2.3.3, Table 1 identifies sample ID, location, rationale, and frequency. The RSW Project continues to collect surface water samples from 13 specific locations within and outside of the SRS boundary as part of an ambient sampling network (Section 2.3.2, Map 5.). Due to area access concerns, sampling at the ambient location Fourmile Branch and United States Forestry Service (USFS) Road C-4 (SV-2045) was suspended for 2008. Samples were collected from this location only during January. At some locations, samples are collected three days per week as part of an enhanced sampling protocol. Tritium, gross alpha, gross beta and gamma analyses are dependent on location and frequency. Some locations were chosen because they are considered to be public access locations. The public access locations are downstream of SRS and provide a potential means for exposure to radionuclides. Quarterly samples are collected for tritium analysis from the five creeks that flow from SRS directly into the Savannah River (Upper Three Runs Creek, Beaver Dam Creek, Fourmile Branch, Steel Creek, and Lower Three Runs Creek). Pen Branch is not sampled because the flow for this creek is interrupted by the Savannah River Swamp and there is no creek mouth access.

The purpose of the enhanced surface water monitoring program is to provide downstream drinking water customers with advance notice of the potential for increased tritium levels in the Savannah River due to an SRS release. This early detection facet is possible because of the continuous monitoring of the six SRS streams that flow to the Savannah River. Samples are analyzed for tritium on the day of collection and results from the tritium analysis are used to project tritium activity in the Savannah River.

An additional component of the RSW Project is the Supplemental Surface Water Monitoring Program implemented in 2005. Sample locations are established along streams in close proximity to the Saltstone facility. This facility is responsible for stabilizing and disposing of low-activity liquid radioactive waste produced on SRS (SRS 2009). The purpose of this sampling program is to monitor any potential releases of gross alpha/beta emitting radionuclides primarily along Upper Three Runs and Fourmile Branch. Samples are collected on Tuesday and analyzed the same day as part of a quick scan early notification procedure.

ESOP began random sampling in 2004 to include more random coverage of perimeter samples (those within 50 miles of the SRS center point) and background samples (those greater than 50 miles from the SRS center point). This sampling program was implemented to allow future probabilistic comparisons of SRS perimeter and South Carolina (SC) background contaminant levels. These locations were randomly selected from a quadrant system established by the U.S. Department of Interior on a 7.5’ topographical map of SC revision 10/92. Quadrants were established based on longitude and latitude limits (USDOI 1992). These quadrant locations are shown in Map 1. ESOP collected surface water samples in 2008 from eight perimeter sites and five background sites.

During the last quarter of 2007, ESOP began collecting samples from a location at SC Highway 125 and Lower Three Runs Creek. This sampling was conducted in response to elevated tritium levels detected in groundwater samples near the Chem-Nuclear facility in Snelling, SC. The purpose of adding this location was to determine any potential tritium contributions to Lower Three Runs from Chem-Nuclear. This sampling location was moved to a location (Lower Three Runs Creek and Patterson Mill Road, SV-328) closer to the source during the last quarter of 2007. Samples were collected from this location during 2008.

The RSW Project will continue to collect and analyze surface water on and adjacent to SRS. This monitoring effort will provide an improved understanding of radionuclide levels in SRS surface waters and valuable information relative to human health exposure pathways.

Results and Discussion

ESOP Surface Water Data

All monitoring data is in Section 2.3.4 and summary statistics are in Section 2.3.5. All sampling locations are in Section 2.3.3, Table 1.

Tritium

In 2008, tritium activity was detected at all ambient locations where weekly samples were collected (Section 2.3.5). Average tritium activity in upstream background ambient locations (Jackson Boat Landing, SV-2010) and Upper Three Runs Creek at USFS Rd E-2, SV-2027) was lower than average tritium activity at the other ambient sample locations. The 2008 tritium average for the two background ambient locations was 360 (±506) pCi/L for SV-2010 and 247 (±55) pCi/L for SV-2027. The SV-2010 average is strongly influenced by one detection of 2,181 pCi/L collected on July 9th, 2008. Samples collected from this location typically yield results that are below detection (15 detections out of 52 samples for 2008). This single high detection could be attributed to unspecified naturally occurring radioactive material (NORM). If this detection is not included, the average is 230 (±45) pCi/L. The highest tritium detection at SV-2010 during the period of 1999-2007 was 548 pCi/L (±2 Standard Deviations (SD) 107) pCi/L in 2003 (SCDHEC 2004b). SV-2010 is located upstream from SRS and is not directly impacted by site releases. Fourmile Branch at USFS Rd. 13.2 (SV-2039) and Pen Branch at USFS Rd. 13.2 (SV-2047) continue to yield the highest levels of tritium activity (Section 2.2.5, Summary Statistics). Tritium activity ranged from 247 (± 55) pCi/L at SV-2027 to 48,043(± 17,702) pCi/L at SV-2047. Section 2.2.3, Figure 1 shows trending for 2003-2008 tritium averages. There was a slight increase in tritium levels at SV-2010, Upper Three Runs Creek at SC Highway 125 (SV-325), Beaver Dam Creek (SV-2040), and US Highway 301 at the Savannah River (SV-118) in 2008. Fourmile Branch at USFS Rd 13.2 (SV-2039), Steel Creek at SC Highway 125 (SV-327), and Pen Branch at USFS Rd 13.2 (SV-2047) showed a decrease in tritium levels in 2008.

Tritium activity in the Savannah River at the confluences of the five SRS streams was scheduled for monitoring on a quarterly basis (Section 2.3.5). Three samples were collected at Fourmile Branch (SV-2015): one from the creek mouth, one from 30 feet downstream of the creek mouth, and one from 150 feet downstream of the creek mouth. Samples were taken at these three intervals to show the effect of the mixing zone created by the Savannah River flow. Samples collected directly at the creek mouth of Fourmile Branch had the highest average tritium activity, 36,197 (±15,495) pCi/L, of all creek mouth locations.

Only random perimeter samples were collected during the first quarter because no background samples were scheduled to be collected. Due to travel restrictions, no random samples were collected during the second and third quarters. Random background and perimeter samples were collected during the fourth quarter. However, these samples were sent out for gamma and alpha/beta analysis before tritium samples could be prepared. Therefore, no fourth quarter samples were analyzed for tritium. These locations will be sampled again in 2009 for tritium analysis. Tritium was detected in two first quarter random perimeter samples in 2008 (Section 2.3.4, Random Sample Data). Samples collected in Allendale County (RWE38) and Hampton County (RWE61) yielded detections of 1,060 (±122) pCi/L and 190 (±87) pCi/L, respectively.

Random sampling began in 2004 and there have been only four detections out of 45 perimeter samples collected and three detections out of 53 background samples collected. Since there was no tritium analysis done on random background samples collected in 2008, no comparison to random perimeter samples was made. For the period of 2004-2007, there were only two years where tritium was detected in perimeter samples: one detection of 230 (±92) pCi/L in 2006 and one detection of 265 (±91) pCi/L in 2007. Furthermore, for the same time period, there were only two years where tritium was detected in background samples: one detection of 247 (± 91) pCi/L in 2004 and an average of 242 (±53) pCi/L for two detections in 2007. The 2008 random perimeter sample average, 625 (±615) pCi/L, is based on two detections out of six samples collected. There is a high standard deviation associated with this average due to the variability in the two samples. The 2004-2008 tritium average for background and perimeter samples was 243 (±38) pCi/L and 436 (±427) pCi/L, respectively. The 2004-2008 background average is within one standard deviation of the 2004-2008 perimeter average and is much lower than the perimeter average.

Gamma

As part of a gamma spectroscopy analysis, samples were analyzed for gamma-emitting radionuclides (Section 2.3.3, Table 2). Cesium-137 was detected in a sample collected from Fourmile Branch at USFS Rd 13.2, SV-2039 (3.55 (±1.58)) pCi/L, in August 2008 (Section 2.2.5, Summary Statistics). In past years, Cs-137 has been detected in samples collected from SV-2039 in 2003, 2005, and 2006, in addition to Lower Three Runs Creek at SRS Road B (SV-2053) in 2002 (SCDHEC 2003, 2004b, 2006b, 2007b,). Fourmile Branch was affected by releases from reactor activities, so periodic Cs-137 detections are likely in samples collected from this location. In 2008, Co-60 and Am-241 results were incorporated in the RSW project report for comparison purposes with SRS data. In the years from 1999-2007, no comparison for these particular analytes was made. There were no detections for Co-60 and Am-241 in ambient samples collected in 2008. All other radionuclides from the gamma analysis were below detection. There were no detections of Cs-137 for the 45 perimeter and 53 background samples collected from 2004-2008 and no detections for Co-60 and Am-241 for 2008 random samples (SCDHEC 2005a, 2006b, 2007b, 2008a).

Alpha

Alpha-emitting radionuclides were detected at seven of the nine locations where monthly composite samples were collected, with no detections at Jackson Boat Landing (SV-2010) and Steel Creek Boat Landing (SV-2018) (Section 2.3.5). The sampling location at US Highway 301 and the Savannah River (SV-118) had only one detection out of 12 samples collected, 5.38 (±2.19) pCi/L. Average activity for the other locations ranged from 3.11 (±0.46) pCi/L at Steel Creek and SC Highway 125 (SV-327) to 6.38 (±2.55) pCi/L at Upper Three Runs Creek at SC Highway 125 (SV-325). SV-325 had detections for nine of 12 samples collected. Tims Branch, which flows into Upper Three Runs Creek, was the primary stream affected by M-Area releases (Till et al. 2001). This may account for the common occurrence of alpha detections at this location.

Ambient monitoring average annual alpha trends for 2003-2008 are shown in Section 2.2.3, Figure 2. All averages were below the USEPA Maximum Contaminant Level (MCL) of 15 pCi/L for gross alpha-emitting particles in drinking water (USEPA 2002b).

Alpha-emitting radionuclides were detected in two random samples in 2008. Perimeter samples collected in Aiken County (RWE41) and Allendale County (RWE64) had detections of 5.70 (±1.82) pCi/L and 6.20 (±2.22) pCi/L, respectively. The 2008 random perimeter average was 5.95 (±0.35) pCi/L and is based on two detections out of eight samples collected. There were no detections for gross alpha in background samples collected in 2008. For the entire sampling period of 2004-2008, there were only three detections out of 53 background samples and seven out of 45 perimeter samples (SCDHEC 2005a, 2006b, 2007b, 2008a). The 2004-2008 alpha average for background and perimeter samples was 2.73 (±1.16) pCi/L and 3.92 (±2.28) pCi/L, respectively. The 2004-2008 background average is within one standard deviation of the 2004-2008 perimeter average and is slightly lower than the perimeter average. These few alpha detections could be attributed to unspecified NORM.

Beta

Beta-emitting radionuclide activity was detected in eight of nine locations where monthly composite samples were collected, with no detections at SV-118 (Section 2.3.5). There were four locations (Jackson Boat Landing (SV-2010), Upper Three Runs Creek at SC Highway 125 (SV-325), Pen Branch at USFS Rd. 13.2 (SV-2047), and Steel Creek at SC Highway 125 (SV-327)) that had only one detection out of 12 samples collected. For these locations, activities ranged from 2.94 (±1.47) pCi/L at SV-2047 to 7.14 (±2.17) pCi/L at SV-327. For the other four locations with multiple detections (Beaver Dam Creek in D-Area (SV-2040), Fourmile Branch at USFS Rd 13.2 (SV-2039), Steel Creek Boat Landing (SV-2018), and Lower Three Runs Creek at SRS Rd. B (SV-2053)), the average activity ranged from 3.52 (±0.78) pCi/L at SV-2040 to 5.92 (±2.59) pCi/L at SV-2039. The sampling location at SV-2039 yielded 12 detections out of 12 samples collected. Fourmile Branch was primarily affected by releases from the separations areas, so gross beta detections can be expected at this location.

Ambient monitoring average annual beta trends for 2003-2008 are shown in Section 2.3.3, Figure 3. The USEPA screening MCL for gross beta-emitting particles for drinking water systems is 50 pCi/L (USEPA 2002b), and all averages were below this limit.

Beta-emitting radionuclides were not detected in any random samples collected in 2008, so no comparison can be made to the previous time period of 2004-2007. For the sampling period of 2004-2008, there were nine detections out of 53 background samples collected and five detections out of 45 perimeter samples collected (SCDHEC 2005a, 2006b, 2007b, 2008a). The 2004-2008 beta average for background and perimeter samples was 3.85 (±1.45) pCi/L and 5.90 (±1.65) pCi/L, respectively. The 2004-2008 background average is within two standard deviations of the 2004-2008 perimeter average and is slightly lower than the perimeter average. These few beta detections could be attributed to unspecified NORM.

SCDHEC/DOE-SR Data Comparison

Data from 2008 reported in this project was compared to DOE-SR reported results (Section 2.3.3, Tables 3, 4, and 5). The ESOP and DOE-SR colocated sampling sites were Upper Three Runs Creek and SC Highway 125; Fourmile Branch and United States Forestry Service (USFS) Road 12.2; Pen Branch and USFS Road 13.2; Steel Creek and SC Highway 125; Lower Three Runs Creek and SRS Road B; and US Highway 301 Bridge at the Savannah River.

Tritium

SCDHEC and DOE-SR had detections for tritium at all colocated sample locations (Section 2.3.3, Table 3). DOE-SR average tritium activities for all colocated sites were within one SD of SCDHEC average tritium activities. SCDHEC and DOE-SR samples indicate that Fourmile Branch (47,347 (±8,889) pCi/L and 47,992 (±7,337) pCi/L (SRNS 2009), respectively) and Pen Branch Creek (48,043 (±17,702) pCi/L and 47,483 (±16,755) pCi/L (SRNS 2009), respectively) have the highest tritium activity of all SRS streams. The 2008 SCDHEC and DOE-SR tritium results appear to be consistent with historically reported data values (Section 2.3.3, Figures 4-9) (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a, SRNS 2009).

Gamma

DOE-SR reports all values, including values that are negative and ones that are below detection. Therefore, DOE-SR reports an average for all locations derived from detections and nondetection values. DOE-SR did not detect Cs-137 at any colocated sample location with SCDHEC. DOE-SR reported a nondetection average of 1.61 (±. 68) pCi/L (SRNS 2009) at the colocated sampling location at Fourmile Branch. SCDHEC had one Cs-137 detection, 3.55 (±1.58) pCi/L, at this location in August 2008.

Alpha

SCDHEC detected gross alpha activity at all of the colocated sample locations with DOE-SR (Section 2.3.3, Table 4). DOE-SR average gross alpha activities were within one SD of SCDHEC average gross alpha activities at Lower Three Runs Creek and three SDs at Upper Three Runs Creek and Steel Creek. DOE-SR average activities for Fourmile Branch and Pen Branch were greater than three SDs. This could be explained by the fact that DOE-SR uses nondetection values when calculating averages, which yields lower averages than SCDHEC. Furthermore, it is difficult to compare gross alpha analyses due to the unknown nature of the contributing alphas in collected samples. DOE-SR reported an average of 0.33 (±0.39) pCi/L at the Highway 301 location (SRNS 2009). SCDHEC had only one detection, 5.38 (±2.19) pCi/L, at this location. SCDHEC and DOE-SR samples collected from Upper Three Runs Creek at SC Highway 125 exhibited the highest gross alpha average concentration (6.38 (±2.55) pCi/L and 11.51 (±7.49) pCi/L (SRNS 2009), respectively).

Beta

SCDHEC and DOE-SR detected gross beta activity at all of the colocated sampling locations (Section 2.3.3, Table 5) with the exception of Highway 301. DOE-SR reported an average of 0.33 (±0.39) pCi/L at this location while SCDHEC reported no detections. DOE-SR average gross beta activities were within one SD of ESOP average gross beta activities at Fourmile Branch and Lower Three Runs Creek. DOE-SR reported a monthly average at Upper Three Runs Creek, Pen Branch, and Steel Creek. SCDHEC had only one detection at these locations. The SCDHEC single detection was within one SD of the DOE-SR average at Upper Three Runs and Pen Branch and within three SDs at Steel Creek. SCDHEC and DOE-SR samples collected from Fourmile Branch exhibited the highest gross beta average activities, 5.92 (±2.59) pCi/L, and 7.78 (±1.18) pCi/L (SRNS 2009), respectively. It is difficult to compare gross beta analyses due to the unknown nature of the contributing betas in collected samples.

Conclusions and Recommendations

All tritium results for the public access locations downstream from SRS were below the EPA MCL annual average of 20,000 pCi/L for drinking water. However, data generated from samples collected at the mouth of Fourmile Branch (SV-2015) indicate that the public could come into contact with tritium activity greater than the MCL at that location.

ESOP utilizes Minimum Detectable Activities (MDAs) in reporting radioactivity and does not report anything below MDA. DOE-SR, however, incorporates all values, including those below the MDA and negative numbers. This approach accounts for seemingly large differences between average values, which yields DOE-SR averages that are greater than three SDs from the SCDHEC average. Also, differences could be attributed, in part, to the nature of the water medium and the specific point and time when the sample was collected.

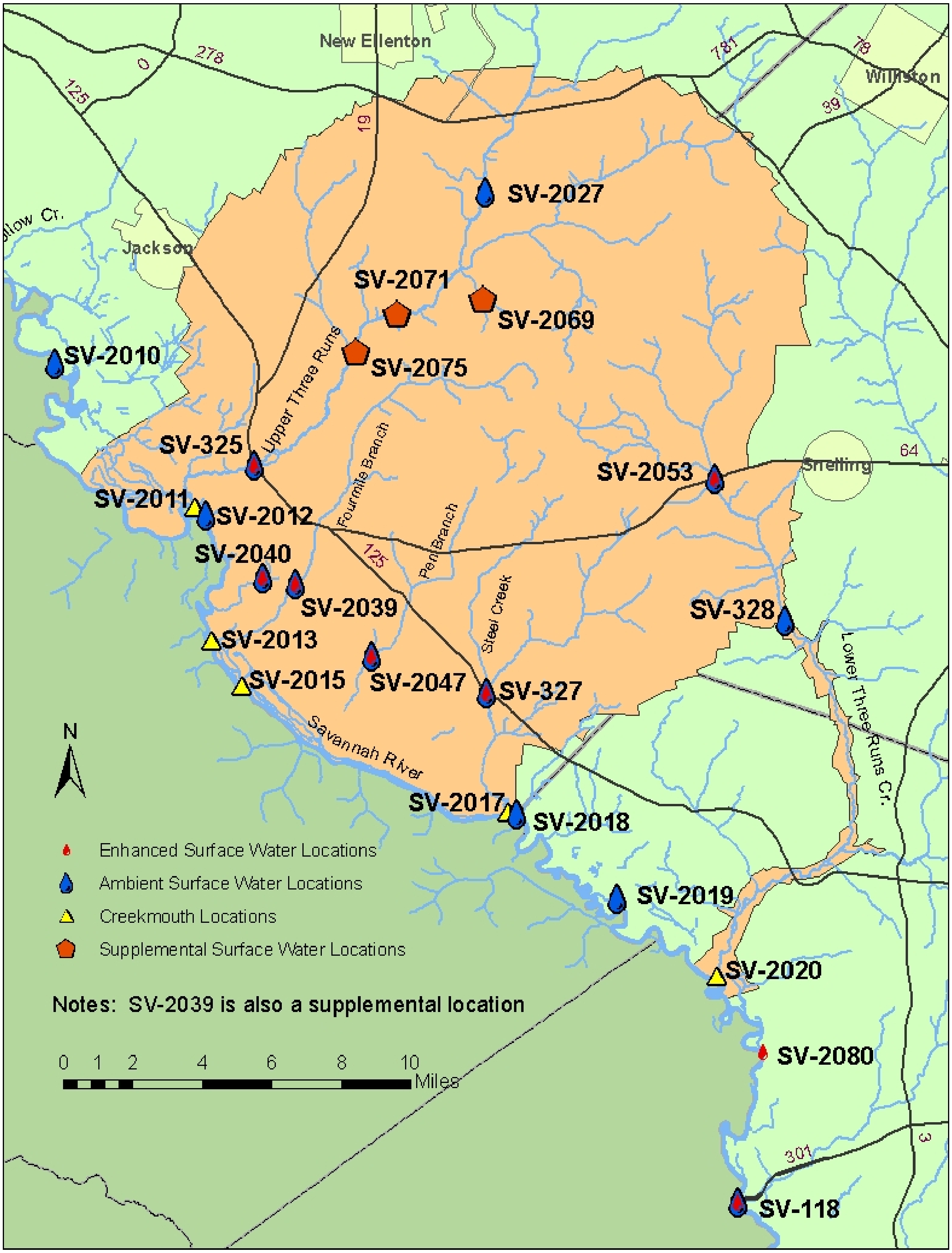
Differences in analytical results for tritium activity at sampling sites colocated with DOE-SR showed DOE-SR results were within one SD of SCDHEC results. Typically, ESOP samples do not exhibit Cs-137 on an annual basis. The single Cs-137 detection within the particular sample from Fourmile Branch at USFS Rd. 13.2 (SV-2039) may be attributed to sediment disturbance due to storm events. Also, a comparison of gross alpha data identified DOE-SR results within one SD of SCDHEC results at one location (Lower Three Runs Creek) and within two SDs at two locations (Upper Three Runs and Steel Creek). DOE-SR gross beta average for Fourmile Branch was within one SD of the SCDHEC average. ESOP and DOE-SR typically detect gross alpha emitting radionuclides from samples collected from the Upper Three Runs Creek location. Samples collected from this stream may continue to yield alpha detections due to past site operations in M-Area. ESOP only had one detection for gross beta at Upper Three Runs Creek, Pen Branch, and Steel Creek. ESOP had 12 detections out of 12 samples and DOE-SR had 12 detections out of 12 samples for the sampling location at Fourmile Branch. These beta detections are most likely attributed to past activities that occurred in the separation areas (F-Area and H-Area). This sampling location may continue to yield beta detections.

The ESOP RSW project will continue independent monitoring of surface water and will periodically evaluate modifications of the monitoring activities to better accomplish the project's goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide activity in SRS surface waters and the Savannah River, which will provide valuable information to human health exposure pathways. This comparison of data results allows for independent data evaluation of DOE-SR monitoring activities.

TOC

2.3.2

Map 5. Radiological Monitoring of Surface Water Sampling Locations TOC



Radiological Monitoring of Surface Water

Table 1. 2008 Surface Water Sampling Locations and Frequency

Ambient Monitoring Locations

ID	Location	Rationale	Frequency
SV-2010	Savannah River at RM 170.5 (Jackson Boat Landing)	Accessible to public; Above all SRS operations; Near Jackson population center; Upriver control; River monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-325	Upper Three Runs Creek at SC 125 (SRS Road A)	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-2012	Savannah River at RM 170.5 (TNX Boat Landing)	Adjacent to SRS perimeter; River monitoring	Weekly H3
SV-2040	Beaver Dam Creek at D-Area	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-2039	Fourmile Branch at Road A-13.2	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-2047	Pen Branch at Road A-13.2	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-327	Steel Creek at SC 125 (SRS Road A)	Within SRS perimeter; Below SRS operations areas; Tributary monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-2018	Savannah River at RM 141 (Steel Creek Boat Landing)	Accessible to public; Adjacent to SRS perimeter; Below SRS operations and tributaries; River monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-2019	Savannah River at RM 134.5 (Little Hell Boat Landing)	Accessible to public; Below SRS operations and tributaries; River monitoring	Weekly H3
SV-2080	Svannah River at RM 125 (Jackson Boat Landing)	Accessible to public; Below SRS operations and tributaries; River monitoring	TriWeekly H3 Grab
SV-118	Savannah River at RM 118.8 (Highway 301 Bridge)	Accessible to public; Below SRS operations and tributaries; River monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-328	Lower Three Runs Creek at Patterson Mill Rd.	Within SRS perimeter; Below SRS operations areas and PAR pond; Tributary monitoring	Weekly H3
SV-2053	Lower Three Runs Creek at Road B	Within SRS perimeter; Below SRS operations areas and PAR pond; Tributary monitoring	Weekly H3 / Monthly AB, Gamma Composite
SV-2027	Upper Three Runs Creek at SRS Road 2-1	Within SRS perimeter; Upstream from SRS operations; Upstream control; Tributary monitoring	Weekly H3

Notes:
1. ID is Sampling Location Identification Code Number
2. RM is River Mile
3. H3 is Tritium
4. AB is Alpha/Beta

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Table 1. (Cont.)

Creek Mouth Locations

ID	Location	Rationale	Frequency
SV-2011	Upper Three Runs Creek Mouth at RM 157.4	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2013	Beaver Dam Creek Mouth at RM 152.3	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2015a	Fourmile Branch at RM 150.6 (Creek Mouth)	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2015b	Fourmile Branch at RM 150.6 (30 ' downstream from Creek Mouth)	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2015c	Fourmile Branch at RM 150.6 (150' downstream from Creek Mouth)	Accessible to public; Adjacent to SRS; Below SRS operations areas; Tributary monitoring	Quarterly H3
SV-2017	Steel Creek Mouth at RM 141.5	Accessible to public; Adjacent to SRS; Downstream from SRS operations; Tributary monitoring	Quarterly H3
SV-2020	Lower Three Runs Creek Mouth at RM 129.1	Accessible to public; Adjacent to SRS; Downstream from SRS operations; Tributary monitoring	Quarterly H3

Supplemental Locations

ID	Location	Rationale	Frequency
SV-2069	McQueen Branch off Monroe Owens Rd.	Downstream from SRS operations; Z-Area	Weekly AB
SV-2071	Upper Three Runs Creek at Road C-4	Downstream from F- & H-Area HLW Tanks	Weekly AB
SV-2075	Upper Three Runs Creek at Road C	Downstream from F- & H-Area HLW Tanks	Weekly AB
SV-2039	Fourmile Branch at Road A-12.2	Downstream from F- & H-Area HLW Tanks	Weekly AB

Notes:
1. ID is Sampling Location Identification Code Number
2. RM is River Mile
3. H3 is Tritium
4. AB is Alpha/Beta

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Table 2. Radiological Analytes for Gamma Spectroscopy Analysis.

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Table 3. 2008 Tritium Data Comparison for SCDHEC and DOE-SR Colocated Sampling Location

Sample Location	Average Concentration (pCi/L)	Standard Deviation (pCi/L)	Median (pCi/L)	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs Creek (SV-325)	2,738	2,721	1,711	481	13,178	52	52
U3R-4 at Road A	2,630	2,343	NA	765	8,730	12	12
Fourmile Branch (SV-2039)	47,347	8,889	49,096	15,717	62,221	52	52
FM-6 at Road A-12.2	47,992	7,337	NA	38,100	61,600	12	12
Pen Branch (SV-2047)	48,043	17,702	53,680	7,719	73,037	52	52
PB-3 at Road 13.2	47,483	16,755	NA	18,800	67,000	12	12
Steel Creek (SV-327)	3,157	1,176	2,841	1,666	6,690	52	52
SC-4 Steel Creek at Road A	3,262	1,348	NA	1,880	6,840	12	12
Highway 301 Bridge (SV-118)	734	478	567	221	2,376	52	49
River Mile 118.8	686	171	NA	174	2,370	52	52
Lower Three Runs Creek at Patterson Mill Rd. (SV-328)	2,780	990	2,676	1,054	4,674	52	51
L3R-2 at Patterson Mill Rd	2,708	856	NA	1,420	4,270	12	12
Lower Three Runs Creek(SV-2053)	386	91	370	214	546	52	49
L3R-1A at Road B	422	392	NA	66	1,550	12	3

Notes:
1. Shaded areas represent SCDHEC data and unshaded areas represent DOE-SR data.
2. DOE-SR data is from the SRS Environmental Data Report for 2009 (SRNS 2009).
3. NA is Not Applicable
4. DOE-SR sampling locations:
   - U3R-4: Upper Three Runs at SC Highway 125
   - FM-6: Fourmile Branch at USFS Road A-12.2
   - PB-3: Pen Branch at USFS Road 13.2
   - SC-4: Steel Creek at SC Highway 125
   - L3R-2: Lower Three Runs at Patterson Mill Road
   - L3R-1A: Lower Three Runs at SRS Road B

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Table 4. 2008 Alpha Data Comparison for SCDHEC and DOE-SR Colocated Sampling Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation (pCi/L)	Median (pCi/L)	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs Creek (SV-325)	6.38	2.55	7.12	3.09	10.5	12	9
U3R-4 at Road A	11.51	7.49	NR	2.29	25.0	12	12
Fourmile Branch (SV-2039)	3.77	0.29	3.77	3.56	3.97	12	2
FM-6 at Road A-12.2	0.49	0.25	NR	0.13	0.91	12	4
Pen Branch Creek (SV-2047)	3.93	0.29	3.93	3.72	4.13	12	2
PB-3 at Road 13.2	2.34	1.31	NR	1.02	5.54	12	10
Steel Creek (SV-327)	3.11	0.46	3.21	2.37	3.58	12	5
SC-4 Steel Creek at Road A	2.04	3.39	NR	0.02	12.40	12	8
Highway 301 Bridge (SV-118)	**5.38***	**2.19***	NA	NA	NA	12	1
River Mile 118.8	0.33	0.39	NR	-0.21	1.52	52	1
Lower Three Runs Creek (SV-2053)	3.66	2.74	3.66	1.72	5.59	12	2
L3R-1A at Road B	3.08	3.39	NR	-0.01	10.3	12	9

Table 5. 2008 Beta Data Comparison for SCDHEC and DOE-SR Colocated Sampling Locations

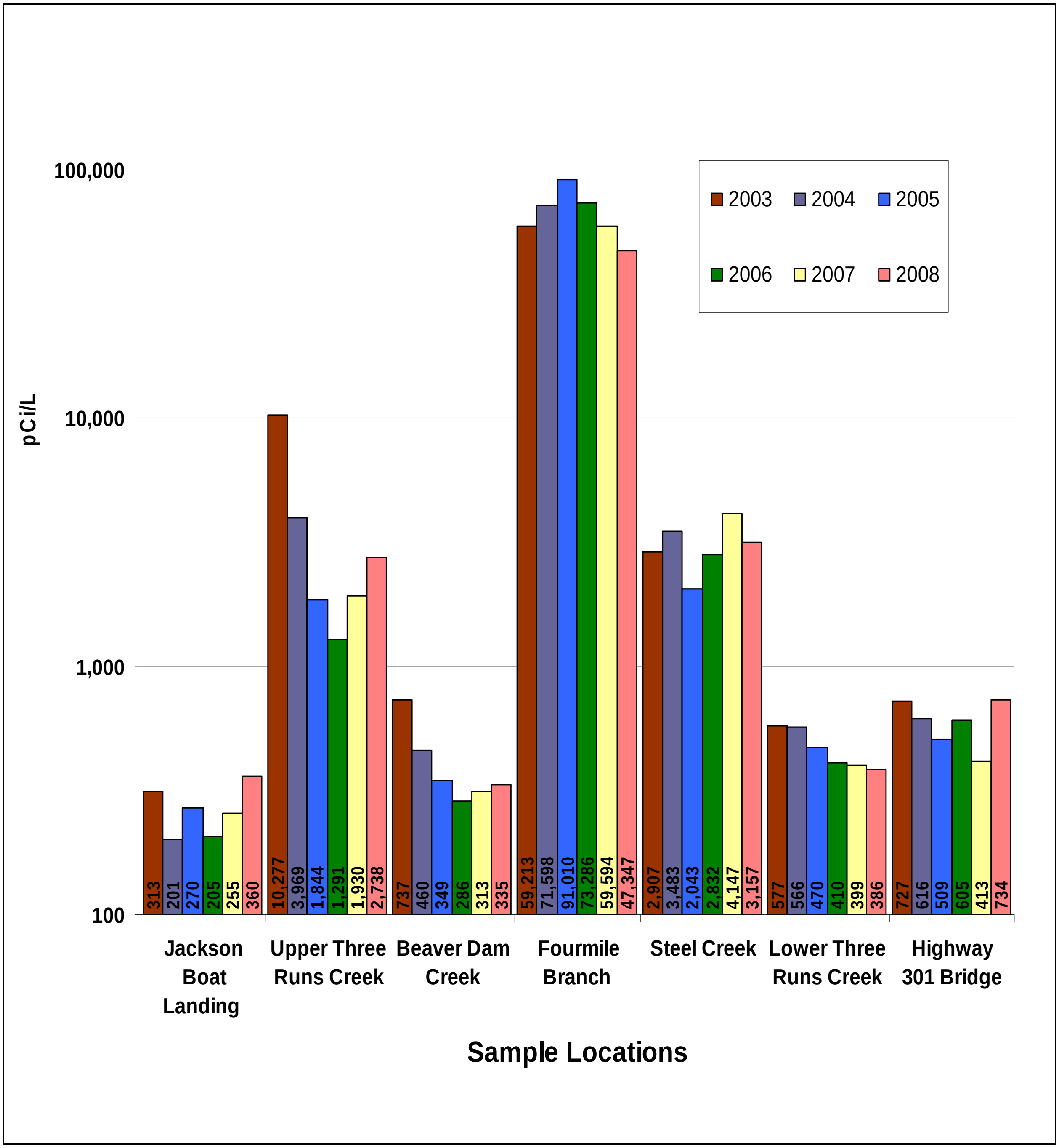
Sample Location	Average Concentration (pCi/L)	Standard Deviation (pCi/L)	Median (pCi/L)	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs Creek (SV-325)	**3.65***	**2.03***	NA	NA	NA	12	1
U3R-4 at Road A	4.02	2.52	NR	1.12	9.95	12	9
Fourmile Branch (SV-2039)	5.92	2.59	5.19	3.69	13.10	12	12
FM-6 at Road A-12.2	7.78	1.18	NR	6.35	9.35	12	12
Pen Branch Creek (SV-2047)	**2.94***	**1.47***	NA	NA	NA	12	1
PB-3 at Road 13.2	1.96	1.16	NR	0.25	4	12	8
Steel Creek (SV-327)	**7.14***	**2.17***	NA	NA	NA	12	1
SC-4 Steel Creek at Road A	1.87	1.49	NR	0.91	6.35	12	11
Highway 301 Bridge (SV-118)	ND	NA	NA	NA	NA	12	0
River Mile 118.8	2.47	0.90	NR	0.41	4.46	52	42
Lower Three Runs Creek (SV-2053)	4.20	0.99	4.20	3.50	4.90	12	2
L3R-1A at Road B	4.39	2.82	NR	-0.15	9.97	12	10

Notes:
1. Shaded areas represent SCDHEC data and unshaded areas represent DOE-SR data.
2. DOE-SR data is from the SRS Environmental Data Report for 2009 (SRNS 2009).
3. NA is Not Applicable.
4. ND is No Detects.
5. NR is Not Reported.
6. * denotes actual value and uncertainty (±2sd) for one detection for sampling location.
7. DOE-SR sampling locations:
   - U3R-4: Upper Three Runs at SC Highway 125
   - FM-6: Fourmile Branch at USFS Road A-12.2
   - PB-3: Pen Branch at USFS Road 13.2
   - SC-4: Steel Creek at SC Highway 125
   - L3R-2: Lower Three Runs at Patterson Mill Road
   - L3R-1A: Lower Three Runs at SRS Road B

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

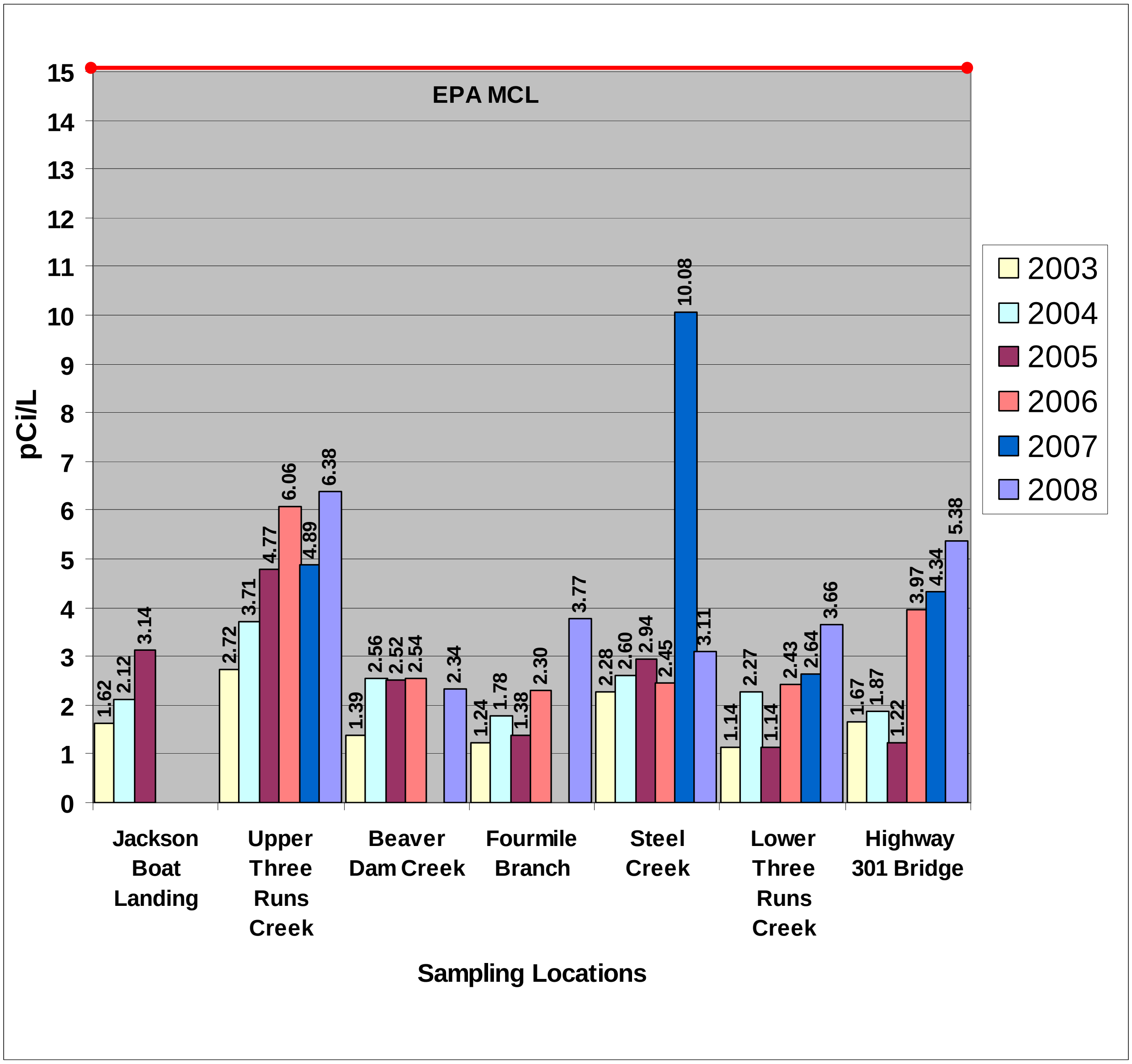
Figure 1. SCDHEC Average Tritium Trends for 2003-2008 (SCDHEC 2004b, 2005a, 2006b, 2007b, 2008a).



Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Figure 2. SCDHEC 2003-2008 Average Alpha Data (SCDHEC 2004b, 2005a, 2006b, 2007b, 2008a)

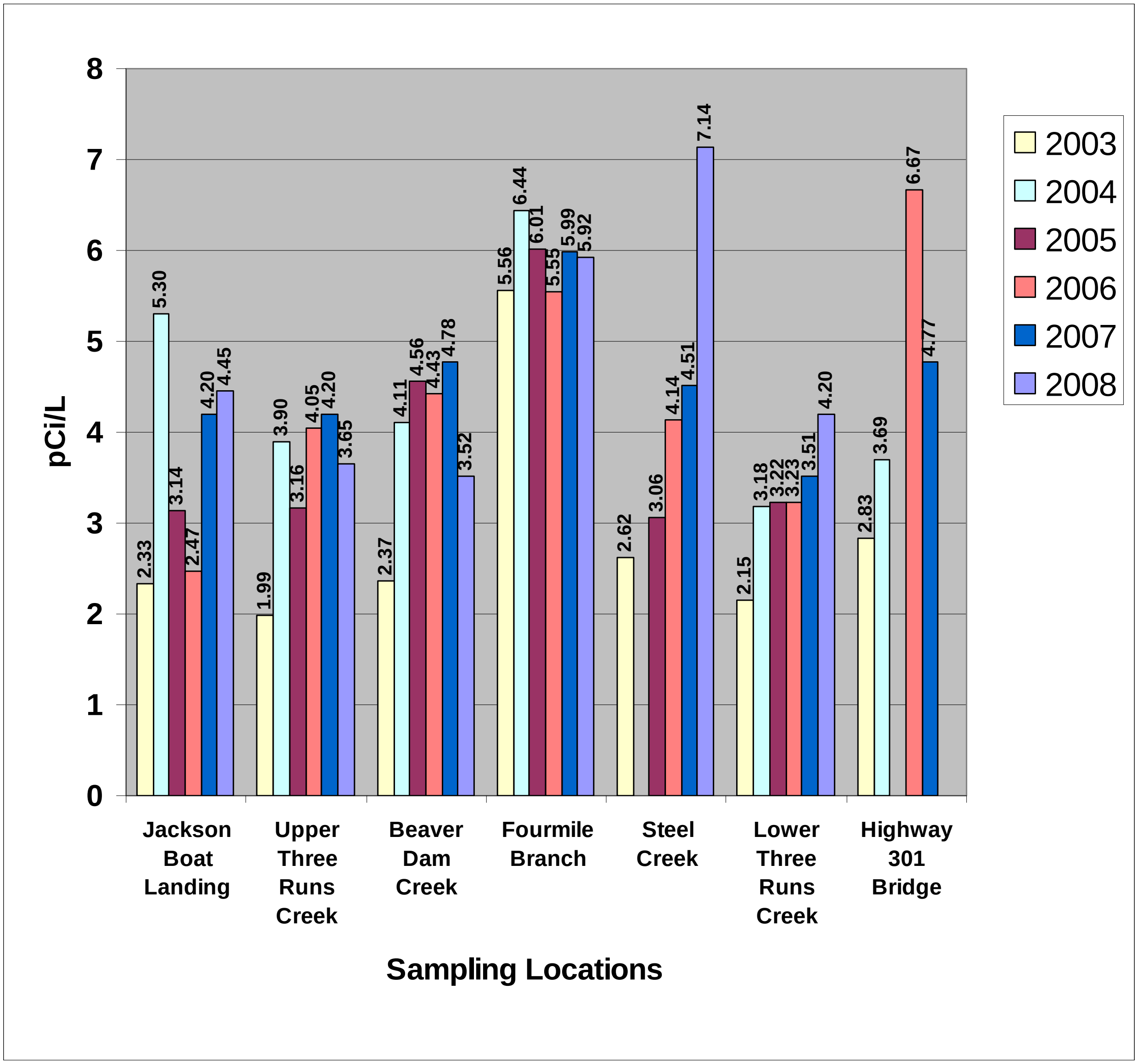


Notes:
1. No detections at Jackson Landing in 2006, 2007, and 2008.
2. No detections at Beaver Dam Creek 2007 and 2008.
3. No detections at Fourmile Branch in 2007.

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Figure 3. SCDHEC 2003-2008 Average Beta Data (SCDHEC 2004b, 2005a, 2006b, 2007b, 2008a)

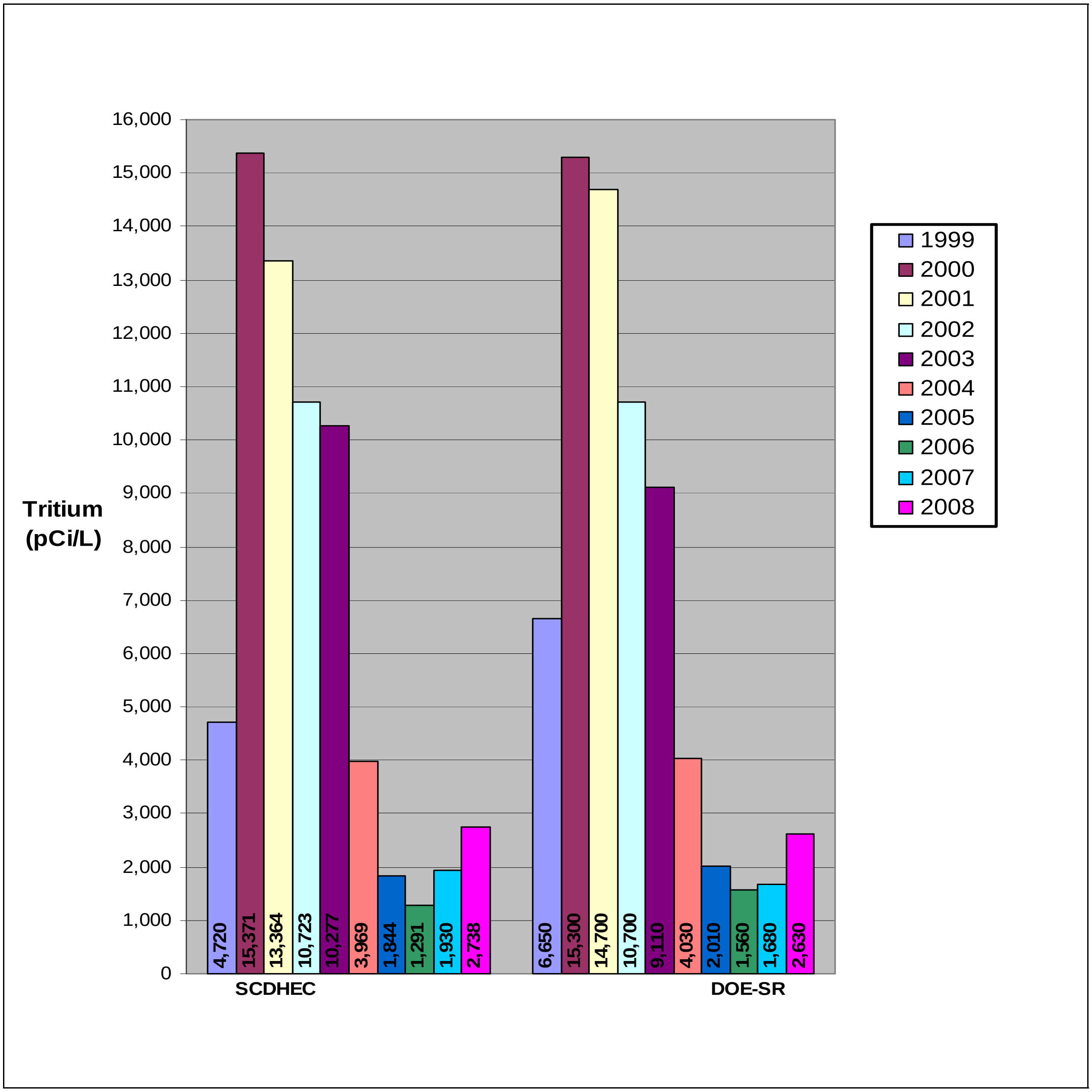


Notes:
1. The EPA screening level MCL for gross beta particles is 50 pCi/L.
2. No detections at Steel Creek in 2004.
3 No detections at Highway 301 in 2005 and 2008.

Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

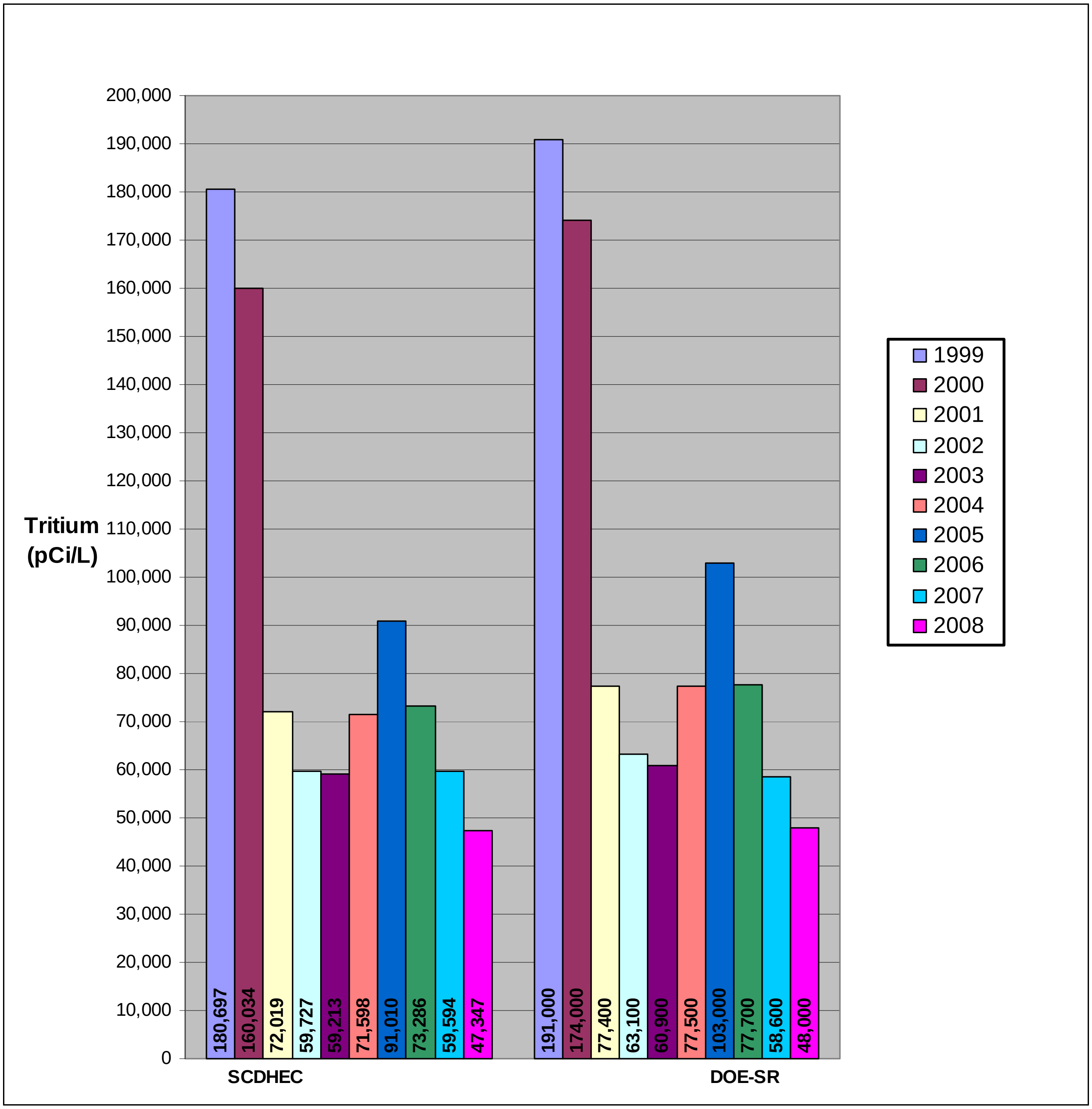
Figure 4. Average Tritium Data Trends For SCDHEC and DOE-SR at Upper Three Runs Creek and SC Highway 125 (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a).



Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

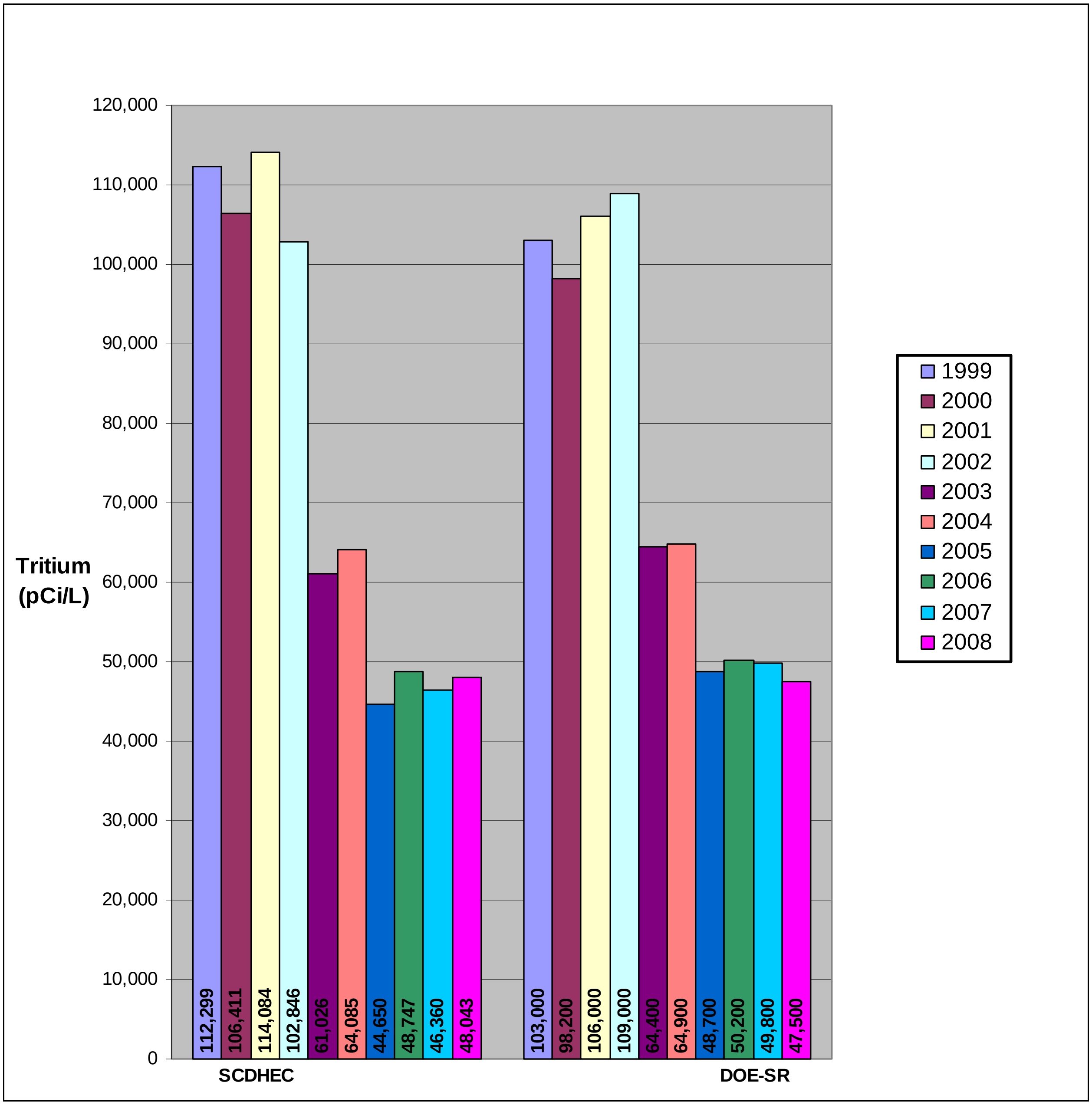
Figure 5. Average Tritium Data Trends For SCDHEC and DOE-SR at Fourmile Branch and USFS Road 12.2 (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a).



Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

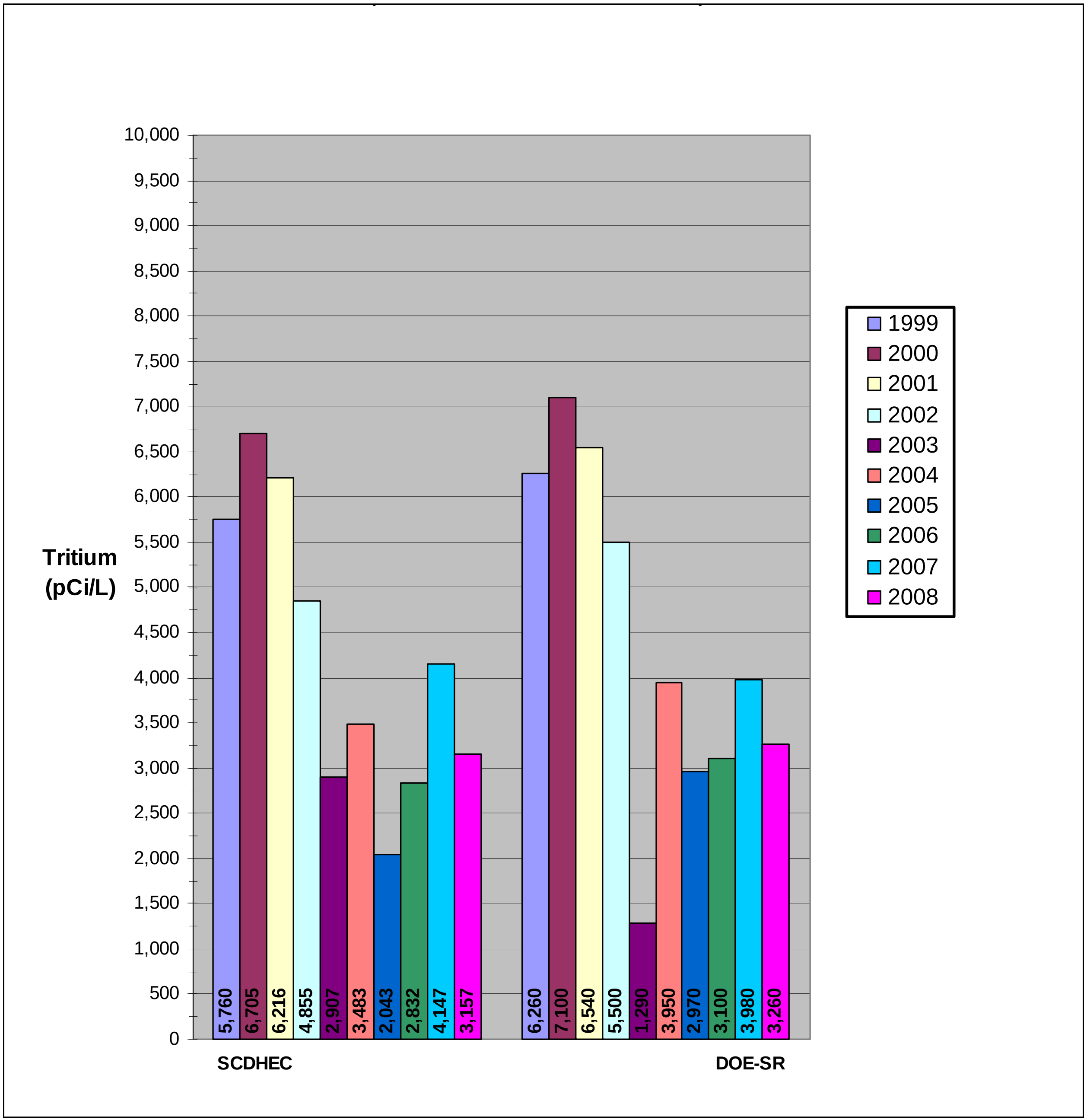
Figure 6. Average Tritium Data Trends For SCDHEC and DOE-SR at Pen Branch and USFS Road 13.2 (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a).



Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

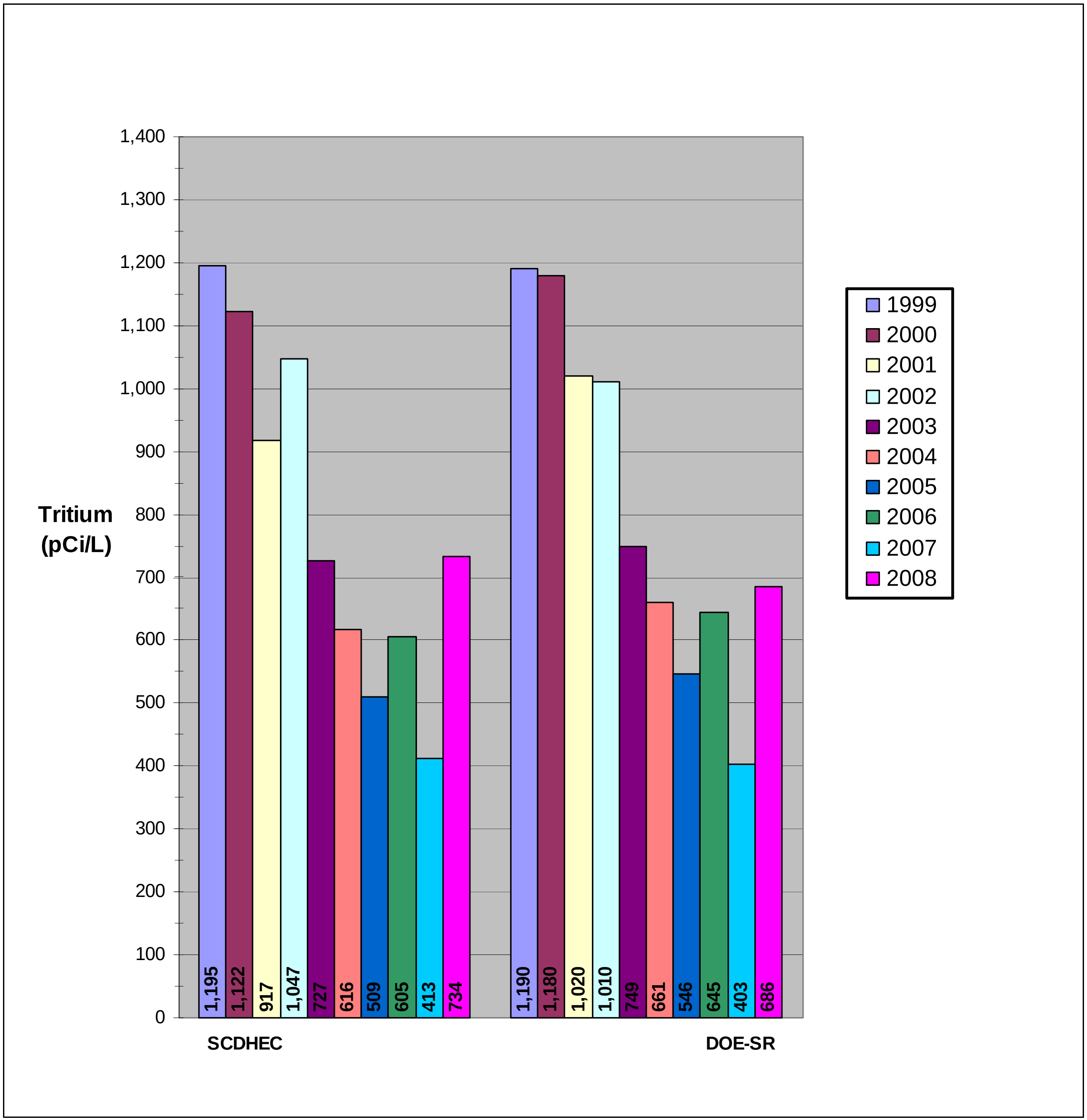
Figure 7. Average Tritium Data Trends For SCDHEC and DOE-SR at Steel Creek and SC Highway 125 (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a).



Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

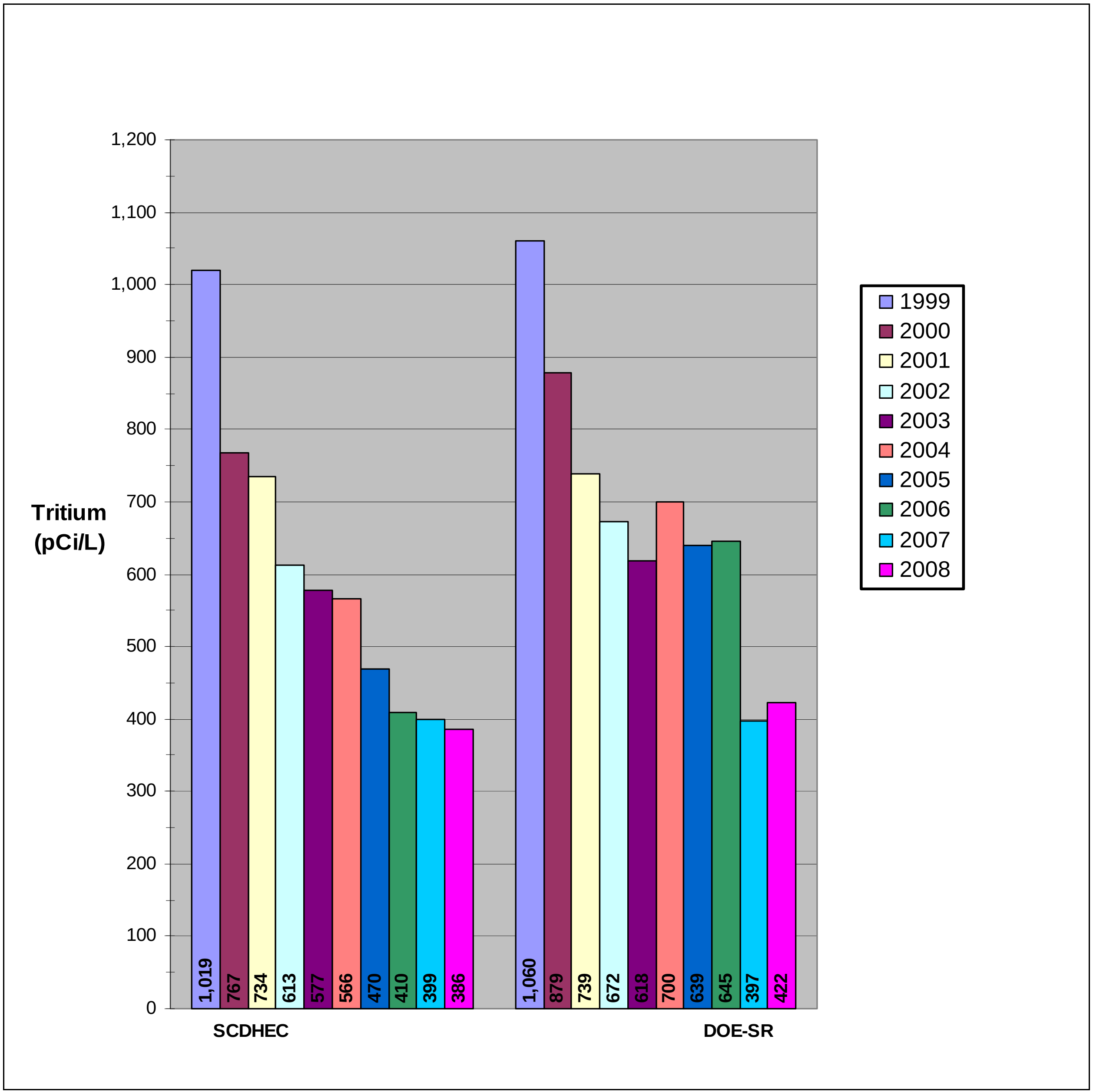
Figure 8. Average Tritium Data Trends For SCDHEC and DOE-SR at Lower Three Runs Creek and SRS Road B (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a).



Tables and Figures

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Figure 9. Average Tritium Data Trends For SCDHEC and DOE-SR at the Savannah River and US Highway 301 Bridge (WSRC 2000a, 2001a, 2002a, 2003a, 2004, 2005a, 2006, 2007,2008a, SRNS 2009, SCDHEC 2000, 2001c, 2002, 2003, 2004b, 2005a, 2006a, 2007b, 2008a).



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Radiological Monitoring of Surface Water

Notes:
1. Bold numbers indicate detections.
2. “MDA” is Minimum Detectable Activity.
3. “NA” is Not Applicable.
4. “NS” is No Sample.
5. “LLD” is Lower Limit of Detection.

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-2010 Jackson Boat Landing

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	<LLD	NA	178
	01/09/2008	**197**	**87**	**184**
	01/16/2008	<LLD	NA	187
	01/23/2008	**370**	**95**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	<LLD	NA	196
	02/13/2008	<LLD	NA	200
	02/20/2008	<LLD	NA	184
	02/27/2008	**220**	**92**	**193**
March	03/05/2008	<LLD	NA	197
	03/12/2008	<LLD	NA	192
	03/19/2008	<LLD	NA	187
	03/26/2008	**223**	**91**	**193**
April	04/02/2008	<LLD	NA	201
	04/09/2008	<LLD	NA	196
	04/16/2008	<LLD	NA	184
	04/23/2008	<LLD	NA	193
	04/30/2008	**183**	**83**	**177**
May	05/07/2008	<LLD	NA	180
	05/14/2008	<LLD	NA	191
	05/21/2008	<LLD	NA	190
	05/28/2008	<LLD	NA	194
June	06/04/2008	<LLD	NA	203
	06/11/2008	<LLD	NA	190
	06/18/2008	<LLD	NA	184
	06/25/2008	<LLD	NA	185
July	07/02/2008	<LLD	NA	192
	07/09/2008	**2181**	**155**	**189**
	07/16/2008	<LLD	NA	192
	07/23/2008	**242**	**95**	**197**
	07/30/2008	**218**	**89**	**189**
August	08/06/2008	<LLD	NA	200
	08/13/2008	<LLD	NA	200
	08/20/2008	<LLD	NA	192
	08/27/2008	**237**	**91**	**190**
September	09/03/2008	<LLD	NA	190
	09/10/2008	<LLD	NA	200
	09/17/2008	<LLD	NA	203
	09/24/2008	**222**	**94**	**201**
October	10/01/2008	**217**	**90**	**193**
	10/08/2008	<184	NA	184
	10/15/2008	**238**	**94**	**200**
	10/22/2008	<LLD	NA	189
	10/29/2008	**205**	**90**	**191**
November	11/05/2008	<LLD	NA	211
	11/12/2008	<LLD	NA	208
	11/19/2008	<LLD	NA	197
	11/26/2008	**256**	**91**	**188**
December	12/03/2008	**193**	**86**	**179**
	12/10/2008	<LLD	NA	189
	12/17/2008	<LLD	NA	185
	12/24/2008	<LLD	NA	196
	12/31/2008	<LLD	NA	189

SV-325 Upper Three Runs Creek and SC Highway 125

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**1379**	**119**	**178**
	01/09/2008	**3778**	**190**	**184**
	01/16/2008	**3877**	**191**	**187**
	01/23/2008	**1139**	**123**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**956**	**120**	**196**
	02/13/2008	**946**	**125**	**200**
	02/20/2008	**744**	**115**	**184**
	02/27/2008	**802**	**114**	**193**
March	03/05/2008	**733**	**114**	**197**
	03/12/2008	**829**	**116**	**192**
	03/19/2008	**1444**	**133**	**187**
	03/26/2008	**3319**	**182**	**193**
April	04/02/2008	**1436**	**136**	**201**
	04/09/2008	**1843**	**148**	**196**
	04/16/2008	**1512**	**136**	**184**
	04/23/2008	**1392**	**133**	**193**
	04/30/2008	**1313**	**126**	**177**
May	05/07/2008	**2451**	**158**	**180**
	05/14/2008	**1194**	**126**	**191**
	05/21/2008	**2779**	**168**	**190**
	05/28/2008	**3006**	**175**	**194**
June	06/04/2008	**1908**	**149**	**203**
	06/11/2008	**2301**	**157**	**190**
	06/18/2008	**1796**	**141**	**184**
	06/25/2008	**3332**	**179**	**185**
July	07/02/2008	**13178**	**330**	**192**
	07/09/2008	**9786**	**292**	**189**
	07/16/2008	**9163**	**280**	**192**
	07/23/2008	**5825**	**227**	**197**
	07/30/2008	**10976**	**301**	**189**
August	08/06/2008	**6863**	**254**	**200**
	08/13/2008	**5995**	**241**	**200**
	08/20/2008	**2854**	**176**	**192**
	08/27/2008	**1396**	**134**	**190**
September	09/03/2008	**2825**	**171**	**190**
	09/10/2008	**1337**	**137**	**200**
	09/17/2008	**481**	**106**	**203**
	09/24/2008	**2224**	**160**	**201**
October	10/01/2008	**1487**	**136**	**193**
	10/08/2008	**1514**	**134**	**184**
	10/15/2008	**1353**	**133**	**200**
	10/22/2008	**2181**	**155**	**189**
	10/29/2008	**1625**	**140**	**191**
November	11/05/2008	**2479**	**165**	**211**
	11/12/2008	**2917**	**176**	**208**
	11/19/2008	**1256**	**131**	**197**
	11/26/2008	**1981**	**148**	**188**
December	12/03/2008	**1041**	**120**	**179**
	12/10/2008	**1420**	**131**	**189**
	12/17/2008	**1129**	**126**	**185**
	12/24/2008	**959**	**121**	**196**
	12/31/2008	**1947**	**149**	**189**

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-2012 TNX Boat Landing

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**549**	**100**	**178**
	01/09/2008	**1104**	**121**	**184**
	01/16/2008	**1269**	**126**	**187**
	01/23/2008	**507**	**100**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**481**	**105**	**196**
	02/13/2008	<LLD	NA	200
	02/20/2008	**228**	**94**	**184**
	02/27/2008	**241**	**92**	**193**
March	03/05/2008	**364**	**99**	**197**
	03/12/2008	**389**	**99**	**192**
	03/19/2008	**305**	**93**	**187**
	03/26/2008	**965**	**119**	**193**
April	04/02/2008	**1077**	**125**	**201**
	04/09/2008	**846**	**116**	**196**
	04/16/2008	**854**	**113**	**184**
	04/23/2008	**916**	**117**	**193**
	04/30/2008	**295**	**88**	**177**
May	05/07/2008	<LLD	NA	180
	05/14/2008	<LLD	NA	191
	05/21/2008	<LLD	NA	190
	05/28/2008	<LLD	NA	194
June	06/04/2008	<LLD	NA	203
	06/11/2008	<LLD	NA	190
	06/18/2008	**783**	**110**	**184**
	06/25/2008	<LLD	NA	185
July	07/02/2008	**3179**	**177**	**192**
	07/09/2008	**3554**	**187**	**189**
	07/16/2008	**2427**	**161**	**192**
	07/23/2008	**2570**	**163**	**197**
	07/30/2008	**3141**	**175**	**189**
August	08/06/2008	**259**	**96**	**200**
	08/13/2008	**207**	**94**	**200**
	08/20/2008	**209**	**91**	**192**
	08/27/2008	**388**	**98**	**190**
September	09/03/2008	**306**	**96**	**190**
	09/10/2008	**1127**	**131**	**200**
	09/17/2008	<LLD	NA	203
	09/24/2008	**234**	**95**	**201**
October	10/01/2008	<LLD	NA	193
	10/08/2008	**199**	**87**	**184**
	10/15/2008	<LLD	NA	200
	10/22/2008	<LLD	NA	189
	10/29/2008	**227**	**91**	**191**
November	11/05/2008	<LLD	NA	211
	11/12/2008	**399**	**104**	**208**
	11/19/2008	**255**	**95**	**197**
	11/26/2008	<LLD	NA	188
December	12/03/2008	**444**	**97**	**179**
	12/10/2008	**303**	**94**	**189**
	12/17/2008	**199**	**91**	**185**
	12/24/2008	**311**	**96**	**196**
	12/31/2008	**335**	**96**	**189**

SV-2040 Beaver Dam Creek

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**303**	**89**	**178**
	01/09/2008	**311**	**92**	**184**
	01/16/2008	**229**	**89**	**187**
	01/23/2008	**253**	**89**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**425**	**100**	**196**
	02/13/2008	<LLD	NA	200
	02/20/2008	**333**	**98**	**184**
	02/27/2008	<LLD	NA	193
March	03/05/2008	**337**	**97**	**197**
	03/12/2008	**217**	**91**	**192**
	03/19/2008	**241**	**90**	**187**
	03/26/2008	**422**	**99**	**193**
April	04/02/2008	<LLD	NA	201
	04/09/2008	<LLD	NA	196
	04/16/2008	**205**	**87**	**184**
	04/23/2008	**285**	**93**	**193**
	04/30/2008	**473**	**96**	**177**
May	05/07/2008	**212**	**86**	**180**
	05/14/2008	**328**	**95**	**191**
	05/21/2008	<LLD	NA	190
	05/28/2008	**195**	**91**	**194**
June	06/04/2008	<LLD	NA	203
	06/11/2008	**211**	**89**	**190**
	06/18/2008	**380**	**94**	**184**
	06/25/2008	**233**	**88**	**185**
July	07/02/2008	**370**	**97**	**192**
	07/09/2008	**457**	**100**	**189**
	07/16/2008	**527**	**103**	**192**
	07/23/2008	**375**	**99**	**197**
	07/30/2008	**711**	**108**	**189**
August	08/06/2008	**552**	**108**	**200**
	08/13/2008	**376**	**100**	**200**
	08/20/2008	**383**	**99**	**192**
	08/27/2008	**322**	**95**	**190**
September	09/03/2008	**461**	**101**	**190**
	09/10/2008	<LLD	NA	200
	09/17/2008	**285**	**97**	**203**
	09/24/2008	**325**	**97**	**201**
October	10/01/2008	**394**	**97**	**193**
	10/08/2008	**247**	**89**	**184**
	10/15/2008	<LLD	NA	200
	10/22/2008	**280**	**92**	**189**
	10/29/2008	**271**	**93**	**191**
November	11/05/2008	**312**	**111**	**211**
	11/12/2008	**211**	**96**	**208**
	11/19/2008	**325**	**97**	**197**
	11/26/2008	**303**	**93**	**188**
December	12/03/2008	**408**	**95**	**179**
	12/10/2008	**222**	**90**	**189**
	12/17/2008	<LLD	NA	185
	12/24/2008	<LLD	NA	196
	12/31/2008	**380**	**98**	**189**

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-2039 Fourmile Branch at USFS Rd. 13.2

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**43271**	**585**	**178**
	01/09/2008	**52365**	**644**	**184**
	01/16/2008	**52087**	**638**	**187**
	01/23/2008	**49150**	**628**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**43012**	**589**	**196**
	02/13/2008	**62221**	**706**	**200**
	02/20/2008	**51633**	**645**	**184**
	02/27/2008	**61279**	**702**	**193**
March	03/05/2008	**50395**	**644**	**197**
	03/12/2008	**47835**	**625**	**192**
	03/19/2008	**46185**	**608**	**187**
	03/26/2008	**49041**	**628**	**193**
April	04/02/2008	**53969**	**661**	**201**
	04/09/2008	**46540**	**615**	**196**
	04/16/2008	**51353**	**665**	**184**
	04/23/2008	**57056**	**718**	**193**
	04/30/2008	**58453**	**680**	**177**
May	05/07/2008	**53997**	**658**	**180**
	05/14/2008	**55378**	**665**	**191**
	05/21/2008	**51000**	**634**	**190**
	05/28/2008	**50225**	**636**	**194**
June	06/04/2008	**53900**	**658**	**203**
	06/11/2008	**54370**	**659**	**190**
	06/18/2008	**52703**	**649**	**184**
	06/25/2008	**43209**	**584**	**185**
July	07/02/2008	**50305**	**631**	**192**
	07/09/2008	**45850**	**617**	**189**
	07/16/2008	**46461**	**629**	**192**
	07/23/2008	**43547**	**603**	**197**
	07/30/2008	**38466**	**551**	**189**
August	08/06/2008	**41569**	**586**	**200**
	08/13/2008	**40638**	**580**	**200**
	08/20/2008	**38797**	**557**	**192**
	08/27/2008	**43753**	**594**	**190**
September	09/03/2008	**37400**	**566**	**190**
	09/10/2008	**42980**	**601**	**200**
	09/17/2008	**49918**	**648**	**203**
	09/24/2008	**48699**	**634**	**201**
October	10/01/2008	**50924**	**644**	**193**
	10/08/2008	**48499**	**622**	**184**
	10/15/2008	**52423**	**643**	**200**
	10/22/2008	**47798**	**619**	**189**
	10/29/2008	**45114**	**599**	**185**
November	11/05/2008	**51678**	**651**	**211**
	11/12/2008	**53993**	**663**	**208**
	11/19/2008	**31895**	**514**	**197**
	11/26/2008	**15717**	**361**	**188**
December	12/03/2008	**17040**	**378**	**179**
	12/10/2008	**38388**	**558**	**189**
	12/17/2008	**39243**	**563**	**185**
	12/24/2008	**52020**	**648**	**196**
	12/31/2008	**58283**	**687**	**189**

SV-2047 Pen Branch at USFS Rd. 13.2

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**34529**	**522**	**178**
	01/09/2008	**19676**	**398**	**184**
	01/16/2008	**19707**	**398**	**187**
	01/23/2008	**19308**	**399**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**24124**	**448**	**196**
	02/13/2008	**32512**	**514**	**200**
	02/20/2008	**31780**	**512**	**184**
	02/27/2008	**32316**	**512**	**193**
March	03/05/2008	**27277**	**479**	**197**
	03/12/2008	**25131**	**463**	**192**
	03/19/2008	**27036**	**474**	**187**
	03/26/2008	**31278**	**510**	**193**
April	04/02/2008	**34670**	**537**	**201**
	04/09/2008	**27104**	**479**	**196**
	04/16/2008	**36755**	**554**	**184**
	04/23/2008	**46801**	**619**	**193**
	04/30/2008	**47122**	**612**	**177**
May	05/07/2008	**53389**	**654**	**180**
	05/14/2008	**47354**	**618**	**191**
	05/21/2008	**57303**	**674**	**190**
	05/28/2008	**61583**	**705**	**194**
June	06/04/2008	**67289**	**732**	**203**
	06/11/2008	**65533**	**726**	**190**
	06/18/2008	**67497**	**734**	**184**
	06/25/2008	**70827**	**745**	**185**
July	07/02/2008	**66219**	**723**	**192**
	07/09/2008	**59397**	**713**	**189**
	07/16/2008	**60465**	**695**	**192**
	07/23/2008	**66793**	**733**	**197**
	07/30/2008	**62019**	**707**	**189**
August	08/06/2008	**67324**	**751**	**200**
	08/13/2008	**67921**	**740**	**200**
	08/20/2008	**58142**	**690**	**192**
	08/27/2008	**53970**	**660**	**190**
September	09/03/2008	**41446**	**587**	**190**
	09/10/2008	**56122**	**672**	**200**
	09/17/2008	**73037**	**785**	**203**
	09/24/2008	**71110**	**759**	**201**
October	10/01/2008	**68284**	**738**	**193**
	10/08/2008	**67294**	**730**	**184**
	10/15/2008	**59797**	**687**	**200**
	10/22/2008	**65819**	**726**	**189**
	10/29/2008	**54502**	**664**	**191**
November	11/05/2008	**58799**	**685**	**211**
	11/12/2008	**66158**	**731**	**208**
	11/19/2008	**40112**	**576**	**197**
	11/26/2008	**60080**	**692**	**188**
December	12/03/2008	**41587**	**584**	**179**
	12/10/2008	**35473**	**539**	**189**
	12/17/2008	**7719**	**264**	**185**
	12/24/2008	**26246**	**466**	**196**
	12/31/2008	**34485**	**532**	**189**

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-327 Steel Creek at SC Highway 125

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**6690**	**238**	**178**
	01/09/2008	**6042**	**229**	**184**
	01/16/2008	**6252**	**233**	**187**
	01/23/2008	**2606**	**163**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**1672**	**142**	**196**
	02/13/2008	**5802**	**229**	**200**
	02/20/2008	**1942**	**150**	**184**
	02/27/2008	**5809**	**228**	**193**
March	03/05/2008	**2616**	**169**	**197**
	03/12/2008	**3616**	**188**	**192**
	03/19/2008	**2039**	**150**	**187**
	03/26/2008	**3158**	**178**	**193**
April	04/02/2008	**2046**	**154**	**201**
	04/09/2008	**1898**	**148**	**196**
	04/16/2008	**2353**	**158**	**184**
	04/23/2008	**2632**	**167**	**193**
	04/30/2008	**2528**	**159**	**177**
May	05/07/2008	**2846**	**169**	**180**
	05/14/2008	**2574**	**164**	**191**
	05/21/2008	**3127**	**176**	**190**
	05/28/2008	**3048**	**175**	**194**
June	06/04/2008	**2788**	**174**	**203**
	06/11/2008	**3789**	**192**	**190**
	06/18/2008	**3775**	**188**	**184**
	06/25/2008	**4068**	**193**	**185**
July	07/02/2008	**3941**	**193**	**192**
	07/09/2008	**3163**	**181**	**189**
	07/16/2008	**2976**	**174**	**192**
	07/23/2008	**3849**	**191**	**197**
	07/30/2008	**2835**	**168**	**189**
August	08/06/2008	**2349**	**160**	**200**
	08/13/2008	**3169**	**181**	**200**
	08/20/2008	**2783**	**171**	**192**
	08/27/2008	**2383**	**158**	**190**
September	09/03/2008	**2724**	**170**	**190**
	09/10/2008	**3288**	**187**	**200**
	09/17/2008	**2947**	**175**	**203**
	09/24/2008	**3206**	**179**	**201**
October	10/01/2008	**3308**	**180**	**193**
	10/08/2008	**3335**	**179**	**184**
	10/15/2008	**2094**	**152**	**200**
	10/22/2008	**2867**	**171**	**189**
	10/29/2008	**2378**	**160**	**191**
November	11/05/2008	**2756**	**172**	**211**
	11/12/2008	**2693**	**171**	**208**
	11/19/2008	**2290**	**160**	**197**
	11/26/2008	**2321**	**156**	**188**
December	12/03/2008	**1666**	**139**	**179**
	12/10/2008	**3632**	**187**	**189**
	12/17/2008	**4985**	**220**	**185**
	12/24/2008	**2091**	**153**	**196**
	12/31/2008	**2407**	**163**	**189**

SV-2018 Steel Creek Boat Landing

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**1268**	**124**	**178**
	01/09/2008	**1321**	**128**	**184**
	01/16/2008	**1386**	**130**	**187**
	01/23/2008	**1348**	**128**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**4689**	**210**	**196**
	02/13/2008	**1283**	**131**	**200**
	02/20/2008	**878**	**118**	**184**
	02/27/2008	**1209**	**127**	**193**
March	03/05/2008	**1279**	**131**	**197**
	03/12/2008	**2114**	**154**	**192**
	03/19/2008	**984**	**119**	**187**
	03/26/2008	**782**	**114**	**193**
April	04/02/2008	**1076**	**126**	**201**
	04/09/2008	**904**	**119**	**196**
	04/16/2008	**774**	**110**	**184**
	04/23/2008	**584**	**105**	**193**
	04/30/2008	**729**	**106**	**177**
May	05/07/2008	**521**	**100**	**180**
	05/14/2008	**338**	**95**	**191**
	05/21/2008	**329**	**94**	**190**
	05/28/2008	**275**	**94**	**194**
June	06/04/2008	**256**	**97**	**203**
	06/11/2008	**210**	**89**	**190**
	06/18/2008	**189**	**86**	**184**
	06/25/2008	**186**	**86**	**185**
July	07/02/2008	**791**	**112**	**192**
	07/09/2008	**530**	**102**	**189**
	07/16/2008	**479**	**102**	**192**
	07/23/2008	**294**	**96**	**197**
	07/30/2008	**824**	**113**	**189**
August	08/06/2008	**333**	**98**	**200**
	08/13/2008	**484**	**106**	**200**
	08/20/2008	**287**	**94**	**192**
	08/27/2008	**518**	**102**	**190**
September	09/03/2008	**687**	**109**	**190**
	09/10/2008	**1702**	**143**	**200**
	09/17/2008	**4384**	**207**	**203**
	09/24/2008	**441**	**102**	**201**
October	10/01/2008	**388**	**97**	**193**
	10/08/2008	<184	NA	184
	10/15/2008	<LLD	NA	200
	10/22/2008	**335**	**95**	**189**
	10/29/2008	**375**	**97**	**191**
November	11/05/2008	**238**	**97**	**211**
	11/12/2008	<LLD	NA	208
	11/19/2008	**392**	**100**	**197**
	11/26/2008	**355**	**95**	**188**
December	12/03/2008	**443**	**96**	**179**
	12/10/2008	**2267**	**157**	**189**
	12/17/2008	**3215**	**183**	**185**
	12/24/2008	**1087**	**125**	**196**
	12/31/2008	**940**	**119**	**189**

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-2019 Little Hell Landing

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	180	83	178
	01/09/2008	<LLD	NA	184
	01/16/2008	<LLD	NA	187
	01/23/2008	554	101	182
	01/30/2008	NS	NS	NS
February	02/06/2008	422	101	196
	02/13/2008	344	99	200
	02/20/2008	836	117	184
	02/27/2008	392	98	193
March	03/05/2008	341	98	197
	03/12/2008	349	97	192
	03/19/2008	569	105	187
	03/26/2008	729	112	193
April	04/02/2008	428	106	201
	04/09/2008	<LLD	NA	196
	04/16/2008	282	91	184
	04/23/2008	307	95	193
	04/30/2008	456	95	177
May	05/07/2008	349	93	180
	05/14/2008	335	95	191
	05/21/2008	496	102	190
	05/28/2008	561	106	194
June	06/04/2008	219	95	203
	06/11/2008	329	95	190
	06/18/2008	578	103	184
	06/25/2008	189	87	185
July	07/02/2008	272	93	192
	07/09/2008	425	101	189
	07/16/2008	504	103	192
	07/23/2008	1187	126	197
	07/30/2008	2735	166	189
August	08/06/2008	726	112	200
	08/13/2008	537	105	200
	08/20/2008	537	104	192
	08/27/2008	451	99	190
September	09/03/2008	744	113	190
	09/10/2008	1573	139	200
	09/17/2008	1471	138	203
	09/24/2008	835	116	201
October	10/01/2008	749	112	193
	10/08/2008	602	103	184
	10/15/2008	493	104	200
	10/22/2008	448	100	189
	10/29/2008	341	96	191
November	11/05/2008	255	98	211
	11/12/2008	<LLD	NA	208
	11/19/2008	<LLD	NA	197
	11/26/2008	308	93	188
December	12/03/2008	523	99	179
	12/10/2008	193	89	189
	12/17/2008	<LLD	NA	185
	12/24/2008	404	100	196
	12/31/2008	359	97	189

SV-118 US Highway 301 Bridge

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	494	97	178
	01/09/2008	601	103	184
	01/16/2008	590	104	187
	01/23/2008	1291	126	182
	01/30/2008	NS	NS	NS
February	02/06/2008	563	106	196
	02/13/2008	599	109	200
	02/20/2008	<LLD	NA	184
	02/27/2008	<LLD	NA	193
March	03/05/2008	558	106	197
	03/12/2008	495	103	192
	03/19/2008	1291	128	187
	03/26/2008	1803	145	193
April	04/02/2008	951	121	201
	04/09/2008	422	100	196
	04/16/2008	528	101	184
	04/23/2008	359	96	193
	04/30/2008	562	99	177
May	05/07/2008	504	99	180
	05/14/2008	498	101	191
	05/21/2008	329	94	190
	05/28/2008	567	106	194
June	06/04/2008	271	97	203
	06/11/2008	698	109	190
	06/18/2008	564	102	184
	06/25/2008	309	92	185
July	07/02/2008	310	95	192
	07/09/2008	601	105	189
	07/16/2008	500	102	192
	07/23/2008	1680	143	197
	07/30/2008	2208	153	189
August	08/06/2008	1151	130	200
	08/13/2008	487	104	200
	08/20/2008	640	108	192
	08/27/2008	1183	125	190
September	09/03/2008	578	105	190
	09/10/2008	1324	132	200
	09/17/2008	2376	160	203
	09/24/2008	1145	126	201
October	10/01/2008	773	112	193
	10/08/2008	542	101	184
	10/15/2008	435	103	200
	10/22/2008	483	101	189
	10/29/2008	360	97	191
November	11/05/2008	221	97	211
	11/12/2008	<LLD	NA	208
	11/19/2008	326	96	197
	11/26/2008	522	102	188
December	12/03/2008	839	112	179
	12/10/2008	609	106	189
	12/17/2008	619	108	185
	12/24/2008	605	108	196
	12/31/2008	598	106	189

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-328 Lower Three Runs Creek at Patterson Mill Rd.

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**1954**	**144**	**178**
	01/09/2008	**2203**	**151**	**184**
	01/16/2008	**2666**	**165**	**187**
	01/23/2008	**2183**	**151**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**1200**	**128**	**196**
	02/13/2008	**1913**	**149**	**200**
	02/20/2008	**1901**	**149**	**184**
	02/27/2008	**1917**	**148**	**193**
March	03/05/2008	**1054**	**125**	**197**
	03/12/2008	**1633**	**140**	**192**
	03/19/2008	**1646**	**138**	**187**
	03/26/2008	**1933**	**92**	**193**
April	04/02/2008	**1487**	**138**	**201**
	04/09/2008	**1360**	**95**	**196**
	04/16/2008	**1863**	**96**	**184**
	04/23/2008	**2466**	**94**	**193**
	04/30/2008	**2044**	**95**	**177**
May	05/07/2008	**2888**	**169**	**180**
	05/14/2008	**2517**	**161**	**191**
	05/21/2008	**2927**	**171**	**190**
	05/28/2008	**3429**	**183**	**194**
June	06/04/2008	**3923**	**195**	**203**
	06/11/2008	**4674**	**208**	**190**
	06/18/2008	**4671**	**207**	**184**
	06/25/2008	**4609**	**205**	**185**
July	07/02/2008	**4123**	**197**	**192**
	07/09/2008	**3677**	**189**	**189**
	07/16/2008	**3228**	**178**	**192**
	07/23/2008	**4124**	**196**	**197**
	07/30/2008	**3953**	**193**	**189**
August	08/06/2008	**3724**	**190**	**200**
	08/13/2008	**3503**	**187**	**200**
	08/20/2008	**3833**	**191**	**192**
	08/27/2008	**1076**	**123**	**190**
September	09/03/2008	**3588**	**188**	**190**
	09/10/2008	**3785**	**192**	**200**
	09/17/2008	**3506**	**188**	**203**
	09/24/2008	**3687**	**191**	**201**
October	10/01/2008	**3393**	**183**	**193**
	10/08/2008	**3581**	**185**	**184**
	10/15/2008	**2536**	**164**	**200**
	10/22/2008	**3547**	**187**	**189**
	10/29/2008	**3053**	**175**	**191**
November	11/05/2008	**3043**	**178**	**211**
	11/12/2008	NS	NS	NS
	11/19/2008	**2676**	**166**	**197**
	11/26/2008	**2793**	**168**	**188**
December	12/03/2008	**2275**	**155**	**179**
	12/10/2008	**2330**	**158**	**189**
	12/17/2008	**1917**	**147**	**185**
	12/24/2008	**1860**	**146**	**196**
	12/31/2008	**1894**	**147**	**189**

SV-2053 Lower Three Runs Creek at SRS Rd. B

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**290**	**88**	**178**
	01/09/2008	**352**	**93**	**184**
	01/16/2008	**507**	**101**	**187**
	01/23/2008	**491**	**98**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	**339**	**96**	**196**
	02/13/2008	**324**	**97**	**200**
	02/20/2008	**352**	**99**	**184**
	02/27/2008	**394**	**98**	**193**
March	03/05/2008	**453**	**102**	**197**
	03/12/2008	**370**	**98**	**192**
	03/19/2008	**442**	**98**	**187**
	03/26/2008	**238**	**90**	**193**
April	04/02/2008	**384**	**101**	**201**
	04/09/2008	**305**	**91**	**196**
	04/16/2008	**421**	**96**	**184**
	04/23/2008	**319**	**94**	**193**
	04/30/2008	**453**	**95**	**177**
May	05/07/2008	**443**	**97**	**180**
	05/14/2008	**229**	**90**	**191**
	05/21/2008	**301**	**93**	**190**
	05/28/2008	<LLD	NA	194
June	06/04/2008	**311**	**98**	**203**
	06/11/2008	**503**	**101**	**190**
	06/18/2008	**516**	**100**	**184**
	06/25/2008	**355**	**94**	**185**
July	07/02/2008	**334**	**95**	**192**
	07/09/2008	**356**	**95**	**189**
	07/16/2008	<LLD	NA	192
	07/23/2008	**277**	**94**	**197**
	07/30/2008	**472**	**99**	**189**
August	08/06/2008	**543**	**107**	**200**
	08/13/2008	**401**	**102**	**200**
	08/20/2008	**463**	**101**	**192**
	08/27/2008	**290**	**93**	**190**
September	09/03/2008	**302**	**95**	**190**
	09/10/2008	**281**	**96**	**200**
	09/17/2008	**524**	**108**	**203**
	09/24/2008	**542**	**107**	**201**
October	10/01/2008	**428**	**101**	**193**
	10/08/2008	**431**	**98**	**184**
	10/15/2008	**214**	**94**	**200**
	10/22/2008	**546**	**105**	**189**
	10/29/2008	**441**	**100**	**191**
November	11/05/2008	**368**	**102**	**211**
	11/12/2008	<LLD	NA	208
	11/19/2008	**422**	**100**	**197**
	11/26/2008	**325**	**94**	**188**
December	12/03/2008	**510**	**98**	**179**
	12/10/2008	**265**	**92**	**189**
	12/17/2008	**334**	**94**	**185**
	12/24/2008	**326**	**96**	**196**
	12/31/2008	**437**	**99**	**189**

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Tritium Data

SV-2027 Upper Three Runs Creek at USFS Rd. E-2

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**236**	**86**	**178**
	01/09/2008	**202**	**87**	**184**
	01/16/2008	<LLD	NA	187
	01/23/2008	**210**	**86**	**182**
	01/30/2008	NS	NS	NS
February	02/06/2008	<LLD	NA	196
	02/13/2008	**267**	**96**	**200**
	02/20/2008	**199**	**93**	**184**
	02/27/2008	<LLD	NA	193
March	03/05/2008	<LLD	NA	197
	03/12/2008	**290**	**94**	**192**
	03/19/2008	**195**	**88**	**187**
	03/26/2008	<LLD	NA	193
April	04/02/2008	<LLD	NA	201
	04/09/2008	**202**	**154**	**196**
	04/16/2008	**340**	**156**	**184**
	04/23/2008	<LLD	NA	193
	04/30/2008	**395**	**93**	**177**
May	05/07/2008	**273**	**91**	**180**
	05/14/2008	<LLD	NA	191
	05/21/2008	**199**	**89**	**190**
	05/28/2008	<LLD	NA	194
June	06/04/2008	<LLD	NA	203
	06/11/2008	**334**	**95**	**190**
	06/18/2008	<LLD	NA	184
	06/25/2008	**234**	**89**	**185**
July	07/02/2008	<LLD	NA	192
	07/09/2008	<LLD	NA	189
	07/16/2008	<LLD	NA	192
	07/23/2008	<LLD	NA	197
	07/30/2008	**283**	**93**	**189**
August	08/06/2008	**261**	**98**	**200**
	08/13/2008	<LLD	NA	200
	08/20/2008	**236**	**94**	**192**
	08/27/2008	**191**	**89**	**190**
September	09/03/2008	**225**	**92**	**190**
	09/10/2008	<LLD	NA	200
	09/17/2008	<LLD	NA	203
	09/24/2008	<LLD	NA	201
October	10/01/2008	<LLD	NA	193
	10/08/2008	**185**	**86**	**184**
	10/15/2008	<LLD	NA	200
	10/22/2008	<LLD	NA	189
	10/29/2008	**293**	**94**	**191**
November	11/05/2008	<LLD	NA	211
	11/12/2008	<LLD	NA	208
	11/19/2008	**226**	**93**	**197**
	11/26/2008	**276**	**91**	**188**
December	12/03/2008	**187**	**85**	**179**
	12/10/2008	<LLD	NA	189
	12/17/2008	<LLD	NA	185
	12/24/2008	<LLD	NA	196
	12/31/2008	<LLD	NA	189

SV-2045 Fourmile Branch at USFS Road C-4

Month	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
January	01/02/2008	**81154**	**802**	**178**
	01/09/2008	**134329**	**1033**	**184**
	01/16/2008	**131131**	**1011**	**187**
	01/23/2008	**110078**	**937**	**182**
	01/30/2008	NS	NS	NS

*Location only sampled during January 2008. Sampling supsended at this monitoring location due to area access concerns.

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Gamma Data

SV-2010 Jackson Boat Landing

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.01	<MDA	NA	3.27	<MDA	NA	72.55
February	1/30/2008	<MDA	NA	1.63	<MDA	NA	1.78	<MDA	NA	12.09
March	2/27/2008	<MDA	NA	2.34	<MDA	NA	2.58	<MDA	NA	25.03
April	3/26/2008	<MDA	NA	3.05	<MDA	NA	3.97	<MDA	NA	74.75
May	4/30/2008	<MDA	NA	2.03	<MDA	NA	2.32	<MDA	NA	22.02
June	5/28/2008	<MDA	NA	2.05	<MDA	NA	2.21	<MDA	NA	20.99
July	6/25/2008	<MDA	NA	2.00	<MDA	NA	2.32	<MDA	NA	22.35
August	7/30/2008	<MDA	NA	1.68	<MDA	NA	1.66	<MDA	NA	12.20
September	8/27/2008	<MDA	NA	2.21	<MDA	NA	2.30	<MDA	NA	22.52
October	9/24/2008	<MDA	NA	1.83	<MDA	NA	1.69	<MDA	NA	12.38
November	10/29/2008	<MDA	NA	1.93	<MDA	NA	2.37	<MDA	NA	21.68
December	12/3/2008	<MDA	NA	1.50	<MDA	NA	1.88	<MDA	NA	12.04

SV-325 Upper Three Runs Creek at SC Highway 125

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	2.95	<MDA	NA	3.68	<MDA	NA	71.78
February	1/30/2008	<MDA	NA	1.68	<MDA	NA	1.57	<MDA	NA	12.62
March	2/27/2008	<MDA	NA	2.19	<MDA	NA	2.34	<MDA	NA	24.15
April	3/26/2008	<MDA	NA	3.14	<MDA	NA	3.99	<MDA	NA	76.52
May	4/30/2008	<MDA	NA	1.84	<MDA	NA	2.30	<MDA	NA	23.28
June	5/28/2008	<MDA	NA	2.07	<MDA	NA	2.46	<MDA	NA	23.37
July	6/25/2008	<MDA	NA	1.70	<MDA	NA	2.10	<MDA	NA	22.73
August	7/30/2008	<MDA	NA	1.60	<MDA	NA	1.75	<MDA	NA	12.96
September	8/27/2008	<MDA	NA	2.04	<MDA	NA	2.27	<MDA	NA	23.26
October	9/24/2008	<MDA	NA	1.62	<MDA	NA	1.90	<MDA	NA	12.84
November	10/29/2008	<MDA	NA	1.79	<MDA	NA	2.12	<MDA	NA	22.49
December	12/3/2008	<MDA	NA	1.81	<MDA	NA	1.77	<MDA	NA	12.24

SV-2040 Beaver Dam Creek

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.13	<MDA	NA	4.00	<MDA	NA	71.91
February	1/30/2008	<MDA	NA	1.46	<MDA	NA	1.81	<MDA	NA	12.24
March	2/27/2008	<MDA	NA	2.35	<MDA	NA	2.53	<MDA	NA	23.50
April	3/26/2008	<MDA	NA	2.93	<MDA	NA	3.54	<MDA	NA	78.44
May	4/30/2008	<MDA	NA	2.14	<MDA	NA	2.41	<MDA	NA	23.64
June	5/28/2008	<MDA	NA	2.19	<MDA	NA	2.35	<MDA	NA	22.72
July	6/25/2008	<MDA	NA	1.92	<MDA	NA	2.16	<MDA	NA	23.18
August	7/30/2008	<MDA	NA	1.63	<MDA	NA	1.97	<MDA	NA	11.99
September	8/27/2008	<MDA	NA	1.91	<MDA	NA	2.07	<MDA	NA	22.80
October	9/24/2008	<MDA	NA	1.68	<MDA	NA	1.60	<MDA	NA	12.13
November	10/29/2008	<MDA	NA	1.97	<MDA	NA	2.29	<MDA	NA	22.28
December	12/3/2008	<MDA	NA	1.67	<MDA	NA	2.02	<MDA	NA	12.66

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Gamma Data

SV-2039 Fourmile Branch at USFS Rd. A-13

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.06	<MDA	NA	4.00	<MDA	NA	74.72
February	1/30/2008	<MDA	NA	1.39	<MDA	NA	2.15	<MDA	NA	11.50
March	2/27/2008	<MDA	NA	2.19	<MDA	NA	2.44	<MDA	NA	24.39
April	3/26/2008	<MDA	NA	3.15	<MDA	NA	4.00	<MDA	NA	73.41
May	4/30/2008	<MDA	NA	2.13	<MDA	NA	2.61	<MDA	NA	22.09
June	5/28/2008	<MDA	NA	2.14	<MDA	NA	2.60	<MDA	NA	22.15
July	6/25/2008	<MDA	NA	1.89	<MDA	NA	2.43	<MDA	NA	23.46
August	7/30/2008	<MDA	NA	1.62	**3.55**	**1.58**	**1.69**	<MDA	NA	12.24
September	8/27/2008	<MDA	NA	1.62	<MDA	NA	2.29	<MDA	NA	23.40
October	9/24/2008	<MDA	NA	1.86	<MDA	NA	1.73	<MDA	NA	11.31
November	10/29/2008	<MDA	NA	2.14	<MDA	NA	2.55	<MDA	NA	23.40
December	12/3/2008	<MDA	NA	1.61	<MDA	NA	2.05	<MDA	NA	13.27

SV-2047 Pen Branch at USFS Rd. A-13

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.10	<MDA	NA	3.99	<MDA	NA	77.75
February	1/30/2008	<MDA	NA	1.67	<MDA	NA	1.88	<MDA	NA	11.65
March	2/27/2008	<MDA	NA	2.32	<MDA	NA	2.34	<MDA	NA	23.66
April	3/26/2008	<MDA	NA	2.96	<MDA	NA	3.82	<MDA	NA	81.33
May	4/30/2008	<MDA	NA	2.03	<MDA	NA	2.27	<MDA	NA	23.45
June	5/28/2008	<MDA	NA	1.92	<MDA	NA	2.55	<MDA	NA	21.88
July	6/25/2008	<MDA	NA	1.95	<MDA	NA	2.32	<MDA	NA	22.37
August	7/30/2008	<MDA	NA	1.66	<MDA	NA	1.68	<MDA	NA	12.07
September	8/27/2008	<MDA	NA	1.94	<MDA	NA	2.44	<MDA	NA	24.14
October	9/24/2008	<MDA	NA	1.67	<MDA	NA	1.77	<MDA	NA	12.09
November	10/29/2008	<MDA	NA	1.86	<MDA	NA	2.21	<MDA	NA	23.34
December	12/3/2008	<MDA	NA	1.44	<MDA	NA	1.85	<MDA	NA	13.23

SV-327 Steel Creek at SC Highway 125

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.45	<MDA	NA	3.95	<MDA	NA	76.64
February	1/30/2008	<MDA	NA	1.54	<MDA	NA	2.10	<MDA	NA	12.32
March	2/27/2008	<MDA	NA	2.15	<MDA	NA	2.67	<MDA	NA	22.68
April	3/26/2008	<MDA	NA	3.71	<MDA	NA	3.99	<MDA	NA	85.43
May	4/30/2008	<MDA	NA	2.19	<MDA	NA	2.35	<MDA	NA	22.80
June	5/28/2008	<MDA	NA	2.10	<MDA	NA	2.58	<MDA	NA	24.08
July	6/25/2008	<MDA	NA	1.90	<MDA	NA	2.19	<MDA	NA	22.61
August	7/30/2008	<MDA	NA	1.56	<MDA	NA	1.86	<MDA	NA	12.70
September	8/27/2008	<MDA	NA	1.98	<MDA	NA	2.39	<MDA	NA	23.88
October	9/24/2008	<MDA	NA	1.61	<MDA	NA	1.71	<MDA	NA	11.28
November	10/29/2008	<MDA	NA	1.80	<MDA	NA	2.07	<MDA	NA	23.54
December	12/3/2008	<MDA	NA	1.79	<MDA	NA	2.02	<MDA	NA	11.94

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Gamma Data

SV-2018 Steel Creek Boat Landing

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.73	<MDA	NA	3.86	<MDA	NA	74.81
February	1/30/2008	<MDA	NA	1.70	<MDA	NA	1.64	<MDA	NA	11.41
March	2/27/2008	<MDA	NA	2.31	<MDA	NA	2.43	<MDA	NA	22.86
April	3/26/2008	<MDA	NA	3.45	<MDA	NA	3.87	<MDA	NA	78.91
May	4/30/2008	<MDA	NA	1.81	<MDA	NA	2.41	<MDA	NA	23.19
June	5/28/2008	<MDA	NA	1.86	<MDA	NA	2.32	<MDA	NA	22.27
July	6/25/2008	<MDA	NA	2.18	<MDA	NA	2.33	<MDA	NA	23.52
August	7/30/2008	<MDA	NA	1.59	<MDA	NA	1.78	<MDA	NA	12.64
September	8/27/2008	<MDA	NA	2.05	<MDA	NA	2.47	<MDA	NA	24.26
October	9/24/2008	<MDA	NA	1.68	<MDA	NA	1.70	<MDA	NA	11.58
November	10/29/2008	<MDA	NA	1.98	<MDA	NA	2.35	<MDA	NA	23.50
December	12/3/2008	<MDA	NA	1.72	<MDA	NA	1.82	<MDA	NA	12.91

SV-118 US Highway 301 at the Savannah River

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	3.31	<MDA	NA	3.60	<MDA	NA	82.24
February	1/30/2008	<MDA	NA	1.53	<MDA	NA	1.92	<MDA	NA	12.52
March	2/27/2008	<MDA	NA	2.07	<MDA	NA	2.32	<MDA	NA	24.12
April	3/26/2008	<MDA	NA	3.45	<MDA	NA	3.92	<MDA	NA	77.65
May	4/30/2008	<MDA	NA	1.65	<MDA	NA	2.22	<MDA	NA	22.43
June	5/28/2008	<MDA	NA	1.98	<MDA	NA	2.40	<MDA	NA	22.37
July	6/25/2008	<MDA	NA	2.13	<MDA	NA	2.27	<MDA	NA	22.68
August	7/30/2008	<MDA	NA	1.69	<MDA	NA	1.94	<MDA	NA	11.62
September	8/27/2008	<MDA	NA	2.24	<MDA	NA	2.27	<MDA	NA	23.60
October	9/24/2008	<MDA	NA	1.69	<MDA	NA	1.83	<MDA	NA	11.80
November	10/29/2008	<MDA	NA	2.05	<MDA	NA	2.28	<MDA	NA	23.36
December	12/3/2008	<MDA	NA	1.63	<MDA	NA	1.65	<MDA	NA	12.75

SV-2053 Lower Three Runs Creek at SRS Rd. B

Month	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
Janurary	12/26/2007	<MDA	NA	2.93	<MDA	NA	3.84	<MDA	NA	80.00
February	1/30/2008	<MDA	NA	1.76	<MDA	NA	1.92	<MDA	NA	12.46
March	2/27/2008	<MDA	NA	2.29	<MDA	NA	2.82	<MDA	NA	23.27
April	3/26/2008	<MDA	NA	3.03	<MDA	NA	3.65	<MDA	NA	74.57
May	4/30/2008	<MDA	NA	1.92	<MDA	NA	2.57	<MDA	NA	22.59
June	5/28/2008	<MDA	NA	2.02	<MDA	NA	2.55	<MDA	NA	23.80
July	6/25/2008	<MDA	NA	2.12	<MDA	NA	2.71	<MDA	NA	23.22
August	7/30/2008	<MDA	NA	1.62	<MDA	NA	2.25	<MDA	NA	12.49
September	8/27/2008	<MDA	NA	1.94	<MDA	NA	2.79	<MDA	NA	22.47
October	9/24/2008	<MDA	NA	1.34	<MDA	NA	2.01	<MDA	NA	11.77
November	10/29/2008	<MDA	NA	2.20	<MDA	NA	2.79	<MDA	NA	24.18
December	12/3/2008	<MDA	NA	1.57	<MDA	NA	1.83	<MDA	NA	12.58

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Alpha/Beta Data

SV-2010 Jackson Boat Landing

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.76	<LLD	NA	2.53
February	1/30/2008	<LLD	NA	2.40	<LLD	NA	2.51
March	2/27/2008	<LLD	NA	2.65	<LLD	NA	3.60
April	3/26/2008	<LLD	NA	2.09	<LLD	NA	2.60
May	4/30/2008	<LLD	NA	1.52	<LLD	NA	2.59
June	5/28/2008	<LLD	NA	2.96	<LLD	NA	3.85
July	6/25/2008	<LLD	NA	3.35	<LLD	NA	4.11
August	7/30/2008	<LLD	NA	2.32	<LLD	NA	2.49
September	8/27/2008	<LLD	NA	2.58	<LLD	NA	3.53
October	9/24/2008	<LLD	NA	3.01	**4.45**	**2.05**	**3.67**
November	10/29/2008	<LLD	NA	2.62	<LLD	NA	2.30
December	12/3/2008	<LLD	NA	2.70	<LLD	NA	3.70

SV-325 Upper Three Runs Creek and SC Highway 125

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.42	<LLD	NA	2.48
February	1/30/2008	**3.92**	**1.58**	**2.11**	<LLD	NA	2.47
March	2/27/2008	<LLD	NA	2.23	<LLD	NA	3.53
April	3/26/2008	**5.31**	**1.62**	**1.82**	<LLD	NA	2.55
May	4/30/2008	**7.12**	**1.74**	**1.37**	<LLD	NA	2.55
June	5/28/2008	**7.73**	**2.13**	**2.60**	<LLD	NA	3.78
July	6/25/2008	**7.43**	**2.20**	**2.88**	<LLD	NA	4.03
August	7/30/2008	**8.76**	**2.01**	**2.07**	<LLD	NA	2.45
September	8/27/2008	**3.60**	**1.61**	**2.10**	<LLD	NA	3.46
October	9/24/2008	**10.5**	**2.49**	**2.63**	**3.65**	**2.03**	**3.62**
November	10/29/2008	<LLD	NA	3.08	<LLD	NA	4.11
December	12/3/2008	**3.09**	**1.59**	**2.27**	<LLD	NA	3.63

SV-2040 Beaver Dam Creek

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.79	<LLD	NA	2.53
February	1/30/2008	<LLD	NA	2.39	<LLD	NA	2.51
March	2/27/2008	<LLD	NA	2.65	<LLD	NA	3.60
April	3/26/2008	**2.45**	**1.45**	**2.12**	<LLD	NA	2.61
May	4/30/2008	**2.23**	**1.23**	**1.55**	<LLD	NA	2.60
June	5/28/2008	<LLD	NA	3.00	<LLD	NA	3.85
July	6/25/2008	<LLD	NA	3.38	<LLD	NA	4.11
August	7/30/2008	<LLD	NA	2.33	<LLD	NA	2.49
September	8/27/2008	<LLD	NA	2.74	**4.07**	**1.98**	**3.55**
October	9/24/2008	<LLD	NA	3.12	<LLD	NA	3.68
November	10/29/2008	<LLD	NA	2.67	**2.97**	**1.38**	**2.30**
December	12/3/2008	<LLD	NA	2.58	<LLD	NA	2.82

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Alpha/Beta Data

SV-2039 Fourmile Branch at USFS Rd. A-13.2

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.70	**5.47**	**1.59**	**2.52**
February	1/30/2008	**3.97**	**1.64**	**2.21**	**4.90**	**1.58**	**2.48**
March	2/27/2008	<LLD	NA	2.36	**4.32**	**1.98**	**3.55**
April	3/26/2008	<LLD	NA	1.92	**3.69**	**1.52**	**2.57**
May	4/30/2008	<LLD	NA	1.40	**3.84**	**1.54**	**2.56**
June	5/28/2008	<LLD	NA	2.82	**5.78**	**2.17**	**3.82**
July	6/25/2008	<LLD	NA	3.12	**4.64**	**2.24**	**4.07**
August	7/30/2008	<LLD	NA	2.20	**6.99**	**1.66**	**2.47**
September	8/27/2008	<LLD	NA	2.32	**6.47**	**2.05**	**3.49**
October	9/24/2008	**3.56**	**1.85**	**2.72**	**13.1**	**2.38**	**3.63**
November	10/29/2008	<LLD	NA	2.47	**4.18**	**1.45**	**2.28**
December	12/3/2008	<LLD	NA	2.46	**7.62**	**2.18**	**3.66**

SV-2047 Pen Branch at USFS Rd. A-13.2

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.89	<LLD	NA	2.54
February	1/30/2008	<LLD	NA	2.39	**2.94**	**1.47**	**2.51**
March	2/27/2008	<LLD	NA	2.50	<LLD	NA	3.58
April	3/26/2008	<LLD	NA	2.09	<LLD	NA	2.60
May	4/30/2008	**3.72**	**1.53**	**1.69**	<LLD	NA	2.62
June	5/28/2008	<LLD	NA	2.96	<LLD	NA	3.85
July	6/25/2008	<LLD	NA	3.29	<LLD	NA	4.10
August	7/30/2008	**4.13**	**1.89**	**2.67**	<LLD	NA	2.53
September	8/27/2008	<LLD	NA	2.49	<LLD	NA	3.51
October	9/24/2008	<LLD	NA	2.90	<LLD	NA	3.65
November	10/29/2008	<LLD	NA	2.71	<LLD	NA	2.31
December	12/3/2008	<LLD	NA	2.64	<LLD	NA	3.69

SV-327 Steel Creek at SC Highway 125

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.99	<LLD	NA	2.55
February	1/30/2008	<LLD	NA	2.30	<LLD	NA	2.50
March	2/27/2008	<LLD	NA	2.51	<LLD	NA	3.58
April	3/26/2008	**2.37**	**1.40**	**2.05**	<LLD	NA	2.59
May	4/30/2008	**3.04**	**1.42**	**1.67**	<LLD	NA	2.62
June	5/28/2008	<LLD	NA	3.71	<LLD	NA	3.95
July	6/25/2008	<LLD	NA	3.30	<LLD	NA	4.10
August	7/30/2008	**3.33**	**1.73**	**2.55**	<LLD	NA	2.52
September	8/27/2008	<LLD	NA	2.46	<LLD	NA	3.51
October	9/24/2008	**3.58**	**2.00**	**3.00**	**7.14**	**2.17**	**3.67**
November	10/29/2008	<LLD	NA	2.57	<LLD	NA	2.29
December	12/3/2008	**3.21**	**1.79**	**2.61**	<LLD	NA	3.68

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Ambient Alpha/Beta Data

SV-2018 Steel Creek Boat Landing

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.75	<LLD	NA	2.53
February	1/30/2008	<LLD	NA	2.49	<LLD	NA	2.52
March	2/27/2008	<LLD	NA	2.61	<LLD	NA	3.59
April	3/26/2008	<LLD	NA	2.10	<LLD	NA	2.60
May	4/30/2008	<LLD	NA	1.74	<LLD	NA	2.63
June	5/28/2008	<LLD	NA	3.04	<LLD	NA	3.86
July	6/25/2008	<LLD	NA	3.36	<LLD	NA	4.11
August	7/30/2008	<LLD	NA	2.32	<LLD	NA	2.49
September	8/27/2008	<LLD	NA	2.56	<LLD	NA	3.52
October	9/24/2008	<LLD	NA	3.03	<LLD	NA	3.67
November	10/29/2008	<LLD	NA	2.77	**4.38**	**2.10**	**3.78**
December	12/3/2008	<LLD	NA	2.73	**4.10**	**2.05**	**3.70**

SV-118 US Highway 301 and Savannah River

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.84	<LLD	NA	2.54
February	1/30/2008	<LLD	NA	2.40	<LLD	NA	2.51
March	2/27/2008	<LLD	NA	2.63	<LLD	NA	3.60
April	3/26/2008	<LLD	NA	2.09	<LLD	NA	2.60
May	4/30/2008	<LLD	NA	1.67	<LLD	NA	2.62
June	5/28/2008	<LLD	NA	2.99	<LLD	NA	3.85
July	6/25/2008	<LLD	NA	3.40	<LLD	NA	4.11
August	7/30/2008	<LLD	NA	2.32	<LLD	NA	2.49
September	8/27/2008	<LLD	NA	2.63	<LLD	NA	3.53
October	9/24/2008	<LLD	NA	3.04	<LLD	NA	3.67
November	10/29/2008	<LLD	NA	3.07	<LLD	NA	3.82
December	12/3/2008	**5.38**	**2.19**	**3.04**	<LLD	NA	2.88

SV-2053 Lower Three Runs Creek and SRS Rd. B

Month	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
Janurary	12/26/2007	<LLD	NA	2.64	<LLD	NA	2.51
February	1/30/2008	<LLD	NA	2.01	<LLD	NA	2.45
March	2/27/2008	<LLD	NA	2.33	<LLD	NA	3.55
April	3/26/2008	<LLD	NA	1.87	<LLD	NA	2.56
May	4/30/2008	**1.72**	**1.05**	**1.38**	<LLD	NA	2.56
June	5/28/2008	<LLD	NA	2.87	<LLD	NA	3.83
July	6/25/2008	<LLD	NA	3.18	<LLD	NA	4.08
August	7/30/2008	<LLD	NA	3.40	<LLD	NA	3.76
September	8/27/2008	**5.59**	**2.00**	**2.37**	**3.50**	**1.95**	**3.50**
October	9/24/2008	<LLD	NA	3.58	**4.90**	**2.12**	**3.77**
November	10/29/2008	<LLD	NA	2.59	<LLD	NA	3.76
December	12/3/2008	<LLD	NA	2.39	<LLD	NA	3.65

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Boat Run Data

Creek Mouth Locations

SV-2011 Upper Three Runs Creek

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	699	108	187
05/12/2008	6716	246	185
09/15/08	470	102	193
11/24/2008	573	105	192

SV-2013 Beaver Dam

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	305	93	187
05/12/2008	403	96	185
09/15/08	265	94	193
11/24/2008	215	91	192

SV-2015a Fourmile Branch (Creek Mouth)

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	35853	536	187
05/12/2008	49134	627	185
09/15/08	45288	600	187
11/24/2008	14513	349	192

SV-2015b Fourmile Branch (30')

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	35807	536	187
05/12/2008	37686	550	185
09/15/08	17094	387	193
11/24/2008	9575	287	192

SV-2015c Fourmile Branch (150')

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	35934	539	187
05/12/2008	25188	450	185
09/15/08	5030	220	193
11/24/2008	5436	223	192

SV-2017 Steel Creek

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	9135	283	187
05/12/2008	3101	180	185
09/15/08	3286	190	193
11/24/2008	2099	153	192

SV-2020 Lower Three Runs Creek

Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
02/25/2008	486	101	187
05/12/2008	870	114	185
09/15/08	1287	137	193
11/24/2008	931	118	192

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Random Sample Tritium Data

Location Description	Collection Date	Tritium Activity	Tritium Confidence Interval	Tritium LLD
RWE38	03/05/2008	**1060**	**122**	**187**
RWE61	03/05/2008	**190**	**87**	**187**
RWE51	03/05/2008	<LLD	NA	187
RWE53	03/13/2008	<LLD	NA	187
RWE41	03/13/2008	<LLD	NA	187
RWE59	03/13/2008	<LLD	NA	187

Random Sample Gamma Data

Perimeter Locations (< 50 Miles from SRS)

Location Description	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
RWE38	3/5/2008	<MDA	NA	1.51	<MDA	NA	1.59	<MDA	NA	11.75
RWE61	3/5/2008	<MDA	NA	1.63	<MDA	NA	1.99	<MDA	NA	11.79
RWE51	3/5/2008	<MDA	NA	1.67	<MDA	NA	1.83	<MDA	NA	12.21
RWE53	3/13/2008	<MDA	NA	1.48	<MDA	NA	1.79	<MDA	NA	12.24
RWE41	3/13/2008	<MDA	NA	1.59	<MDA	NA	1.79	<MDA	NA	12.35
RWE59	3/13/2008	<MDA	NA	1.55	<MDA	NA	1.70	<MDA	NA	12.63
RWE64	12/17/2008	<MDA	NA	1.76	<MDA	NA	1.72	<MDA	NA	12.41
RWE58	12/23/2008	<MDA	NA	1.51	<MDA	NA	1.91	<MDA	NA	12.18

Random Sample Gamma Data

Background Locations (> 50 Miles from SRS)

Location Description	Collection Date	Co-60 Activity	Co-60 Confidence Interval	Co-60 MDA	Cs-137 Activity	Cs-137 Confidence Interval	Cs-137 MDA	Am-241 Activity	Am-241 Confidence Interval	Am-241 MDA
RWB59	12/18/2008	<MDA	NA	1.91	<MDA	NA	1.79	<MDA	NA	12.58
RWB61	12/18/2008	<MDA	NA	1.48	<MDA	NA	1.69	<MDA	NA	11.64
RWB51	12/18/2008	<MDA	NA	1.48	<MDA	NA	1.75	<MDA	NA	11.96
RWB54	12/30/2008	<MDA	NA	1.61	<MDA	NA	1.76	<MDA	NA	11.95
RWB60	12/30/2008	<MDA	NA	1.78	<MDA	NA	1.63	<MDA	NA	12.21

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Random Sample Alpha/Beta Data

Perimeter Locations (< 50 Miles from SRS)

Location Description	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
RWE38	3/5/2008	<LLD	NA	2.98	<LLD	NA	2.67
RWE61	3/5/2008	<LLD	NA	2.76	<LLD	NA	2.64
RWE51	3/5/2008	<LLD	NA	2.78	<LLD	NA	2.64
RWE53	3/13/2008	<LLD	NA	2.40	<LLD	NA	2.59
RWE41	3/13/2008	**5.70**	**1.82**	**2.40**	<LLD	NA	2.59
RWE59	3/13/2008	<LLD	NA	2.37	<LLD	NA	2.58
RWE64	12/17/2008	**6.20**	**2.22**	**3.07**	<LLD	NA	4.11
RWE58	12/23/2008	<LLD	NA	4.46	<LLD	NA	4.25

Random Sample Alpha/Beta Data

Background Locations (>50 Miles from SRS)

Location Description	Collection Date	Alpha Activity	Alpha Confidence Interval	Alpha LLD	Beta Activity	Beta Confidence Interval	Beta LLD
RWB59	12/18/2008	<LLD	NA	550.0	<LLD	NA	260.0
RWB61	12/18/2008	<LLD	NA	155.0	<LLD	NA	65.3
RWB51	12/18/2008	<LLD	NA	4.95	<LLD	NA	4.28
RWB54	12/30/2008	<LLD	NA	2.73	<LLD	NA	2.48
RWB60	12/30/2008	<LLD	NA	2.66	<LLD	NA	2.47

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2.3.5 Summary Statistics

Radiological Monitoring of Surface Water

Notes:
1) “pCi/L” is “picocuries per Liter”.
2) “ND” is “No Detection”.
3) “NA” is “Not Applicable”.
4) “*” Denotes actual value and uncertainty (± 2sd) for one detection for sampling location.

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Summary Statistics

Tritium Data for Ambient Monitoring Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Jackson Landing (SV-2010)	360	506	222	183	2,181	52	15
Upper Three Runs Creek (SV-325)	2,738	2,721	1,711	481	13,178	52	52
TNX Boat Landing (SV-2012)	828	913	394	199	3,554	52	38
Beaver Dam Creek (SV-2040)	335	108	323	195	711	52	42
Fourmile Branch (SV-2039)	47,347	8,889	49,096	15,717	62,221	52	52
Pen Branch (SV-2047)	48,043	17,702	53,680	7,719	73,037	52	52
Steel Creek (SV-327)	3,157	1,176	2,841	1,666	6,690	52	52
Steel Creek Boat Landing (SV-2018)	953	959	687	186	4,689	52	49
Little Hell Landing (SV-2019)	563	440	449	180	2,735	52	46
Highway 301 Bridge (SV-118)	734	478	567	221	2,376	52	49
Lower Three Runs Creek and Patterson Mill Rd. (SV-328)	2,780	990	2,676	1,054	4,674	52	51
Lower Three Runs Creek (SV-2053)	386	91	370	214	546	52	49
Upper Three Runs Creek (SV-2027)	247	55	235	185	395	52	24

Tritium Data for Creek Mouth Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Upper Three Runs Creek Creek Mouth (SV-2011)	2,114	3,069	636	470	6,716	4	4
Beaver Dam Creek Creek Mouth (SV-2013)	297	80	285	215	403	4	4
Fourmile Branch Creek Mouth (SV-2015)	36,197	15,495	40,571	14,513	49,134	4	4
Fourmile Branch (SV-2015) 30' downstream from Creek Mouth	25,040	13,882	26,450	9,575	37,686	4	4
Fourmile Branch (SV-2015) 150' downstream from Creek Mouth	17,897	15,268	15,312	5,030	35,934	4	4
Steel Creek Creek Mouth (SV-2017)	4,405	3,196	3,194	2,099	9,135	4	4
Lower Three Runs Creek Creek Mouth (SV-2020)	893	328	900	486	1,287	4	4

Tritium Data for Random Samples

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Random Perimeter (< 50 Miles)	625	615	625	190	1,060	6	2

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Summary Statistics

Alpha Data for Ambient Monitoring Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Jackson Landing (SV-2010)	ND	NA	NA	NA	NA	12	0
Upper Three Runs Creek (SV-325)	6.38	2.55	7.12	3.09	10.5	12	9
Beaver Dam Creek (SV-2040)	2.34	0.16	2.34	2.23	2.45	12	2
Fourmile Branch Creek (SV-2039)	3.77	0.29	3.77	3.56	3.97	12	2
Pen Branch (SV-2047)	3.93	0.29	3.93	3.72	4.13	12	2
Steel Creek (SV-327)	3.11	0.46	3.21	2.37	3.58	12	5
Steel Creek Boat Landing (SV-2018)	ND	NA	NA	NA	NA	12	0
Highway 301 Bridge (SV-118)	5.38*	2.19*	NA	NA	NA	12	1
Lower Three Runs Creek (SV-2053)	3.66	2.74	3.66	1.72	5.59	12	2

Alpha Data for Random Samples

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Random Perimeter (< 50 Miles)	5.95	0.35	5.95	5.70	6.20	8	2
Random Background (> 50 Miles)	ND	NA	NA	NA	NA	5	0

Radiological Monitoring of Surface Water On and Adjacent to the SRS

Summary Statistics

Beta Data for Ambient Monitoring Locations

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Jackson Landing (SV-2010)	4.45*	2.05*	NA	NA	NA	12	1
Upper Three Runs Creek (SV-325)	3.65*	2.03*	NA	NA	NA	12	1
Beaver Dam Creek (SV-2040)	3.52	0.78	3.52	2.97	4.07	12	2
Fourmile Branch (SV-2039)	5.92	2.59	5.19	3.69	13.1	12	12
Pen Branch (SV-2047)	2.94*	1.47*	NA	NA	NA	12	1
Steel Creek (SV-327)	7.14*	2.17*	NA	NA	NA	12	1
Steel Creek Boat Landing (SV-2018)	4.24	0.20	4.24	4.10	4.38	12	2
Highway 301 Bridge (SV-118)	ND	NA	NA	NA	NA	12	0
Lower Three Runs Creek (SV-2053)	4.20	0.99	4.20	3.50	4.90	12	2

Beta Data for Random Samples

Sample Location	Average Concentration (pCi/L)	Standard Deviation	Median	Minimum Concentration (pCi/L)	Maximum Concentration (pCi/L)	Number of Samples	Number of Detects
Random Perimeter (< 50 Miles)	ND	NA	NA	NA	NA	8	0
Random Background (> 50 Miles)	ND	NA	NA	NA	NA	5	0

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2.4 Nonradiological Monitoring of Surface Water on and Adjacent to the SRS

2.4.1 Summary

The streams located on the Savannah River Site (SRS) receive treated wastewater and nonpoint source runoff from on-site facilities. Data from SRS Environmental Reports and South Carolina Department of Health and Environmental Control's (SCDHEC) Environmental Surveillance Oversight Program's (ESOP) monitoring indicate that SRS surface waters are in accordance with Freshwaters Standard guidelines stated in SCDHEC's Water Classifications and Standards (Regulation 61-68), (SCDHEC 2008).

The ESOP assessed the surface water quality for nonradiological parameters in 2008 at SRS by sampling the on-site streams for inorganic and organic contaminants. Specific parameters were analyzed monthly and bi-annually. Sampling locations were strategically chosen to monitor ambient surface water conditions to detect the nonradiological impact from the Department of Energy – Savannah River (DOE-SR) operations.

Water quality on the SRS for nonradiological parameters meets the Freshwaters Standard for South Carolina (SC) streams. Streams are tested for these parameters on a monthly interval; pH, temperature, dissolved oxygen (DO), alkalinity, turbidity, biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform (FC), ammonium, nitrite, nitrate, total phosphorous, and Total Kjeldahl Nitrogen (TKN). Cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), mercury (Hg), manganese (Mn), nickel (Ni), lead (Pb), zinc (Zn), total organic carbon (TOC), and volatile organic carbons (VOC) were sampled bi-annually. These are some of the same parameters used to sample streams around SC (SCDHEC 2005). Historically, all but one of the surface water parameters, pH, continued to be within expected ranges for SC streams (SCDHEC 2008) (SRNS 2008a). Surface water pH from a few of the sampling locations displayed lower pH levels than typical SC streams. This trend is typical for blackwater streams, such as Upper Three Runs (USGS 2000). Data from ESOP surface water locations were compared to DOE-SR data where sample points were colocated (SCDHEC 2006) (SRNS 2008b). There were no notable differences between the ESOP and DOE-SR surface water data.

Results and Discussion

<u>pH Results</u>

ESOP field personnel recorded pH at each sample location during each sampling event. All surface water data can be found in Section 2.4.4. The Freshwaters pH standard for SC is between 6.0 and 8.5 standard units (su) (SCDHEC 2008). Measurements below the standard range for pH were observed at Upper Three Runs at Road 2-1 (SV-2027), (5.62 ± 0.78 su); Upper Three Runs at Highway 125 (SV-325), (6.35 ± 0.55 su); and Tims Branch at Road C (SV-324), (6.22 ± 0.67 su). The streams encountered at SRS are typical of southeastern streams characterized as blackwater. A blackwater river is a river with a deep, slow-moving channel that flows through forested swamps and wetlands. Decaying vegetation in the water results in the leaching of tannins from the vegetation, resulting in transparent, acidic water that is darkly stained, resembling tea or coffee. Low pH is typical for black water streams, such as those sampled at SRS (USGS 2000).

Dissolved Oxygen Results

Dissolved Oxygen measurements were recorded at each sample location as part of each sampling event. Freshwaters DO Standard for SC Streams are to have a daily average no less than 5.0 milligrams per Liter (mg/L) with a minimum of 4.0 mg/L (SCDHEC 2007). All sample locations met this requirement for freshwater streams. See Figure 1, Section 2.4.3 for comparison data between SCDHEC and DOE-SR environmental monitoring programs.

Fecal Coliform Results

ESOP field personnel collected surface water samples for FC analysis at each location during each sampling event. According to the SC freshwater FC standard, five consecutive stream samples during any 30 day period shall not exceed a geometric mean of 200 colonies/100 milliliters (mL) of FC, nor shall more than ten percent of total samples during any 30 day period exceed 400 colonies/100 mL of FC (SCDHEC 2008). Since ESOP does not collect samples every day of the month, this standard cannot accurately be used to analyze the results for this parameter. However, none of the locations had a yearly average for FC that exceeded 400 colonies/100mL.

Nitrate/Nitrite

There are no official SC freshwater standards for nitrate levels; however, there are federally established drinking water standards. All 2008 freshwater SRS stream samples for nitrate and nitrite parameters were below the United States Environmental Protection Agency (USEPA) drinking water standard of 10 mg/L and 1 mg/L, respectively (USEPA 2003). Drinking water standards are designed to protect the public from consumption and are a conservative measurement for freshwater streams, yet all data meets this criterion. See Figure 7, Section 2.4.3 for comparison data between SCDHEC and DOE-SR environmental monitoring programs.

Alkalinity Results

Alkalinity is important for fish and other aquatic life in freshwater systems because it buffers pH changes that occur naturally as a result of photosynthetic activity of the chlorophyll-bearing vegetation. Components of alkalinity, such as carbonate and bicarbonate, will incorporate some toxic heavy metals and reduce their toxicity. For these reasons, the National Technical Advisory Committee (NATC) recommended a minimum alkalinity of 20 mg/L and that natural alkalinity not be reduced by more than 25 percent, National Academy of Science (NAS) Report (NAS 1974). The use of the 25 percent reduction avoids the problem of establishing standards on waters where natural alkalinity is at or below 20 mg/L. Waters having sufficient alkalinity do not have to be supplemented with artificially added materials to increase the alkalinity. Alkalinity resulting from naturally occurring materials, such as carbonate and bicarbonate, is not considered a health hazard in drinking water supplies, and naturally occurring maximum levels up to approximately 400 mg/L as calcium carbonate are not considered a problem to human health (NAS 1974).

ESOP sampling locations Upper Three Runs Creek at Road 2-1 (SV-2027), (1.78 ± 0.53 mg/L); Tims Branch at Road C (SV-324), (8.33 ± 14.79 mg/L); and Upper Three Runs Creek at Highway 125 (SV-325), (3.19 ± 0.79 mg/L); had annual averages below the NAS recommended (20 mg/L ± 4 mg) for alkalinity. This may be due to naturally low occurring buffering chemicals in Upper Three Runs and Tims Branch, which tributary of Upper Three Runs creek. It may be necessary to evaluate Tinker Creek, another tributary of Upper Three Runs to further investigate the low alkalinity concentrations in that area.

Turbidity Results

The freshwater quality standard for turbidity in SC streams is not to exceed 50 nephelometric turbidity units (NTU) provided existing uses are maintained (SCDHEC 2008). All ESOP monitored streams were in compliance for this parameter.

Iron Results

The USEPA recommended limit for iron in freshwater streams is 1 mg/L (USEPA 2008). Two ESOP streams sampled at SRS Tims Branch Road C (SV-324), (1.75 ± 1.70 mg/L); and Pen Branch at Risher Pond Road (SV-2047), (0.98 ± 0.63 mg/L); were above the recommended limit. Iron is a parameter that is only evaluated bi-annually and may need to become a monthly parameter to further determine the cause for elevated iron concentrations in these areas. See Figure 5, Section 2.4.3 for comparison data between SCDHEC and DOE-SR environmental monitoring programs.

Other Parameters

Samples were also analyzed for other parameters; including, but not limited to metals, mercury, TOC, VOC, and pesticides. The results indicate that the SRS streams met the applicable freshwater standards during this study (SCDHEC 2006). All surface water data are located in Section 2.4.4. Surface water statistical analyses can be found in Section 2.4.5.

ESOP and DOE-SR Data Comparison

The following ESOP sampling locations were collocated with DOE-SR sampling locations: SV-2027, SV-325, SV- 327, SV-328, SV-2047, SV-324, and SV-2039 (Section 2.4.2, Map 6). Table 1, Section 2.4.3, defines the geographic locations of the ESOP sampling locations and Table 2 in Section 2.4.3 defines the sampling schedule for surface streams at DOE-SR. Comparisons were made with the collocated sampling locations to see if there were any significant statistical differences: dissolved oxygen (Figure 1, Section 2.4.3); pH (Figure 2, Section 2.4.3); water temperature (Figure 3, Section 2.4.3); total phosphorous (Figure 4, Section 2.4.3); iron (Figure 5, Section 2.4.3); TSS (Figure 6, Section 2.4.3); and nitrate (Figure 7, Section 2.4.3). All collocated stations had data within one standard deviation. All the less than lower limit of detections (<LLD) were left out of the graphs for lack of numerical data. Small discrepancies in data between DOE-SR and SCDHEC can be attributed to differences in sample collection date and time, error in sampling, sample preservation, and lab analysis.

Conclusions/Recommendations

Historically elevated nitrate/nitrite levels were observed in samples collected from Fourmile Branch (SCDHEC 2006); however, this year elevated nitrate levels were not observed. On August 12, 2008, an official letter was sent from Washington Savannah River Company (WSRC) to the United States Environmental Protection Agency explaining the cause of higher nitrate/nitrite levels in Fourmile Branch experienced during previous years. The elevated nitrate/nitrite levels were explained by the wastewater treatment plant, located upstream from the sampling location, or from ground water beneath F-Area and H-Area seepage basins outcropping into Fourmile Branch (RAC 1999) (Smith 2008).

Once the source of the elevated nitrate/nitrite was identified and documented, two sampling locations were dropped from the 2008 ESOP surface water monitoring program; Fourmile Branch at Gravel Road across from H-Area (SV-2030), and Fourmile Branch at Road C-4 (SV-2045) (SCDHEC 2006) and one location was added; Fourmile Branch at Leigh Road (SV-2039), Section 2.4.2, Map 6). The SV-2039 location on Fourmile Branch is further downstream that the SV-2030 and SV-2045 locations, ad would capture any inputs that would be detected at the upstream locations. It was determined that this location would provide a better illustration of the freshwater characteristics of this stream before it deposits into the Savannah River.

In general, stream water from SRS is not influenced significantly according to the data collected, from any industrial process to raise concerns above SCDHEC set standards for water quality (SCDHEC 2008) (USEPA 2008).

The parameters identified that were above or below USEPA and SCDHEC recommended levels for particular streams (iron and alkalinity) will be further evaluated to determine the cause.

SC state averages are from the Summary of Selected Water Quality Parameter Concentrations in SC Water and Sediments (SCDHEC 1998b). The state averages will continue to be used to evaluate data.

ESOP will continue the nonradiological independent monitoring and surveillance of SRS surface water to verify and validate water quality. Continued monitoring is required because of increased land disturbance from accelerated clean-up, new facility construction, logging, and new missions. The locations, numbers of samples, sample frequencies and monitoring parameters are reviewed and modified annually to maximize available resources and address SRS mission changes.

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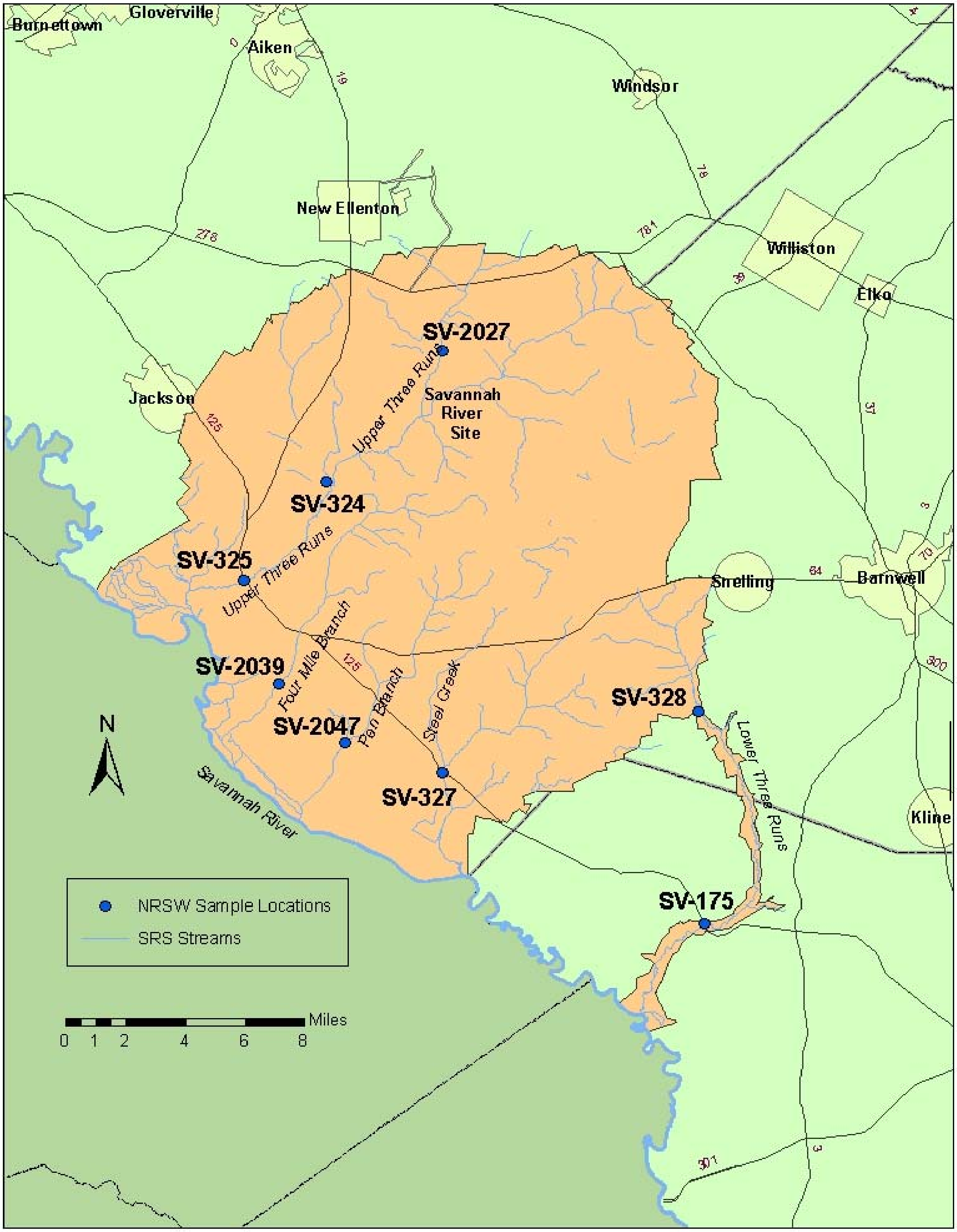
Map 6. ESOP Nonradiological Surface Water (NRSW) Monitoring Locations



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Tables And Figures

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Table 1. ESOP Nonradiological Surface Water Sample Locations

Sample Location	Location Description	Location Rationale
SV-2027	Upper Three Runs at Road 2-1	Background Sample
SV-324	Tim's Branch at Road C	Downstream from M- & A-Areas
SV-2039	Fourmile Branch at Leigh Rd	Downstream from F- & H-Areas and Central Sanitation Wastewater Facility
SV-325	Upper Three Runs at Highway 125	Downstream from F-Area
SV-2047	Pen Branch at Risher Pond Rd	Downstream from K-Area
SV-327	Steel Creek at Highway 125	Downstream from L-Lake
SV-175	Lower Three Runs at Highway 125	Downstream from Par Pond
SV-328	Lower Three Runs at Patterson Mill Road	Downstream from Par Pond

Table 2. Water Quality Parameter Analyses for ESOP

Laboratory	Frequency	Parameter
Aiken Lab	Monthly (Surface Water)	Turbidity, BOD, FC, and TSS
Columbia Lab	Monthly (Surface Water)	Ammonia, Nitrite/Nitrate, Total Phosphorus, Alkalinity, and TKN
	Semi-annual (Surface Water)	Heavy Metals, TOC, Pesticides, and VOC
Field	Monthly (Surface Water)	Temperature, pH, and Dissolved Oxygen

(SCDHEC 2005)

Tables and Figures

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Figure 1. Dissolved Oxygen Comparisons

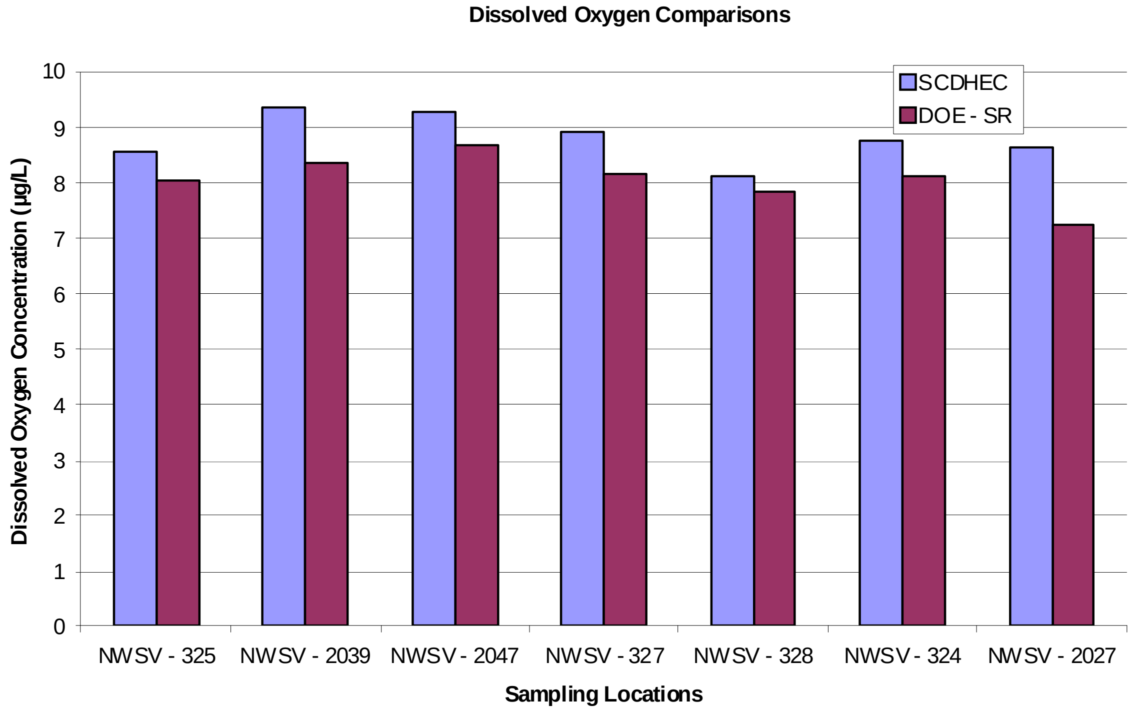
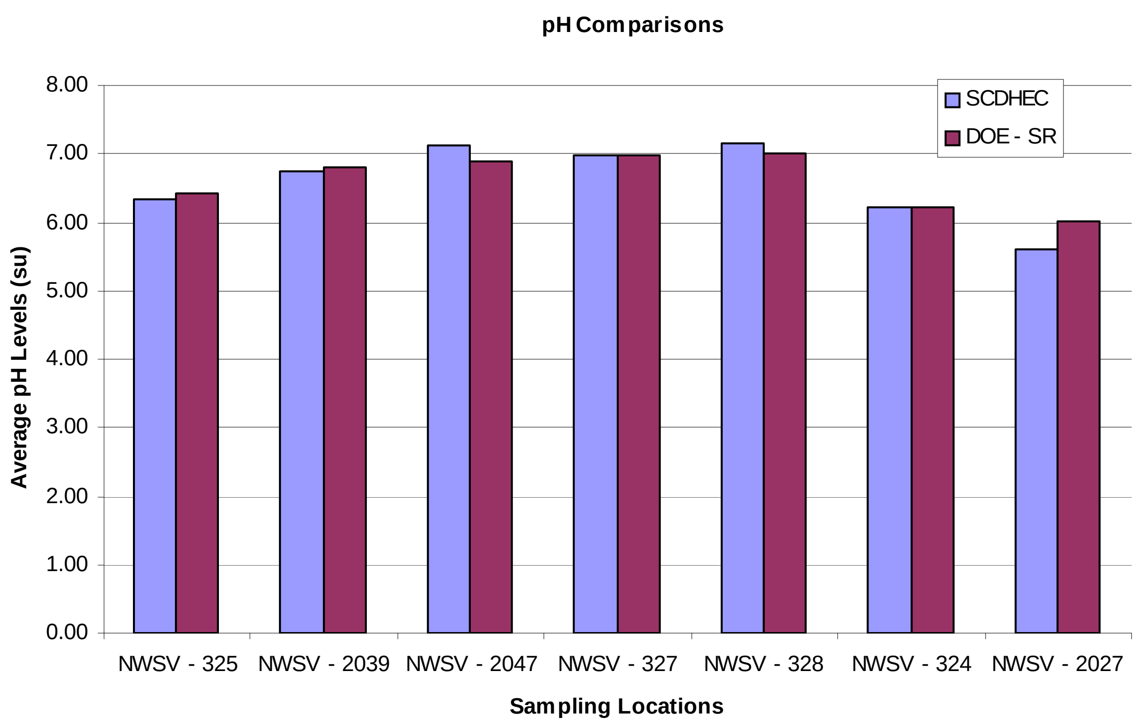


Figure 2. pH Comparisons



Tables and Figures

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Figure 3. Water Temperature Comparisons

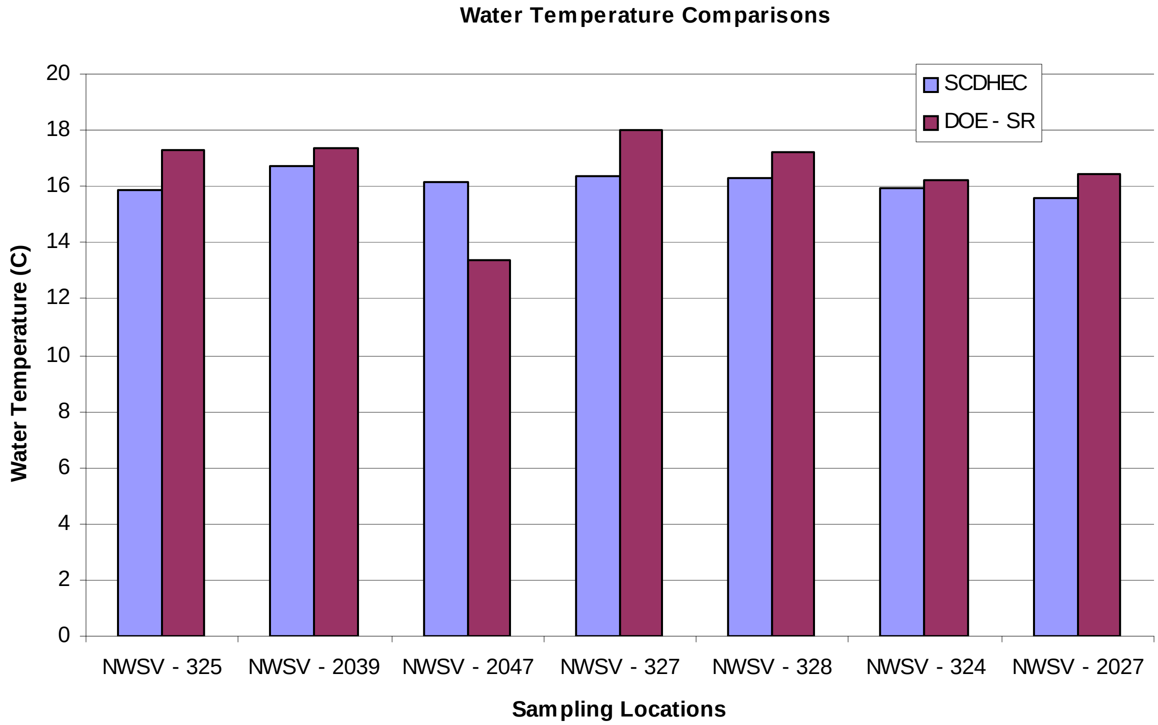
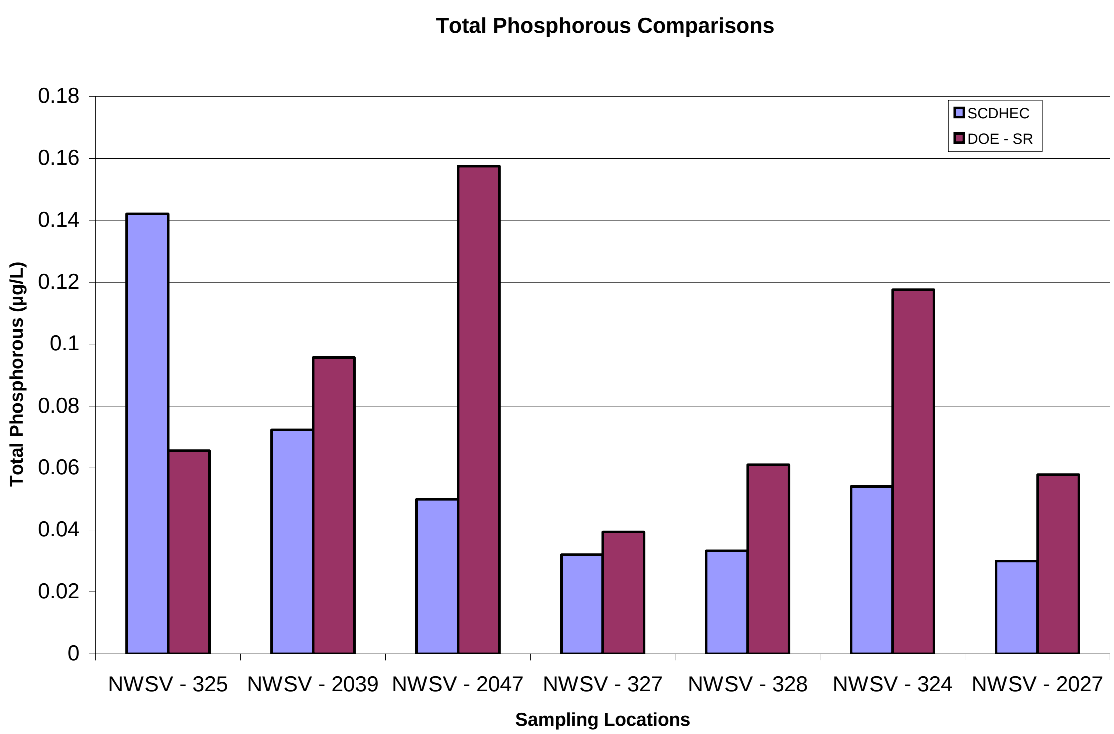


Figure 4. Total Phosphorus Comparisons



Tables and Figures

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Figure 5. Iron Comparisons

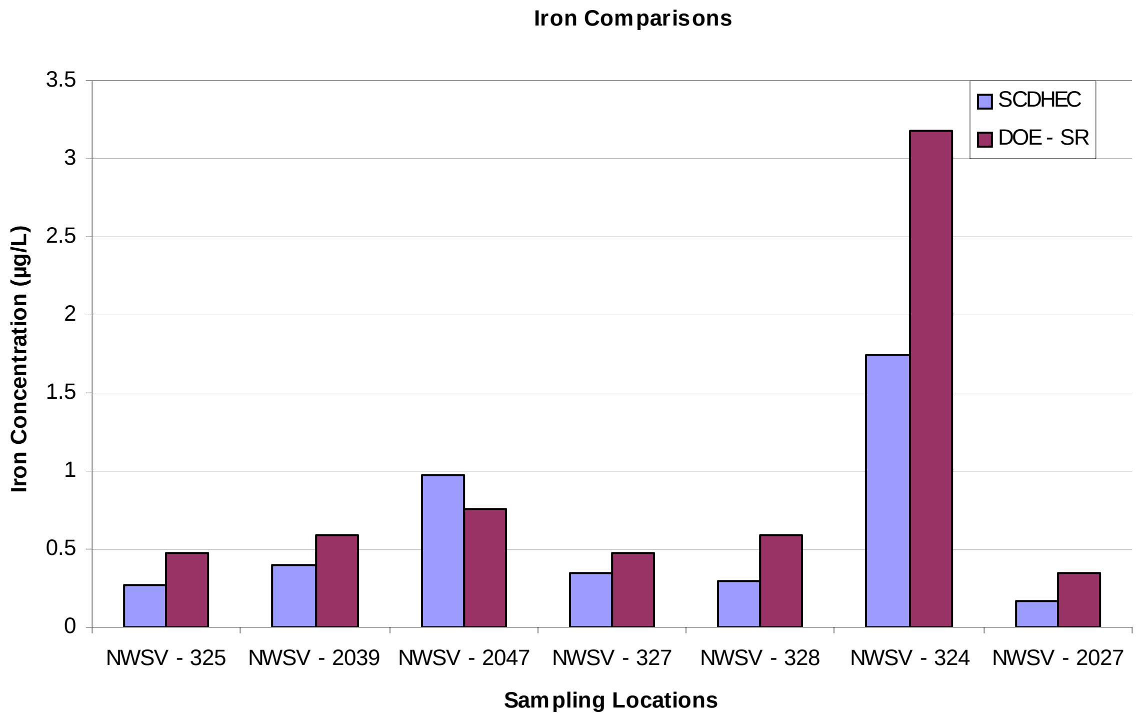
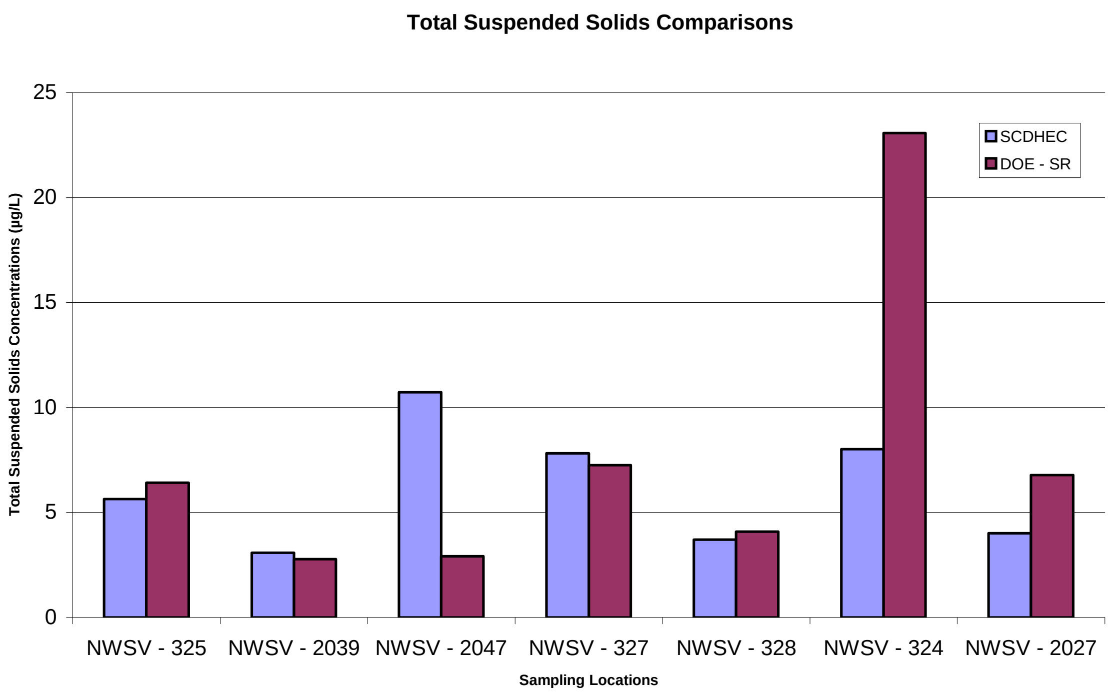


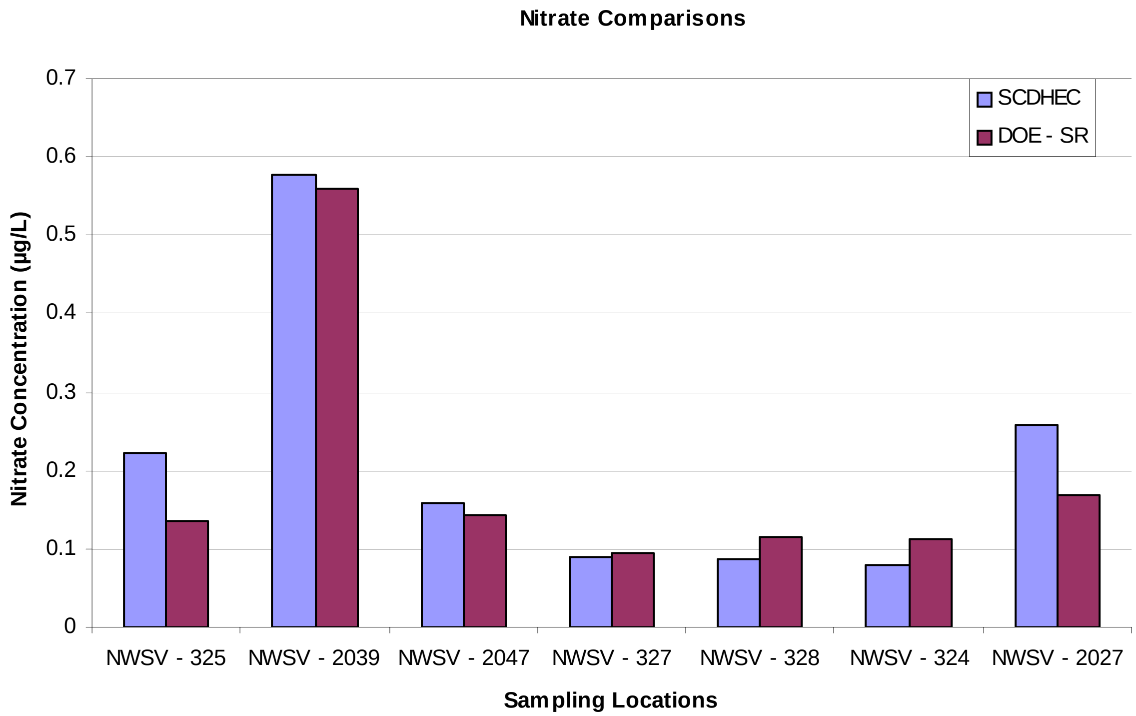
Figure 6. TSS Comparisons



Tables and Figures

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Figure 7. Nitrate Comparisons



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Data

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Notes:

1. Shaded Empty Cells displayed in tables represent time frames that were unable to be sampled due to adjustments to the project structure in the middle of the year due to access to sampling locations or due to bi-annual sampling criteria.
2. AE = Analytical Error
3. est = Estimated Amount
4. < = Less Than
5. BOD = Biochemical Oxygen Demand

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data

SV-2027												
	January	February	March	April	May	June	July	August	September	October	November	December
pH	5.73	5.78	5.33	5.73	4.97	4.75	5.47	4.54	5.57	6.34	5.7	7.53
Dissolved Oxygen	AE	9.97	9.24	8.76	7.46	7.63	7.69	6.83	7.01	9.43	11.5	9.66
Water Temeprature	9.38	11.85	16.12	15.86	18.42	19.64	20.58	20.55	19.33	13.91	9.14	12.23
Alkalinity	1.0	<1.0	1.6	2.1	2.4	<1.0	1.8	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	3	3.6	2	2.2	3.6	2.4	2.2	9.2	1.5	1.3	1	1.3
5 Day BOD Streams	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2	<2.0	<2.0
Total Suspended Solids	5.4	2.9	2.8	3.8	3.7	3.2	4.7	13	3.4	2.1	1.1	2
Fecal Coliform - Membrane Filter	140	510	260	160	120	78	94	700	140	75	100	100
Total Kjeldahl Nitrogen in Water	<0.10	<0.10	<0.10	0.36	0.33	AE	AE	0.41	<0.10	0.43	0.64	0.24
Ammonia	<0.050	<0.050	<0.050	0.057	<0.050	<0.050	0.066	<0.050	<0.050	0.074	<0.050	<0.050
Nitrate/Nitrite	0.29	0.23	0.23	0.24	0.27	0.25	0.25	0.19	0.24	0.27	0.25	0.39
Total Phosphorus in Water	<0.020	<0.020	<0.020	<0.020	0.027	<0.020	0.031	0.026	0.02	0.046	<0.020	<0.020
Total Organic Carbon	<2.0					2.2						<2.0
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.067					0.23						0.19
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	<0.010					<0.010						<0.010
Nickel in Water	<0.020					<0.020						<0.020
Zinc in Water	<0.010					0.016						<0.010
Mercury in Water	<0.00020					<0.00020						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV-324												
	January	February	March	April	May	June	July	August	September	October	November	December
pH	5.73	6.97	6.43	6.17	5.74	5.1	6.15	5.61	6.08	6.87	6.2	7.53
Dissolved Oxygen	AE	10.68	9.47	8.74	7.26	7.33	7.4	7.26	6.9	9.48	12.3	9.66
Water Temeprature	9.38	9.96	15.91	16.35	19.52	21.01	23.26	22.14	21.05	13.25	7.03	12.23
Alkalinity	2.5	5	5.6	5.7	55	6.3	6.1	2.2	1.7	3.2	2.8	3.8
Turbidity	3.9	5.9	12	5.5	8.2	10	11	29	11	5.6	6.6	6.6
5 Day BOD Streams	<2.0	<2.0	<2.0	2.4	<2.0	<2.0	<2.0	2.7	<2.0	3.4	<2.0	<2.0
Total Suspended Solids	2.3	4.3	7.8	2.8	7.9	6.1	2.1	39	8	5	4.1	6.8
Fecal Coliform - Membrane Filter	<5 est	57	87	150	360 est	57	60 est	1700 est	260	30 est	<5	47
Total Kjeldahl Nitrogen in Water	0.13	0.18	<0.10	0.39	0.29	AE	AE	0.63	0.29	0.31	0.3	0.29
Ammonia	<0.050	0.058	0.057	0.077	0.12	0.096	AE	<0.050	<0.050	0.067	<0.050	<0.050
Nitrate/Nitrite	0.17	0.1	0.082	0.065	0.072	0.11	AE	<0.020	0.023	0.057	0.041	<0.020
Total Phosphorus in Water	0.057	0.045	0.05	0.022	0.051	0.072	AE	0.12	0.056	0.043	0.041	0.037
Total Organic Carbon	3.7					7.4						4.8
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.25					3.6						1.4
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	0.06					0.14						0.095
Nickel in Water	<0.020					<0.020						<0.020
Zinc in Water	<0.010					0.029						0.018
Mercury in Water	<0.00020					<0.00020						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV-325												
	January	February	March	April	May	June	July	August	September	October	November	December
pH	6.75	6.59	5.81	6.18	5.8	5.71	6.31	5.96	6.26	7.1	6.24	7.51
Dissolved Oxygen	AE	10.1	9.11	8.66	7	7.63	6.94	6.86	7.7	9.1	11.71	9.45
Water Temeprature	10.61	11.29	15.88	16.37	19.15	21.14	22.32	21.46	18.94	13.13	8.3	12.23
Alkalinity	2.9	2.4	4.1	4.2	2.4	<1.0	3.7	<1.0	<1.0	2.6	<1.0	<1.0
Turbidity	2.8	11	4.7	3.5	4.7	4	5	8.3	4.9	4.2	2.1	1.8
5 Day BOD Streams	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.3	<2.0	<2.0	<2.0
Total Suspended Solids	4.8	7	4.3	7.1	7.8	4.4	6.5	15	5.1	2.5	1.4	1.7
Fecal Coliform - Membrane Filter	40 est	190	100	180	200	120	120	1400 est	240	130	57	30 est
Total Kjeldahl Nitrogen in Water	0.14	0.14	<0.10	<0.10	0.22	AE	AE	0.22	0.19	<0.10	0.23	0.41
Ammonia	<0.050	<0.050	<0.050	<0.050	0.06	<0.050	AE	<0.050	<0.050	<0.050	<0.050	0.074
Nitrate/Nitrite	1.1	0.11	0.12	0.16	0.17	0.43	AE	0.13	0.14	0.028	0.024	0.025
Total Phosphorus in Water	0.073	0.05	0.029	0.021	0.028	0.033	AE	0.056	0.024	0.21	0.099	0.94
Total Organic Carbon	3					2.3						4
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.23					0.32						0.27
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	0.015					0.012						0.017
Nickel in Water	<0.020					<0.020						<0.020
Zinc in Water	<0.010					<0.010						0.017
Mercury in Water	<0.00020					<0.00020						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV-2039												
	January	February	March	April	May	June	July	August	September	October	November	December
pH		6.73	6.12	6.13	6.15	6.58	6.67	6.76	6.64	7.67	6.88	7.88
Dissolved Oxygen		10.88	9.45	8.68	8	8.03	11.37	7.48	7.49	9.84	11.91	9.95
Water Temeprature		9.6	16.17	16.71	20.56	22.26	23.08	22.34	19.35	12.61	8.74	12.25
Alkalinity		8.6	16	17	24	25	23	17	16	16	9.2	13
Turbidity		15	3.2	3.9	2.4	1.9	2.4	5	1.6	1.8	4.9	2.5
5 Day BOD Streams		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids		4.4	2.5	2.9	1.8	1.2	1.8	7.4	1.6	1.7	7.2	1.4
Fecal Coliform - Membrane Filter		200	68	80	110	120	57	380	180	190	120	140
Total Kjeldahl Nitrogen in Water		0.29	0.14	0.21	0.48	AE	0.31	AE	0.17	0.17	0.26	0.4
Ammonia		0.05	0.063	0.066	0.09	0.085	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate/Nitrite		0.96	0.94	0.62	0.45	0.43	0.25	0.12	0.3	0.84	0.35	1.1
Total Phosphorus in Water		0.062	0.081	0.067	0.082	0.087	0.081	0.086	0.048	0.054	0.083	0.065
Total Organic Carbon						4.5						3
Cadmium in Water						<0.010						<0.010
Chromium in Water						<0.010						<0.010
Copper in Water						<0.010						<0.010
Iron in Water						0.42						0.37
Lead in Water						<0.050						<0.050
Manganese in Water						0.031						0.038
Nickel in Water						<0.020						<0.020
Zinc in Water						<0.010						0.014
Mercury in Water						<0.00020						<0.00020

Note: SV-2039 was added in February 2008 because of accessibility issues on Fourmile Branch; therefore it was not sampled for VOC's in January with the rest of the streams.

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV-2047												
	January	February	March	April	May	June	July	August	September	October	November	December
pH	8.02	6.81	6.36	6.36	6.53	6.85	7.09	7.16	6.83	7.98	7.42	8.12
Dissolved Oxygen	AE	10.35	8.9	8.78	7.41	8.09	11.38	7.38	7.14	9.63	13.05	9.99
Water Temeprature	9.7	9.68	16.01	16.65	20.87	23.06	23.19	22.31	19.63	13.01	7.41	12.41
Alkalinity	15	1.4	16	24	26	24	28	21	22	22	21	16
Turbidity	14	6.8	4.6	4.2	4.5	3.7	7.1	8.7	2.5	2.2	2.7	35
5 Day BOD Streams	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.2
Total Suspended Solids	13	4.3	4.5	5	3.2	2.6	22	10	3.2	0.8	2.2	58
Fecal Coliform - Membrane Filter	100	160	100	77	210	89	180	740	300	230	100 EST	390
Total Kjeldahl Nitrogen in Water	0.28	0.27	0.22	0.17	0.3	AE	0.18	0.21	<0.10	0.26	0.13	0.32
Ammonia	0.074	0.066	0.082	0.068	0.11	<0.050	0.056	<0.050	<0.050	<0.050	<0.050	0.065
Nitrate/Nitrite	0.29	0.1	0.1	0.12	0.12	0.42	0.12	0.12	0.12	0.15	0.15	0.081
Total Phosphorus in Water	0.12	<0.020	0.027	0.029	0.029	0.038	0.039	0.042	0.02	0.021	0.024	0.16
Total Organic Carbon	5					4						4
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.74					0.5						1.7
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	0.062					0.034						0.14
Nickel in Water	<0.020					<0.020						<0.020
Zinc in Water	0.011					0.019						0.025
Mercury in Water	<0.00020					<0.00020						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV-327												
	January	February	March	April	May	June	July	August	September	October	November	December
pH	7.5	6.68	6.48	6.28	6.01	6.91	6.91	7.02	6.92	7.91	6.88	8.13
Dissolved Oxygen	AE	10.41	9	8.3	6.65	7.94	11.01	7.03	6.79	9.08	12.12	10.1
Water Temeprature	10.21	10.07	16.07	17	20.61	23.33	23.37	22.51	20.15	14.17	7.06	12.07
Alkalinity	22	5.1	21	25	18	27	28	22	22	24	23	18
Turbidity	3.9	3.5	2.8	5	6	4.2	4.3	19	2.3	5.5	1.5	4.4
5 Day BOD Streams	<2.0	<2.0	<2.0	2	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	3.8	3.6	7.7	5.6	7.8	4	4.1	41	3	7.2	1.2	4.8
Fecal Coliform - Membrane Filter	100	200	240	140	300	110	77	1200	230	140	80	30
Total Kjeldahl Nitrogen in Water	0.12	0.2	0.13	0.28	<0.10	AE	0.1	0.25	0.16	0.14	0.31	0.42
Ammonia	0.062	0.057	0.067	0.087	0.082	0.074	0.068	0.055	<0.050	<0.050	<0.050	<0.050
Nitrate/Nitrite	0.088	0.16	0.042	0.06	0.057	0.31	0.072	0.051	0.062	0.046	<0.020	0.025
Total Phosphorus in Water	0.028	<0.020	0.034	<0.020	0.029	0.03	0.025	0.058	<0.020	0.028	<0.020	0.024
Total Organic Carbon	4.9					4.4						3.4
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.38					0.45						0.21
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	0.061					0.039						0.018
Nickel in Water	<0.020					<0.020						<0.020
Zinc in Water	0.012					0.016						0.012
Mercury in Water	<0.00020					<0.00020						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV- 175												
	January	February	March	April	May	June	July	August	Septembe	October	November	December
pH	7.31	7.45	7	7	6.61	6.39	7.51	7.75	6.8	7.65	7.08	8.17
Dissolved Oxygen	AE	10.1	8.75	8.02	6.41	6.77	7.1	5.12	7.27	7.7	11.9	8.53
Water Temeprature	10.33	10.42	16.36	16.06	19.78	22.42	22.89	21.79	19.88	13.91	6.89	13.76
Alkalinity	39	20	38	45	41	54	75	46	50	51	45	40
Turbidity	2	4.3	3.2	2.9	3.9	4.2	3.6	7.3	3.3	2	2.6	2
5 Day BOD Streams	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	1.8	3.9	4.2	3.9	4.6	3.1	3.3	10	3.2	3.6	4.9	2
Fecal Coliform - Membrane Filter	240	280	140	230	130	170	80	520	160	120	100	71
Total Kjeldahl Nitrogen in Water	0.15	0.26	0.3	0.29	0.29	AE	AE	0.36	0.18	0.13	0.31	0.47
Ammonia	<0.050	0.057	0.1	0.079	0.098	0.096	AE	AE	0.084	<0.050	<0.050	<0.050
Nitrate/Nitrite	0.096	0.047	0.045	0.098	0.13	0.29	AE	0.1	0.11	0.1	0.029	0.021
Total Phosphorus in Water	0.047	0.028	0.037	0.022	0.04	0.049	AE	0.073	0.032	0.028	0.036	0.033
Total Organic Carbon	6.1					7.3						5.4
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.32					0.57						0.35
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	0.029					0.052						0.024
Nickel in Water	<0.020					<0.00020						<0.020
Zinc in Water	0.02					<0.020						<0.010
Mercury in Water	<0.00020					0.013						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data (cont.)

SV-328												
	January	February	March	April	May	June	July	August	September	October	November	December
pH	7.33	7.4	6.43	6.79	6.21	6.5	7.42	7.5	7.18	7.69	7.3	8.19
Dissolved Oxygen	AE	9.97	8.81	8.1	7.05	7.4	7.28	5.95	7.06	8.63	11.11	8.22
Water Temeprature	12.04	10.78	16.44	16.26	19.85	21.27	21.47	20.61	19.35	14.3	8.55	14.74
Alkalinity	47	16	39	45	49	56	58	47	64	57	53	45
Turbidity	2.9	4.3	3.6	1.8	4	3	2.4	6.2	2.3	2.9	1.6	1.4
5 Day BOD Streams	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	<2.0
Total Suspended Solids	5.6	3.2	5.2	4.1	3.9	4.9	2.6	7.6	2.4	1	2.2	1.8
Fecal Coliform - Membrane Filter	290	160	91	30	130	93	77	>4000	160	130	180	100
Total Kjeldahl Nitrogen in Water	0.12	0.19	<0.10	0.21	0.2	AE	AE	0.25	<0.10	0.32	0.12	0.29
Ammonia	<0.050	0.068	0.074	0.056	0.082	0.13	AE	AE	<0.050	<0.050	<0.050	<0.050
Nitrate/Nitrite	0.098	0.034	0.036	0.076	0.1	0.15	AE	0.1	0.11	0.13	0.034	0.1
Total Phosphorus in Water	0.04	0.025	0.028	<0.020	0.04	0.045	AE	0.04	0.025	0.033	0.025	0.032
Total Organic Carbon	9.1					5.4						3.8
Cadmium in Water	<0.010					<0.010						<0.010
Chromium in Water	<0.010					<0.010						<0.010
Copper in Water	<0.010					<0.010						<0.010
Iron in Water	0.24					0.36						0.3
Lead in Water	<0.050					<0.050						<0.050
Manganese in Water	0.045					0.053						0.048
Nickel in Water	<0.020					<0.00020						<0.020
Zinc in Water	0.012					<0.020						0.015
Mercury in Water	<0.00020					0.028						<0.00020
Acetone	<0.0500											
Chloromethane	<0.00500											
Vinyl chloride	<0.00500											
Bromomethane	<0.00500											
Chloroethane	<0.00500											
1,1-Dichloroethene	<0.00500											
Carbon Disulfide	<0.00500											
Dichloromethane	<0.00500											
trans-1,2-Dichloroethene	<0.00500											
1,1-Dichloroethane	<0.00500											
2-Butanone	<0.00500											
cis-1,2-Dichloroethylene	<0.00500											
Chloroform	<0.00500											
1,1,1-Trichloroethane	<0.00500											
Carbon tetrachloride	<0.00500											
Benzene	<0.00500											
1,2-Dichloroethane	<0.00500											
Trichloroethene	<0.00500											
1,2-Dichloropropane	<0.00500											
Bromodichloromethane	<0.00500											
2-Hexanone	<0.00500											
cis-1,3-Dichloropropene	<0.00500											
Toluene	<0.00500											
trans-1,3-Dichloropropene	<0.00500											
1,1,2-Trichloroethane	<0.00500											
4-Methyl-2-Pentanone	<0.00500											
Tetrachloroethene	<0.00500											
Dibromochloromethane	<0.00500											
Chlorobenzene	<0.00500											
Ethyl benzene	<0.00500											
m,p-Xylenes	<0.0100											
o-Xylene	<0.00500											
Styrene	<0.00500											
Bromoform	<0.00500											
1,1,2,2-Tetrachloroethane	<0.00500											

TOC

2.4.5 Summary Statistics

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS

Notes:

1. <LLD = Lower Limit of Detection
2. N/A = Not Applicable
3. STDEV = Standard Deviation
4. AVG = Average
5. n = number of samples above the limit of detection

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-2027							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12	5.62	5.64	0.78	0.61	4.54	7.53
Dissolved Oxygen	11	8.65	8.76	1.46	2.12	6.83	11.5
Water Temeprature	12	15.58	15.99	4.23	17.87	9.14	20.58
Alkalinity	5	1.78	1.80	0.53	0.28	1.0	2.4
Turbidity	12	2.78	2.20	2.20	4.84	9.2	1
5 Day BOD Streams	1	2.00	2.00	N/A	N/A	2	2
Total Suspended Solids	12	4.01	3.30	3.06	9.39	13	1.1
Fecal Coliform - Membrane Filter	12	206.42	130.00	196.83	38740.99	700	75
Total Kjeldahl Nitrogen in Water	6	0.40	0.39	0.13	0.02	0.64	0.24
Ammonia	3	0.07	0.07	0.01	0.00	0.074	0.057
Nitrate/Nitrite	12	0.26	0.25	0.05	0.00	0.39	0.19
Total Phosphorus in Water	5	0.03	0.03	0.01	0.00	0.046	0.02
Total Organic Carbon	1	2.20	2.20	N/A	N/A	2.2	2.2
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	3	0.16	0.19	0.08	0.01	0.23	0.067
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	1	0.02	0.02	N/A	N/A	0.016	0.016
Mercury in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-324							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12	6.22	6.16	0.67	0.44	5.10	7.53
Dissolved Oxygen	11	8.77	8.74	1.73	2.99	6.90	12.30
Water Temeprature	12	15.92	16.13	5.53	30.55	7.03	23.26
Alkalinity	12	8.33	4.40	14.79	218.69	1.70	55.00
Turbidity	12	9.61	7.40	6.64	44.10	3.90	29.00
5 Day BOD Streams	3	2.83	2.70	0.51	0.26	2.40	3.40
Total Suspended Solids	12	8.02	5.55	9.99	99.85	2.10	39.00
Fecal Coliform - Membrane Filter	6	109.67	72.00	82.72	6843.07	47.00	260.00
Total Kjeldahl Nitrogen in Water	9	0.31	0.29	0.14	0.02	0.13	0.63
Ammonia	6	0.08	0.07	0.02	0.00	0.06	0.12
Nitrate/Nitrite	9	0.08	0.07	0.04	0.00	0.02	0.17
Total Phosphorus in Water	11	0.05	0.05	0.03	0.00	0.02	0.12
Total Organic Carbon	3	5.30	4.80	1.90	3.61	3.70	7.40
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	3	1.75	1.40	1.70	2.90	0.25	3.60
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	3	0.10	0.10	0.04	0.00	0.06	0.14
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	2	0.02	0.02	0.01	0.00	0.02	0.03
Mercury in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-325							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12	6.35	6.25	0.55	0.30	5.71	7.51
Dissolved Oxygen	11	8.57	8.66	1.52	2.32	6.86	11.71
Water Temeprature	12	15.90	16.13	4.75	22.52	8.30	22.32
Alkalinity	7	3.19	2.90	0.79	0.63	2.40	4.20
Turbidity	12	4.75	4.45	2.59	6.70	1.80	11.00
5 Day BOD Streams	1	3.30	3.30	N/A	N/A	3.30	3.30
Total Suspended Solids	12	5.63	4.95	3.63	13.15	1.40	15.00
Fecal Coliform - Membrane Filter	9	148.56	130.00	57.48	3303.78	57.00	240.00
Total Kjeldahl Nitrogen in Water	7	0.22	0.22	0.09	0.01	0.14	0.41
Ammonia	2	0.07	0.07	0.01	0.00	0.06	0.07
Nitrate/Nitrite	11	0.22	0.13	0.31	0.10	0.02	1.10
Total Phosphorus in Water	11	0.14	0.05	0.27	0.07	0.02	0.94
Total Organic Carbon	3	3.10	3.00	0.85	0.73	2.30	4.00
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	0.00	0.00
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	0.00	0.00
Copper in Water	<LLD	N/A	N/A	N/A	N/A	0.00	0.00
Iron in Water	3	0.27	0.27	0.05	0.00	0.23	0.32
Lead in Water	<LLD	N/A	N	N/A	N/A	0.00	0.00
Manganese in Water	3	0.01	0.02	0.00	0.00	0.01	0.02
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	0.00	0.00
Zinc in Water	1	0.02	0.02	N/A	N/A	0.02	0.02
Mercury in Water	<LLD	N/A	N/A	N/A	N/A	0.00	0.00
Acetone	1	5.40	5.40	N/A	N/A	5.40	5.40
Chloromethane	1	1.60	1.60	N/A	N/A	1.60	1.60
Vinyl chloride	1	0.33	0.33	N/A	N/A	0.33	0.33
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-2039							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	11	6.75	6.67	0.58	0.33	6.12	7.88
Dissolved Oxygen	11	9.37	9.45	1.57	2.46	7.48	11.91
Water Temeprature	11	16.70	16.71	5.25	27.59	8.74	23.08
Alkalinity	11	16.80	16.00	5.47	29.90	8.6	25
Turbidity	11	4.05	2.50	3.82	14.58	1.6	15
5 Day BOD Streams	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Total Suspended Solids	11	3.08	1.80	2.27	5.15	1.2	7.4
Fecal Coliform - Membrane Filter	11	149.55	120.00	90.37	8167.07	57	380
Total Kjeldahl Nitrogen in Water	9	0.27	0.26	0.11	0.01	0.14	0.48
Ammonia	5	0.07	0.07	0.02	0.00	0.05	0.09
Nitrate/Nitrite	11	0.58	0.45	0.33	0.11	0.12	1.1
Total Phosphorus in Water	11	0.07	0.08	0.01	0.00	0.048	0.087
Total Organic Carbon	2	3.75	3.75	1.06	1.13	3	4.5
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	2	0.40	0.40	0.04	0.00	0.37	0.42
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	2	0.03	0.03	0.00	0.00	0.031	0.038
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	1	0.01	0.01	N/A	N/A	0.014	0.014
Mercury in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

Note: SV-2039 was added in February 2008 because of accessibility issues on Fourmile Branch; therefore it was not sampled for VOC's in January with the rest of the streams.

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-2047							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12	7.13	6.97	0.63	0.40	6.36	8.12
Dissolved Oxygen	11	9.28	8.90	1.84	3.39	7.14	13.05
Water Temeprature	12	16.16	16.33	5.67	32.15	7.41	23.19
Alkalinity	12	19.70	21.50	7.03	49.44	1.40	28.00
Turbidity	12	8.00	4.55	9.13	83.31	2.20	35.00
5 Day BOD Streams	1	2.20	2.20	N/A	N/A	2.20	2.20
Total Suspended Solids	12	10.73	4.40	16.04	257.36	0.80	58.00
Fecal Coliform - Membrane Filter	11	234.18	180.00	193.73	37529.76	77.00	740.00
Total Kjeldahl Nitrogen in Water	10	0.23	0.24	0.06	0.00	0.13	0.32
Ammonia	7	0.07	0.07	0.02	0.00	0.06	0.11
Nitrate/Nitrite	12	0.16	0.12	0.10	0.01	0.08	0.42
Total Phosphorus in Water	11	0.05	0.03	0.05	0.00	0.02	0.16
Total Organic Carbon	3	4.33	4.00	0.58	0.33	4.00	5.00
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	3	0.98	0.74	0.63	0.40	0.50	1.70
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	3	0.08	0.06	0.05	0.00	0.03	0.14
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	3	0.02	0.02	0.01	0.00	0.01	0.03
Mercury in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-327							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12	6.97	6.91	0.62	0.39	6.01	8.13
Dissolved Oxygen	11	8.95	9.00	1.81	3.29	6.65	12.12
Water Temeprature	12	16.39	16.54	5.69	32.32	7.06	23.37
Alkalinity	12	21.26	22.00	5.93	35.18	5.10	28.00
Turbidity	12	5.20	4.25	4.53	20.55	1.50	19.00
5 Day BOD Streams	2	2.05	2.05	0.07	0.01	2.00	2.10
Total Suspended Solids	12	7.82	4.45	10.64	113.17	1.20	41.00
Fecal Coliform - Membrane Filter	12	237.25	140.00	313.28	98143.48	30.00	1200.00
Total Kjeldahl Nitrogen in Water	10	0.21	0.18	0.10	0.01	0.10	0.42
Ammonia	8	0.07	0.07	0.01	0.00	0.06	0.09
Nitrate/Nitrite	11	0.09	0.06	0.08	0.01	0.03	0.31
Total Phosphorus in Water	8	0.03	0.03	0.01	0.00	0.02	0.06
Total Organic Carbon	3	4.23	4.40	0.76	0.58	3.40	4.90
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	3	0.35	0.38	0.12	0.02	0.21	0.45
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	3	0.04	0.04	0.02	0.00	0.02	0.06
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	3	0.01	0.01	0.00	0.00	0.01	0.02
Mercury in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV- 175							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12	7.23	7.20	0.51	0.26	6.39	8.17
Dissolved Oxygen	11	7.97	7.70	1.85	3.42	5.12	11.90
Water Temeprature	12	16.21	16.21	5.28	27.89	6.89	22.89
Alkalinity	12	45.33	45.00	12.77	162.97	20.00	75.00
Turbidity	12	3.44	3.25	1.47	2.16	2.00	7.30
5 Day BOD Streams	<LLD	N/A	N/A	N/A	N/A	0.00	0.00
Total Suspended Solids	12	4.04	3.75	2.09	4.38	1.80	10.00
Fecal Coliform - Membrane Filter	12	186.75	150.00	123.45	15239.48	71.00	520.00
Total Kjeldahl Nitrogen in Water	10	0.27	0.29	0.10	0.01	0.13	0.47
Ammonia	6	0.09	0.09	0.02	0.00	0.06	0.10
Nitrate/Nitrite	11	0.10	0.10	0.07	0.01	0.02	0.29
Total Phosphorus in Water	11	0.04	0.04	0.01	0.00	0.02	0.07
Total Organic Carbon	3	6.27	6.10	0.96	0.92	5.40	7.30
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	3	0.41	0.35	0.14	0.02	0.32	0.57
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	3	0.04	0.03	0.01	0.00	0.02	0.05
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	1	0.02	0.02	N/A	N/A	0.02	0.02
Mercury in Water	1	0.01	0.01	N/A	N/A	0.01	0.01
Acetone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

2008 Nonradiological Monitoring Of Ambient Surface Water At SRS Data Summary Statistics

SV-328							
	n	AVG	Median	STDEV	Variance	Minimum	Maximum
pH	12.00	7.16	7.32	0.58	0.33	6.21	8.19
Dissolved Oxygen	11.00	8.14	8.10	1.46	2.13	5.95	11.11
Water Temeprature	12.00	16.31	16.35	4.34	18.82	8.55	21.47
Alkalinity	12.00	48.00	48.00	12.25	150.18	16.00	64.00
Turbidity	12.00	3.03	2.90	1.35	1.83	1.40	6.20
5 Day BOD Streams	1.00	2.30	2.30	N/A	N/A	2.30	2.30
Total Suspended Solids	12.00	3.71	3.55	1.88	3.55	1.00	7.60
Fecal Coliform - Membrane Filter	11.00	131.00	130.00	68.18	4648.80	30.00	290.00
Total Kjeldahl Nitrogen in Water	8.00	0.21	0.21	0.07	0.01	0.12	0.32
Ammonia	5.00	0.08	0.07	0.03	0.00	0.06	0.13
Nitrate/Nitrite	11.00	0.09	0.10	0.04	0.00	0.03	0.15
Total Phosphorus in Water	10.00	0.03	0.03	0.01	0.00	0.03	0.05
Total Organic Carbon	3.00	6.10	5.40	2.72	7.39	3.80	9.10
Cadmium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chromium in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Copper in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Iron in Water	3.00	0.30	0.30	0.06	0.00	0.24	0.36
Lead in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Manganese in Water	3.00	0.05	0.05	0.00	0.00	0.05	0.05
Nickel in Water	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Zinc in Water	2.00	0.01	0.01	0.00	0.00	0.01	0.02
Mercury in Water	1.00	0.03	0.03	N/A	N/A	0.03	0.03
Acetone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl chloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Disulfide	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,2-Dichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Butanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,1-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromodichloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
2-Hexanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
trans-1,3-Dichloropropene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2-Trichloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-Pentanone	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Dibromochloromethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Chlorobenzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Ethyl benzene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
m,p-Xylenes	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
o-Xylene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Styrene	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	<LLD	N/A	N/A	N/A	N/A	N/A	N/A
1,1,2,2-Tetrachloroethane	<LLD	N/A	N/A	N/A	N/A	N/A	N/A

TOC

2.5 Radiological and Nonradiological Monitoring of Sediments

2.5.1 Summary

The accumulation of radiological and nonradiological contaminants in sediment can have direct impacts on aquatic organisms that can result in human exposure. Point source and nonpoint source pollutants impact water bodies through direct discharge, atmospheric fallout, or through runoff. These accumulated contaminants may become resuspended in streams and rivers. Contaminants dispersed downstream potentially impact drinking water supplies and fish consumed by the public. The high mobility of sediments is a complicated issue as stream flow changes can redistribute contaminants or bury them as part of the natural sedimentation process. Patterns of sediment contamination are strongly affected by hydrologic factors and the physical and chemical characterization of the sediment (USEPA 1987).

The Department of Energy's Savannah River Site (DOE-SR) streams receive surface water runoff and water from permitted discharges (USDOE 1995). Stormwater basins may receive runoff and atmospheric fallout from diffuse and fugitive sources. Cesium-137 (Cs-137) contamination occurs along the entire length of Lower Three Runs (LTR) and Steel Creek on the Savannah River Site (SRS), and the private property of Creek Plantation due to accidental releases of nuclear materials from past operations. LTR and Steel Creek watersheds represent a possible pathway for release of contamination from SRS activities to both on-site and off-site receptors in the environment (WSRC 2002b). Flooding and dam releases from Par Pond and L-Lake scour creek bottoms that may result in the movement of contaminated sediments. The SRS is within the Savannah River watershed with five major SRS streams feeding into the Savannah River. Dispersal of any contaminants from these SRS streams has the potential to impact the publically accessible Savannah River.

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) provides independent evaluation of DOE-SR environmental monitoring programs. ESOP personnel independently evaluated sediment samples for radionuclide and nonradionuclide contaminant concentrations in SRS streams, SRS stormwater basins, creek mouths along the boundary of SRS, the Savannah River, and publically accessible sites in the SRS vicinity. Background locations are sampled to compare ambient levels of radionuclides from past nuclear fallout events to those sampled on SRS to determine impacts due to SRS operations. Sediment samples on SRS are routinely split with DOE-SR in order to compare results.

The ESOP ambient sediment monitoring project changed in 2007 to include more random coverage of perimeter sediments (those within 50 miles of the SRS center point, but outside the SRS boundary) and background sediments (those greater than 50 miles from the SRS center point) within the boundaries of the state of South Carolina. This sampling program was implemented to allow statistical comparisons of the SRS perimeter and South Carolina background contaminant levels in sediment. The United States Geological Survey 7.5' Quadrangle Coverage for South Carolina (USDOI 1992) was used to determine the ESOP random quadrant sampling areas.

ESOP sampled 20 locations at SRS in 2008 with the cooperation of DOE-SR personnel. SRS sediment sampling locations are illustrated in Section 2.5.2, Map 7. Split samples were collected from seven stream locations on SRS and from seven stormwater basins. These locations were not publically accessible. Creek mouth sediment samples at five publically accessible locations along the Savannah River, as well as one downstream location in the river were also co-sampled (Section 2.5.3, Table 1). ESOP independently sampled 12 random perimeter sediments and 12 random background sediments. Refer to Section 2.5.3, Table 2 and Map 1 for random sampling locations. Additional sediment samples from nine publically accessible boat landings along the Savannah River were collected. Six of the landings chosen were downstream of SRS and three were chosen upstream as background samples (Section 2.5.3, Table 3). These sites were selected due to public exposure to sediments through sporting and recreational activities.

All samples were analyzed for gross alpha, gross non-volatile beta, gamma, and metals. The stream sediment samples from SRS are also analyzed for organic and inorganic constituents. Evaluation of radiological and nonradiological contaminants in sediment is necessary to detect any impact from DOE-SR operations beyond historically impacted areas. Radionuclide detections in sediment are the result of accumulation over many years and do not represent yearly depositions. ESOP continued a study that began in 2007 to compare annual in-situ Cs-137 radiation results in the LTR and Steel Creek floodplains using a portable Sodium Iodide (NaI) detector.

Gross alpha-emitting radionuclides were detected in the two samples from Upper Three Runs on SRS. There also were single detections among the random perimeter samples and the background samples. Gross alpha-emitting particles were not detected among the publically accessible boat landing sediments. Gross non-volatile beta was detected in nine SRS stream sediment samples and four stormwater basins. Seven boat landing samples had non-volatile beta detections. The random perimeter samples did not have detectable levels of beta particles, although three background samples did detect gross non-volatile beta.

Gamma spectroscopy led to detections of man-made radionuclides. On average, Cs-137 levels were highest in samples collected from on-site SRS streams, followed by the creek mouth samples, and SRS stormwater basins. Savannah River sediments collected upstream and downstream of SRS had similar Cs-137 levels with elevated concentrations occurring at several creek mouths along the SRS boundary. Although lower than those collected on SRS, the background samples were on average higher than those within 50 miles of the SRS perimeter (Section 2.5.3, Figure 1). Americium-241 (Am-241) was only detected in one sample that was located in Upper Three Runs Creek on SRS.

Isotopic analysis of technetium-99 (Tc-99), plutonium-238 (Pu-238), plutonium 239/240 (Pu-239/240), iodine-129 (I-129), and total strontium (Sr-89/90) was performed on samples from two SRS stream locations, one stormwater basin, the five creek mouth samples, and the downstream Savannah River sediment sample. Technetium-99 was only present in the Savannah River sediment sample located downstream of SRS. Plutonium-238 and Pu-239/240 were found in two stream samples and the stormwater basin. Plutonium-239 was found in the Upper Three Runs creek mouth location. Total strontium was found in the Fourmile Branch creek mouth. Inorganic metals data analysis reveals that Savannah River sediment samples collected downstream of SRS operations were lower than those in samples collected upstream of SRS. Also, there were some organic contaminant detections such as the pesticide dichlorodiphenyltrichloroethane (DDT) at very low levels in one SRS stream sediment sample.

Radiological data comparison of 2008 sediment split samples from SCDHEC and DOE-SR resulted in similar findings. Both split sample data sets report that the highest Cs-137 levels were found in Lower Three Runs. SCDHEC Cs-137 data from the SRS creek mouths were trended for 2003-2008 (Section 2.5.3, Figure 5). Although down from 2003 levels, average Cs-137 levels increased from 2006 to 2007. The 2008 average was only slightly higher than the previous year. Due to flooding disturbances in sediments and other media characteristics, variability in sediment samples can be anticipated.

In addition to sediment analysis, ESOP measured Cs-137 levels with the portable NaI detector in two of the three transects developed in 2007. A third transect was inaccessible due to extensive storm damage in 2008. Although the results for 2008 are slightly lower than from the previous year, a comparison of yearly in-situ Cs-137 measurements using a portable NaI detector will be necessary in order to trend Cs-137 in-situ data.

The continuation of sediment sampling and analysis, along with trending of data, is necessary to closely monitor SRS sediments. The potential for contaminants to impact the environment of SRS and the publically accessible Savannah River warrants these monitoring efforts.

Results and Discussion

Radiological Parameter Results

Sediments were evaluated for gross alpha and gross non-volatile beta as well as a suite of 24 gamma-emitting radionuclides. Selected samples were also analyzed for I-129, Tc-99, Pu-238, Pu-239, Pu-239/240, and Sr-89/90. A complete list of gamma-emitting radionuclides that SCDHEC analyzed for in 2008 can be found in Section 2.5.3, Table 4.

Cesium-137 is an artificially produced fission product. Atmospheric Cs-137 was released from the separation areas and was a key radionuclide released to water and air, mainly from F and H areas (CDC 2006). The liquid releases were also from the reactors as a result of leaking fuel elements in the 1950s and 60s (WSRC 1998). The largest single source of Cs-137 was fallout from atmospheric nuclear weapons tests in the 1950s and 1960s, which dispersed and deposited Cs-137 world-wide. However much of the cesium-137 from testing has now decayed (USEPA 2009a). Due to the half-life of 30 years, Cs-137 has an impact on the SRS environment. Cesium was detected in five on-site non-publically accessible SRS stream sediment samples at an average of 1.806 (± 2.285) picocuries per gram (pCi/g) and ranged from 0.143 to 5.707 pCi/g. The highest detection was located at SMSV-175 (Lower Three Runs at SC 125). Four of the seven stormwater basins sampled had detections averaging 0.755 (± 1.122) pCi/g and ranging from 0.107 to 2.431 pCi/g. Z Basin had the highest detection.

All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 1.11 (± 1.384) pCi/g and ranged from 0.066 to 3.726 pCi/g. The mouth of Steel Creek (SMSV-2017) had the highest detection. Four of the boat landings detected Cs-137 at an average of 0.229 (± 0.128) pCi/g and ranged from 0.136 to 0.415 pCi/g. The highest amount was found at Steel Creek Landing, just down river of SRS in Barnwell County.

Two random perimeter samples and four random background samples detected Cs-137. The random perimeter samples averaged 0.089 (± 0.063) pCi/g and ranged from 0.044 to 0.133 pCi/g. The highest detection was in sediment collected in quadrant E31 in Aiken County, which is in the Edisto River watershed. The random background samples had detections averaging 0.315 (± 0.219) pCi/g and ranged from 0.058 to 0.576 pCi/g. The highest detection in background sediments collected in 2008 was from a sample collected in quadrant B21 in Sumter County in the Black River watershed.

Cesium-137 levels in all the samples collected outside of SRS boundaries are within the expected range based on previous SCDHEC background data. The 2008 averages for the random background, random perimeter, and public boat landings are within one standard deviation of the 2007 background average (0.28 (± 0.35) pCi/g) (SCDHEC 2008a). The samples from the Savannah River and creek mouths along the SRS boundary show that elevated Cs-137 occurs in several SRS creek mouths, but returns to expected levels immediately downstream of SRS. Figure 2 in Section 2.5.3 illustrates Cs-137 activity in sediment samples collected from public boat landings upstream and downstream of SRS as well as the creek mouths of SRS

Only one sediment sample collected in 2008 had a detection for Am-241. Sediment from SMSV-2073 on SRS detected Am-241 at 0.382 pCi/g. Americium-241 is a man-made transuranic nuclide produced during the fission process. With a half-life of 432 years, this nuclide may be a legacy of past nuclear fallout events. However, previous studies indicate that Am-241 was released in significant quantities from the SRS (Till et. al. 2001). Along with Cs-137, Am-241 was released to the air from SRS (CDC 2006).

Results for europium-155 and manganese-54 could not be reported due to interference from the naturally occurring actinium-228 in the gamma spectroscopy. These radiological false positives occur because a naturally occurring nuclide, or combination of nuclides, may cause gamma instrument software to report a false positive of a reactor product (WSRC 2003b).

There were detections of actinium-228, potassium-40, lead-212, lead-214, radium-226, and thorium-234. These are Naturally Occurring Radioactive Material (NORM) decay products that may account for these detections. All other gamma-emitting radionuclides had no detections above their respective minimum detectable activity (MDA).

Gross alpha-emitting radionuclides were released to the air at SRS primarily from M-area, the reactor areas and the separations facilities (CDC 2006). Gross alpha was detected in the two samples collected from Upper Three Runs Creek. SMSV-2073 (Upper Three Runs at Road C) had a detection of 38.4 pCi/g and SMSV-2011 (Upper Three Runs creek mouth) had a detection of 46.9 pCi/g. There were no detections from the stormwater basins or the boat landings.
One random perimeter sample as well as one background sample detected gross alpha-emitting particles. The random perimeter sample from quadrant E31 in Aiken County had a detection of 22.4 pCi/g. The random background sample that had a detection of 19.9 pCi/g was collected from quadrant B28 in Williamsburg County.

Gross beta-emitting radionuclides were released from the separations areas on the SRS (CDC 2006). Gross non-volatile beta was detected in three on-site SRS stream locations at an average of 14.3 (± 8.3) pCi/g and ranged from 7.98 to 23.7 pCi/g. The highest detection was located at SMSV-2073. All six of the samples collected from publically accessible creek mouths and the Savannah River had detectable levels of gross non-volatile beta at an average of 27.85 (± 17.09) pCi/g. Samples ranged from 12.8 to 59.0 pCi/g. The highest detection was from SMSV-2011. Four of the seven stormwater basins sampled had detections averaging 12.18 (± 2.6) pCi/g and ranged from 8.6 to 14.3 pCi/g. Basin E-005 had the highest detection. Seven of the nine boat landings yielded gross non-volatile beta at an average of 17.3 (± 5.4) pCi/g and ranged from 8.83 to 24.1 pCi/g. The highest amount was found at a background location (Fury's Ferry Landing) up river of SRS in McCormick County.

There were no gross-beta detections from the random perimeter samples although there were three detections among the background samples. The random background samples had detections averaging 10.39 (± 1.25) pCi/g, ranging from 8.82 to 11.4 pCi/g. The highest detection was from a sample collected in quadrant B22 in Fairfield County. A graph comparing alpha and beta results can be found in Section 2.5.3, Figure 3.

Iodine-129 is a fission product of reactor fuel that has a very long (~16 million year) half-life. Most releases occurred during fuel processing (Till et al. 2001). There were no detections above the MDA for the three samples analyzed from SMSV-2069 (McQueen Branch), SMSV-2073 (Upper Three Runs Creek at Rd. C), and SM-Z Basin (stormwater basin behind the Saltstone Facility).

Technetium-99 was produced in SRS production reactors as a fission byproduct of uranium and plutonium. This radionuclide was released to the environment from the separation areas ventilation systems, the aqueous environment from liquid waste in waste tanks, and the Solid Waste Disposal Facility (WSRC 1993). Technetium-99 has also been released to the environment from atmospheric weapons tests, nuclear reactor airborne emissions, nuclear fuel reprocessing plant airborne emissions, and facilities that treat or store radioactive waste (USEPA 2009b). Technetium-99 was analyzed in two samples from SRS streams (McQueen Branch and Upper Three Runs Creek), all five creek mouth locations on the SRS and Savannah River border, and at a downstream river location (SMSV-118). One basin (SM-Z Basin) was also sampled for Tc-99. Although there were no detections in the creek mouths, the down river location (SMSV-118) was the only sample where Tc-99 was detected at 0.371 pCi/g.

Plutonium releases at SRS occurred primarily through the discharge of liquid effluent. Plutonium was manufactured on SRS in H Area for fuel rods and in F Area for targets (Till et al. 2001). Plutonium-238 and Pu-239/240 were found in the two stream samples (SMSV-2069 and SMSV-2073) and the stormwater basin (SM-Z Basin). Plutonium-238 was highest at SMSV-2073 (0.0637 pCi/g) followed by SMSV-2069 (0.0416 pCi/g) and SM-Z Basin (0.0103 pCi/g). Plutonium-239 was found in SMSV-2011, the Upper Three Runs creek mouth location (0.0169 pCi/g wet weight and 0.0500 pCi/g dry weight). Plutonium-239/240 at SMSV-2069 was 0.0174 pCi/g, 0.0137 pCi/g at SMSV-2073, and 0.0091 pCi/g at SM-Z Basin.

Most strontium found in the SRS environment originated as fission products in nuclear fuel targets and the operation of the five reactors. Reactors are the largest source of strontium 90 (Sr-90) to streams at SRS (Till et al. 2001). Strontium is also present worldwide as the result of past nuclear weapons testing (USEPA 2007a). Sr-89/90 was analyzed for in SMSV-2069, SMSV-2073, SM-Z Basin, the five creek mouth samples, and the downstream Savannah River sediment sample. Only SMSV-2015 (Fourmile Branch creek mouth) had a detectable level of Sr-80/90 (0.402 pCi/g wet weight and 0.552 pCi/g dry weight). Isotopic analysis results can be found in Section 2.5.3, Figure 4.

SCDHEC 2008 radiological data can be found in Section 2.5.4 and statistical data can be found in Section 2.5.5. SCDHEC and DOE-SR have shared split-samples and data since 2006. Until more split sample data can be collected, this report will only trend SCDHEC Cs-137 data for the SRS creek mouth sediments that are sampled annually. The SCDHEC data from 2003-2008 shows the five creek mouths declined in average Cs-137 levels. The creek mouths of Beaver Dam Creek, Steel Creek, and Lower Three Runs Creek showed an overall decline in Cs-137 levels, while Fourmile Branch and Upper Three Runs showed an overall increase. Trending data for Cs-137 in Savannah River sediment samples is in Figure 5, Section 2.5.3.

Although historical fallout from weapons testing has been the most important man-made contributor to radioactive contamination of the global environment, there are other anthropogenic sources such as SRS operations. Also, some radionuclides occur naturally in the environment. Separating radioactivity contributed by releases from the SRS from weapons fallout is difficult for some radioisotopes (Till et al. 2001).

Nonradiological Parameter Results

A USEPA Target Analyte List of 24 metals was analyzed in all of the stream sediment samples collected in 2008. One stormwater basin was also analyzed for metals. Samples collected in coordination with DOE-SR personnel were also analyzed for organic pesticides, herbicides, PCBs, and organic base neutral/acid analysis (BNA). A complete list of all nonradiological analytes can be found in Section 2.5.3, Tables 5 and 6. Comparisons were made to the Ecological Screening Value (ESV) for sediment which does not represent remediation goals or cleanup levels, but is used to identify constituents of potential concern (WSRC 2005b). The South Carolina state averages are from “Elements in South Carolina Inferred Background Soil and Stream Sediment Samples” (Canova 1999).

While many samples exceeded the ESV, most metals found in SRS stream sediments were lower than those found in the creek mouths on the Savannah River. The creek mouth sediments were lower than those found in the Savannah River channel. Higher levels of metals than were found on SRS occurred upstream of SRS and declined at downstream locations. Zinc was the only exception where levels were higher in the SRS stream sediments than in the other locations. A graph depicting the metal averages for all sample types can be found in Section 2.5.3, Figure 6.

All beryllium, chromium, copper, lead, manganese, and nickel were below the ESV. All samples were below the ESV for zinc with the exception of the stormwater basin. Cobalt exceeded the ESV in only two samples. Aluminum, iron, magnesium, titanium, and vanadium do not have an ESV. The ESV for barium was exceeded in the average of detections for all sample types except the random perimeter samples. The ESV for cadmium was exceeded in the average of detections for all samples types. The ESV for mercury was exceeded in one creek mouth sample (SMSV-2011).

There were no detections above the minimum detection level (MDL) for antimony, arsenic, boron, molybdenum, selenium, tin, silver, and thallium. The following discussion of individual analytes will be limited to those of potential concern due to SRS operations.

Barium has been a constituent of the H Area Hazardous Waste Management Facility (WSRC 1993b). The majority of the samples collected from SRS and the Savannah River were above the South Carolina state average (32 milligrams per kilogram (mg/kg)) and the ESV for sediment (20 mg/kg). However, barium was also detected in the majority of the off site random samples, nearly half of which exceeded the ESV and one quarter exceeded the state average. Barium was detected in seven on-site SRS stream sediment samples as well as Z-Basin. Barium averaged 57 (± 31) mg/kg, and ranged from 32 to 120 mg/kg. SMSV-175 had the highest detection. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 75 (± 26) mg/kg and ranged from 37 to 110 mg/kg. SMSV-118 had the highest detection. Eight of the boat landings detected barium at an average of 47 (± 36) mg/kg and ranged from 5.4 to 120 mg/kg. The highest amount was found at Jackson Boat Landing, up river of SRS in Aiken County. The random perimeter sediment samples averaged 19.7 (± 17.9) mg/kg and ranged from 5.8 to 62 mg/kg. The highest detection was in sediment collected in quadrant E31 in Aiken County. The random background samples had detections averaging 37.8 (± 26.7) mg/kg and ranged from 6.3 to 89 mg/kg. The highest detection in background sediments collected in 2008 was from a sample collected in quadrant B21 in Sumter County.

Cadmium enters the atmosphere through fuel and coal combustion (Till et al. 2001). Cadmium was found above the South Carolina state average of 0.8 mg/kg in nearly all the samples from SRS and the Savannah River. Although one third of the background samples also had above average levels, only one random perimeter samples had a detection. All samples exceeded the ESV for cadmium (0.6 mg/kg). Cadmium was higher upriver of SRS at Jackson Boat Landing than in any of the SRS streams and creek mouths. Cadmium was detected in seven on-site SRS sediment samples and Z-Basin at an average of 2 (± 1) mg/kg, and ranged from 1.1 to 3.4 mg/kg. SM-Z Basin had the highest detection. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 3 (± 1) mg/kg and ranged from 1.4 to 3.9 mg/kg with SMSV-118 having the highest detection. Five of the boat landings detected cadmium at an average of 2.7 (± 1.6) mg/kg and ranged from 1.2 to 4.7 mg/kg. The single random perimeter sediment detection collected from quadrant E31 in Aiken County was 1.1 mg/kg, while the four random background sediment detections averaged 2.8 (± 2.0) mg/kg. The background samples ranged from 1.1 to 4.8 mg/kg, with the highest located in quadrant B16 in Oconee County.

Chromium solutions were used at the SRS as corrosive inhibitors. Chromium was a part of wastewater solutions resulting from dissolving stainless steel. It was also used in cleaning solutions in the separation areas (Till et al. 2001). Chromium was detected in the majority of the samples and was above the South Carolina state average of 11 mg/kg in close to half the samples from SRS and the Savannah River. While none of the random perimeter samples were above the state average, only three background locations were above the state average. All samples were below the ESV for sediment (36 mg/kg). Chromium was detected in all seven on-site SRS stream sediment samples and Z-Basin. SMSV-175 and SM-Z Basin each had a detection of 25 mg/kg. Detections averaged 13 (± 9) mg/kg, and ranged from 2.4 to 25 mg/kg. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 14 (± 5) mg/kg and ranged from 7.5 to 20 mg/kg. SMSV-118 had the highest detection. Eight of the boat landings detected chromium at an average of 11.4 (± 9.0) mg/kg and ranged from 1.6 to 27 mg/kg. The highest amount was found at Parkville Recreation Area, up river of SRS in McCormick County. The random perimeter sediment samples averaged 2.3 (± 1.0) mg/kg and ranged from 1.4 to 4.1 mg/kg. The highest detection was in sediment collected in quadrant E37 in Bamberg County. The random background samples had detections averaging 8.8 (± 8.1) mg/kg and ranged from 1.2 to 30 mg/kg. The highest detection in background sediments collected in 2008 was from a sample collected in quadrant B27 in McCormick County. Copper, while naturally occurring, can also be released to the environment through the combustion of wood, coal, and oil (Alloway 1995). These mechanisms are possible sources of elevated copper in the sediments. All 2008 samples were below the ESV of 18.7 mg/kg. Copper was detected in six on-site SRS stream sediment samples and Z-Basin and was above the South Carolina state average of 6 mg/kg in two of the sample locations. SMSV-2069 had the highest detection. Detections averaged 6 (± 5) mg/kg, and ranged from 1.8 to 15 mg/kg. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 7 (± 3) mg/kg and ranged from 2.2 to 11 mg/kg. SMSV-118 had the highest detection. Seven of the boat landings detected copper at an average of 6.9 (± 6.4) mg/kg and ranged from 2.2 to 18 mg/kg. The highest amount was found at Parksville Recreation Area. The random perimeter sediment samples averaged 2.2 (± 0.9) mg/kg and ranged from 1.5 to 2.8 mg/kg. The highest detection was in sediment collected in quadrant E31 in Aiken County. The random background samples had detections averaging 4.4 (± 3.5) mg/kg and ranged from 1.4 to 11 mg/kg. The highest detection in background sediments was from a sample collected in quadrant B16 in Oconee County.

Atmospheric emissions of lead from SRS occurred through coal and fuel combustion (Till et al. 2001). Lead can deposit in sediments where it has a long residence time when compared to other pollutants (Alloway 1995). Lead was detected in five on-site SRS stream sediment samples and Z-Basin and was above the South Carolina state average of 11 mg/kg in one sample. SMSV-175 had the highest detection. Detections averaged 9 (± 3) mg/kg, and ranged from 5.8 to 13 mg/kg. Five of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 9 (± 3) mg/kg and ranged from 6 to 13 mg/kg. SMSV-2011 had the highest detection. Four of the boat landings detected lead at an average of 8.8 (± 3.8) mg/kg and ranged from 5.2 to 13 mg/kg. The highest amount was found at Jackson Boat Landing. Only one random perimeter sediment sample, collected in quadrant E31 in Aiken County, had a detection of 6.6 mg/kg. The random background samples had seven detections averaging 11.9 (± 3.9) mg/kg and ranged from 6 to 15 mg/kg. The highest detection in background sediments was from a sample collected in quadrant B29 in Colleton County. Lead levels were all below the ESV of 30.2.

Manganese has been released in the separations area head end processes and discharged to liquid waste tanks. It is also a byproduct of coal burning (Till et al. 2001). Manganese was detected in all seven on-site SRS stream sediment samples and Z-Basin and was above the South Carolina state average of 137 mg/kg in three samples. Detections averaged 176 (± 219) mg/kg, and ranged from 9.1 to 690 mg/kg. SMSV-175 had the highest detection. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 522 (± 260) mg/kg and ranged from 240 to 880 mg/kg. SMSV-118 had the highest detection. All nine of the boat landings detected manganese at an average of 678 (± 503) mg/kg and ranged from 37 to 1600 mg/kg. Manganese was higher upriver of SRS at Jackson Boat Landing than in any of the SRS streams and creek mouths. The ESV for sediment (630 mg/kg) was exceeded in one SRS stream, one creek mouth, two samples upstream of SRS, and two downstream of SRS. The random perimeter sediment samples averaged 72.1 (±108.9) mg/kg and ranged from 1.5 to 310 mg/kg. The highest detection was in sediment collected in quadrant E31 in Aiken County. The random background samples had detections averaging 194.2 (± 245.6) mg/kg and ranged from

4.2 to 700 mg/kg. The highest detection in background sediments was from a sample collected in quadrant B27 in McCormick County.

Mercury in sediment may be attributed to atmospheric fallout. SRS facilities such as F and H area, tritium facilities, waste tanks, and the coal-fired power plants have emitted mercury to the atmosphere (Till et al. 2001). Mercury was above the minimum detection limit (MDL) of 0.10 mg/kg in only one sample in 2008. The sample collected from the Upper Three Runs creek mouth (SMSV-2011), a publically accessible creek mouth on the site boundary at the Savannah River, had a detection of 0.16 mg/kg. The ESV for sediment is 0.13 mg/kg.

Nickel was released to Tim's Branch from M-area processes (Till et al. 2001). Upper Three Runs creek is the receptor of effluent from Tim's Branch. Nickel was detected in six on-site SRS stream sediment samples and Z-Basin and was equal to or above the South Carolina state average of 5 mg/kg in five samples. Detections averaged 5 (± 2) mg/kg, and ranged from 3.2 to 9.4 mg/kg. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 8 (± 5) mg/kg and ranged from 3.7 to 19 mg/kg. The highest detections came from the samples collected just downstream of the confluence of Tim's Branch in Upper Three Runs Creek (SMSV-2073 at road C and the creek mouth SMSV-2011). Only the Upper Three Runs creek mouth sample exceeded the ESV of 15.9 mg/kg. Six of the boat landing samples detected nickel at an average of 5.8 (± 3.4) mg/kg and ranged from 2.6 to 11 mg/kg. The highest amount was found at Jackson Boat Landing, located upstream of SRS. Only one random perimeter sediment samples had a detection of 2.8 mg/kg and was collected in quadrant E31 in Aiken County. Half the random background samples had detections averaging 3.4 (± 0.7) mg/kg and ranged from 2.5 to 4.1 mg/kg. The highest detection in background sediments was from a sample collected in quadrant B21 in Sumter County.

Zinc was released in relatively small amounts to the separations area seepage basins as well as the M-area seepage basin (Till et al. 2001). Zinc was detected in all seven on-site SRS stream sediment samples and Z-Basin and was above the South Carolina state average of 23 mg/kg in five samples. Zinc levels declined in 2008 from 2007 in McQueen Branch and Upper Three Runs, two locations that warranted concern in the 2007 findings. Sediment from Z-Basin had the highest level of zinc (180 mg/kg) from any sample collected in 2008 and was the only sample to exceed the ESV of 98 mg/kg. Detections averaged 40 (± 57) mg/kg, and ranged from 2.3 to 180 mg/kg. All six of the samples collected from publically accessible creek mouths and the Savannah River had detections averaging 35 (± 10) mg/kg and ranged from 21 to 48 mg/kg. SMSV-118, located downstream of all SRS streams in the Savannah River, had the highest detection. All nine of the boat landings detected zinc at an average of 18.2 (± 11.4) mg/kg and ranged from 2.9 to 35 mg/kg. The highest amount was found at Jackson Boat Landing. The random perimeter sediment samples averaged 4.9 (± 4.0) mg/kg and ranged from 1.2 to 13 mg/kg. The highest detection was in sediment collected in quadrant E31 in Aiken County. The random background samples had detections averaging 10.4 (± 7.0) mg/kg and ranged from 1.8 to 21 mg/kg. The highest detection in background sediments was from a sample collected in quadrant B27 in McCormick County.

There were some organic contaminant detections at very low levels. One sample, SMSV-2011, showed traces of the pesticide DDT. The DDT isomers p,p'-DDD, p,p'-DDE, and p,p'-DDT were found in this one location, but were all below the ESV of 2.0, 1.42, and 1.0 respectively. Although DDT was banned in the United States in 1972, releases of this long-lived pesticide from waste sites may continue to contaminate the environment (ATSDR 2002). The only detection through BNA analysis occurred from SMSV-2049 for the semi-volatile organic compound di-n-octylphthalate. This contaminant enters the environment from atmospheric deposition from the manufacturing and/or burning of plastics (ATSDR 1997). All other BNA, pesticide, PCB, and herbicide analytes were below detection limits.

SCDHEC nonradiological sediment data can be found in Section 2.5.4 and nonradiological statistical data can be found in Section 2.5.5. A statistical summary can be found in Section 2.5.3, Table 8.

Sodium Iodide (NaI) Detector Results

Data was collected with a NaI detector for two of the three sampling transects established in 2007 in order to ascertain levels of Cs-137 in the floodplains of LTR and Steel Creek. The net count rate in the Cs-137 gamma ray peak was determined at each location. All transects extend across higher Cs-137 activities to background areas bisecting the floodplain. The first LTR transect (LTR 1) is located north of Patterson Mill Road. The Steel Creek transect is located on the flood plain of Creek Plantation, a privately owned land area on the southeastern border of SRS, approximately 100 meters from the Steel Creek boat ramp public access point. Data could not be collected for the second LTR transect (LTR 2), situated approximately one mile from the Savannah River, due to extensive storm damage in 2008. Transect construction and data collection details are outlined in the ESOP Data Report for 2007. In 2007, evaluation of NaI field measurements compared to the standard laboratory analyses of Cs-137 indicated that the NaI field method provides a good indicator of areas of Cs-137 contamination (SCDHEC 2008a). Although the results for 2008 are slightly lower than the previous year, future readings will be necessary in order to trend Cs-137 in-situ data. Refer to Section 2.5.3, Table 9 and Figure 7-8 for NaI detector results.

SCDHEC and DOE-SR Data Comparison

DOE-SR and SCDHEC-ESOP split 13 SRS stream sediment and seven stormwater basin sediment samples in 2008. All SCDHEC samples were analyzed for gross alpha- and gross beta-emitting particles and gamma-emitting radionuclides. Select samples (the five creek mouths, SMSV-118, SMSV-2069, SMSV-2073, and SM-Z Basin) were also analyzed for Tc-99, Pu-238, Pu-239, and Sr-89/90. Additionally, SMSV-2069, SMSV-2073, and SM-Z Basin were analyzed for I-129. Nonradiological results of the split samples by SCDHEC were previously discussed in this report. A comparison to the DOE-SR split samples could not be made because DOE-SR results could not be obtained at the time of this report.

Cs-137, Co-60, and Am-241 were the only nonNORM gamma-emitting radionuclides where SCDHEC and DOE-SR shared gamma analysis results (SRNS 2009). There were no detections above the MDA for Co-60 in either dataset.

Both agencies detected the highest Cs-137 concentration at Lower Three Runs at SC 125 (SMSV-175). DOE-SR detected 4.393 pCi/g while SCDHEC detected 5.707 pCi/g. When averaging all the SRS on-site stream sediment samples, SCDHEC found 1.806 (± 2.285) pCi/g Cs-137 while DOE-SR found 1.390 (± 1.783) pCi/g. The publically accessible Savannah River and SRS creek mouths averaged 1.110 (± 1.384) pCi/g in the SCDHEC data and 1.116 (± 1.258) pCi/g in the DOE-SR data. The average of Cs-137 in the stormwater basins was found to be

0.755 (± 1.122) pCi/g by SCDHEC compared to 0.587 (± 0.835) pCi/g as found by DOE-SR. Analytical results of Cs-137 for DOE-SR are within one standard deviation of the data from SCDHEC. Figures 9-11 in Section 2.5.3 illustrate the findings.
SCDHEC had one Am-241 detection at SMSV-2073 (0.382 pCi/g). DOE-SR had detections in two samples (SMSV-2049 and SMSV-2013) at an average of 0.025 (± 0.028) pCi/g in stream sediments and in three samples (0.003 (± 0.001) pCi/g) in the stormwater basin sediments. The average MDA for the 2008 SCDHEC sediment samples was 0.182 pCi/g, which is much higher than the DOE-SR minimum detectable concentration (MDC) of 0.0039 pCi/g (SRNS 2009). Since DOE-SR has a much lower MDC, this may explain why the SCDHEC data does not report more detections above the MDA. Also, values less than the MDC are included in the DOE-SR data (SRNS 2009). Only detections are averaged from the SCDHEC data.

SCDHEC did not have Pu-238 detections in the six creek mouth and the one Savannah River (SMSV-118) sediment samples. DOE-SR had detections in all these samples at an average of 0.041 (± 0.078) pCi/g. SCDHEC detected Pu-238 in the two on-site stream sediment samples that were analyzed - SMSV-2073 (0.064 pCi/g) and SMSV-2069 (0.042 pCi/g). DOE-SR reported detections in five of the on-site stream sediment samples averaging 0.012 (± 0.011) pCi/g. However, DOE-SR did not report a detection at SMSV-2073. Plutonium-238 was analyzed by SCDHEC in one stormwater basin location (SM-Z Basin) and was detected at 0.010 pCi/g. DOE-SR reports that five of the stormwater basin sediment samples had detections averaging 0.010 (±0.009) pCi/g. The average MDC for the 2008 SCDHEC sediment samples was 0.0157 pCi/g, which is higher than the DOE-SR representative MDC of 0.0029 pCi/g (SRNS 2009). Since DOE-SR has a much lower MDC, this may explain why the SCDHEC data does not report more detections above the MDC.

SCDHEC had one Pu-239 detection from the six creek mouth and Savannah River sediment samples at SMSV-2011 (0.017 pCi/g). DOE-SR had detections in three of these samples at an average of 0.022 (± 0.008) pCi/g. SCDHEC detected Pu-239 in the two on-site stream sediment samples that were analyzed - SMSV-2073 (0.014 pCi/g) and SMSV-2069 (0.017 pCi/g). DOE-SR reported detections in four of the on-site stream sediment samples averaging 0.006 (± 0.004) pCi/g. However, DOE-SR did not report a detection at SMSV-2073. Plutonium-239 was analyzed by SCDHEC in one stormwater basin location (SM-Z Basin) and was detected at 0.009 pCi/g. DOE-SR reports that four of the stormwater basin sediment samples had detections averaging 0.003 (±0.002) pCi/g. However, DOE-SR did not report a detection at SM-Z Basin. The average MDC for the 2008 SCDHEC sediment samples was 0.0169 pCi/g, which is higher than the DOE-SR representative MDC of 0.0028 pCi/g (SRNS 2009). Since DOE-SR has a much lower MDC, this may explain why the SCDHEC data does not report more detections above the MDC

SCDHEC had only one Sr-89/90 detection from a SRS creek mouth at SMSV-2015 (0.402 pCi/g). DOE-SR did not have any detections above the MDC from any of the creek mouth samples. DOE-SR reports only one Sr-89/90 detection at the on-site stream location SMSV-2049, whereas SCDHEC did not have any detections from the two on-site stream samples that were analyzed for Sr-89/90. Neither agency had detections above the MDC in the stormwater basins that were analyzed. Technetium-99 results for SCDHEC were previously discussed. DOE-SR did not analyze for Tc-99. Iodine-129 was not detected by SCDHEC in the three sediment samples analyzed. DOE-SR did not analyze for I-129. The tables comparing results from SCDHEC and DOE-SR is in Section 2.5.3, Tables 10-11.

Statistical Summary

Background (B) sample averages were subtracted from perimeter (E) sample averages to determine the SRS random environmental concentrations above the background (Section 2.5.3, Tables 7-8). If this number was greater than zero and the radionuclide was associated with SRS, then further statistical analysis was conducted. Statistical analysis of data between SCDHEC and DOE-SR cannot be done since DOE-SR does not do random sampling. However, since ESOP collects random samples, statistical test comparisons can be done between SRS perimeter and South Carolina background samples. This comparison can be used to determine the statistical significance of any differences encountered between perimeter and background samples collected by ESOP. When the random perimeter and random background samples were averaged, only lead-212, lead-214, and actinium-228 had an "E-B" average and median value greater than zero. Radium-226 had an E-B value greater than zero for the median value. These averages were calculated to provide a more accurate characterization of the contaminant concentrations throughout the sampling area.

Statistical analyses of Cs-137 were done using SCDHEC random sampling averages. Nonparametric Wilcoxon-Mann-Whitney and Quantile statistical tests (USEPA 2007b) of 22 perimeter and 11 background observations were used to test the hypothesis that the study area (50-mile SRS perimeter) and the South Carolina background are the same for the stated radionuclide based locations. The 2008 sediment Cs-137 null hypothesis was not rejected at the 5% significance level.

The SCDHEC random sample data was used to calculate "E-B" averages from the "detections only" data for metals. Only cobalt had "E-B" averages greater than zero.

Conclusions and Recommendations

The creek mouths of SRS are a conduit for the dispersal of radionuclides into publically accessible water. Cesium-137, Pu-239, and Sr-89/90 were found in the sediment within several creek mouths at their confluences with the Savannah River. Additionally, Tc-99 was found in the Savannah River sediment, downstream of SRS.

Cesium-137 is the most abundant radionuclide found in the sediment samples. Cesium-137 levels of 2008 from all the samples collected outside of SRS boundaries are within the expected range consistent with previous SCDHEC background data and may be attributed, in part, to fallout from past nuclear events in the 1950s and 1960s. The highest level of Cs-137 from all 2008 sediment samples occurred in the on-site sample collected from LTR. Past releases from SRS into LTR may account for this elevated level due to accumulation in the sediment. Three of the publically accessible creek mouths of the SRS streams had Cs-137 activity, which was higher than average when compared to background levels. The creek mouths of Upper Three Runs and Steel Creek exhibited higher Cs-137 than in the previous year. The 2008 levels in Upper Three Runs creek mouth were higher than in 2003, when data trending began. Levels in the mouth of Steel Creek were lower in 2008 than in 2003. The mouth of Fourmile Branch had lower Cs-137 in 2008 than in 2007, yet the past two years were higher than when data trending began in 2003. The creek mouth sediment of Upper Three Runs also had detectable levels of Pu-239. Fourmile Branch creek mouth had detectable levels of Sr-89/90 at the downstream location. The Savannah

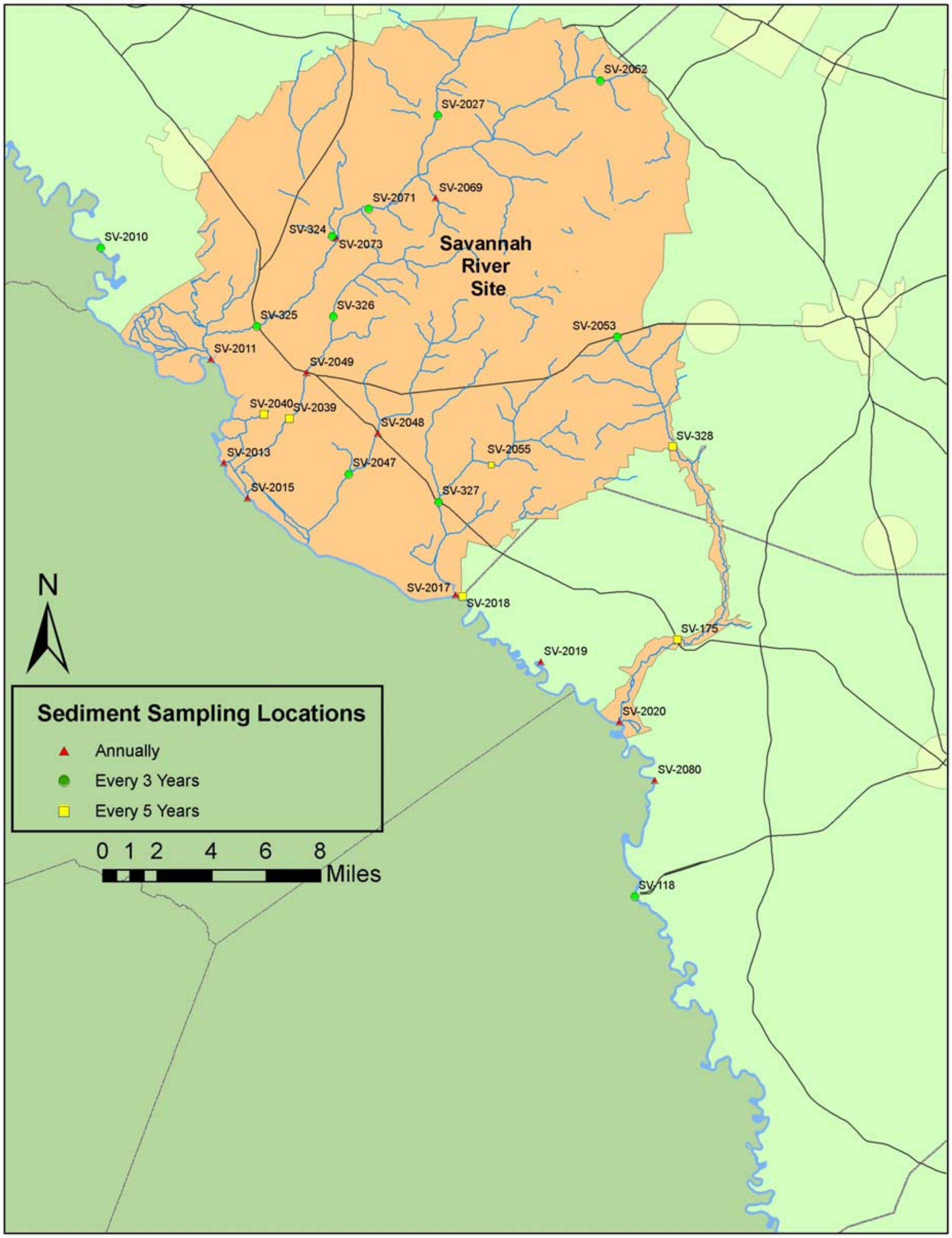
River had a detection for Tc-99 at one location, whereas no detections occurred in the creek mouth samples.

Metals in sediment can be naturally occurring or a result of man-made processes such as those used in SRS operations, which have released elevated amounts into streams on the SRS. Re-distribution of sediment from flooding can mobilize contaminants to downstream locations. Geological factors in the Savannah River basin contribute to the levels of metals through erosion and sediment deposition. Comparisons to background levels are used to determine the anthropogenic contribution. Savannah River metals were on average higher upstream of SRS than were downstream of SRS operations. All 2008 samples were below the ESV for chromium, copper and lead. The creek mouth sediment of Upper Three Runs had ESV exceedances for mercury and nickel. Zinc was only exceeded in Z basin. Manganese ESV exceedances were found in the samples from LTR, although these levels were much lower than the sediment collected at Jackson Boat Landing, upstream of SRS on the Savannah River. Cadmium had ESV exceedances on SRS, although the highest level was found in a background sample from Oconee County. The majority of samples found barium greater than the ESV. The highest on-site sample on LTR was equal to what was found at Jackson Boat Landing. DDT was detected at levels less than the ESV in the creek mouth sediment of Upper Three Runs.

SRS sediments should continue to be monitored due to the potential of discharges from SRS operations, legacy wastes, and clean up activities. Year to year data comparisons are difficult to interpret due to the nature of sediment. Differences among samples may be due to the fraction of clays that most effectively retain radionuclides. There is also difficulty in replicating the exact sampling point due to the movement of sediment. Monitoring of on-site sediments is of great importance as streams are a migration route for radionuclides to enter waters and sediment outside of the SRS boundary. ESOP will continue independent monitoring of SRS and Savannah River sediments and will periodically evaluate modification of the monitoring activities to better accomplish project goals and objectives. Other locations will be sampled to evaluate impacts of SRS within the surrounding area. Multiple background locations are sampled for a comparison to ambient levels of radionuclides. ESOP will perform annual in-situ monitoring of the three floodplain transects and will compare data to previous results to see if Cs-137 net results are declining by natural radioactive decay or possibly increasing due to the movement of re-suspended sediment along the floodplains. Monitoring will continue at the SRS as long as there is a potential for contamination. Continued monitoring will provide an improved understanding of radionuclide and non-radionuclide levels in SRS sediments and the Savannah River which will impart valuable information to human health exposure pathways. Trending of data over multiple years will give a more definitive answer whether radionuclide concentrations in the SRS area are declining due to radioactive decay or possibly increasing due to disturbances on SRS. The comparison of data results allows for independent data evaluation of DOE-SR monitoring activities. To compare the environmental monitoring programs of ESOP and DOE-SR, the sediment samples from SRS will be collected in cooperation with DOE-SR personnel. Each program will then independently analyze the samples for radiological and nonradiological parameters and results will be compared in the 2009 ESOP Data Report. Cooperation between DOE-SR and SCDHEC provides credibility and confidence in the information being provided to the public.

2.5.2 Radiological and Nonradiological Monitoring of Sediments [TOC]

Map 7. SRS Sediment Sampling Locations



2.5.3 Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 1. Locations of SRS Sediment Samples

2008 ESOP Sediment Sample Locations on SRS		
Sample Location	**Location Description**	**Stream Abbr.**
SV-2011	Upper Three Runs mouth @ RM 157.4	UTR
SV-2013	Beaver Dam Creek mouth @ RM 152.3	BDC
SV-2015	Fourmile Branch creek mouth @ RM 150.6	FMB
SV-2017	Steel Creek mouth @ RM 141.5	SC
SV-2020	Lower Three Runs mouth @ RM 129.1	LTR
SV-2048	Pen Branch @ Road 125	PB
SV-2049	Fourmile Branch @ Road 125	FMB
SV-2069	McQueen Branch off Monroe Owens Road.	McQ
SV-2073	Upper Three Runs off Road C.	UTR
SV-118	Savannah River @ RM 118.8 (Highway 301 Bridge)	118
SV-327	Steel Creek @ SC 125 (SRS Road A)	SC
SV-2053	Lower Three Runs @ Road B	LTR
SV-175	Lower Three Runs at Highway 125.	LTR
SME-001	E-001 E Area stormwater basin	
SME-002	E-002 E Area stormwater basin	
SME-003	E-003 E Area stormwater basin	
SME-004	E-004 E Area stormwater basin	
SME-005	E-005 E Area stormwater basin	
SME-006	E-006 E Area stormwater basin	
SME-Z BASIN	Stormwater basin in N.E. perimeter of Z Area	

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 2. Random Quadrant Locations

2008 Random Sediment Sampling Locations

Random Quadrants Outside the 50-mile SRS Perimeter or "B" Quadrants.

Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long	Geological Region
B13	Sharon	3452.5 by 3500 and -8115 by -8122.5	PM
B16X	Westminster (NRX)	3437.5 by 3445 and -8300 by -8307.5	PM
B17X	Hartwell Dam (GAX)	3415 by 3422.5 and -8245 by -8252.5	PM
B18X	Hartsville South (NRX)	3415 by 3422.5 and -8000 by -8007.5	UCP
B19	Salters	3330 by 3337.5 and -7945 by -7952.5	LCP
B21	Mayesville	3352.5 by 3400 and -8007.5 by -8015	LCP
B22	Carlisle SE	3430 by 3437.5 and -8115 by -8122.5	PM
B23	Outland	3337.5 by 3345 and -7915 by -7922.5	LCP
B26X&E22X	Grays (50mi.)	3237.5 by 3245 and -8100 by -8107.5	LCP
B27X&E26X	Parksville (50mi.)	3345 by 3352.5 and -8207.5 by -8215	PM
B28	Lake City West	3345 by 3352.5 and -7945 by -7952.5	LCP
B29	Neyles	3245 by 3252.5 and -8030 by -8037.5	LCP

Random Quadrants Within SRS Perimeter or "E" Quadrants

Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long	Geological Region
E29	Allendale	3300 by 3307.5 and -8115 by -8122.5	LCP
E30	Graniteville	3330 by 3337.5 and -8145 by -8152.5	UCP
E31	Oakwood	3330 by 3337.5 and -8130 by -8137.5	UCP
E32X	Martinez(GAX)	3330 by 3337.5 and -8200 by -8207.5	PM
E33X	Snellings (SRS)	3307.5 by 3315 and -8122.5 by -8130	UCP
E34X&B41X	Gilbert (50mi.)	3352.5 by 3400 and -8122.5 by -8130	PM
E35	Steedman	3345 by 3352.5 and -8122.5 by -8130	UCP
E36	Springfield	3322.5 by 3330 and -8115 by -8122.5	UCP
E37	Sycamore	3300 by 3307.5 and -8107.5 by -8115	LCP
E38X	Brier Creek Island(GAX)	3245 by 3252.5.5 and -8122.5 by -8130	LCP
E39X	Bull Pond(GAX)	3252.5 by 3300 and -8122.5 by -8130	LCP
E40	Blackville	3315 by 3322.5 and -8115 by -8122.5	UCP

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" samples.
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.
5. Parenthesis info by quad name identifies type of exclusion (NCX is North Carolina, GAX is Georgia, NRX is nuclear reactor, SRS is Savannah River Site exclusion zone border).
6. Purpose of random sampling is to compare public dose within 50 miles of SRS to a S. C. background.
7. Geological Regions are Blue Ridge (BR), Piedmont (PM), Upper & Lower Coastal Plain (U&LCP). Quadrants split by geological regions are assigned to the upper most region in the quadrant.

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 3. Sediment Samples Collected from Savannah River Boat Landings in 2008

2008 Publicly Accessable Boat Landing Sediment Sampling Locations		
Sample Name	**Abbr.**	**Location Description**
Upstream of SRS		
SSPRA001	PRA	Parksville Recreation Area Boat Landing, McCormick County
SSFF001	FF	Fury's Ferry Boat Landing, McCormick County
SSJBL002	JBL	Jackson Boat Landing, Aiken County
Downstream of SRS		
SSSCL002	SCL	Steel Creek Landing, Barnwell County
SSLHL002	LHL	Little Hell Landing, Allendale County
SSJL001	JL	Johnson's Landing, Allendale County
SS301GA002	301	Burton's Ferry Landing near HWY. 301 Bridge, Screven County, GA
SSCB001	CB	Cohen's Bluff Landing, Allendale County
SSSBL001	SB	Stoke's Bluff Landing, Hampton County

Table 4. Gamma Analytes

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Note: Units are reported in pCi/g.

Table 5. Inorganic Metal Analytes

Analyte	Abbreviation	MDL	ESV
Silver	Ag	3.0	0.73
Aluminum	Al	10	N/A
Arsenic	As	10	5.9
Boron	B	10	N/A
Barium	Ba	5.0	20
Beryllium	Be	0.30	1.1
Cadmium	Cd	1.0	0.6
Cobalt	Co	2.0	9.0
Chromium	Cr	1.0	36
Copper	Cu	1.0	18.7
Iron	Fe	2.0	N/A
Mercury	Hg	0.10	0.13
Magnesium	Mg	5.0	N/A
Manganese	Mn	1.0	630
Molybdenum	Mo	2.0	3.0
Nickel	Ni	2.0	15.9
Lead	Pb	5.0	30.2
Antimony	Sb	5.0	2.0
Selenium	Se	10	0.7
Thallium	Tl	50	1.0
Tin	Sn	50	900
Titanium	Ti	2.0	N/A
Vanadium	V	2.0	N/A
Zinc	Zn	1.0	98

Note: Units are reported in mg/kg.

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 6. Nonradiological Analytes

Organic Pesticide Analysis	MDL
Aldrin	0.0020
alpha-BHC	0.0020
beta-BHC	0.0020
Chlordane	0.015
delta-BHC	0.0020
Dieldrin	0.0020
Endosulfan I	0.0020
Endosulfan II	0.0020
Endosulfan Sulfate	0.0020
Endrin	0.0020
Endrin aldehyde	0.0020
Heptachlor	0.0020
Heptachlor epoxide	0.0020
Lindane	0.0020
p,p'-DDD	0.0020
p,p'-DDE	0.0020
p,p'-DDT	0.0020

PCB Analysis	MDL
PCB 1016	0.015
PCB 1221	0.030
PCB 1232	0.015
PCB 1242	0.015
PCB 1248	0.015
PCB 1254	0.015
PCB 1260	0.015
Toxaphene	0.070

Herbicides in Sediment
2,4-D
2,4,5-T
2.4.5-TP

Organic Base Neutral/Acid Analysis (MDL = 0.30)

1,2,4-trichlorobenzene	4-chlorophenyl phenyl ether	Dibenzofuran
1,2-dichlorobenzene	4-methylphenol	Diethyl phthalate
1,3-dichlorobenzene	4-nitroaniline	Dimethyl phthalate
1,4-dichlorobenzene	4-nitrophenol	Di-n-butylphthalate
2,4,5-trichlorophenol	Acenaphthene	Di-n-octylphthalate
2,4,6-trichlorophenol	Acenaphthylene	Fluoranthene
2,4-dichlorophenol	Aniline	Fluorene
2,4-dimethyl phenol	Anthracene	Hexachlorobenzene
2,4-Dinitrophenol	Azobenzene	Hexachlorobutadiene
2,4-dinitrotoluene	Benzo(a)anthracene	Hexachlorocyclopentadiene
2,6-dinitrotoluene	Benzo(a)pyrene	Hexachloroethane
2-chloronaphthalene	Benzo(b)fluoranthene	Indeno(1,2,3-cd)pyrene
2-chlorophenol	Benzo(ghi)perylene	Isophorone
2-methyl naphthalene	Benzo(k)fluoranthene	Naphthalene
2-methyl-4,6-dinitrophenol	Benzoic acid	Nitrobenzene
2-methylphenol	Benzyl alcohol	N-nitrosodimethylamine
2-nitroaniline	Bis(2-chloroethoxy)methane	N-nitrosodi-n-propylamine
2-nitrophenol	Bis(2-chloroethyl)ether	N-nitrosodiphenylamine
3,3'-dichlorobenzidine	Bis(2-chloroisopropyl)ether	Pentachlorophenol
3-nitroaniline	Bis(2-ethylhexyl)phthalate	Phenanthrene
4-bromophenyl phenyl ether	Butylbenzyl phthalate	Phenol
4-chloro-3 methyl phenol	Chrysene	Pyrene
4-chloroaniline	Dibenzo(a,h)anthracene	

Note: Results reported in mg/kg

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 7. Radiological statistics for random SRS perimeter and SC background sediment samples collected in 2008.

RANDOM SAMPLES ONLY

	Perimeter Samples (<50 Miles)			Background Samples (>50 miles)			E-B	E-B
Analyte	Average	Standard Deviation	Median	Average	Standard Deviation	Median	Average	Median
Be-7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
K-40	2.829	4.154	1.339	6.970	7.749	3.475	-4.141	-2.136
Zr-95	0.503	N/A	0.503	N/A	N/A	N/A	N/A	N/A
Cs-137	0.089	0.063	0.089	0.315	0.219	0.314	-0.227	-0.225
Ce-144	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pb-212	0.980	0.619	0.772	0.765	0.457	0.729	0.215	0.043
Pb-214	1.175	1.677	0.667	0.650	0.371	0.604	0.526	0.063
Ra-226	2.597	3.124	1.440	1.949	0.816	1.749	0.648	-0.309
Ac-228	1.276	0.733	1.061	0.687	0.372	0.588	0.589	0.474
U/Th-238	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Am-241	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154.Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Table 8. Metals statistics for random SRS perimeter and SC background sediment samples collected in 2008.

RANDOM SAMPLES ONLY

	Perimeter Samples (<50 Miles)			Background Samples (>50 miles)			E-B	E-B
Analyte	Average	Standard Deviation	Median	Average	Standard Deviation	Median	Average	Median
Aluminum	1261	1095	880	6165	4971	5450	-4904	-4570
Barium	19.7	17.9	16	37.8	26.7	29.5	-18.1	-14.0
Beryllium	N/A	N/A	N/A	0.56	0.21	0.57	N/A	N/A
Cadmium	1.1	N/A	1.1	2.8	2.0	2.6	-1.7	-1.5
Chromium	2.3	1.0	2.0	8.8	8.1	7.3	-6.5	-5.3
Cobalt	5.2	N/A	5.2	4.8	2.0	4.5	0.4	0.8
Copper	2.2	0.9	2.2	4.4	3.5	3.0	-2.2	-0.9
Iron	1538	1644	865	6824	7235	4150	-5287	-3285
Lead	6.6	N/A	6.6	11.9	3.9	14.0	-5.3	-7.4
Magnesium	49.4	58.0	27.0	436	348	425	-387.0	-398.0
Manganese	72.1	108.9	35.0	194.2	245.6	105.0	-122.1	-70.0
Mercury	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	2.8	N/A	2.8	3.4	0.7	3.5	-0.6	-0.7
Titanium	44	33	39	158	159	70	-113	-31
Vanadium	4.3	2.3	3.3	19.6	18.3	13.5	-15.3	-10.2
Zinc	4.9	4.0	3.3	10.4	7.0	9.9	-5.6	-6.6

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, Tl, and Sn.

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 9. NaI Field Counts

LTRC 1	NaI Gross Counts	NaI Background Counts	NaI Net Counts
Location	Counts/Second	Counts/Second	Counts/Second
1	108	57	51
2	142	98	44
3	1440	564	876
4	391	227	164
5	381	297	84
6	1162	510	652
7	1240	556	684
8	466	227	239
9	111	58	53
10	60	33	27

Creek Plantation	NaI Gross Counts	NaI Background Counts	NaI Net Counts
Location	Counts/Second	Counts/Second	Counts/Second
1	536	274	262
2	645	365	280
3	1032	533	499
4	1099	530	569
5	1634	660	974
6	1130	536	594
7	1097	558	539
8	1120	538	582
9	1067	471	596
10	426	233	193
11	56	28	28

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 10. SCDHEC and DOE-SR Radiological Data for Stream Sediment Split Samples

Savannah River Creek Mouths and Savannah River Sediment

SCDHEC Data in pCi/g	Am-241	Co-60	Cs-137	Gross A	Gross B	Pu-238	Pu-239	Sr-89/90
SMSV-118	ND	ND	**0.318**	ND	**18.2**	ND	ND	ND
SMSV-2011	ND	ND	**0.611**	**46.9**	**59.0**	ND	**0.017**	ND
SMSV-2013	ND	ND	**0.066**	ND	**32.2**	ND	ND	ND
SMSV-2015	ND	ND	**1.575**	ND	**12.8**	ND	ND	**0.402**
SMSV-2017	ND	ND	**3.726**	ND	**15.6**	ND	ND	ND
SMSV-2020	ND	ND	**0.366**	ND	**29.3**	ND	ND	ND
Average	N/A	N/A	**1.110**	**46.900**	**27.850**	N/A	**0.017**	**0.402**
Median	N/A	N/A	**0.489**	N/A	**23.750**	N/A	N/A	N/A
Standard Deviation	N/A	N/A	**1.384**	N/A	**17.094**	N/A	N/A	N/A

DOE-SR Data in pCi/g	Am-241	Co-60	Cs-137	Gross A	Gross B	Pu-238	Pu-239	Sr-89/90
SMSV-118	ND	ND	**0.286**	N/A	N/A	**0.200**	**0.013**	ND
SMSV-2011	ND	ND	**0.411**	N/A	N/A	**0.002**	**0.027**	ND
SMSV-2013	**0.045**	ND	ND	N/A	N/A	**0.014**	**0.028**	ND
SMSV-2015	ND	ND	**1.400**	N/A	N/A	**0.005**	ND	ND
SMSV-2017	ND	ND	**3.204**	**11.643**	ND	**0.009**	ND	ND
SMSV-2020	ND	ND	**0.278**	N/A	N/A	**0.018**	ND	ND
Average	**0.045**	N/A	**1.116**	**11.643**	N/A	**0.041**	**0.022**	N/A
Median	**0.045**	N/A	**0.411**	**11.643**	N/A	**0.012**	**0.027**	N/A
Standard Deviation	N/A	N/A	**1.258**	N/A	N/A	**0.078**	**0.008**	N/A

SRS On-Site Streams

SCDHEC Data in pCi/g	Am-241	Co-60	Cs-137	Gross A	Gross B	Pu-238	Pu-239	Sr-89/90
SMSV-175	ND	ND	**5.707**	ND	**11.2**	N/A	N/A	N/A
SMSV-2048	ND	ND	ND	ND	ND	N/A	N/A	N/A
SMSV-2049	ND	ND	**1.8**	ND	**7.98**	N/A	N/A	N/A
SMSV-2053	ND	ND	**0.143**	ND	ND	N/A	N/A	N/A
SMSV-2069	ND	ND	ND	ND	ND	**0.042**	**0.017**	ND
SMSV-2073	**0.382**	ND	**0.242**	**38.4**	**23.7**	**0.064**	**0.014**	ND
SMSV-327	ND	ND	**1.137**	ND	ND	N/A	N/A	N/A
Average	**0.382**	N/A	**1.806**	**38.400**	**14.293**	**0.053**	**0.016**	N/A
Median	N/A	N/A	**1.137**	N/A	**11.200**	**0.053**	**0.016**	N/A
Standard Deviation	N/A	N/A	**2.285**	N/A	**8.304**	**0.016**	**0.003**	N/A

DOE-SR Data in pCi/g	Am-241	Co-60	Cs-137	Gross A	Gross B	Pu-238	Pu-239	Sr-89/90
SMSV-175	ND	ND	**4.393**	**10.827**	**12.446**	**0.004**	**0.003**	ND
SMSV-2048	ND	ND	ND	**15.007**	**6.466**	ND	ND	ND
SMSV-2049	**0.006**	ND	**1.558**	**6.246**	**3.451**	**0.018**	**0.007**	**0.150**
SMSV-2053	ND	ND	**0.141**	**2.830**	ND	**0.002**	ND	ND
SMSV-2069	ND	ND	**0.067**	**11.055**	**4.982**	**0.028**	**0.012**	ND
SMSV-2073	ND	ND	ND	**31.980**	**15.654**	ND	ND	ND
SMSV-327	ND	ND	**0.792**	**5.957**	**3.699**	**0.007**	**0.003**	ND
Average	**0.006**	N/A	**1.390**	**11.986**	**7.783**	**0.012**	**0.006**	**0.150**
Median	N/A	N/A	**0.792**	**10.827**	**5.724**	**0.007**	**0.005**	**0.150**
Standard Deviation	N/A	N/A	**1.783**	**9.697**	**5.074**	**0.011**	**0.004**	N/A

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Table 11. SCDHEC and DOE-SR Radiological Data for SRS Stormwater Basin Sediment Split Samples

SCDHEC Data in pCi/g

Location Description	Gross A	Gross B	Am-241	Co-60	Cs-137	Pu-238	Pu-239	Sr-89/90
SME-001	ND	**11.9**	ND	ND	**0.346**	N/A	N/A	N/A
SME-002	ND	ND	ND	ND	ND	N/A	N/A	N/A
SME-003	ND	ND	ND	ND	ND	N/A	N/A	N/A
SME-004	ND	ND	ND	ND	ND	N/A	N/A	N/A
SME-005	ND	**14.3**	ND	ND	**0.137**	N/A	N/A	N/A
SME-006	ND	**8.61**	ND	ND	**0.107**	N/A	N/A	N/A
SME-Z Area	ND	**13.9**	ND	ND	**2.431**	**0.010**	**0.009**	ND
Average	N/A	**12.178**	N/A	N/A	**0.755**	**0.010**	**0.009**	N/A
Median	N/A	**12.900**	N/A	N/A	**0.241**	**0.010**	**0.009**	N/A
Standard Deviation	N/A	**2.600**	N/A	N/A	**1.122**	N/A	N/A	N/A

DOE-SR Data in pCi/g

Location Description	Gross A	Gross B	Am-241	Co-60	Cs-137	Pu-238	Pu-239	Sr-89/90
SME-001	N/A	N/A	**0.003**	ND	**0.308**	**0.013**	ND	ND
SME-002	N/A	N/A	**0.003**	ND	ND	**0.025**	**0.003**	ND
SME-003	N/A	N/A	ND	ND	**0.087**	ND	**0.002**	ND
SME-004	N/A	N/A	ND	ND	ND	**0.003**	**0.006**	ND
SME-005	N/A	N/A	ND	ND	**0.121**	**0.007**	**0.002**	ND
SME-006	N/A	N/A	**0.002**	ND	ND	ND	ND	ND
SME-Z Area	N/A	N/A	ND	ND	**1.830**	**0.003**	ND	ND
Average	N/A	N/A	**0.003**	N/A	**0.587**	**0.010**	**0.003**	N/A
Median	N/A	N/A	**0.003**	N/A	**0.215**	**0.007**	**0.003**	N/A
Standard Deviation	N/A	N/A	**0.001**	N/A	**0.835**	**0.009**	**0.002**	N/A

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Figure 1. Comparisons of Cs-137 Activity Among Sample Groups

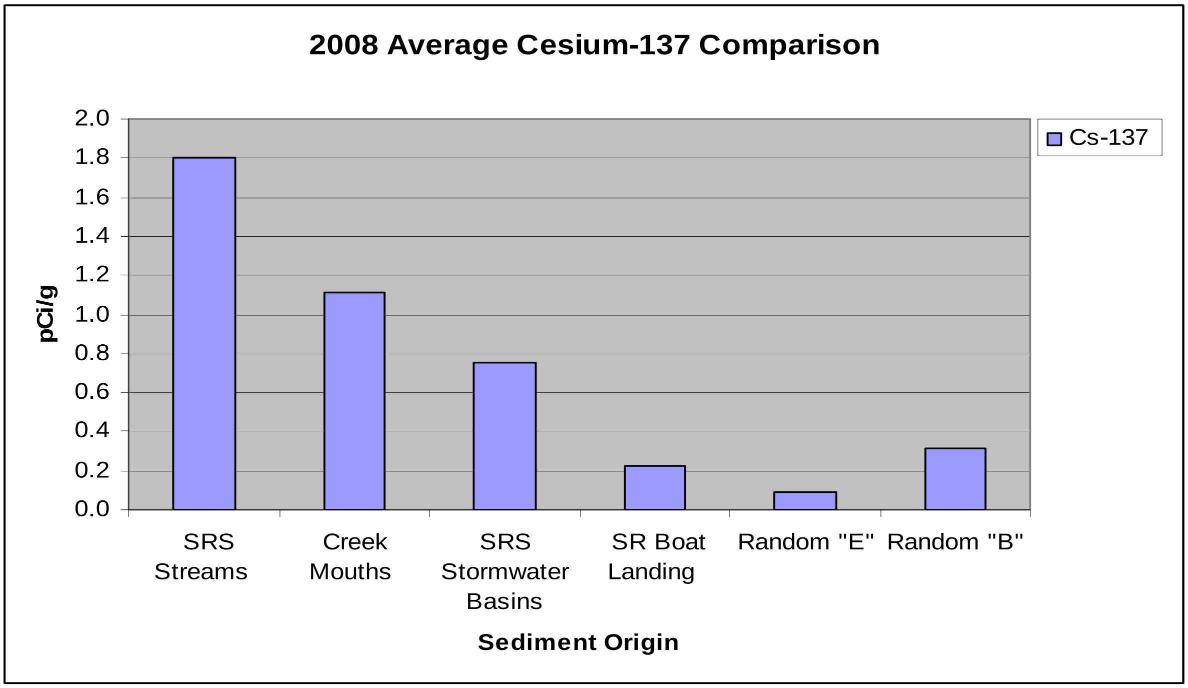
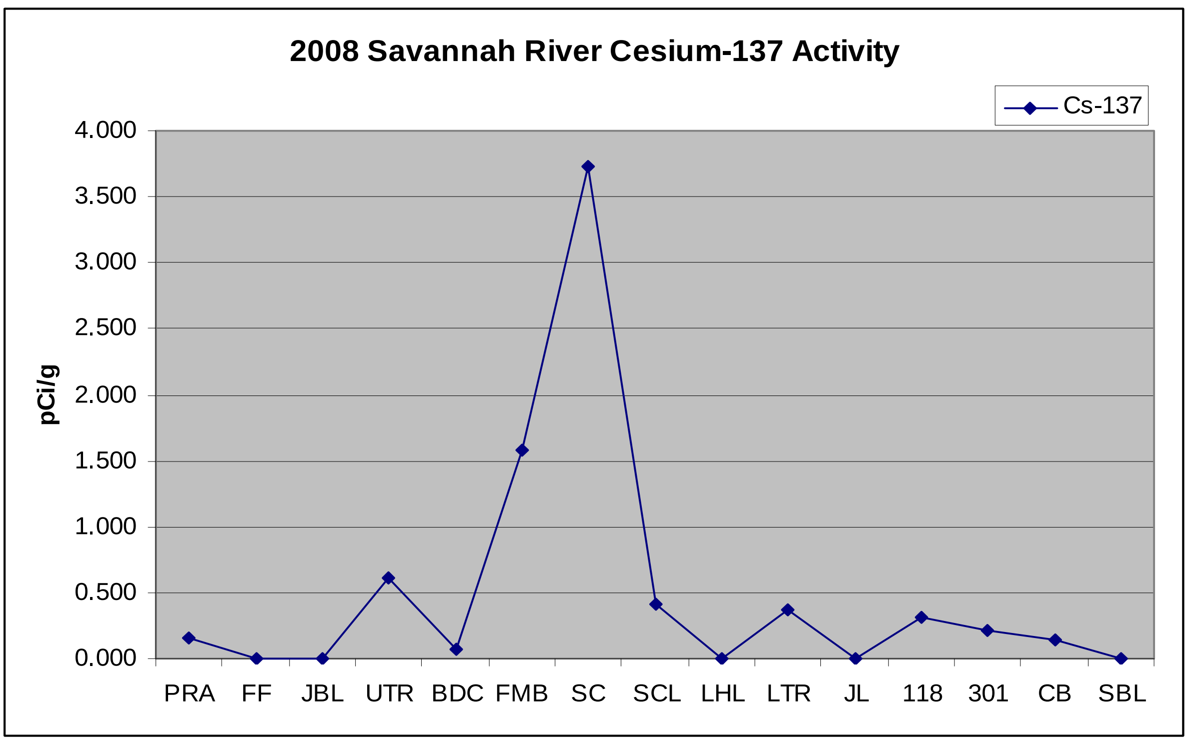


Figure 2. Cesium-137 Activity in Savannah River Sediment Samples



Note: Graph depicts samples in order of location along the Savannah River. The most upstream sample is on the left and the most downstream sample is on the right of the graph.

Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Figure 3. Comparisons of Gross-Alpha and Non-volatile Beta Activity Among Sample Groups

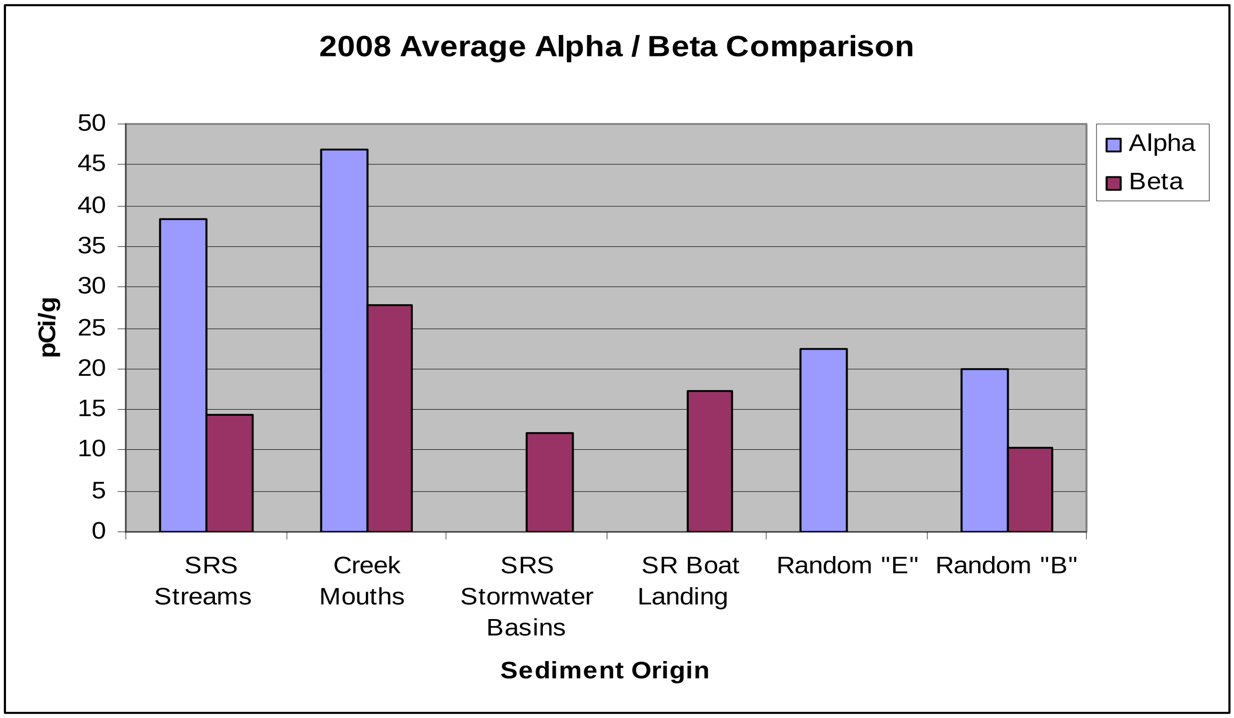


Figure 4. Results of Isotopic Analysis

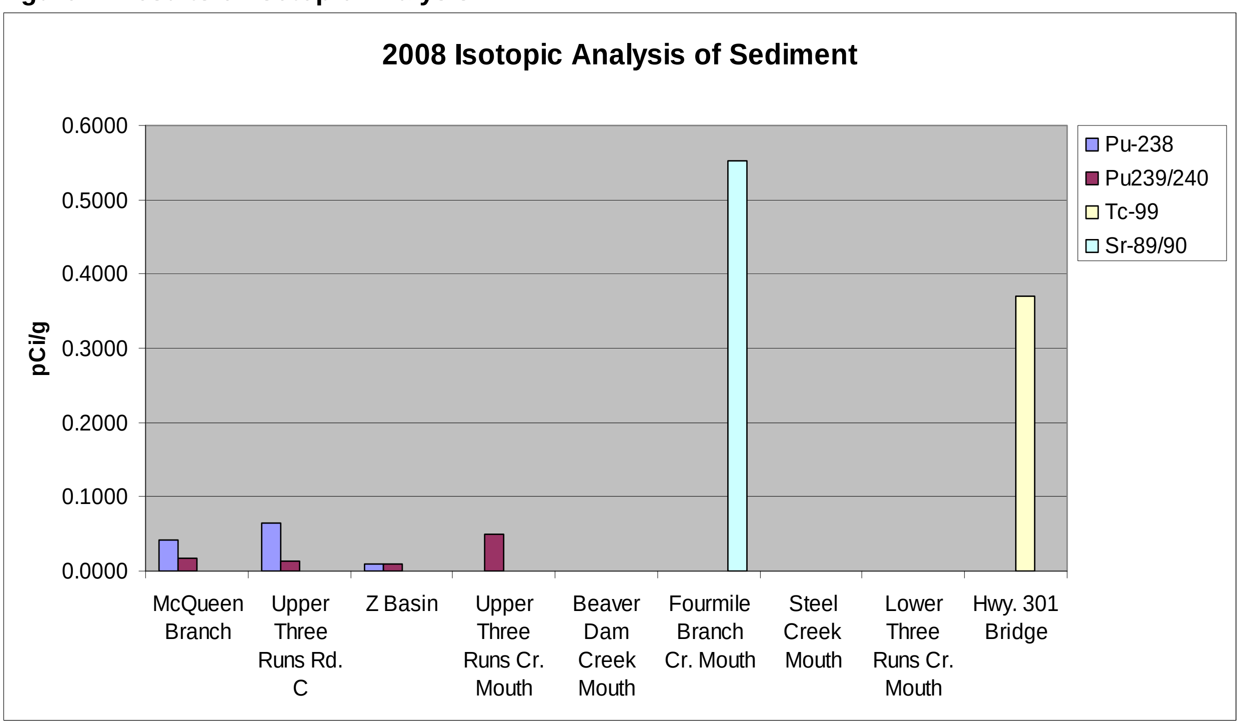


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Figure 5. Trending Data for Cs-137 in SRS Creek Mouth Samples

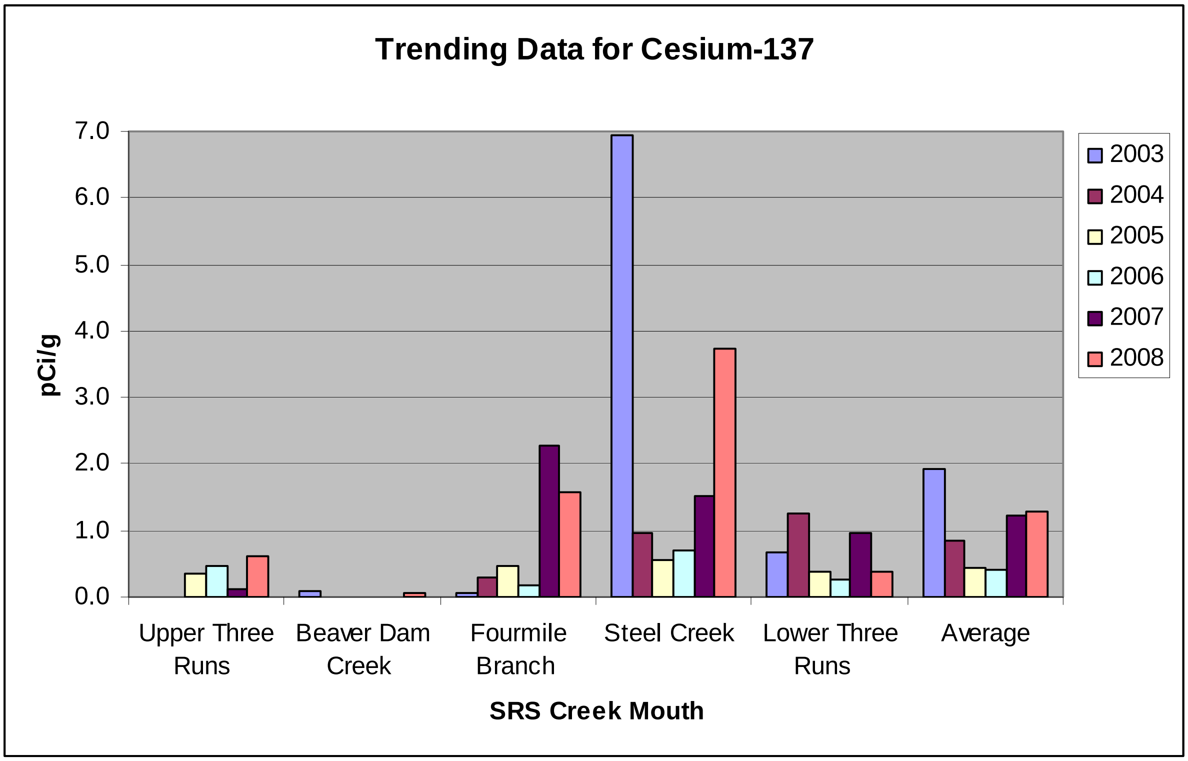
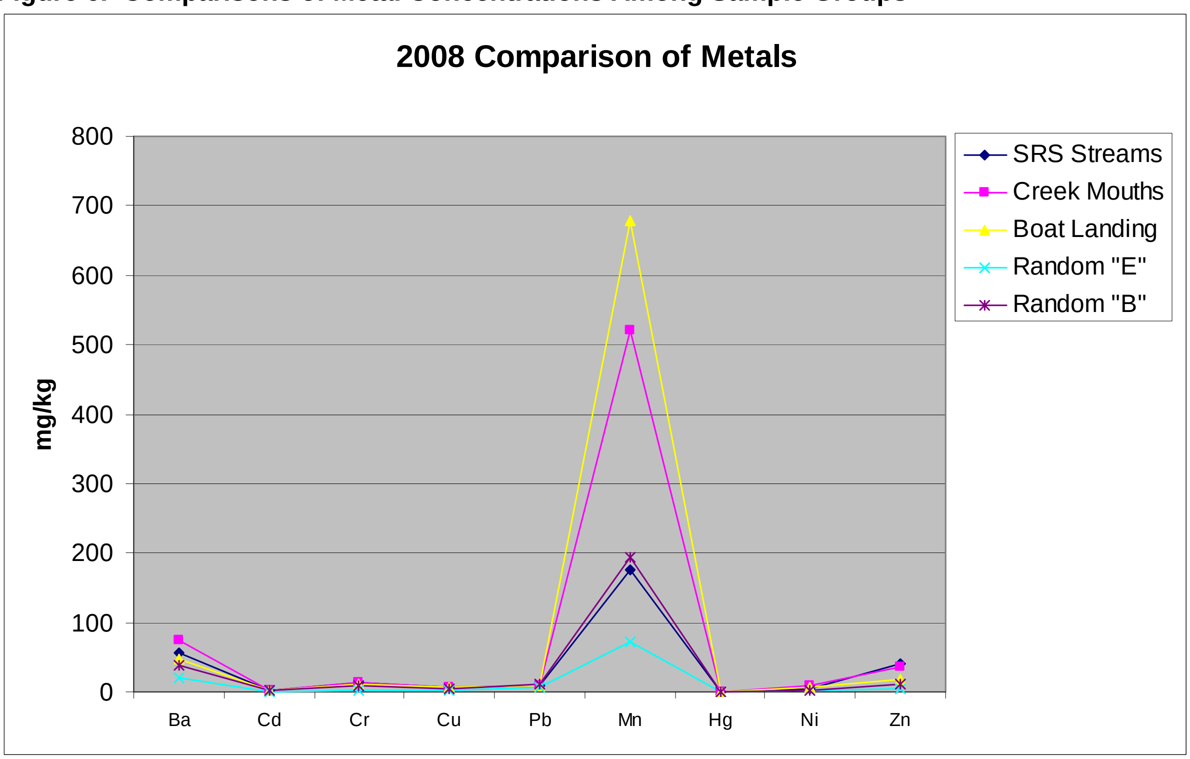


Figure 6. Comparisons of Metal Concentrations Among Sample Groups



Tables and Figures

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Figure 7. NaI Field Measurements for Lower Three Runs 1

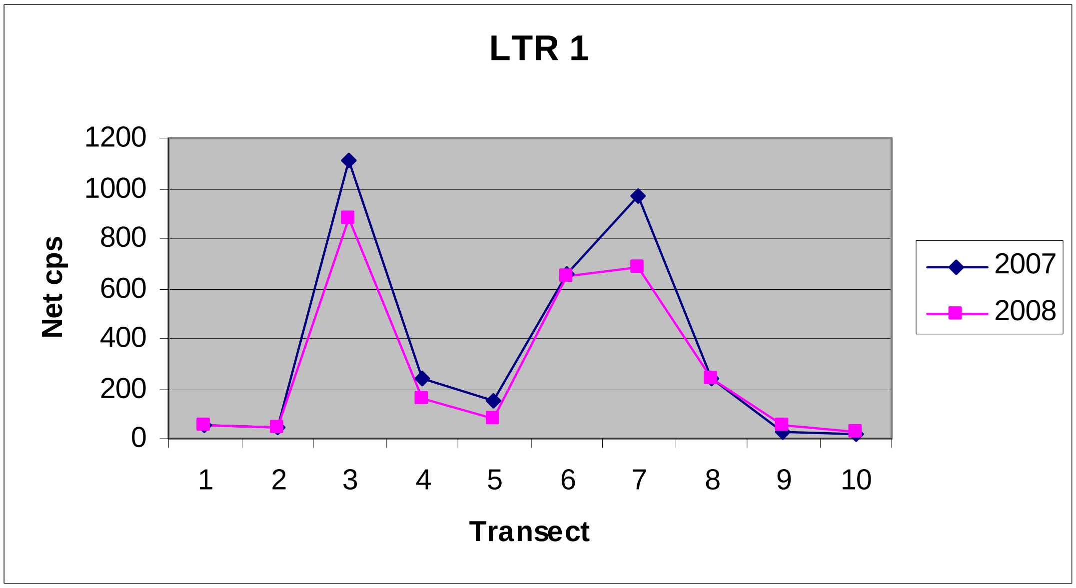
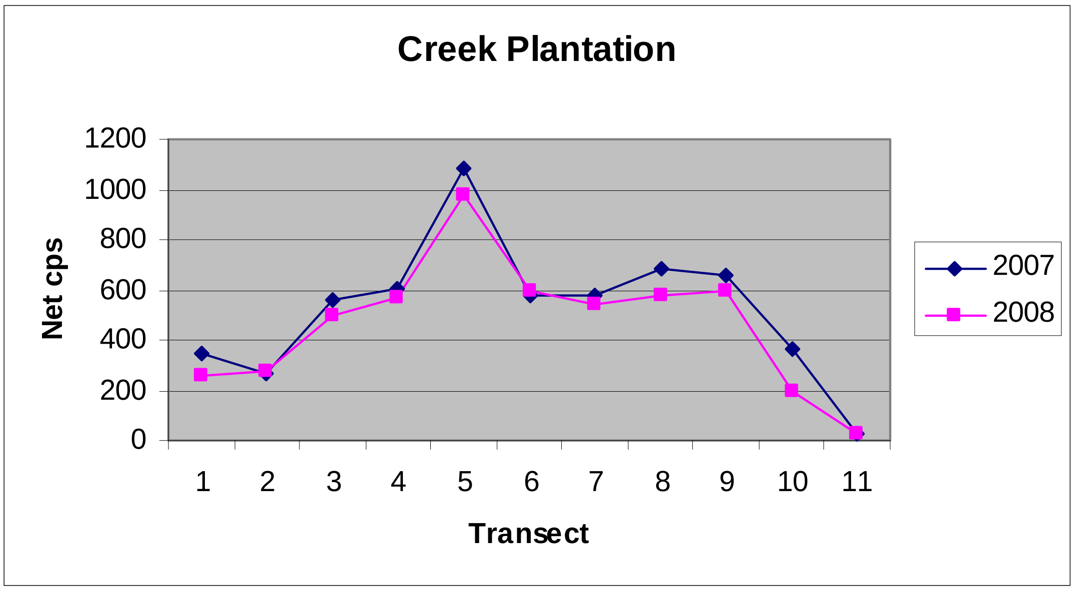


Figure 8. NaI Field Measurements for Creek Plantation



Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Figure 9. Cesium-137 in Savannah River Creek Mouths – SCDHEC Comparison to DOE-SR Data

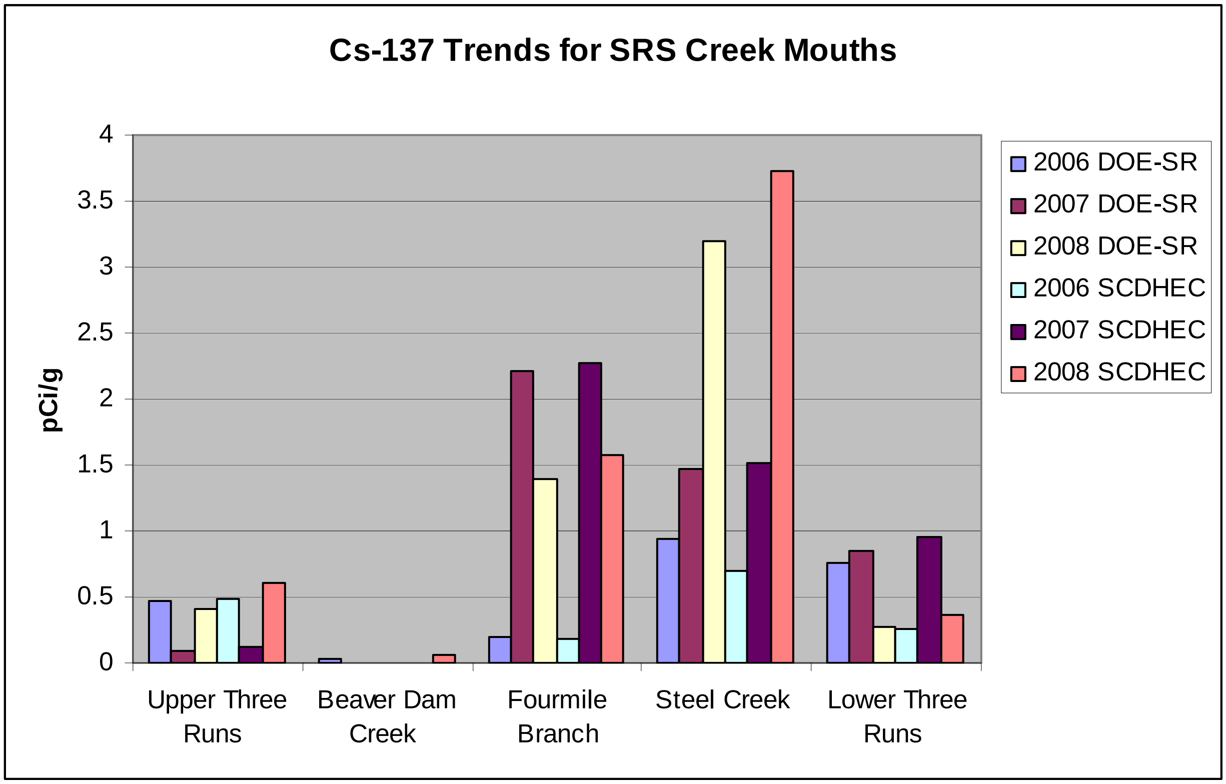
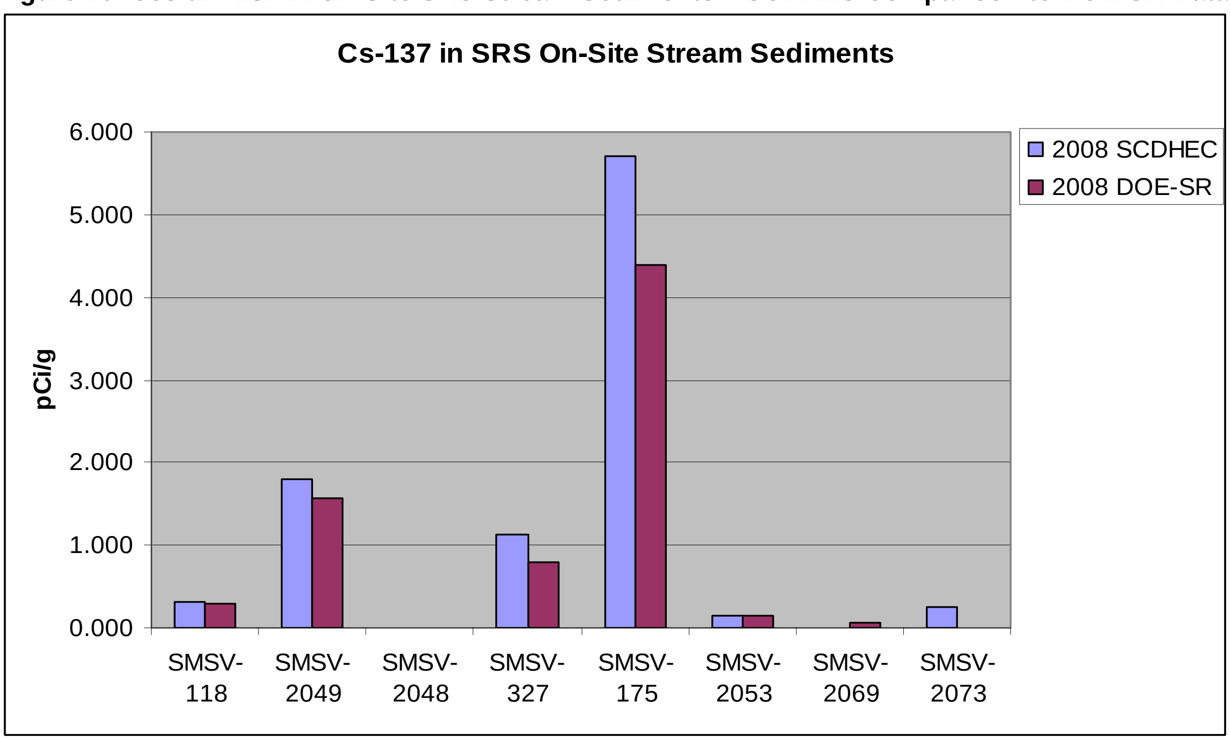


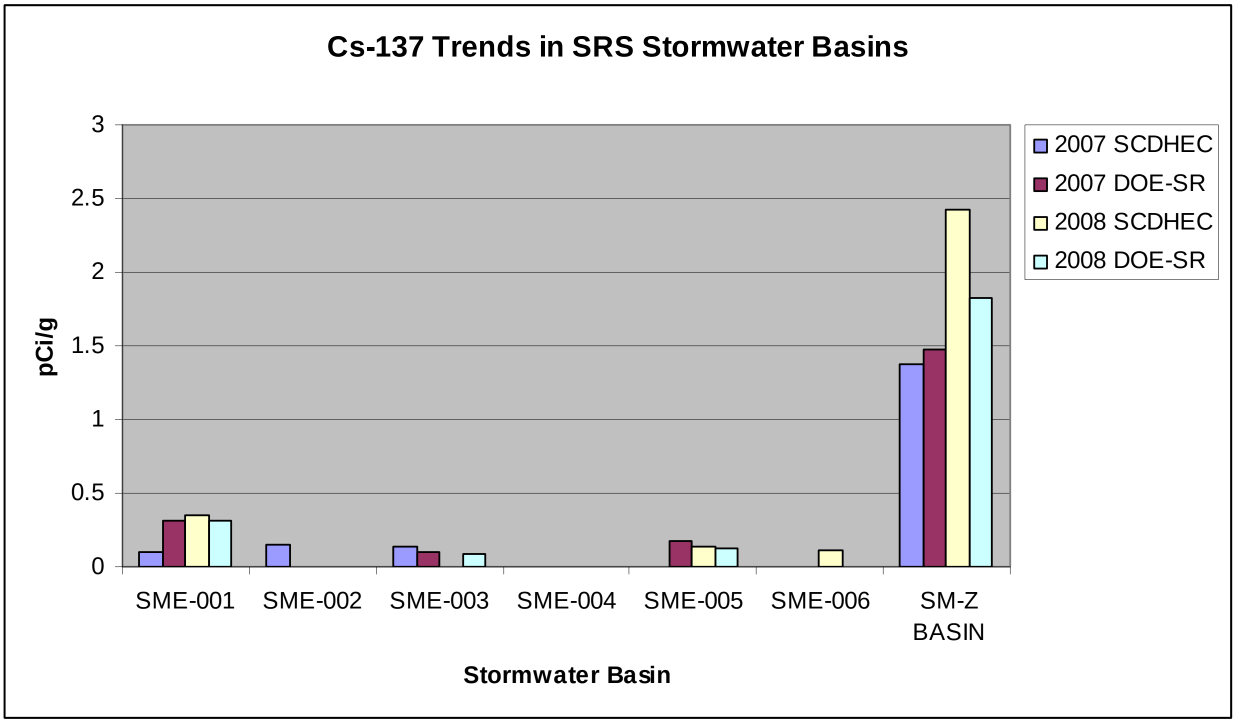
Figure 10. Cesium-137 in On-Site SRS Stream Sediments – SCDHEC Comparison to DOE-SR Data



Tables and Figures

Radiological and Nonradiological Monitoring of Sediments

Figure 11. Cesium-137 in SRS Stormwater Basins – SCDHEC Comparison to DOE-SR Data



TOC

2.5.4 Data

Radiological and Nonradiological Monitoring of Sediments

Notes:
1. Bold numbers denotes a detection.
2. A blank field following ±2 SIGMA occurs when the sample is <LLD.
3. LLD= Lower Limit of Detection
4. MDA= Minimum Detectable Activity

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Savannah River and Creek Mouths Accessible to the Public

Location Description	SMSV-2011	SMSV-2013	SMSV-2015
Collection Date	**4/16/2008**	**4/16/2008**	**4/16/2008**
Alpha Activity	**46.9**	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	**23.4**	NA	NA
Alpha LLD	**30.4**	27.8	28.5
Beta Activity	**59.0**	**32.2**	**12.8**
Beta Confidence Interval (± 2 SD)	**7.17**	**6.00**	**4.71**
Beta LLD	**6.99**	**7.39**	**7.29**
Be-7 Activity	<MDA	**0.895**	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	**0.359**	NA
Be-7 MDA	0.673	**0.379**	0.320
K-40 Activity	**9.541**	**16.12**	**15.74**
K-40 Confidence Interval (± 2 SD)	**0.912**	**1.18**	**1.119**
K-40 MDA	**0.405**	**0.194**	**0.138**
Zr-95 Activity	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA
Zr-95 MDA	0.119	0.078	0.052
Cs-137 Activity	**0.611**	**0.066**	**1.575**
Cs-137 Confidence Interval (± 2 SD)	**0.063**	**0.022**	**0.130**
Cs-137 MDA	**0.039**	**0.025**	**0.019**
Ce-144 Activity	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA
Ce-144 MDA	0.414	0.234	0.177
Pb-212 Activity	**1.688**	**2.019**	**1.149**
Pb-212 Confidence Interval (± 2 SD)	**0.114**	**0.174**	**0.102**
Pb-212 MDA	**0.087**	**0.049**	**0.038**
Pb-214 Activity	**13.26**	**1.959**	**1.048**
Pb-214 Confidence Interval (± 2 SD)	**0.504**	**0.111**	**0.065**
Pb-214 MDA	**0.095**	**0.051**	**0.041**
Ra-226 Activity	**26.26**	**3.971**	**2.083**
Ra-226 Confidence Interval (± 2 SD)	**2.174**	**0.670**	**0.504**
Ra-226 MDA	**1.226**	**0.645**	**0.498**
Ac-228 Activity	**1.858**	**2.049**	**1.093**
Ac-228 Confidence Interval (± 2 SD)	**0.151**	**0.127**	**0.075**
Ac-228 MDA	**0.155**	**0.089**	**0.058**
U/Th-238 Activity	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA
U/Th-238 MDA	1.982	1.453	1.054
Am-241 Activity	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA
Am-241 MDA	0.445	0.239	0.178

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Savannah River and Creek Mouths Accessible to the Public

Location Description	SMSV-2017	SMSV-2020	SMSV-118
Collection Date	4/16/2008	4/17/2008	4/17/2008
Alpha Activity	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA
Alpha LLD	27.7	26.5	28.9
Beta Activity	**15.6**	**29.3**	**18.2**
Beta Confidence Interval (± 2 SD)	**4.95**	**5.72**	**5.15**
Beta LLD	**7.34**	**7.21**	**7.40**
Be-7 Activity	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA
Be-7 MDA	0.524	0.361	0.397
K-40 Activity	**11.8**	**17.8**	**18.94**
K-40 Confidence Interval (± 2 SD)	**0.922**	**1.272**	**1.365**
K-40 MDA	**0.190**	**0.173**	**0.197**
Zr-95 Activity	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA
Zr-95 MDA	0.070	0.057	0.070
Cs-137 Activity	**3.726**	**0.366**	**0.318**
Cs-137 Confidence Interval (± 2 SD)	**0.299**	**0.038**	**0.039**
Cs-137 MDA	**0.027**	**0.021**	**0.029**
Ce-144 Activity	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA
Ce-144 MDA	0.237	0.211	0.229
Pb-212 Activity	**1.487**	**1.192**	**1.553**
Pb-212 Confidence Interval (± 2 SD)	**0.135**	**0.580**	**0.138**
Pb-212 MDA	**0.052**	**0.044**	**0.047**
Pb-214 Activity	**1.325**	**1.486**	**1.854**
Pb-214 Confidence Interval (± 2 SD)	**0.090**	**0.085**	**0.103**
Pb-214 MDA	**0.058**	**0.046**	**0.051**
Ra-226 Activity	**2.663**	**3.177**	**3.63**
Ra-226 Confidence Interval (± 2 SD)	**0.771**	**0.595**	**0.761**
Ra-226 MDA	**0.656**	**0.565**	**0.629**
Ac-228 Activity	**1.494**	**1.351**	**1.535**
Ac-228 Confidence Interval (± 2 SD)	**0.105**	**0.094**	**0.108**
Ac-228 MDA	**0.073**	**0.076**	**0.082**
U/Th-238 Activity	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA
U/Th-238 MDA	1.4	1.281	1.088
Am-241 Activity	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA
Am-241 MDA	0.234	0.209	0.235

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Savannah River Site Streams That Are Not Publicly Accessible

Location Description	SMSV-2049	SMSV-2048	SMSV-327
Collection Date	3/26/2008	3/26/2008	3/26/2008
Alpha Activity	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA
Alpha LLD	26.2	26.1	26.0
Beta Activity	**7.98**	<LLD	<LLD
Beta Confidence Interval (± 2 SD)	**4.44**	NA	NA
Beta LLD	**7.49**	7.52	7.89
Be-7 Activity	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA
Be-7 MDA	0.998	0.736	1.033
K-40 Activity	**0.920**	**0.754**	**1.145**
K-40 Confidence Interval (± 2 SD)	**0.313**	**0.293**	**0.360**
K-40 MDA	**0.324**	**0.252**	**0.337**
Zr-95 Activity	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA
Zr-95 MDA	0.131	0.141	0.153
Cs-137 Activity	**1.8**	<MDA	**1.137**
Cs-137 Confidence Interval (± 2 SD)	**0.151**	NA	**0.116**
Cs-137 MDA	**0.042**	0.036	**0.043**
Ce-144 Activity	<MDA	**0.274**	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	**0.124**	NA
Ce-144 MDA	0.338	**0.300**	0.348
Pb-212 Activity	**0.743**	**1.95**	**0.327**
Pb-212 Confidence Interval (± 2 SD)	**0.086**	**0.171**	**0.062**
Pb-212 MDA	**0.045**	**0.048**	**0.046**
Pb-214 Activity	**1.186**	**1.145**	**0.916**
Pb-214 Confidence Interval (± 2 SD)	**0.091**	**0.078**	**0.097**
Pb-214 MDA	**0.087**	**0.070**	**0.099**
Ra-226 Activity	**2.793**	**1.953**	**2.559**
Ra-226 Confidence Interval (± 2 SD)	**0.843**	**0.651**	**1.099**
Ra-226 MDA	**0.930**	**0.825**	**0.926**
Ac-228 Activity	**0.666**	**1.807**	<MDA
Ac-228 Confidence Interval (± 2 SD)	**0.098**	**0.138**	NA
Ac-228 MDA	**0.125**	**0.114**	0.247
U/Th-238 Activity	**3.277**	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	**1.538**	NA	NA
U/Th-238 MDA	**0.772**	0.752	0.763
Am-241 Activity	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA
Am-241 MDA	0.097	0.109	0.097

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Savannah River Site Streams That Are Not Publicly Accessible

Location Description	SMSV-175	SMSV-2053	SMSV-2069	SMSV-2073
Collection Date	3/26/2008	3/26/2008	3/26/2008	3/26/2008
Alpha Activity	<LLD	<LLD	<LLD	**38.4**
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	**19.9**
Alpha LLD	26.2	26.1	26.1	**26.3**
Beta Activity	**11.2**	<LLD	<LLD	**23.7**
Beta Confidence Interval (± 2 SD)	**4.90**	NA	NA	**5.78**
Beta LLD	**7.96**	7.53	7.95	**7.82**
Be-7 Activity	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Be-7 MDA	1.778	0.545	0.671	1.799
K-40 Activity	**1.657**	**0.678**	**1.306**	**2.037**
K-40 Confidence Interval (± 2 SD)	**0.578**	**0.207**	**0.390**	**0.658**
K-40 MDA	**0.479**	**0.195**	**0.249**	**0.686**
Zr-95 Activity	<MDA	<MDA	<MDA	**0.836**
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	**0.312**
Zr-95 MDA	0.217	0.101	0.129	**0.289**
Cs-137 Activity	**5.707**	**0.143**	<MDA	**0.242**
Cs-137 Confidence Interval (± 2 SD)	**0.439**	**0.033**	NA	**0.085**
Cs-137 MDA	**0.063**	**0.027**	0.034	**0.080**
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Ce-144 MDA	0.521	0.223	0.265	0.701
Pb-212 Activity	**1.11**	<MDA	<MDA	**2.442**
Pb-212 Confidence Interval (± 2 SD)	**0.087**	NA	NA	**0.230**
Pb-212 MDA	**0.073**	0.029	0.035	**0.089**
Pb-214 Activity	**2.499**	**0.476**	**0.988**	**9.037**
Pb-214 Confidence Interval (± 2 SD)	**0.164**	**0.048**	**0.319**	**0.378**
Pb-214 MDA	**0.148**	**0.052**	**0.060**	**0.172**
Ra-226 Activity	**4.527**	**1.145**	**1.561**	**0.159**
Ra-226 Confidence Interval (± 2 SD)	**1.363**	**0.560**	**0.551**	**2.007**
Ra-226 MDA	**1.472**	**0.577**	**0.704**	**1.936**
Ac-228 Activity	<MDA	**0.697**	**0.681**	**3.061**
Ac-228 Confidence Interval (± 2 SD)	NA	**0.087**	**0.090**	**0.293**
Ac-228 MDA	0.342	**0.078**	**0.112**	**0.276**
U/Th-238 Activity	<MDA	<MDA	<MDA	**8.202**
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	**3.708**
U/Th-238 MDA	1.151	0.579	0.606	**1.543**
Am-241 Activity	<MDA	<MDA	<MDA	**0.382**
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	**0.160**
Am-241 MDA	0.164	0.073	0.089	**0.199**

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for SRS Stormwater Basins That Are Not Publicly Accessible

Location Description	SME-Z BASIN	SME-001	SME-002
Collection Date	3/27/2008	3/27/2008	3/27/2008
Alpha Activity	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA
Alpha LLD	26.0	26.0	26.0
Beta Activity	**13.9**	**11.9**	<LLD
Beta Confidence Interval (± 2 SD)	**4.91**	**4.84**	NA
Beta LLD	**7.55**	**7.65**	7.87
Be-7 Activity	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA
Be-7 MDA	1.13	1.245	0.750
K-40 Activity	**2.282**	**6.341**	**1.761**
K-40 Confidence Interval (± 2 SD)	**0.427**	**0.716**	**0.342**
K-40 MDA	**0.274**	**0.444**	**0.242**
Zr-95 Activity	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA
Zr-95 MDA	0.144	0.237	0.128
Cs-137 Activity	**2.431**	**0.346**	<MDA
Cs-137 Confidence Interval (± 2 SD)	**0.195**	**0.070**	NA
Cs-137 MDA	**0.040**	**0.059**	0.039
Ce-144 Activity	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA
Ce-144 MDA	0.346	0.501	0.301
Pb-212 Activity	**1.243**	**3.808**	**1.3**
Pb-212 Confidence Interval (± 2 SD)	**0.126**	**1.337**	**0.120**
Pb-212 MDA	**0.049**	**0.076**	**0.046**
Pb-214 Activity	**0.909**	**2.36**	**0.832**
Pb-214 Confidence Interval (± 2 SD)	**0.087**	**0.148**	**0.067**
Pb-214 MDA	**0.089**	**0.117**	**0.064**
Ra-226 Activity	**2.247**	**6.252**	**1.826**
Ra-226 Confidence Interval (± 2 SD)	**0.933**	**1.251**	**0.590**
Ra-226 MDA	**0.944**	**1.29**	**0.751**
Ac-228 Activity	**1.265**	**2.981**	**1.22**
Ac-228 Confidence Interval (± 2 SD)	**0.126**	**0.224**	**0.125**
Ac-228 MDA	**0.116**	**0.190**	**0.122**
U/Th-238 Activity	<MDA	**2.965**	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	**1.461**	NA
U/Th-238 MDA	0.844	**1.335**	0.809
Am-241 Activity	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA
Am-241 MDA	0.116	0.143	0.1

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for SRS Stormwater Basins That Are Not Publicly Accessible

Location Description	SME-003	SME-004	SME-005	SME-006
Collection Date	**3/27/2008**	**3/27/2008**	**3/27/2008**	**3/27/2008**
Alpha Activity	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA
Alpha LLD	26.2	26.5	26.2	26.2
Beta Activity	<LLD	<LLD	**14.3**	**8.61**
Beta Confidence Interval (± 2 SD)	NA	NA	**5.09**	**4.54**
Beta LLD	7.60	7.78	**7.88**	**7.55**
Be-7 Activity	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Be-7 MDA	0.795	1.14	0.968	1.208
K-40 Activity	**4.413**	**3.604**	**1.865**	**3.741**
K-40 Confidence Interval (± 2 SD)	**0.467**	**0.533**	**0.365**	**0.572**
K-40 MDA	**0.273**	**0.358**	**0.307**	**0.376**
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Zr-95 MDA	0.143	0.210	0.169	0.211
Cs-137 Activity	<MDA	<MDA	**0.137**	**0.107**
Cs-137 Confidence Interval (± 2 SD)	NA	NA	**0.047**	**0.043**
Cs-137 MDA	0.034	0.052	**0.041**	**0.053**
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Ce-144 MDA	0.304	0.419	0.362	0.434
Pb-212 Activity	**1.295**	**2.164**	**2.166**	**2.205**
Pb-212 Confidence Interval (± 2 SD)	**0.121**	**0.199**	**0.202**	**0.201**
Pb-212 MDA	**0.046**	**0.053**	**0.048**	**0.055**
Pb-214 Activity	**0.961**	**1.533**	**1.239**	**1.605**
Pb-214 Confidence Interval (± 2 SD)	**0.070**	**0.147**	**0.092**	**0.115**
Pb-214 MDA	**0.067**	**0.097**	**0.080**	**0.099**
Ra-226 Activity	**1.774**	**2.365**	**2.840**	**3.417**
Ra-226 Confidence Interval (± 2 SD)	**0.625**	**0.919**	**0.833**	**1.046**
Ra-226 MDA	**0.778**	**1.057**	**0.920**	**1.13**
Ac-228 Activity	**1.324**	**2.143**	**1.879**	**2.281**
Ac-228 Confidence Interval (± 2 SD)	**0.119**	**0.165**	**0.135**	**0.167**
Ac-228 MDA	**0.116**	**0.154**	**0.138**	**0.176**
U/Th-238 Activity	<MDA	<MDA	**2.714**	**3.352**
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	**1.34**	**1.639**
U/Th-238 MDA	0.700	0.915	**0.829**	**0.948**
Am-241 Activity	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Am-241 MDA	0.100	0.119	0.102	0.122

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Isotopic Data for SRS Streams and Stormwater Basins That Are Not Publicly Accessible

Location Description	SMSV-2069	SMSV-2073	SM-Z Basin
Collection Date	3/26/2008	3/26/2008	3/27/2008
Iodine-129 Activity	<MDA	<MDA	<MDA
Iodine-129 CSU (2-sigma)	N/A	N/A	N/A
Iodine-129 MDA	0.0966	0.2006	0.1425
Plutonium-238 Activity	**0.0416**	**0.0637**	**0.0103**
Plutonium-238 CSU (2-sigma)	**0.0143**	**0.0215**	**0.0063**
Plutonium-238 MDA	**0.0065**	**0.0077**	**0.0047**
Plutonium-239/240 Activity	**0.0174**	**0.0137**	**0.0091**
Plutonium-239/240 CSU (2-sigma)	**0.0089**	**0.0093**	**0.0060**
Plutonium-239/240 MDA	**0.0065**	**0.0077**	**0.0057**
Technetium-99 Activity	<MDA	<MDA	<MDA
Technetium-99 CSU (2-sigma)	N/A	N/A	N/A
Technetium-99 MDA	1.9983	1.9219	1.9985
Total Strontium Activity	<MDA	<MDA	<MDA
Total Strontium CSU (2-sigma)	N/A	N/A	N/A
Total Strontium MDA	0.2051	0.2226	0.1819

Note: Units are in picocuries per gram (pCi/g).
CSU = Combined Standard Uncertainty
MDA = Minimum Detectable Activity

Radiological and Nonradiological Monitoring of Sediments

2008 Radiological Isotopic Data for Savannah River and Creek Mouths That Are Publicly Accessible

Location Description	SMSV-2011	SMSV-2013	SMSV-2015
Collection Date	4/16/2008	4/16/2008	4/16/2008
PU-238 WET Activity	<MDC	<MDC	<MDC
PU-238 WET TPU	NA	NA	NA
PU-238 WET MDC	0.0145	0.0191	0.0353
PU-238 DRY Activity	<MDC	<MDC	<MDC
PU-238 DRY TPU	NA	NA	NA
PU-238 DRY MDC	0.0428	0.0349	0.0484
PU-239 WET Activity	**0.0169**	<MDC	<MDC
PU-239 WET TPU	**0.0279**	NA	NA
PU-239 WET MDC	**0.0140**	0.0200	0.0396
PU-239 DRY Activity	**0.0500**	<MDC	<MDC
PU-239 DRY TPU	**0.0823**	NA	NA
PU-239 DRY MDC	**0.0412**	0.0365	0.0544
TOTAL SR WET Activity	<MDC	<MDC	**0.402**
TOTAL SR WET TPU	NA	NA	**0.154**
TOTAL SR WET MDC	0.120	0.240	**0.270**
TOTAL SR DRYActivity	<MDC	<MDC	**0.552**
TOTAL SR DRY TPU	NA	NA	**0.211**
TOTAL SR DRY MDC	0.354	0.440	**0.370**
TC-99 WET Activity	<MDC	<MDC	<MDC
TC-99 WET TPU	NA	NA	NA
TC-99 WET MDC	0.320	0.266	0.263

Note: Units are in picocuries per gram (pCi/g).
TPU = Total Propagation of Uncertainty
MDC = Minimum Detectable Concentration

Radiological and Nonradiological Monitoring of Sediments

2008 Radiological Isotopic Data for Savannah River and Creek Mouths That Are Publicly Accessible

Location Description	SMSV-2017	SMSV-2020	SMSV-118
Collection Date	4/16/2008	4/17/2008	4/17/2008
PU-238 WET Activity	<MDC	<MDC	<MDC
PU-238 WET TPU	NA	NA	NA
PU-238 WET MDC	0.0139	0.0232	0.0162
PU-238 DRY Activity	<MDC	<MDC	<MDC
PU-238 DRY TPU	NA	NA	NA
PU-238 DRY MDC	0.0274	0.0398	0.0310
PU-239 WET Activity	<MDC	<MDC	<MDC
PU-239 WET TPU	NA	NA	NA
PU-239 WET MDC	0.0164	0.0243	0.0181
PU-239 DRY Activity	<MDC	<MDC	<MDC
PU-239 DRY TPU	NA	NA	NA
PU-239 DRY MDC	0.0323	0.0416	0.0348
TOTAL SR WET Activity	<MDC	<MDC	<MDC
TOTAL SR WET TPU	NA	NA	NA
TOTAL SR WET MDC	0.184	0.247	0.240
TOTAL SR DRYActivity	<MDC	<MDC	<MDC
TOTAL SR DRY TPU	NA	NA	NA
TOTAL SR DRY MDC	0.362	0.423	0.460
TC-99 WET Activity	<MDC	<MDC	**0.371**
TC-99 WET TPU	NA	NA	**0.194**
TC-99 WET MDC	0.324	0.294	**0.315**

Note: Units are in picocuries per gram (pCi/g).
TPU = Total Propagation of Uncertainty
MDC = Minimum Detectable Concentration

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Savannah River Boat Landings That Are Publicly Accessible

Location Description	SMSBL001	SMCB001	SM301GA002	SMJL001	SMLHL002
Collection Date	7/23/2008	7/23/2008	7/23/2008	7/23/2008	7/23/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
Alpha LLD	26.1	27.3	25.2	25.2	27.9
Beta Activity	<LLD	**12.9**	**19.7**	**17.1**	<LLD
Beta Confidence Interval (± 2 SD)	NA	**4.65**	**5.25**	**4.97**	NA
Beta LLD	7.20	**7.11**	**7.42**	**7.24**	7.43
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
Be-7 MDA	0.396	0.551	0.631	0.633	0.383
K-40 Activity	**5.66**	**11.7**	**15.0**	**10.5**	**3.70**
K-40 Confidence Interval (± 2 SD)	**0.496**	**0.892**	**1.09**	**0.822**	**0.386**
K-40 MDA	**0.128**	**0.170**	**0.237**	**0.201**	**0.140**
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
Zr-95 MDA	0.0763	0.108	0.107	0.115	0.0685
Cs-137 Activity	<MDA	**0.136**	**0.207**	<MDA	<MDA
Cs-137 Confidence Interval (± 2 SD)	NA	**0.0274**	**0.0329**	NA	NA
Cs-137 MDA	0.0188	**0.0269**	**0.0296**	0.0295	0.0179
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
Ce-144 MDA	0.137	0.192	0.233	0.224	0.124
Pb-212 Activity	<MDA	<MDA	<MDA	**1.545**	**0.309**
Pb-212 Confidence Interval (± 2 SD)	NA	NA	NA	**0.140**	**0.0396**
Pb-212 MDA	0.0182	0.0270	0.0335	**0.0325**	**0.0180**
Pb-214 Activity	**0.283**	**0.782**	**1.288**	**1.069**	**0.295**
Pb-214 Confidence Interval (± 2 SD)	**0.0396**	**0.0646**	**0.0822**	**0.0740**	**0.0392**
Pb-214 MDA	**0.0336**	**0.0467**	**0.0554**	**0.0525**	**0.0305**
Ra-226 Activity	<MDA	**1.605**	**2.398**	**1.87**	<MDA
Ra-226 Confidence Interval (± 2 SD)	NA	**0.483**	**0.688**	**0.538**	NA
Ra-226 MDA	0.367	**0.509**	**0.614**	**0.595**	0.329
Ac-228 Activity	**0.390**	**0.887**	**1.287**	**1.52**	**0.312**
Ac-228 Confidence Interval (± 2 SD)	**0.0537**	**0.0879**	**0.106**	**0.114**	**0.0467**
Ac-228 MDA	**0.0636**	**0.0887**	**0.0995**	**0.0936**	**0.0552**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
U/Th-238 MDA	0.377	0.478	0.575	0.572	0.353
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
Am-241 MDA	0.0406	0.0618	0.0726	0.0701	0.0380

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Savannah River Boat Landings That Are Publicly Accessible

Location Description	SMSCL002	SMPRA001	SMFF001	SMJBL002
Collection Date	7/23/2008	7/24/2008	7/24/2008	7/25/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA
Alpha LLD	27.3	27.8	27.8	26.2
Beta Activity	**15.5**	**8.83**	**24.1**	**22.9**
Beta Confidence Interval (± 2 SD)	**4.82**	**4.30**	**5.43**	**5.60**
Beta LLD	**7.11**	**7.10**	**7.24**	**7.68**
Be-7 Activity	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Be-7 MDA	0.779	0.531	0.635	0.827
K-40 Activity	**13.5**	**6.04**	**14.8**	**15.0**
K-40 Confidence Interval (± 2 SD)	**1.08**	**0.634**	**1.09**	**1.17**
K-40 MDA	**0.223**	**0.215**	**0.200**	**0.288**
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Zr-95 MDA	0.140	0.101	0.129	0.155
Cs-137 Activity	**0.415**	**0.157**	<MDA	<MDA
Cs-137 Confidence Interval (± 2 SD)	**0.0486**	**0.0347**	NA	NA
Cs-137 MDA	**0.0313**	**0.0246**	0.0288	0.0399
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Ce-144 MDA	0.253	0.190	0.217	0.277
Pb-212 Activity	**1.646**	**0.718**	**1.186**	**1.906**
Pb-212 Confidence Interval (± 2 SD)	**0.151**	**0.0760**	**0.112**	**0.174**
Pb-212 MDA	**0.0389**	**0.0251**	**0.0319**	**0.0429**
Pb-214 Activity	**1.326**	**0.546**	**1.054**	**1.713**
Pb-214 Confidence Interval (± 2 SD)	**0.0894**	**0.0559**	**0.0730**	**0.107**
Pb-214 MDA	**0.0616**	**0.0472**	**0.0529**	**0.0690**
Ra-226 Activity	**3.946**	**1.785**	**2.182**	**3.309**
Ra-226 Confidence Interval (± 2 SD)	**0.866**	**0.686**	**0.638**	**0.891**
Ra-226 MDA	**0.687**	**0.492**	**0.565**	**0.752**
Ac-228 Activity	**1.683**	**0.722**	**1.274**	**1.786**
Ac-228 Confidence Interval (± 2 SD)	**0.127**	**0.0872**	**0.0988**	**0.138**
Ac-228 MDA	**0.112**	**0.0939**	**0.102**	**0.123**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA
U/Th-238 MDA	0.634	0.454	0.546	0.707
Am-241 Activity	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA
Am-241 MDA	0.0741	0.0578	0.0691	0.0896

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Random Perimeter “E” Samples < 50 miles from the SRS Center Point

Location Description	SME31	SME36	SME40	SME30	SME32	SME34
Collection Date	1/24/2008	1/24/2008	1/24/2008	5/15/2008	5/27/2008	6/27/2008
Alpha Activity	**22.4**	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	**14.8**	NA	NA	NA	NA	NA
Alpha LLD	**16.4**	16.0	16.0	28.4	28.8	28.7
Beta Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Beta Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Beta LLD	8.10	7.97	8.18	9.52	9.35	9.62
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Be-7 MDA	2.096	1.26	1.225	0.550	0.534	0.414
K-40 Activity	**1.951**	<MDA	<MDA	<MDA	**12.06**	**0.857**
K-40 Confidence Interval (± 2 SD)	**0.756**	NA	NA	NA	**1.038**	**0.315**
K-40 MDA	**0.824**	0.454	0.318	0.151	**0.185**	**0.207**
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	**0.503**	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA	**0.119**	NA
Zr-95 MDA	0.379	0.232	0.213	0.092	**0.090**	0.077
Cs-137 Activity	**0.133**	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-137 Confidence Interval (± 2 SD)	**0.055**	NA	NA	NA	NA	NA
Cs-137 MDA	**0.082**	0.040	0.036	0.024	0.025	0.029
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Ce-144 MDA	0.598	0.280	0.266	0.239	0.262	0.281
Pb-212 Activity	**1.998**	**0.543**	**0.602**	**0.322**	**1.217**	**2.219**
Pb-212 Confidence Interval (± 2 SD)	**0.204**	**0.069**	**0.071**	**0.050**	**0.116**	**0.202**
Pb-212 MDA	**0.082**	**0.032**	**0.031**	**0.045**	**0.049**	**0.056**
Pb-214 Activity	**6.427**	**0.365**	**0.639**	**0.410**	**0.823**	**1.321**
Pb-214 Confidence Interval (± 2 SD)	**0.304**	**0.059**	**0.065**	**0.046**	**0.071**	**0.097**
Pb-214 MDA	**0.163**	**0.069**	**0.064**	**0.047**	**0.051**	**0.057**
Ra-226 Activity	**10.77**	<MDA	<MDA	<MDA	**1.44**	**2.523**
Ra-226 Confidence Interval (± 2 SD)	**1.641**	NA	NA	NA	**0.534**	**0.695**
Ra-226 MDA	**1.675**	0.813	0.669	0.577	**0.629**	**0.739**
Ac-228 Activity	**2.436**	<MDA	<MDA	<MDA	**1.387**	**2.288**
Ac-228 Confidence Interval (± 2 SD)	**0.237**	NA	NA	NA	**0.103**	**0.136**
Ac-228 MDA	**0.306**	0.225	0.218	0.152	**0.082**	**0.079**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.399	0.563	0.550	1.329	1.574	1.878
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.172	0.069	0.068	0.513	0.578	0.709

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Random Perimeter “E” Samples < 50 miles from the SRS Center Point

Location Description	SME35	SM E37	SM E29	SME33	SME38	SME39
Collection Date	6/27/2008	7/9/2008	7/9/2008	12/2/2008	12/23/2008	12/23/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Alpha LLD	28.4	32.9	33.3	23.7	23.2	23.3
Beta Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Beta Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Beta LLD	9.23	7.69	8.09	8.45	8.33	8.35
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Be-7 MDA	0.330	2.334	1.568	0.5041	0.4744	0.4065
K-40 Activity	**2.718**	<MDA	<MDA	**0.4086**	**1.339**	**0.4676**
K-40 Confidence Interval (± 2 SD)	**0.431**	NA	NA	**0.1955**	**0.3156**	**0.185**
K-40 MDA	**0.167**	0.2206	0.1354	**0.1606**	**0.1825**	**0.1482**
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Zr-95 MDA	0.065	0.3854	0.2477	0.0795	0.0829	0.0676
Cs-137 Activity	<MDA	<MDA	<MDA	<MDA	**0.0445**	<MDA
Cs-137 Confidence Interval (± 2 SD)	NA	NA	NA	NA	**0.0214**	NA
Cs-137 MDA	0.021	0.0351	0.0191	0.0243	**0.0231**	0.0213
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Ce-144 MDA	0.226	0.2772	0.1936	0.1613	0.1915	0.1494
Pb-212 Activity	**1.249**	**1.183**	**0.5102**	**0.4642**	**0.9429**	**0.5162**
Pb-212 Confidence Interval (± 2 SD)	**0.595**	**0.5528**	**0.0556**	**0.0547**	**0.0923**	**0.0577**
Pb-212 MDA	**0.045**	**0.0329**	**0.0212**	**0.0345**	**0.0423**	**0.0332**
Pb-214 Activity	**0.695**	**1.081**	**0.5384**	**0.5841**	**0.761**	**0.4599**
Pb-214 Confidence Interval (± 2 SD)	**0.063**	**0.0766**	**0.0497**	**0.0514**	**0.0622**	**0.0437**
Pb-214 MDA	**0.047**	**0.0524**	**0.0374**	**0.0398**	**0.0490**	**0.0390**
Ra-226 Activity	**1.547**	**2.598**	**1.099**	**1.396**	**1.107**	**0.8942**
Ra-226 Confidence Interval (± 2 SD)	**0.589**	**0.7312**	**0.3638**	**0.4873**	**0.5459**	**0.4165**
Ra-226 MDA	**0.584**	**0.5869**	**0.4041**	**0.4217**	**0.5207**	**0.4104**
Ac-228 Activity	**0.990**	**1.133**	**0.4881**	<MDA	**0.945**	**0.5381**
Ac-228 Confidence Interval (± 2 SD)	**0.086**	**0.1010**	**0.0607**	NA	**0.0828**	**0.0627**
Ac-228 MDA	**0.076**	**0.0873**	**0.0706**	0.1587	**0.0796**	**0.0645**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.465	0.5119	0.3614	0.4243	0.4862	0.4183
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.557	0.0705	0.0453	0.0568	0.0606	0.0477

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Random Background "B" Samples > 50 miles from the SRS Center Point

Location Description	SMB23	SMB19	SMB28	SMB16	SMB18	SMB21
Collection Date	2/14/2008	2/25/2008	2/25/2008	5/6/2008	5/8/2008	5/8/2008
Alpha Activity	<LLD	<LLD	**19.9**	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	**14.2**	NA	NA	NA
Alpha LLD	16.3	16.2	**16.4**	28.8	28.1	28.9
Beta Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Beta Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Beta LLD	8.09	7.79	8.15	9.44	9.50	9.57
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Be-7 MDA	1.048	0.846	1.193	0.590	0.553	1.904
K-40 Activity	**2.62**	**1.939**	<MDA	**3.00**	<MDA	<MDA
K-40 Confidence Interval (± 2 SD)	**0.499**	**0.460**	NA	**0.422**	NA	NA
K-40 MDA	**0.326**	**0.293**	0.416	**0.156**	0.490	0.452
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Zr-95 MDA	0.198	0.161	0.209	0.105	0.089	0.264
Cs-137 Activity	<MDA	<MDA	**0.385**	<MDA	<MDA	**0.576**
Cs-137 Confidence Interval (± 2 SD)	NA	NA	**0.073**	NA	NA	**0.075**
Cs-137 MDA	0.040	0.040	**0.053**	0.024	0.022	**0.058**
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Ce-144 MDA	0.300	0.253	0.358	0.245	0.224	0.644
Pb-212 Activity	**0.975**	**0.494**	<MDA	<MDA	<MDA	**1.508**
Pb-212 Confidence Interval (± 2 SD)	**0.103**	**0.054**	NA	NA	NA	**0.156**
Pb-212 MDA	**0.037**	**0.030**	0.049	0.044	0.040	**0.122**
Pb-214 Activity	**0.735**	**0.606**	**0.923**	**0.602**	**0.309**	**1.52**
Pb-214 Confidence Interval (± 2 SD)	**0.064**	**0.070**	**0.095**	**0.063**	**0.042**	**0.164**
Pb-214 MDA	**0.076**	**0.069**	**0.096**	**0.046**	**0.044**	**0.133**
Ra-226 Activity	**1.608**	**1.627**	**2.021**	**1.197**	<MDA	**3.695**
Ra-226 Confidence Interval (± 2 SD)	**0.578**	**0.691**	**0.781**	**0.577**	NA	**1.627**
Ra-226 MDA	**0.762**	**0.664**	**0.997**	**0.561**	0.510	**1.576**
Ac-228 Activity	**1.001**	**0.781**	**0.901**	**0.490**	**0.426**	**1.644**
Ac-228 Confidence Interval (± 2 SD)	**0.111**	**0.111**	**0.139**	**0.072**	**0.065**	**0.201**
Ac-228 MDA	**0.145**	**0.127**	**0.143**	**0.070**	**0.067**	**0.202**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	0.642	0.473	0.745	1.416	1.236	3.998
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.079	0.069	0.081	0.514	0.453	1.439

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Radiological Data for Random Background "B" Samples > 50 miles from the SRS Center Point

Location Description	SM B26	SM B13	SM B22	SMB27	SMB17	SMB29
Collection Date	7/9/2008	7/18/2008	7/18/2008	7/24/2008	12/29/2008	12/23/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Alpha LLD	32.1	32.4	32.1	27.7	22.8	25.9
Beta Activity	<LLD	**8.82**	**11.4**	**9.94**	11.4	<LLD
Beta Confidence Interval (± 2 SD)	NA	**4.67**	**4.78**	**4.68**	5.25	NA
Beta LLD	7.74	**7.89**	**7.77**	**7.63**	8.8	8.64
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Be-7 MDA	1.925	1.392	1.551	0.428	0.5085	0.671
K-40 Activity	**0.9873**	**3.949**	**16.38**	**4.98**	**21.9**	<MDA
K-40 Confidence Interval (± 2 SD)	**0.2774**	**0.3940**	**1.139**	**0.509**	**1.535**	NA
K-40 MDA	**0.2233**	**0.1400**	**0.1608**	**0.150**	**0.2159**	0.2798
Zr-95 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Zr-95 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Zr-95 MDA	0.2704	0.1832	0.2458	0.0768	0.0981	0.1143
Cs-137 Activity	**0.0578**	<MDA	<MDA	<MDA	<MDA	**0.2427**
Cs-137 Confidence Interval (± 2 SD)	**0.0260**	NA	NA	NA	NA	**0.0430**
Cs-137 MDA	**0.0258**	0.0183	0.0253	0.0216	0.0326	**0.0362**
Ce-144 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Ce-144 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Ce-144 MDA	0.2170	0.1547	0.1945	0.141	0.2011	0.2267
Pb-212 Activity	<MDA	**0.1562**	<MDA	<MDA	**0.7442**	**0.7147**
Pb-212 Confidence Interval (± 2 SD)	NA	**0.0286**	NA	NA	**0.0799**	**0.0839**
Pb-212 MDA	0.0239	**0.0160**	0.0225	0.0207	**0.0458**	**0.0520**
Pb-214 Activity	**0.4666**	**0.2404**	**0.3371**	**0.278**	**0.8770**	**0.9024**
Pb-214 Confidence Interval (± 2 SD)	**0.0549**	**0.0341**	**0.0430**	**0.0342**	**0.0716**	**0.0819**
Pb-214 MDA	**0.0460**	**0.0304**	**0.0403**	**0.0343**	**0.0510**	**0.0648**
Ra-226 Activity	**1.170**	<MDA	<MDA	<MDA	**1.871**	**2.403**
Ra-226 Confidence Interval (± 2 SD)	**0.3986**	NA	NA	NA	**0.6614**	**0.8021**
Ra-226 MDA	**0.4597**	0.3141	0.4195	0.382	**0.5514**	**0.6456**
Ac-228 Activity	**0.5138**	**0.2411**	**0.5032**	**0.395**	**0.6826**	**0.6618**
Ac-228 Confidence Interval (± 2 SD)	**0.0709**	**0.0517**	**0.0702**	**0.0594**	**0.101**	**0.0972**
Ac-228 MDA	**0.0823**	**0.0684**	**0.8811**	**0.0676**	**0.0990**	**0.1157**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	0.3887	0.3013	0.3677	0.406	0.5258	0.5682
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.0502	0.0336	0.0481	0.0436	0.0662	0.0719

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Nonradiological Data for Savannah River and Creek Mouths Accessible to the Public

Location Description	SMSV-2011	SMSV-2013	SMSV-2015
Collection Date	4/16/2008	4/16/2008	4/16/2008
Analyte	mg/kg	mg/kg	mg/kg
Aluminum	10000	6000	3900
Barium	81	65	37
Beryllium	1.7	0.92	0.31
Cadmium	2.3	2	1.4
Chromium	19	10	7.5
Cobalt	16	8.1	4.6
Copper	8.7	9.1	2.2
Iron	9700	9500	7000
Lead	13	6	<5.0
Magnesium	830	730	600
Manganese	240	560	360
Mercury	0.16	<0.10	<0.10
Nickel	19	7.7	3.7
Titanium	240	280	260
Vanadium	22	18	12
Zinc	44	35	21

Location Description	SMSV-2017	SMSV-2020	SMSV-118
Collection Date	4/16/2008	4/17/2008	4/17/2008
Analyte	mg/kg	mg/kg	mg/kg
Aluminum	7100	11000	14000
Barium	62	94	110
Beryllium	0.51	0.63	0.76
Cadmium	3.4	3.1	3.9
Chromium	11	15	20
Cobalt	7.6	8.5	11
Copper	5.3	7.6	11
Iron	16000	15000	19000
Lead	7	7.8	9.4
Magnesium	640	1500	1900
Manganese	320	770	880
Mercury	<0.10	<0.10	<0.10
Nickel	4.7	6.9	8.5
Titanium	260	530	620
Vanadium	22	24	32
Zinc	26	38	48

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, TI, and Sn.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Nonradiological Data for Savannah River Site Streams and Stormwater Basins That Are Not Publicly Accessible

Location Description	SMSV-2049	SMSV-2048	SMSV-327	SMSV-175
Collection Date	3/26/2008	3/26/2008	3/26/2008	3/26/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	1900	10000	6600	9300
Barium	32	45	65	120
Beryllium	<0.30	0.53	0.5	0.83
Cadmium	1.5	1.1	1.4	2.7
Chromium	4.4	13	16	25
Cobalt	2.8	<2.0	3.3	11
Copper	2.1	1.8	3.9	5.2
Iron	5200	3400	4600	9500
Lead	<5.0	5.8	9.2	13
Magnesium	89	220	170	320
Manganese	140	240	81	690
Mercury	<0.10	<0.10	<0.10	<0.10
Nickel	3.2	3.3	5	6
Titanium	36	50	58	53
Vanadium	5.4	8.1	14	12
Zinc	30	6.7	25	32

Location Description	SMSV-2053	SMSV-2069	SMSV-2073	SM-ZBASIN
Collection Date	3/26/2008	3/26/2008	3/26/2008	3/27/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	330	4200	5600	9100
Barium	<5.0	36	65	34
Beryllium	<0.30	0.63	1	0.66
Cadmium	<1.0	1.6	1.8	3.4
Chromium	2.4	7.2	11	25
Cobalt	<2.0	3.8	7.1	<2.0
Copper	<1.0	15	3.7	8
Iron	1100	6400	6600	17000
Lead	<5.0	6.3	7.7	9.3
Magnesium	20	150	200	250
Manganese	9.1	120	84	40
Mercury	<0.10	<0.10	<0.10	<0.10
Nickel	<2.0	5.3	9.4	5
Titanium	16	51	68	140
Vanadium	<2.0	9.6	11	42
Zinc	2.3	26	20	180

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, Tl, and Sn.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Nonradiological Data for Savannah River Boat Landings That Are Publicly Accessible

Location Description	SMSBL001	SMCB001	SM301GA002	SMJL001
Collection Date	7/23/2008	7/23/2008	7/23/2008	7/23/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	810	4100	8700	2400
Barium	5.4	28	71	21
Beryllium	<0.30	0.32	0.6	<0.30
Cadmium	<1.0	<1.0	2.3	<1.0
Chromium	1.6	7	12	4.7
Cobalt	<2.0	2.2	6.9	<2.0
Copper	<1.0	3.3	5.2	2.2
Iron	1000	5000	11000	4000
Lead	<5.0	<5.0	5.9	<5.0
Magnesium	25	76	470	170
Manganese	37	580	1100	500
Mercury	<0.10	<0.10	<0.10	<0.10
Nickel	<2.0	2.7	6.4	2.6
Titanium	50	260	500	220
Vanadium	2.4	11	22	7.1
Zinc	3.6	17	32	22

Location Description	SMLHL002	SMSCL002	SMPRA001	SMFF001	SMJBL002
Collection Date	7/23/2008	7/23/2008	7/24/2008	7/24/2008	7/25/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	540	4900	9200	5200	22000
Barium	<5.0	41	58	30	120
Beryllium	<0.30	0.32	0.44	<0.30	0.89
Cadmium	<1.0	1.2	4.1	1.2	4.7
Chromium	<1.0	8.1	27	7.5	23
Cobalt	<2.0	3.8	11	2.9	11
Copper	<1.0	2.7	18	2.8	14
Iron	880	6200	20000	7000	30000
Lead	<5.0	<5.0	11	5.2	13
Magnesium	5.9	220	460	260	860
Manganese	39	740	1000	510	1600
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	<2.0	3.7	8.2	<2.0	11
Titanium	24	380	210	310	710
Vanadium	<2.0	13	36	15	52
Zinc	2.9	18	24	9.5	35

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, Tl, and Sn.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Nonradiological Data for Random Perimeter "E" Samples < 50 miles from the SRS Center Point

Location Description	SME29	SME30	SME31	SME32	SME33	SME34
Collection Date	7/9/2008	5/15/2008	1/24/2008	5/27/2008	12/2/2008	6/27/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	740	760	4100	1500	710	1100
Barium	5.8	21	62	20	9.3	<5.0
Beryllium	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium	<1.0	<1.0	1.1	<1.0	<1.0	<1.0
Chromium	1.4	2.3	4	1.9	1.7	1.4
Cobalt	<2.0	<2.0	5.2	<2.0	<2.0	<2.0
Copper	<1.0	<1.0	2.8	<1.0	<1.0	<1.0
Iron	4700	1500	4600	3000	970	360
Lead	<5.0	<5.0	6.6	<5.0	<5.0	<5.0
Magnesium	12	17	110	200	29	27
Manganese	25	1.5	310	290	45	4.4
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	<2.0	<2.0	2.8	<2.0	<2.0	<2.0
Titanium	19	14	46	120	79	42
Vanadium	<2.0	3.3	8.3	4.4	<2.0	<2.0
Zinc	2	1.5	13	5.9	5.0	1.8

Location Description	SME35	SME36	SME37	SME38	SME39	SME40
Collection Date	6/27/2008	1/24/2008	7/9/2008	12/23/2008	12/23/2008	1/24/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	290	430	2400	1800	300	1000
Barium	<5.0	<5.0	17	14	<5.0	8.7
Beryllium	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	<1.0	<1.0	4.1	2	<1.0	2.1
Cobalt	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Copper	<1.0	<1.0	1.5	<1.0	<1.0	<1.0
Iron	230	150	1100	760	330	750
Lead	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	11	9.1	62	41	<5.0	25
Manganese	11	2.7	67	58	4.9	46
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Titanium	12	14	58	67	35	23
Vanadium	<2.0	<2.0	2.8	2.8	<2.0	<2.0
Zinc	3.2	1.2	9.9	9.8	1.7	3.4

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, Tl, and Sn.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Nonradiological Data for Random Background "B" Samples > 50 miles from the SRS Center Point

Location Description	SMB13	SMB16	SMB17	SMB18	SMB19	SMB21
Collection Date	7/18/2008	5/6/2008	12/29/2008	5/8/2008	2/25/2008	5/8/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	2300	15000	5400	1400	660	12000
Barium	27	31	52	16	6.3	89
Beryllium	<0.30	<0.30	0.33	<0.30	<0.30	0.45
Cadmium	<1.0	4.8	<1.0	<1.0	<1.0	1.1
Chromium	6.5	15	4.3	1.2	1.7	9.8
Cobalt	4	4.9	2.9	<2.0	<2.0	2.5
Copper	2.9	11	<1.0	<1.0	<1.0	3
Iron	5600	21000	9600	970	860	5500
Lead	<5.0	6.4	<5.0	<5.0	<5.0	14
Magnesium	540	520	960	39	39	460
Manganese	570	180	120	6.8	100	110
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	<2.0	4	<2.0	<2.0	<2.0	4.1
Titanium	150	470	390	14	26	68
Vanadium	15	65	13	2.6	<2.0	14
Zinc	5.8	20	17	3.3	1.8	17

Location Description	SMB22	SMB23	SMB26	SMB27	SMB28	SMB29
Collection Date	7/18/2008	2/14/2008	7/9/2008	7/24/2008	2/25/2008	12/23/2008
Analyte	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Aluminum	5700	3200	920	5500	8900	13000
Barium	51	13	10	54	28	76
Beryllium	<0.30	<0.30	<0.30	0.69	<0.30	0.78
Cadmium	1.1	<1.0	<1.0	4.1	<1.0	<1.0
Chromium	14	3.9	1.5	30	8	10
Cobalt	7.5	<2.0	<2.0	6.8	<2.0	<2.0
Copper	8.5	<1.0	1.6	3	1.4	3.5
Iron	11000	1700	360	20000	2800	2500
Lead	6	14	<5.0	14	14	15
Magnesium	1100	130	88	390	310	660
Manganese	480	4.2	6.4	700	13	40
Mercury	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Nickel	3.9	<2.0	<2.0	2.7	3	2.5
Titanium	310	49	54	260	71	28
Vanadium	30	6.8	<2.0	30	9.9	10
Zinc	12	4.2	3.1	21	7.8	12

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, Tl, and Sn.

Radiological and Nonradiological Monitoring of Sediments Data

2008 Nonradiological Data for SRS Streams, Creek Mouths, and Savannah River

Organic Analysis		Pesticide/PCBs			BNA
Location Description	**Collection Date**	**p,p'-DDD**	**p,p'-DDE**	**p,p'-DDT**	**Di-n-octylphthalate**
SMSV-2049	**3/26/2008**	<0.0020	<0.0020	<0.0020	**0.4**
SMSV-2048	**3/26/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-327	**3/26/2008**	<0.0020	0.005	<0.0020	<0.30
SMSV-175	**3/26/2008**	<0.0020	0.0057	0.0022	<0.30
SMSV-2053	**3/26/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-2069	**3/26/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-2073	**3/26/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-2011	**4/16/2008**	**0.018**	**0.013**	**0.0072**	<0.30
SMSV-2013	**4/16/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-2015	**4/16/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-2017	**4/16/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-2020	**4/17/2008**	<0.0020	<0.0020	<0.0020	<0.30
SMSV-118	**4/17/2008**	<0.0020	<0.0020	<0.0020	<0.30

Note: Units are in mg/kg. Only samples with detections are included in this table. Refer to Table 5 for a complete list of analytes.

TOC

2.5.5 Summary Statistics

Radiological and Nonradiological Monitoring of Sediments

Notes:
3. N/A = Not Applicable
4. Min. – Minimum
5. Max. = Maximum

Radiological and Nonradiological Monitoring of Sediments Summary Statistics

Publically Accessable SRS Creek Mouths and Savannah River Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Alpha	46.900	N/A	46.900	46.900	46.900	1	6
Beta	27.850	17.094	23.750	12.800	59.000	6	6
Be-7	0.895	N/A	0.895	0.895	0.895	1	6
K-40	14.990	3.611	15.930	9.541	18.940	6	6
Zr-95	N/A	N/A	N/A	N/A	N/A	0	6
Cs-137	1.110	1.384	0.489	0.066	3.726	6	6
Ce-144	N/A	N/A	N/A	N/A	N/A	0	6
Pb-212	1.515	0.324	1.520	1.149	2.019	6	6
Pb-214	3.489	4.799	1.670	1.048	13.260	6	6
Ra-226	6.964	9.477	3.404	2.083	26.260	6	6
Ac-228	1.563	0.345	1.515	1.093	2.049	6	6
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	6
Am-241	N/A	N/A	N/A	N/A	N/A	0	6
Pu-238 WET	N/A	N/A	N/A	N/A	N/A	0	6
Pu-238 DRY	N/A	N/A	N/A	N/A	N/A	0	6
Pu-239 WET	0.017	N/A	0.017	0.017	0.017	1	6
Pu-239 DRY	0.050	N/A	0.050	0.050	0.050	1	6
Sr-89/90 WET	0.402	N/A	0.402	0.402	0.402	1	6
Sr-89/90 DRY	0.552	N/A	0.552	0.552	0.552	1	6
Tc-99 WET	0.371	N/A	0.371	0.371	0.371	1	6

Non-Publically Accessable SRS Stream Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Alpha	38.400	N/A	38.400	38.400	38.400	1	7
Beta	14.293	8.304	11.200	7.980	23.700	3	7
Be-7	N/A	N/A	N/A	N/A	N/A	0	7
K-40	1.214	0.495	1.145	0.678	2.037	7	7
Zr-95	0.836	N/A	0.836	0.836	0.836	1	7
Cs-137	1.806	2.285	1.137	0.143	5.707	5	7
Ce-144	0.274	N/A	0.274	0.274	0.274	1	7
Pb-212	1.314	0.869	1.110	0.327	2.442	5	7
Pb-214	2.321	3.027	1.145	0.476	9.037	7	7
Ra-226	2.100	1.389	1.953	0.159	4.527	7	7
Ac-228	1.383	1.057	0.697	0.666	3.061	5	7
U/Th-238	5.740	3.483	5.740	3.277	8.202	2	7
Am-241	0.382	N/A	0.382	0.382	0.382	1	7
I-129	N/A	N/A	N/A	N/A	N/A	0	2
Pu-238	0.053	0.016	0.053	0.042	0.064	2	2
Pu-239/240	0.016	0.003	0.016	0.014	0.017	2	2
Tc-99	N/A	N/A	N/A	N/A	N/A	0	2
Sr-89/90	N/A	N/A	N/A	N/A	N/A	0	2

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Summary Statistics

Non-Publically Accessable SRS Stormwater Basin Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Alpha	N/A	N/A	N/A	N/A	N/A	0	7
Beta	12.178	2.600	12.900	8.610	14.300	4	7
Be-7	N/A	N/A	N/A	N/A	N/A	0	7
K-40	3.430	1.639	3.604	1.761	6.341	7	7
Zr-95	N/A	N/A	N/A	N/A	N/A	0	7
Cs-137	0.755	1.122	0.241	0.107	2.431	4	7
Ce-144	N/A	N/A	N/A	N/A	N/A	0	7
Pb-212	2.026	0.906	2.164	1.243	3.808	7	7
Pb-214	1.348	0.539	1.239	0.832	2.360	7	7
Ra-226	2.960	1.561	2.365	1.774	6.252	7	7
Ac-228	1.870	0.654	1.879	1.220	2.981	7	7
U/Th-238	3.010	0.321	2.965	2.714	3.352	3	7
Am-241	N/A	N/A	N/A	N/A	N/A	0	7
I-129	N/A	N/A	N/A	N/A	N/A	0	1
Pu-238	0.010	N/A	0.010	0.010	0.010	1	1
Pu-239/240	0.009	N/A	0.009	0.009	0.009	1	1
Tc-99	N/A	N/A	N/A	N/A	N/A	0	1
Sr-89/90	N/A	N/A	N/A	N/A	N/A	0	1

Publically Accessable Savannah River Boat Landing Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Alpha	N/A	N/A	N/A	N/A	N/A	0	9
Beta	17.3	5.4	17.1	8.83	24.1	7	9
Be-7	N/A	N/A	N/A	N/A	N/A	0	9
K-40	10.7	4.5	11.7	3.7	15.0	9	9
Zr-95	N/A	N/A	N/A	N/A	N/A	0	9
Cs-137	0.229	0.128	0.182	0.136	0.415	4	9
Ce-144	N/A	N/A	N/A	N/A	N/A	0	9
Pb-212	1.218	0.607	1.366	0.309	1.906	6	9
Pb-214	0.928	0.490	1.054	0.283	1.713	9	9
Ra-226	2.442	0.870	2.182	1.605	3.946	7	9
Ac-228	1.096	0.544	1.274	0.312	1.786	9	9
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	9
Am-241	N/A	N/A	N/A	N/A	N/A	0	9

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Summary Statistics

Random Perimeter Sediment Samples (<50 miles from SRS center point)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Alpha	22.400	N/A	22.400	22.400	22.400	1	12
Beta	N/A	N/A	N/A	N/A	N/A	0	12
Be-7	N/A	N/A	N/A	N/A	N/A	0	12
K-40	2.829	4.154	1.339	0.409	12.060	7	12
Zr-95	0.503	N/A	0.503	0.503	0.503	1	12
Cs-137	0.089	0.063	0.089	0.044	0.133	2	12
Ce-144	N/A	N/A	N/A	N/A	N/A	0	12
Pb-212	0.980	0.619	0.772	0.322	2.219	12	12
Pb-214	1.175	1.677	0.667	0.365	6.427	12	12
Ra-226	2.597	3.124	1.440	0.894	10.770	9	12
Ac-228	1.276	0.733	1.061	0.488	2.436	8	12
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	12
Am-241	N/A	N/A	N/A	N/A	N/A	0	12

Random Background Sediment Samples (>50 miles from SRS center point)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Alpha	19.900	N/A	19.900	19.900	19.900	1	12
Beta	10.390	1.253	10.670	8.820	11.400	3	12
Be-7	N/A	N/A	N/A	N/A	N/A	0	12
K-40	6.970	7.749	3.475	0.987	21.900	8	12
Zr-95	N/A	N/A	N/A	N/A	N/A	0	12
Cs-137	0.315	0.219	0.314	0.058	0.576	4	12
Ce-144	N/A	N/A	N/A	N/A	N/A	0	12
Pb-212	0.765	0.457	0.729	0.156	1.508	6	12
Pb-214	0.650	0.371	0.604	0.240	1.520	12	12
Ra-226	1.949	0.816	1.749	1.170	3.695	8	12
Ac-228	0.687	0.372	0.588	0.241	1.644	12	12
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	12
Am-241	N/A	N/A	N/A	N/A	N/A	0	12

Note: Units are in pCi/g. There were no detections in any 2008 sediment sample above the MDA for: Na-22, Co-58, Co-60, Zn-65, Y-88, Ru-103, Sb-125, I-131, Cs-134, Eu-152, and Eu-154. Mn-54 not reported due to interference from Ac-228. Eu-155 not reported due to interference from Ac-228 or U-235.

Radiological and Nonradiological Monitoring of Sediments Summary Statistics

Publically Accessable SRS Creek Mouths and Savannah River Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Aluminum	8667	3687	8550	3900	14000	6	6
Barium	75	26	73	37	110	6	6
Beryllium	1	0	0.695	0.31	1.7	6	6
Cadmium	3	1	2.7	1.4	3.9	6	6
Chromium	14	5	13	7.5	20	6	6
Cobalt	9	4	8.3	4.6	16	6	6
Copper	7	3	8.15	2.2	11	6	6
Iron	12700	4639	12350	7000	19000	6	6
Lead	9	3	7.8	6	13	5	6
Magnesium	1033	538	780	600	1900	6	6
Manganese	522	260	460	240	880	6	6
Mercury	0.16	N/A	0.16	0.16	0.16	1	6
Nickel	8	5	7.3	3.7	19	6	6
Titanium	365	166	270	240	620	6	6
Vanadium	22	7	22	12	32	6	6
Zinc	35	10	36.5	21	48	6	6

Non-Publically Accessable SRS Stream Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Aluminum	5879	3568	6100	330	10000	8	8
Barium	57	31	45	32	120	7	8
Beryllium	1	0	0.645	0.5	1	6	8
Cadmium	2	1	1.6	1.1	3.4	7	8
Chromium	13	9	12	2.4	25	8	8
Cobalt	6	3	3.8	2.8	11	5	8
Copper	6	5	3.9	1.8	15	7	8
Iron	6725	4825	5800	1100	17000	8	8
Lead	9	3	8.45	5.8	13	6	8
Magnesium	177	94	185	20	320	8	8
Manganese	176	219	102	9.1	690	8	8
Mercury	N/A	N/A	N/A	N/A	N/A	0	8
Nickel	5	2	5	3.2	9.4	7	8
Titanium	59	36	52	16	140	8	8
Vanadium	15	12	11	5.4	42	7	8
Zinc	40	57	25.5	2.3	180	8	8

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, TI, and Sn.

Radiological and Nonradiological Monitoring of Sediments Summary Statistics

Publically Accessable Savannah River Boat Landing Sediments

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Aluminum	6428	6586	4900	540	22000	9	9
Barium	47	36	36	5.4	120	8	9
Beryllium	0.51	0.24	0.44	0.32	0.89	5	9
Cadmium	2.7	1.6	2.3	1.2	4.7	5	9
Chromium	11.4	9.0	7.8	1.6	27	8	9
Cobalt	6.3	4.0	5.4	2.2	11	6	9
Copper	6.9	6.4	3.3	2.2	18	7	9
Iron	9453	9663	6200	880	30000	9	9
Lead	8.8	3.8	8.5	5.2	13	4	9
Magnesium	283	274	220	5.9	860	9	9
Manganese	678	503	580	37	1600	9	9
Mercury	N/A	N/A	N/A	N/A	N/A	0	9
Nickel	5.8	3.4	5.1	2.6	11	6	9
Titanium	296	215	260	24	710	9	9
Vanadium	19.8	16.5	14.0	2.4	52	8	9
Zinc	18.2	11.4	18.0	2.9	35	9	9

Random Perimeter Sediment Samples (<50 miles from SRS center point)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Aluminum	1261	1095	880	290	4100	12	12
Barium	19.7	17.9	16	5.8	62	8	12
Beryllium	N/A	N/A	N/A	N/A	N/A	0	12
Cadmium	1.1	N/A	1.1	1.1	1.1	1	12
Chromium	2.3	1.0	2.0	1.4	4.1	9	12
Cobalt	5.2	N/A	5.2	5.2	5.2	1	12
Copper	2.2	0.9	2.2	1.5	2.8	2	12
Iron	1538	1644	865	150	4700	12	12
Lead	6.6	N/A	6.6	6.6	6.6	1	12
Magnesium	49.4	58.0	27.0	9.1	200	11	12
Manganese	72.1	108.9	35.0	1.5	310	12	12
Mercury	N/A	N/A	N/A	N/A	N/A	0	12
Nickel	2.8	N/A	2.8	2.8	2.8	1	12
Titanium	44	33	39	12	120	12	12
Vanadium	4.3	2.3	3.3	2.8	8.3	5	12
Zinc	4.9	4.0	3.3	1.2	13	12	12

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, TI, and Sn.

Radiological and Nonradiological Monitoring of Sediments Summary Statistics

Random Background Sediment Samples (>50 miles from SRS center point)

	Average	Standard Deviation	Median	Minimum	Maximum	No. of Detections	Total Number Sampled
Aluminum	6165	4971	5450	660	15000	12	12
Barium	37.8	26.7	29.5	6.3	89	12	12
Beryllium	0.56	0.21	0.57	0.33	0.78	4	12
Cadmium	2.8	2.0	2.6	1.1	4.8	4	12
Chromium	8.8	8.1	7.3	1.2	30	12	12
Cobalt	4.8	2.0	4.5	2.5	7.5	6	12
Copper	4.4	3.5	3.0	1.4	11	8	12
Iron	6824	7235	4150	360	21000	12	12
Lead	11.9	3.9	14.0	6	15	7	12
Magnesium	436	348	425	39	1100	12	12
Manganese	194.2	245.6	105.0	4.2	700	12	12
Mercury	N/A	N/A	N/A	N/A	N/A	0	12
Nickel	3.4	0.7	3.5	2.5	4.1	6	12
Titanium	158	159	70	14	470	12	12
Vanadium	19.6	18.3	13.5	2.6	65	10	12
Zinc	10.4	7.0	9.9	1.8	21	12	12

Note: Units are in mg/kg. There were no detections in any 2008 sediment sample above the MDL for: Ag, As, B, Mo, Sb, Se, Tl, and Sn.

TOC

3.1 Surface Soil Monitoring

3.1.1 Summary

Surface soil is an important medium that can be contaminated by radionuclides and metals, and transported to other ecological systems. Plants absorb contaminants from soil that in turn introduce contaminants to the food chain. Radionuclides and metals in soil can leach into groundwater and possibly emerge into surface water, thus exposing aquatic systems (Corey 1980). Air and water are subject to a much greater mixing than soil; therefore, dilution of metal load does not occur in soil as in other media. As a result, the accumulation of metals in surface soils is often more intense on both local and global scales than in the other components of the biosphere (Alloway 1995). The re-suspension and subsequent airborne contamination of materials, due to cleanup processes and prescribed burns, facilitates the movement of contaminants to areas outside of the Savannah River Site (SRS) boundary.

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) provides independent evaluation of Department of Energy – Savannah River (DOE-SR) environmental monitoring programs. ESOP personnel independently evaluated surface soils for gross alpha and gross non-volatile beta and select gamma-emitting radionuclides as well as a United States Environmental Protection Agency (USEPA) specified Target Analyte List (TAL) for metals. These soil samples were collected to determine if SRS activities might have impacted areas outside of the site boundary. Radionuclide detections in soil are the result of accumulation over many years and do not represent yearly depositions.

The ESOP surface soil monitoring project changed in 2004 to include more random coverage of perimeter soils (those within 50 miles of the SRS center point, but outside the SRS boundary) and background soils (those greater than 50 miles from the SRS center point) within the boundaries of the state of South Carolina. This sampling program was implemented to allow statistical comparisons of the SRS perimeter and South Carolina background contaminant levels in soils. The United States Geological Survey (USGS) 7.5' Quadrangle Coverage for South Carolina (USDOI 1992) was used to determine the ESOP random quadrant sampling areas. Refer to Section 3.1.3, Table 1 and Map 1 for random sampling locations. ESOP initiated the random sampling system to determine if elevated levels of contaminants are attributed to SRS activities. Averages for random background (B) samples were subtracted from random perimeter (E) samples to determine SRS off-site 50-mile perimeter environmental concentrations above the South Carolina background levels. Perimeter and background averages were used to determine if SCDHEC data were comparable to radiological data from DOE-SR data. Since DOE-SR does not report metals data for surface soil, no direct data comparisons can be made. Assessment of radiological and nonradiological contaminants in surface soil is necessary to detect any impact from DOE-SR operations beyond historically impacted areas. In 2007, in addition to samples collected near the perimeter of SRS, publicly accessible boat landings were included in the sampling regime to exemplify areas where direct contact to surface soil often occurs by the public.

ESOP collected 46 samples in 2008 from 12 random perimeter sites within the 50-mile radius of the SRS center point and 13 random background sites outside of the 50-mile SRS center point radius. Twelve nonrandom samples were collected from SRS perimeter locations as well as riverbank soils from nine publicly accessible boat landings. Nonrandom SRS perimeter sampling locations are depicted on Map 8 of Section 3.1.2. A list of all nonrandom sampling locations is in Section 3.1.3, Table 2. Gamma spectroscopy led to detections of the anthropogenic radionuclide cesium-137 (Cs-137). The majority of all the samples had detectable amounts of Cs-137 that were consistent with levels attributed to atmospheric fallout from past nuclear weapons testing. Those samples collected near the SRS perimeter yielded the highest concentrations of Cs-137, followed by those from the riverbanks. The average of those collected as a background sample was third highest, being slightly higher than those randomly collected within 50 miles of SRS. These patterns coincide with levels detected by ESOP in the past. Only two surface soil samples yielded Cs-137 above the USEPA Preliminary Remediation Goals (PRG). These higher detections, found in the Steel Creek delta were likely caused by past releases from SRS.

Gross alpha-emitting radionuclides were detected in two samples from the SRS perimeter and none from the riverbank soils. There was one detection among the random perimeter samples and none from the background samples. On average, those collected within 50 miles of SRS were higher than those collected greater than 50 miles. Gross non-volatile beta was detected among all sample types. Highest averages were from the SRS perimeter. Those from the riverbanks and random samples from both a 50-mile radius, as well as all background samples, had similar averages. Gross alpha and gross non-volatile beta are not necessarily directly comparable due to variances in contributing radionuclides. Concentrations of radionuclides vary temporally and spatially and can be affected by soil types at the various sampling locations.

SCDHEC metals data shows that among all the random samples collected in 2008, only chromium has a higher average within 50 miles of SRS than in the background samples. All 24 metal analytes were below the USEPA PRG. Metals data has been trended over time and the samples collected near the SRS perimeter are similar to those collected randomly throughout South Carolina.

Data comparison of 2008 surface soil data from SCDHEC and DOE-SR resulted in similar findings. Both data sets report average Cs-137 levels higher within 50 miles of SRS than in background samples. Cesium-137 data has been trended since 2003. SCDHEC data from 2008 shows a slightly decreased average level of Cs-137 from the 2007 data. DOE-SR reports for 2008 that Cs-137 concentrations are consistent with historical results. Metals could not be compared to SCDHEC results since SRS does not analyze nonradiological contaminants.

RESULTS AND DISCUSSION

Radiological Parameter Results

Surface soils were evaluated for gross alpha and gross non-volatile beta as well as a suite of 24 gamma-emitting radionuclides. Radioisotopes were detected in not only samples collected on SRS, but in background samples as well. The USEPA PRG is used as a screening tool that corresponds to certain levels of human risk in soil (USEPA 2009c). The conservative PRG corresponds to a chronic risk for soil ingestion for a residential scenario and a one in a million (1E-06) increased cancer risk. In 2008, ESOP analyzed for all of the radioisotopes listed in Section 3.1.3, Table 3.

Cesium-137 is a man-made fission product. Atmospheric Cs-137 was released from the separation areas and was a key radionuclide released to water and air, mainly from F and H areas (CDC 2006). Cesium-137 was detected in 10 SRS nonrandom perimeter samples at an average of 1.157 (± 2.402) picocuries per gram (pCi/g) and ranged from 0.084 to 7.952 pCi/g. The highest detection was located at SSALD0801 in Allendale County. Eight riverbank soil samples had Cs-137 detections at an average of 1.008 (± 1.904) pCi/g. The samples ranged from 0.129 to 5.686 pCi/g. The highest detection was at Steel Creek Boat Landing (SSSCL-002). The two samples with Cs-137 levels above the PRG (3.88 pCi/g) were SSALD-0801 (7.952 pCi/g) and SSSCL-002 (5.686 pCi/g). Both samples were collected at Steel Creek Boat Landing at different dates. This area in the Steel Creek floodplain has a history of elevated Cs-137 due to releases from SRS operations (WSRC 2005a). Analysis of Cs-137 from riverbank soils collected at public boat landings show that all landings sampled in 2008, with the exception of Steel Creek Boat Landing, had Cs-137 levels consistent with levels attributed to atmospheric fallout from past nuclear weapons testing. Results are depicted in Section 3.1.3, Figure 1.The Steel Creek Boat Landing is located immediately downstream of SRS and has historically experienced periodic flooding. These past events may have led to the increased levels of Cs-137 in the surface soil (WSRC 2005a).

Eight random perimeter samples as well as 11 random background samples detected Cs-137. The random perimeter samples' detections averaged 0.273 (± 0.229) pCi/g and ranged from 0.062 to 0.795 pCi/g. The random background samples had detections averaging 0.322 (± 0.289) pCi/g and ranged from 0.080 to 1.020 pCi/g. The highest random perimeter detection originated from soil collected in quadrant E55 in Bamberg County and the highest random background detection originated from a sample collected in quadrant B53 in McCormick County. Cesium-137, on average, was highest in the SRS perimeter samples followed by the riverbank soils. These averages were followed by the random background samples, which were slightly higher than the random perimeter samples. Trending of data from 2004 to 2008 for the SRS perimeter, random perimeter and random background locations illustrate that while the SRS perimeter samples have lower levels of Cs-137 in 2008 compared to the five year average, the results of both the random perimeter and background samples show that Cs-137 was higher in 2008 than the five year averages (SCDHEC 2005a, 2006a, 2007b, 2008a). The results are depicted in Section 3.1.3, Figure 2.

In addition, potassium-40, lead-212, lead-214, radium-226, actinium-228, and thorium-234 were the only other gamma-emitting radionuclides detected among surface soil samples. These are Naturally Occurring Radioactive Material (NORM) decay products that may account for these detections. All other gamma-emitting radionuclides had no detections above their respective Minimum Detectable Activity (MDA). Results for europium-155 could not be reported due to interference from the naturally occurring actinium-228 in the gamma spectroscopy. These radiological false positives occur because a naturally occurring nuclide, or combination of nuclides, may cause gamma instrument software to report a false positive of a reactor product (WSRC 2003b).

Gross alpha-emitting radionuclides were released to the air at SRS primarily from M-area, the reactor areas, and the separations facilities (CDC 2006). Analyses were conducted on gross alpha-emitting radionuclides in surface soil samples collected during each quarter of 2008. There were two detections among the nonrandom SRS perimeter and none from the riverbank soil samples. The nonrandom SRS perimeter samples averaged 21.2 (± 2.1) pCi/g and ranged from 19.7 to 22.7 pCi/g. The highest detection was in soil collected in Aiken County. One random perimeter sample detected alpha-emitting radionuclides. The detection (29.6 pCi/g) was from soil collected in quadrant E55 in Bamberg County. This location was re-visited and three additional soil samples were collected in the proximity of the original sample. There were no gross alpha-emitters detected from these repeated samples. There were no detections of alpha-emitting radionuclides from any of the background samples.

Gross beta-emitting radionuclides were released from the separations areas on the SRS (CDC 2006). Gross non-volatile beta was detected in three SRS nonrandom perimeter samples at an average of 24.3 (± 14.1) pCi/g and ranged from 10.4 to 38.5 pCi/g. The highest detection was in soil collected in Aiken County. Eight riverbank soil samples detected gross beta-emitting radionuclides. At an average of 16.6 (± 5.0) pCi/g, the samples ranged from 10.8 to 23.6 pCi/g. Fury's Ferry Landing (SSFF-001) yielded the highest riverbank soil detection. One random perimeter sample as well as seven random background samples detected gross beta-emitting radionuclides. The random perimeter sample collected from quadrant E57 in Aiken County had a detection of 14.8 pCi/g. The random background samples averaged 17.9 (± 10.1) pCi/g and ranged from 8.3 to 38.1 pCi/g. The highest detection was from a sample collected in quadrant B60 in Fairfield County.

When comparing gross alpha and gross non-volatile beta detections among the samples, only two gross alpha detections occurred from the SRS nonrandom perimeter and none were found from the riverbank soil samples. Gross alpha detections were higher in the random perimeter samples collected within 50 miles of SRS and absent from the random background samples collected greater than 50 miles from SRS. Gross beta emitters were greater in the SRS nonrandom perimeter samples than the riverbank, random perimeter, and random background soil samples. Trending of data from the past five years for the SRS perimeter, random perimeter and random background locations show that average alpha levels were higher in 2008 than the five year average for the SRS perimeter samples and random perimeter samples. A comparison could not be made with the random background samples since there were no detections of alpha-emitting radionuclides in the 2008 samples. Average beta levels were higher in 2008 than the five year average for the SRS perimeter, random perimeter and random background samples. Figures 3 and 4 in Section 3.1.3 depict these findings.

All radiological data can be found in Section 3.1.4 and statistical data can be found in Section 3.1.5.

Nonradiological Parameter Results

A USEPA TAL of 24 metals was analyzed in all of the surface soil samples collected in 2008. A complete list of all nonradiological analytes can be found in Section 3.1.3, Table 4. Findings were compared to the USEPA PRGs that are used as a screening tool, corresponding to certain levels of human risk in soils (USEPA 2009d). All samples were below the conservative USEPA PRG, corresponding to a chronic risk for soil ingestion for a residential scenario and a one in a million (1E-06) increased cancer risk. Comparisons were also made to the Ecological Screening Value (ESV) for soils which does not represent remediation goals or cleanup levels, but is used to identify constituents of potential concern (WSRC 2005b). While many samples exceeded the ESV, results of metals found around the perimeter of SRS were similar to those found throughout the state. Analyses of the past five years of random sample data show that only the average of detections for beryllium was slightly higher in the perimeter samples than in the background samples. The average of detections however, is below the ESV. A graph depicting the metal averages for all sample types can be found in Section 3.1.3, Figure 5. ESOP 2008 samples had detections of aluminum, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, titanium, vanadium, and zinc. There were no detections above the MDL for antimony, arsenic, boron, mercury, molybdenum, selenium, tin, silver and thallium. Beryllium, cobalt and titanium were all below the ESV. Although iron and vanadium were above the ESV, they were all below the state average. Aluminum and magnesium do not have an ESV, but both were below the state average (Canova 1999). The following discussion of individual analytes will be limited to those of potential concern due to SRS operations.

Chromium solutions were used at the SRS as corrosive inhibitors. Chromium was a part of wastewater solutions resulting from dissolving stainless steel. It was also used in cleaning solutions in the separation areas (Till et al. 2001). Disposal of fly–ash on land is a contributor of both chromium and nickel to soils (Alloway 1995). Chromium was detected in 12 SRS nonrandom perimeter samples at an average of 10.6 (± 9.1) milligrams per kilogram (mg/kg) and ranged from 2.9 to 34 mg/kg. The highest detection was located in SSALD-0801 in Allendale County. Nine riverbank soil samples had detections of chromium. At an average of 13.8 (± 6.3) mg/kg, the samples ranged from 2.2 to 24 mg/kg. Steel Creek Landing (SSSCL-002) yielded the highest riverbank soil detection. Eleven random perimeter samples, as well as all 13 random background samples, detected chromium. The random perimeter samples averaged 18.6 (± 39.6) mg/kg and ranged from 1.5 to 137 mg/kg. The highest detection was from a sample collected in quadrant E62 in Aiken County. The random background samples had detections averaging 13.2 (± 12.8) mg/kg and ranged from 2.4 to 48 mg/kg. The highest detection was from a sample collected in quadrant B58 in Anderson County. For comparison, the PRG is 280 mg/kg. While all soil samples were below the PRG, all with detections were well over the ESV for soil of 0.4 mg/kg. The South Carolina (SC) state average for chromium in soil is 16 mg/kg (Canova 1999).

Copper, while naturally occurring, can also be released to the environment through the combustion of wood, coal and oil (Alloway 1995). These mechanisms are possible sources of elevated copper in surface soils. Copper was detected in nine SRS nonrandom perimeter samples at an average of 4.9 (± 4.6) mg/kg and ranged from 1.1 to 15 mg/kg. The highest detection was located in Allendale County (SSALD-0801). Nine of the riverbank soil samples detected copper at an average of 8.0 (± 3.5) mg/kg and ranged from 1.2 to 14 mg/kg. The highest detection was located in McCormick County (SSPRA-001). Seven of the random perimeter samples, as well as 11 of the random background samples, detected copper. The random perimeter samples averaged 2.2 (± 1.3) mg/kg and ranged from 1.1 to 4.2 mg/kg. The highest detection was from a sample collected in quadrant E63 in Edgefield County. The random background samples had detections averaging 8.4 (± 7.5) mg/kg and ranged from 1.8 to 26 mg/kg. The highest detection was from quadrant B53 in McCormick County. All samples were below the PRG of 3,100 mg/kg and the ESV for copper (36 mg/kg). The SC state average for copper in soil is 9 mg/kg (Canova 1999).
The largest anthropogenic source of nickel globally is the burning of fuels and coal combustion (Alloway 1995). At SRS, nickel was directly released through M-area effluent from the plating rinse tanks and through site use of diesel generators (Till et al. 2001). Nickel was detected in eight SRS nonrandom perimeter samples at an average of 5.7 (± 4.2) mg/kg and ranged from 2 to 14 mg/kg. The highest detection was located in Allendale County (SSALD-0801). Eight riverbank soil samples had detections of nickel. At an average of 5.8 (± 1.5) mg/kg, the samples ranged from 3.8 to 7.7 mg/kg. Steel Creek Landing (SSSCL-002) yielded the highest riverbank soil detection. Six random perimeter samples, as well as eight random background samples, had detections of nickel. The random perimeter samples averaged 4.1 (± 2.7) mg/kg and ranged from

2.2 to 9.5 mg/kg. The highest detection was from a sample collected in quadrant E55 in Bamberg County. The random background samples had detections averaging 6.5 (± 3.2) mg/kg and ranged from 2.4 to 11 mg/kg. The highest detection was from a sample collected in quadrant B54 in Chester County. Although there were samples above the state average of 6 mg/kg (Canova 1999), all samples were below the PRG (1,500 mg/kg) and ESV for nickel (30 mg/kg).

Atmospheric emissions of lead from SRS occurred through coal and fuel combustion (Till et al. 2001). Depositions of lead in soil have a long residence time compared to other pollutants. Lead tends to accumulate in soil where its bioavailability can exist far into the future (Alloway 1995). Lead was detected in nine SRS nonrandom perimeter samples at an average of 14.8 (± 7.1) mg/kg and ranged from 6.5 to 25 mg/kg. The highest detection was located at SSALD-0802 in Allendale County. Four of these samples exceeded the ESV of 16 mg/kg. Eight riverbank soil samples detected lead. At an average of 10.2 (± 2.8) mg/kg, the samples ranged from 7 to 15 mg/kg. All riverbank soil samples were below the ESV of 16 mg/kg. Steel Creek Landing (SSSCL-002) yielded the highest riverbank soil detection for lead. Seven random perimeter samples, as well as 12 random background samples, had lead detections. The random perimeter samples averaged 12.1 (± 6.7) mg/kg and ranged from 5.1 to 24 mg/kg, two of which exceeded the ESV. The highest detection was from a sample collected in quadrant E55 in Bamberg County. The random background samples had detections averaging 13.7 (± 6.9) mg/kg and ranged from 7.4 to 33 mg/kg, two of which exceeded the ESV. The highest detection was from a sample collected in quadrant B57 in Greenwood County. For comparison, the PRG is 400 mg/kg and the SC state average for lead in soil is 16 mg/kg (Canova 1999).

Zinc was released in relatively small amounts to the separations area seepage basins as well as the M-area seepage basin (Till et al. 2001). Zinc was detected in all 12 SRS nonrandom perimeter samples at an average of 15.4 (± 14.9) mg/kg and ranged from 3 to 51 mg/kg. The highest detection was located at SSALD-0801 in Allendale County, which also exceeded the ESV of 50 mg/kg. All nine riverbank soil samples yielded zinc detections. At an average of 28 (± 11.6) mg/kg, the samples ranged from 4.3 to 42 mg/kg. Johnson’s Landing (SSJL-001) yielded the highest riverbank soil detection. All 12 random perimeter samples, as well as all 13 random background samples, had zinc detections. The random perimeter samples averaged 8.1 (± 6.4) mg/kg and ranged from 1 to 23 mg/kg. The highest detection was from a sample collected in quadrant E55 in Bamberg County. The random background samples had detections averaging 20.7 (± 11.9) mg/kg and ranged from 5.4 to 37 mg/kg. The highest detection was from a sample collected in quadrant B55 in Laurens County. The PRG is 23,000 mg/kg. Although only one sample exceeded the ESV, many were higher than the state average of 23 mg/kg.
SRS facilities such as F and H area, tritium facilities, waste tanks and the coal-fired power plants have emitted mercury to the atmosphere (Till et al. 2001). Atmospheric fallout contributes to mercury findings in surface soil. None of the surface soil samples collected in 2008 yielded detections above the Minimum Detection Limit (MDL) of 0.1 mg/kg for mercury.

Cadmium enters the atmosphere through fuel and coal combustion (Till et al. 2001). Cadmium was detected in three SRS nonrandom perimeter samples at an average of 4.5 (± 1.6) mg/kg and ranged from 2.9 to 6 mg/kg. The highest detection was located at SSALD-0801 in Allendale County. Eight riverbank soil samples had cadmium detections. At an average of 2.7 (± 1.0) mg/kg, the samples ranged from 1.2 to 4 mg/kg. The highest riverbank detection was located in McCormick County (SSPRA-001). Four random perimeter samples had cadmium detections averaging 2.9 (± 1.5) mg/kg and ranging from 1.3 to 4.3 mg/kg. The highest detection was from a sample collected in quadrant E55 in Bamberg County. The random background samples had five detections averaging 3.3 (± 2.1) mg/kg and ranged from 1.2 to 6.6 mg/kg. The highest detection was from a sample collected in quadrant B53 in McCormick County. The PRG for cadmium in soil is 70 mg/kg. While all samples with detections exceeded the ESV of 0.38 mg/kg, they were also higher than the SC state average for soil (1 mg/kg) (Canova 1999).

Barium has been a constituent of the H Area Hazardous Waste Management Facility (WSRC 1993). Barium was detected in all 12 SRS nonrandom perimeter samples at an average of 57 (± 49) mg/kg and ranged from 7.7 to 170 mg/kg. The highest detection (which also exceeded the ESV of 160 mg/kg) was located at SSAIK-0803 in Aiken County. All nine riverbank soil samples yielded barium detections. At an average of 58 (± 29) mg/kg, the samples ranged from 10 to 93 mg/kg. Johnson's Landing (SSJL-001) yielded the highest riverbank soil detection. Ten random perimeter samples, as well as all 13 random background samples, had barium detections. The random perimeter samples averaged 34.7 (± 26.4) mg/kg and ranged from 6.8 to 95 mg/kg. The highest detection was from a sample collected in quadrant E55 in Bamberg County. The random background samples had detections averaging 55.0 (± 45.7) mg/kg and ranged from 9.1 to 140 mg/kg. The highest detection was from a sample collected in quadrant B54 in Chester County. While all samples were well below the PRG of 15,000 mg/kg and the ESV of 160 mg/kg, many were above the state average of 38 mg/kg (Canova 1999).

Manganese has been released in the separations area head end processes and discharged to liquid waste tanks. It is also a byproduct of coal burning (Till et al. 2001). Manganese was detected in all 12 SRS nonrandom perimeter samples at an average of 241 (± 218) mg/kg and ranged from 12 to 630 mg/kg. The highest detection was located at SSALD-0801 in Allendale County. All nine riverbank soil samples yielded manganese detections. At an average of 280 (± 210) mg/kg, the samples ranged from 49 to 660 mg/kg. Johnson's Landing (SSJL-001) yielded the highest riverbank soil detection. All 12 random perimeter samples, as well as all 13 random background samples, had manganese detections. The random perimeter samples averaged 192 (± 253.7) mg/kg and ranged from 3.7 to 750 mg/kg. The highest detection was from a sample collected in quadrant E63 in Edgefield County. The random background samples had detections averaging 539 (± 569) mg/kg and ranged from 17 to 2000 mg/kg. The highest detection was from a sample collected in quadrant B55 in Laurens County. Although a number of samples exceeded the ESV of 100 and were also higher than the state average of 100 mg/kg (Canova 1999) they were below the PRG of 1,800 mg/kg. A statistical summary can be found in Section 3.1.3, Table 8. Data for all metals detected can be found in Section 3.1.4. The statistical data tables are found in Section 3.1.5.

SCDHEC and DOE-SR Data Comparison

Cesium-137, cobalt-60 (Co-60) and Am-241 were the only gamma emitting radionuclides where SCDHEC and DOE-SR shared analytical results. Since there were no detections of Co-60 in either dataset, and SCDHEC did not have any detections of Am-241 above the MDA, only Cs-137 will be compared. DOE-SR did not analyze for alpha or beta emitting radionuclides, nor did they analyze for metals. Samples varied by both location and in number. ESOP collected 31 samples within 50 miles of SRS while DOE-SR collected 15 samples near the SRS perimeter and within 25 miles. ESOP sampled 15 background locations greater than 50 miles from SRS in order to achieve a background average. DOE-SR sampled one background location 100 miles from SRS. Samples were collected from a variety of soil types that should be taken into consideration in regards to data interpretation. Comparative data can be found in Section 3.1.3, Tables 5 and 6.

Cesium-137 was detected within 50 miles of SRS by both DOE-SR and SCDHEC at a rate of 14 detections from the 15 DOE-SR samples and 25 detections of the 31 SCDHEC samples. Cesium-137 was not detected in the DOE-SR background location but was in 12 of the SCDHEC 15 background locations. For the 2008 samples, the SCDHEC perimeter (all samples <50 miles) average for Cs-137 was 0.856 pCi/g with a standard deviation of 1.841 pCi/g. The average for all the background samples was 0.331 (± 0.278) pCi/g. The DOE-SR Cs-137 average for all perimeter samples and those within 50 miles of SRS was 0.1670 (± 0.0796) pCi/g. The background concentration was below the Minimum Detectable Concentration (MDC) of 0.0359 pCi/g (SRNS 2009). The SCDHEC average for Cs-137 falls within one standard deviation (SD) of the DOE-SR data.

Cesium-137 was the only consistently analyzed parameter over past years. Trending data for Cs-137 in SRS perimeter samples is in Figure 6, Section 3.1.3. SCDHEC has trended Cs-137 since 2003 (SCDHEC 2004b, 2005a, 2006a, 2007b, 2008a). Data shows that average levels of Cs-137 in surface soils held steady from 2003 to 2005. There were slightly higher levels in 2006 and even higher levels in 2007. 2008 results show a decline from the previous year. DOE-SR data shows steady levels from 2003-2004, slightly higher in 2005 and 2006 and the lowest average in 2007 (WSRC 2004, 2005c, 2006, 2007, 2008a). The 2008 data shows a slight increase from 2007. This contrasts the SCDHEC data. The results found by both SCDHEC and DOE-SR are influenced by both number of samples to determine the average and by sampling different locations. The average level of Cs-137 in surface soil can vary due to the highly variable nature of soils. Radiocesium bioavailability in soil is influenced by soil properties such as clay content, pH, organic matter, and soil microflora (Absalom et al. 2001). The increase of Cs-137 in the SCDHEC samples could be due to the 2006 addition of samples in closer proximity to the boundary of SRS. In the previous years only random samples within 50 miles of the SRS center point were sampled to determine the yearly average. In 2007, the addition of sampling at public boat landings was initiated. Excursions outside normally expected levels contributed through fallout occurred at boat landings just downstream of SRS. These areas have historically been impacted by SRS operations and higher than background results are to be expected. These gave higher averages in 2006, 2007 and 2008. DOE-SR does not collect samples at these locations.

SCDHEC did not detect Americium-241 in the 2008 surface soil samples. DOE-SR had detections in five perimeter samples at an average of 0.0031 (± 0.0007) pCi/g and at the background location (0.0033 pCi/g). The average MDA for the 2008 SCDHEC surface soil samples was 0.1016 pCi/g, which is much higher than the DOE-SR MDC of 0.0039 pCi/g. Since DOE-SR has a much lower MDC, this may explain why the SCDHEC data does not report detections above the MDA.

Statistical Summary

Random background (B) sample averages were subtracted from random perimeter (E) sample averages to determine the SRS random environmental concentrations above background (Tables 7-8, Section 3.1.3). If this number was greater than zero and it was a man-made radionuclide associated with SRS, then further statistical analysis was conducted. Statistical analysis of data between SCDHEC and DOE-SR cannot be done since DOE-SR does not conduct random sampling. However, since SCDHEC collects random samples, a statistical comparison can be done between SRS perimeter and SC background samples. This comparison can be used to determine the statistical significance of any differences encountered between perimeter and background samples collected by SCDHEC. SCDHEC data can be compared to DOE-SR data using standard deviation. Although the “E-B” was not greater than zero for Cs-137 for the average of the 2008 samples, the median value was greater than zero. Statistical testing for all samples from 2004-2008 was performed.

Statistical analyses of Cs-137 were done using SCDHEC random sampling averages. Nonparametric Wilcoxon-Mann-Whitney and Quantile statistical tests (USEPA 2007b) of 48 perimeter and 48 background observations were used to test the hypothesis that the study area (50-mile SRS perimeter) and the South Carolina background are the same for the stated radionuclide based locations. The 2008 surface soil Cs-137 null hypothesis was not rejected.

When the random perimeter and random background samples were averaged, only lead-212, and actinium-228 had an “E-B” average greater than zero. The median E-B value for Cs-137 was greater than zero although the average was less than zero. These averages were calculated to provide a more accurate characterization of the contaminant concentrations throughout the sampling area. DOE-SR did not conduct analysis of lead-212, and actinium-228. These are NORM and any detected levels may result from the decay of natural products. Cesium-137 is a fission product and any elevated levels could be related to anthropogenic activity. The SCDHEC data was used to calculate “E-B” averages from the “detections only” data for metals. Only one metal, chromium, had an “E-B” average greater than zero. The beryllium median E-B value was greater than zero, although the average was not. All of these averages were below the Region 9 PRG for residential soil established by the USEPA (USEPA 2009c).

Conclusions and Recommendations

ESOP will continue independent monitoring of SRS perimeter surface soil and will periodically evaluate modification of the monitoring activities to better accomplish project goals and objectives. Monitoring will continue as long as there are activities at the SRS that create the potential for contamination entering the environment. Continued monitoring will provide an improved understanding of radionuclide and non-radionuclide activity in SRS perimeter surface soils and the surrounding areas. Additional monitoring will impart valuable information to human health exposure pathways. Trending of data over multiple years will give a more definitive answer as to whether radionuclide concentrations in the SRS area are declining due to radioactive decay or possibly increasing due to disturbances on SRS. The comparison of data results allows for independent data verification of DOE-SR monitoring activities. Cooperation between DOE-SR and SCDHEC provides credibility and confidence in the information being provided to the public.

In 2009, SCDHEC will continue to monitor the surface soil along the perimeter of SRS for radionuclides. Riverbank soil samples will be collected from the publicly accessible Savannah River watershed boat landings where human exposure is likely. Additional samples from the Steel Creek boat landing area will be evaluated as a result of previous elevated Cs-137 levels and potential for public exposure. Other locations will be sampled to evaluate impacts of SRS within the surrounding area as well as sampling multiple background locations for a comparison to ambient levels of radionuclides. Metal analysis will be limited to the perimeter of SRS. These analyses will be compared to averages of data collected over the past five years. The SCDHEC data at this time does not show there is an impact of elevated metal concentrations to areas outside of SRS. However, continued monitoring along the perimeter of SRS is still necessary due to the potential impact of SRS site operations to the surrounding environments. Possible atmospheric releases due to burning and soil disturbance at SRS could elevate metals in the surrounding area. Only through continued monitoring will this be determined. Should metal levels elevate in the perimeter samples; additional samples in the area will also be evaluated.

In order to better compare the environmental monitoring programs of SCDHEC and DOE-SR, a portion of the surface soil samples will be collected as split samples in cooperation with DOE-SR personnel. Each program will then independently analyze the samples for radionuclides and results will be compared in the 2009 ESOP Data Report. SCDHEC will perform metal analysis on the split samples although DOE-SR does not include the analysis of metals in their surface soil monitoring program.

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3.1.2 Surface Soil Monitoring Adjacent to SRS

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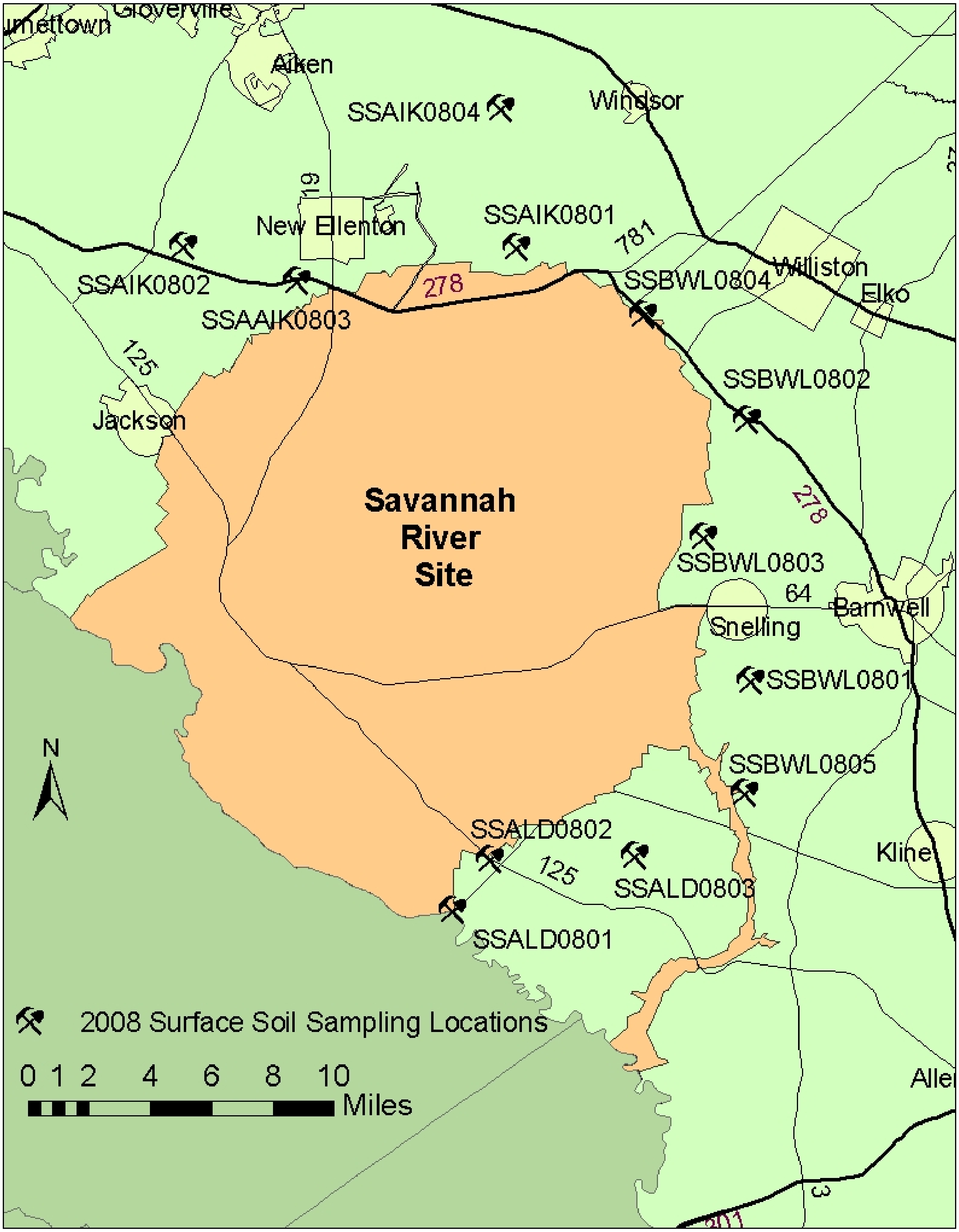
Map 8. SRS Perimeter Surface Soil Monitoring Locations



3.1.3 Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Table 1. Random Soil Samples Collected in 2008

Random Quadrants Outside the 50-mile SRS Perimeter or "B" Quadrants.

Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long	Geological Region
B49	Elloree	3330 by 3337.5 and -8030 by -8037.5	LCP
B51	Stallsville	3252.5 by 3300 and -8007.5 by -8015	LCP
B53X&E25X	Clarks Hill (GAX)	3337.5 by 3345 and -8207.5 by -8215	PM
B54	Stover	3430 by 3437.5 and -8100 by -8107.5	PM
B55	Ware Shoals East	3422.5 by 3430 and -8207.5 by -8015	PM
B56	Chicora	3315 by 3322.5 and -8000 by -8007.5	LCP
B57	Ninety Six	3407.5 by 3415 and -8200 by -8207.5	PM
B58	Anderson North	3430 by 3437.5 and -8237.5 by -8245	PM
B59	Parris Island	3215 by 3222.5 and -8037.5 by -8045	LCP
B60	Winnsboro Mills	3415 by 3422.5 and -8100 by -8107.5	PM
B61	Bennetts Point	3230 by 3237.5 and -8022.5 by -8030	LCP
B62	Butlers Sav	3330 by 3337.5 and -8000 by -8007.5	LCP
B63	Gadsden	3345 by 3352.5 and -8045 by -8052.5	UCP

Random Quadrants Within SRS Perimeter or "E" Quadrants

Quad	7.5' Quad Name	Latitude by Lat and Longitude by Long	Geological Region
E51	Crocketville	3252.5 by 3300 and -8100 by -8107.5	LCP
E53	New Ellenton	3322.5 by 3330 and -8137.5 by -8145	UCP
E54X&B80X	Wolfton(50mi.)	3330 by 3337.5 and -8052.5 by -8100	UCP
E55	Bamburg	3315 by 3322.5 and -8100 by -8107.5	UCP
E56X&B85X	Branchville North(50mi.)	3315 by 3322.5 and -8045 by -8052.5	LCP
E57	North Augusta	3330 by 3337.5 and -8152.5 by -8200	UCP
E58	Tony Hill Bay	3307.5 by 3315 and -8052.5 by -8100	LCP
E59	Williston	3322.5 by 3330 and -8122.5 by -8130	UCP
E61	Shirley	3237.5 by 3245 and -8115 by -8122.5	LCP
E62	New Ellenton SW	3315 by 3322.5 and -8137.5 by -8145	UCP
E63X&B86X	Owdoms(50mi.)	3352.5 by 3400 and -8152.5 by -8200	PM
E64	Martin	3300 by 3307.5 and -8122.5 by -8130	LCP

1. The randomly selected quadrants are from a United States Department of Interior 7.5 Minute Topographic Map Printed by the South Carolina Land Resources Commission, Rv 10/92.
2. "**X**" in any designated ID represents the presence of an **exclusion zone** of either a state border, 50 mi. limit bisector line that splits the quad area into an environmental side and a background side, or occurrence of background random pick area within 10 miles of a nuclear facility.
3. "**E**" means this is a pick selected for SRS perimeter (outside SRS from center point 33 deg. 15' 00" & -81deg. 37' 30"). Public dose outside of SRS and within 10 mi. of a reactor are not excluded for "E" sar
4. "**B**" means this is a South Carolina background pick outside of the 50 mile limit from SRS center point. Ten mile exclusion zone in "B" quads is used to reduce influence of any local reactor on SC background.
5. Parenthesis info by quad name identifies type of exclusion (NCX is North Carolina, GAX is Georgia, NRX is nuclear reactor, SRS is Savannah River Site exclusion zone border).
6. Purpose of random sampling is to compare public dose within 50 miles of SRS to a S. C. background.
7. Geological Regions are Blue Ridge (BR), Piedmont (PM), Upper & Lower Coastal Plain (U&LCP). Quadrants split by geological regions are assigned to the upper most region in the quadrant.

Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Table 2. Nonrandom Soil Samples Collected in 2008

2008 ESOP Surface Soil Sample Locations	
Sample Location	**Location Description**
SSAIK-0801	Aiken County, North of SRS
SSAIK-0802	Aiken County, North West of SRS
SSAIK-0803	Aiken County, North North West of SRS
SSAIK-0804	Aiken County, North of SRS
SSALD-0801	Allendale County, South of SRS
SSALD-0802	Allendale County, South South East of SRS
SSALD-0803	Allendale County, South East of SRS
SSBWL-0801	Barnwell County, East Southeast of SRS
SSBWL-0802	Barnwell County, Northeast of SRS
SSBWL-0803	Barnwell County, East of SRS
SSBWL-0804	Barnwell County, North Northeast of SRS
SSBWL-0805	Barnwell County, Southeast of SRS
SSPRA001	Parksville Recreation Area Boat Landing, McCormick County
SSFF001	Fury's Ferry Boat Landing, McCormick County
SSJBL002	Jackson Boat Landing, Aiken County
SSSCL002	Steel Creek Landing, Barnwell County
SSLHL002	Little Hell Landing, Allendale County
SSJL001	Johnson's Landing, Allendale County
SS301GA002	Burton's Ferry Landing near HWY. 301 Bridge, Screven County, GA
SSCB001	Cohen's Bluff Landing, Allendale County
SSSBL001	Stoke's Bluff Landing, Hampton County

Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Table 3. Radiological Analytes

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Note: Units are reported in pCi/g.

Table 4. Nonradiological Analytes

Analyte	Abbreviation	MDL
Silver	Ag	3.0
Aluminum	Al	10
Arsenic	As	10
Boron	B	10
Barium	Ba	5.0
Beryllium	Be	0.30
Cadmium	Cd	1.0
Cobalt	Co	2.0
Chromium	Cr	1.0
Copper	Cu	1.0
Iron	Fe	2.0
Mercury	Hg	0.10
Magnesium	Mg	5.0
Manganese	Mn	1.0
Molybdenum	Mo	2.0
Nickel	Ni	2.0
Lead	Pb	5.0
Antimony	Sb	5.0
Selenium	Se	10
Thallium	Tl	50
Tin	Sn	50
Titanium	Ti	2.0
Vanadium	V	2.0
Zinc	Zn	1.0

Note: Units are reported in mg/kg.

Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Table 5. Surface Soil Data Comparison: SCDHEC and DOE-SR Surface Soil Samples Collected Off-Site and Within 50 miles of the SRS Center Point.

SCDHEC

Sample ID	County	Cs-137
SSE59	Aiken	<0.040
SSE55	Bamberg	**0.795**
SSE64	Allendale	**0.145**
SSE62	Aiken	**0.322**
SSE53	Aiken	<0.027
SSE57	Aiken	**0.257**
SSE63	Edgefield	<0.027
SS E51	Hampton	**0.2709**
SS E54	Orangeburg	<0.024
SS E56	Orangeburg	**0.2333**
SS E61	Hampton	**0.0985**
SS E58	Bamberg	**0.0621**
SSALD-0801	Allendale	**7.952**
SSALD-0802	Allendale	**0.512**
SSBWL-0801	Barnwell	**0.226**
SSBWL-0802	Barnwell	<0.037
SSAIK-0801	Aiken	**0.084**
SSAIK-0802	Aiken	<0.030
SSBWL-0803	Barnwell	**0.3211**
SSBWL-0804	Barnwell	**0.2412**
SSAIK-0803	Aiken	**0.6600**
SSALD-0803	Allendale	**0.2480**
SSBWL-0805	Barnwell	**0.3241**
SSAIK-0804	Aiken	**1.004**
Cohen's Bluff	Allendale	**0.2945**
Burton's Ferry	Screven	**0.2669**
Johnson's Landing	Allendale	**0.8452**
Little Hell Landing	Allendale	**0.1294**
Steel Creek Landing	Barnwell	**5.6860**
Fury's Ferry	McCormick	**0.2731**
Jackson Boat Landing	Aiken	**0.1398**
AVG		**0.8557**
MEDIAN		**0.2709**
STD		**1.8405**

DOE-SR Off-Site Samples

Sample Location	Cs-137
Allendale Gate	**0.0711**
Barnwell Gate	**0.2050**
D-Area	**0.3590**
Darkhorse @ Williston Gate	**0.1740**
East Talatha	**0.2430**
Green Pond	**0.1180**
Highway 21/167	**0.1660**
Jackson	**0.1160**
Patterson Mill Road	**0.2310**
Talatha Gate	**0.0697**
West Jackson	**0.1220**
Windsor Road	**0.0832**
Aiken Airport	**0.1910**
Augusta Lock and Dam 614	**0.1950**
Highway 301 @ State Line	< -0.0002
AVG	**0.1670**
MEDIAN	**0.1700**
STD	**0.0796**

Note: Units in picocuries per gram (pCi/g).

Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Table 6. Surface Soil Data Comparison: SCDHEC and DOE-SR Surface Soil Samples Collected > 50 miles From the SRS Center Point.

SCDHEC

Sample ID	County	Cs-137
SSB62	Clarendon	**0.205**
SSB49	Orangeburg	**0.119**
SSB63	Richland	<0.051
SSB58	Anderson	**0.686**
SSB53	McCormick	**1.02**
SSB55	Laurens	**0.143**
SSB57	Greenwood	**0.391**
SS B56	Berkeley	**0.3675**
SS B51	Dorchester	**0.0798**
SS B59	Beaufort	**0.1842**
SS B61	Colleton	**0.1459**
SS B54	Chester	**0.1978**
SS B60	Fairfield	<0.0366
SS SBL001	Hampton	**0.4283**
SS PRA001	McCormick	<0.0122
AVG		**0.3306**
MEDIAN		**0.2012**
STD		**0.2777**

DOE-SR

Sample ID	Sample Location	Cs-137
100-Mile Radius	Savannah, GA	<0.0359

Note: Units in picocuries per gram (pCi/g).

Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Table 7. Gamma statistics for random SRS perimeter and SC background surface soil samples collected in 2008.

RANDOM SAMPLES ONLY

	Perimeter Samples (<50 Miles)			Background Samples (>50 miles)			E-B	E-B
Analyte	Average	Standard Deviation	Median	Average	Standard Deviation	Median	Average	Median
K-40	2.687	2.279	1.384	9.376	10.659	4.467	-6.689	-3.083
Cs-137	0.273	0.229	0.245	0.322	0.289	0.198	-0.049	0.048
Pb-212	1.215	0.792	0.981	1.008	0.467	0.955	0.208	0.026
Pb-214	1.018	0.574	0.849	1.138	0.599	0.993	-0.121	-0.144
Ra-226	2.459	1.141	2.170	2.885	1.696	2.450	-0.425	-0.280
Ac-228	1.453	0.666	1.386	1.122	0.400	1.128	0.331	0.259
U/Th-238	N/A	N/A	N/A	3.277	N/A	3.277	N/A	N/A

Table 8. Metals statistics for random SRS perimeter and SC background surface soil samples collected in 2008.

RANDOM SAMPLES ONLY

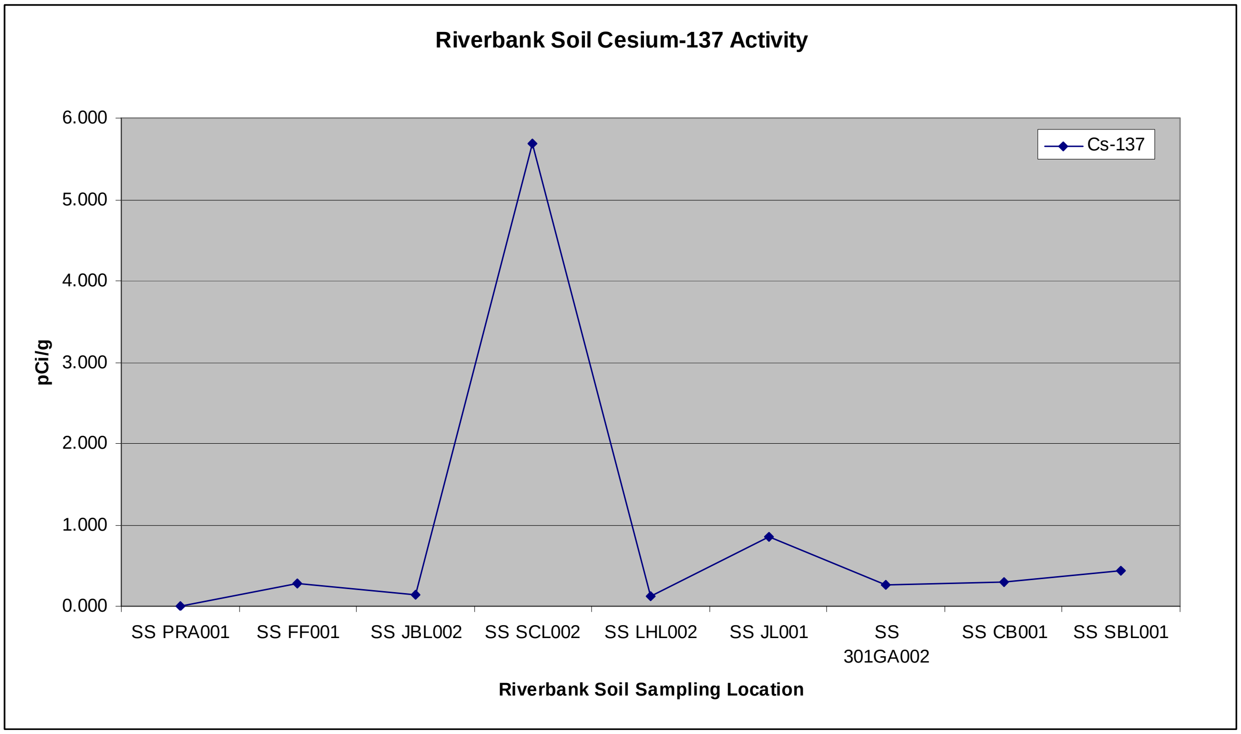
	Perimeter Samples (<50 Miles)			Background Samples (>50 miles)			E-B	E-B
Analyte	Average	Standard Deviation	Median	Average	Standard Deviation	Median	Average	Median
Aluminum	7671	10991	4400	8915	5840	8600	-1245	-4200
Barium	34.7	26.4	29.0	55.0	45.7	37.0	-20.3	-8.0
Beryllium	0.53	0.17	0.48	0.53	0.19	0.47	-0.01	0.01
Cadmium	2.9	1.5	3.0	3.3	2.1	3.2	-0.4	-0.3
Chromium	18.6	39.6	6.5	13.2	12.8	8.4	5.3	-1.9
Cobalt	6.4	0.3	6.4	8.5	2.7	8.6	-2.1	-2.2
Copper	2.2	1.3	1.5	8.4	7.5	5.1	-6.2	-3.6
Iron	5577	6509	3250	10023	9784	4000	-4446	-750
Lead	12.1	6.7	10.0	13.7	6.9	12.5	-1.7	-2.5
Magnesium	123.9	197.5	59.0	547.8	797.7	170.0	-423.9	-111.0
Manganese	192.0	253.7	84.0	538.9	568.7	510.0	-346.9	-426.0
Nickel	4.1	2.7	3.2	6.5	3.2	5.7	-2.5	-2.5
Titanium	82	61	71	235	223	140	-153	-70
Vanadium	16.8	16.0	9.6	26.0	25.4	13.0	-9.1	-3.4
Zinc	8.1	6.4	6.0	20.7	11.9	25.0	-12.6	-19.1

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Tables and Figures

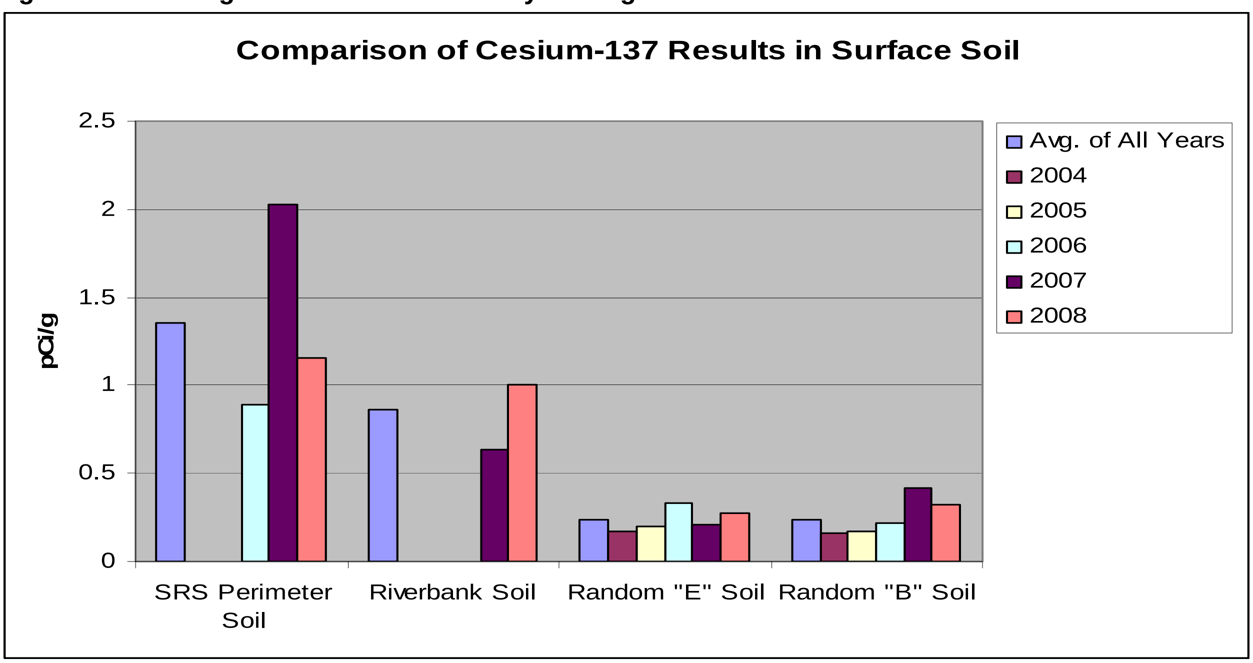
Surface Soil Monitoring Adjacent to SRS

Figure 1. Cesium-137 Levels in Savannah River Riverbank Surface Soil Samples



Note: Graph depicts samples in order of location along the Savannah River. The most upstream sample is on the left and the most downstream sample is on the right of the graph.

Figure 2. Trending Data for Cesium-137 by Average of 2004-2008 and Individual Years

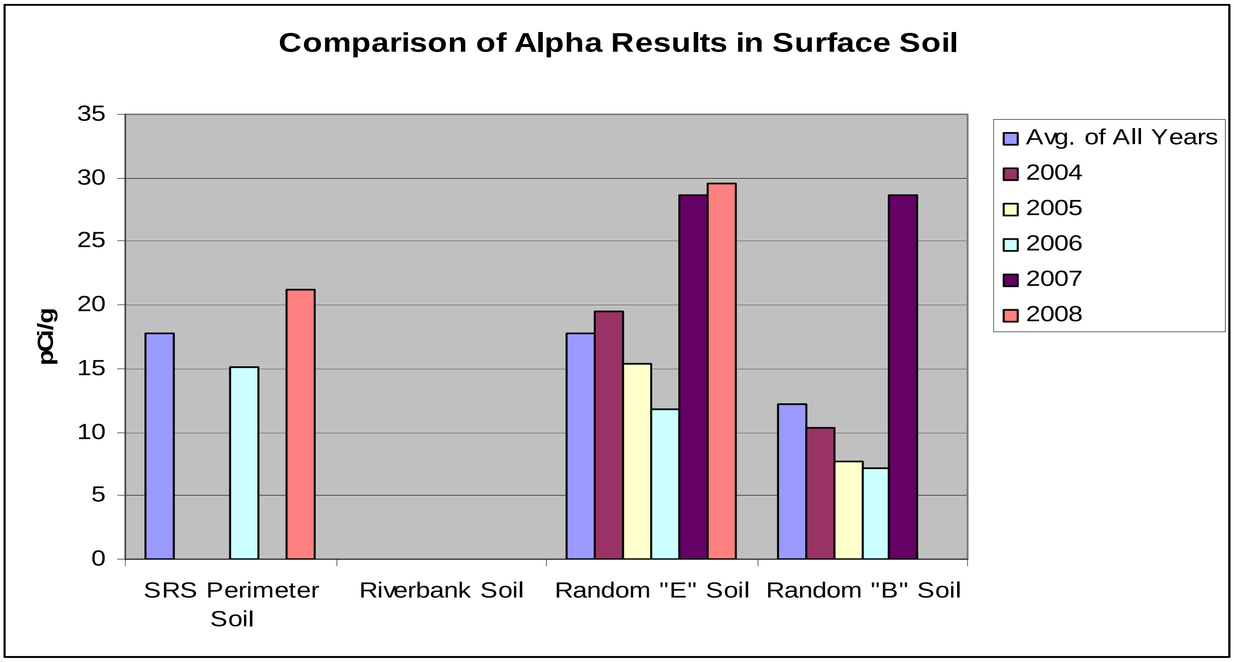


Note: There were no samples collected from the SRS perimeter in 2004 and 2005. There were no samples collected from riverbank soil from 2004-2006.

Tables and Figures

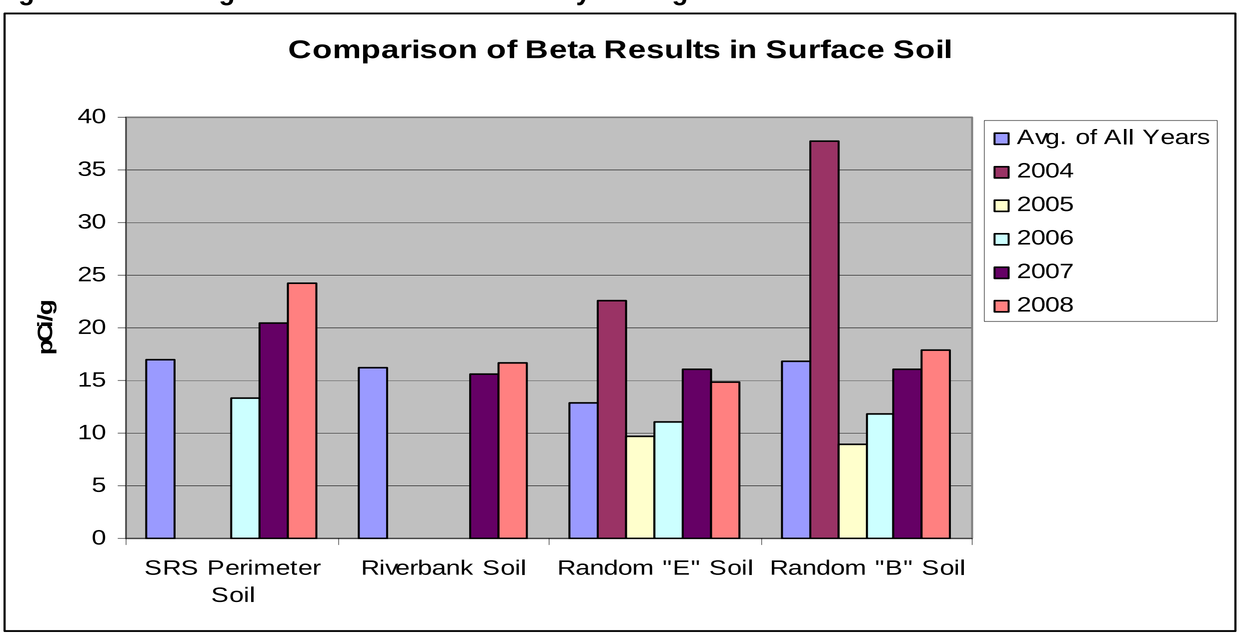
Surface Soil Monitoring Adjacent to SRS

Figure 3. Trending Data for Alpha Detections by Average of 2004-2008 and Individual Years



Note: There were no samples collected from the SRS perimeter in 2004 and 2005. There were no samples collected from riverbank soil from 2004-2006. There were no alpha detections in any of the riverbank soil samples.

Figure 4. Trending Data for Beta Detections by Average of 2004-2008 and Individual Years



Note: There were no samples collected from the SRS perimeter in 2004 and 2005. There were no samples collected from riverbank soil from 2004-2006.

Tables and Figures

Surface Soil Monitoring Adjacent to SRS

Figure 5. Average of All Metals Data to Compare Locations

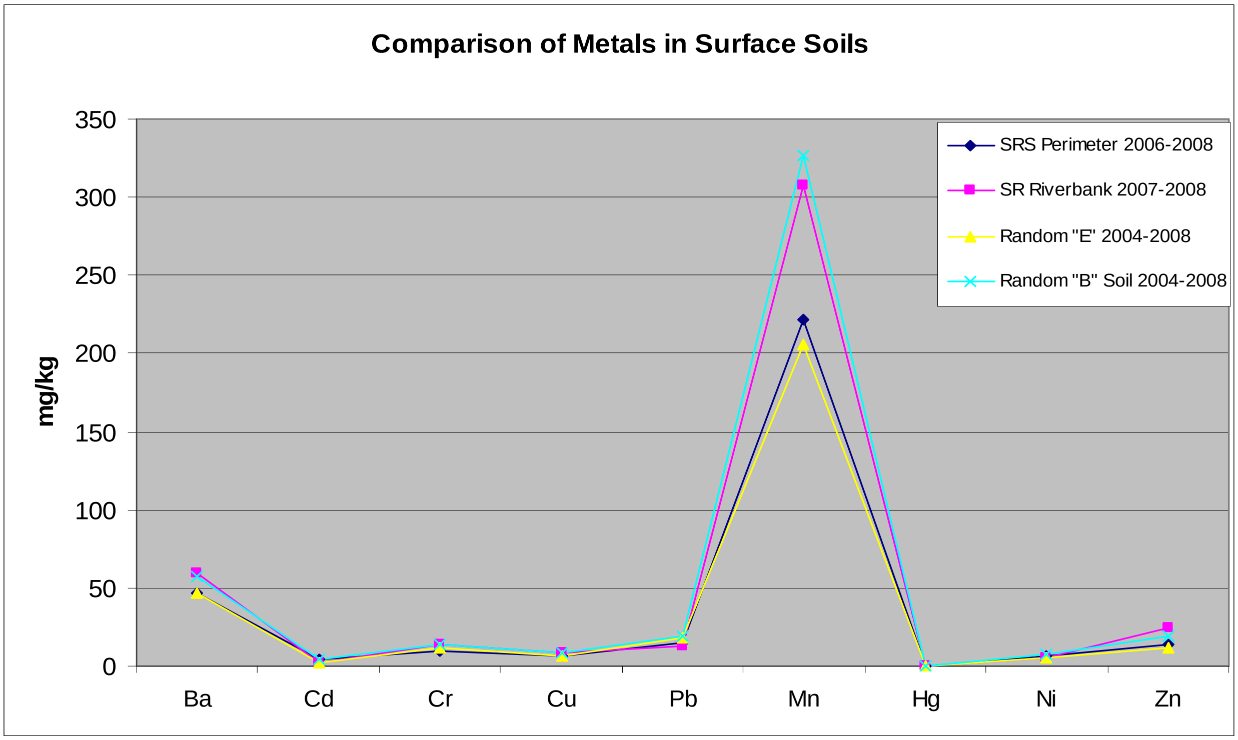
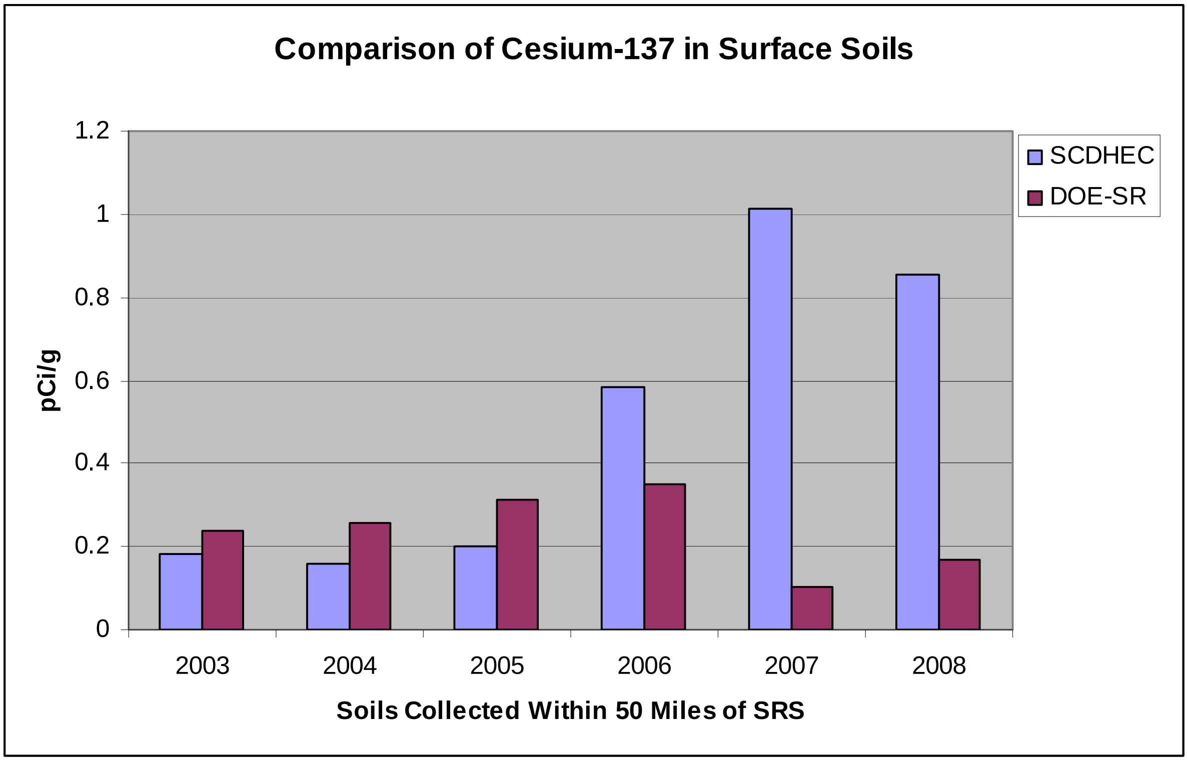


Figure 6. SCDHEC and DOE-SR Trending Data for Cesium-137



TOC

3.1.4 Data

Surface Soil Monitoring Adjacent to SRS

Notes:
1. Bold numbers denotes a detection.
2. LLD= Lower Limit of Detection
3. MDA= Minimum Detectable Activity
4. MDL = Minimum Detection Limit
5. NA = Not Applicable
6. NA Following ±2 SIGMA occurs when the sample is <LLD or <MDA.
7. SS= Surface soil
8. <# = Data is < MDL

2008 Alpha, Beta and Gamma Detections for Nonrandom SRS Perimeter Surface Soil Samples

Location Description	SSALD-0801	SSALD-0802	SSBWL-0801	SSBWL0802	SSAIK0801	SSAIK0802
County	Allendale	Allendale	Barnwell	Barnwell	Aiken	Aiken
Collection Date	1/25/2008	3/14/2008	3/14/2008	5/2/2008	5/2/2008	5/15/2008
Alpha Activity	**19.7**	<LLD	<LLD	<LLD	<LLD	**22.7**
Alpha Confidence Interval (± 2 SD)	**14.1**	NA	NA	NA	NA	**15.0**
Alpha LLD	**16.3**	16.3	16.0	18.9	17.9	**18.3**
Beta Activity	**24.0**	<LLD	<LLD	<LLD	<LLD	<LLD
Beta Confidence Interval (± 2 SD)	**5.54**	NA	NA	NA	NA	NA
Beta LLD	**7.72**	7.92	8.04	8.83	9.03	8.91
K-40 Activity	**12.29**	**1.518**	<MDA	<MDA	**2.163**	**1.535**
K-40 Confidence Interval (± 2 SD)	**1.215**	**0.558**	NA	NA	**0.433**	**0.307**
K-40 MDA	**0.491**	**0.484**	0.402	0.243	**0.270**	**0.223**
Cs-137 Activity	**7.952**	**0.512**	**0.226**	<MDA	**0.084**	<MDA
Cs-137 Confidence Interval (± 2 SD)	**0.617**	**0.071**	**0.051**	NA	**0.036**	NA
Cs-137 MDA	**0.063**	**0.059**	**0.046**	0.037	**0.035**	0.030
Pb-212 Activity	**1.482**	**1.011**	**1.05**	**2.545**	<MDA	<MDA
Pb-212 Confidence Interval (± 2 SD)	**0.168**	**0.116**	**0.120**	**0.222**	NA	NA
Pb-212 MDA	**0.062**	**0.049**	**0.041**	**0.041**	0.041	0.029
Pb-214 Activity	**1.447**	**1.07**	**0.588**	**1.368**	**1.459**	**1.111**
Pb-214 Confidence Interval (± 2 SD)	**0.142**	**0.111**	**0.082**	**0.098**	**0.101**	**0.077**
Pb-214 MDA	**0.154**	**0.108**	**0.083**	**0.064**	**0.069**	**0.047**
Ra-226 Activity	**3.847**	**2.34**	<MDA	**2.53**	**2.875**	**2.247**
Ra-226 Confidence Interval (± 2 SD)	**1.249**	**0.891**	NA	**0.769**	**0.787**	**0.535**
Ra-226 MDA	**1.42**	**0.997**	0.879	**0.714**	**0.728**	**0.558**
Ac-228 Activity	**1.638**	<MDA	**0.713**	**2.535**	**1.251**	**0.840**
Ac-228 Confidence Interval (± 2 SD)	**0.196**	NA	**0.127**	**0.149**	**0.123**	**0.084**
Ac-228 MDA	**0.196**	0.371	**0.147**	**0.097**	**0.137**	**0.080**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.067	0.824	0.675	0.702	0.700	0.504

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Nonrandom SRS Perimeter Surface Soil Samples

Location Description	SS BWL 0803	SS BWL 0804	SS AIK 0803	SS ALD 0803	SS BWL 0805	SS AIK 0804
	Barnwell	Barnwell	Aiken	Allendale	Barnwell	Aiken
Collection Date	8/29/2008	8/29/2008	8/29/2008	12/2/2008	12/2/2008	12/2/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Alpha LLD	25.7	28.2	27.6	25.5	28.8	28.2
Beta Activity	<LLD	<LLD	<LLD	<LLD	**10.4**	**38.5**
Beta Confidence Interval (± 2 SD)	NA	NA	NA	NA	**4.79**	**6.29**
Beta LLD	8.99	9.22	8.64	7.52	**7.72**	**7.38**
K-40 Activity	**0.6135**	**0.7353**	**3.452**	**2.048**	**0.7664**	**3.639**
K-40 Confidence Interval (± 2 SD)	**0.225**	**0.2717**	**0.6114**	**0.4152**	**0.2972**	**1.200**
K-40 MDA	**0.1749**	**0.2088**	**0.3423**	**0.2244**	**0.2150**	**1.223**
Cs-137 Activity	**0.3211**	**0.2412**	**0.6600**	**0.2480**	**0.3241**	**1.004**
Cs-137 Confidence Interval (± 2 SD)	**0.0404**	**0.0371**	**0.0714**	**0.0382**	**0.0468**	**0.1454**
Cs-137 MDA	**0.0238**	**0.0277**	**0.0400**	**0.0324**	**0.0246**	**0.1246**
Pb-212 Activity	<MDA	**0.6735**	**2.172**	**1.203**	**0.6771**	**1.899**
Pb-212 Confidence Interval (± 2 SD)	NA	**0.0823**	**0.1999**	**0.1174**	**0.0731**	**0.2556**
Pb-212 MDA	0.0232	**0.0246**	**0.0536**	**0.0527**	**0.0429**	**0.2184**
Pb-214 Activity	**0.6244**	**0.7528**	**2.696**	**1.095**	**0.6883**	**20.26**
Pb-214 Confidence Interval (± 2 SD)	**0.0535**	**0.0662**	**0.1529**	**0.0830**	**0.0644**	**0.8591**
Pb-214 MDA	**0.0426**	**0.0496**	**0.0843**	**0.0631**	**0.0494**	**0.2620**
Ra-226 Activity	**1.404**	**1.268**	**4.693**	**3.040**	**1.244**	**47.80**
Ra-226 Confidence Interval (± 2 SD)	**0.5409**	**0.6012**	**0.9785**	**0.7084**	**0.5401**	**4.717**
Ra-226 MDA	**0.4443**	**0.5370**	**0.9285**	**0.6491**	**0.5077**	**2.677**
Ac-228 Activity	**0.6381**	**0.8533**	**2.195**	**1.222**	**0.6327**	<MDA
Ac-228 Confidence Interval (± 2 SD)	**0.0756**	**0.0936**	**0.1644**	**0.1096**	**0.0764**	NA
Ac-228 MDA	**0.0713**	**0.0938**	**0.1577**	**0.1064**	**0.0723**	0.7175
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	0.4549	0.4199	0.8397	0.6162	0.5119	2.571

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Savannah River Boat Landing Riverbank Soil Samples

Location Description	SS SBL001	SS CB001	SS 301GA002	SS JL001	SS LHL002
	Stokes Bluff Landing	Cohen's Bluff	Burton's Ferry landing	Johnson's Landing	Little Hell Landing
Collection Date	7/23/2008	7/23/2008	7/23/2008	7/23/2008	7/23/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
Alpha LLD	25.7	27.5	27.3	27.0	26.9
Beta Activity	**10.8**	**19.3**	**14.8**	**17.0**	**12.9**
Beta Confidence Interval (± 2 SD)	**4.82**	**5.43**	**5.09**	**5.26**	**4.85**
Beta LLD	**7.85**	**8.07**	**7.90**	**8.03**	**7.66**
K-40 Activity	**10.25**	**18.64**	**14.74**	**14.12**	**2.629**
K-40 Confidence Interval (± 2 SD)	**0.8147**	**1.325**	**1.072**	**1.126**	**0.3274**
K-40 MDA	**0.1508**	**0.1557**	**0.1662**	**0.2559**	**0.1511**
Cs-137 Activity	**0.4283**	**0.2945**	**0.2669**	**0.8452**	**0.1294**
Cs-137 Confidence Interval (± 2 SD)	**0.0459**	**0.0396**	**0.0382**	**0.0796**	**0.0286**
Cs-137 MDA	**0.0216**	**0.0215**	**0.0219**	**0.0332**	**0.0280**
Pb-212 Activity	**1.148**	**1.406**	**1.439**	**1.381**	**1.688**
Pb-212 Confidence Interval (± 2 SD)	**0.1052**	**0.1252**	**0.1277**	**0.1347**	**0.1498**
Pb-212 MDA	**0.0411**	**0.0435**	**0.0424**	**0.0418**	**0.0325**
Pb-214 Activity	**1.2610**	**1.340**	**1.5070**	**1.360**	**0.8751**
Pb-214 Confidence Interval (± 2 SD)	**0.0791**	**0.0831**	**0.0892**	**0.0973**	**0.0681**
Pb-214 MDA	**0.0417**	**0.0441**	**0.0447**	**0.0710**	**0.0482**
Ra-226 Activity	**2.811**	**2.904**	**2.807**	**3.037**	**1.696**
Ra-226 Confidence Interval (± 2 SD)	**0.6074**	**0.6524**	**0.5752**	**0.7730**	**0.5426**
Ra-226 MDA	**0.5112**	**0.5393**	**0.5413**	**0.7627**	**0.5617**
Ac-228 Activity	**1.165**	**1.414**	**1.373**	**1.415**	**1.806**
Ac-228 Confidence Interval (± 2 SD)	**0.0857**	**0.0955**	**0.0989**	**0.1349**	**0.1061**
Ac-228 MDA	**0.0671**	**0.0723**	**0.0733**	**0.1324**	**0.0803**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA
U/Th-238 MDA	1.243	0.8870	0.9503	0.6891	0.3582

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Savannah River Boat Landing Riverbank Soil Samples

Location Description	SS SCL002	SS PRA001	SS FF001	SS JBL002
	Steel Creek Landing	Parksville	Fury's Ferry	Jackson Landing
Collection Date	7/23/2008	7/24/2008	7/24/2008	7/25/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA
Alpha LLD	26.6	27.1	28.4	26.7
Beta Activity	**23.0**	<LLD	**23.6**	**11.4**
Beta Confidence Interval (± 2 SD)	**5.81**	NA	**5.57**	**4.94**
Beta LLD	**8.29**	8.31	**7.80**	**8.09**
K-40 Activity	**18.73**	**10.95**	**18.38**	**11.16**
K-40 Confidence Interval (± 2 SD)	**1.339**	**0.7870**	**1.304**	**0.8583**
K-40 MDA	**0.153**	**0.1006**	**0.1783**	**0.1651**
Cs-137 Activity	**5.6860**	<MDA	**0.2731**	**0.1398**
Cs-137 Confidence Interval (± 2 SD)	**0.4497**	NA	**0.0314**	**0.0228**
Cs-137 MDA	**0.0286**	0.0122	**0.0188**	**0.0213**
Pb-212 Activity	**1.596**	<MDA	**1.135**	**1.343**
Pb-212 Confidence Interval (± 2 SD)	**0.1431**	NA	**0.1040**	**0.1200**
Pb-212 MDA	**0.0545**	0.0231	**0.0394**	**0.0413**
Pb-214 Activity	**1.503**	**0.3252**	**1.029**	**1.278**
Pb-214 Confidence Interval (± 2 SD)	**0.0999**	**0.0303**	**0.0713**	**0.0773**
Pb-214 MDA	**0.0635**	**0.0255**	**0.0416**	**0.0436**
Ra-226 Activity	**3.161**	**0.8908**	**2.402**	**2.619**
Ra-226 Confidence Interval (± 2 SD)	**0.7745**	**0.3283**	**0.5880**	**0.6033**
Ra-226 MDA	**0.7001**	**0.2918**	**0.4961**	**0.5302**
Ac-228 Activity	**1.533**	**0.5637**	**1.157**	**1.322**
Ac-228 Confidence Interval (± 2 SD)	**0.1102**	**0.0476**	**0.0864**	**0.0967**
Ac-228 MDA	**0.0787**	**0.0414**	**0.0777**	**0.0727**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA
U/Th-238 MDA	1.068	0.6522	1.159	0.9433

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Random Perimeter (<50 miles) Surface Soil Samples

Location Description	SSE59	SSE55	SSE64	SSE62	SSE53	SSE57
Collection Date	1/24/2008	1/24/2008	1/25/2008	4/29/2008	4/29/2008	5/27/2008
Alpha Activity	<LLD	**29.6**	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	**16.3**	NA	NA	NA	NA
Alpha LLD	15.9	**16.2**	16.4	17.2	18.6	18.9
Beta Activity	<LLD	<LLD	<LLD	<LLD	<LLD	**14.8**
Beta Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	**5.48**
Beta LLD	8.24	7.71	7.69	9.04	8.60	**8.92**
K-40 Activity	<MDA	**2.282**	**1.045**	**0.935**	**1.31**	**6.503**
K-40 Confidence Interval (± 2 SD)	NA	**0.652**	**0.340**	**0.249**	**0.334**	**0.667**
K-40 MDA	0.284	**0.457**	**0.312**	**0.180**	**0.196**	**0.257**
Cs-137 Activity	<MDA	**0.795**	**0.145**	**0.322**	<MDA	**0.257**
Cs-137 Confidence Interval (± 2 SD)	NA	**0.087**	**0.041**	**0.043**	NA	**0.049**
Cs-137 MDA	0.040	**0.061**	**0.040**	**0.030**	0.027	**0.039**
Pb-212 Activity	**0.447**	<MDA	**2.506**	**1.69**	**0.684**	**2.449**
Pb-212 Confidence Interval (± 2 SD)	**0.060**	NA	**0.237**	**0.155**	**0.075**	**0.218**
Pb-212 MDA	**0.028**	0.062	**0.035**	**0.038**	**0.027**	**0.043**
Pb-214 Activity	**0.601**	**2.141**	**1.282**	**1.068**	**0.707**	**1.559**
Pb-214 Confidence Interval (± 2 SD)	**0.060**	**0.145**	**0.084**	**0.080**	**0.067**	**0.107**
Pb-214 MDA	**0.063**	**0.113**	**0.074**	**0.058**	**0.048**	**0.074**
Ra-226 Activity	**1.393**	**4.668**	**2.539**	**1.755**	**1.801**	**3.31**
Ra-226 Confidence Interval (± 2 SD)	**0.545**	**1.166**	**0.661**	**0.712**	**0.544**	**0.741**
Ra-226 MDA	**0.640**	**1.207**	**0.790**	**0.670**	**0.505**	**0.791**
Ac-228 Activity	<MDA	**1.78**	**2.342**	**1.748**	<MDA	**2.433**
Ac-228 Confidence Interval (± 2 SD)	NA	**0.203**	**0.148**	**0.126**	NA	**0.164**
Ac-228 MDA	0.194	**0.210**	**0.128**	**0.091**	0.192	**0.116**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	0.531	1.027	0.701	0.627	0.482	0.764

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Random Perimeter (<50 miles) Surface Soil Samples

Location Description	SSE63	SS E51	SS E54	SS E56	SS E61	SS E58
Collection Date	5/27/2008	7/9/2008	7/15/2008	7/15/2008	7/23/2008	12/23/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Alpha LLD	18.6	27.0	26.0	26.8	26.6	25.8
Beta Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Beta Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Beta LLD	9.01	9.38	9.14	9.19	8.55	7.25
K-40 Activity	**5.349**	**1.384**	<MDA	<MDA	<MDA	<MDA
K-40 Confidence Interval (± 2 SD)	**0.574**	**0.3968**	NA	NA	NA	NA
K-40 MDA	**0.157**	**0.2471**	0.1543	0.3237	0.1569	0.1941
Cs-137 Activity	<MDA	**0.2709**	<MDA	**0.2333**	**0.0985**	**0.0621**
Cs-137 Confidence Interval (± 2 SD)	NA	**0.0558**	NA	**0.0566**	**0.0206**	**0.0243**
Cs-137 MDA	0.027	**0.0337**	0.0240	**0.0388**	**0.0166**	**0.0253**
Pb-212 Activity	<MDA	**1.389**	**0.9198**	**1.042**	**0.1746**	**0.8516**
Pb-212 Confidence Interval (± 2 SD)	NA	**0.1341**	**0.0887**	**0.1131**	**0.0311**	**0.0868**
Pb-212 MDA	0.026	**0.0403**	**0.0260**	**0.0410**	**0.0154**	**0.0420**
Pb-214 Activity	**0.534**	**1.783**	**0.6680**	**0.9916**	**0.2063**	**0.6712**
Pb-214 Confidence Interval (± 2 SD)	**0.056**	**0.1100**	**0.0586**	**0.0942**	**0.0311**	**0.0562**
Pb-214 MDA	**0.050**	**0.0655**	**0.0414**	**0.0736**	**0.0302**	**0.0481**
Ra-226 Activity	**1.376**	**3.500**	**1.243**	**3.007**	<MDA	<MDA
Ra-226 Confidence Interval (± 2 SD)	**0.594**	**0.7694**	**0.4920**	**0.7864**	NA	NA
Ra-226 MDA	**0.513**	**0.7204**	**0.4659**	**0.7552**	0.3758	0.5322
Ac-228 Activity	**0.565**	**1.386**	**0.9558**	**1.052**	<MDA	**0.8172**
Ac-228 Confidence Interval (± 2 SD)	**0.079**	**0.1237**	**0.0789**	**0.1388**	NA	**0.0811**
Ac-228 MDA	**0.090**	**0.1174**	**0.0659**	**0.1381**	0.0960	**0.0801**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	0.452	0.6999	0.485	0.7179	0.3129	0.4766

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Random Background (>50 miles) Surface Soil Samples

Location Description	SSB62	SSB49	SSB63	SSB58	SSB53	SSB55
Collection Date	2/25/2008	3/6/2008	3/6/2008	5/6/2008	5/27/2008	6/27/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
Alpha LLD	16.1	16.3	16.2	17.4	18.5	18.7
Beta Activity	<LLD	<LLD	**8.78**	**19.1**	<LLD	**17.1**
Beta Confidence Interval (± 2 SD)	NA	NA	**4.74**	**5.79**	NA	**5.67**
Beta LLD	7.71	8.05	**8.09**	**9.00**	8.96	**8.96**
K-40 Activity	**1.059**	<MDA	**4.455**	**1.617**	**5.425**	**17.48**
K-40 Confidence Interval (± 2 SD)	**0.421**	NA	**0.731**	**1.4**	**0.750**	**0.128**
K-40 MDA	**0.379**	0.395	**0.405**	**0.032**	**0.401**	**0.260**
Cs-137 Activity	**0.205**	**0.119**	<MDA	**0.686**	**1.02**	**0.143**
Cs-137 Confidence Interval (± 2 SD)	**0.051**	**0.051**	NA	**0.089**	**0.107**	**0.039**
Cs-137 MDA	**0.047**	**0.045**	0.051	**0.044**	**0.048**	**0.038**
Pb-212 Activity	<MDA	**0.481**	**1.4**	**0.881**	**0.735**	**2.007**
Pb-212 Confidence Interval (± 2 SD)	NA	**0.068**	**0.151**	**0.105**	**0.096**	**0.180**
Pb-212 MDA	0.042	**0.038**	**0.050**	**0.044**	**0.039**	**0.044**
Pb-214 Activity	**0.707**	**0.474**	**0.939**	**1.304**	**0.757**	**1.593**
Pb-214 Confidence Interval (± 2 SD)	**0.078**	**0.076**	**0.103**	**0.115**	**0.106**	**0.100**
Pb-214 MDA	**0.094**	**0.079**	**0.100**	**0.086**	**0.078**	**0.069**
Ra-226 Activity	**1.539**	<MDA	**3.097**	**2.45**	<MDA	**4.308**
Ra-226 Confidence Interval (± 2 SD)	**0.745**	NA	**1.005**	**1.014**	NA	**0.881**
Ra-226 MDA	**0.939**	0.942	**0.966**	**0.852**	0.750	**0.758**
Ac-228 Activity	**0.965**	<MDA	**1.254**	<MDA	<MDA	**2.05**
Ac-228 Confidence Interval (± 2 SD)	**0.147**	NA	**0.148**	NA	NA	**0.144**
Ac-228 MDA	**0.162**	0.244	**0.164**	0.329	0.283	**0.124**
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	0.763	0.666	0.872	0.791	0.692	0.740

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Alpha, Beta and Gamma Detections for Random Background (>50 miles) Surface Soil Samples

Location Description	SSB57	SS B56	SS B51	SS B59	SS B61	SS B54	SS B60
Collection Date	6/27/2008	7/1/2008	7/1/2008	12/18/2008	12/18/2008	12/30/2008	12/30/2008
Alpha Activity	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Alpha Confidence Interval (± 2 SD)	NA	NA	NA	NA	NA	NA	NA
Alpha LLD	17.6	26.0	24.9	24.6	24.3	28.4	26.9
Beta Activity	<LLD	<LLD	**13.9**	**8.34**	<LLD	**20.3**	**38.1**
Beta Confidence Interval (± 2 SD)	NA	NA	**5.27**	**4.49**	NA	**5.27**	**6.29**
Beta LLD	8.95	8.61	**8.61**	**7.55**	7.48	**7.44**	**7.45**
K-40 Activity	**16.77**	**1.253**	**4.478**	**1.417**	**3.308**	**20.41**	**34.84**
K-40 Confidence Interval (± 2 SD)	**1.267**	**0.4116**	**0.5901**	**0.3408**	**0.4426**	**1.586**	**2.340**
K-40 MDA	**0.272**	**0.2577**	**0.2991**	**0.1933**	**0.1757**	**0.3374**	**0.2702**
Cs-137 Activity	**0.391**	**0.3675**	**0.0798**	**0.1842**	**0.1459**	**0.1978**	<MDA
Cs-137 Confidence Interval (± 2 SD)	**0.056**	**0.0493**	**0.0379**	**0.0359**	**0.0349**	**0.0578**	NA
Cs-137 MDA	**0.038**	**0.0342**	**0.0382**	**0.0267**	**0.0259**	**0.0431**	0.0366
Pb-212 Activity	<MDA	**0.9547**	**0.4297**	**1.029**	**0.6531**	**1.442**	**1.073**
Pb-212 Confidence Interval (± 2 SD)	NA	**0.1032**	**0.0561**	**0.0997**	**0.0698**	**0.1469**	**0.1101**
Pb-212 MDA	0.039	**0.0383**	**0.0483**	**0.0460**	**0.0389**	**0.0718**	**0.0600**
Pb-214 Activity	**1.218**	**1.013**	**2.791**	**0.9933**	**0.6170**	**1.514**	**0.8758**
Pb-214 Confidence Interval (± 2 SD)	**0.086**	**0.0832**	**0.1516**	**0.0750**	**0.0545**	**0.1096**	**0.0767**
Pb-214 MDA	**0.067**	**0.0667**	**0.0770**	**0.0505**	**0.0471**	**0.0827**	**0.0647**
Ra-226 Activity	**2.964**	**2.131**	**7.245**	**1.991**	**1.213**	**3.116**	**1.677**
Ra-226 Confidence Interval (± 2 SD)	**0.720**	**0.7572**	**1.265**	**0.5251**	**0.5113**	**0.9394**	**0.7785**
Ra-226 MDA	**0.690**	**0.6799**	**0.8079**	**0.5684**	**0.4784**	**0.8454**	**0.6900**
Ac-228 Activity	**1.254**	**0.8885**	**0.7058**	**1.155**	**0.5967**	**1.254**	**1.100**
Ac-228 Confidence Interval (± 2 SD)	**0.115**	**0.1143**	**0.1172**	**0.0949**	**0.0793**	**0.1401**	**0.1267**
Ac-228 MDA	**0.125**	**0.1088**	**0.1311**	**0.0886**	**0.0737**	**0.1546**	**0.1436**
U/Th-238 Activity	<MDA	<MDA	**3.277**	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval (± 2 SD)	NA	NA	**1.603**	NA	NA	NA	NA
U/Th-238 MDA	0.652	0.5952	**0.7663**	0.5901	0.5160	0.7731	0.6524

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Data

2008 Metals Detections for Nonrandom SRS Perimeter Surface Soil Samples

Location Description	SSBWL-0801	SSALD-0801	SSALD-0802	SSBWL0802	SSAIK0801	SSAIK0802
County	Barnwell	Allendale	Allendale	Barnwell	Aiken	Aiken
Collection Date	3/14/2008	1/25/2008	3/14/2008	5/2/2008	5/2/2008	5/15/2008
Aluminum	3100	44000	7100	1700	12000	5800
Barium	13	110	47	7.7	79	32
Beryllium	<0.30	0.89	<0.30	<0.30	0.48	<0.30
Cadmium	<1.0	6	<1.0	<1.0	4.7	<1.0
Chromium	5.6	34	5.3	3	15	11
Cobalt	<2.0	14	<2.0	<2.0	2.4	<2.0
Copper	<1.0	15	3.1	<1.0	3.6	3
Iron	1600	32000	3500	1500	23000	4000
Lead	<5.0	15	25	<5.0	8.6	6.5
Magnesium	70	1700	270	47	610	130
Manganese	26	630	33	61	380	280
Nickel	<2.0	14	3.8	<2.0	5.2	2.6
Titanium	59	780	98	84	120	87
Vanadium	4.6	59	8.9	4	28	16
Zinc	3.3	51	13	3	17	13

Location Description	SSAIK0803	SSBWL0803	SSBWL0804	SSALD0803	SSBWL0805	SSAIK0804
County	Aiken	Barnwell	Barnwell	Allendale	Barnwell	Aiken
Collection Date	8/29/2008	8/29/2008	8/29/2008	12/2/2008	12/2/2008	12/2/2008
Aluminum	29000	4100	3600	12000	3500	9200
Barium	170	22	30	49	24	98
Beryllium	0.48	<0.30	<0.30	0.32	<0.30	0.48
Cadmium	2.9	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	19	2.9	4.5	11	3.3	13
Cobalt	<2.0	<2.0	<2.0	<2.0	<2.0	4.3
Copper	9.2	1.3	1.9	1.1	<1.0	5.5
Iron	11000	890	2100	9100	3300	10000
Lead	23	<5.0	8.6	17	8.4	21
Magnesium	210	47	230	260	96	550
Manganese	610	120	140	240	360	12
Nickel	9.4	<2.0	2	2.3	<2.0	6.4
Titanium	130	52	69	67	50	81
Vanadium	35	3.5	6.7	32	8.1	22
Zinc	40	4.7	8.4	12	7.5	12

Note: Units are in mg/kg.
There were no detections in any 2008 surface soil samples above the MDL for: Antimony, Arsenic, Boron, Mercury, Molybdenum, Selenium, Silver, Thallium, Tin.

Surface Soil Monitoring Adjacent to SRS Data

2008 Metals Detections for Savannah River Boat Landing Riverbank Soil Samples

Location Description	SSSBL001	SSCB001	SS301GA002	SSJL001
	Stokes Bluff Landing	Cohen's Bluff	Burton's Ferry Landing	Johnson's Landing
Collection Date	7/23/2008	7/23/2008	7/23/2008	7/23/2008
Aluminum	8900	9900	12000	12000
Barium	64	58	77	93
Beryllium	0.4	0.48	0.54	0.64
Cadmium	1.2	1.7	2.3	3.2
Chromium	12	15	16	17
Cobalt	3.9	6.3	7.1	6.9
Copper	6.9	6.2	7.2	9.6
Iron	6200	8900	12000	14000
Lead	12	7	8.2	12
Magnesium	530	1200	1300	1400
Manganese	200	110	310	660
Nickel	3.8	5.8	6.7	7.6
Titanium	240	540	590	480
Vanadium	22	23	26	29
Zinc	21	35	30	42

Location Description	SSLHL002	SSSCL002	SSPRA001	SSFF001	SSJBL002
	Little Hell Landing	Steel Creek Landing	Parkesville	Fury's Ferry	Jackson Landing
Collection Date	7/23/2008	7/23/2008	7/24/2008	7/24/2008	7/25/2008
Aluminum	2000	14000	1700	9500	13000
Barium	14	66	10	60	84
Beryllium	<0.30	0.73	<0.30	0.37	0.52
Cadmium	<1.0	3.6	4	2.4	3
Chromium	2.2	24	7.4	13	18
Cobalt	<2.0	6.8	2.6	5.6	6.2
Copper	1.2	10	14	6.7	9.9
Iron	1600	16000	18000	12000	15000
Lead	<5.0	15	7.4	8.9	11
Magnesium	91	1500	150	1500	1200
Manganese	49	250	62	340	540
Nickel	<2.0	7.7	4.3	4.6	6.2
Titanium	94	620	45	620	530
Vanadium	3.4	36	12	26	40
Zinc	4.3	34	22	24	39

Note: Units are in mg/kg.
There were no detections in any 2008 surface soil samples above the MDL for: Antimony, Arsenic, Boron, Mercury, Molybdenum, Selenium, Silver, Thallium, Tin.

Surface Soil Monitoring Adjacent to SRS Data

2008 Metals Detections for Random Perimeter (<50 miles) Surface Soil Samples

Location Description	SSE51	SSE53	SSE54	SSE55	SSE56	SSE57
Collection Date	7/9/2008	4/29/2008	7/15/2008	1/24/2008	7/15/2008	5/27/2008
Aluminum	6400	3800	1100	41000	12000	2200
Barium	35	23	<5.0	95	47	45
Beryllium	<0.30	0.43	<0.30	0.52	0.76	<0.30
Cadmium	<1.0	1.3	<1.0	4.3	<1.0	<1.0
Chromium	6.5	7.3	1.5	19	8.6	4.1
Cobalt	<2.0	<2.0	<2.0	6.2	<2.0	<2.0
Copper	1.1	1.5	<1.0	4	1.5	1.5
Iron	1800	4300	390	18000	2200	4800
Lead	5.1	<5.0	<5.0	24	18	10
Magnesium	64	12	4.2	530	4.6	75
Manganese	250	90	27	670	200	130
Nickel	2.6	<2.0	<2.0	9.5	3.9	<2.0
Titanium	24	44	63	120	47	97
Vanadium	5.7	10	<2.0	38	9.2	9.2
Zinc	15	6.1	1.4	23	5.8	11

Location Description	SSE58	SSE59	SSE61	SSE62	SSE63	SSE64
Collection Date	12/23/2008	1/24/2008	7/23/2008	4/29/2008	5/27/2008	1/25/2008
Aluminum	1700	5000	850	8600	5600	3800
Barium	8.3	18	<5.0	6.8	50	19
Beryllium	<0.30	<0.30	<0.30	0.39	<0.30	<0.30
Cadmium	<1.0	<1.0	<1.0	4.1	1.8	<1.0
Chromium	3.1	5.1	<1.0	137	8.5	3.5
Cobalt	<2.0	<2.0	<2.0	<2.0	6.6	<2.0
Copper	<1.0	1.7	<1.0	<1.0	4.2	<1.0
Iron	690	4300	340	19000	9000	2100
Lead	<5.0	<5.0	<5.0	12	6.3	9
Magnesium	54	71	4	8	550	110
Manganese	57	3.7	20	78	750	28
Nickel	<2.0	2.2	<2.0	2.6	3.7	<2.0
Titanium	78	54	23	97	250	86
Vanadium	2.3	16	<2.0	52	20	5.7
Zinc	6.3	4.6	1	5.4	14	4

Note: Units are in mg/kg.
There were no detections in any 2008 surface soil samples above the MDL for: Antimony, Arsenic, Boron, Mercury, Molybdenum, Selenium, Silver, Thallium, Tin.

Surface Soil Monitoring Adjacent to SRS Data

2008 Metals Detections for Random Background (>50 miles) Surface Soil Samples

Location Description	SSB49	SSB51	SSB53	SSB54	SSB55	SSB56
Collection Date	3/6/2008	7/1/2008	5/27/2008	12/30/2008	6/27/2008	7/1/2008
Aluminum	1900	7600	13000	19000	14000	9000
Barium	9.1	22	120	140	110	37
Beryllium	<0.30	0.31	0.4	0.65	0.82	<0.30
Cadmium	<1.0	1.2	6.6	<1.0	3.5	<1.0
Chromium	2.8	14	18	18	26	7.3
Cobalt	<2.0	<2.0	8.2	13	9.2	<2.0
Copper	2.9	2.8	26	12	7.9	5.1
Iron	1700	4000	30000	27000	17000	3800
Lead	13	9.4	19	11	12	15
Magnesium	69	59	1500	2800	480	17
Manganese	25	650	890	960	2000	330
Nickel	<2.0	4.3	6.2	11	9.4	2.4
Titanium	22	80	220	590	730	81
Vanadium	2.6	13	82	52	39	12
Zinc	7.7	25	28	32	37	5.8

Location Description	SSB57	SSB58	SSB59	SSB60	SSB61	SSB62	SSB63
Collection Date	6/27/2008	5/6/2008	12/18/2008	12/30/2008	12/18/2008	2/25/2008	3/6/2008
Aluminum	11000	18000	4700	8600	4800	1500	2800
Barium	80	68	11	64	15	11	28
Beryllium	0.47	0.7	<0.30	0.39	<0.30	<0.30	<0.30
Cadmium	3.2	2	<1.0	<1.0	<1.0	<1.0	<1.0
Chromium	15	48	3.3	8.4	5	2.4	3.7
Cobalt	8.9	5.5	<2.0	6.2	<2.0	<2.0	<2.0
Copper	12	16	<1.0	3.9	1.8	<1.0	2.2
Iron	15000	9000	2100	13000	3900	1000	2800
Lead	33	15	7.4	7.4	13	<5.0	9.5
Magnesium	600	62	170	840	280	150	95
Manganese	810	700	41	510	26	17	47
Nickel	5.1	10	<2.0	3.9	<2.0	<2.0	<2.0
Titanium	300	390	140	320	62	59	65
Vanadium	35	58	3.9	23	7.5	2.6	6.8
Zinc	28	34	5.9	24	27	9.8	5.4

Note: Units are in mg/kg.
There were no detections in any 2008 surface soil samples above the MDL for: Antimony, Arsenic, Boron, Mercury, Molybdenum, Selenium, Silver, Thallium, Tin.

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3.1.5 Summary Statistics

Surface Soil Monitoring Adjacent to SRS

Notes:
1. N/A = Not Applicable

Surface Soil Monitoring Adjacent to SRS Summary Statistics

2008 Summary Statistics - SCDHEC Surface Soil Radiological Data
Nonrandom SRS Perimeter Samples

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Alpha	21.2	2.1	21.2	19.7	22.7	2	12
Beta	24.3	14.1	24.0	10.4	38.5	3	12
K-40	2.876	3.473	1.792	0.614	12.290	10	12
Cs-137	1.157	2.402	0.323	0.084	7.952	10	12
Pb-212	1.413	0.664	1.203	0.674	2.545	9	12
Pb-214	2.763	5.540	1.103	0.588	20.260	12	12
Ra-226	6.663	13.686	2.530	1.244	47.800	11	12
Ac-228	1.252	0.672	1.038	0.633	2.535	10	12
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	12

Nonrandom Savannah River Boat Landing Riverbank Soil

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Alpha	N/A	N/A	N/A	N/A	N/A	0	9
Beta	16.6	5.0	15.9	10.8	23.6	8	9
K-40	13.289	5.242	14.120	2.629	18.730	9	9
Cs-137	1.008	1.904	0.284	0.129	5.686	8	9
Pb-212	1.392	0.193	1.394	1.135	1.688	8	9
Pb-214	1.164	0.376	1.278	0.325	1.507	9	9
Ra-226	2.481	0.736	2.807	0.891	3.161	9	9
Ac-228	1.305	0.340	1.373	0.564	1.806	9	9
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	9

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Summary Statistics

2008 Summary Statistics - SCDHEC Surface Soil Radiological Data
Random Perimeter Samples (<50 miles)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Alpha	29.6	N/A	29.6	29.6	29.6	1	12
Beta	14.8	N/A	14.8	14.8	14.8	1	12
K-40	2.687	2.279	1.384	0.935	6.503	7	12
Cs-137	0.273	0.229	0.245	0.062	0.795	8	12
Pb-212	1.215	0.792	0.981	0.175	2.506	10	12
Pb-214	1.018	0.574	0.849	0.206	2.141	12	12
Ra-226	2.459	1.141	2.170	1.243	4.668	10	12
Ac-228	1.453	0.666	1.386	0.565	2.433	9	12
U/Th-238	N/A	N/A	N/A	N/A	N/A	0	12

Random Background Samples (>50 miles)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Alpha	N/A	N/A	N/A	N/A	N/A	0	13
Beta	17.9	10.1	17.1	8.3	38.1	7	13
K-40	9.376	10.659	4.467	1.059	34.840	12	13
Cs-137	0.322	0.289	0.198	0.080	1.020	11	13
Pb-212	1.008	0.467	0.955	0.430	2.007	11	13
Pb-214	1.138	0.599	0.993	0.474	2.791	13	13
Ra-226	2.885	1.696	2.450	1.213	7.245	11	13
Ac-228	1.122	0.400	1.128	0.597	2.050	10	13
U/Th-238	3.277	N/A	3.277	3.277	3.277	1	13

Note: Units are in pCi/g.
There were no detections in any 2008 surface soil samples above the MDA for: Be-7, Na-22, Mn-54, Co-58, Co-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154, Eu-155, and Am-241.

Surface Soil Monitoring Adjacent to SRS Summary Statistics

2008 Summary Statistics - SCDHEC Surface Soil Metals Data
Nonrandom SRS Perimeter Samples

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Aluminum	11258	12675	6450	1700	44000	12	12
Barium	57	49	39.5	7.7	170	12	12
Beryllium	0.53	0.21	0.48	0.32	0.89	5	12
Cadmium	4.5	1.6	4.7	2.9	6	3	12
Chromium	10.6	9.1	8.3	2.9	34	12	12
Cobalt	6.9	6.2	4.3	2.4	14	3	12
Copper	4.9	4.6	3.1	1.1	15	9	12
Iron	8499	9719	3750	890	32000	12	12
Lead	14.8	7.1	15	6.5	25	9	12
Magnesium	352	463	220	47	1700	12	12
Manganese	241	218	190	12	630	12	12
Nickel	5.7	4.2	4.5	2	14	8	12
Titanium	140	203	83	50	780	12	12
Vanadium	19.0	17.0	12.5	3.5	59	12	12
Zinc	15.4	14.9	12.0	3	51	12	12

Nonrandom Savannah River Boat Landing Riverbank Soil

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Aluminum	9222	4499	9900	1700	14000	9	9
Barium	58	29	64	10	93	9	9
Beryllium	0.53	0.13	0.52	0.37	0.73	7	9
Cadmium	2.7	1.0	2.7	1.2	4	8	9
Chromium	13.8	6.3	15	2.2	24	9	9
Cobalt	5.7	1.6	6.25	2.6	7.1	8	9
Copper	8.0	3.5	7.2	1.2	14	9	9
Iron	11522	5176	12000	1600	18000	9	9
Lead	10.2	2.8	9.95	7	15	8	9
Magnesium	986	570	1200	91	1500	9	9
Manganese	280	210	250	49	660	9	9
Nickel	5.8	1.5	6	3.8	7.7	8	9
Titanium	418	229	530	45	620	9	9
Vanadium	24	11.2	26	3.4	40	9	9
Zinc	28	11.6	30	4.3	42	9	9

Note: Units are in mg/kg.
There were no detections in any 2008 surface soil samples above the MDL for: Antimony, Arsenic, Boron, Mercury, Molybdenum, Selenium, Silver, Thallium, Tin.

Surface Soil Monitoring Adjacent to SRS Summary Statistics

2008 Summary Statistics - SCDHEC Surface Soil Metals Data
Random Perimeter Samples (<50 miles)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Aluminum	7671	10991	4400	850	41000	12	12
Barium	34.7	26.4	29	6.8	95	10	12
Beryllium	0.53	0.17	0.475	0.39	0.76	4	12
Cadmium	2.9	1.5	2.95	1.3	4.3	4	12
Chromium	18.6	39.6	6.5	1.5	137	11	12
Cobalt	6.4	0.3	6.4	6.2	6.6	2	12
Copper	2.2	1.3	1.5	1.1	4.2	7	12
Iron	5577	6509	3250	340	19000	12	12
Lead	12.1	6.7	10	5.1	24	7	12
Magnesium	123.9	197.5	59	4	550	12	12
Manganese	192.0	253.7	84	3.7	750	12	12
Nickel	4.1	2.7	3.15	2.2	9.5	6	12
Titanium	82	61	70.5	23	250	12	12
Vanadium	16.8	16.0	9.6	2.3	52	10	12
Zinc	8.1	6.4	5.95	1	23	12	12

Random Background Samples (>50 miles)

Analyte	Average	Standard Deviation	Median	Minimum	Maximum	Number of Detections	Total Number Sampled
Aluminum	8915	5840	8600	1500	19000	13	13
Barium	55.0	45.7	37	9.1	140	13	13
Beryllium	0.53	0.19	0.47	0.31	0.82	7	13
Cadmium	3.3	2.1	3.2	1.2	6.6	5	13
Chromium	13.2	12.8	8.4	2.4	48	13	13
Cobalt	8.5	2.7	8.55	5.5	13	6	13
Copper	8.4	7.5	5.1	1.8	26	11	13
Iron	10023	9784	4000	1000	30000	13	13
Lead	13.7	6.9	12.5	7.4	33	12	13
Magnesium	548	798	170	17	2800	13	13
Manganese	539	569	510	17	2000	13	13
Nickel	6.5	3.2	5.65	2.4	11	8	13
Titanium	235.31	223.36	140	22	730	13	13
Vanadium	26.0	25.4	13	2.6	82	13	13
Zinc	20.7	11.9	25	5.4	37	13	13

Note: Units are in mg/kg.
There were no detections in any 2008 surface soil samples above the MDL for: Antimony, Arsenic, Boron, Mercury, Molybdenum, Selenium, Silver, Thallium, Tin.

TOC

3.2 Radiological Monitoring of Terrestrial Vegetation

3.2.1 Summary

Terrestrial vegetation, fungi, lichens, mosses, etc., can be contaminated externally by direct deposition of airborne materials, water runoff, and precipitation that contains radioactivity. Vegetation can also be contaminated internally by uptake of radionuclides through the roots. Contaminated vegetation can be transported by physical means and, if eaten by animals, this radioactivity can enter the food chain. As with all ionizing radiation, exposure to tritium and cesium-137 (Cs-137) can increase the risk of developing cancer. The Department of Energy-Savannah River (DOE-SR) contracts for the collection and analysis of terrestrial vegetation, primarily Bermuda grass, to determine concentrations of radionuclides (SRNS 2009).

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) monitors for the presence of radionuclides in vegetation around the Savannah River Site (SRS). In 2008, ESOP conducted independent vegetation monitoring at 17 locations around the perimeter of the SRS; three former SRS monitoring locations 25 miles from the center of SRS; and 24 locations selected at random (12 near SRS and 12 background sites around South Carolina). Sampling was performed quarterly in February, May, August, and November. Perimeter stations sampled in 2008 are shown in Section 3.2.2 Map 9.

Samples from 16 perimeter stations were analyzed for tritium activity, 15 of which exhibited tritium levels greater than the Lower Limit of Detection (LLD). Average activity levels were fairly uniform around SRS, with the highest activity located on the western side. Vegetation was collected for gamma analysis at eight selected perimeter stations where sampling had consistently shown detectable levels of cesium-137 (Cs-137), and one station added in 2005. Cesium-137 was detected at all but one of these locations, with the highest activities from stations on the northern side of the SRS. Both tritium and Cs-137 results are consistent with historical findings.

ESOP data supports the DOE-SR conclusion that elevated tritium levels in vegetation at and near the site perimeter are due to atmospheric releases from SRS, although Plant Vogtle, a commercial nuclear power plant across the Savannah River from SRS, may also have an effect. The DOE-SR program detected tritium from three of 12 perimeter stations, while tritium was detected in samples from 15 of 16 stations by the ESOP program. Cesium-137 was detected from four of 12 locations sampled by DOE-SR, and from eight of nine locations sampled by ESOP. It appears that sampling of broadleaf vegetation may be a better indicator of radionuclide occurrence around the SRS perimeter.

Precedence for the monitoring of fungi was established at the Savannah River Plant when mushroom samples were found to contain 2 to 540 picocuries per gram (pCi/g) of Cs-137 in 1983, and 19 to 640 pCi/g in 1984 at locations within SRS (DuPont 1984). The abundance of mushrooms may be related to weather factors and could explain some Cs-137 concentration variations in deer and hogs. The Cs-137 contribution to food dose in humans was over one hundred times greater for fungi than the next largest food source (berries) at Chernobyl (Botsch 1999). DOE-SR mushroom samples collected in the 1980s were obtained from eleven DOE-SR locations that were administratively controlled to prevent public access.

ESOP added fungi sampling to the vegetation project in 2004. Evidence from European studies of the Chernobyl meltdown radioactive releases indicated that bolete fungi are among the greatest bio-concentrators of many radionuclides (Botsch 1999). Also, the DOE-SR survey of fungi noted that the Cs-137 activity concentration fluctuation in deer may be related to the availability of fungi. Fungi were collected at twelve random perimeter locations, two random background locations and one non-random background composite location in 2008. A special effort to collect bolete fungi resulted in seven bolete samples coming from previously sampled random quadrants in the study area. All three backgrounds were bolete fungi from previously sampled quadrants.

Fungi are routinely collected on a random quadrant basis within 50-miles of an SRS center-point, designated as “E” quadrants, and outside of the 50-mile perimeter but within the remainder of South Carolina as background samples in “B” area quadrants. Samples were analyzed for a gamma suite of radionuclides. Additional non-random samples were collected to compare to other media non-random findings such as Cs-137 in deer.

The 2008 data were summarized on a quadrant average basis for perimeter (E) and background (B) mixed samples and on a sample-type basis for bolete fungi only (Section 3.2.4). The radionuclide detection statistics were compared on a quadrant and sample-type basis (2008), and on a South Carolina geological region basis (for the period from 2004-2008)(Section 3.2.5).

Results and Discussion

Results from vegetation and fungi analyses are included in Section 3.2.4; summary statistics are presented in Section 3.2.5. The following radionuclides were not detected above the minimum detectable activity in 2008 vegetation: sodium-22 (Na-22), manganese-54 (Mn-54), cobalt-58 (Co-58), cobalt-60 (Co-60), zinc-65 (Zn-65), yttrium-88 (Y-88), zirconium-95 (Zr-95), ruthenium-103 (Ru-103), antimony-125 (Sb-125), iodine-131 (I-131), cesium-134 (Cs-134), cerium-144 (Ce-144), europium-152 (Eu-152), europium-154 (Eu-154), europium-155 (Eu-155), actinium-228 (Ac-228), uranium/thorium-238 (U/Th-238), and americium-241 (Am-241).

A ProUCl Wilcoxon-Mann-Whitney hypothesis test (USEPA 2002) was performed on the random sample results of relevant radionuclides (tritium and Cs-137) in non-edible vegetation in 2008. Yearly hypothesis testing of vegetation samples analyzed for tritium and cesium was inconclusive for one year due to the low number of detections and samples on a yearly basis. The same statement applies to the fungi samples for Cs-137. A final statistical analysis of the five-year study will be finished in 2009.

Tritium in Vegetation

Tritium is a naturally occurring radioisotope, although in very low concentrations (USEPA 2007a). Sources of man-made tritium include nuclear reactors and government weapons production plants. Tritium releases on the SRS include both atmospheric and liquid contributions (SRNS 2009). Although the United States Environmental Protection Agency (USEPA) has not established a Maximum Contaminant Level (MCL) for tritium in solid media (e.g. vegetation), the MCL for drinking water has been set at 20,000 picocuries per liter (pCi/L) (USEPA 2008e).

Tritium was detected in vegetation from 15 of the 16 perimeter sites sampled in 2008. None of the stations exhibited tritium levels greater than the LLD in all four sampling months. The highest tritium level in 2008, 889 pCi/L, occurred in February on the north side of SRS at station AKN-004. Station BWL-008, on the southwest side of SRS, produced the highest levels in May and November, 703 pCi/L and 614 pCi/L, respectively. Station AKN-002, on the west side of SRS, exhibited the highest activity in August, 854 pCi/L.

Tritium was detected only once at one of the 25-mile radius stations, in Aiken county. Five of 12 randomly selected stations within 50 miles of SRS and one background station exhibited tritium activity above the LLD.

Three of the four highest quarterly tritium activities in 2008 were from sites on the western side of the SRS. This is similar to results from 2004 through 2007 sampling (Figure 1, Section 3.2.3; SCDHEC 2008c). Tritium releases from the nearby Vogtle Electric Generating Plant in Georgia may account for elevated tritium levels in this area of the SRS, or the influence of Fourmile Branch and Pen Branch, both of which have high levels of tritium. However, stations on the north and south sides of SRS also exhibited relatively high tritium activities in 2008. These results underscore the variability of tritium occurrence around SRS.

Sampling was also conducted in twelve randomly selected quadrants within 50 miles of SRS ("E" sites) and in twelve random background quadrants ("B") throughout South Carolina (Section 3.2.4). Tritium was detected in samples from five 50-mile locations and one background location; however, the size of this data set was insufficient to conclude there was a significant difference between the near-SRS samples and the background samples.

Tritium analysis results from SCDHEC and DOE-SR sampling are presented in Table 1, Section 3.2.3. However, differences between the two programs in sampling dates, the vegetation sampled, and analysis methods should be considered during comparison. Data comparison of associated locations from the two programs was conducted by converting from pCi/g to pCi/L, using a dry/wet weight ratio of 0.3 furnished by DOE-SR, using the formula:

$$\text{pCi/L} = \text{pCi/ml} \times 1000 = [\text{pCi/g} \times (1/0.3)] / (1 - 0.3).$$

Results from the two colocations were less than the detection limit for the both programs, although SCDHEC had tritium detections at those locations during other times of the year. The DOE-SR program detected tritium from three perimeter stations in 2008; SCDHEC detected tritium in samples from four comparable stations at similar times. Average tritium levels at the stations in Table 1 were compared, using only detections to calculate averages. The DOE-SR average, 181 (± 11) pCi/L, was within two standard deviations of the SCDHEC average, 289 (± 87) pCi/L.

Gamma in Vegetation

The naturally occurring isotope potassium-40 (K-40) was detected from all stations where gamma samples were collected in 2008. Beryllium-7 (Be-7) and the lead (Pb) isotopes Pb-212 and Pb-214 were also detected, but not from all locations. Because these are naturally occurring isotopes the results will not be discussed in this section, but are presented in Section 3.2.4.

Cesium-137 is a man-made fission product, and was a constituent of air and water releases on SRS, mainly from F- and H-Areas. Liquid releases also occurred from the production reactors as a result of leaking fuel elements in the 1950s and 60s (WSRC 1999a).

Cesium-137 was detected at eight of nine perimeter stations sampled in 2008, and six of the eight stations produced Cs-137 results greater than the Minimum Detectable Activity (MDA) in all four months (Section 3.2.4). AKN-008 exhibited the highest Cs-137 activity in February and November, 0.433 and 0.524 pCi/g, respectively. AKN-005 exhibited the highest activity in May and August, 0.622 and 0.625 pCi/g; the latter was the highest activity in 2008.

Two of twelve randomly selected stations within 50 miles of SRS, in Orangeburg and Bamberg counties, exhibited Cs-137 activity above the MDA. One of twelve random background samples, from Beaufort County, exhibited detectable Cs-137 activity. Based on the limited number of samples and detections, no conclusions could be drawn from these results.

Results of analysis for Cs-137 followed established trends in 2008 (Figure 2, Section 3.2.3; SCDHEC 2008c). Stations around the perimeter of SRS selected for sampling because of continued Cs-137 detections again produced detectable activity, with the exception of AKN-002. AKN-008 on the north side of the SRS near New Ellenton exhibited the highest average activity for 2008. This station was added west of AKN-005 in 2005 to document Cs-137 activity in this area. Station AKN-005 exhibited the second-highest average in 2008.

Gamma analysis results for Cs-137 from ESOP and DOE-SR sampling in 2008 are presented in Table 2, Section 3.2.3. The two colocations sampled by the programs exhibited dissimilar results in 2008. DOE-SR did not detect Cs-137 at either location, whereas SCDHEC had detections of 0.189 (± 0.027) pCi/g at the Patterson Mill location (BWL-004) and 0.434 (± 0.045) pCi/g at Allendale Gate (BWL-006). Differences in analysis and sampling methods (e.g., ESOP collects leaves from trees, whereas EMS collects grass) may account for this disparity.

For the other DOE-SR stations, the closest ESOP stations were selected for comparison. At the three locations where DOE-SR detected Cs-137, DOE-SR and ESOP data were similar, with the greatest difference being 0.294 pCi/g. These results include the DOE-SR East Talatha station and the ESOP stations AKN-008 at New Ellenton and AKN-005, which is approximately two miles east of New Ellenton. AKN-005 and AKN-008 have consistently exhibited Cs-137 activity, usually the highest activity of the sites around SRS, while the East Talatha location produced the highest DOE-SR result in 2008. Average Cs-137 levels at the stations in Table 2 were compared, using only detections to calculate averages. The DOE-SR average (0.452 ± 0.347 pCi/g) was within one standard deviation of the ESOP average (0.329 ± 0.232 pCi/g).

Gamma in Fungi

Fungi, whether edible or non-edible, are an excellent survey media for detecting Cs-137 from atmospheric depositions. Bolete fungi are a primary bioconcentrator of Cs-137 (Botsch 1999). Cesium-137 is the primary radionuclide of concern due to the extremely high levels detected in fungi by Botsch and the possible biomagnification in mushroom consumers (man, deer, and other game).

Many of the radionuclides surveyed were naturally occurring radioactive materials (NORM) that have also been stored or produced as byproducts at DOE-SR. Detections above background were not necessarily due to DOE-SR production activities, since many radionuclides could have other sources such as NORM in soil, past nuclear test fallout, or commercial nuclear facility releases. Also, radionuclide detections in fungi represent bioaccumulations over many years, and do not represent yearly deposits in South Carolina.

Since DOE-SR stopped reactor operations, the primary radionuclides of concern in this gamma survey were generally long-lived radionuclide contaminants released in the past that have significant risk potential to airborne critical pathways (WSRC 1997). These included americium-241 (Am-241), Cs-137, Cs-134, cobalt-60 (Co-60), europium-154 (Eu-154), Eu-155, and thorium-234 (Th-234). Only those radionuclide concentrations found outside of the SRS and within the 50-Mile perimeter of a DOE-SR center-point that were greater than the South Carolina background warranted discussion.

Table 1, Section 3.2.5, summarizes the statistics for mixed-fungi and for bolete fungi radionuclide detections in 2008. Mixed-fungi samples from 12 random perimeter quadrants ("E" inside the 50-mile perimeter) of SRS and three South Carolina random background quadrants ("B" outside of the 50-mile perimeter) were summarized for average, standard deviation, and median. The two areas are also summarized in the bottom part of Table 1 for bolete fungi only. Six out of 24 radioisotopes surveyed were detected in mixed-fungi samples collected throughout South Carolina in 2008: Be-7, K-40, Cs-137, Pb-212, Pb-214, and radium-226 (Ra-226)(Table 2, Section 3.2.4). A comparison of mixed-fungi (top part of Table 1) and bolete fungi (bottom part of) showed that Be-7 and Ra-226 were not found in bolete fungi in 2008 (Table 1, Section 3.2.5). However, Be-7 and Ra-226 may be outliers, possibly due to soil type and low number of detections (only one for Ra-226). The results of background subtraction indicated that Bolete fungi contained higher levels of Cs-137 (4.44 pCi/g) compared to mixed-fungi (0.08 pCi/g) on an average basis, and on a median basis (2.62 pCi/g and <Bkg, respectively). The median confirmed the importance of surveying specific fungi for specific radionuclides. This alone is evidence of a greater degree of Cs-137 bioconcentration in boletes compared to mixed-fungi.

Mixed-fungi sample statistics based on quadrant sample averages showed a higher average activity concentration in the 50-mile perimeter versus the South Carolina background for Be-7, Cs-137, Pb-212, Pb-214, and Ra-226. This suggests a possible correlation with SRS releases, but other sources are possible such as past nuclear test fallout tracks. The median comparison indicated the same radionuclides except for Cs-137 in mixed fungi for quadrant-basis samples. The maximum Cs-137 activity concentration in 2008 was 11.02 pCi/g in bolete fungi, and occurred in the Long Branch Quadrant (E24) of the upper coastal plain (Section 3.2.4). This was greater than four standard deviations above the Cs-137 (1.42 pCi/g, ± 2.19) activity concentration for 2004-2008 (Tables 1 and 2, Section 3.2.5).

2004-2008 Mixed Fungi Statistics

Table 2, Section 3.2.5, summarizes the statistics for mixed-fungi on a geological regional basis versus all of South Carolina, and Figure 3, Section 3.2.3, shows the yearly trends of radionuclide activity concentrations in fungi. Maximum concentrations for more than one radionuclide occurring in the same quadrant may be indicators of some common influence such as soil type.

A comparison of the 2004-2008 Cs-137 averages above background for random fungi (1.50 pCi/g for all South Carolina) and surface soil (0.00 pCi/g) indicated a consistently higher Cs-137 activity concentration in fungi (compare Table 2, Section 3.2.5, to 2008 Soil Monitoring, Section

3.1). Also, a comparison of the 2004-2008 Cs-137 medians above background for random fungi (0.91 pCi/g for all South Carolina) and surface soil (0.00 pCi/g) indicated a consistently higher Cs-137 activity concentration in fungi. Thus, both average and median basis statistics confirm that Cs-137 activity was bioconcentrated in fungi relative to soil concentrations.

Refer to Section 3.2.5. Note that the average and median values of K-40, Cs-137, Pb-212, Pb-214, and Ra-226 were all higher in the upper coastal plain geological region compared to the overall average (All South Carolina) that included all geological regions. Beryllium-7 was the only isotope with a higher detection average in the Piedmont region compared to the overall average. Cesium-137 concentration was highest in the upper coastal plain, the lower coastal plain second, and lowest in the piedmont. The upper coastal plain is the geological regional location of DOE-SR and lies generally northeast of the site in South Carolina. The upper coastal plain dominance for Cs-137 may reflect past depositions from nuclear tests in the 1950's and 1960's that tracked across South Carolina (Plumbbob, Priscilla shot, Whitney shot, Galileo shot, Doppler shot) from the southwest to the northeast (Aracnet 1957**).** The dominance of the other radioisotopes may reflect radioactive decay products from NORM since DOE-SR reactors have been inactive for many years.

These results indicate that Cs-137 may become bioconcentrated in fungi, and represent increased exposure for the wild mushroom consumer, whether deer or human. Research of the literature suggests the occurrence of a higher Cs-137 concentration may be dependent on the depth and content of the organic layer, and on K-40 availability at the sampled locations (Linkov and Schell 1999). The uptake of particular elements or compounds is heavily influenced by the lack of or abundance of other elements within the local soil type. Cesium-137, for example, tends to be bound in the organic layer of soil. Thus, soils that are very sandy and overlain only by a thin organic layer may tend to have increased leaching of Cs-137 to deeper soil layers not accessible by many plant roots or fungal mycelia.

All maximums, whether mixed-sample or bolete-only samples, occurred in the upper coastal plain. However, this is not solely assignable to SRS due to other Cs-137 sources in the environment. Current concentrations of Cs-137 in fungi samples were detectable, but well below concentrations that would pose a public health threat from a radiological standpoint (USDHHS 1998).

Conclusions and Recommendations

ESOP conducted independent vegetation monitoring in 2008 at 17 locations around the perimeter of the SRS, three locations 25 miles from the center of SRS, 12 locations selected at random from within a 50-mile radius of SRS, and 12 background locations greater than 50 miles from SRS. Tritium was detected in vegetation from all of the perimeter and 25-mile stations, but none of the 50-mile or background stations. As in previous years, activity levels were higher in vegetation collected from the western side of SRS. ESOP data supports the DOE-SR conclusion that elevated tritium levels at the site perimeter are due to atmospheric releases from SRS, although Plant Vogtle, a commercial nuclear power plant across the Savannah River from SRS, may also have an effect. Tritium levels decrease with increasing distance from SRS facilities.

A comparison of ESOP and DOE-SR tritium data was performed. DOE-SR samples did not exhibit tritium activity at either colocation, while both ESOP samples did. DOE-SR detected tritium from four perimeter stations, while ESOP detected tritium at all perimeter locations.

There are differences in analysis and sampling methods between the programs (e.g., ESOP collects leaves from trees, whereas EMS conducts annual grass collections), but the abundance of tritium detections by ESOP in tree leaves versus DOE-SR grass needs further investigation. It appears that sampling of broadleaf vegetation may be a better indicator of radionuclide occurrence around the SRS perimeter. DOE-SR data are reported in pCi/g without denoting whether this activity relates to a gram of water or a gram of wet vegetation. ESOP recommends that DOE-SR report tritium activity in a more relevant manner, such as pCi/ml as in previous reports, to reflect the tritium activity in the water extracted from the sample.

Samples from eight of nine SRS perimeter stations exhibited Cs-137 activity at levels similar to 2004-2007, although there appears to be a downward trend in activity levels. It is unclear why these sites have higher cesium levels, as they are not located near SRS facilities, or in areas known to be affected by past releases. A review of the deposition plume from the 1955 Teapot Hornet test (Till et al. 2001) showed the highest radiation levels were not associated with the areas where ESOP finds the highest Cs-137 levels in vegetation. ESOP and DOE-SR results from the colocations on Patterson Mill Road and at the Allendale Gate exhibited dissimilar Cs-137 activity levels, with DOE-SR not detecting any activity while the ESOP samples exhibited activity at both locations.

A quarterly sampling schedule will be continued in 2009. Sampling will again be conducted at randomly selected sites around South Carolina to determine background and near-SRS levels for tritium and gamma-emitting radionuclides.

Radionuclide detections in fungi occurred only for Be-7, K-40, Cs-137, Pb-212, Pb-214, and Ra-226. The 2004 to 2008 Cs-137 activity concentration in mixed-fungi within the 50-mile SRS perimeter indicated increasing concentrations as the comparison was narrowed to the upper coastal plain regions. All maximum detections occurred in the upper coastal plain of South Carolina within the 50-mile perimeter study area around SRS. A comparison of mixed-fungi samples and samples containing only bolete fungi indicated that boletes bioconcentrate Cs-137 over 40 times more than mixed-fungi in general. The comparison of fungi and soil Cs-137 activity concentrations found in the random quadrants from 2004 through 2008 indicated a consistently higher average Cs-137 activity concentration in mixed-fungi and especially in bolete fungi compared to soil. These results indicate that Cs-137 may become bioconcentrated in some fungi, and represent increased exposure for the wild mushroom consumer, whether deer or human.

The radioisotope background contributions found in fungi from 2004 to 2008, which exclude a 10-mile radius from reactors, may have originated from past atomic tests or other nuclear power sources. This historical contamination cannot be distinguished from the DOE-SR site contributions within a 50-mile perimeter of a center-point within the SRS. Elevated levels of Cs-137 in mushroom consumers after Chernobyl indicated that most of the bioconcentration seemed to occur primarily in bolete fungi (Botsch 1999). Increased summer rainfall and other factors such as controlled burns may determine bolete fruit abundance and the subsequent increase of Cs-137 in wild mushroom consumers. Research of the literature suggests the occurrence of a higher Cs-137 concentration in backgrounds may be dependent on the depth and content of the organic layer at the sampled locations (Linkov and Schell 1999). SCDHEC will continue to collect fungi, preferably boletes when available, to monitor the bioaccumulation of Cs-137 in fungi and contributions to human uptake or exposure.

Cesium-137 is the primary contributor to human exposure within the study area and a study during August, September, and no later than October, of bolete abundance related to weather, K-40, and Cs-137 concentrations in deer and boletes could prove fruitful. This would quantify the relative importance of bolete fungi and deer consumption to the sportsman and mushroom consumer.

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3.2.2 Radiological Monitoring of Terrestrial Vegetation

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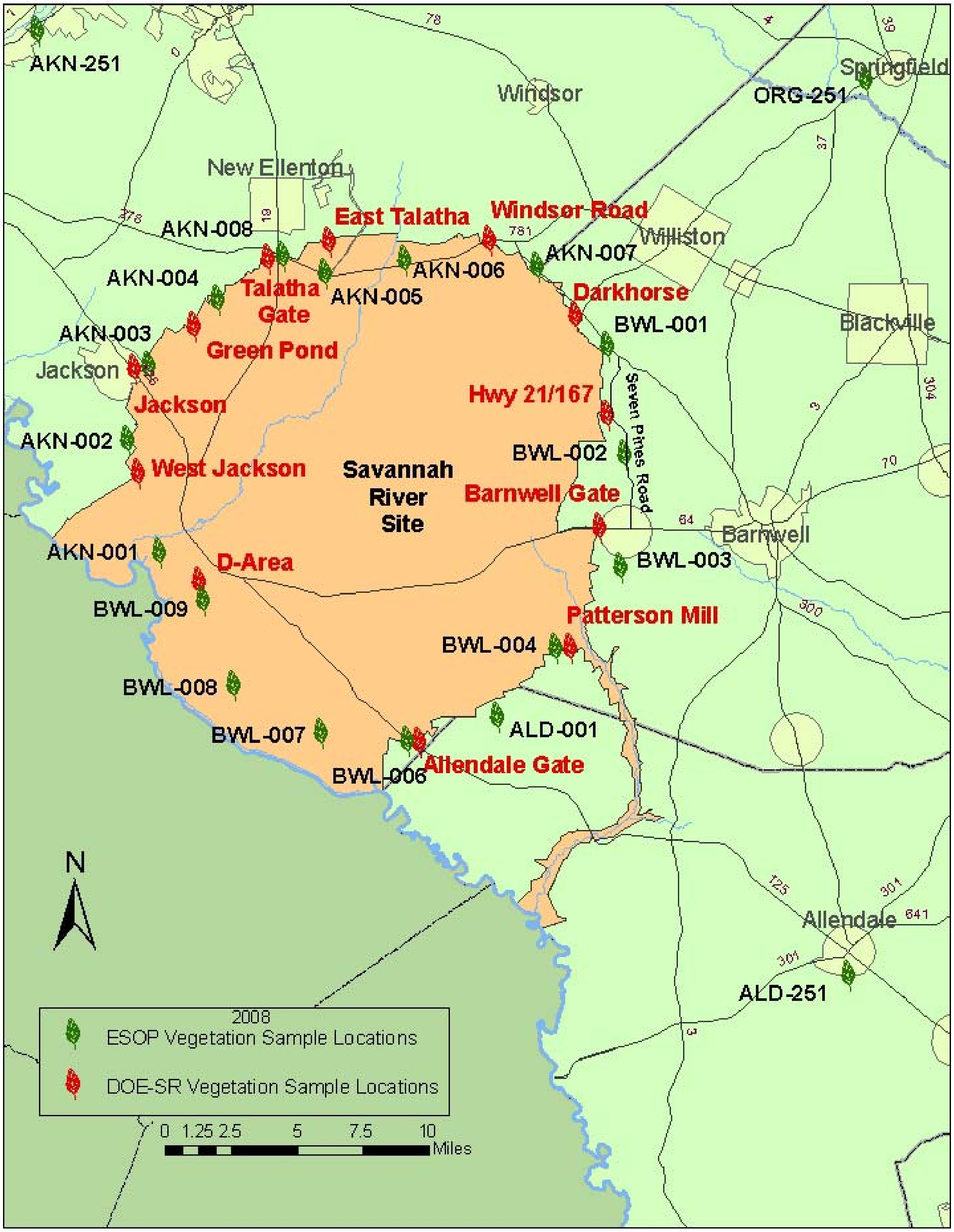
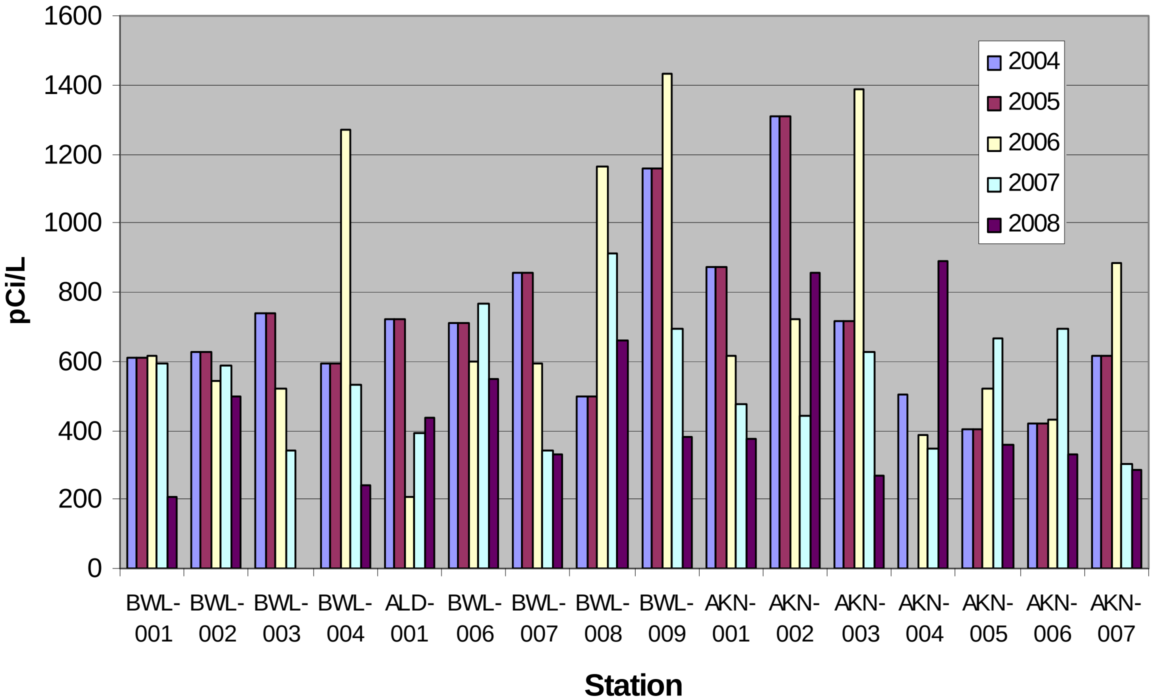
Map 9. ESOP and DOE-SR Radiological Vegetation Sampling Locations



Tables and Figures

Radiological Monitoring of Terrestrial Vegetation

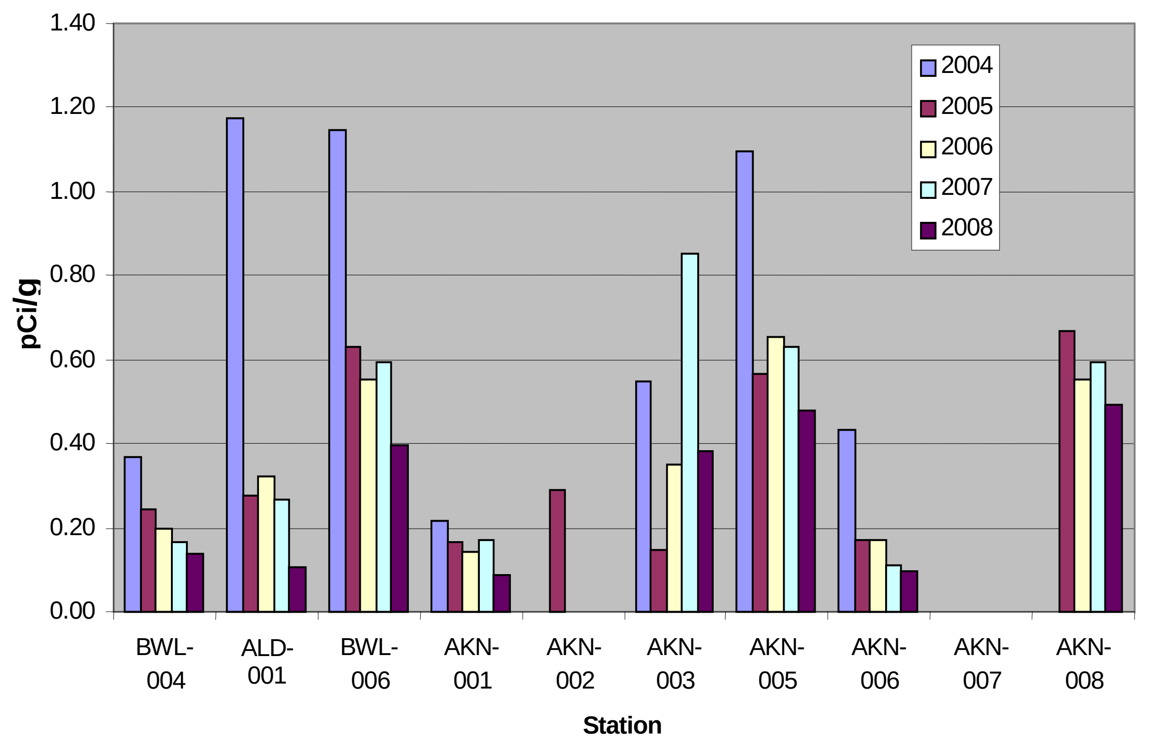
Figure 1. Average Tritium in Vegetation at SRS Perimeter Stations, 2004 - 2008



Tables and Figures

Radiological Monitoring of Terrestrial Vegetation

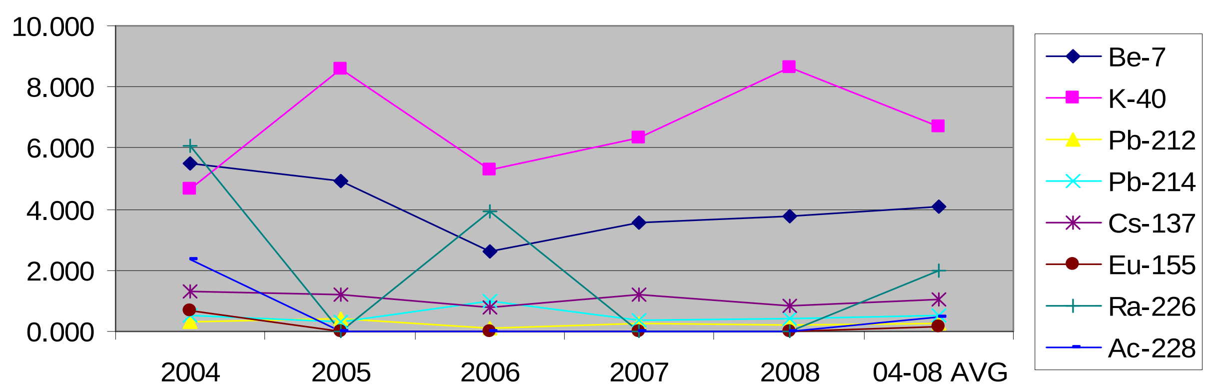
Figure 2. Average Cs-137 in vegetation at SRS Perimeter Stations, 2004 - 2008



Notes:

1. AKN-002, only one Cs-137 detection, in 2005
2. AKN-007 sampled only in 2004
3. AKN-008 added in 2005

Figure 3. Yearly Radionuclide Detection Averages (pCi/g) in Fungi



Tables and Figures

Radiological Monitoring of Terrestrial Vegetation

Table 1. Comparison of Tritium Analyses, DOE-SR and ESOP Data, 2008

DOE-SR DATA (SRNS 2009)		Tritium			ESOP DATA		Tritium	
Station	**Date**	**pCi/g**	**+/- 1 sig**	**pCi /L[a]**	**Station**	**Date**	**pCi/L**	**+/- 2 sig**
D-Area	5/7/2008	<MDC			BWL-009 [b]	5/14/2008	410	97
West Jackson	5/7/2008	<MDC			AKN-002	5/8/2008	<LLD	
Jackson	5/7/2008	<MDC			AKN-003 [b]	5/8/2008	<LLD	
Green Pond	5/7/2008	0.0403	0.0132	192	AKN-004 [b]	5/1/2008	<LLD	
Talatha Gate	5/7/2008	<MDC			AKN-005 [b]	5/13/2008	260	89
East Talatha	5/7/2008	0.0378	0.013	180	AKN-006 [b]	5/13/2008	280	90
Windsor Road	5/7/2008	<MDC			AKN-007	5/1/2008	<LLD	
Darkhorse	5/7/2008	<MDC			BWL-001 [b]	5/1/2008	205	86
Highway 21/167	5/7/2008	0.0359	0.011	171	BWL-002 [b]	5/1/2008	<LLD	
Barnwell Gate	5/7/2008	<MDC						
					BWL-003	5/1/2008	<LLD	
Patterson Mill Road [c]	5/7/2008	<MDC			BWL-004 [c]	5/13/2008	<LLD	
					ALD-001	5/13/2008	<LLD	
Allendale Gate [c]	5/7/2008	<MDC			BWL-006 [c]	5/13/2008	<LLD	
			Average	181		**Average**	289	
			Std Dev	11		**Std Dev**	87	
			Median	180		**Median**	270	

<MDC denotes less than the DOE-SR Minimum Detectable Concentration
< LLD denotes less than reported Lower Limit of Detection
[a] Converted (See Section 5.1) [b] Comparable ESOP location [c] Colocation
Std Dev denotes Standard Deviation

Tables and Figures

Radiological Monitoring of Terrestrial Vegetation

Table 2. Comparison of Cs-137 Analyses, DOE-SR and ESOP Data, 2008

DOE-SR DATA (SRNS 2009)		Cs-137		ESOP DATA		Cs-137	
Location	**Date**	**pCi/g (dry)**	**+/- 1 sig**	**Station**	**Date**	**pCi/g (fresh)**	**+/- 2 sig**
D-Area	5/7/2008	<MDC		AKN-001 [a]	5/8/2008	0.059	0.017
West Jackson	5/7/2008	<MDC		AKN-002 [a]	5/8/2008	<MDA	
Jackson	5/7/2008	<MDC		AKN-003 [a]	5/8/2008	0.481	0.048
Green Pond	5/7/2008	<MDC		AKN-003 [a]	5/8/2008	0.481	0.048
Talatha Gate	5/7/2008	<MDC		AKN-008 [a]	5/13/2008	0.607	0.083
East Talatha	5/7/2008	0.916	0.0846	AKN-005 [a]	5/13/2008	0.622	0.059
Windsor Road	5/7/2008	<MDC		AKN-006 [a]	5/13/2008	0.144	0.024
Darkhorse	5/7/2008	0.145	0.0471	AKN-006 [a]	5/13/2008	0.144	0.024
Highway 21/167	5/7/2008	0.511	0.0872				
Barnwell Gate	5/7/2008	0.234	0.0588	BWL-004 [a]	5/13/2008	0.189	0.027
Patterson Mill Road [b]	5/7/2008	<MDC		BWL-004 [b]	5/13/2008	0.189	0.027
				ALD-001 [a]	5/13/2008	0.099	0.021
Allendale Gate [b]	5/7/2008	<MDC		BWL-006 [b]	5/13/2008	0.434	0.045

Average	0.452	**Average**	0.329
Std Dev	0.347	**Std Dev**	0.232
Median	0.373	**Median**	0.312

<MDC denotes less than the DOE-SR Minimum Detectable Concentration
< LLD denotes less than reported Lower Limit of Detection
[a] Comparable ESOP location [b] Colocation

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3.2.3 Data

Radiological Monitoring of Terrestrial Vegetation

Notes:
1. pCi/L - picocuries per liter
2. pCi/g - picocuries per gram
3. ND denotes non-detect
4. NA denotes not applicable
5. Std Dev – standard deviation
6. LLD - Lower Limit of Detection
7. MDA - Minimum Detectable Activity
8. >8hle – Indicates no determination due to greater than 8 half-lives elapsed
9. C.I. – Confidence Interval
10. See Appendix A for radionuclide definitions

Radiological Monitoring of Terrestrial Vegetation Data

2008 Tritium in Vegetation

Location Description	Analyte	Collection Date / Result	Collection Date / Result	Collection Date / Result	Collection Date / Result
	Results (pCi/L)	2/20/2008	5/8/2008	8/19/2008	11/10/2008
VGAKN-001	Tritium Activity	<LLD	<LLD	311	439
VGAKN-001	Tritium Confidence Interval	NA	NA	94	94
VGAKN-001	Tritium LLD	187	184	189	179
	Results (pCi/L)	2/20/2008	5/8/2008	8/19/2008	11/10/2008
VGAKN-002	Tritium Activity	<LLD	<LLD	854	<LLD
VGAKN-002	Tritium Confidence Interval	NA	NA	114	NA
VGAKN-002	Tritium LLD	187	184	189	179
	Results (pCi/L)	2/20/2008	5/8/2008	8/19/2008	11/10/2008
VGAKN-003	Tritium Activity	239	<LLD	293	<LLD
VGAKN-003	Tritium Confidence Interval	89	NA	93	NA
VGAKN-003	Tritium LLD	187	184	189	179
	Results (pCi/L)	2/12/2008	5/1/2008	8/20/2008	11/6/2008
VGAKN-004	Tritium Activity	889	<LLD	<LLD	<LLD
VGAKN-004	Tritium Confidence Interval	114	NA	NA	NA
VGAKN-004	Tritium LLD	191	184	198	190
	Results (pCi/L)	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGAKN-005	Tritium Activity	453	260	<LLD	<LLD
VGAKN-005	Tritium Confidence Interval	99	89	NA	NA
VGAKN-005	Tritium LLD	191	184	189	179
	Results (pCi/L)	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGAKN-006	Tritium Activity	382	280	<LLD	<LLD
VGAKN-006	Tritium Confidence Interval	96	90	NA	NA
VGAKN-006	Tritium LLD	191	184	189	179
	Results (pCi/L)	2/12/2008	5/1/2008	8/20/2008	11/6/2008
VGAKN-007	Tritium Activity	<LLD	288	<LLD	<LLD
VGAKN-007	Tritium Confidence Interval	NA	90	NA	NA
VGAKN-007	Tritium LLD	191	184	198	190
	Results (pCi/L)	2/12/2008	5/1/2008	8/20/2008	11/6/2008
VGBWL-001	Tritium Activity	<LLD	205	<LLD	<LLD
VGBWL-001	Tritium Confidence Interval	NA	86	NA	NA
VGBWL-001	Tritium LLD	191	184	198	190
	Results (pCi/L)	2/12/2008	5/1/2008	8/20/2008	11/6/2008
VGBWL-002	Tritium Activity	<LLD	<LLD	<LLD	496
VGBWL-002	Tritium Confidence Interval	NA	NA	NA	100
VGBWL-002	Tritium LLD	191	184	198	190

Radiological Monitoring of Terrestrial Vegetation Data

2008 Tritium in Vegetation

Location Description	Analyte	Collection Date / Result	Collection Date / Result	Collection Date / Result	Collection Date / Result
	Results (pCi/L)	2/14/2008	5/1/2008	8/20/2008	11/6/2008
VGBWL-003	Tritium Activity	<LLD	<LLD	<LLD	<LLD
VGBWL-003	Tritium Confidence Interval	NA	NA	NA	NA
VGBWL-003	Tritium LLD	191	184	198	190
	Results (pCi/L)	2/14/2008	5/13/2008	8/20/2008	11/10/2008
VGBWL-004	Tritium Activity	<LLD	<LLD	<LLD	242
VGBWL-004	Tritium Confidence Interval	NA	NA	NA	85
VGBWL-004	Tritium LLD	191	183	198	179
	Results (pCi/L)	2/14/2008	5/13/2008	8/20/2008	11/10/2008
VGALD-001	Tritium Activity	538	<LLD	<LLD	340
VGALD-001	Tritium Confidence Interval	103	NA	NA	90
VGALD-001	Tritium LLD	191	183	198	179
	Results (pCi/L)	2/14/2008	5/13/2008	8/20/2008	11/10/2008
VGBWL-006	Tritium Activity	666	<LLD	<LLD	432
VGBWL-006	Tritium Confidence Interval	107	NA	NA	93
VGBWL-006	Tritium LLD	191	183	198	179
	Results (pCi/L)	2/12/2008	5/13/2008	8/15/2008	11/7/2008
VGBWL-007	Tritium Activity	<LLD	329	<LLD	<LLD
VGBWL-007	Tritium Confidence Interval	NA	93	NA	NA
VGBWL-007	Tritium LLD	191	183	189	190
	Results (pCi/L)	2/12/2008	5/14/2008	8/15/2008	11/7/2008
VGBWL-008	Tritium Activity	<LLD	703	<LLD	614
VGBWL-008	Tritium Confidence Interval	NA	106	NA	106
VGBWL-008	Tritium LLD	191	183	189	193
	Results (pCi/L)	2/20/2008	5/14/2008	8/19/2008	11/7/2008
VGBWL-009	Tritium Activity	<LLD	410	410	313
VGBWL-009	Tritium Confidence Interval	NA	97	98	101
VGBWL-009	Tritium LLD	187	183	189	190
	Results (pCi/L)	2/12/2008	5/1/2008	8/18/2008	11/6/2008
VGAKN-251	Tritium Activity	373	<LLD	<LLD	<LLD
VGAKN-251	Tritium Confidence Interval	96	NA	NA	NA
VGAKN-251	Tritium LLD	191	184	189	190
	Results (pCi/L)	2/12/2008	5/1/2008	8/18/2008	11/7/2008
VGALD-251	Tritium Activity	<LLD	<LLD	<LLD	<LLD
VGALD-251	Tritium Confidence Interval	NA	NA	NA	NA
VGALD-251	Tritium LLD	191	184	189	190
	Results (pCi/L)	2/12/2008	5/1/2008	8/18/2008	11/6/2008
VGORG-251	Tritium Activity	<LLD	<LLD	<LLD	<LLD
VGORG-251	Tritium Confidence Interval	NA	NA	NA	NA
VGORG-251	Tritium LLD	191	184	189	190

Radiological Monitoring of Terrestrial Vegetation Data

2008 Tritium in Vegetation

Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/L)	2/28/2008		Results (pCi/L)	2/28/2008
VGE53	Tritium Activity	<LLD	VGE59	Tritium Activity	<LLD
VGE53	Tritium Confidence Interval	NA	VGE59	Tritium Confidence Interval	NA
VGE53	Tritium LLD	187	VGE59	Tritium LLD	187
	Results (pCi/L)	2/28/2008		Results (pCi/L)	2/29/2008
VGE62	Tritium Activity	211	VGB49	Tritium Activity	<LLD
VGE62	Tritium Confidence Interval	87	VGB49	Tritium Confidence Interval	NA
VGE62	Tritium LLD	187	VGB49	Tritium LLD	187
	Results (pCi/L)	2/29/2008		Results (pCi/L)	2/29/2008
VGB56	Tritium Activity	<LLD	VGB62	Tritium Activity	<LLD
VGB56	Tritium Confidence Interval	NA	VGB62	Tritium Confidence Interval	NA
VGB56	Tritium LLD	187	VGB62	Tritium LLD	187
	Results (pCi/L)	5/28/2008		Results (pCi/L)	5/27/2008
VGE54	Tritium Activity	<LLD	VGE57	Tritium Activity	<LLD
VGE54	Tritium Confidence Interval	NA	VGE57	Tritium Confidence Interval	NA
VGE54	Tritium LLD	183	VGE57	Tritium LLD	183
	Results (pCi/L)	5/27/2008		Results (pCi/L)	5/27/2008
VGE63	Tritium Activity	201	VGB53	Tritium Activity	<LLD
VGE63	Tritium Confidence Interval	87	VGB53	Tritium Confidence Interval	NA
VGE63	Tritium LLD	183	VGB53	Tritium LLD	183
	Results (pCi/L)	5/28/2008		Results (pCi/L)	5/28/2008
VGB54	Tritium Activity	204	VGB60	Tritium Activity	<LLD
VGB54	Tritium Confidence Interval	87	VGB60	Tritium Confidence Interval	NA
VGB54	Tritium LLD	183	VGB60	Tritium LLD	183
	Results (pCi/L)	8/18/2008		Results (pCi/L)	8/18/2008
VGE55	Tritium Activity	251	VGE56	Tritium Activity	247
VGE55	Tritium Confidence Interval	91	VGE56	Tritium Confidence Interval	91
VGE55	Tritium LLD	189	VGE56	Tritium LLD	189
	Results (pCi/L)	8/18/2008		Results (pCi/L)	8/27/2008
VGE58	Tritium Activity	429	VGB55	Tritium Activity	<LLD
VGE58	Tritium Confidence Interval	98	VGB55	Tritium Confidence Interval	NA
VGE58	Tritium LLD	189	VGB55	Tritium LLD	198
	Results (pCi/L)	8/27/2008		Results (pCi/L)	8/27/2008
VGB57	Tritium Activity	<LLD	VGB58	Tritium Activity	<LLD
VGB57	Tritium Confidence Interval	NA	VGB58	Tritium Confidence Interval	NA
VGB57	Tritium LLD	198	VGB58	Tritium LLD	198

Radiological Monitoring of Terrestrial Vegetation Data

2008 Tritium in Vegetation

Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/L)	12/17/2008		Results (pCi/L)	12/17/2008
VGE51	Tritium Activity	<LLD	VGE61	Tritium Activity	<LLD
VGE51	Tritium Confidence Interval	NA	VGE61	Tritium Confidence Interval	NA
VGE51	Tritium LLD	176	VGE61	Tritium LLD	176
	Results (pCi/L)	12/17/2008		Results (pCi/L)	12/18/2008
VGE64	Tritium Activity	<LLD	VGB51	Tritium Activity	<LLD
VGE64	Tritium Confidence Interval	NA	VGB51	Tritium Confidence Interval	NA
VGE64	Tritium LLD	176	VGB51	Tritium LLD	176
	Results (pCi/L)	12/18/2008		Results (pCi/L)	12/18/2008
VGB59	Tritium Activity	<LLD	VGB61	Tritium Activity	<LLD
VGB59	Tritium Confidence Interval	NA	VGB61	Tritium Confidence Interval	NA
VGB59	Tritium LLD	176	VGB61	Tritium LLD	176

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Vegetation

Location Description	Analyte	Collection Date / Result	Collection Date / Result	Collection Date / Result	Collection Date / Result
	Results (pCi/g) fresh weight	2/20/2008	5/8/2008	8/19/2008	11/10/2008
VGAKN-001	Be-7 Activity	2.980	0.356	1.633	0.660
VGAKN-001	Be-7 Confidence Interval	0.435	0.152	0.391	0.279
VGAKN-001	Be-7 MDA	0.289	0.167	0.298	0.256
VGAKN-001	K-40 Activity	1.690	2.797	2.053	1.897
VGAKN-001	K-40 Confidence Interval	0.280	0.332	0.285	0.275
VGAKN-001	K-40 MDA	0.161	0.122	0.119	0.127
VGAKN-001	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-001	Co-60 Confidence Interval	NA	NA	NA	NA
VGAKN-001	Co-60 MDA	0.018	0.013	0.014	0.012
VGAKN-001	Cs-137 Activity	0.115	0.059	<MDA	<MDA
VGAKN-001	Cs-137 Confidence Interval	0.026	0.017	NA	NA
VGAKN-001	Cs-137 MDA	0.018	0.015	0.015	0.014
VGAKN-001	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-001	Pb-212 Confidence Interval	NA	NA	NA	NA
VGAKN-001	Pb-212 MDA	0.039	0.030	0.032	0.030
VGAKN-001	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-001	Pb-214 Confidence Interval	NA	NA	NA	NA
VGAKN-001	Pb-214 MDA	0.043	0.035	0.035	0.039
VGAKN-001	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-001	Am-241 Confidence Interval	NA	NA	NA	NA
VGAKN-001	Am-241 MDA	0.129	0.099	0.106	0.112

	Results (pCi/g) fresh weight	2/20/2008	5/8/2008	8/19/2008	11/10/2008
VGAKN-002	Be-7 Activity	4.189	0.842	3.286	1.000
VGAKN-002	Be-7 Confidence Interval	0.476	0.199	0.767	0.284
VGAKN-002	Be-7 MDA	0.301	0.154	0.496	0.271
VGAKN-002	K-40 Activity	2.953	2.826	3.774	3.086
VGAKN-002	K-40 Confidence Interval	0.349	0.316	0.484	0.341
VGAKN-002	K-40 MDA	0.152	0.104	0.176	0.127
VGAKN-002	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-002	Co-60 Confidence Interval	NA	NA	NA	NA
VGAKN-002	Co-60 MDA	0.018	0.011	0.022	0.016
VGAKN-002	Cs-137 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-002	Cs-137 Confidence Interval	NA	NA	NA	NA
VGAKN-002	Cs-137 MDA	0.018	0.015	0.028	0.016
VGAKN-002	Pb-212 Activity	<MDA	<MDA	<MDA	0.059
VGAKN-002	Pb-212 Confidence Interval	NA	NA	NA	0.019
VGAKN-002	Pb-212 MDA	0.041	0.029	0.059	0.029
VGAKN-002	Pb-214 Activity	<MDA	<MDA	<MDA	0.373
VGAKN-002	Pb-214 Confidence Interval	NA	NA	NA	0.040
VGAKN-002	Pb-214 MDA	0.051	0.032	0.067	0.032
VGAKN-002	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-002	Am-241 Confidence Interval	NA	NA	NA	NA
VGAKN-002	Am-241 MDA	0.152	0.101	0.196	0.128

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Location Description	Analyte	Collection Date / Result	Collection Date / Result	Collection Date / Result	Collection Date / Result
	Results (pCi/g) fresh weight	2/20/2008	5/8/2008	8/19/2008	11/10/2008
VGAKN-003	Be-7 Activity	3.410	0.530	1.532	1.841
VGAKN-003	Be-7 Confidence Interval	0.394	0.169	0.340	0.382
VGAKN-003	Be-7 MDA	0.295	0.173	0.334	0.292
VGAKN-003	K-40 Activity	2.568	2.572	2.525	2.019
VGAKN-003	K-40 Confidence Interval	0.319	0.286	0.311	0.285
VGAKN-003	K-40 MDA	0.145	0.089	0.120	0.118
VGAKN-003	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-003	Co-60 Confidence Interval	NA	NA	NA	NA
VGAKN-003	Co-60 MDA	0.019	0.011	0.015	0.015
VGAKN-003	Cs-137 Activity	0.212	0.481	0.381	0.446
VGAKN-003	Cs-137 Confidence Interval	0.029	0.048	0.040	0.047
VGAKN-003	Cs-137 MDA	0.017	0.014	0.015	0.015
VGAKN-003	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-003	Pb-212 Confidence Interval	NA	NA	NA	NA
VGAKN-003	Pb-212 MDA	0.039	0.028	0.031	0.033
VGAKN-003	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-003	Pb-214 Confidence Interval	NA	NA	NA	NA
VGAKN-003	Pb-214 MDA	0.043	0.031	0.035	0.040
VGAKN-003	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-003	Am-241 Confidence Interval	NA	NA	NA	NA
VGAKN-003	Am-241 MDA	0.142	0.100	0.112	0.114

	Results (pCi/g) fresh weight	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGAKN-005	Be-7 Activity	2.683	0.422	1.395	1.623
VGAKN-005	Be-7 Confidence Interval	0.411	0.158	0.369	0.386
VGAKN-005	Be-7 MDA	0.310	0.186	0.373	0.273
VGAKN-005	K-40 Activity	2.011	3.227	2.127	1.845
VGAKN-005	K-40 Confidence Interval	0.304	0.342	0.293	0.275
VGAKN-005	K-40 MDA	0.156	0.099	0.115	0.136
VGAKN-005	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-005	Co-60 Confidence Interval	NA	NA	NA	NA
VGAKN-005	Co-60 MDA	0.020	0.012	0.013	0.015
VGAKN-005	Cs-137 Activity	0.315	0.622	0.625	0.360
VGAKN-005	Cs-137 Confidence Interval	0.038	0.061	0.062	0.041
VGAKN-005	Cs-137 MDA	0.018	0.015	0.015	0.015
VGAKN-005	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-005	Pb-212 Confidence Interval	NA	NA	NA	NA
VGAKN-005	Pb-212 MDA	0.038	0.029	0.033	0.032
VGAKN-005	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-005	Pb-214 Confidence Interval	NA	NA	NA	NA
VGAKN-005	Pb-214 MDA	0.043	0.033	0.036	0.038
VGAKN-005	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-005	Am-241 Confidence Interval	NA	NA	NA	NA
VGAKN-005	Am-241 MDA	0.146	0.107	0.117	0.130

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Location Description	Analyte	Collection Date / Result	Collection Date / Result	Collection Date / Result	Collection Date / Result
	Results (pCi/g) fresh weight	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGAKN-006	Be-7 Activity	3.837	0.853	2.401	1.342
VGAKN-006	Be-7 Confidence Interval	0.507	0.184	0.410	0.324
VGAKN-006	Be-7 MDA	0.279	0.148	0.320	0.264
VGAKN-006	K-40 Activity	1.599	2.540	1.694	1.621
VGAKN-006	K-40 Confidence Interval	0.261	0.302	0.252	0.281
VGAKN-006	K-40 MDA	0.129	0.099	0.113	0.130
VGAKN-006	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-006	Co-60 Confidence Interval	NA	NA	NA	NA
VGAKN-006	Co-60 MDA	0.016	0.013	0.012	0.014
VGAKN-006	Cs-137 Activity	0.047	0.144	0.111	0.085
VGAKN-006	Cs-137 Confidence Interval	0.018	0.024	0.019	0.017
VGAKN-006	Cs-137 MDA	0.018	0.013	0.014	0.014
VGAKN-006	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-006	Pb-212 Confidence Interval	NA	NA	NA	NA
VGAKN-006	Pb-212 MDA	0.038	0.029	0.032	0.032
VGAKN-006	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-006	Pb-214 Confidence Interval	NA	NA	NA	NA
VGAKN-006	Pb-214 MDA	0.046	0.032	0.038	0.040
VGAKN-006	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-006	Am-241 Confidence Interval	NA	NA	NA	NA
VGAKN-006	Am-241 MDA	0.136	0.097	0.106	0.109

	Results (pCi/g) fresh weight	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGAKN-008	Be-7 Activity	2.181	0.504	1.367	2.407
VGAKN-008	Be-7 Confidence Interval	0.370	0.214	0.487	0.354
VGAKN-008	Be-7 MDA	0.322	0.189	0.316	0.286
VGAKN-008	K-40 Activity	2.498	2.870	2.191	2.138
VGAKN-008	K-40 Confidence Interval	0.333	0.318	0.293	0.292
VGAKN-008	K-40 MDA	0.123	0.115	0.117	0.131
VGAKN-008	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-008	Co-60 Confidence Interval	NA	NA	NA	NA
VGAKN-008	Co-60 MDA	0.018	0.015	0.015	0.012
VGAKN-008	Cs-137 Activity	0.433	0.607	0.400	0.524
VGAKN-008	Cs-137 Confidence Interval	0.045	0.059	0.043	0.053
VGAKN-008	Cs-137 MDA	0.019	0.015	0.016	0.014
VGAKN-008	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-008	Pb-212 Confidence Interval	NA	NA	NA	NA
VGAKN-008	Pb-212 MDA	0.040	0.031	0.031	0.032
VGAKN-008	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-008	Pb-214 Confidence Interval	NA	NA	NA	NA
VGAKN-008	Pb-214 MDA	0.043	0.036	0.036	0.038
VGAKN-008	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGAKN-008	Am-241 Confidence Interval	NA	NA	NA	NA
VGAKN-008	Am-241 MDA	0.141	0.127	0.115	0.112

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Location Description	**Analyte**	**Collection Date / Result**	**Collection Date / Result**	**Collection Date / Result**	**Collection Date / Result**
	Results (pCi/g) fresh weight	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGBWL-004	Be-7 Activity	1.764	0.386	0.727	2.265
VGBWL-004	Be-7 Confidence Interval	0.301	0.160	0.257	0.405
VGBWL-004	Be-7 MDA	0.269	0.171	0.344	0.264
VGBWL-004	K-40 Activity	2.231	2.905	2.356	2.081
VGBWL-004	K-40 Confidence Interval	0.274	0.349	0.348	0.297
VGBWL-004	K-40 MDA	0.134	0.118	0.120	0.125
VGBWL-004	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-004	Co-60 Confidence Interval	NA	NA	NA	NA
VGBWL-004	Co-60 MDA	0.016	0.013	0.015	0.015
VGBWL-004	Cs-137 Activity	0.041	0.189	0.195	0.132
VGBWL-004	Cs-137 Confidence Interval	0.020	0.027	0.030	0.020
VGBWL-004	Cs-137 MDA	0.016	0.013	0.016	0.014
VGBWL-004	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-004	Pb-212 Confidence Interval	NA	NA	NA	NA
VGBWL-004	Pb-212 MDA	0.034	0.029	0.032	0.032
VGBWL-004	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-004	Pb-214 Confidence Interval	NA	NA	NA	NA
VGBWL-004	Pb-214 MDA	0.038	0.034	0.039	0.041
VGBWL-004	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-004	Am-241 Confidence Interval	NA	NA	NA	NA
VGBWL-004	Am-241 MDA	0.118	0.110	0.108	0.115

	Results (pCi/g) fresh weight	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGALD-001	Be-7 Activity	1.319	<MDA	0.877	<MDA
VGALD-001	Be-7 Confidence Interval	0.284	NA	0.416	NA
VGALD-001	Be-7 MDA	0.289	0.190	0.320	0.265
VGALD-001	K-40 Activity	2.594	3.371	2.752	2.547
VGALD-001	K-40 Confidence Interval	0.322	0.341	0.353	0.309
VGALD-001	K-40 MDA	0.151	0.111	0.123	0.113
VGALD-001	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGALD-001	Co-60 Confidence Interval	NA	NA	NA	NA
VGALD-001	Co-60 MDA	0.016	0.014	0.014	0.014
VGALD-001	Cs-137 Activity	<MDA	0.099	0.114	<MDA
VGALD-001	Cs-137 Confidence Interval	NA	0.021	0.022	NA
VGALD-001	Cs-137 MDA	0.019	0.015	0.016	0.014
VGALD-001	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGALD-001	Pb-212 Confidence Interval	NA	NA	NA	NA
VGALD-001	Pb-212 MDA	0.039	0.031	0.031	0.030
VGALD-001	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGALD-001	Pb-214 Confidence Interval	NA	NA	NA	NA
VGALD-001	Pb-214 MDA	0.045	0.034	0.037	0.034
VGALD-001	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGALD-001	Am-241 Confidence Interval	NA	NA	NA	NA
VGALD-001	Am-241 MDA	0.133	0.112	0.109	0.114

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Location Description	Analyte	Collection Date / Result	Collection Date / Result	Collection Date / Result	Collection Date / Result
	Results (pCi/g) fresh weight	2/14/2008	5/13/2008	8/19/2008	11/10/2008
VGBWL-006	Be-7 Activity	1.811	0.493	1.324	1.181
VGBWL-006	Be-7 Confidence Interval	0.391	0.178	0.396	0.315
VGBWL-006	Be-7 MDA	0.330	0.213	0.344	0.306
VGBWL-006	K-40 Activity	2.120	2.645	1.300	1.801
VGBWL-006	K-40 Confidence Interval	0.313	0.317	0.241	0.265
VGBWL-006	K-40 MDA	0.146	0.119	0.116	0.101
VGBWL-006	Co-60 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-006	Co-60 Confidence Interval	NA	NA	NA	NA
VGBWL-006	Co-60 MDA	0.018	0.013	0.013	0.012
VGBWL-006	Cs-137 Activity	0.238	0.434	0.623	0.287
VGBWL-006	Cs-137 Confidence Interval	0.029	0.045	0.062	0.035
VGBWL-006	Cs-137 MDA	0.018	0.015	0.014	0.015
VGBWL-006	Pb-212 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-006	Pb-212 Confidence Interval	NA	NA	NA	NA
VGBWL-006	Pb-212 MDA	0.038	0.031	0.031	0.033
VGBWL-006	Pb-214 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-006	Pb-214 Confidence Interval	NA	NA	NA	NA
VGBWL-006	Pb-214 MDA	0.047	0.037	0.035	0.038
VGBWL-006	Am-241 Activity	<MDA	<MDA	<MDA	<MDA
VGBWL-006	Am-241 Confidence Interval	NA	NA	NA	NA
VGBWL-006	Am-241 MDA	0.147	0.120	0.115	0.116

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Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/g) fresh weight	2/28/2008		Results (pCi/g) fresh weight	2/28/2008
VGE53	Be-7 Activity	1.529	VGE59	Be-7 Activity	2.587
VGE53	Be-7 Confidence Interval	0.320	VGE59	Be-7 Confidence Interval	0.352
VGE53	Be-7 MDA	0.248	VGE59	Be-7 MDA	0.269
VGE53	K-40 Activity	3.805	VGE59	K-40 Activity	2.659
VGE53	K-40 Confidence Interval	0.399	VGE59	K-40 Confidence Interval	0.357
VGE53	K-40 MDA	0.127	VGE59	K-40 MDA	0.145
VGE53	Co-60 Activity	<MDA	VGE59	Co-60 Activity	<MDA
VGE53	Co-60 Confidence Interval	NA	VGE59	Co-60 Confidence Interval	NA
VGE53	Co-60 MDA	0.017	VGE59	Co-60 MDA	0.018
VGE53	Cs-137 Activity	<MDA	VGE59	Cs-137 Activity	<MDA
VGE53	Cs-137 Confidence Interval	NA	VGE59	Cs-137 Confidence Interval	NA
VGE53	Cs-137 MDA	0.019	VGE59	Cs-137 MDA	0.020
VGE53	Pb-212 Activity	<MDA	VGE59	Pb-212 Activity	<MDA
VGE53	Pb-212 Confidence Interval	NA	VGE59	Pb-212 Confidence Interval	NA
VGE53	Pb-212 MDA	0.039	VGE59	Pb-212 MDA	0.040
VGE53	Pb-214 Activity	<MDA	VGE59	Pb-214 Activity	<MDA
VGE53	Pb-214 Confidence Interval	NA	VGE59	Pb-214 Confidence Interval	NA
VGE53	Pb-214 MDA	0.045	VGE59	Pb-214 MDA	0.050
VGE53	Am-241 Activity	<MDA	VGE59	Am-241 Activity	<MDA
VGE53	Am-241 Confidence Interval	NA	VGE59	Am-241 Confidence Interval	NA
VGE53	Am-241 MDA	0.141	VGE59	Am-241 MDA	0.137

	Results (pCi/g) fresh weight	2/28/2008		Results (pCi/g) fresh weight	2/29/2008
VGE62	Be-7 Activity	1.481	VGB49	Be-7 Activity	1.974
VGE62	Be-7 Confidence Interval	0.291	VGB49	Be-7 Confidence Interval	0.322
VGE62	Be-7 MDA	0.280	VGB49	Be-7 MDA	0.265
VGE62	K-40 Activity	3.701	VGB49	K-40 Activity	5.251
VGE62	K-40 Confidence Interval	0.401	VGB49	K-40 Confidence Interval	0.489
VGE62	K-40 MDA	0.147	VGB49	K-40 MDA	0.134
VGE62	Co-60 Activity	<MDA	VGB49	Co-60 Activity	<MDA
VGE62	Co-60 Confidence Interval	NA	VGB49	Co-60 Confidence Interval	NA
VGE62	Co-60 MDA	0.018	VGB49	Co-60 MDA	0.019
VGE62	Cs-137 Activity	<MDA	VGB49	Cs-137 Activity	<MDA
VGE62	Cs-137 Confidence Interval	NA	VGB49	Cs-137 Confidence Interval	NA
VGE62	Cs-137 MDA	0.018	VGB49	Cs-137 MDA	0.018
VGE62	Pb-212 Activity	<MDA	VGB49	Pb-212 Activity	<MDA
VGE62	Pb-212 Confidence Interval	NA	VGB49	Pb-212 Confidence Interval	NA
VGE62	Pb-212 MDA	0.040	VGB49	Pb-212 MDA	0.039
VGE62	Pb-214 Activity	<MDA	VGB49	Pb-214 Activity	<MDA
VGE62	Pb-214 Confidence Interval	NA	VGB49	Pb-214 Confidence Interval	NA
VGE62	Pb-214 MDA	0.049	VGB49	Pb-214 MDA	0.044
VGE62	Am-241 Activity	<MDA	VGB49	Am-241 Activity	<MDA
VGE62	Am-241 Confidence Interval	NA	VGB49	Am-241 Confidence Interval	NA
VGE62	Am-241 MDA	0.141	VGB49	Am-241 MDA	0.138

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Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/g) fresh weight	2/29/2008		Results (pCi/g) fresh weight	2/29/2008
VGB56	Be-7 Activity	2.602	VGB62	Be-7 Activity	2.710
VGB56	Be-7 Confidence Interval	0.372	VGB62	Be-7 Confidence Interval	0.437
VGB56	Be-7 MDA	0.263	VGB62	Be-7 MDA	0.290
VGB56	K-40 Activity	1.286	VGB62	K-40 Activity	3.167
VGB56	K-40 Confidence Interval	0.233	VGB62	K-40 Confidence Interval	0.371
VGB56	K-40 MDA	0.114	VGB62	K-40 MDA	0.143
VGB56	Co-60 Activity	<MDA	VGB62	Co-60 Activity	<MDA
VGB56	Co-60 Confidence Interval	NA	VGB62	Co-60 Confidence Interval	NA
VGB56	Co-60 MDA	0.015	VGB62	Co-60 MDA	0.014
VGB56	Cs-137 Activity	<MDA	VGB62	Cs-137 Activity	<MDA
VGB56	Cs-137 Confidence Interval	NA	VGB62	Cs-137 Confidence Interval	NA
VGB56	Cs-137 MDA	0.019	VGB62	Cs-137 MDA	0.018
VGB56	Pb-212 Activity	<MDA	VGB62	Pb-212 Activity	<MDA
VGB56	Pb-212 Confidence Interval	NA	VGB62	Pb-212 Confidence Interval	NA
VGB56	Pb-212 MDA	0.037	VGB62	Pb-212 MDA	0.038
VGB56	Pb-214 Activity	<MDA	VGB62	Pb-214 Activity	<MDA
VGB56	Pb-214 Confidence Interval	NA	VGB62	Pb-214 Confidence Interval	NA
VGB56	Pb-214 MDA	0.043	VGB62	Pb-214 MDA	0.045
VGB56	Am-241 Activity	<MDA	VGB62	Am-241 Activity	<MDA
VGB56	Am-241 Confidence Interval	NA	VGB62	Am-241 Confidence Interval	NA
VGB56	Am-241 MDA	0.135	VGB62	Am-241 MDA	0.142

	Results (pCi/g) fresh weight	5/28/2008		Results (pCi/g) fresh weight	5/27/2008
VGE54	Be-7 Activity	0.945	VGE57	Be-7 Activity	0.794
VGE54	Be-7 Confidence Interval	0.215	VGE57	Be-7 Confidence Interval	0.164
VGE54	Be-7 MDA	0.160	VGE57	Be-7 MDA	0.147
VGE54	K-40 Activity	2.579	VGE57	K-40 Activity	2.837
VGE54	K-40 Confidence Interval	0.324	VGE57	K-40 Confidence Interval	0.328
VGE54	K-40 MDA	0.123	VGE57	K-40 MDA	0.128
VGE54	Co-60 Activity	<MDA	VGE57	Co-60 Activity	<MDA
VGE54	Co-60 Confidence Interval	NA	VGE57	Co-60 Confidence Interval	NA
VGE54	Co-60 MDA	0.015	VGE57	Co-60 MDA	0.015
VGE54	Cs-137 Activity	<MDA	VGE57	Cs-137 Activity	<MDA
VGE54	Cs-137 Confidence Interval	NA	VGE57	Cs-137 Confidence Interval	NA
VGE54	Cs-137 MDA	0.015	VGE57	Cs-137 MDA	0.016
VGE54	Pb-212 Activity	<MDA	VGE57	Pb-212 Activity	<MDA
VGE54	Pb-212 Confidence Interval	NA	VGE57	Pb-212 Confidence Interval	NA
VGE54	Pb-212 MDA	0.030	VGE57	Pb-212 MDA	0.035
VGE54	Pb-214 Activity	<MDA	VGE57	Pb-214 Activity	0.113
VGE54	Pb-214 Confidence Interval	NA	VGE57	Pb-214 Confidence Interval	0.030
VGE54	Pb-214 MDA	0.033	VGE57	Pb-214 MDA	0.030
VGE54	Am-241 Activity	<MDA	VGE57	Am-241 Activity	<MDA
VGE54	Am-241 Confidence Interval	NA	VGE57	Am-241 Confidence Interval	NA
VGE54	Am-241 MDA	0.099	VGE57	Am-241 MDA	0.117

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Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/g) fresh weight	5/27/2008		Results (pCi/g) fresh weight	5/27/2008
VGE63	Be-7 Activity	0.366	VGB53	Be-7 Activity	1.485
VGE63	Be-7 Confidence Interval	0.138	VGB53	Be-7 Confidence Interval	0.235
VGE63	Be-7 MDA	0.133	VGB53	Be-7 MDA	0.152
VGE63	K-40 Activity	4.992	VGB53	K-40 Activity	2.250
VGE63	K-40 Confidence Interval	0.443	VGB53	K-40 Confidence Interval	0.318
VGE63	K-40 MDA	0.123	VGB53	K-40 MDA	0.120
VGE63	Co-60 Activity	<MDA	VGB53	Co-60 Activity	<MDA
VGE63	Co-60 Confidence Interval	NA	VGB53	Co-60 Confidence Interval	NA
VGE63	Co-60 MDA	0.015	VGB53	Co-60 MDA	0.015
VGE63	Cs-137 Activity	<MDA	VGB53	Cs-137 Activity	<MDA
VGE63	Cs-137 Confidence Interval	NA	VGB53	Cs-137 Confidence Interval	NA
VGE63	Cs-137 MDA	0.014	VGB53	Cs-137 MDA	0.013
VGE63	Pb-212 Activity	<MDA	VGB53	Pb-212 Activity	<MDA
VGE63	Pb-212 Confidence Interval	NA	VGB53	Pb-212 Confidence Interval	NA
VGE63	Pb-212 MDA	0.029	VGB53	Pb-212 MDA	0.031
VGE63	Pb-214 Activity	<MDA	VGB53	Pb-214 Activity	<MDA
VGE63	Pb-214 Confidence Interval	NA	VGB53	Pb-214 Confidence Interval	NA
VGE63	Pb-214 MDA	0.034	VGB53	Pb-214 MDA	0.037
VGE63	Am-241 Activity	<MDA	VGB53	Am-241 Activity	<MDA
VGE63	Am-241 Confidence Interval	NA	VGB53	Am-241 Confidence Interval	NA
VGE63	Am-241 MDA	0.112	VGB53	Am-241 MDA	0.104

	Results (pCi/g) fresh weight	5/28/2008		Results (pCi/g) fresh weight	5/28/2008
VGB54	Be-7 Activity	<MDA	VGB60	Be-7 Activity	0.622
VGB54	Be-7 Confidence Interval	NA	VGB60	Be-7 Confidence Interval	0.233
VGB54	Be-7 MDA	0.160	VGB60	Be-7 MDA	0.148
VGB54	K-40 Activity	3.377	VGB60	K-40 Activity	2.628
VGB54	K-40 Confidence Interval	0.366	VGB60	K-40 Confidence Interval	0.339
VGB54	K-40 MDA	0.129	VGB60	K-40 MDA	0.121
VGB54	Co-60 Activity	<MDA	VGB60	Co-60 Activity	<MDA
VGB54	Co-60 Confidence Interval	NA	VGB60	Co-60 Confidence Interval	NA
VGB54	Co-60 MDA	0.013	VGB60	Co-60 MDA	0.014
VGB54	Cs-137 Activity	<MDA	VGB60	Cs-137 Activity	<MDA
VGB54	Cs-137 Confidence Interval	NA	VGB60	Cs-137 Confidence Interval	NA
VGB54	Cs-137 MDA	0.015	VGB60	Cs-137 MDA	0.016
VGB54	Pb-212 Activity	<MDA	VGB60	Pb-212 Activity	<MDA
VGB54	Pb-212 Confidence Interval	NA	VGB60	Pb-212 Confidence Interval	NA
VGB54	Pb-212 MDA	0.031	VGB60	Pb-212 MDA	0.030
VGB54	Pb-214 Activity	<MDA	VGB60	Pb-214 Activity	<MDA
VGB54	Pb-214 Confidence Interval	NA	VGB60	Pb-214 Confidence Interval	NA
VGB54	Pb-214 MDA	0.036	VGB60	Pb-214 MDA	0.036
VGB54	Am-241 Activity	<MDA	VGB60	Am-241 Activity	<MDA
VGB54	Am-241 Confidence Interval	NA	VGB60	Am-241 Confidence Interval	NA
VGB54	Am-241 MDA	0.111	VGB60	Am-241 MDA	0.115

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Vegetation

Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/g) fresh weight	8/18/2008		Results (pCi/g) fresh weight	8/18/2008
VGE55	Be-7 Activity	1.629	VGE56	Be-7 Activity	1.709
VGE55	Be-7 Confidence Interval	0.439	VGE56	Be-7 Confidence Interval	0.365
VGE55	Be-7 MDA	0.274	VGE56	Be-7 MDA	0.278
VGE55	K-40 Activity	2.146	VGE56	K-40 Activity	1.338
VGE55	K-40 Confidence Interval	0.288	VGE56	K-40 Confidence Interval	0.224
VGE55	K-40 MDA	0.100	VGE56	K-40 MDA	0.116
VGE55	Co-60 Activity	<MDA	VGE56	Co-60 Activity	<MDA
VGE55	Co-60 Confidence Interval	NA	VGE56	Co-60 Confidence Interval	NA
VGE55	Co-60 MDA	0.012	VGE56	Co-60 MDA	0.012
VGE55	Cs-137 Activity	<MDA	VGE56	Cs-137 Activity	0.082
VGE55	Cs-137 Confidence Interval	NA	VGE56	Cs-137 Confidence Interval	0.023
VGE55	Cs-137 MDA	0.014	VGE56	Cs-137 MDA	0.014
VGE55	Pb-212 Activity	<MDA	VGE56	Pb-212 Activity	<MDA
VGE55	Pb-212 Confidence Interval	NA	VGE56	Pb-212 Confidence Interval	NA
VGE55	Pb-212 MDA	0.036	VGE56	Pb-212 MDA	0.032
VGE55	Pb-214 Activity	0.122	VGE56	Pb-214 Activity	<MDA
VGE55	Pb-214 Confidence Interval	0.031	VGE56	Pb-214 Confidence Interval	NA
VGE55	Pb-214 MDA	0.029	VGE56	Pb-214 MDA	0.042
VGE55	Am-241 Activity	<MDA	VGE56	Am-241 Activity	<MDA
VGE55	Am-241 Confidence Interval	NA	VGE56	Am-241 Confidence Interval	NA
VGE55	Am-241 MDA	0.119	VGE56	Am-241 MDA	0.112

	Results (pCi/g) fresh weight	8/18/2008		Results (pCi/g) fresh weight	8/27/2008
VGE58	Be-7 Activity	1.048	VGB55	Be-7 Activity	1.011
VGE58	Be-7 Confidence Interval	0.395	VGB55	Be-7 Confidence Interval	0.405
VGE58	Be-7 MDA	0.282	VGB55	Be-7 MDA	0.331
VGE58	K-40 Activity	1.077	VGB55	K-40 Activity	2.661
VGE58	K-40 Confidence Interval	0.248	VGB55	K-40 Confidence Interval	0.353
VGE58	K-40 MDA	0.124	VGB55	K-40 MDA	0.132
VGE58	Co-60 Activity	<MDA	VGB55	Co-60 Activity	<MDA
VGE58	Co-60 Confidence Interval	NA	VGB55	Co-60 Confidence Interval	NA
VGE58	Co-60 MDA	0.014	VGB55	Co-60 MDA	0.017
VGE58	Cs-137 Activity	0.037	VGB55	Cs-137 Activity	<MDA
VGE58	Cs-137 Confidence Interval	0.015	VGB55	Cs-137 Confidence Interval	NA
VGE58	Cs-137 MDA	0.015	VGB55	Cs-137 MDA	0.016
VGE58	Pb-212 Activity	<MDA	VGB55	Pb-212 Activity	<MDA
VGE58	Pb-212 Confidence Interval	NA	VGB55	Pb-212 Confidence Interval	NA
VGE58	Pb-212 MDA	0.034	VGB55	Pb-212 MDA	0.039
VGE58	Pb-214 Activity	0.103	VGB55	Pb-214 Activity	0.228
VGE58	Pb-214 Confidence Interval	0.027	VGB55	Pb-214 Confidence Interval	0.033
VGE58	Pb-214 MDA	0.030	VGB55	Pb-214 MDA	0.032
VGE58	Am-241 Activity	<MDA	VGB55	Am-241 Activity	<MDA
VGE58	Am-241 Confidence Interval	NA	VGB55	Am-241 Confidence Interval	NA
VGE58	Am-241 MDA	0.119	VGB55	Am-241 MDA	0.125

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Vegetation

Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/g) fresh weight	8/27/2008		Results (pCi/g) fresh weight	8/27/2008
VGB57	Be-7 Activity	1.110	VGB58	Be-7 Activity	0.979
VGB57	Be-7 Confidence Interval	0.413	VGB58	Be-7 Confidence Interval	0.409
VGB57	Be-7 MDA	0.344	VGB58	Be-7 MDA	0.341
VGB57	K-40 Activity	3.063	VGB58	K-40 Activity	2.492
VGB57	K-40 Confidence Interval	0.367	VGB58	K-40 Confidence Interval	0.329
VGB57	K-40 MDA	0.151	VGB58	K-40 MDA	0.109
VGB57	Co-60 Activity	<MDA	VGB58	Co-60 Activity	<MDA
VGB57	Co-60 Confidence Interval	NA	VGB58	Co-60 Confidence Interval	NA
VGB57	Co-60 MDA	0.014	VGB58	Co-60 MDA	0.016
VGB57	Cs-137 Activity	<MDA	VGB58	Cs-137 Activity	<MDA
VGB57	Cs-137 Confidence Interval	NA	VGB58	Cs-137 Confidence Interval	NA
VGB57	Cs-137 MDA	0.015	VGB58	Cs-137 MDA	0.014
VGB57	Pb-212 Activity	<MDA	VGB58	Pb-212 Activity	<MDA
VGB57	Pb-212 Confidence Interval	NA	VGB58	Pb-212 Confidence Interval	NA
VGB57	Pb-212 MDA	0.035	VGB58	Pb-212 MDA	0.034
VGB57	Pb-214 Activity	0.064	VGB58	Pb-214 Activity	0.061
VGB57	Pb-214 Confidence Interval	0.027	VGB58	Pb-214 Confidence Interval	0.027
VGB57	Pb-214 MDA	0.031	VGB58	Pb-214 MDA	0.029
VGB57	Am-241 Activity	<MDA	VGB58	Am-241 Activity	<MDA
VGB57	Am-241 Confidence Interval	NA	VGB58	Am-241 Confidence Interval	NA
VGB57	Am-241 MDA	0.118	VGB58	Am-241 MDA	0.114

	Results (pCi/g) fresh weight	12/17/2008		Results (pCi/g) fresh weight	12/17/2008
VGE51	Be-7 Activity	1.409	VGE61	Be-7 Activity	3.365
VGE51	Be-7 Confidence Interval	0.197	VGE61	Be-7 Confidence Interval	0.338
VGE51	Be-7 MDA	0.142	VGE61	Be-7 MDA	0.141
VGE51	K-40 Activity	1.123	VGE61	K-40 Activity	1.109
VGE51	K-40 Confidence Interval	0.216	VGE61	K-40 Confidence Interval	0.216
VGE51	K-40 MDA	0.094	VGE61	K-40 MDA	0.108
VGE51	Co-60 Activity	<MDA	VGE61	Co-60 Activity	<MDA
VGE51	Co-60 Confidence Interval	NA	VGE61	Co-60 Confidence Interval	NA
VGE51	Co-60 MDA	0.011	VGE61	Co-60 MDA	0.011
VGE51	Cs-137 Activity	<MDA	VGE61	Cs-137 Activity	<MDA
VGE51	Cs-137 Confidence Interval	NA	VGE61	Cs-137 Confidence Interval	NA
VGE51	Cs-137 MDA	0.013	VGE61	Cs-137 MDA	0.013
VGE51	Pb-212 Activity	<MDA	VGE61	Pb-212 Activity	<MDA
VGE51	Pb-212 Confidence Interval	NA	VGE61	Pb-212 Confidence Interval	NA
VGE51	Pb-212 MDA	0.027	VGE61	Pb-212 MDA	0.027
VGE51	Pb-214 Activity	0.056	VGE61	Pb-214 Activity	0.039
VGE51	Pb-214 Confidence Interval	0.026	VGE61	Pb-214 Confidence Interval	0.019
VGE51	Pb-214 MDA	0.024	VGE61	Pb-214 MDA	0.022
VGE51	Am-241 Activity	<MDA	VGE61	Am-241 Activity	<MDA
VGE51	Am-241 Confidence Interval	NA	VGE61	Am-241 Confidence Interval	NA
VGE51	Am-241 MDA	0.092	VGE61	Am-241 MDA	0.095

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Vegetation

Location Description	Analyte	Collection Date / Result	Location Description	Analyte	Collection Date / Result
	Results (pCi/g) fresh weight	12/17/2008		Results (pCi/g) fresh weight	12/18/2008
VGE64	Be-7 Activity	1.794	VGB51	Be-7 Activity	1.373
VGE64	Be-7 Confidence Interval	0.233	VGB51	Be-7 Confidence Interval	0.223
VGE64	Be-7 MDA	0.146	VGB51	Be-7 MDA	0.144
VGE64	K-40 Activity	1.283	VGB51	K-40 Activity	1.678
VGE64	K-40 Confidence Interval	0.242	VGB51	K-40 Confidence Interval	0.237
VGE64	K-40 MDA	0.109	VGB51	K-40 MDA	0.103
VGE64	Co-60 Activity	<MDA	VGB51	Co-60 Activity	<MDA
VGE64	Co-60 Confidence Interval	NA	VGB51	Co-60 Confidence Interval	NA
VGE64	Co-60 MDA	0.012	VGB51	Co-60 MDA	0.011
VGE64	Cs-137 Activity	<MDA	VGB51	Cs-137 Activity	<MDA
VGE64	Cs-137 Confidence Interval	NA	VGB51	Cs-137 Confidence Interval	NA
VGE64	Cs-137 MDA	0.015	VGB51	Cs-137 MDA	0.013
VGE64	Pb-212 Activity	<MDA	VGB51	Pb-212 Activity	<MDA
VGE64	Pb-212 Confidence Interval	NA	VGB51	Pb-212 Confidence Interval	NA
VGE64	Pb-212 MDA	0.031	VGB51	Pb-212 MDA	0.026
VGE64	Pb-214 Activity	0.117	VGB51	Pb-214 Activity	0.131
VGE64	Pb-214 Confidence Interval	0.027	VGB51	Pb-214 Confidence Interval	0.024
VGE64	Pb-214 MDA	0.024	VGB51	Pb-214 MDA	0.025
VGE64	Am-241 Activity	<MDA	VGB51	Am-241 Activity	<MDA
VGE64	Am-241 Confidence Interval	NA	VGB51	Am-241 Confidence Interval	NA
VGE64	Am-241 MDA	0.096	VGB51	Am-241 MDA	0.095

	Results (pCi/g) fresh weight	12/18/2008		Results (pCi/g) fresh weight	12/18/2008
VGB59	Be-7 Activity	2.033	VGB61	Be-7 Activity	2.636
VGB59	Be-7 Confidence Interval	0.229	VGB61	Be-7 Confidence Interval	0.298
VGB59	Be-7 MDA	0.161	VGB61	Be-7 MDA	0.144
VGB59	K-40 Activity	1.537	VGB61	K-40 Activity	1.499
VGB59	K-40 Confidence Interval	0.218	VGB61	K-40 Confidence Interval	0.219
VGB59	K-40 MDA	0.089	VGB61	K-40 MDA	0.092
VGB59	Co-60 Activity	<MDA	VGB61	Co-60 Activity	<MDA
VGB59	Co-60 Confidence Interval	NA	VGB61	Co-60 Confidence Interval	NA
VGB59	Co-60 MDA	0.011	VGB61	Co-60 MDA	0.010
VGB59	Cs-137 Activity	0.029	VGB61	Cs-137 Activity	<MDA
VGB59	Cs-137 Confidence Interval	0.013	VGB61	Cs-137 Confidence Interval	NA
VGB59	Cs-137 MDA	0.012	VGB61	Cs-137 MDA	0.012
VGB59	Pb-212 Activity	<MDA	VGB61	Pb-212 Activity	<MDA
VGB59	Pb-212 Confidence Interval	NA	VGB61	Pb-212 Confidence Interval	NA
VGB59	Pb-212 MDA	0.027	VGB61	Pb-212 MDA	0.023
VGB59	Pb-214 Activity	<MDA	VGB61	Pb-214 Activity	<MDA
VGB59	Pb-214 Confidence Interval	NA	VGB61	Pb-214 Confidence Interval	NA
VGB59	Pb-214 MDA	0.034	VGB61	Pb-214 MDA	0.028
VGB59	Am-241 Activity	<MDA	VGB61	Am-241 Activity	<MDA
VGB59	Am-241 Confidence Interval	NA	VGB61	Am-241 Confidence Interval	NA
VGB59	Am-241 MDA	0.093	VGB61	Am-241 MDA	0.087

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Fungi (pCi/g)

2008 Mixed-Fungi 50-Mile Perimeter Random Quadrant Average Detections												
Quad	**E4**	**E24**	**E41**	**E44**	**E50**	**E51**	**E53**	**E56**	**E57**	**E58**	**E60**	**E63**
Isotope												
Be-7	<MDA	<MDA	<MDA	**5.63**	<MDA	<MDA	<MDA	**5.42**	<MDA	<MDA	**3.16**	<MDA
C.I.	NA	NA	NA	2.36	NA	NA	NA	2.51	NA	NA	1.30	NA
MDA	3.98	4.68	2.76	2.81	2.01	1.86	2.67	2.66	3.45	2.50	1.51	4.33
K-40	**20.10**	**19.57**	**16.23**	**<MDA**	**9.08**	**3.73**	**7.32**	**2.11**	**2.67**	**3.33**	**25.37**	**11.05**
C.I.	2.00	1.74	1.48	NA	1.27	0.62	1.28	0.72	0.89	0.93	2.27	1.51
MDA	0.45	0.41	0.37	2.17	0.40	0.36	0.78	0.51	0.53	0.52	0.63	0.64
Cs-137	**0.30**	**6.67**	**3.14**	<MDA	**0.26**	**1.21**	**0.22**	**0.55**	<MDA	**0.22**	**0.21**	<MDA
C.I.	0.07	0.49	0.26	NA	0.06	0.11	0.10	0.11	NA	0.07	0.10	NA
MDA	0.06	0.05	0.05	0.15	0.05	0.03	0.09	0.06	0.06	0.06	0.07	0.08
Pb-212	<MDA	**0.09**	**0.21**	<MDA	<MDA	<MDA	**0.22**	<MDA	<MDA	<MDA	<MDA	<MDA
C.I.	NA	0.03	0.05	NA	NA	NA	0.05	NA	NA	NA	NA	NA
MDA	0.05	0.04	0.03	0.09	0.03	0.03	0.06	0.04	0.05	0.04	0.05	0.05
Pb-214	**0.30**	**0.42**	**0.47**	**0.44**	**0.18**	<MDA	**1.36**	<MDA	**0.39**	<MDA	<MDA	**0.50**
C.I.	0.10	0.13	0.10	0.17	0.08	NA	0.16	NA	0.10	NA	NA	0.14
MDA	0.10	0.13	0.10	0.25	0.09	0.09	0.15	0.10	0.11	0.10	0.13	0.14
Ra-226	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	**8.49**	<MDA	<MDA	<MDA	<MDA	<MDA
C.I.	NA	NA	NA	NA	NA	NA	1.67	NA	NA	NA	NA	NA
MDA	1.05	1.01	0.87	2.77	0.93	0.71	1.41	1.13	1.18	0.77	1.22	1.27

Note:
All other radionuclides (Na-22, Mn-54, Co-58, C0-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154 Eu-155, Ac-228, Th-234, Am-241) were less than the minimum detectable activity.
The symbol names are located in Appendix A.

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Fungi (pCi/g)

2008 Mixed-Fungi South Carolina Background Quadrant Averages			
Quad	**Composite**	**B8**	**B83**
Isotope	**Nonrandom**	**Random**	**Random**
Be-7	<MDA	<MDA	<MDA
C.I.	NA	NA	NA
MDA	7.17	4.16	2.33
K-40	**25.00**	**30.53**	**21.06**
C.I.	2.76	2.92	1.79
MDA	0.94	0.77	0.41
Cs-137	<MDA	**2.10**	**0.57**
C.I.	NA	0.24	0.07
MDA	0.10	0.09	0.05
Pb-212	**0.10**	<MDA	<MDA
C.I.	0.05	NA	NA
MDA	0.06	0.06	0.04
Pb-214	**0.43**	<MDA	<MDA
C.I.	0.17	NA	NA
MDA	0.17	0.20	0.12

Note:
All other radionuclides (Na-22, Mn-54, Co-58, C0-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154 Eu-155, Ac-228, Th-234, Am-241) were less than the minimum detectable activity.
The symbol names are located in Appendix A.

Radiological Monitoring of Terrestrial Vegetation Data

2008 Gamma in Fungi (pCi/g)

Only Bolete Fungi Sample-Type										
	Within 50-Mile Perimeter							**South Carolina Background**		
Quad	**E24**	**E41**	**E24**	**E24**	**E24**	**E41**	**E41**	**Composite**	**B8**	**B83**
Sample	**NR21**	**NR22**	**NR26**	**NR29**	**NR36**	**NR38A**	**NR38B**	**Nonrandom**	**Random**	**Random**
Be-7	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA	<MDA
C.I.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MDA	8.31	0.71	8.12	0.61	5.76	3.61	3.97	7.17	4.16	2.33
K-40	**15.81**	**12.45**	**14.32**	**20.07**	**27.56**	**17.61**	**18.63**	**25.00**	**30.53**	**21.06**
C.I.	1.62	1.14	1.56	1.57	2.40	1.59	1.72	2.76	2.92	1.79
MDA	0.53	0.32	0.44	0.26	0.54	0.36	0.44	0.94	0.77	0.41
Cs-137	**8.98**	**1.50**	**11.02**	**2.29**	**8.74**	**3.96**	**3.95**	<MDA	**2.10**	**0.57**
C.I.	0.66	0.14	0.81	0.18	0.65	0.31	0.32	NA	0.24	0.07
MDA	0.06	0.04	0.06	0.04	0.07	0.05	0.06	0.10	0.09	0.05
Pb-212	**0.09**	**0.34**	<MDA	<MDA	<MDA	<MDA	**0.07**	**0.10**	<MDA	<MDA
C.I.	0.03	0.06	NA	NA	NA	NA	0.03	0.05	NA	NA
MDA	0.03	0.03	0.06	0.02	0.05	0.04	0.03	0.06	0.06	0.04
Pb-214	<MDA	**0.32**	**0.42**	<MDA	<MDA	<MDA	**0.62**	**0.43**	<MDA	<MDA
C.I.	NA	0.07	0.13	NA	NA	NA	0.14	0.17	NA	NA
MDA	0.16	0.07	0.16	0.09	0.15	0.11	0.11	0.17	0.20	0.12

Note:
All other radionuclides (Na-22, Mn-54, Co-58, C0-60, Zn-65, Y-88, Zr-95, Ru-103, Sb-125, I-131, Cs-134, Ce-144, Eu-152, Eu-154 Eu-155, Ac-228, Th-234, Am-241) were less than the minimum detectable activity
The symbol names are located in Appendix A.

TOC

3.2.5 Summary Statistics

Radiological Monitoring of Terrestrial Vegetation Data

Notes:

1. pCi/L - picocuries per liter
2. pCi/g - picocuries per gram
3. N denotes number of samples
4. ND denotes non-detect
5. NA denotes not applicable
6. Std Dev / SD – standard deviation
7. LLD - Lower Limit of Detection
8. MDA - Minimum Detectable Activity
9. >8hle – Indicates no determination due to greater than 8 half-lives elapsed
10. See Appendix A for radionuclide definitions

Radiological Monitoring of Terrestrial Vegetation Summary Statistics

2008 Vegetation Statistics

Tritium Levels (pCi/L) in Vegetation from SRS Perimeter Stations, 2008

Station	N (ND)	Average	Std Dev	Median	Maximum	Minimum
AKN-001	2 (2)	375	90.2	375	439	311
AKN-002	1 (3)	854	NA	854	854	
AKN-003	2 (2)	266	38.2	266	293	239
AKN-004	1 (3)	889	NA	889	889	
AKN-005	2 (2)	357	136.5	357	453	260
AKN-006	2 (2)	331	72.1	331	382	280
AKN-007	1 (3)	288	NA	288	288	
BWL-001	1 (3)	205	NA	205	205	
BWL-002	1 (3)	496	NA	496	496	
BWL-003	0 (4)	NA	NA	NA		
BWL-004	1 (3)	242	NA	242	242	
ALD-001	2 (2)	439	139.9	439	538	340
BWL-006	2 (2)	549	165.5	549	666	432
BWL-007	1 (3)	329	NA	329	329	
BWL-008	2 (2)	658	62.5	658	703	614
BWL-009	3 (1)	378	56.0	410	410	313
AKN-251	1 (3)	373	NA	373	373	
ALD-251	0 (4)	NA	NA	NA		
ORG-251	0 (4)	NA	NA	NA		

Averages exclude non-detections

Tritium Levels (pCi/L) in SRS Perimeter Vegetation Samples, 2008

N (ND)	Average	Std Dev	Median	Maximum	Minimum
24 (40)	433	190	396	889	239

Tritium Levels (pCi/L) in 25-mile Radius Vegetation Samples, 2008

N (ND)	Average	Std Dev	Median	Maximum	Minimum
1 (12)	373	NA	373	373	

Tritium Levels (pCi/L) in 50-mile Radius Vegetation Samples, 2008

N (ND)	Average	Std Dev	Median	Maximum	Minimum
5 (7)	268	92	247	429	201

Tritium Levels (pCi/L) in S.C. Background Vegetation Samples, 2008

N (ND)	Average	Std Dev	Median	Maximum	Minimum
1 (11)	204	NA	204	204	

Radiological Monitoring of Terrestrial Vegetation Summary Statistics

2008 Vegetation Statistics

Cesium-137 Levels (pCi/g-fresh) in SRS Perimeter Vegetation Samples, 2008						
Station	**N (ND)**	**Average**	**Std Dev**	**Median**	**Maximum**	**Minimum**
AKN-001	2 (2)	0.087	0.040	0.087	0.115	0.059
AKN-002	0 (4)	NA	NA	NA	NA	NA
AKN-003	4 (0)	0.380	0.120	0.414	0.481	0.212
AKN-005	4 (0)	0.480	0.166	0.491	0.625	0.315
AKN-006	4 (0)	0.097	0.041	0.098	0.144	0.047
AKN-008	4 (0)	0.491	0.093	0.478	0.607	0.400
BWL-004	4 (0)	0.139	0.071	0.160	0.195	0.041
ALD-006	2 (2)	0.106	0.011	0.106	0.114	0.099
BWL-006	4 (0)	0.395	0.173	0.360	0.623	0.238

Cs-137 Levels (pCi/g) in SRS Perimeter Vegetation Samples, 2008					
N (ND)	**Average**	**Std Dev**	**Median**	**Maximum**	**Minimum**
28 (8)	0.297	0.196	0.263	0.625	0.041

Cs-137 Levels (pCi/g) in 50-mile Radius Vegetation Samples, 2008					
N (ND)	**Average**	**Std Dev**	**Median**	**Maximum**	**Minimum**
2 (10)	0.060	0.032	0.060	0.082	0.037

Cs-137 Levels (pCi/g) in S.C. Background Vegetation Samples, 2008					
N (ND)	**Average**	**Std Dev**	**Median**	**Maximum**	**Minimum**
1 (11)	0.029	NA	0.029	0.029	

Radiological Monitoring of Terrestrial Vegetation Summary Statistics

2008 Fungi Statistics (pCi/g)

Table 1. Gamma in Fungi - 2008 Summary										
Quadrant Basis Statistics for All Fungi										
Mixed	E Quads	N=12		Bkg Quads	N=3		E minus B		Highest Cs-137	
Fungi	Average	SD	Median	Average	SD	Median	Avg	Median	Max	LOC
Be-7	**4.74**	1.37	**5.42**	NA	NA	NA	**4.74**	**5.42**	**6.07**	E44UCP
K-40	**10.96**	8.17	**9.08**	**25.53**	4.76	**25.00**	**<Bkg**	**<Bkg**	**27.56**	E24UCP
Cs-137	**1.42**	2.19	**0.30**	**1.34**	1.08	**1.34**	**0.08**	**<Bkg**	**11.02**	E24UCP
Pb-212	**0.17**	0.07	**0.21**	**0.10**	NA	**0.10**	**0.07**	**0.11**	**0.36**	E53UCP
Pb-214	**0.51**	0.36	**0.43**	**0.43**	NA	**0.43**	**0.08**	**0.00**	**2.04**	E53UCP
Ra-226	**8.49**	NA	**8.49**	NA	NA	NA	**8.49**	**8.49**	**8.49**	E53UCP
Sample-Type Statistics for Boletes Only										
Bolete	E Quads	50-Mile	N=7	B Quads	Bkg	N=3	E minus B		Highest Cs-137	
Fungi	Average	SD	Median	Average	SD	Median	Avg	Median	Max	LOC
Be-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
K-40	**18.06**	4.92	**17.61**	**25.53**	4.76	**25.00**	**<Bkg**	**<Bkg**	**27.56**	E24UCP
Cs-137	**5.78**	3.73	**3.96**	**1.34**	1.08	**1.34**	**4.44**	**2.61**	**11.02**	E24UCP
Pb-212	**0.17**	0.15	**0.09**	**0.10**	NA	**0.10**	**0.07**	**<Bkg**	**0.34**	E41UCP
Pb-214	**0.45**	0.15	**0.42**	**0.43**	NA	**0.43**	**0.02**	**<Bkg**	**0.62**	E41UCP
Ra-226	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2. Fungi Sample Statistics 2004-2008 by Geological Region																
Region	ALL South Carolina				Piedmont (PM)				Upper Coastal Plain (UCP)				Lower Coastal Plain (LCP)			
Isotope	AVG	SD	MED	N	AVG	SD	MED	N	AVG	SD	MED	N	AVG	SD	MED	N
Be-7	**4.01**	2.64	**3.16**	15	**5.28**	4.11	**5.28**	2	**3.91**	2.77	**3.16**	9	**3.60**	2.23	**3.60**	4
K-40	**7.88**	6.72	**5.81**	42	**6.46**	6.41	**2.67**	9	**8.06**	7.08	**5.61**	24	**7.85**	6.35	**5.83**	13
Cs-137	**1.50**	2.04	**0.91**	44	**0.94**	0.95	**0.29**	5	**1.70**	2.32	**0.97**	24	**1.28**	1.79	**0.66**	14
Pb-212	**0.24**	0.17	**0.22**	7	**0.34**	NA	**0.34**	1	**0.32**	0.23	**0.23**	6	**0.08**	NA	**0.08**	1
Pb-214	**0.63**	0.67	**0.35**	28	**0.42**	0.28	**0.35**	6	**0.82**	0.84	**0.48**	17	**0.40**	0.25	**0.30**	6
Ra-226	**5.18**	3.42	**4.59**	6	NA	NA	NA	NA	**5.30**	3.60	**4.59**	6	NA	NA	NA	NA

Notes:

1 – See Acronyms and Radionuclide lists for definitions.

2 – E minus B refers to the result after subtracting backgrounds from environmental study area or 50-mile perimeter.

3 – Quads refer to sample results from 7.5 minute U. S. Geological Survey Quadrants in South Carolina.

4 – Highlighted items place emphasis on items to compare. The median is usually a better indicator of the central tendency among large (>100) samples of environmental media.

5 – The underlined values denote maximums for radionuclides by geological regions.

6 – All data in tables are in pCi/g.

TOC

3.3 Radiological Monitoring of Edible Vegetation

3.3.1 Summary

Radionuclide deposition on crops and other plants may result in entry into the food chain in several ways. One pathway is by direct absorption into the plant through the foliage; another is by ingestion of the contaminated plant by animals or man. Radionuclides deposited on plants may also be washed off and enter the ground where they can be taken up by plants or may enter aquatic systems (Kathren 1984). Plant uptake of radionuclides depends upon many factors including species, tissue type, soil-water-plant relationships, soil type, and the chemical nature of the radionuclide in the soil (Hanlon IAFS 2004). "Sampling and analyzing native vegetation can provide information about the presence and movement of radionuclides in the environment" (LLNL 1997).

The Radiological Monitoring of Edible Vegetation Project is a component of the South Carolina Department of Health and Environmental Control's (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) that monitors edible food products from perimeter and background locations around the Savannah River Site (SRS). SCDHEC ESOP addresses public concerns pertaining to SRS operations through independent monitoring of radionuclide activities in edible vegetation grown around the perimeter of SRS. Edible vegetation was collected based solely on availability, and was directly dependent upon the growing season. To gain access to samples, relationships are established on an ongoing basis with farmers, gardeners, and/or businesses surrounding the perimeter of SRS. Vegetation samples, such as wild plums and pears, were collected as available.

ESOP initiated a random sampling system to determine if elevated levels of contaminants were attributed to SRS activities. This provides a more random coverage of the perimeter (E's, locations within 50 miles of the SRS center point, but outside the SRS boundary) and background (B's, locations greater than 50 miles from the SRS center point) within the boundaries of the state of South Carolina. This sampling scheme was implemented to allow statistical comparisons of the SRS perimeter and South Carolina background radionuclide levels in edible vegetation. The United States Geological Survey (USGS) 7.5' Quadrangle Coverage for South Carolina (USDOI 1992) was used to determine the ESOP random quadrant sampling areas.

Annual sampling began in January 2008 with ESOP collecting samples on a routine basis through the end of November using the random quadrant system previously described. Thirty-six samples were collected from 31 sampling locations: 10 randomly selected background locations, 21 randomly selected environmental locations, and five non-random perimeter locations. Section 3.3.2, Map 10 depicts only sampling collection sites that have become annual sampling locations for the project.

The DOE-SR annually collects and analyzes terrestrial food products to determine the presence of gamma-emitting radionuclides, tritium, total strontium (Sr-89/90), uranium-234 (U-234), uranium-235 (U-235), uranium-238 (U-238), plutonium-238 (Pu-238), plutonium-239 (Pu-239), americium-241 (Am-241), cobalt-60 (Co-60), curium-244 (Cm-244), gross alpha, and gross beta. In comparison, the ESOP analyzes food products collected to determine the presence of gamma-emitting radionuclides (cesium-137 (Cs-137), Co-60, iodine-131 (I-131), radium-226 (Ra-226), uranium/thorium-238 (U/Th238, Am-241), tritium, Sr-89/90. Alphas (or betas) are not directly comparable due to the unknown nature (species) of the contributing alphas (or betas) in any two compared samples. A complete list of the gamma-emitting radionuclides suite can be found in Table 1a. As resources become available and situations warrant, samples are shipped to a contract laboratory for U-234, U-235, U-238, P-238, P-239 testing. The DOE-SR collects collards and watermelons annually from one location within each of four quadrants. Secondary crops are also included on an annual rotating schedule (pecans, peanuts, soybeans, corn, cabbage, and wheat).

According to the 2008 DOE-SR reported data, edible vegetation samples (watermelon, collards, pecans, and peanuts) collected in 2008 were found to have activities above the minimum detectable concentrations (MDC) for cesium-137 (Cs-137), total strontium (Sr-89/90), uranium-238 (U-238), americium-241, gross beta and gross alpha. ESOP reported activities above the minimum detectable concentrations for tritium and Sr-89/90 in greens (mustards, turnips and collards) samples, soybeans and fruit samples. The only comparisons that could be made between ESOP and DOE-SR program were for watermelon and collards.

To improve comparisons between the two programs, ESOP seeks to establish better annual perimeter sampling, mirror the types of edible vegetation that DOE-SR collects annually, and split some samples with DOE-SR.

Results and Discussion

The International Atomic Energy Agency (IAEA) has established guideline levels for radionuclides in foods for general consumption for gamma-, beta-, and alpha-emitters. Table 1b in Section 3.3.3 shows the radionuclides of concern, the guideline level and their conversion to pCi/g for data comparison. IAEA emphasizes that the limits refer to the cumulative radioactivity in the food for a particular category (beta-emitters, alpha-emitters, and gamma-emitters) and should not be considered as individual limits for each nuclide.

Between the years of 2004-2008, ESOP collected 144 edible vegetation samples consisting of various fruits and vegetables for analysis across South Carolina. There were 107 perimeter and 37 background samples collected. Radionuclide detections among these samples were 37 detects of tritium, 14 detects of strontium 89/90 (Sr-89/90), and all other gamma-emitting radionuclides were below the MDA. Data tables for 2004-2008 are found in Tables 2 – 4d in Section 3.3.3. For comparison purposes, the data discussions for this time period can be located below within the discussion for the respective radionuclides. In comparing the fruits, grains and corn to the IAEA guidelines, all detections are well below the guideline levels.

In addition, potassium-40, lead-212, lead-214, and beryllium-7 were the only other gamma-emitting radionuclides detected among edible vegetation samples. These are Naturally Occurring Radioactive Material (NORM) decay products, which includes all radioactive elements found in the environment (World-Nuclear Organization 2009), that may account for these detections. All other gamma-emitting radionuclides had no detections above their respective MDA.

Tritium

Tritium is naturally present as a very small percentage of ordinary hydrogen in water, both liquid and vapor (ANL 2005). Historically, the main sources of tritium releases from the SRS operations were the reactor areas, the chemical separation facilities, and the tritium packaging areas. Tritium releases on the SRS include both atmospheric and liquid contributions (WSRC

2008). Because it moves through living cells in the same manner as water, tritiated water is more hazardous biologically than tritium gas (CDC SRSHES 1997).

Since 1988, when the last heavy water reactor at SRS was shut down, the tritium supply was re-established using the new Tritium Extraction Facility (TEF). This facility's mission is to transfer new tritium gas to the nation's tritium inventory (WSRC 2008). Adjacent to the SRS, the Southern Nuclear Operating Company operates the Vogtle Electric Generating Plant (VEGP) located in Burke County, GA. Permitted tritium releases coming from the VEGP are a result of spent fuel pools during power operation, during reactor operation by the fission process, and from fuel assemblies mainly during reactor operation and shortly after shutdown (Federal Register 1998).

2004-2008 Tritium Detections

As stated earlier, ESOP collected 144 edible vegetation samples both perimeter and background between 2004 and 2008. The tritium (H-3) average for all edible vegetation detections across all locations was 0.297 ((±0.127) pCi/g with a median of 0.271 pCi/g. The maximum detection during this time period was in a 2004 sample of plums from the Snelling area, 0.803 pCi/g, while the minimum detection was in a 2004 sample of passion fruit from the Williston area. Both detections were within 50 miles of the SRS. Also, during this time, tritium detections from perimeter samples (E's) averaged 0.297 (± 0.138) pCi/g while background sample detections (B's) averaged 0.301 (±0.065) pCi/g. The perimeter tritium average was less than one standard deviation from the background average. Both averages are well below the IAEA guideline for beta emitters (i.e. H-3) indicating that fallout from rain events may be the cause.

Fifteen pear samples have been collected since 2004 (eight perimeter and seven background). Of these, only three samples (one perimeter and two background) have had detects of tritium with an average of 0.300 pCi/g (±0.46) and a median of 0.280 pCi/g.

Twenty plum samples were collected between 2004 and 2008, all perimeter samples. No background samples were collected, as they are hard to locate for sampling. Only four samples (Allendale, Snelling and Aiken) of the 20 have had detects of tritium. The average was 0.422 pCi/g (±0.255) with a median of 0.306 pCi/g. The highest and lowest detects during this time period were in 2004, with a detect of 0.803 pCi/g in Snelling and 0.273 pCi/g in Allendale, respectively.

Of the 11 watermelon samples collected during this time period, only four had detects of tritium (three perimeter and one background). The average was 0.293 pCi/g (±0.093) with a median of 0.272 pCi/g across SC. The highest detect came from a sample near Bamberg County (Clear Pond), 0.423 pCi/g. The background sample, near Gilbert, was 0.204 pCi/g.

Sixteen grain samples (soybeans and wheat) have been collected between 2004 and 2008. The four samples of wheat (two each from the perimeter and background) had no detects of tritium. Of the 12 soybean samples (eight perimeter and four background), six samples (five perimeter and one background) had detections of tritium. The average tritium result was 0.326 pCi/g (±0.179) with a median of 0.269 pCi/g.
Thirty-three samples of greens have been collected across South Carolina since 2004. Of these, six (all perimeter samples) had detects of tritium. The tritium average was 0.223 pCi/g (±0.028) with a median of 0.214 pCi/g.

Seventeen corn samples were collected during this time period across SC (11 perimeter and six background) with only three detects of tritium (one perimeter and two background). The highest, a background sample from Gilbert, SC, was 0.403 pCi/g. The tritium average for corn was 0.303 (± 0.253) pCi/g with a median of 0.087 pCi/g.

In comparing the 2004-2008 perimeter with the background (Table 2c), the perimeter average, 0.297 (±0.138) pCi/g with a median of 0.262 pCi/g, is less than one standard deviation of the background average, 0.301 (± 0.065) pCi/g with a median of 0.302 pCi/g. This shows that the average perimeter and average background are very similar for tritium. All the results presented for this time period are less than the IAEA guidelines for tritium.

2008 Tritium

Tritium was detected in five of the total 37 ESOP samples collected in 2008 across South Carolina. Of these, three detections were within the 50-mile perimeter of the SRS. The highest detection from these perimeter samples, found in soybeans from a Barnwell location, was 0.673 pCi/g. The lowest perimeter tritium detection (0.202 pCi/g) was also found in a soybean sample from the Sycamore quad (Ulmer, SC). The tritium average for the edible vegetation from the perimeter locations was 0.383 (±0.254) pCi/g with a median of 0.273 pCi/g. Of the background samples that ESOP collected, there was one detection of tritium, 0.353 pCi/g, in a sample of pears from the Antreville quad (Abbeville County, Table 2). The tritium average for all 2008 edible vegetation across all locations was 0.366 (±0.181) pCi/g with a median of 0.329 pCi/g.

During 2008, ESOP collected plums from five of the six perimeter plum sampling locations (Aiken, Barnwell, Snelling, Jackson, and New Ellenton). Since plum trees at the Allendale location were destroyed, ESOP will be locating another suitable location to replace this collection site. Section 3.3.2, Map 10 depicts the permanent sampling locations established for collecting plums around the perimeter of SRS. Tritium detections were less than the lower limit of detection (LLD) in all samples except the Aiken location off of Highway 278, which had a detection of 0.329 pCi/g (Section 3.3.3). All of the detects described are well below the IAEA guideline for tritium (beta emitters).

The 2008 DOE-SR data reflects no tritium detections in any of the edible vegetation samples. ESOP reported tritium activity (0.273 pCi/g) in one watermelon collected from Millet, less than 50 miles from the SRS. Other tritium detections ESOP reported within the 50-mile perimeter of SRS were in one sample of plums (0.329 pCi/g) and two samples of soybeans (0.673 and 0.202 pCi/g).

A comparison of those 2008 locations < 50 miles from SRS (E's) to those > 50 miles from SRS (B's) indicates that the tritium levels are localized. This could indicate the levels are coming from SRS, other nuclear facilities or historical nuclear weapons testing.

Cesium-137

Cesium-137 is an alkali metal which is chemically and metabolically similar to potassium. If ingested, it is distributed relatively uniformly throughout the whole body, including bone marrow (Federal Radiation Council 1965). The largest source of Cs-137 in the environment was fallout from atmospheric nuclear weapons tests in the 1950's and 1960's that dispersed and deposited Cs-137 worldwide; however, much of that has now decayed (EPA 2000).

Pathways through plant foods are relatively unimportant as cesium is poorly absorbed by the plants from the soil. Cesium is relatively uniformly distributed throughout all portions of the plant and does not tend to concentrate in the edible portions. Grains, however, do tend to have relatively high concentrations although fruits and root vegetables, which have a high water content, tend to have low concentrations of cesium (Kathren 1984).

Cs-137 is a major radionuclide in spent nuclear fuel, high level radioactive waste resulting from the processing of spent nuclear fuel, and radioactive wastes associated with the operation of nuclear reactors and fuel reprocessing plants. Radioactive cesium is present in soil around the world largely as a result of fallout from past atmospheric nuclear weapons tests. The concentration of Cs-137 in surface soil from fallout ranges from about 0.1 to 1 pCi/g, averaging less than 0.4 pCi/g. Cesium is generally one of the less mobile radioactive metals in the environment. It preferentially adheres quite well to soil, and the concentration associated with sandy soil particles is estimated to be 280 times higher than in interstitial water; concentration ratios are much higher in clay and loam soils. Thus, cesium is generally not a major contaminant in groundwater at DOE sites or other locations (ANL 2005).

The DOE-SR data indicates that there were two Cs-137 detections in greens (collards, 0.034 and 0.052 pCi/g), both within the 0-10 mile designated quadrants (Section 3.3.5, "DOE-SR Detections"). However, none of the 36 ESOP samples collected in 2008 had Cs-137 detects. The difference in detectable concentrations between the two programs can be contributed to the respective detection limits. The average minimum detectable concentration for the ESOP program is 0.0289 pCi/g whereas the minimum detectable concentration for DOE-SR is 0.0059 pCi/g.

All ESOP samples, both perimeter and background, between 2004 and 2008 (Section 3.3.3) were also less than the minimum detectable activity for Cs-137. Statistical comparisons between the two programs cannot be made at this time due to Cs-137 data from the ESOP program being lower than the detection limit.

Strontium 89/90

The food crop pathway for strontium is important largely because the downward movement of strontium in soils is relatively slow; even in soils with low clay and humus content, through which movement is fastest, most of the strontium will remain in the upper few centimeters several years after deposition. Strontium preferentially adheres to soil particles, and the amount in sandy soil is typically about 15 times higher than in interstitial water; concentrations ratios are typically higher (110) in clay soil (ANL 2007). Low calcium content of the soil furthers strontium uptake by plants, as does low pH. Treatment of soil with lime to increase pH has been suggested as a means of reducing plant uptake of radiostrontiums from soil (Kathren 1984).

Although ESOP and DOE-SR analyzes for total strontium (Sr89/90), ANL states that Sr-90 is present in surface soil around the world as a result of fallout from past atmospheric nuclear weapons tests. According to ANL, in 2005, Sr-90 levels in surface soil typically ranged from 0.01 to 1 pCi/g reflecting various rainfall and wind patterns, elevation, and terrain. Most levels fall between 0.05 and 0.5 pCi/g, with 0.1 pCi/g as a general average.

2004-2008 Strontium 89/90

Sr-89/90 was detected in 14 samples from all locations sampled with an average of 0.264 pCi/g (±0.396) with a median of 0.084 pCi/g. The highest detection was from a collards sample collected from Saluda (1.50 pCi/g), and the lowest detection was from a soybeans sample (0.009 pCi/g) collected near Salters, SC. There was a minor increase of 0.010 pCi/g from 2007. The IAEA guidelines for gamma emitters (Sr-89) and beta emitters (Sr-90) are 27 pCi/g and 2.7 pCi/g, respectively. An average comparison to these guidelines cannot be done at this time due to ESOP analyzing for total Sr-89/90. However, the average for total Sr-89/90 from these locations is lower than either guideline.

Pears, plums and watermelon had no reported Sr-89/90 for this time period. Of the 33 samples of greens collected since 2004, 10 (eight perimeter and two background) samples had detections of Sr-89/90. The Sr-89/90 average was 0.259 pCi/g (±0.454) with a median of 0.076 pCi/g. Of the 16 grain samples collected during this same time period, only three samples (one perimeter and two background) of soybeans had detections of Sr-89/90. The Sr-89/90 average was 0.024 pCi/g ((±0.023) with a median of 0.013 pCi/g.

2008 Strontium 89/90

In 2008, ESOP analyzed three plum samples for Sr-89/90. Two of the samples were lost during laboratory processing. The plum sample from the Barnwell was below the MDA. ESOP could not make plum data comparisons with DOE-SR since plums are not collected by DOE-SR.

Strontium-89/90 was detected in four samples of greens from two quad locations during 2008. All four samples of greens were collected within the SRS 50-mile perimeter. The Sr-89/90 average for all locations was 0.051 pCi/g (±0.043) with a median of 0.037 pCi/g. In comparing this average to the IAEA guidelines, the 2008 average for total Sr-89/90 is much lower than either the Sr-90 or the Sr-89 guideline.

A 2008 mustards sample from Hollowcreek, just outside the SRS perimeter, had a detection of 0.623 pCi/g while a collards sample collected from the Saluda, SC area yielded a detection of 1.50 pCi/g. There is inconclusive evidence at this time where the contamination originated.

For Sr-89/90, DOE-SR reported detections in all five of the collards samples ranging from 0.172 pCi/g to 0.370 pCi/g. ESOP reported one collard sample detection (0.03 pCi/g) within the 50-mile perimeter (Jackson) of SRS. Other greens samples (mustards and turnips) that ESOP collected from within the 50-mile perimeter of the SRS also had detections of Sr-89/90 (Section 3.3.5, “All Locations”).

Naturally Occurring Isotopes

Lead (Pb-212, Pb-214), Beryllium-7 (Be-7), and Potassium-40 (K-40) are all naturally occurring radioactive isotopes in the environment. Pb-212/Pb-214 and Be-7 were detected in several samples (soybeans, corn, and greens) ESOP collected this year (Section 3.3.4). Discussion on these isotopes are brief as they do not occur on a routine basis. K-40 is discussed briefly as it is detected in all edible vegetation samples (Section 3.3.4).

Lead occurs everywhere in the environment with concentrations in U.S. soil typically ranging from less than 10 to 30 milligrams of lead per kilogram of soil (mg/kg). Concentrations in sandy soil particles are estimated to be 270 times higher than in the water in pore spaces; binding even more tightly to clay and loam soils, with concentration ratios of about 500 to more than 16,000. Reported concentrations of lead in various foods range from 0.002 to 0.65 mg/kg with higher levels generally found in vegetables. The typical concentration of lead in plants to that in the soil on which they grow is estimated at roughly four percent (ANL 2007). In 2008, Pb-212 was below MDA for all samples, while Pb-214 was detected in four greens samples, as well as one sample each of pears, soybeans, and corn.

Beryllium (Be-7), like potassium, occurs naturally in the earth's crust. The concentration generally ranges from 1 to 15 milligrams per kilogram (mg/kg), which is the same as parts per million (ppm). The average concentration of naturally occurring beryllium in U.S. soils is 0.6 ppm and levels typically range from 0 to 40 ppm. Concentrations in sandy soil are estimated to be up to 250 times higher than in the water in the pore space between the soil particles, with much higher concentration ratios in loam and clay soils. Being naturally present in various food types, beryllium has a median concentration of 22.5 micrograms/kilograms reported across 38 different food types, ranging from less than 0.1 microgram/kilogram to 2,200 micrograms/kilogram in kidney beans (for example). The major source of environmental releases from human activities is combustion of coal and fuel oil (ANL 2007). Beryllium-7 was detected in two greens (mustard) samples during 2008. The Aiken (EV70A) sample had a detect of 1.355 pCi/g while the Jackson (EV14A) detection was 0.899 pCi/g. All other samples were below the MDA.

Potassium occurs in the earth's crust, oceans and all organic material. Potassium binds preferentially to soil, with the concentration associated with sandy soil particles estimated to be 15 times higher than in the pore spaces between soil particles; it binds more tightly to loam and clay soil, so those concentration ratios are higher (above 50). Together with nitrogen and phosphorous, potassium is a major soil fertilizer, so levels of potassium-40 (K-40) in soils are strongly influenced by fertilizer use; it is estimated that about 3,000 Ci of K-40 are added annually to U.S. soils. Potassium behaves in the environment the same as other potassium isotopes, being assimilated into the tissues of all plants and animals through normal biological processes. For example, milk contains about 2000 pCi/L of natural potassium-40 (ANL 2007).

Potassium-40 was detected in all food samples collected around the perimeter of the SRS with concentrations ranging from a minimum detection of 1.033 pCi/g (pears) to a maximum detection of 17.430 pCi/g (soybeans). All background samples collected had detections of K-40 except one. Background concentrations ranged from 1.250 pCi/g (pears) from Landrum, SC to 3.038 pCi/g (wheat) from Hartsville, SC.

ESOP and DOE-SR Data Comparison

In comparing averages between ESOP and the DOE-SR programs, the only nuclides common to both were tritium, Cs-137, and Sr-89/90. The DOE-SR reported no detects for any comparable samples in 2008. ESOP, however, reported five detections across all vegetation collected. The ESOP tritium average was 0.366 pCi/g (±0.0.181) with a median of 0.329 pCi/g. The DOE-SR data indicates only two detects of Cs-137, both in greens (collards) within the 0-10 mile designated quadrants, with an average of 0.043 pCi/g (±0.012) and a median of 0.043 pCi/g. The ESOP average MDA for Cs-137 was 0.0289 where as the DOE-SR representative minimum detectable concentration was 0.0059 pCi/g. None of the 36 ESOP samples collected in 2008 had Cs-137 detects, therefore a Cs-137 comparison between the two programs cannot be made at this time. The DOE-SR Sr-89/90 average for greens (collards) was 0.242 pCi/g (±0.075) with a median of 0.223 pCi/g. The average for the ESOP Sr-89/90 detections was 0.291 pCi/g (±0.231) with a median of 0.224 pCi/g. In comparison, the ESOP Sr-89/90 data is within one standard deviation of the DOE-SRS data. Between 2004 and 2008, the ESOP Sr-89/90 average was 0.259 pCi/g (±0.454) with a median of 0.076 pCi/g for all greens (mustards, turnips and collards) collected around the perimeter of SRS. For the same time period, there was only one detect of Sr-89/90 in a collards sample (1.59 pCi/g) from a background location in Saluda. Since the DOE-SR does not collect data greater than 50 miles from the perimeter of the SRS, ESOP background statistical data could not be compared.

Conclusions and Recommendations

ESOP and DOE-SR have similar sampling schemes. The DOE-SR has annual participants from 0-10 miles from the perimeter of the SRS and has a 25 mile control station. The ESOP will continue to establish relationships with annual contributors around the perimeter of the SRS for similar food products for DOE-SR data comparisons, and continue to collect plums from the established locations for expanding the body of data for a fruit around the perimeter of SRS.

Tritium continues to be the prevailing analyte across all edible vegetation, along with Sr-89/90. Averages for both tritium and strontium for all edible vegetation sampled around SRS are well below (approximately three orders of magnitude) the IAEA standards for these emitters. Traces of the naturally occurring radionuclides Pb-212/Pb-214, Be-7, and K-40 continue to be sporadically detected in edible vegetation.

ESOP compared results with DOE-SR and found that the data that could be compared (Cs-137 and Sr-89/90) was within one standard deviation between the two programs. Historically, both programs have had tritium detects; however, this year DOE-SR had no detects while ESOP detected tritium. DOE-SR has historically had Cs-137 detects in edible vegetation, whereas ESOP edible vegetation samples have not had any detects. The ESOP average Cs-137 MDA across all 2008 samples was 0.029 pCi/g, whereas the DOE-SR representative minimum detectable concentration for Cs-137 in foodstuffs is 0.0059 pCi/g (WSRC 2008; Section 3.3.5). Differences in sampling methodology, location of samples or a difference in minimum detection levels of analysis equipment could explain the detection difference between the two programs. All ESOP samples with detections were well below the IAEA guidelines for tritium, Cs-137 and Sr-89/90.

In 2009, ESOP plans to improve comparisons between the two programs by obtaining a sampling list from DOE-SR so ESOP can collect the same vegetation as DOE-SR, establish more annual perimeter sampling locations, split some samples with DOE-SR and consider analyzing for gross alpha and beta on edible vegetation samples. As ESOP collects more data from the perimeter of SRS, concentrations versus distance comparisons will be made by type of vegetation.

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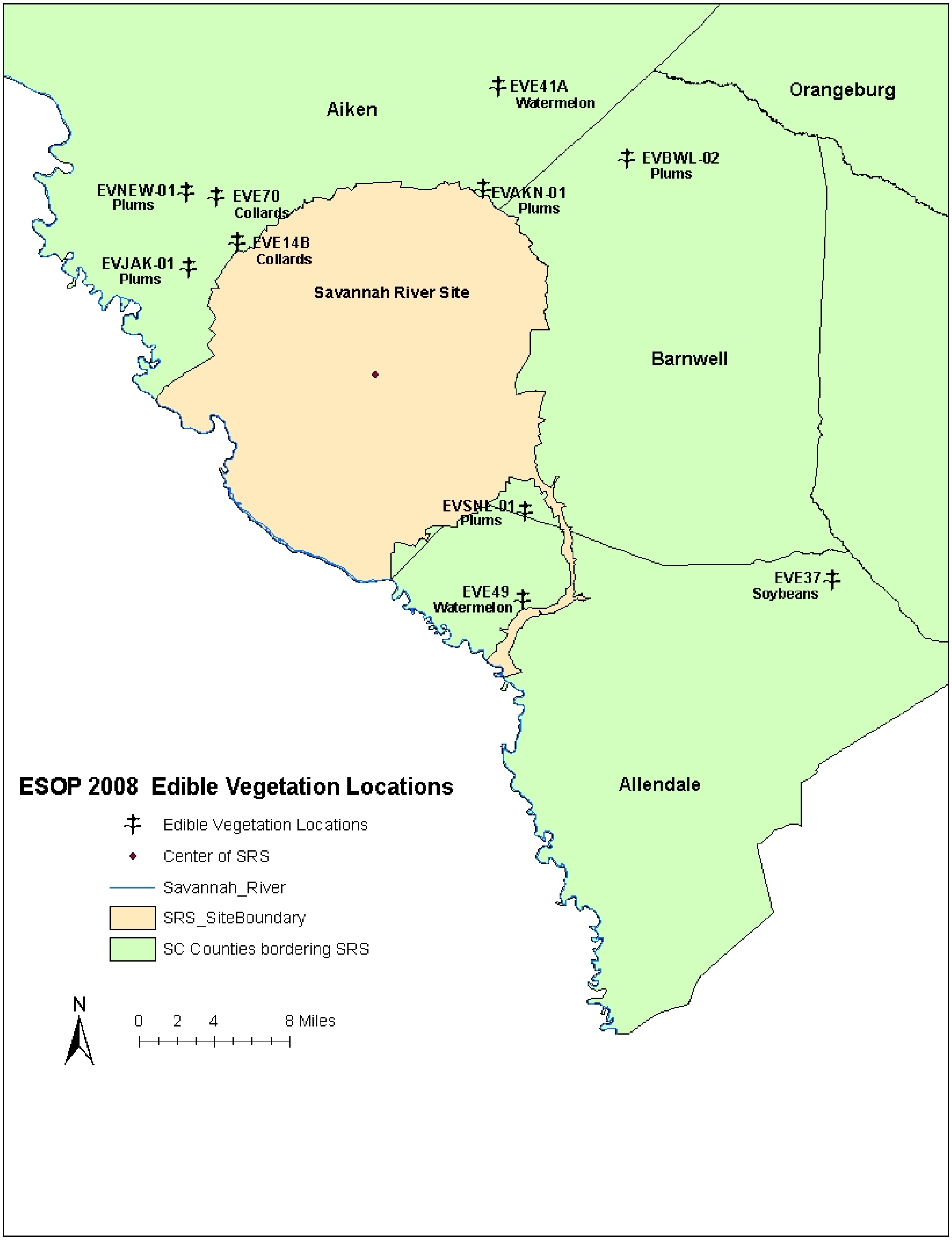
3.3.2

Map 9. Edible Vegetation Locations



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3.3.2 Tables and Figures

2008 Radiological Monitoring of Edible Vegetation

Note: All reported values are in pCi/g.

Table 1 a. Gamma-emitting Radionuclide Suite

Radioisotope	Abbreviation
Actinium-228	Ac-228
Americium-241	Am-241
Berylium-7	Be-7
Cerium-144	Ce-144
Cobalt-58	Co-58
Cobalt-60	Co-60
Cesium-134	Cs-134
Cesium-137	Cs-137
Europium-152	Eu-152
Europium-154	Eu-154
Europium-155	Eu-155
Iodine-131	I-131
Potassium-40	K-40
Manganese-54	Mn-54
Sodium-22	Na-22
Lead-212	Pb-212
Lead-214	Pb-214
Radium-226	Ra-226
Ruthenium-103	Ru-103
Antimony-125	Sb-125
Thorium-234	Th-234
Ytrium-88	Y-88
Zinc-65	Zn-65
Zirconium-95	Zr-95

Table 1 b. International Atomic Energy Agency Radionuclides Guidelines for Food

(To convert Bq/kg to pCi/g, multiply by 0.027) (SCI Journals 2009, IAEA 2009)

Radionuclides in foods	Guideline Levels	
	(Bq/kg)	pCi/g
Pu-238, Pu-239, Pu-240, Am-241	1	0.27
Sr-90, Ru-106, I-129, I-131, U-235	100	2.7
S-35, Co-60, Sr-89, Ru-103, Cs-134, Cs-137, Ce-144, Ir-192	1000	27
H-3, C-14, Tc-99	10000	270

2008 Radiological Monitoring of Edible Vegetation

Table 2. 2004-2008 All Edible Vegetation - Detects Only

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137	Sr-89/90
ALN-201	Allendale	6/3/04	Fruit	Plums	0.273	<0.017	
ALN-203	Allendale	6/3/04	Fruit	Plums	0.284	<0.018	
SNL-203	Snellings	6/3/04	Fruit	Plums	0.803	<0.016	
WIL-204	Williston	8/29/04	Fruit	Passion Fruit	0.189	<0.016	
AKN202	Aiken	10/22/04	Fruit	Pears	0.266	<0.024	
WIN-201	Windsor	10/22/04	Fruit	Persimmons	0.224	<0.018	
ESTE1-001	Furman	6/17/05	Greens	Turnips	0.201	<0.021	
ESTE1-002	Furman	6/17/05	Greens	Turnips	0.212	<0.018	
PINEB2-001	Estill	6/17/05	Vegetable	Corn	0.253	<0.024	
ESTE1-003	Furman	6/17/05	Vegetable	Squash	0.201	<0.018	
EVE2-001	Barnwell	10/7/05	Grain	Soybeans	0.257	<0.025	
EVE3X	New Ellenton, SE	10/12/05	Fruit	Grapes	0.195	<0.021	
EVE14	Jackson	2/2/06	Greens	Mustards	<0.188	<0.019	0.321
EVB6B	Antreville (Laurens Co)	2/8/06	Greens	Collards	<0.188	<0.022	0.383
EVB6A	Antreville (Laurens Co)	2/8/06	Vegetable	Broccoli	<0.188	<0.024	0.076
EVE21-001	Clear Pond	6/23/06	Fruit	Blackberries	0.371	<0.022	
EVE21-002	Clear Pond	6/23/06	Fruit	Watermelon	0.423	<0.033	
EVE18-001	Midway	6/23/06	Vegetable	Corn	0.252	<0.040	
EVE18-002	Midway	6/23/06	Vegetable	Squash	0.246	<0.037	
EVE18-003	Midway	6/23/06	Vegetable	Tomatoes	0.371	<0.038	
EVE22	Grays	8/4/06	Vegetable	Okra	0.332	<0.025	
EVE24-002	Long Branch	8/16/06	Fruit	Apples	0.192	<0.024	
EVE32	Martinez	10/26/06	Greens	Mustards	0.199	<0.040	0.035
EVE30-001	Graniteville	11/17/06	Greens	Collards	0.271	<0.023	
EVE28	Salley	1/30/07	Greens	Collards	0.240	<0.185	0.076
EVE36	Springfield	2/6/07	Greens	Mustards	0.216	<0.040	0.076
EVB32-02	Saluda South	3/30/07	Greens	Collards	<0.213	<0.040	1.50
EVB41-01	Gilbert	7/19/07	Fruit	Watermelon	0.204	<0.017	
EVB41-02	Gilbert	7/19/07	Vegetable	Corn	0.403	<0.025	
EVE35-02	Steedman	8/10/07	Fruit	Peaches	0.410	<0.018	
EVE35-01	Steedman	8/10/07	Fruit	Watermelon	0.271	<0.019	
EVBLAN	Landrum	8/21/07	Fruit	Peaches	0.315	<0.013	
EVB14	Lake Murray E	8/31/07	Fruit	Pears	0.280	<0.011	
EVB19	Salters	10/1/07	Grain	Soybeans	<0.213	<0.040	0.009
EVB12	Summerton	10/12/07	Grain	Soybeans	0.302	<0.028	0.013
EVE45	Gifford	10/12/07	Grain	Soybeans	0.329	<0.023	0.051
EVE51	Crocketville	10/12/07	Grain	Soybeans	0.191	<0.027	
EVE70A	HollowCreek	1/31/08	Greens	Mustards	<0.204	<0.028	0.113
EVE70B	HollowCreek	1/31/08	Greens	Turnips	<0.204	<0.029	0.045
EVE14A	Jackson	2/8/08	Greens	Mustards	N/A	<0.036	0.015
EVE14B	Jackson	2/14/08	Greens	Collards	<0.204	<0.025	0.03
EVAKN-01	Aiken	5/2/08	Fruit	Plums	0.329	<0.026	
EVE4908	Millett	8/6/08	Fruit	Watermelon	0.273	<0.029	
EVB608	Antreville (Laurens Co)	9/3/08	Fruit	Pears	0.353	<0.023	
EVE3708	Sycamore	10/29/08	Grain	Soybeans	0.202	<0.040	
EVE4008	Blackville	10/29/08	Grain	Soybeans	0.673	<0.040	
				Average	0.297		0.196
				Median	0.271		0.063
				SD	0.127		0.392
				n	37		14
				Max	0.803		1.5
				Min	0.189		0.009

Denotes Not Analyzed

Tables and Figures

2008 Radiological Monitoring of Edible Vegetation

Table 2a. 2004-2008 All Edible Vegetation < 50 Miles (E's) from SRS (Detects Only)

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137	Sr-89/90
EVE24-002	Long Branch	8/16/06	Fruit	Apples	0.192	<0.024	
EVE21-001	Clear Pond	6/23/06	Fruit	Blackberries	0.371	<0.022	
EVE3X	New Ellenton, SE	10/12/05	Fruit	Grapes	0.195	<0.021	
WIL-204	Williston	8/29/04	Fruit	Passion Fruit	0.189	<0.016	
EVE35-02	Steedman	8/10/07	Fruit	Peaches	0.410	<0.018	
AKN202	Aiken	10/22/04	Fruit	Pears	0.266	<0.024	
WIN-201	Windsor	10/22/04	Fruit	Persimmons	0.224	<0.018	
ALN-201	Allendale	6/3/04	Fruit	Plums	0.273	<0.017	
ALN-203	Allendale	6/3/04	Fruit	Plums	0.284	<0.018	
SNL-203	Snellings	6/3/04	Fruit	Plums	0.803	<0.016	
EVAKN-01	Aiken	5/2/08	Fruit	Plums	0.329	<0.026	
EVE21-002	Clear Pond	6/23/06	Fruit	Watermelon	0.423	<0.033	
EVE35-01	Steedman	8/10/07	Fruit	Watermelon	0.271	<0.019	
EVE4908	Millett	8/6/08	Fruit	Watermelon	0.273	<0.029	
EVE2-001	Barnwell	10/7/05	Grain	Soybeans	0.257	<0.025	
EVE45	Gifford	10/12/07	Grain	Soybeans	0.329	<0.023	0.051
EVE51	Crocketville	10/12/07	Grain	Soybeans	0.191	<0.027	
EVE3708	Sycamore	10/29/08	Grain	Soybeans	0.202	<0.040	
EVE4008	Blackville	10/29/08	Grain	Soybeans	0.673	<0.040	
EVE30-001	Graniteville	11/17/06	Greens	Collards	0.271	<0.023	
EVE28	Salley	1/30/07	Greens	Collards	0.240	<0.185	0.076
EVE14B	Jackson	2/14/08	Greens	Collards	<0.204	<0.025	0.03
EVE14	Jackson	2/2/06	Greens	Mustards	<0.188	<0.019	0.321
EVE32	Martinez	10/26/06	Greens	Mustards	0.199	<0.040	0.035
EVE36	Springfield	2/6/07	Greens	Mustards	0.216	<0.040	0.076
EVE70A	HollowCreek	1/31/08	Greens	Mustards	<0.204	<0.028	0.113
EVE14A	Jackson	2/8/08	Greens	Mustards	N/A	<0.036	0.015
ESTE1-001	Furman	6/17/05	Greens	Turnips	0.201	<0.021	
ESTE1-002	Furman	6/17/05	Greens	Turnips	0.212	<0.018	
EVE70B	HollowCreek	1/31/08	Greens	Turnips	<0.204	<0.029	0.045
EVE18-001	Midway	6/23/06	Vegetable	Corn	0.252	<0.040	
EVE22	Grays	8/4/06	Vegetable	Okra	0.332	<0.025	
ESTE1-003	Furman	6/17/05	Vegetable	Squash	0.201	<0.018	
EVE18-002	Midway	6/23/06	Vegetable	Squash	0.246	<0.037	
EVE18-003	Midway	6/23/06	Vegetable	Tomatoes	0.371	<0.038	
				Average	0.297		0.0846
				Median	0.262		0.051
				SD	0.138		0.093
				n	30		9
				Max	0.803		0.321
				Min	0.189		0.015

(grey box) Denotes Not Analyzed

Tables and Figures

2008 Radiological Monitoring of Edible Vegetation

Table 2b. 2004-2008 All Edible Vegetation > 50 Miles (B's) from SRS (Detects Only)

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137	Sr-89/90
EVBLAN	Landrum	8/21/07	Fruit	Peaches	0.315	<0.013	
EVB14	Lake Murray E	8/31/07	Fruit	Pears	0.280	<0.011	
EVB608	Antreville (Laurens Co	9/3/08	Fruit	Pears	0.353	<0.023	
EVB41-01	Gilbert	7/19/07	Fruit	Watermelon	0.204	<0.017	
EVB19	Salters	10/1/07	Grain	Soybeans	<0.213	<0.040	0.009
EVB12	Summerton	10/12/07	Grain	Soybeans	0.302	<0.028	0.013
EVB6B	Antreville (Laurens Co	2/8/06	Greens	Collards	<0.188	<0.022	0.383
EVB32-02	Saluda South	3/30/07	Greens	Collards	<0.213	<0.040	1.50
EVB6A	Antreville (Laurens Co	2/8/06	Vegetable	Broccoli	<0.188	<0.024	0.076
PINEB2-001	Estill	6/17/05	Vegetable	Corn	0.253	<0.024	
EVB41-02	Gilbert	7/19/07	Vegetable	Corn	0.403	<0.025	
				Average	0.301		0.396
				Median	0.302		0.076
				SD	0.065		0.636
				n	7		5
				Max	0.403		1.5
				Min	0.204		0.009

Denotes Not Analyzed

Table 2c. Average Perimeter Minus Average Background

	E Average	E Median	E SD	B Average	B Median	B SD	E-B Average	E-B Median	E-B SD
Tritium	0.297	0.262	0.138	0.301	0.302	0.065	-0.004	-0.164	0.073
Sr-89/90	0.085	0.051	0.093	0.339	0.063	0.586	-0.254	0.03	-0.493

Notes: SD = Standard Deviation

Table 3a. 2008 Edible Vegetation Annual Stations

Location	Station	Date	Type
Hollow Creek	EVE70A	1/31/08	Mustards
Jackson	EVE14B	2/14/08	Collards
New Ellenton	EVNEW-01	4/29/08	Plums
Jackson	EVJAK-01	5/1/08	Plums
Aiken	EVAKN-01	5/2/08	Plums
Barnwell	EVBWL-01	5/2/08	Plums
Snelling	EVSNL-01	5/2/08	Plums
Williston	EVE59-01	6/2/08	Plums
Williston	EVE59-02	6/23/08	Corn
Windsor	EVE4108	7/21/08	Watermelon
Millet	EVE4908	8/6/08	Watermelon
Ulmer	EVE3708	10/29/08	Soybeans

Table 3b. 2008 Edible Vegetation Annual Stations - Detections

Analyte	Average	Median	SD	N
Be-7 Activity	1.355	1.355	N/A	1
K-40 Activity	4.510	2.795	4.617	12
Co-60 Activity	N/A	N/A	N/A	0
I-131 Activity	N/A	N/A	N/A	0
Cs-134 Activity	N/A	N/A	N/A	0
Cs-137 Activity	N/A	N/A	N/A	0
Pb-212 Activity	N/A	N/A	N/A	0
Pb-214 Activity	0.142	0.142	N/A	1
Ra-226 Activity	N/A	N/A	N/A	0
Ac-228 Activity	N/A	N/A	N/A	0
U/Th-238 Activity	N/A	N/A	N/A	0
Am-241 Activity	N/A	N/A	N/A	0
Tritium Activity	0.268	0.273	0.064	3
Sr-89/90 Activity	0.072	0.072	0.059	2
U-238 Activity	0.409	0.409	0.303	2

N = number of detects SD = Standard Deviation N/A = not applicable

Table 3c. All Edible Vegetation – Locations < 50 Miles around SRS

Analyte	Average	Median	Standard Deviation	N
Be-7 Activity	1.127	1.127	0.322	2
K-40 Activity	5.240	3.949	4.858	21
Co-60 Activity	N/A	N/A	N/A	0
I-131 Activity	N/A	N/A	N/A	0
Cs-137 Activity	N/A	N/A	N/A	0
Pb-214 Activity	0.167	0.147	0.053	6
Ra-226 Activity	N/A	N/A	N/A	0
U/Th-238 Activity	N/A	N/A	N/A	0
Am-241 Activity	N/A	N/A	N/A	0
Tritium Activity	0.383	0.273	0.254	3
Sr-89/90 Activity	0.291	0.224	0.231	4

Table 3d. All Edible Vegetation – Locations > 50 Miles around SRS

Analyte:	Average	Median	Standard Deviation	N
Be-7 Activity	N/A	N/A	N/A	0
K-40 Activity	2.180	2.084	0.728	9
Co-60 Activity	N/A	N/A	N/A	0
I-131 Activity	N/A	N/A	N/A	0
Cs-137 Activity	N/A	N/A	N/A	0
Pb-214 Activity	0.227	0.227	N/A	1
Ra-226 Activity	N/A	N/A	N/A	0
U/Th-238 Activity	N/A	N/A	N/A	0
Am-241 Activity	N/A	N/A	N/A	0
Tritium Activity	0.353	0.353	N/A	1

Table 3e. All Edible Vegetation - Averages

Analyte:	Average	Median	SD	N	Max	Min
Be-7 Activity	1.127	1.127	0.322	2	1.355	0.899
K-40 Activity	4.101	2.822	4.008	35	17.430	1.033
Pb-214 Activity	0.176	0.152	0.054	7	0.273	0.127
Tritium Activity	0.366	0.329	0.181	5	0.673	0.202
Sr-89/90 pCi/g	0.291	0.224	0.231	4	0.623	0.091

Notes: N = number of detects SD = Standard Deviation N/A = not applicable

Table 4a. 2004-2008 Edible Vegetation – Fruits

Detects Only

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3(pCi/g)	Cs-137
AKN202	Aiken	10/22/04	Fruit	Pears	0.266	<0.024
EVB14	Lake Murray E	8/31/07	Fruit	Pears	0.280	<0.011
EVB608	Antreville (Laurens Co)	9/3/08	Fruit	Pears	0.353	<0.023
				Average	0.300	
				Median	0.280	
				SD	0.046	
				n	3	

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3(pCi/g)	Cs-137
ALN-201	Allendale	6/3/04	Fruit	Plums	0.273	<0.017
ALN-203	Allendale	6/3/04	Fruit	Plums	0.284	<0.018
SNL-203	Snellings	6/3/04	Fruit	Plums	0.803	<0.016
EVAKN-01	Aiken	5/2/08	Fruit	Plums	0.329	<0.026
				Average	0.422	
				Median	0.306	
				SD	0.255	
				n	4	

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3(pCi/g)	Cs-137
EVE21-002	Clear Pond	6/23/06	Fruit	Watermelon	0.423	<0.033
EVB41-01	Gilbert	7/19/07	Fruit	Watermelon	0.204	<0.017
EVE35-01	Steedman	8/10/07	Fruit	Watermelon	0.271	<0.019
EVE4908	Millett	8/6/08	Fruit	Watermelon	0.273	<0.029
				Average	0.293	
				Median	0.272	
				SD	0.093	
				n	4	

Tables and Figures

2008 Radiological Monitoring of Edible Vegetation

Table 4b. 2004-2008 Edible Vegetation – Grains

Detects Only

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137	Sr-89/90
EVE2-001	Barnwell	10/7/05	Grain	Soybeans	0.257	<0.025	
EVB19	Salters	10/1/07	Grain	Soybeans	<0.213	<0.040	0.009
EVB12	Summerton	10/12/07	Grain	Soybeans	0.302	<0.028	0.013
EVE45	Gifford	10/12/07	Grain	Soybeans	0.329	<0.023	0.051
EVE51	Crocketville	10/12/07	Grain	Soybeans	0.191	<0.027	
EVE3708	Sycamore	10/29/08	Grain	Soybeans	0.202	<0.040	
EVE4008	Blackville	10/29/08	Grain	Soybeans	0.673	<0.040	
				Average	0.326	N/A	0.024
				Median	0.280	N/A	0.013
				SD	0.179	N/A	0.023
				n	6	0	3

Table 4c. 2004-2008 Edible Vegetation – Greens

Detects Only

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137	Sr-89/90
EVB6B	Antreville (Laurens Co)	2/8/06	Greens	Collards	<0.188	<0.022	0.383
EVE30-001	Graniteville	11/17/06	Greens	Collards	0.271	<0.023	
EVE28	Salley	1/30/07	Greens	Collards	0.240	<0.185	0.076
EVB32-02	Saluda South	3/30/07	Greens	Collards	<0.213	<0.040	1.50
EVE14B	Jackson	2/14/08	Greens	Collards	<0.204	<0.025	0.03
EVE14	Jackson	2/2/06	Greens	Mustards	<0.188	<0.019	0.321
EVE32	Martinez	10/26/06	Greens	Mustards	0.199	<0.040	0.035
EVE36	Springfield	2/6/07	Greens	Mustards	0.216	<0.040	0.076
EVE70A	HollowCreek	1/31/08	Greens	Mustards	<0.204	<0.028	0.113
EVE14A	Jackson	2/8/08	Greens	Mustards	N/A	<0.036	0.015
ESTE1-001	Furman	6/17/05	Greens	Turnips	0.201	<0.021	
ESTE1-002	Furman	6/17/05	Greens	Turnips	0.212	<0.018	
EVE70B	HollowCreek	1/31/08	Greens	Turnips	<0.204	<0.029	0.045
				Average	0.223	N/A	0.259
				Median	0.214	N/A	0.076
				SD	0.028	N/A	0.454
				n	6	N/A	10

Table 4d. 2004-2008 Edible Vegetation – Corn

Detects Only

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137
PINEB2-001	Estill	6/17/05	Vegetable	Corn	0.253	<0.024
EVE18-001	Midway	6/23/06	Vegetable	Corn	0.252	<0.040
EVB41-02	Gilbert	7/19/07	Vegetable	Corn	0.403	<0.025
			Average		0.303	N/A
			Median		0.253	N/A
			SD		0.087	N/A
			n		3	

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3.3.3 Data

2008 Edible Vegetation Radiological Monitoring Data

Notes:
1. Bold numbers denote a detection.
2. A blank field following ±2 SIGMA occurs when the sample is <LLD.
3. LLD= Lower Limit of Detection
4. MDA= Minimum Detectable Activity
5. * More than 8 half lives had elapsed
6. Denotes not analyzed.
7. All units are in pCi/g.

2008 Edible Vegetation Radiological Monitoring Data

Environmental Samples - Perimeter Locations < 50 miles from SRS

Location:	EVE70A	EVE70B	EVE14A	EVE53	EVE14B
Date:	1/31/08	1/31/08	2/8/08	2/8/08	2/14/08
Type:	Mustards	Turnips	Mustards	Cabbage	Collards
Be-7 Activity	**1.355**	**<MDA**	**0.899**	**<MDA**	**<MDA**
Be-7 Confidence Interval	0.339	NA	0.373	NA	NA
Be-7 MDA	0.325	0.319	0.358	0.362	0.273
K-40 Activity	**9.499**	**5.027**	**3.951**	**5.129**	**6.506**
K-40 Confidence Interval	0.934	0.640	0.631	0.686	0.721
K-40 MDA	0.227	0.204	0.250	0.261	0.194
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA
Co-60 MDA	0.027	0.029	0.034	0.027	0.030
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA	NA	NA	NA
I-131 MDA	0.464	0.520	0.321	0.304	0.168
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA
Cs-137 MDA	0.028	0.029	0.036	0.031	0.025
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA
Pb-212 MDA	0.054	0.058	0.074	0.060	0.056
Pb-214 Activity	**<MDA**	**0.141**	**0.273**	**0.152**	**<MDA**
Pb-214 Confidence Interval	NA	0.055	0.068	0.055	NA
Pb-214 MDA	0.070	0.056	0.067	0.059	0.054
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA
Ra-226 MDA	0.656	0.728	0.879	0.784	0.682
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA
U/Th-238 MDA	1.325	1.433	1.619	1.523	1.433
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA
Am-241 MDA	0.340	0.376	0.472	0.420	0.377
Tritium Activity	**<LLD**	**<LLD**	**N/A**	**<LLD**	**<LLD**
Tritium Confidence Interval	NA	NA	N/A	NA	NA
Tritium LLD	0.204	0.204	N/A	0.204	0.204
Sr-89/90	**0.113**	**0.045**	**0.015**		**0.03**
Sr- 89/90 Confidence Interval	0.010	0.006	0.003		0.004
Sr-MDC	0.006	0.007	0.005		0.004

2008 Edible Vegetation Radiological Monitoring Data

Environmental Samples - Perimeter Locations < 50 miles from SRS

Location:	EVE64	EVE62	EVE51-01	EVE51-02	EVE56
Date:	3/14/08	5/15/08	5/23/08	5/23/08	5/23/08
Type:	Collards	Wheat	Wheat	Cabbage	Plums
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Be-7 Confidence Interval	NA	NA	NA	NA	NA
Be-7 MDA	0.273	0.440	0.400	0.322	0.335
K-40 Activity	**3.310**	**2.160**	**3.949**	**4.446**	**2.689**
K-40 Confidence Interval	0.413	0.634	0.692	0.661	0.549
K-40 MDA	0.139	0.265	0.260	0.249	0.218
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA
Co-60 MDA	0.017	0.033	0.036	0.027	0.026
I-131 Activity	**N/A**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA	NA	NA	NA
I-131 MDA	NA	0.327	0.179	0.157	0.164
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA
Cs-137 MDA	0.017	0.035	0.040	0.031	0.029
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA
Pb-212 MDA	0.028	0.080	0.079	0.066	0.067
Pb-214 Activity	**<MDA**	**<MDA**	**<MDA**	**0.127**	**<MDA**
Pb-214 Confidence Interval	NA	NA	NA	0.050	NA
Pb-214 MDA	0.030	0.094	0.099	0.059	0.084
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA
Ra-226 MDA	0.425	1.018	0.961	0.766	0.709
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA
U/Th-238 MDA	0.662	1.998	1.911	1.605	1.593
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA
Am-241 MDA	0.087	0.528	0.513	0.439	0.445
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**
Tritium Confidence Interval	NA	NA	NA	NA	NA
Tritium LLD	0.204	0.204	0.204	0.204	0.204
Sr-89/90					
Sr- 89/90 Confidence Interval					
Sr-MDC					

2008 Edible Vegetation Radiological Monitoring Data

Environmental Samples - Perimeter Locations < 50 miles from SRS

Location:	EVE58	EVE59-01	EVE59-02	EVE2408	EVE4108
Date:	5/23/08	6/2/08	6/23/08	7/8/08	7/21/08
Type:	Cabbage	Plums	Corn	Corn	Watermelon
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Be-7 Confidence Interval	NA	NA	NA	NA	NA
Be-7 MDA	0.289	0.138	0.144	0.450	0.335
K-40 Activity	**4.506**	**1.847**	**2.768**	**2.800**	**1.156**
K-40 Confidence Interval	0.626	0.251	0.386	0.602	0.382
K-40 MDA	0.234	0.102	0.173	0.257	0.148
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA
Co-60 MDA	0.027	0.012	0.015	0.027	0.020
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA	NA	NA	NA
I-131 MDA	0.160	0.236	0.060	1.979	0.920
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA
Cs-137 MDA	0.029	0.012	0.015	0.032	0.021
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA
Pb-212 MDA	0.064	0.021	0.030	0.064	0.052
Pb-214 Activity	**<MDA**	**<MDA**	**0.142**	**<MDA**	**<MDA**
Pb-214 Confidence Interval	NA	NA	0.031	NA	NA
Pb-214 MDA	0.080	0.028	0.031	0.078	0.058
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA
Ra-226 MDA	0.756	0.313	0.413	0.838	0.618
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA
U/Th-238 MDA	1.495	0.530	0.703	1.550	1.185
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA
Am-241 MDA	0.398	0.061	0.085	0.441	0.336
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**
Tritium Confidence Interval	NA	NA	NA	NA	NA
Tritium LLD	0.204	0.204	0.204	0.185	0.185
Sr-89/90					
Sr- 89/90 Confidence Interval					
Sr-MDC					

2008 Edible Vegetation Radiological Monitoring Data

Environmental Samples - Perimeter Locations < 50 miles from SRS

Location:	EVE4908	EVE108	EVE208	EVE4008	EVE208	EVE3708
Date:	8/6/08	8/19/08	8/19/08	10/29/08	10/29/08	10/29/08
Type:	Watermelon	Pears	Pears	Soybeans	Soybeans	Soybeans
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Be-7 Confidence Interval	NA	NA	NA	NA	NA	NA
Be-7 MDA	0.348	0.297	0.239	0.536	0.673	0.690
K-40 Activity	**1.353**	**1.033**	**1.142**	**17.430**	**12.230**	**17.100**
K-40 Confidence Interval	0.407	0.472	0.388	1.489	1.193	1.480
K-40 MDA	0.202	0.217	0.174	0.329	0.293	0.340
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA
Co-60 MDA	0.022	0.024	0.018	0.041	0.045	0.046
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA
I-131 MDA	0.476	0.174	0.152	3.199	6.322	6.310
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA
Cs-137 MDA	0.029	0.026	0.023	0.040	0.036	0.040
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA	NA
Pb-212 MDA	0.062	0.060	0.052	0.027	0.027	0.028
Pb-214 Activity	**<MDA**	**<MDA**	**<MDA**	**0.169**	**<MDA**	**<MDA**
Pb-214 Confidence Interval	NA	NA	NA	0.056	NA	NA
Pb-214 MDA	0.075	0.067	0.062	0.060	0.083	0.091
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA
Ra-226 MDA	0.733	0.737	0.627	0.656	0.770	0.811
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.436	1.455	1.225	0.399	0.457	0.471
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.410	0.419	0.339	0.042	0.045	0.045
Tritium Activity	**0.273**	**<LLD**	**<LLD**	**0.673**	**<LLD**	**0.202**
Tritium Confidence Interval	0.091	NA	NA	0.103	NA	0.083
Tritium LLD	0.185	0.185	0.185	0.182	0.182	0.182
Sr-89/90						
Sr- 89/90 Confidence Interval						
Sr-MDC						

2008 Edible Vegetation Radiological Monitoring Data

Background Samples - Perimeter Locations > 50 miles from SRS

Location:	EVB21	EVB18	EVB13	EVB2201	EVB2202
Date:	5/8/08	5/8/08	7/18/08	7/18/08	7/18/08
Type:	Wheat	Wheat	Corn	Corn	Peaches
Analyte:					
Be-7 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Be-7 Confidence Interval	NA	NA	NA	NA	NA
Be-7 MDA	0.563	0.502	0.422	0.340	0.381
K-40 Activity	**2.926**	**3.038**	**2.676**	**2.964**	**2.084**
K-40 Confidence Interval	0.725	0.681	0.581	0.507	0.484
K-40 MDA	0.324	0.245	0.211	0.183	0.229
Co-60 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Co-60 Confidence Interval	NA	NA	NA	NA	NA
Co-60 MDA	0.037	0.031	0.028	0.023	0.026
I-131 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
I-131 Confidence Interval	NA	NA	NA	NA	NA
I-131 MDA	0.911	1.100	0.935	0.890	0.938
Cs-137 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Cs-137 Confidence Interval	NA	NA	NA	NA	NA
Cs-137 MDA	0.045	0.040	0.028	0.024	0.029
Pb-212 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-212 Confidence Interval	NA	NA	NA	NA	NA
Pb-212 MDA	0.091	0.083	0.066	0.055	0.063
Pb-214 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Pb-214 Confidence Interval	NA	NA	NA	NA	NA
Pb-214 MDA	0.113	0.092	0.073	0.066	0.071
Ra-226 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Ra-226 Confidence Interval	NA	NA	NA	NA	NA
Ra-226 MDA	1.109	0.990	0.794	0.657	0.770
U/Th-238 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA
U/Th-238 MDA	2.154	1.985	1.554	1.320	1.465
Am-241 Activity	<MDA	<MDA	<MDA	<MDA	<MDA
Am-241 Confidence Interval	NA	NA	NA	NA	NA
Am-241 MDA	0.582	0.525	0.412	0.387	0.411
Tritium Activity	<LLD	<LLD	<LLD	<LLD	<LLD
Tritium Confidence Interval	NA	NA	NA	NA	NA
Tritium LLD	0.204	0.204	0.185	0.185	0.185

2008 Edible Vegetation Radiological Monitoring Data

Background Samples – Perimeter Locations > 50 miles from SRS

Location:	EVB208	EVB308	EVB708	EVB608	EVB808
Date:	8/20/08	8/22/08	8/28/08	9/3/08	10/1/08
Type:	Pears	Pears	Pears	Pears	Pears
Analyte:					
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Be-7 Confidence Interval	NA	NA	NA	NA	NA
Be-7 MDA	0.324	0.315	0.726	0.714	0.535
K-40 Activity	**1.731**	**<MDA**	**1.250**	**1.370**	**1.583**
K-40 Confidence Interval	0.507	NA	0.365	0.320	0.375
K-40 MDA	0.231	0.234	0.204	0.204	0.190
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA
Co-60 MDA	0.027	0.027	0.024	0.024	0.022
I-131 Activity	**<MDA**	**<MDA**	**NA**	**NA**	**NA**
I-131 Confidence Interval	NA	NA	NA	NA	NA
I-131 MDA	0.178	0.157	NA	NA	NA
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA
Cs-137 MDA	0.030	0.031	0.023	0.023	0.027
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA
Pb-212 MDA	0.067	0.068	0.018	0.023	0.021
Pb-214 Activity	**<MDA**	**<MDA**	**<MDA**	**0.227**	**<MDA**
Pb-214 Confidence Interval	NA	NA	NA	0.051	NA
Pb-214 MDA	0.078	0.079	0.063	0.045	0.070
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA
Ra-226 MDA	0.796	0.824	0.524	0.547	0.507
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA
U/Th-238 MDA	1.596	1.632	0.293	0.311	0.295
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA
Am-241 MDA	0.420	0.426	0.027	0.031	0.029
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**0.353**	**<LLD**
Tritium Confidence Interval	NA	NA	NA	94	NA
Tritium LLD	0.185	0.185	0.185	0.185	0.182

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3.3.4 Summary Statistics

2008 Radiological Monitoring of Edible Vegetation

Notes:

6. N/A = Not Applicable
7. Min. – Minimum
8. Max. = Maximum
9. * more than 8 half lives had elapsed
10. Sample not analyzed
11. Not applicable
12. Units of measure used in tables is picocuries per gram (pCi/g).

2008 Radiological Monitoring of Edible Vegetation

Grains - Wheat

Location:	EVE62	EVE51-01	EVB21	EVB18	Average	Median	SD	N
Date:	5/15/08	5/23/08	5/8/08	5/8/08				
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Be-7 Confidence Interval	NA	NA	NA	NA				
Be-7 MDA	0.440	0.400	0.563	0.502				
K-40 Activity	**2.160**	**3.949**	**2.926**	**3.038**	**3.018**	**2.982**	**0.733**	**4**
K-40 Confidence Interval	0.634	0.692	0.725	0.681				
K-40 MDA	0.265	0.260	0.324	0.245				
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Co-60 Confidence Interval	NA	NA	NA	NA				
Co-60 MDA	0.033	0.036	0.037	0.031				
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
I-131 Confidence Interval	NA	NA	NA	NA				
I-131 MDA	0.327	0.179	0.911	1.100				
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Cs-137 Confidence Interval	NA	NA	NA	NA				
Cs-137 MDA	0.035	0.040	0.045	0.040				
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Pb-212 Confidence Interval	NA	NA	NA	NA				
Pb-212 MDA	0.080	0.079	0.091	0.083				
Pb-214 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Pb-214 Confidence Interval	NA	NA	NA	NA				
Pb-214 MDA	0.094	0.099	0.113	0.092				
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Ra-226 Confidence Interval	NA	NA	NA	NA				
Ra-226 MDA	1.018	0.961	1.109	0.990				
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
U/Th-238 Confidence Interval	NA	NA	NA	NA				
U/Th-238 MDA	1.998	1.911	2.154	1.985				
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Am-241 Confidence Interval	NA	NA	NA	NA				
Am-241 MDA	0.528	0.513	0.582	0.525				
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**N/A**	**N/A**	**N/A**	**0**
Tritium Confidence Interval	NA	NA	NA	NA				
Tritium LLD	0.204	0.204	0.204	0.204				
Sr-89/90 Wet pCi/g					**N/A**	**N/A**	**N/A**	**0**
Sr- 89/90 Confidence Interval								
Sr-MDC								
Sr-89/90 Dry pCi/g					**N/A**	**N/A**	**N/A**	**0**
Sr- 89/90 Confidence Interval								
Sr-MDC								

Analyte	Average	Median	Std Dev	N
K-40 Activity	**3.018**	**2.982**	**0.733**	**4**

2008 Radiological Monitoring of Edible Vegetation

Grains – Soybeans

Location:	EVE4008	EVE208	EVE3708	Average	Median	Std Dev	N
Date:	10/29/08	10/29/08	10/29/08				
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Be-7 Confidence Interval	NA	NA	NA				
Be-7 MDA	0.536	0.673	0.690				
K-40 Activity	**17.430**	**12.230**	**17.100**	**15.587**	**17.100**	**2.912**	**3**
K-40 Confidence Interval	1.489	1.193	1.480				
K-40 MDA	0.329	0.293	0.340				
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Co-60 Confidence Interval	NA	NA	NA				
Co-60 MDA	0.041	0.045	0.046				
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
I-131 Confidence Interval	NA	NA	NA				
I-131 MDA	3.199	6.322	6.310				
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Cs-137 Confidence Interval	NA	NA	NA				
Cs-137 MDA	0.040	0.036	0.040				
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Pb-212 Confidence Interval	NA	NA	NA				
Pb-212 MDA	0.027	0.027	0.028				
Pb-214 Activity	**0.169**	**<MDA**	**<MDA**	**0.169**	**0.169**	**N/A**	**1**
Pb-214 Confidence Interval	0.056	NA	NA				
Pb-214 MDA	0.060	0.083	0.091				
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Ra-226 Confidence Interval	NA	NA	NA				
Ra-226 MDA	0.656	0.770	0.811				
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
U/Th-238 Confidence Interval	NA	NA	NA				
U/Th-238 MDA	0.399	0.457	0.471				
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Am-241 Confidence Interval	NA	NA	NA				
Am-241 MDA	0.042	0.045	0.045				
Tritium Activity	**0.673**	**<LLD**	**0.202**	**0.437**	**0.437**	**0.333**	**2**
Tritium Confidence Interval	0.103	NA	0.083				
Tritium LLD	0.182	0.182	0.182				
Sr-89/90 Wet pCi/g				**N/A**	**N/A**	**N/A**	**0**
Sr- 89/90 Confidence Interval							
Sr-MDC							
Sr-89/90 Dry pCi/g				**N/A**	**N/A**	**N/A**	**0**
Sr- 89/90 Confidence Interval							
Sr-MDC							

Analyte	Average	Median	Std Dev	N
K-40 Activity	**15.587**	**17.100**	**2.912**	**3**
Pb-214 Activity	**0.169**	**0.169**	**N/A**	**1**
Tritium Activity	**0.437**	**0.437**	**0.333**	**2**

2008 Radiological Monitoring of Edible Vegetation

Corn

Location:	EVE59-02	EVE2408	EVB13	EVB2201	Average	Median	Std Dev	N
Date:	6/23/08	7/8/08	7/18/08	7/18/08				
Be-7 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Be-7 Confidence Interval	NA	NA	NA	NA				
Be-7 MDA	0.144	0.450	0.422	0.340				
K-40 Activity	**2.768**	**2.800**	**2.676**	**2.964**	**2.802**	**2.784**	**0.120**	**4**
K-40 Confidence Interval	0.386	0.602	0.581	0.507				
K-40 MDA	0.173	0.257	0.211	0.183				
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Co-60 Confidence Interval	NA	NA	NA	NA				
Co-60 MDA	0.015	0.027	0.028	0.023				
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
I-131 Confidence Interval	NA	NA	NA	NA				
I-131 MDA	0.060	1.979	0.935	0.890				
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Cs-137 Confidence Interval	NA	NA	NA	NA				
Cs-137 MDA	0.015	0.032	0.028	0.024				
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Pb-212 Confidence Interval	NA	NA	NA	NA				
Pb-212 MDA	0.030	0.064	0.066	0.055				
Pb-214 Activity	**0.142**	**<MDA**	**<MDA**	**<MDA**	**0.142**	**0.142**	**N/A**	**1**
Pb-214 Confidence Interval	0.031	NA	NA	NA				
Pb-214 MDA	0.031	0.078	0.073	0.066				
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Ra-226 Confidence Interval	NA	NA	NA	NA				
Ra-226 MDA	0.413	0.838	0.794	0.657				
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
U/Th-238 Confidence Interval	NA	NA	NA	NA				
U/Th-238 MDA	0.703	1.550	1.554	1.320				
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**N/A**	**N/A**	**N/A**	**0**
Am-241 Confidence Interval	NA	NA	NA	NA				
Am-241 MDA	0.085	0.441	0.412	0.387				
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**N/A**	**N/A**	**N/A**	**0**
Tritium Confidence Interval	NA	NA	NA	NA				
Tritium LLD	0.204	0.185	0.185	0.185				
Sr-89/90 Wet pCi/g					**N/A**	**N/A**	**N/A**	**0**
Sr- 89/90 Confidence Interval								
Sr-MDC								
Sr-89/90 Dry pCi/g					**N/A**	**N/A**	**N/A**	**0**
Sr- 89/90 Confidence Interval								
Sr-MDC								

Analyte	Average	Median	Std Dev	N
K-40 Activity	**2.802**	**2.784**	**0.120**	**4**
Pb-214 Activity	**0.142**	**0.142**	**N/A**	**1**

2008 Radiological Monitoring of Edible Vegetation

Greens

Location:	EVE70B	EVE70A	EVE14A	EVE14B	EVE64	EVE51-02	EVE58	EVE53
Date:	1/31/08	1/31/08	2/8/08	2/14/08	3/14/08	5/23/08	5/23/08	2/8/08
Type:	Turnips	Mustards	Mustards	Collards	Collards	Cabbage	Cabbage	Cabbage
Be-7 Activity	**<MDA**	**1.355**	**0.899**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Be-7 Confidence Interval	NA	0.339	0.373	NA	NA	NA	NA	NA
Be-7 MDA	0.319	0.325	0.358	0.273	0.273	0.322	0.289	0.362
K-40 Activity	**5.027**	**9.499**	**3.951**	**6.506**	**3.310**	**4.446**	**4.506**	**5.129**
K-40 Confidence Interval	0.640	0.934	0.631	0.721	0.413	0.661	0.626	0.686
K-40 MDA	0.204	0.227	0.250	0.194	0.139	0.249	0.234	0.261
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
Co-60 MDA	0.029	0.027	0.034	0.030	0.017	0.027	0.027	0.027
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	*	**<MDA**	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
I-131 MDA	0.520	0.464	0.321	0.168	NA	0.157	0.160	0.304
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
Cs-137 MDA	0.029	0.028	0.036	0.025	0.017	0.031	0.029	0.031
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
Pb-212 MDA	0.058	0.054	0.074	0.056	0.028	0.066	0.064	0.060
Pb-214 Activity	**0.141**	**<MDA**	**0.273**	**<MDA**	**<MDA**	**0.127**	**<MDA**	**0.152**
Pb-214 Confidence Interval	0.055	NA	0.068	NA	NA	0.050	NA	0.055
Pb-214 MDA	0.056	0.070	0.067	0.054	0.030	0.059	0.080	0.059
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
Ra-226 MDA	0.728	0.656	0.879	0.682	0.425	0.766	0.756	0.784
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.433	1.325	1.619	1.433	0.662	1.605	1.495	1.523
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.376	0.340	0.472	0.377	0.087	0.439	0.398	0.420
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**
Tritium Confidence Interval	NA	NA	N/A	NA	NA	NA	NA	NA
Tritium LLD	0.204	0.204	0.204	0.204	0.204	0.204	0.204	0.204
Sr-89/90 Wet pCi/g	**0.045**	**0.113**	**0.015**	**0.03**				
Sr- 89/90 Confidence Interval	0.006	0.010	0.003	0.004				
Sr-MDC	0.007	0.006	0.005	0.004				

Analyte:	Avg	Median	Std Dev	N
Be-7 Activity	**1.127**	**1.127**	**0.322**	**2**
K-40 Activity	**5.297**	**4.767**	**1.939**	**8**
Pb-214 Activity	**0.173**	**0.147**	**0.067**	**4**
Sr-89/90 Wet pCi/g	**0.051**	**0.037**	**0.043**	**4**

2008 Radiological Monitoring of Edible Vegetation

Fruit - Plums

Location:	EVNEW-01	EVJAK-01	EVSNL-01	EVBWL-01	EVAKN-01	EVE56	EVE59-01
Date:	4/29/08	5/1/08	5/2/08	5/2/08	5/2/08	5/23/08	6/2/08
K-40 Activity	**2.965**	**2.822**	**3.341**	**2.572**	**2.185**	**2.689**	**1.847**
K-40 Confidence Interval	0.504	0.556	0.538	0.528	0.468	0.549	0.251
K-40 MDA	0.178	0.209	0.225	0.201	0.168	0.218	0.102
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Co-60 MDA	0.025	0.029	0.024	0.024	0.024	0.026	0.012
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
I-131 MDA	1.160	1.140	1.034	1.136	0.995	0.164	0.236
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Cs-137 MDA	0.027	0.030	0.029	0.027	0.026	0.029	0.012
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Ra-226 MDA	0.708	0.807	0.772	0.785	0.734	0.709	0.313
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.376	1.619	1.542	1.511	1.427	1.593	0.530
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.379	0.446	0.422	0.422	0.367	0.445	0.061
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**0.329**	**<LLD**	**<LLD**
Tritium Confidence Interval	NA	NA	NA	NA	97	NA	NA
Tritium LLD	204	204	204	204	204	204	204
Sr-89/90 Activity				**<MDA**			
Sr-89/90 Confidence Interval				NA			
Sr-89/90 MDA				0.096			
U-238 Activity				**<MDA**			
U-238 Confidence Interval				NA			
U-238 MDA				0.001			

Analyte:	Average	Median	Std Dev	N
K-40 Activity	**2.632**	**2.689**	**0.495**	**7**
Tritium Activity	**0.329**	**0.329**	**N/A**	**1**

2008 Radiological Monitoring of Edible Vegetation

Fruit - Pears

Location	EVE108	EVE208	EVB208	EVB308	EVB708	EVB608	EVB808
Date:	8/19/08	8/19/08	8/20/08	8/22/08	8/28/08	9/3/08	10/1/08
K-40 Activity	**1.033**	**1.142**	**1.731**	**<MDA**	**1.250**	**1.370**	**1.583**
K-40 Confidence Interval	0.472	0.388	0.507	NA	0.365	0.320	0.375
K-40 MDA	0.217	0.174	0.231	0.234	0.204	0.204	0.190
Co-60 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Co-60 MDA	0.024	0.018	0.027	0.027	0.024	0.024	0.022
I-131 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**NA**	**NA**	**NA**
I-131 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
I-131 MDA	0.174	0.152	0.178	0.157	NA	NA	NA
Cs-137 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Cs-137 MDA	0.026	0.023	0.030	0.031	0.023	0.023	0.027
Pb-212 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Pb-212 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Pb-212 MDA	0.060	0.052	0.067	0.068	0.018	0.023	0.021
Pb-214 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**0.227**	**<MDA**
Pb-214 Confidence Interval	NA	NA	NA	NA	NA	0.051	NA
Pb-214 MDA	0.067	0.062	0.078	0.079	0.063	0.045	0.070
Ra-226 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Ra-226 MDA	0.737	0.627	0.796	0.824	0.524	0.547	0.507
U/Th-238 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
U/Th-238 MDA	1.455	1.225	1.596	1.632	0.293	0.311	0.295
Am-241 Activity	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA	NA	NA	NA	NA	NA
Am-241 MDA	0.419	0.339	0.420	0.426	0.027	0.031	0.029
Tritium Activity	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**<LLD**	**0.353**	**<LLD**
Tritium Confidence Interval	NA	NA	NA	NA	NA	94	NA
Tritium LLD	0.185	0.185	185	185	185	185	182
Sr-89/90 Activity							
Sr-89/90 Confidence Interval							
Sr-89/90 MDA							
U-238 Activity							
U-238 Confidence Interval							
U-238 MDA							

Analyte	Average	Median	Std Dev	N
K-40 Activity	**1.352**	**1.310**	**0.266**	**6**
Tritium Activity	**0.353**	**0.353**	**N/A**	**1**

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Fruit - Watermelon

Location:	EVE4108	EVE4908
Date:	7/21/08	8/6/08
Be-7 Activity	**<MDA**	**<MDA**
Be-7 Confidence Interval	NA	NA
Be-7 MDA	0.335	0.348
K-40 Activity	**1.156**	**1.353**
K-40 Confidence Interval	0.382	0.407
K-40 MDA	0.148	0.202
Co-60 Activity	**<MDA**	**<MDA**
Co-60 Confidence Interval	NA	NA
Co-60 MDA	0.020	0.022
I-131 Activity	**<MDA**	**<MDA**
I-131 Confidence Interval	NA	NA
I-131 MDA	0.920	0.476
Cs-137 Activity	**<MDA**	**<MDA**
Cs-137 Confidence Interval	NA	NA
Cs-137 MDA	0.021	0.029
Pb-214 Activity	**<MDA**	**<MDA**
Pb-214 Confidence Interval	NA	NA
Pb-214 MDA	0.058	0.075
Ra-226 Activity	**<MDA**	**<MDA**
Ra-226 Confidence Interval	NA	NA
Ra-226 MDA	0.618	0.733
U/Th-238 Activity	**<MDA**	**<MDA**
U/Th-238 Confidence Interval	NA	NA
U/Th-238 MDA	1.185	1.436
Am-241 Activity	**<MDA**	**<MDA**
Am-241 Confidence Interval	NA	NA
Am-241 MDA	0.336	0.410
Tritium Activity	**<LLD**	**0.273**
Tritium Confidence Interval	NA	0.091
Tritium LLD	0.185	0.185
Sr-89/90 Activity		
Sr-89/90 Confidence Interval		
Sr-89/90 MDA		

Analyte:	Average	Median	Std DEV	N
K-40 Activity	**1.255**	**1.255**	**0.139**	**2**
Tritium Activity	**0.273**	**0.273**	**N/A**	**1**

2008 Radiological Monitoring of Edible Vegetation

All Locations – Detects Only

Sample Location	Quad Location	Sample Date	Matrix	Type	H-3	Cs-137	Sr-89/90
EVE70A	HollowCreek	1/31/08	Greens	Mustards	<0.204	<0.028	0.113
EVE70B	HollowCreek	1/31/08	Greens	Turnips	<0.204	<0.029	0.045
EVE53	New Ellenton	2/8/08	Greens	Cabbage	<0.204	<0.031	
EVE14A	Jackson	2/8/08	Greens	Mustards	N/A	<0.036	0.015
EVE14B	Jackson	2/14/08	Greens	Collards	<0.204	<0.025	0.03
EVE64	New Ellenton	3/14/08	Greens	Collards	<0.205	<0.017	
EVNEW-01	New Ellenton, SE	4/29/08	Fruit	Plums	<0.204	<0.027	
EVJAK-01	Jackson	5/1/08	Fruit	Plums	<0.204	<0.030	
EVAKN-01	Aiken	5/2/08	Fruit	Plums	0.329	<0.026	
EVBWL-01	Barnwell	5/2/08	Fruit	Plums	<0.204	<0.029	
EVSNL-01	Snelling	5/2/08	Fruit	Plums	<0.204	<0.027	
EVB18	Hartsville South	5/8/08	Grain	Wheat	<0.204	<0.04	
EVB21	Mayesville	5/8/08	Grain	Wheat	<0.204	<0.045	
EVE62	Martin	5/15/08	Grain	Wheat	<0.204	<0.035	
EVE51-02	Crocketville	5/23/08	Greens	Cabbage	<0.204	<0.031	
EVE58	Tony Hill Bay	5/23/08	Greens	Cabbage	<0.204	<0.029	
EVE56	Branchville North	5/23/08	Fruit	Plums	<0.204	<0.029	
EVE51-01	Crocketville	5/23/08	Grain	Wheat	<0.204	<0.04	
EVE59-01	Williston	6/2/08	Fruit	Plums	<0.204	<0.012	
EVE59-02	Williston	6/23/08	Vegetable	Corn	<0.204	<0.015	
EVE2408	LongBranch	7/8/08	Vegetable	Corn	<0.185	<0.032	
EVB2201	Carlisle SE	7/18/08	Vegetable	Corn	<0.185	<0.024	
EVB13	Sharon	7/18/08	Vegetable	Corn	<0.185	<0.028	
EVB2202	Carlisle SE	7/18/08	Fruit	Peaches	<0.185	0.029	
EVE4108	Windsor	7/21/08	Fruit	Watermelon	<0.185	<0.02127	
EVE4908	Millett	8/6/08	Fruit	Watermelon	0.273	<0.02879	
EVE208	Barnwell	8/19/08	Fruit	Pears	<0.185	<0.02267	
EVE108	Furman	8/19/08	Fruit	Pears	<0.185	<0.02558	
EVB208	Furman	8/20/08	Fruit	Pears	<0.185	<0.03007	
EVB308	Felderville (Oburg C	8/22/08	Fruit	Pears	<0.185	<0.03052	
EVB708	Saluda	8/28/08	Fruit	Pears	<0.185	<0.0234	
EVB608	Antreville (Laurens (	9/3/08	Fruit	Pears	0.353	<0.0227	
EVB808	Bingham	10/1/08	Fruit	Pears	<0.185	<0.0272	
EVE208	Barnwell	10/29/08	Grain	Soybeans	<0.182	<0.03594	
EVE4008	Blackville	10/29/08	Grain	Soybeans	0.673	<0.03999	
EVE3708	Sycamore	10/29/08	Grain	Soybeans	0.202	<0.0397	

Analyte:	Average	Median	SD	N	Max	Min
Be-7 Activity	1.127	1.127	0.322	2	1.355	0.899
K-40 Activity	4.101	2.822	4.008	35	17.430	1.033
Pb-214 Activity	0.176	0.152	0.054	7	0.273	0.127
Tritium Activity	0.366	0.329	0.181	5	0.673	0.202
Sr-89/90 pCi/g	0.291	0.224	0.231	4	0.623	0.091

2008 ESOP Average Minimum Detectable Concentrations
Total Samples: 36

Analyte	Average
Co-60	0.0271
I-131	1.0364
Cs-137	0.0289
Ra-226	0.7278
U/Th-238	1.2802
Am-241	0.3254
Tritium	0.195
Sr-89/90	0.0235

2008 DOE-SR Detects and MDCs

DOE-SR Detects Only			Sample Concentration	DOE-SR MDC
Greens (Collards)				
SE Quadrant 0-10 Miles	Cs-137	30-Jan-08	0.034	0.0059
SW Quadrant 0-10 Miles	Cs-137	30-Jan-08	0.052	0.0059
		Average	**0.043**	
		Median	**0.043**	
		SD	**0.012**	
		n	**5**	
NE Quadrant 0-10 Miles	Sr-89/90	16-Jan-08	0.172	0.199
NW Quadrant 0-10 Miles	Sr-89/90	30-Jan-08	0.223	0.199
SE Quadrant 0-10 Miles	Sr-89/90	30-Jan-08	0.214	0.199
SE Quadrant 25 Miles	Sr-89/90	16-Jan-08	0.230	0.199
SW Quadrant 0-10 Miles	Sr-89/90	30-Jan-08	0.370	0.199
		Average	**0.242**	
		Median	**0.223**	
		SD	**0.075**	
		n	**5**	

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3.4 Radiological Monitoring of Dairy Milk

3.4.1 Summary

Operations at the Savannah River Site (SRS) have resulted in the potential for radiological constituents to be released to the surrounding environment. Milk from dairies around the SRS are routinely analyzed for levels of radioactivity that could impact human health. This project provides radiological dairy milk monitoring of selected cow dairies within a 50-mile radius of the SRS in South Carolina (SC). This project also provides analytical data for comparison to published Department of Energy-Savannah River (DOE-SR) data.

Plants and animals assimilate different radioisotopes based on the chemistry and not on the radioactive nature of the components. Cesium-137 (Cs-137) is less readily taken up by plant roots than Strontium-90 (Sr-90), but the opposite is true for direct absorption from foliar (leaf) deposits. Cesium-137 is transferred rapidly from pasture grass to the muscle of animals. Strontium-90 is an isotope that can bioconcentrate in bones when there is a deficiency of calcium in the diet of the individual. This pathway is of particular importance in the case of infants and children because they are more likely to drink large quantities of milk, and they are actively developing bones and teeth (Kathren 1984). Irrigation of a pasture with contaminated groundwater or uptake by plants from contaminated soil can provide alternate modes of release and contribution to this exposure pathway. Iodine-131 (I-131) is rapidly transferred to milk and accumulates in the thyroid of humans. Most of the Cobalt-60 (Co-60) contamination came from the period 1968 to 1984 when Co-60 was used as a heat source for a thermoelectric generator (WSRC 1998). Tritium (H-3) is a radioisotope of hydrogen that produces beta particles, and therefore can impact anything containing water or hydrocarbons. Tritium exists everywhere in the environment**,** and its volatility quickly achieves equilibrium in the environment and the body, and therefore targets the whole body**.**

Consumption of milk products containing radioactive materials can be an important human exposure pathway to radioactivity. When an atmospheric release occurs, radionuclides can be deposited on pastures and ingested by grazing dairy cows. The cows would then release a portion of the radioactivity into the milk that is consumed by humans (CDC 2001). The milk pathway is especially important in the case of infants and children. They are more likely to drink large quantities of milk, and are actively developing bones and teeth. Radioactive strontium is a calcium analogue and may show a tendency to accumulate in these structures (Kathren 1984).

During 2008, DOE-SR collected samples from seven dairy locations, four of which are located in South Carolina (SRNS 2009). DOE-SR milk samples are collected quarterly within a 25-mile radius of the SRS. Only four of the dairies that DOE-SR sample are located in South Carolina and the remaining three are located in Georgia. The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) collected milk at seven cow dairy locations within the state (five perimeter and two background) to provide an independent source of data on radionuclide concentrations of concern in milk (Map 11, Section 3.4.2).

SCDHEC personnel collected unpasteurized milk samples on a quarterly basis in 2008. Cow milk samples from each quarter were analyzed for tritium, strontium-89/90 (Sr-89/90), and select gamma-emitting radionuclides, specifically iodine-131 (I-131), cesium-137 (Cs-137), and cobalt-60 (Co-60).

SCDHEC did not detect any man-made gamma-emitting radionuclides in any of the 28 milk samples collected during 2008. Tritium was detected in one sample collected from a perimeter location in 2008. Sr-89/90 was detected in two samples collected from perimeter locations in 2008. The source of the strontium is likely due to historical atmospheric nuclear weapons testing. Strontium has slow long-term fallout properties and a long half-life (Larson 1958). None of the Sr-89/90 detections in 2008 exceeded the United States Environmental Protection Agency (USEPA) drinking water Maximum Contaminant Level (MCL) of 8 picocuries per liter (pCi/L) for strontium-90 (Sr-90) (USEPA 2002).

DOE-SR did not detect gamma-emitting radionuclides of concern Cs-137, Co-60, or Sr-90 in 2008. Tritium was detected in one DOE-SR sample, collected during July in Girard, Georgia (GA), which was just above the DOE-SR detection limit of 416 pCi/L (SRNS 2009).

During 2008, concentrations of radionuclides of concern in milk did not deviate from historically expected levels as measured by DOE-SR and SCDHEC. SCDHEC will continue to monitor dairies for radionuclides that have the potential to impact human health.

Results and Discussion

Tritium Results

Historically tritium has been the main product of operations at SRS, produced as a nuclear weapon enhancement component. The majority of tritium released was in the production reactors and separation areas (CDC 2001). Cow milk tritium contributions come not only from atmospheric depositions, but from food sources and groundwater wells also. Over 99% of tritium occurs as tritiated water and groundwater background test wells (SCDHEC 2003) have tritium contributions (atomic legacy source likely) that are higher than the range found in milk. Tritium averages lower in milk because of plant uptake factors, intrinsic transfer factors, bioelimination factors, and the variation in distributions of atmospheric depositions.

One SCDHEC perimeter milk sample, collected in June 2008 from Norway, South Carolina, (SC) exhibited tritium activity of 218 (±128) pCi/L. In 2007 there were no detections above the Lower Limit of Detection (LLD) in SCDHEC milk samples (SCDHEC 2008). Figure 1 of Section 3.4.3 illustrates average tritium detections for the eleven years SCDHEC has sampled milk. All tritium detections have been below the USEPA drinking water MCL of 20,000 pCi/L for tritium. DOE-SR detected tritium in one Georgia sample that exhibited a tritium activity of 600 (± 78.8) pCi/L (SRNS 2009). The tritium results for all milk samples collected by SCDHEC are given in Section 3.4.4. These radionuclide contributions to cow milk come from the SRS, other nuclear facilities, and legacy contamination from the cold war period.

Gamma-emitting Radionuclides Results

The gamma-emitting radionuclides I-131, Cs-137, and Co-60 are man-made radioactive elements that can impact public health and were all products of SRS activities. These radionuclides were produced by fission in reactor fuels. They were primarily released in surface streams in the 1960s, or into the atmosphere in the separation areas (CDC 2001; WSRC 1998).

SCDHEC tested for I-131, Cs-137, and Co-60 in all milk samples collected in 2008. All analytical results for these radionuclides were below the sample Minimum Detectable Activity (MDA). These results are consistent with 2007 results (SCDHEC 2008). All analytical results for gamma-emitting radionuclides are located in Section 3.4.4. No summary statistics were calculated for these radionuclides as all results were below the MDA. DOE-SR detected gamma-emitting radionuclides from two samples in 2008. One DOE-SR sample from Denmark, SC exhibited a Cs-137 activity of 3.68 pCi/L and one sample from Govan, SC exhibited a Co-60 activity of 3.76 pCi/L. (SRNS 2009).

Strontium-89/90 Results

Strontium is present around the world due to nuclear weapons testing in the 1950s and 1960s (CDC 2001). Since strontium has slow fallout from the atmosphere and a 29-year half-life, it is still present in the environment; however, concentrations are low and continue to decrease over time (USEPA 2002; Larson 1958). SRS operations have also released strontium into the environment through normal site operations and equipment failure. Strontium was a product of fission in SRS reactors, and was subsequently released in the F and H separation areas (WSRC 1998). Samples were collected quarterly in 2008 for Sr-89/90 analysis (Section 3.4.4). Two SCDHEC milk samples collected in 2008 exhibited strontium activities above the MDA. The range for these detections was 0.80 pCi/L to 1.08 pCi/L, with the minimum detection in a sample from Govan, SC, and the maximum detection in a sample from Leesville, SC. These perimeter detections averaged 0.94 (± 0.20) pCi/L (Section 7.0). This perimeter average is below the USEPA established MCL of 8 pCi/L for Sr-90 in drinking water (USEPA 2002). This average is a decrease from 2007, when the strontium average was 4.06 (± 8.22) pCi/L (SCDHEC 2007). Figure 2 (Section 5.0) shows the trend for SCDHEC strontium detections for the last eleven years. All strontium detections have been below the USEPA established MCL of 8 pCi/L for Sr-90 since testing began in 1998. Sampling at the Norway, SC, dairy was discontinued during the fourth quarter of 2008. No further sampling will be conducted at this location. DOE-SR detected Sr-90 in two samples from locations in Girard and Waynesboro, GA. The range for these detections was 2.61 pCi/L to 7.08 pCi/L, with the minimum detection from Waynesboro, and the maximum detection from Girard.

Statistical Summary

Statistical analysis was limited to a comparison of averages of all perimeter samples collected within 50 miles of the SRS perimeter and all background samples, as shown in Section 3.4.5. Locations closer to SRS have higher strontium levels than background locations for averaged values.

Conclusions and Recommendations

The DOE-SR uses all analytical results, including below MDC, to compute averages. SCDHEC uses only detections to compute averages. Consequently, dairy milk analytical data comparisons between SCDHEC and DOE-SR were not conducted.
An evaluation of average concentrations by sampling location is included in Section 3.4.5. Perimeter data show higher strontium than background locations for averaged values.

A large portion of the radiological activity observed in collected milk samples can be attributed to fallout from past nuclear testing. Also, radionuclides within soil and plants can potentially be redistributed as a result of farming practices and prescribed burns. SCDHEC will continue to monitor tritium, gamma-emitting radionuclides that can affect human health, and strontium in cow milk to ensure the safety of milk consumption by the public.

The dairies in the ESOP South Carolina study area and background locations appear to be doing well and have give no indication of closing in the foreseeable future. ESOP has had no indication of any new diaries opening within the study area. Additional dairy sources will be added to the network if and when they become available.

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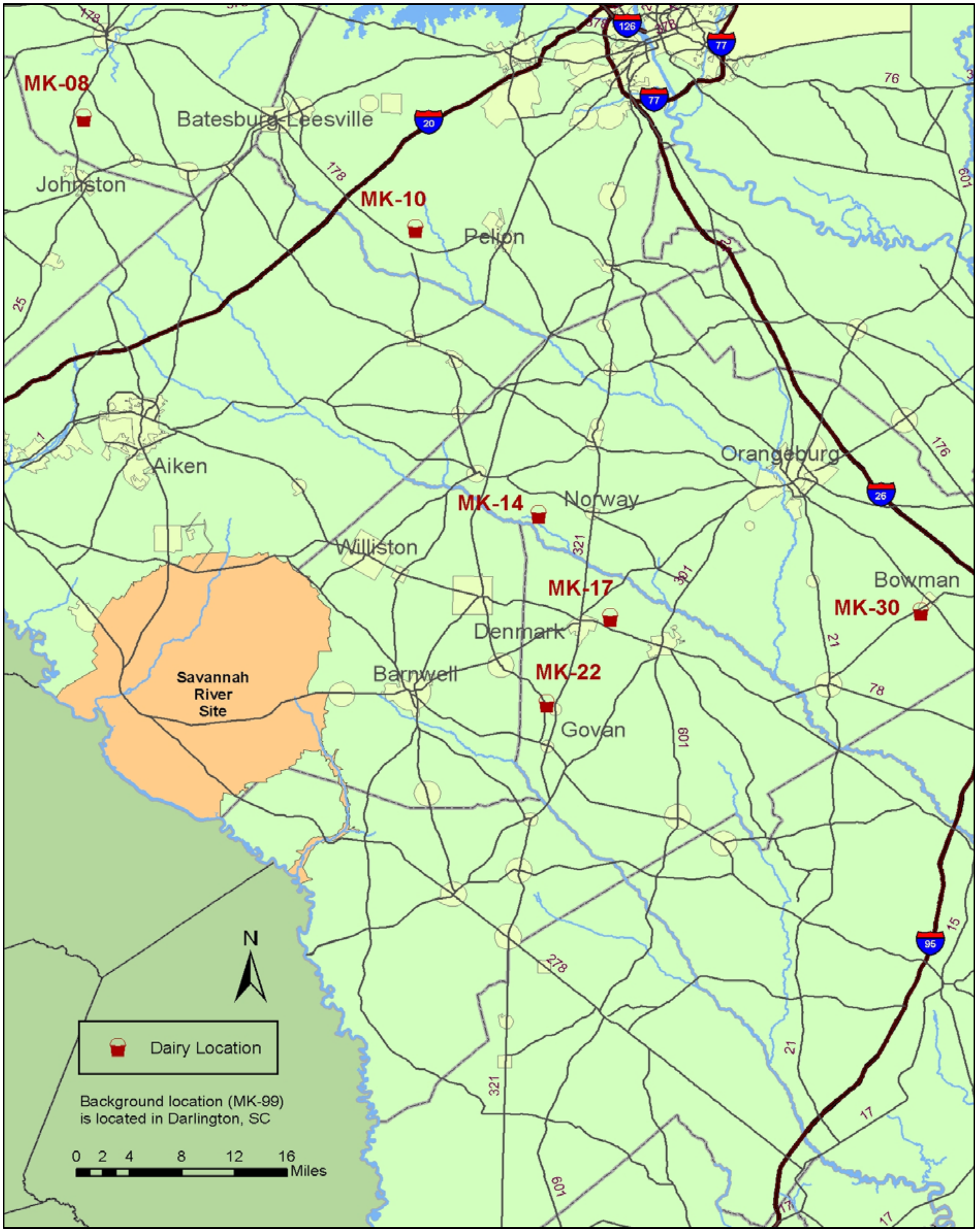
3.4.2 Radiological Monitoring of Dairy Milk

Map 11. SCDHEC Radiological Monitoring Locations for Dairy Milk



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3.4.3 Tables and Figures

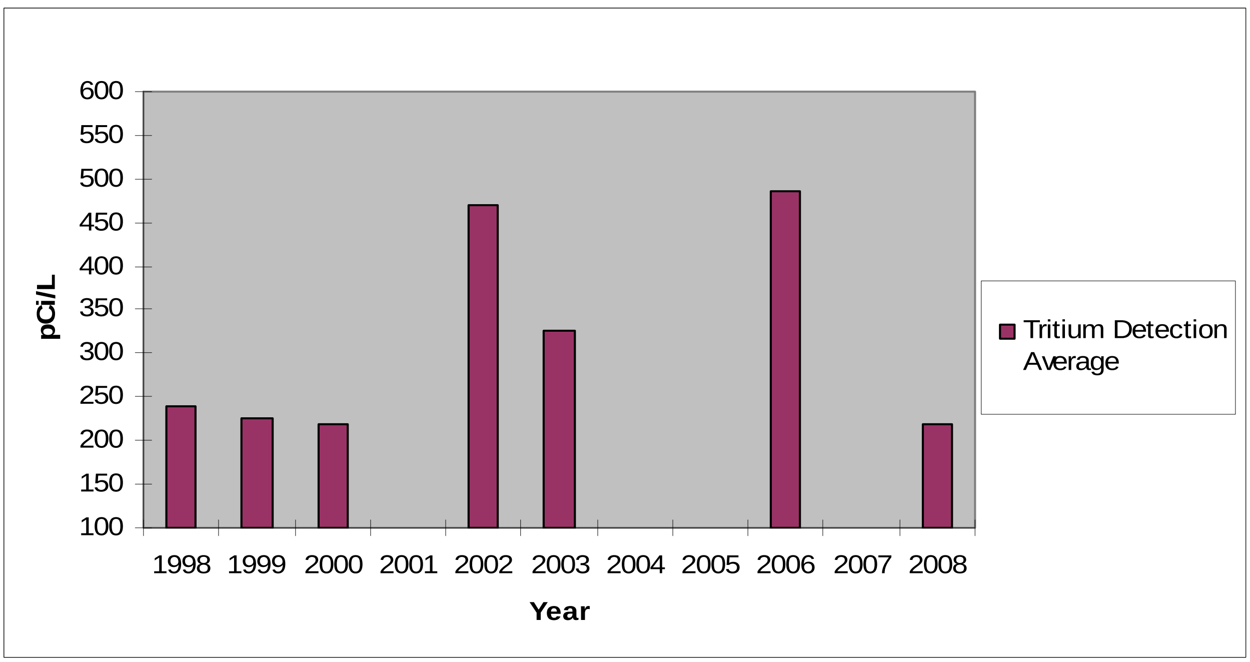
Radiological Monitoring of Dairy Milk

Table 1. 2008 SCDHEC and DOE-SR Dairy Milk Sampling Locations

2008 SCDHEC and DOE-SR Dairy Milk Sampling Locations	
SCDHEC Cow Dairy Locations	**DOE-SR Cow Dairy Locations**
Denmark, SC, MK-17	Barnwell, SC
Norway, SC, MK-14	Denmark, SC
Leesville, SC, MK-10	Ehrhardt Road, Govan, SC
Johnston, SC, MK-8	Partridge Rd, Govan, SC
Govan, SC, MK-22	Girard, GA
Bowman, SC*, MK-30	Hwy 23 Girard, GA
Darlington, SC*, MK-99	Waynesboro, GA

*Background Locations

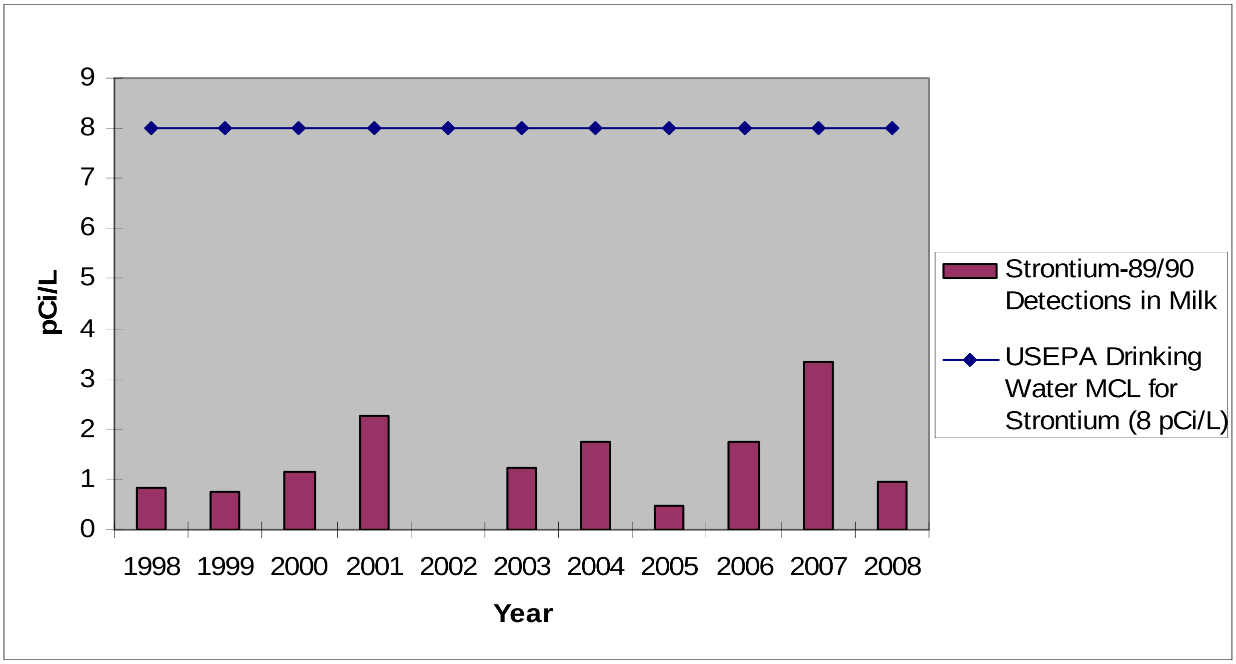
Figure 1. Average Tritium Detections in SCDHEC Milk, 1998-2008



Tables and Figures

Radiological Monitoring of Dairy Milk

Figure 2. Strontium-89/90 Detection Averages, 1998-2008



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3.4.4 Data

Radiological Monitoring of Dairy Milk

Notes:

5. LLD - Lower Limit of Detection
6. MDA - Minimum Detectable Activity
7. MDC - Minimum Detectable Concentration
8. SC - South Carolina
9. * Indicates a background sampling location

Radiological Monitoring Of Dairy Milk Data

2008 Tritium and Gamma-emitting Milk Data

Sample Location		MK-8 Johnston, SC			
Collection Date		3/19/2008	6/11/2008	08/11/08	12/16/08
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	+/- 2 sigma				
	LLD	197	209	215	225
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.60E+00	2.08E+00	2.69E+00	2.31E+00
	I-131 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	1.54E+02	4.49E+01	1.16E+02	1.59E+01
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.49E+00	2.69E+00	2.70E+00	2.46E+00

Sample Location		MK-10 Leesville, SC			
Collection Date		3/19/2008	6/11/2008	08/08/08	12/09/08
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	+/- 2 sigma				
	LLD	197	208	235	222
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.53E+00	2.51E+00	2.45E+00	2.26E+00
	I-131 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	1.58E+02	4.48E+01	1.25E+02	3.01E+01
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.42E+00	2.47E+00	2.70E+00	2.32E+00

Sample Location		MK-14 Norway, SC			
Collection Date		3/18/2008	6/03/2008	8/06/2008	No Sample
Radionuclides:	Tritium (pCi/L)	<LLD	218	<LLD	
	+/- 2 sigma		128		
	LLD	196	211	215	
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	
	+/- 2 sigma				
	MDA	2.32E+00	2.49E+00	2.41E+00	
	I-131 (pCi/L)	<MDA	<MDA	<MDA	
	+/- 2 sigma				
	MDA	1.50E+02	6.51E+01	1.41E+02	
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	
	+/- 2 sigma				
	MDA	2.44E+00	2.58E+00	2.69E+00	

Radiological Monitoring of Dairy Milk Data

2008 Tritium and Gamma-emitting Milk Data

Sample Location		MK-17 Denmark, SC			
Collection Date		3/18/2008	6/03/2008	8/06/2008	12/09/2008
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	+/- 2 sigma				
	LLD	197	210	217	225
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.34E+00	2.34E+00	3.10E+00	2.11E+00
	I-131 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	1.14E+02	5.88E+01	1.40E+02	2.35E+01
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.43E+00	2.70E+00	2.70E+00	2.12E+00

Sample Location		MK-22 Govan, SC			
Collection Date		3/18/2008	6/03/2008	8/08/2008	12/11/2008
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	+/- 2 sigma				
	LLD	198	209	215	225
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.48E+00	2.42E+00	2.62E+00	2.03E+00
	I-131 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	1.10E+02	5.45E+01	1.28E+02	2.03E+01
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.59E+00	2.70E+00	2.69E+00	2.25E+00

Sample Location		MK-30 Bowman, SC*			
Collection Date		3/31/2008	6/04/2008	8/05/2008	12/10/2008
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	+/- 2 sigma				
	LLD	196	208	216	225
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.62E+00	2.66E+00	2.76E+00	2.43E+00
	I-131 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	6.16E+01	6.55E+01	1.40E+02	3.14E+01
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.46E+00	2.69E+00	2.70E+00	2.70E+00

Radiological Monitoring of Dairy Milk Data

2008 Tritium and Gamma-emitting Milk Data

Sample Location		MK-99 Darlington, SC*			
Collection Date		3/31/2008	6/04/2008	8/05/2008	12/10/2008
Radionuclides:	Tritium (pCi/L)	<LLD	<LLD	<LLD	<LLD
	+/- 2 sigma				
	LLD	197	207	216	225
	Co-60 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.40E+00	2.67E+00	2.93E+00	2.61E+00
	I-131 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	5.85E+01	6.30E+01	9.57E+01	2.91E+01
	Cs-137 (pCi/L)	<MDA	<MDA	<MDA	<MDA
	+/- 2 sigma				
	MDA	2.49E+00	2.70E+00	2.70E+00	2.69E+00

Radiological Monitoring of Dairy Milk Data

2008 Strontium Milk Data

Units are in picocuries per Liter (pCi/L)

Sample Location	MK-8 Johnston, SC			
Collection Date	3/19/2008	6/11/2008	8/11/2008	12/16/2008
Sr - 89/90	<MDC	<MDA	<MDA	<MDA
± 2 sigma				
MDA	1.16	0.81	0.72	0.47

Sample Location	MK-10 Leesville, SC			
Collection Date	3/19/2008	6/11/2008	8/8/2008	12/9/2008
Sr - 89/90	1.08	<MDA	<MDA	<MDA
± 2 sigma	0.58			
MDA	1.07	0.60	0.83	0.51

Sample Location	MK-14 Norway, SC			
Collection Date	3/18/2008	6/3/2008	8/6/2008	No Sample
Sr - 89/90	<MDC	<MDA	<MDA	
± 2 sigma				
MDA	1.03	0.61	0.86	

Sample Location	MK-17 Denmark, SC			
Collection Date	3/18/2008	6/3/2008	8/6/2008	12/9/2008
Sr - 89/90	<MDC	<MDA	<MDA	<MDA
± 2 sigma				
MDA	1.13	0.82	0.60	0.62

Sample Location	MK-22 Govan, SC			
Collection Date	3/18/2008	6/3/2008	8/8/2008	12/11/2008
Sr - 89/90	<MDC	0.80	<MDA	<MDA
± 2 sigma		0.21		
MDA	1.17	0.65	0.76	0.47

Sample Location	MK-30 Bowman, SC*			
Collection Date	3/31/2008	6/4/2008	8/5/2008	12/10/2008
Sr - 89/90	<MDC	<MDA	<MDA	<MDA
± 2 sigma				
MDA	1.22	0.63	0.75	0.44

Sample Location	MK-99 Darlington, SC*			
Collection Date	3/31/2008	6/4/2008	8/5/2008	12/10/2008
Sr - 89/90	<MDC	<MDA	<MDA	<MDA
± 2 sigma				
MDA	1.08	0.81	0.72	0.52

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3.4.5 Summary Statistics

Radiological Monitoring of Dairy Milk Data

Notes:

13. Avg. - Average
14. St. Dev. - Standard Deviation
15. Min. - Minimum
16. Max. - Maximum
17. Statistics calculated for detections only
18. Non-detect denotes <MDA
19. N/A - Not Applicable

Radiological Monitoring of Dairy Milk Data

2008 Tritium Summary Statistics for all Milk Sample Detections

Units are in picocuries per liter (pCi/L)

Radionuclide:		Tritium					
Statistical Analysis:		**N**	**Avg.**	**St. Dev.**	**Median**	**Min**	**Max**
Sample Locations	**MK-8**	0 (4)	<LLD	N/A	N/A	N/A	N/A
	MK-10	0 (4)	<LLD	N/A	N/A	N/A	N/A
	MK-14	1 (3)	218	N/A	218	218	218
	MK-17	0 (4)	<LLD	N/A	N/A	N/A	N/A
	MK-22	0 (4)	<LLD	N/A	N/A	N/A	N/A
	MK-30	0 (4)	<LLD	N/A	N/A	N/A	N/A
	MK-99	0 (4)	<LLD	N/A	N/A	N/A	N/A
Yearly Average			218				
Standard Deviation			N/A				
Median			218				

Non-detects ( ) excluded from computations

2008 Strontium Summary Statistics for all Milk Sample Detections

Units are in picocuries per liter (pCi/L)

Radionuclide:		Strontium-89/90					
Statistical Analysis:		**N**	**Avg.**	**St. Dev.**	**Median**	**Min**	**Max**
Sample Locations	**MK-8**	0 (4)	<MDA	N/A	N/A	N/A	N/A
	MK-10	1 (4)	1.08	N/A	1.08	1.08	1.08
	MK-14	0 (3)	<MDA	N/A	N/A	N/A	N/A
	MK-17	0 (4)	<MDA	N/A	N/A	N/A	N/A
	MK-22	1 (4)	0.80	N/A	0.80	0.80	0.80
	MK-30	0 (4)	<MDA	N/A	N/A	N/A	N/A
	MK-99	0 (4)	<MDA	N/A	N/A	N/A	N/A
Yearly Average			0.94				
Standard Deviation			0.20				
Median			0.94				

Non-detects ( ) excluded from computations

Radiological Monitoring of Dairy Milk Data

2008 Tritium Summary Statistics Comparison of Perimeter and Background Locations

Units are in picocuries per liter (pCi/L)

	Perimeter Locations (E) (< 50 miles)			Background locations (B) (> 50 Miles)			E minus B	
	Average	**Std Dev.**	**Median**	**Average**	**Std Dev.**	**Median**	**Average**	**Median**
Tritium	(N=1) 218	N/A	218	< LLD	N/A	N/A	218	218

2008 Strontium Summary Statistics Comparison of Perimeter and Background Locations

Units are in picocuries per liter (pCi/L)

	Perimeter Locations (E) (< 50 miles)			Background locations (B) (> 50 Miles)			E minus B	
	Average	**Std Dev.**	**Median**	**Average**	**Std Dev.**	**Median**	**Average**	**Median**
Sr-89/90	(N=2) 0.94	N/A	0.94	N/A	N/A	N/A	0.94	0.94

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3.5 FFA Oversight Monitoring

3.5.1 Summary

The Site Evaluation (SE) program evaluates areas with potential contamination of hazardous substances. The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Surveillance and Oversight Program (ESOP) personnel provide Quality Assurance / Quality Control (QA/QC) of Department of Energy – Savannah River (DOE-SR) contractor activities associated with SE investigations by splitting soil samples, observing sampling activities, and observing adherence to established Washington Savannah River Company (WSRC) protocols and procedures (i.e., sampling, equipment decontamination, etc.).

The following is an overview of the Miscellaneous Rubble Pile #2 (MSRP #2) featured in the Sampling and Analysis Plan (SGCP-SAP-2008-00003) published by WSRC.

"The miscellaneous Rubble Pile (MSRP) #2 is a newly discovered waste area located near the central portion of the Savannah River Site (SRS), immediately south of N Area. The area was discovered during a field visit to Carolina Bay # 125. The area contains drums, light bulbs, concrete and asbestos. There is no history or records of the Miscellaneous Rubble Pile #2. However, it is believed that the Miscellaneous Rubble Pile #2 was associated with the Miscellaneous Rubble Pile (631-7G) Site Evaluation Area (SEA), since they are in close proximity (approximately 600 ft) and similar rubble was found at both rubble piles.

The Miscellaneous Rubble Pile (631-7G) was originally graded in the mid-1950's for use as a short term storage area for portable sheds. The site was used as a shed storage area from the mid 1950's until 1975. The shed area contained several rubble piles, two piles of lumber, six empty corroded and broken 55-gallon drums, and one abandoned 55-gallon drum pallet. A Removal Action was performed at the Miscellaneous Rubble Pile (631-7G) and the area was granted a "No Further Action" response.

The Miscellaneous Rubble Pile #2 is an area of approximately 25,375 ft^2 (2,357.43 m^2) located in the central portion of the SRS. The center of the pile is located approximately at SRS coordinates N61132, E48297; Latitude 33.23978N and Longitude –81.65837W; or north 3677871.03/east 438662.53 (meters) on the Universal Transverse Mercator (UTM) grid. It is located in a relatively flat area, which slopes gradually to the southwest. It is wooded with heavy underbrush. It contains no stressed vegetation or other indications of contamination.

There is no history of radiological material being disposed or any associated with Miscellaneous Rubble Pile #2. A radiological control survey was performed at the Miscellaneous Rubble Pile # 2 during June 2007. The area has been designated as a "Clean Area" in accordance with WSRC Procedure 5Q 1.2".

In July of 2008, soil sampling activities were conducted at the Miscellaneous Rubble Pile #2 Section 3.5.2, Map 12. All composite soil samples were analyzed for inorganics on the Target Analyte List (TAL) of metals and the Target Compound List (TCL) of semi-volatile organic compounds, volatile organic compounds and pesticides/polychlorinated biphenyls (PCB's). These are all considered protocol analyses for the SE program.
Section 3.5.2, Map 12 depicts the selected SE area location on the SRS. Guidance provided by the United States Environmental Protection Agency (USEPA 1992) was utilized by ESOP personnel for site inspections. No deviations from established DOE-SR sampling procedures

and protocols were observed. SCDHEC's ASD performed the TAL analyses for metals on the split soil samples.

The objective of the sampling activities at MSRP #2 was to evaluate any potential impact to soil due to DOE-SR activities. The samples were acquired at depths ranging from 0-1 foot and 1-4 feet via hand augering. The samples were mixed thoroughly in stainless steel bowls with a stainless steel spoon and subsequently placed in the appropriate labeled sample bottle. The samples were labeled with the following information: sample location, date, time, sampler, and analysis requested. The samples were immediately placed on ice in a cooler. Proper documentation was provided for each sample that included the chain-of-custody records, labeling, and QA/QC adherence.

ESOP personnel observed the sampling and split soil samples from various locations (Section 3.5.2, Map 13). These samples were identified with either a "01" or "02" suffix that denotes the depth. If the sample was obtained from a depth of 0-1 foot, the corresponding suffix was a "01." If the depth was 1-4 feet, the corresponding suffix was a "02."

Upon completion of ESOP's oversight activities, the acquired split samples were screened by SRS personnel for potential radiological contamination. No contamination was detected during this screening process. After notification from DOE-SR concerning the radiological screening results, ESOP personnel were permitted to obtain the split soil samples and transport them to Columbia, South Carolina for analysis. The SCDHEC Analytical Services Division (ASD) performed the Target Analyte List (TAL) analyses for metals and Target Compound List (TCL) analyses for volatile organic compounds on the split soil samples.

All data collected by DOE-SR and SCDHEC were in agreement, with the majority of the results being below laboratory detection limits. When metals were detected, the concentrations were below their respective PRGs. No significant discrepancies in data or methods were noted as a result of this effort.

Results and Discussion

Nonradiological Parameter Results

The sampling event conducted at MSRP #2 yielded detections for numerous analytes including aluminum, barium, beryllium, calcium, cadmium, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc. Although these analytes were detected, none of these concentrations exceeded the EPA established Preliminary Remediation Goals (PRGs). As a result, these concentrations are not considered to be known health risks to humans.

ESOP and DOE-SR Data Comparison

A review of DOE-SR analytical data indicated no exceedances of the EPA residential PRG for any of the split soil samples collected by SCDHEC. The following tables located in Section 3.5.3, present all of the analytical laboratory data for the split samples collected. All of the values presented are measured in milligrams per kilogram (mg/kg).

Statistical Summary

A statistical analysis was performed on the soil data collected from MSRP #2. Statistics were calculated for the mean, median, and standard deviation for various heavy metals. Overall, DOE-SR analytical averaged results were within two standard deviations (SD) of ESOP results. There were no gross discrepancies identified between DOE-SR and SCDHEC analytical laboratory data.

Conclusions and Recommendations

The project attempted to provide an independent source of information concerning results of monitoring, and evaluate sampling protocol through observation of sampling for adherence to established WSRC standard operating procedures and monitoring strategy. Statistical tests demonstrate the majority of DOE-SR analytical results were comparable with ESOP results. These results were found to be within two standard deviations.

QA/QC oversight objectives of DOE-SR contractor's pre-characterization sampling activities at this site were met and will continue at selected SE areas as needed. Continued oversight will provide assurance to the public that DOE-SR contractors' SE sampling activities adhere to prescribed procedures and independent sampling results are obtained.

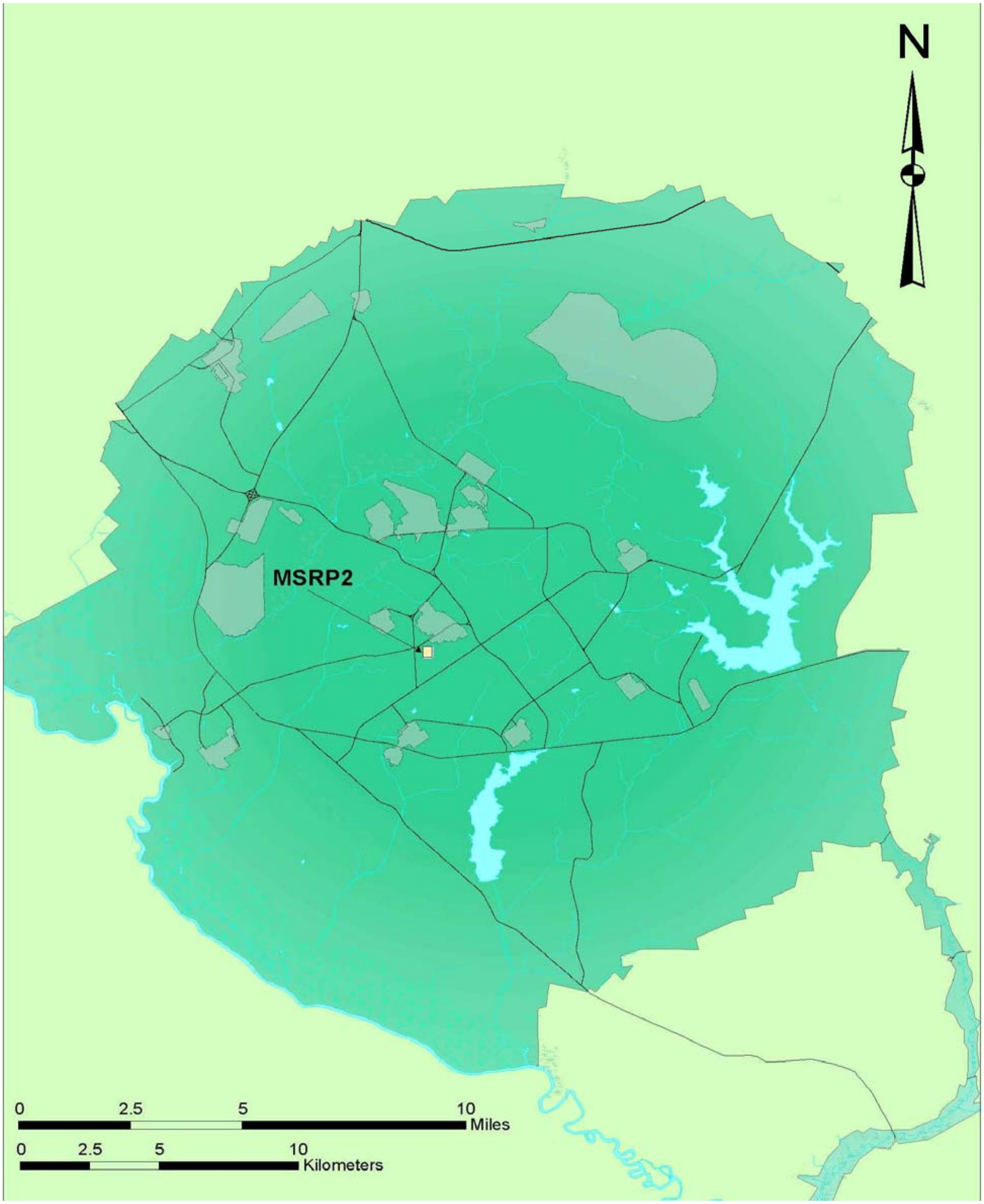
Several SCDHEC sample analytes were identified as non-detections. Some of these samples include beryllium, lead and manganese. However, these corresponding analytes were detected by the SRS laboratory. During future sampling events, soil samples may be sent to a contract lab when reduced detection limits are required.

In conclusion, all data collected by DOE-SR and SCDHEC were in agreement, with the majority of the results being below laboratory detection limits. When metals were detected, the concentrations were below their respective PRGs. No significant discrepancies in data or methods were noted as a result of this effort.

TOC

3.5.2 Map

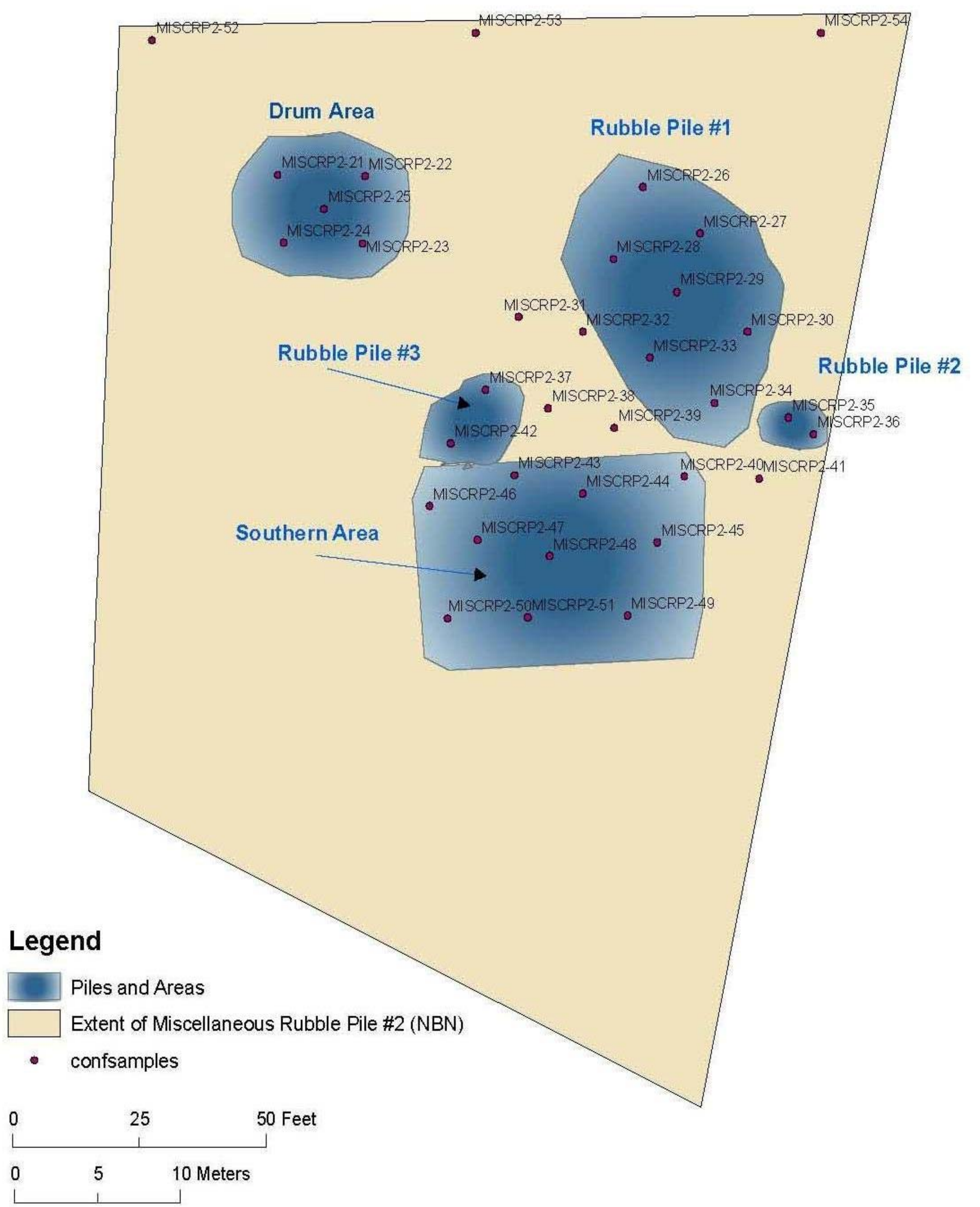
Map 12. MSRP #2 location on the Savannah River Site



Source: WSRC Sampling and Analysis Plan for MSRP #2 (SGCP-SAP-2008-00003)

TOC

Map 13. Sample Locations at MSRP #2 (SGCP-SAP-2008-00003)



Source: WSRC Sampling and Analysis Plan for MSRP #2 (SGCP-SAP-2008-00003)

TOC

3.5.3 Data

2008 Environmental Soil Sampling Performed at SRS Miscellaneous Rubble Pile #2

Notes: 1. mg/kg = milligrams per kilogram
2. MISCRP = Sample Identifier

TOC

FFA Data

2008 Nonradiological Data

Location Description	MISCRP2-27-01	MISCRP2-27-02	MISCRP2-30-01	MISCRP2-30-02	MISCRP2-31-01	MISCRP2-31-02
Collection Date	7/8/2008	7/8/2008	7/8/2008	7/8/2008	7/8/2008	7/8/2008
Time Collected	10:10	10:18	13:00	13:10	13:25	13:40
Analysis						
Silver in Sediment	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Aluminum in Sediment	9300.00	20000.00	14000.00	17000.00	7500.00	17000.00
Barium in Sediment	36.00	21.00	44.00	19.00	27.00	24.00
Beryllium in Sediment	<0.30	<0.30	<0.30	0.34	<0.30	0.39
Calcium in Sediment	410.00	630.00	370.00	290.00	310.00	340.00
Cadmium in Sediment	1.20	4.60	1.80	4.80	<1.0	5.40
Chromium in Sediment	7.80	22.00	10.00	21.00	7.20	21.00
Cobalt in Sediment	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Copper in Sediment	2.20	4.40	3.40	3.80	2.10	3.20
Iron in Sediment	5200.00	19000.00	7600.00	26000.00	4600.00	28000.00
Potassium in Sediment	180.00	240.00	290.00	230.00	160.00	220.00
Magnesium in Sediment	180.00	250.00	260.00	230.00	190.00	220.00
Manganese in Sediment	72.00	4.50	39.00	<1.0	76.00	2.30
Sodium in Sediment	15.00	21.00	20.00	20.00	<10	11.00
Nickel in Sediment	2.60	4.60	4.30	3.60	2.90	4.00
Lead in Sediment	<5.0	6.00	<5.0	6.80	<5.0	6.80
Antimony in Sediment	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thallium in Sediment	<50	<50	<50	<50	<50	<50
Vanadium in Sediment	13.00	47.00	20.00	60.00	12.00	57.00
Zinc in Sediment	7.80	8.50	10.00	6.90	5.20	6.30
Selenium in Sediment	<10	<10	<10	<10	<10	<10
Mercury in Sediment	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Arsenic in Sediment	<10	<10	<10	<10	<10	<10
N-nitrosodimethylamine	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Aniline	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Phenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bis(2-chloroethyl)ether	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-chlorophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
1,3-dichlorobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
1,4-dichlorobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzyl alcohol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
1,2-dichlorobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-methylphenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bis(2-chloroisopropyl)ether	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
4-methylphenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
N-nitrosodi-n-propylamine	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Hexachloroethane	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Nitrobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Isophorone	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-nitrophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,4-dimethyl phenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzoic acid	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bis(2-chloroethoxy)methane	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,4-dichlorophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
1,2,4-trichlorobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Naphthalene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
4-chloroaniline	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Hexachlorobutadiene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30

FFA Data

2008 Nonradiological Data

Location Description	MISCRP2-32-01	MISCRP2-32-02	MISCRP2-33-01	MISCRP2-33-02
Collection Date	7/8/2008	7/8/2008	7/8/2008	7/8/2008
Time Collected	14:00	14:15	14:30	14:40
Analysis				
Silver in Sediment	<3.0	<3.0	<3.0	<3.0
Aluminum in Sediment	9000.00	16000.00	5700.00	18000.00
Barium in Sediment	34.00	23.00	26.00	37.00
Beryllium in Sediment	<0.30	<0.30	<0.30	<0.30
Calcium in Sediment	250.00	230.00	280.00	540.00
Cadmium in Sediment	1.10	2.20	<1.0	2.80
Chromium in Sediment	7.20	14.00	5.00	17.00
Cobalt in Sediment	<2.0	<2.0	<2.0	<2.0
Copper in Sediment	2.20	4.00	1.40	4.60
Iron in Sediment	5600.00	12000.00	3600.00	15000.00
Potassium in Sediment	190.00	260.00	150.00	350.00
Magnesium in Sediment	190.00	280.00	120.00	270.00
Manganese in Sediment	53.00	6.80	72.00	15.00
Sodium in Sediment	<10	17.00	<10	16.00
Nickel in Sediment	3.10	5.00	2.20	5.70
Lead in Sediment	<5.0	5.90	<5.0	6.60
Antimony in Sediment	<5.0	<5.0	<5.0	<5.0
Thallium in Sediment	<50	<50	<50	<50
Vanadium in Sediment	13.00	30.00	8.80	37.00
Zinc in Sediment	5.80	8.10	3.30	9.20
Selenium in Sediment	<10	<10	<10	<10
Mercury in Sediment	<0.10	<0.10	<0.10	<0.10
Arsenic in Sediment	<10	<10	<10	<10
N-nitrosodimethylamine	<0.30	<0.30	<0.30	<0.30
Aniline	<0.30	<0.30	<0.30	<0.30
Phenol	<0.30	<0.30	<0.30	<0.30
Bis(2-chloroethyl)ether	<0.30	<0.30	<0.30	<0.30
2-chlorophenol	<0.30	<0.30	<0.30	<0.30
1,3-dichlorobenzene	<0.30	<0.30	<0.30	<0.30
1,4-dichlorobenzene	<0.30	<0.30	<0.30	<0.30
Benzyl alcohol	<0.30	<0.30	<0.30	<0.30
1,2-dichlorobenzene	<0.30	<0.30	<0.30	<0.30
2-methylphenol	<0.30	<0.30	<0.30	<0.30
Bis(2-chloroisopropyl)ether	<0.30	<0.30	<0.30	<0.30
4-methylphenol	<0.30	<0.30	<0.30	<0.30
N-nitrosodi-n-propylamine	<0.30	<0.30	<0.30	<0.30
Hexachloroethane	<0.30	<0.30	<0.30	<0.30
Nitrobenzene	<0.30	<0.30	<0.30	<0.30
Isophorone	<0.30	<0.30	<0.30	<0.30
2-nitrophenol	<0.30	<0.30	<0.30	<0.30
2,4-dimethyl phenol	<0.30	<0.30	<0.30	<0.30
Benzoic acid	<0.30	<0.30	<0.30	<0.30
Bis(2-chloroethoxy)methane	<0.30	<0.30	<0.30	<0.30
2,4-dichlorophenol	<0.30	<0.30	<0.30	<0.30
1,2,4-trichlorobenzene	<0.30	<0.30	<0.30	<0.30
Naphthalene	<0.30	<0.30	<0.30	<0.30
4-chloroaniline	<0.30	<0.30	<0.30	<0.30
Hexachlorobutadiene	<0.30	<0.30	<0.30	<0.30

FFA Data

2008 Nonradiological Data

Location Description	MISCRP2-27-01	MISCRP2-27-02	MISCRP2-30-01	MISCRP2-30-02	MISCRP2-31-01	MISCRP2-31-02
Collection Date	7/8/2008	7/8/2008	7/8/2008	7/8/2008	7/8/2008	7/8/2008
Time Collected	10:10	10:18	13:00	13:10	13:25	13:40
Analysis						
4-chloro-3 methyl phenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-methyl naphthalene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Hexachlorocyclopentadiene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,4,6-trichlorophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,4,5-trichlorophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-chloronaphthalene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-nitroaniline	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Dimethyl phthalate	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Acenaphthylene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,6-dinitrotoluene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
3-nitroaniline	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Acenaphthene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
4-nitrophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Dibenzofuran	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,4-dinitrotoluene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Diethyl phthalate	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
4-chlorophenyl phenyl ether	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Fluorene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
4-nitroaniline	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Azobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2-methyl-4,6-dinitrophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
N-nitrosodiphenylamine	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
4-bromophenyl phenyl ether	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Hexachlorobenzene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Pentachlorophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Phenanthrene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Anthracene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Di-n-butylphthalate	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Fluoranthene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Pyrene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Butylbenzyl phthalate	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
3,3'-dichlorobenzidine	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(a)anthracene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Chrysene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Bis(2-ethylhexyl)phthalate	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Di-n-octylphthalate	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(b)fluoranthene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(k)fluoranthene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(a)pyrene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Indeno(1,2,3-cd)pyrene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Dibenzo(a,h)anthracene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Benzo(ghi)perylene	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
2,4-Dinitrophenol	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Aldrin	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
alpha-BHC	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
beta-BHC	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
delta-BHC	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020

FFA Data

2008 Nonradiological Data

Location Description	MISCRP2-32-01	MISCRP2-32-02	MISCRP2-33-01	MISCRP2-33-02
Collection Date	7/8/2008	7/8/2008	7/8/2008	7/8/2008
Time Collected	14:00	14:15	14:30	14:40
Analysis				
4-chloro-3 methyl phenol	<0.30	<0.30	<0.30	<0.30
2-methyl naphthalene	<0.30	<0.30	<0.30	<0.30
Hexachlorocyclopentadiene	<0.30	<0.30	<0.30	<0.30
2,4,6-trichlorophenol	<0.30	<0.30	<0.30	<0.30
2,4,5-trichlorophenol	<0.30	<0.30	<0.30	<0.30
2-chloronaphthalene	<0.30	<0.30	<0.30	<0.30
2-nitroaniline	<0.30	<0.30	<0.30	<0.30
Dimethyl phthalate	<0.30	<0.30	<0.30	<0.30
Acenaphthylene	<0.30	<0.30	<0.30	<0.30
2,6-dinitrotoluene	<0.30	<0.30	<0.30	<0.30
3-nitroaniline	<0.30	<0.30	<0.30	<0.30
Acenaphthene	<0.30	<0.30	<0.30	<0.30
4-nitrophenol	<0.30	<0.30	<0.30	<0.30
Dibenzofuran	<0.30	<0.30	<0.30	<0.30
2,4-dinitrotoluene	<0.30	<0.30	<0.30	<0.30
Diethyl phthalate	<0.30	<0.30	<0.30	<0.30
4-chlorophenyl phenyl ether	<0.30	<0.30	<0.30	<0.30
Fluorene	<0.30	<0.30	<0.30	<0.30
4-nitroaniline	<0.30	<0.30	<0.30	<0.30
Azobenzene	<0.30	<0.30	<0.30	<0.30
2-methyl-4,6-dinitrophenol	<0.30	<0.30	<0.30	<0.30
N-nitrosodiphenylamine	<0.30	<0.30	<0.30	<0.30
4-bromophenyl phenyl ether	<0.30	<0.30	<0.30	<0.30
Hexachlorobenzene	<0.30	<0.30	<0.30	<0.30
Pentachlorophenol	<0.30	<0.30	<0.30	<0.30
Phenanthrene	<0.30	<0.30	<0.30	<0.30
Anthracene	<0.30	<0.30	<0.30	<0.30
Di-n-butylphthalate	<0.30	<0.30	<0.30	<0.30
Fluoranthene	<0.30	<0.30	<0.30	<0.30
Pyrene	<0.30	<0.30	<0.30	<0.30
Butylbenzyl phthalate	<0.30	<0.30	<0.30	<0.30
3,3'-dichlorobenzidine	<0.30	<0.30	<0.30	<0.30
Benzo(a)anthracene	<0.30	<0.30	<0.30	<0.30
Chrysene	<0.30	<0.30	<0.30	<0.30
Bis(2-ethylhexyl)phthalate	<0.30	<0.30	<0.30	<0.30
Di-n-octylphthalate	<0.30	<0.30	<0.30	<0.30
Benzo(b)fluoranthene	<0.30	<0.30	<0.30	<0.30
Benzo(k)fluoranthene	<0.30	<0.30	<0.30	<0.30
Benzo(a)pyrene	<0.30	<0.30	<0.30	<0.30
Indeno(1,2,3-cd)pyrene	<0.30	<0.30	<0.30	<0.30
Dibenzo(a,h)anthracene	<0.30	<0.30	<0.30	<0.30
Benzo(ghi)perylene	<0.30	<0.30	<0.30	<0.30
2,4-Dinitrophenol	<0.30	<0.30	<0.30	<0.30
Aldrin	<0.0020	<0.0020	<0.0020	<0.0020
alpha-BHC	<0.0020	<0.0020	<0.0020	<0.0020
beta-BHC	<0.0020	<0.0020	<0.0020	<0.0020
delta-BHC	<0.0020	<0.0020	<0.0020	<0.0020

FFA Data

2008 Nonradiological Data

Location Description	MISCRP2-27-01	MISCRP2-27-02	MISCRP2-30-01	MISCRP2-30-02	MISCRP2-31-01	MISCRP2-31-02
Collection Date	7/8/2008	7/8/2008	7/8/2008	7/8/2008	7/8/2008	7/8/2008
Time Collected	10:10	10:18	13:00	13:10	13:25	13:40
Analysis						
Lindane	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Chlordane	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
p,p'-DDD	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
p,p'-DDE	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
p,p'-DDT	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dieldrin	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Endosulfan I	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Endosulfan II	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Endosulfan Sulfate	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Endrin	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Endrin aldehyde	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Heptachlor	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Heptachlor epoxide	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Toxaphene	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070
PCB 1016	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
PCB 1221	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
PCB 1232	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
PCB 1242	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
PCB 1248	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
PCB 1254	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
PCB 1260	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Acetone	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloromethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Vinyl chloride	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Bromomethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chloroethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1-Dichloroethene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Carbon Disulfide	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dichloromethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
trans-1,2-Dichloroethene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1-Dichloroethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
2-Butanone	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cis-1,2-Dichloroethylene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chloroform	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1,1-Trichloroethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Carbon tetrachloride	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Benzene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,2-Dichloroethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Trichloroethene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,2-Dichloropropane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Bromodichloromethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
2-Hexanone	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
cis-1,3-Dichloropropene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Toluene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
trans-1,3-Dichloropropene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1,2-Trichloroethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
4-Methyl-2-Pentanone	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Tetrachloroethene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Dibromochloromethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chlorobenzene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Ethyl benzene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
m,p-Xylenes	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
o-Xylene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Styrene	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Bromoform	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
1,1,2,2-Tetrachloroethane	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020

FFA Data

2008 Nonradiological Data

Location Description	MISCRP2-32-01	MISCRP2-32-02	MISCRP2-33-01	MISCRP2-33-02
Collection Date	7/8/2008	7/8/2008	7/8/2008	7/8/2008
Time Collected	14:00	14:15	14:30	14:40
Analysis				
Lindane	<0.0020	<0.0020	<0.0020	<0.0020
Chlordane	<0.015	<0.015	<0.015	<0.015
p,p'-DDD	<0.0020	<0.0020	<0.0020	<0.0020
p,p'-DDE	<0.0020	<0.0020	<0.0020	<0.0020
p,p'-DDT	<0.0020	<0.0020	<0.0020	<0.0020
Dieldrin	<0.0020	<0.0020	<0.0020	<0.0020
Endosulfan I	<0.0020	<0.0020	<0.0020	<0.0020
Endosulfan II	<0.0020	<0.0020	<0.0020	<0.0020
Endosulfan Sulfate	<0.0020	<0.0020	<0.0020	<0.0020
Endrin	<0.0020	<0.0020	<0.0020	<0.0020
Endrin aldehyde	<0.0020	<0.0020	<0.0020	<0.0020
Heptachlor	<0.0020	<0.0020	<0.0020	<0.0020
Heptachlor epoxide	<0.0020	<0.0020	<0.0020	<0.0020
Toxaphene	<0.070	<0.070	<0.070	<0.070
PCB 1016	<0.015	<0.015	<0.015	<0.015
PCB 1221	<0.030	<0.030	<0.030	<0.030
PCB 1232	<0.015	<0.015	<0.015	<0.015
PCB 1242	<0.015	<0.015	<0.015	<0.015
PCB 1248	<0.015	<0.015	<0.015	<0.015
PCB 1254	<0.015	<0.015	<0.015	<0.015
PCB 1260	<0.015	<0.015	<0.015	<0.015
Acetone	<0.050	<0.050	<0.050	<0.050
Chloromethane	<0.020	<0.020	<0.020	<0.020
Vinyl chloride	<0.020	<0.020	<0.020	<0.020
Bromomethane	<0.020	<0.020	<0.020	<0.020
Chloroethane	<0.020	<0.020	<0.020	<0.020
1,1-Dichloroethene	<0.020	<0.020	<0.020	<0.020
Carbon Disulfide	<0.020	<0.020	<0.020	<0.020
Dichloromethane	<0.020	<0.020	<0.020	<0.020
trans-1,2-Dichloroethene	<0.020	<0.020	<0.020	<0.020
1,1-Dichloroethane	<0.020	<0.020	<0.020	<0.020
2-Butanone	<0.020	<0.020	<0.020	<0.020
cis-1,2-Dichloroethylene	<0.020	<0.020	<0.020	<0.020
Chloroform	<0.020	<0.020	<0.020	<0.020
1,1,1-Trichloroethane	<0.020	<0.020	<0.020	<0.020
Carbon tetrachloride	<0.020	<0.020	<0.020	<0.020
Benzene	<0.020	<0.020	<0.020	<0.020
1,2-Dichloroethane	<0.020	<0.020	<0.020	<0.020
Trichloroethene	<0.020	<0.020	<0.020	<0.020
1,2-Dichloropropane	<0.020	<0.020	<0.020	<0.020
Bromodichloromethane	<0.020	<0.020	<0.020	<0.020
2-Hexanone	<0.020	<0.020	<0.020	<0.020
cis-1,3-Dichloropropene	<0.020	<0.020	<0.020	<0.020
Toluene	<0.020	<0.020	<0.020	<0.020
trans-1,3-Dichloropropene	<0.020	<0.020	<0.020	<0.020
1,1,2-Trichloroethane	<0.020	<0.020	<0.020	<0.020
4-Methyl-2-Pentanone	<0.020	<0.020	<0.020	<0.020
Tetrachloroethene	<0.020	<0.020	<0.020	<0.020
Dibromochloromethane	<0.020	<0.020	<0.020	<0.020
Chlorobenzene	<0.020	<0.020	<0.020	<0.020
Ethyl benzene	<0.020	<0.020	<0.020	<0.020
m,p-Xylenes	<0.040	<0.040	<0.040	<0.040
o-Xylene	<0.020	<0.020	<0.020	<0.020
Styrene	<0.020	<0.020	<0.020	<0.020
Bromoform	<0.020	<0.020	<0.020	<0.020
1,1,2,2-Tetrachloroethane	<0.020	<0.020	<0.020	<0.020

TOC

3.5.4 Summary Statistics

2008 Environmental Soil Sampling Performed at SRS Miscellaneous Rubble Pile #2

Notes: 1. Shaded Box = Non Detection
2. mg/kg = milligrams per kilogram

Summary Statistics

2008 Nonradiological Statistics

SCDHEC

Analyte (mg/kg)	MISCRP2-27-01	MISCRP2-27-02	MISCRP2-30-01	MISCRP2-30-02	MISCRP2-31-01	MISCRP2-31-02	MISCRP2-32-01	MISCRP2-32-02	MISCRP2-33-01	MISCRP2-33-02	Mean	Standard Dev.	Median
Aluminum	9300.00	20000.00	14000.00	17000.00	7500.00	17000.00	9000.00	16000.00	5700.00	18000.00	13350.0	5033	15000.0
Barium	36.00	21.00	44.00	19.00	27.00	24.00	34.00	23.00	26.00	37.00	29.1	8	26.5
Beryllium				0.34		0.39					0.4	0	0.4
Calcium	410.00	630.00	370.00	290.00	310.00	340.00	250.00	230.00	280.00	540.00	365.0	129.5	325.0
Cadmium	1.20	4.60	1.80	4.80		5.40	1.10	2.20		2.80	3.0	1.7	2.5
Chromium	7.80	22.00	10.00	21.00	7.20	21.00	7.20	14.00	5.00	17.00	13.2	6.6	12.0
Copper	2.20	4.40	3.40	3.80	2.10	3.20	2.20	4.00	1.40	4.60	3.1	1.1	3.3
Iron	5200.00	19000.00	7600.00	26000.00	4600.00	28000.00	5600.00	12000.00	3600.00	15000.00	12660.0	9052.5	9800.0
Lead		6.00		6.80		6.80		5.90		6.60	6.4	0.4	6.6
Magnesium	180.00	250.00	260.00	230.00	190.00	220.00	190.00	280.00	120.00	270.00	219.0	49.5	225.0
Manganese	72.00	4.50	39.00		76.00	2.30	53.00	6.80	72.00	15.00	37.8	31.4	39.0
Nickel	2.60	4.60	4.30	3.60	2.90	4.00	3.10	5.00	2.20	5.70	3.8	1.1	3.8
Potassium	180.00	240.00	290.00	230.00	160.00	220.00	190.00	260.00	150.00	350.00	227.0	61.8	225.0
Sodium	15.00	21.00	20.00	20.00		11.00		17.00		16.00	17.1	3.5	17.0
Vanadium	13.00	47.00	20.00	60.00	12.00	57.00	13.00	30.00	8.80	37.00	29.8	19.5	25.0
Zinc	7.80	8.50	10.00	6.90	5.20	6.30	5.80	8.10	3.30	9.20	7.1	2.0	7.4

WSRC

Analyte (mg/kg)	MISCRP2-27-01	MISCRP2-27-02	MISCRP2-30-01	MISCRP2-30-02	MISCRP2-31-01	MISCRP2-31-02	MISCRP2-32-01	MISCRP2-32-02	MISCRP2-33-01	MISCRP2-33-02	Mean	Standard Dev.	Median
Aluminum	5990.00	11400.00	9130.00	11800.00	5930.00	11500.00	10000.00	9460.00	4590.00	11900.00	9170.0	2731	9730.0
Barium	34.50	22.20	48.40	15.50	29.40	28.60	20.30	46.00	28.80	38.80	31.3	11	29.1
Beryllium	0.21	0.25	0.30	0.20	0.22	0.24	0.16	0.37	0.20	0.25	0.2	0.1	0.2
Calcium	469.00	603.00	407.00	326.00	284.00	385.00	377.00	323.00	375.00	611.00	416.0	112.7	381.0
Cadmium	0.15	0.95	0.20	0.86	0.12	0.30	0.33	0.22	0.51	0.41	0.4	0.3	0.3
Chromium	5.93	97.20	9.24	46.80	6.15	12.70	39.80	13.90	4.17	13.90	25.0	29.3	13.3
Copper	1.89	3.41	2.83	4.33	2.21	3.26	2.84	3.21	1.49	3.40	2.9	0.8	3.0
Iron	5340.00	33700.00	9230.00	30200.00	5460.00	12600.00	9840.00	14800.00	3930.00	14300.00	13940.0	10233.8	11220.0
Lead	5.35	11.20	6.14	6.27	5.91	5.93	7.08	5.35	4.28	5.40	6.3	1.9	5.9
Magnesium	101.00	137.00	122.00	146.00	116.00	175.00	159.00	170.00	74.10	118.00	131.8	31.8	129.5
Manganese	87.60	15.30	54.40	6.89	102.00	19.10	79.40	11.90	96.80	20.60	49.4	38.8	37.5
Nickel	1.55	1.98	2.36	1.50	1.56	2.35	2.46	1.98	1.30	2.37	1.9	0.4	2.0
Potassium	83.30	57.60	145.00	51.60	73.90	82.10	113.00	86.90	95.80	152.00	94.1	33.6	85.1
Sodium	7.46	12.40	13.50	16.80	6.70	8.82	8.44	10.20	6.29	9.77	10.0	3.3	9.3
Vanadium	12.80	98.90	22.50	83.10	13.30	30.40	24.50	37.20	9.64	34.90	36.7	30.3	27.5
Zinc	2.55	0.67	3.21	0.66	3.04	2.73	3.42	1.94	2.07	2.64	2.3	1.0	2.6

TOC

4.1 Radiological Fish Monitoring

4.1.1 Summary

The Department of Energy-Savannah River (DOE-SR) has historically monitored the uptake of radionuclides in fish. However, DOE-SR reported results were not routinely evaluated by an independent monitoring source. Because of the size, scope and complexity of the activities at the Savannah River Site (SRS), the Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) was tasked with providing a non-regulatory independent monitoring and surveillance program at the SRS.

Radiocesium, released from 1954-1975, has been reported by DOE-SR as one of the most significant radionuclides related to human exposure (WSRC 1997). At SRS, the majority of liquid releases of cesium-137 (Cs-137) were due to leaking fuel rods in the 1950s and 1960s. Fuel rods were stored in basins, and Cs-137 was released to SRS streams when the basins were purged. In the early 1970s, physical and administrative controls were implemented to control the releases of most fission and activation products. During subsequent years, tritium, which cannot be filtered from effluent streams, became more significant than cesium (WSRC 1999a).

ESOP conducts fish monitoring for radionuclide activity in an effort to determine the magnitude, extent, and trends of radionuclide levels. Largemouth bass (*Micropterus salmoides)* and catfish (*Ameiurus catus* or *Ictalurus punctatus*) were collected from ten sample locations. Studies have shown that these species bioaccumulate measurable amounts of radionuclides (Cummins 1994; USEPA 2000b). Chain pickerel (*Esox niger*) were also collected as part of an ongoing effort to sample an additional species each study year. Red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), and striped mullet (*Mugil cephalus*) were collected near Savannah, Georgia. Stations sampled in 2008 are shown in Section 4.1.2, Map 14.

Fish were collected using boat-mounted electrofishing equipment. Samples were collected at five stations where creeks from the SRS meet the Savannah River (SV-2011, SV-2013, SV-2015, SV-2017, SV-2020). Samples were also collected from an upstream tributary of the river as a background location (SV-2059), one Savannah River station upstream of the SRS (SV-2028), and four stations downstream of the SRS (SV-118, SV-355, SV-2090, and SV-2091). All these locations are accessible to the public. Typically, five fish of each species were collected at each sample location. Each species was separated into edible and non-edible portions, and the portions were combined into homogeneous composites. Edible composites were analyzed for gamma-emitting isotopes and tritium. Non-edible composites were analyzed for gamma-emitters and strontium.

Three locations did not produce samples with detectable tritium activity in 2008: the background site, the location upstream of SRS near Augusta, Georgia, and Beaver Dam Creek. All other locations adjacent to and downstream of SRS exhibited detectable tritium activity. Five locations did not exhibit Cs-137 activity: the background, upstream, and saltwater locations, Beaver Dam Creek, and Stokes Bluff downstream of SRS. Activities of strontium-89, 90 (Sr-89, 90) were reported from all locations.

The DOE-SR also conducts fish monitoring to assess the environmental effects of current and historical releases of radionuclides. SCDHEC data were compared to DOE-SR reported results. Dissimilarities in these results could be attributed to the natural variation of radionuclide levels. Although there are differences between reported values, the data is consistent with historically reported data. In the past, samples have been collected and split between SCDHEC and DOE-SR for analyses, and no great variations in the data results were found. This would potentially rule out methodology differences and substantiate that differences result from the variability in samples analyzed by the two programs.

Independent monitoring of radionuclide levels in Savannah River fish will continue along with evaluating the DOE-SR Radiological Fish Monitoring Program. The information provided will assist in advising, informing, and protecting the people at risk, and in comparing current and historical data.

Results and Discussion

The following radionuclides were not detected above the minimum detectable activity (MDA) in 2008: beryllium-7 (Be-7), sodium-22 (Na-22), manganese-54 (Mn-54), cobalt-58 (Co-58), cobalt-60 (Co-60), zinc-65 (Zn-65), yttrium-88 (Y-88), zirconium-95 (Zr-95), ruthenium-103 (Ru-103), antimony-125 (Sb-125), iodine-131 (I-131), cesium-134 (Cs-134), cerium-144 (Ce-144), europium-152 (Eu-152), europium-154 (Eu-154), europium-155 (Eu-155), radium-226 (Ra-226), actinium-228 (Ac-228), uranium/thorium-238 (U/Th-238), and americium-241 (Am-241).

Fish collections were conducted from April 4 through November 25, 2008. Five largemouth bass were collected from all Savannah River locations and the Stevens Creek background site. Five channel catfish were collected at seven Savannah River locations; five white catfish were collected at two other river locations and a random location in Barnwell County. Although several attempts were made, no catfish were collected from Stevens Creek (SV-2059). Chain pickerel were collected at two Savannah River stations. Five red drum, five spotted seatrout, and five mullet were collected from the saltwater location.

A total of 119 fish was collected. Forty-seven composites and five individual fish samples were processed. The SCDHEC Region 5 tritium laboratory analyzed aliquots from all edible samples except one chain pickerel, which did not produce enough tissue for multiple analyses. Edible and non-edible samples were sent to the SCDHEC Radiological Environmental Monitoring Division in Columbia, South Carolina, for radiological analysis of gamma-emitting radionuclides. Portions of some non-edible samples were sent to Eberline Services for strontium analysis. Graphic presentations of 2008 and 2004-2008 activity levels of tritium, cesium-137 (Cs-137), and strontium-89, 90 (Sr-89, 90) are reported in Section 4.1.3. Activity levels of radionuclides for all samples and SCDHEC historical data from 2004 – 2008 are reported in Section 4.1.4. Summary statistics are presented in Section 4.1.5. Tritium results represent the activity level in the water distilled from the fish tissue. Cesium and strontium results represent the activity level in the wet sample itself.

<u>Tritium Results</u>

Tritium is a naturally occurring radioisotope, although in very low concentrations (USEPA 2007a). Sources of man-made tritium include nuclear reactors and government weapons production plants. Tritium releases at SRS include both atmospheric and liquid contributions (SRNS 2009). Although the United States Environmental Protection Agency (USEPA) has not established a Maximum Contaminant Level (MCL) for tritium in solid media (e.g. fish, vegetation), the MCL for drinking water has been set at 20,000 picocuries per liter (pCi/L) (USEPA 2008e).

Activity levels of tritium were analyzed in 24 edible composites and three individual samples. Seven of the ten freshwater stations exhibited detectable tritium activity in 2008 (Section 4.1.3, Figure 1a); the saltwater sampling location (SV-2091) produced one detection, in mullet. The Stevens Creek background location, above a hydroelectric generating plant spillway that completely blocks movement of fish from the lower Savannah River, did not produce tritium activity. The uppermost Savannah River location near the New Savannah Bluff Lock and Dam (SV-2028) and the location near Beaver Dam Creek (SV-2013) also had no tritium activity. The only chain pickerel analyzed for tritium, a single large individual from the Upper Three Runs location (SV-2011), did not exhibit tritium activity. All stations downstream of Beaver Dam Creek exhibited tritium activity.

Six of nine bass samples from the Savannah River exhibited detectable tritium activity, with an average of 404 (± 280) pCi/L. The composite from the Steel Creek location (SV-2017) had the highest reported tritium activity, 954 pCi/L. Five of nine Savannah River catfish samples exhibited tritium activity, with an average of 362 (± 104) pCi/L. The highest tritium level observed in the catfish composites, 507 pCi/L, was from the Fourmile Branch location (SV-2015).

White catfish collected from Lake Brown in Barnwell (E2), a randomly selected location within 50 miles of SRS, produced no tritium activity, nor did the largemouth bass collected from this location in 2006. Two random background locations sampled in 2006, Lake Secession in Anderson County and the Broad River between Chester and Union Counties, did not exhibit tritium in either the bass or catfish samples.

Samples from downstream of SRS exhibited little tritium activity in 2008. 2008 data were generally similar to SCDHEC historically reported data (Section 4.1.3, Figures 1b and 1c; SCDHEC 2008e). Although results can be quite variable between years, tritium levels tend to be highest at locations adjacent to SRS (creek mouth stations) and decrease with distance downstream. Tritium has been detected upstream of SRS only occasionally, and at low levels.

Gamma Results

The naturally occurring isotope of potassium-40 (K-40) was detected from all stations where gamma samples were collected in 2008. The lead isotopes Pb-212 and Pb-214 were also detected, but not from all locations. Because these are naturally occurring isotopes, the results will not be discussed in this report but are presented in Section 4.1.4.

Cesium-137 is a man-made fission product, and was a constituent of air and water releases on SRS, mainly from F- and H-Areas. Liquid releases also occurred from the production reactors as a result of leaking fuel elements in the 1950s and 1960s, and reactor basin purges were discharged to SRS streams, including Fourmile Branch, Steel Creek, and Lower Three Runs (WSRC 1999a).

Activity levels of Cs-137 were analyzed in 47 edible and non-edible portions of bass, catfish, and pickerel composites, and five individual samples. The Stevens Creek background location, New Savannah Bluff Lock & Dam, Beaver Dam Creek, Stokes Bluff (SV-355), and the saltwater location did not exhibit Cs-137 activity in any sample (Section 4.1.3, Figures 2a and 3a).

Six of nine edible bass composites from Savannah River locations exhibited detectable levels of Cs-137, ranging from 0.047 to 0.700 picocuries per gram (pCi/g), with an average of 0.244 (± 0.266) pCi/g (Section 4.1.3, Figure 2a). The sample from the Steel Creek location had the highest reported activity level. Cesium-137 levels reported above the MDA were observed in edible bass composites from four of five creek mouth locations adjacent to SRS and two of three locations downstream of the SRS. Cesium-137 activity was detected in non-edible bass composites from three creek mouth locations and one downstream location

Four edible catfish composites exhibited detectable levels of Cs-137, ranging from 0.026 to 0.138 pCi/g, with an average of 0.057 (± 0.054) pCi/g (Section 4.1.3, Figure 3a). Two non-edible catfish composites produced detectable Cs-137 activity. The Upper Three Runs location exhibited the highest activity for both the edible and non-edible samples

One of two edible chain pickerel composites, from Fourmile Branch, exhibited detectable Cs-137 activity, 0.480 pCi/g (Section 4.1.3, Figure 2a). White catfish from the random location, Lake Brown in Barnwell, exhibited low levels of Cs-137 activity in both the edible and non-edible samples, 0.037 and 0.017 pCi/g respectively (Section 4.1.3, Figure 3a). The largemouth bass collected from this location in 2006 did not produce Cs-137 activity. The two random background locations sampled in 2006, Lake Secession and the Broad River, did not exhibit Cs-137 in either the bass or catfish samples

Consistent with historically reported SCDHEC data, higher levels of Cs-137 were reported from locations adjacent to the SRS, especially Fourmile Branch, Steel Creek, and Lower Three Runs (SV-2020) (Section 4.1.3, Figure 2b and 2c, 3b and 3c) (SCDHEC 2008e). Higher activity levels in samples from these locations are not unexpected based on historical releases to these streams and the Savannah River swamp, and the Cs-137 contamination still present.

Strontium Results

ESOP contracted with a private laboratory for Sr-89, 90 analysis of fish samples in 2008. Strontium-89 and -90 are present around the world as a result of fallout from past atmospheric nuclear weapons tests (MII 2008). Strontium-90 is the more important isotope in the environment, although Sr-89 can be found around reactors. Strontium-90 behaves like calcium in the body, and tends to deposit in bone and bone marrow. Internal exposure is linked to several forms of cancer (USEPA 2007a).

Portions of 23 non-edible composites were selected for Sr-89, 90 analysis in 2008. All locations produced detectable strontium activity, including the upstream background station (Section 4.1.3, Figure 4a). Sr-89, 90 levels reported are for wet results, from analysis of fresh fish tissue. Averages noted below are for Savannah River freshwater species only, excluding the Stevens Creek location.

Levels of Sr-89, 90 in bass ranged from 0.034 to 0.182 pCi/g, with an average of 0.065 (± 0.047) pCi/g. The sample from the Fourmile Branch location had the highest activity level. Strontium levels in catfish samples ranged from 0.023 to 0.055 pCi/g, with an average of 0.036 (± 0.009) pCi/g. The Beaver Dam Creek location exhibited the highest activity. For comparison, the USEPA has established an MCL of 8 pCi/L in public drinking water for Sr-90 (USEPA 2008e).

The catfish from Lake Brown were not analyzed for strontium in 2008. However, the largemouth bass collected from there in 2006, as well as the bass and catfish collected from the random background locations, all exhibited Sr-89, 90 activity.

Section 4.1.3, Figures 4b and 4c show historically reported SCDHEC data for Sr-89, 90 (SCDHEC 2008e). The data from 2005-2007 represents calculated wet results using a dry/wet conversion ratio from the actual dry analyses. The 2008 data were reported as wet results by the contract laboratory that year. Results from 2004 were excluded because no dry/wet conversions were available for that data. Results are highly variable, but Sr-89, 90 appears to be widespread.

Individual Fish Analyses

Larger, older fish may bioaccumulate more contaminants over time (USEPA 2000b). ESOP analyzed and compared data from two large fish versus the composites they were a part of in order to ascertain the impact a large fish might have on a composite sample. Edible and non-edible portions of one bass from the Upper Three Runs location and one catfish from the Steel Creek location were analyzed separately for tritium and gamma activity.

Tritium was not detected in either the individual or composite bass sample. Tritium detected in the individual catfish sample, 256 pCi/L, was nearly the same as the corresponding composite sample, 247 pCi/L. The gamma analyses of the individual bass did not produce Cs-137 activity, while the composite bass samples only produced one detection at a low level (0.047 pCi/g in the edible portion). The Cs-137 detected in the edible individual catfish sample, 0.026 pCi/g, was nearly the same as the corresponding composite sample, 0.032 pCi/g. Both non-edible catfish samples were non-detections. In these instances, the larger fish would not have increased the radionuclide activity in the composite sample.

SCDHEC and DOE-SR Data Comparison

SCDHEC bass and catfish data collected for this project in 2008 were compared to DOE-SR reported information (SRNS 2009). Data comparison summaries are located in Section 4.1.4. One difference between the two programs is that ESOP analyzes one composite type from each species for each location, whereas the DOE-SR program analyzes three composite types per location. Therefore, a single composite for an ESOP location was compared to the average of the three DOE-SR composites reported, although DOE-SR uses results below the Minimum Detectable Concentration (MDC) when calculating averages.

ESOP detected tritium in fish from seven of nine Savannah River freshwater locations, while DOE-SR detected tritium at four locations. ESOP largemouth bass samples from six locations and DOE-SR bass samples from four locations exhibited tritium activity. ESOP detected tritium in catfish samples from five sites, DOE-SR from only two. Cesium-137 was detected in fish from most locations by both programs in 2008, especially adjacent to SRS. Cesium-137 results for bass and catfish from ESOP and DOE-SR were less than 1.00 pCi/g. Strontium-89, 90 was detected at all locations by both programs, although all values were less than 1.00 pCi/g. (SRNS 2009).

Average results of tritium, Cs-137, and Sr-89, 90 analyses were used for direct comparisons of data between the two programs. Averages were calculated using only detections, including from separate DOE-SR composite analyses. For tritium in bass, DOE-SR results were within one standard deviation of the ESOP results. For tritium in catfish, DOE-SR results were within three standard deviations of ESOP results. For all Cs-137 and Sr-89, 90 bass samples, and Cs-137 catfish samples, DOE-SR results were within one standard deviation of the ESOP results. DOE-SR and ESOP results for catfish were five standard deviations apart for Sr-89, 90, but the detections were at very low levels, averaging 0.09 pCi/g for DOE-SR and 0.04 pCi/g for ESOP.

Conclusions and Recommendations

A review of SCDHEC data indicates that DOE-SR operations have impacted fish. Higher levels of radionuclides are found in Savannah River fish collected adjacent to and downstream of SRS compared to upstream. Previous studies have shown that tritium and cesium in the SRS environment from historical and continuing releases can be manifested in the SRS biota (Cummins 1994; WSRC 1997). Fish from background locations tend not to exhibit detectable levels of man-made radionuclides, except for Sr-89, 90, which is present worldwide from past nuclear weapons testing (USEPA 2007a).

The project attempted to determine if activity levels in larger fish might impact a composite of relatively smaller fish. Separate portions of one bass and one catfish, considerably larger than the other fish sampled, were analyzed and compared to the respective composites. Results of the tritium and gamma analyses of the bass indicated that the larger fish did not make a significant contribution to the composite sample. Collections of larger fish will continue in 2009 to provide additional data for assessment.

SCDHEC project data was compared to DOE-SR reported information (SRNS 2009). Based on standard deviations, tritium, Cs-137, and Sr-89, 90 data were generally similar. Differences in results could be due to the natural variation of radionuclide levels in individual fish. Both programs detected Sr-89, 90 at all locations.

Independent monitoring of radionuclide levels in Savannah River fish will continue along with evaluating the DOE-SR Radiological Fish Monitoring Program. Continued monitoring will provide a better understanding of actual radionuclide levels, their extent, and trends. Several important benefits can be realized as a result. Foremost is the ability for the SCDHEC Bureau of Water and the Division of Health Hazard Evaluation to further evaluate the potential human health risk associated with consumption of Savannah River fish. SCDHEC will be able to better advise, inform, and protect those people at risk. Although Cs-137 and Sr-89, 90 are found in some Savannah River fish, the levels are low and have decreased over time. If the public follows the SCDHEC mercury advisories for consumption of fish from the river, the health risk from these radioactive elements is very low (SCDHEC 2009). Another benefit will be the ability to compare this data with historical data. Data comparison will also be part of the further evaluation of the DOE-SR program. This independent evaluation will provide credibility and confidence in the DOE-SR data and its uses.

Future analyses of the target species may include mercury and selected metals analyses. This will augment the existing data on Savannah River fish, provide information for human health assessment, and provide another basis for comparison of results with DOE-SR data on these non-radiological constituents.

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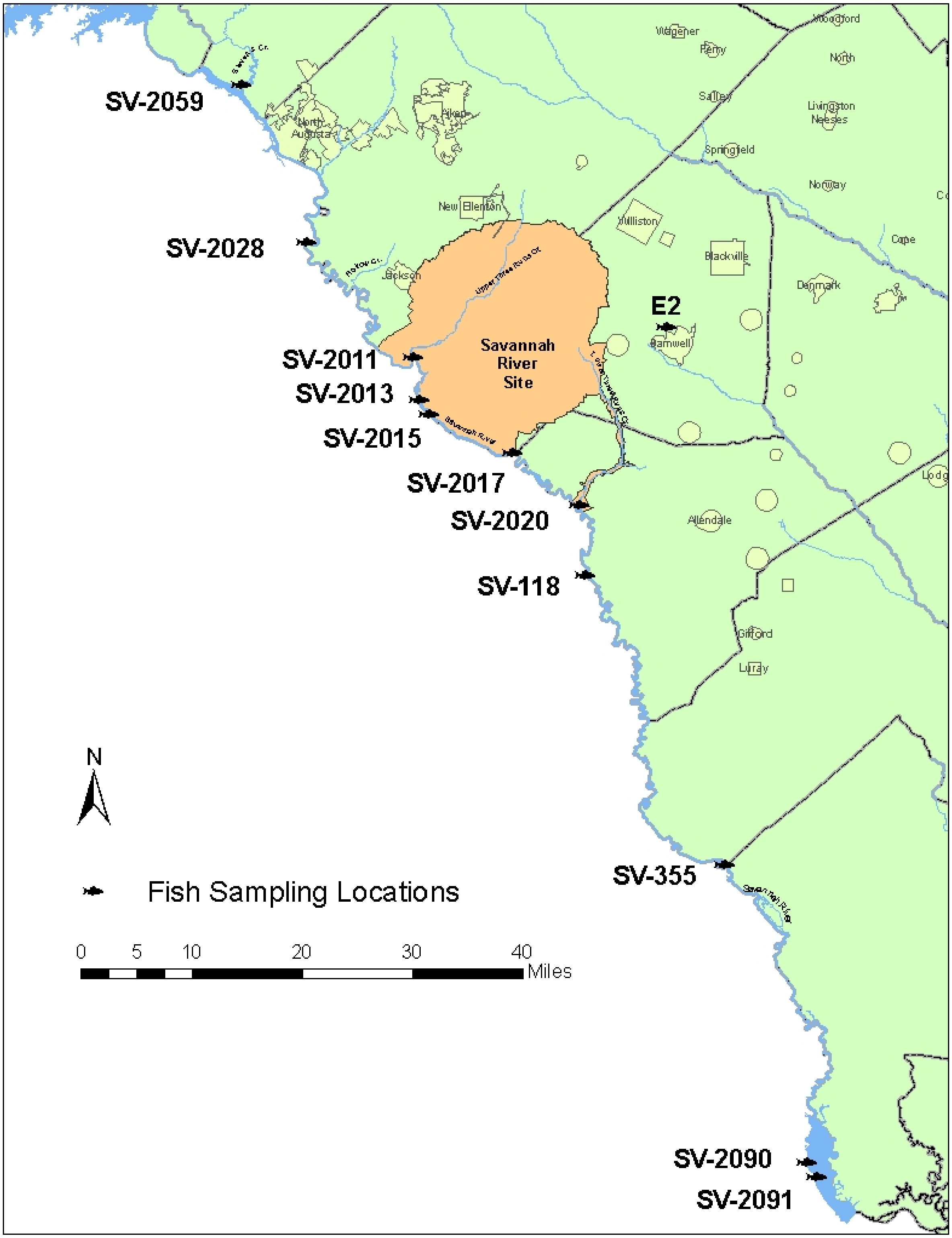
4.1.2
Map 14. Radiological Fish Monitoring Sampling Locations



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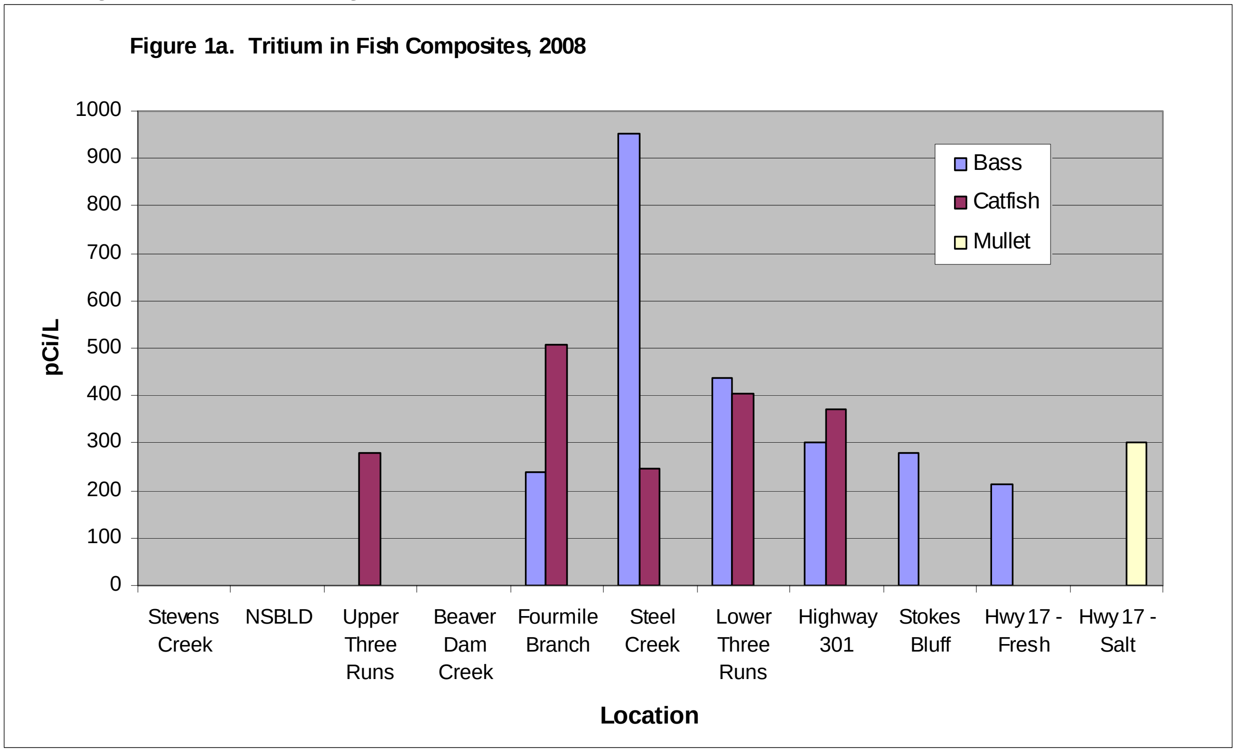
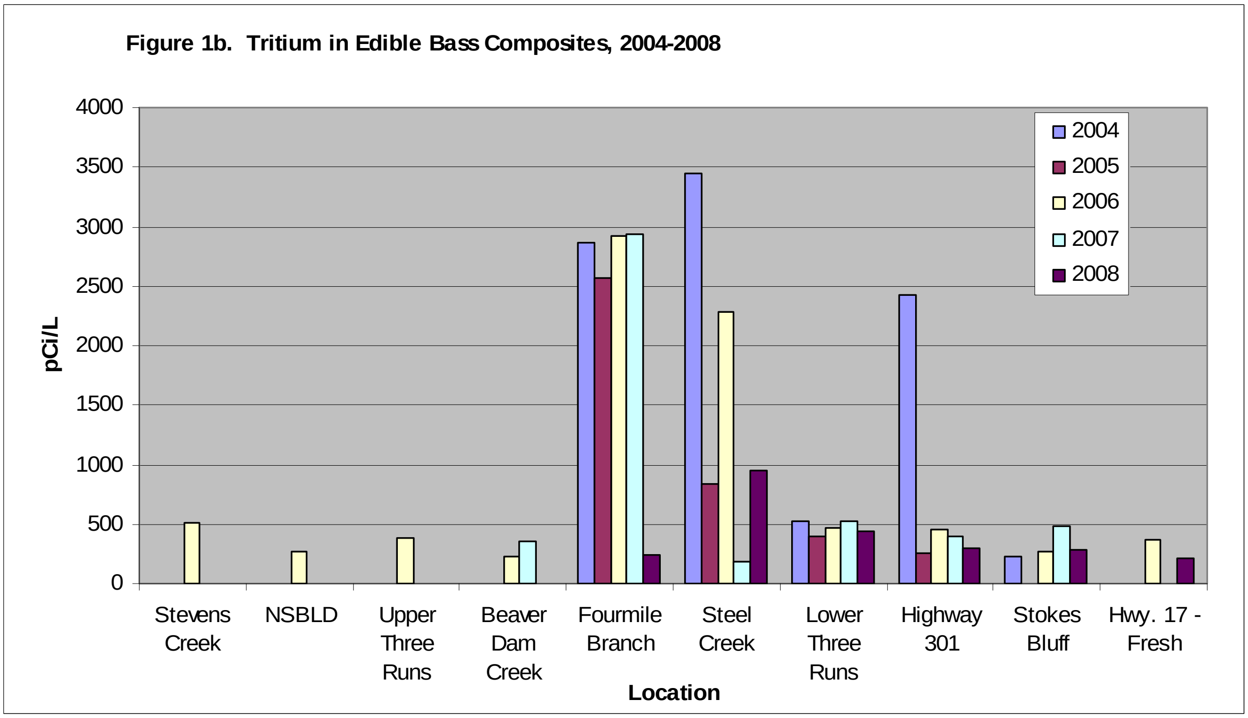
4.1.3 Tables and Figures

Radiological Fish Monitoring



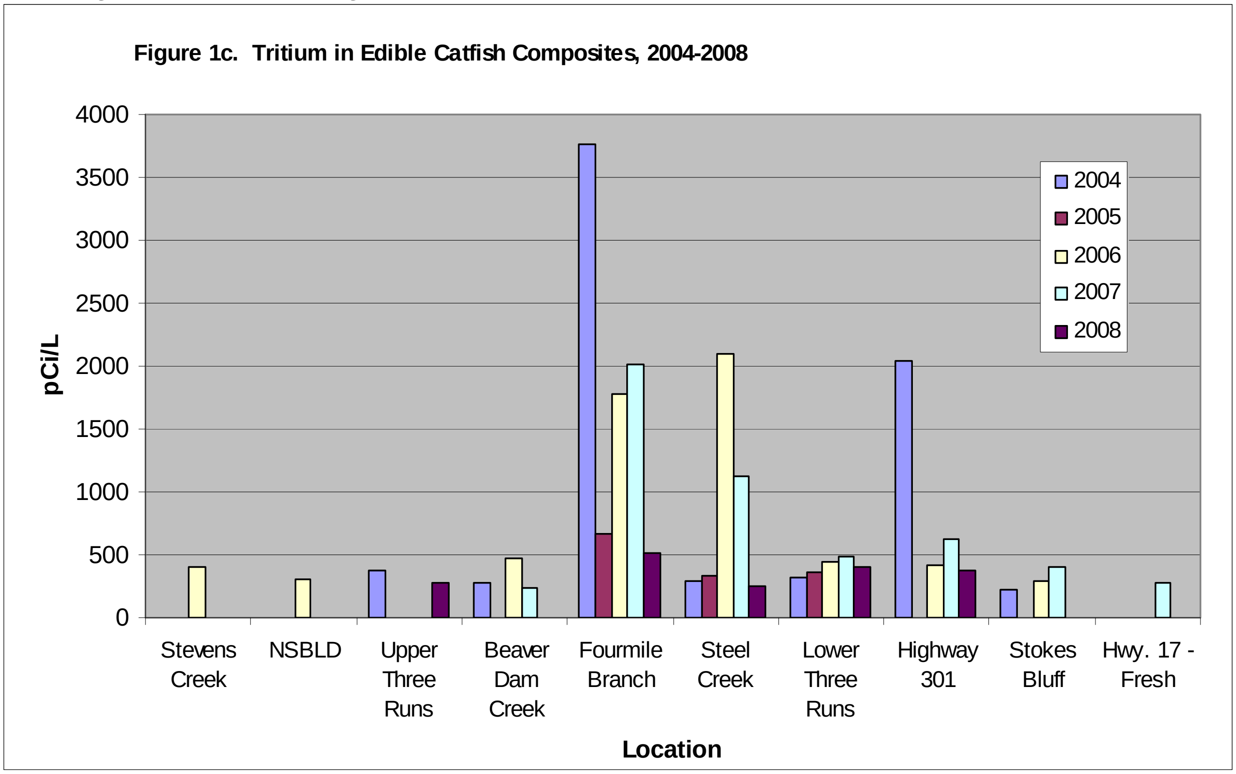
Note: Catfish not collected from Stevens Creek
No tritium activity in pickerel, red drum, or sea trout samples



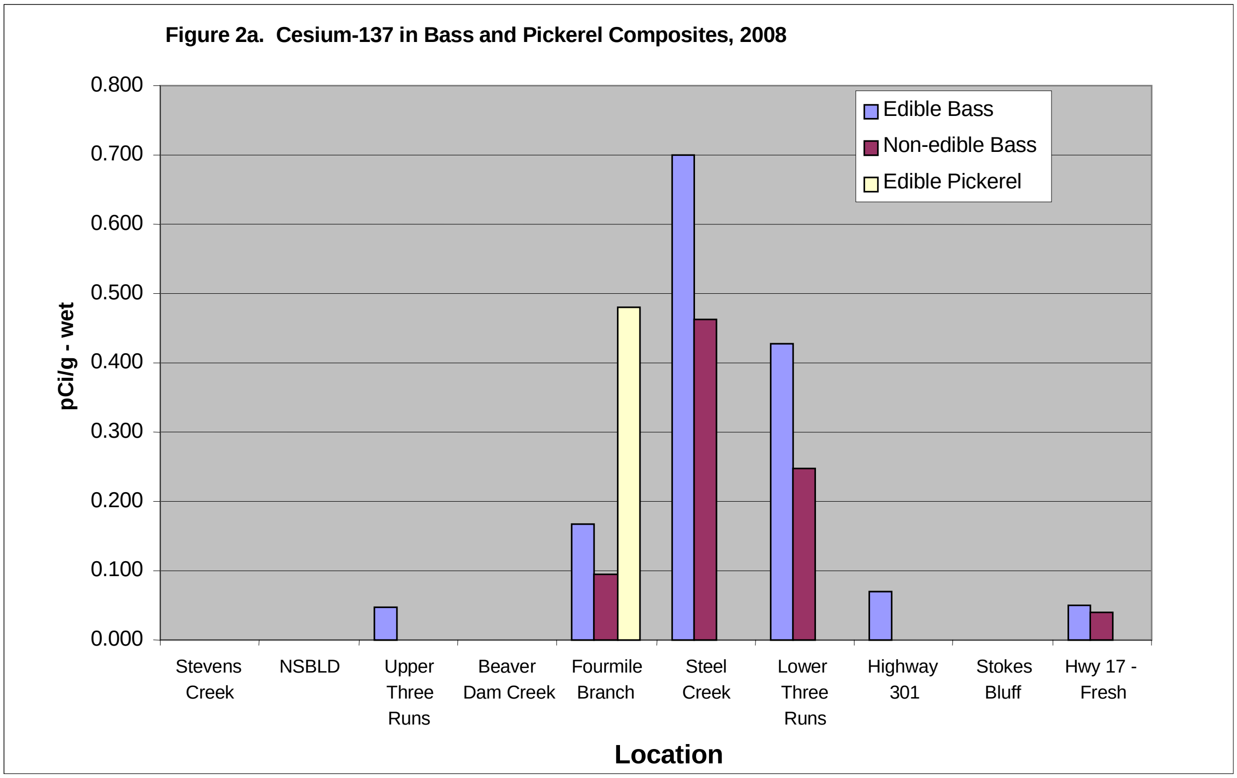
Note: Sampling at the Hwy. 17 location started in 2006

Tables and Figures

Radiological Fish Monitoring



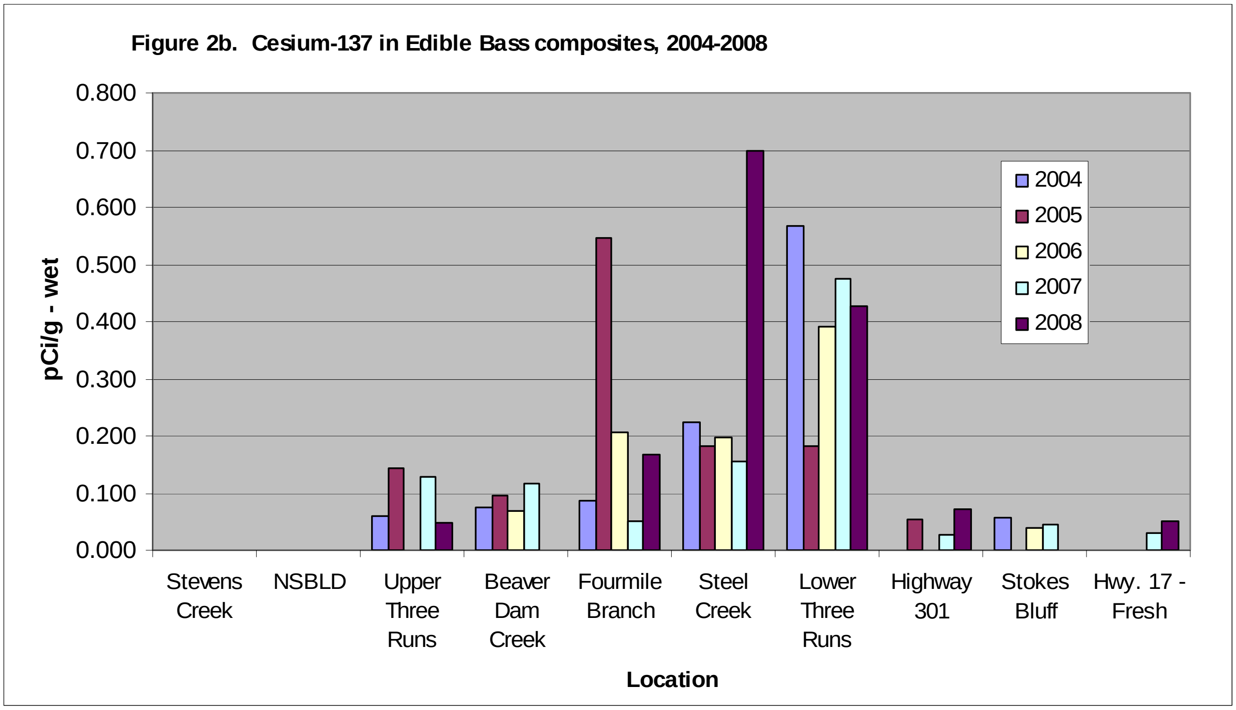
Note: Sampling at the Hwy. 17 location started in 2006



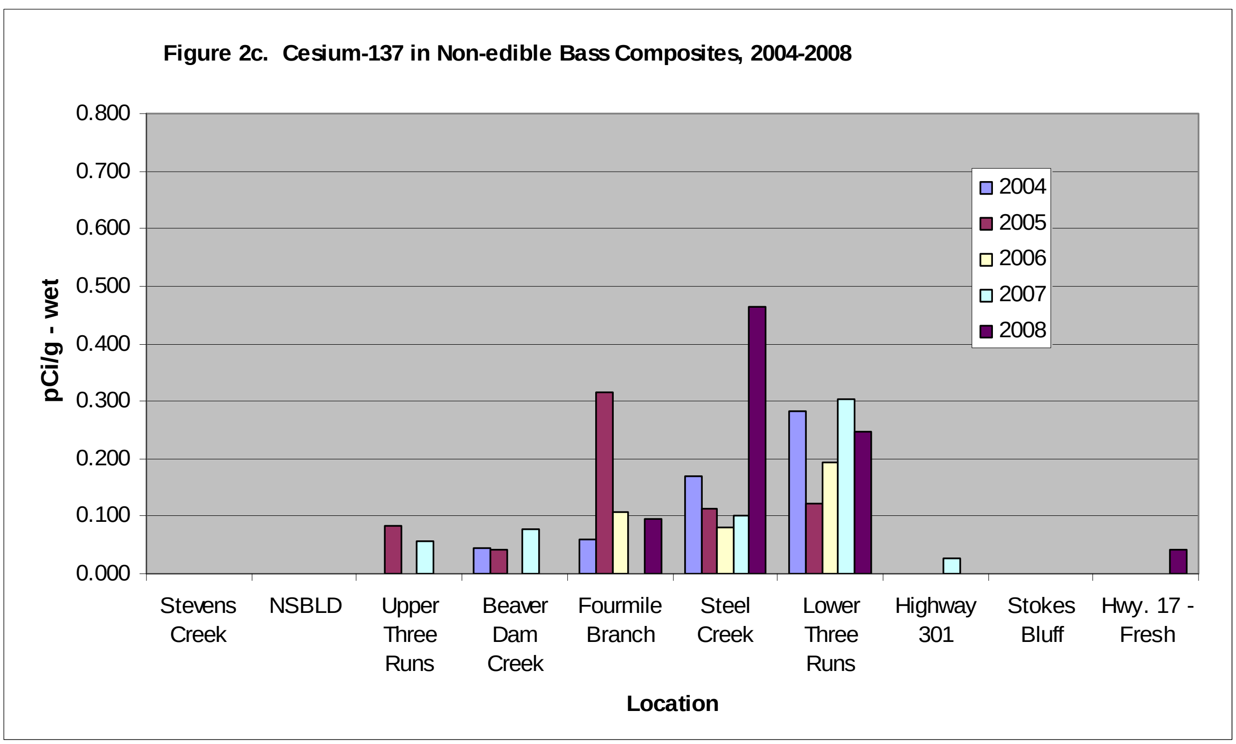
Note: Pickerel collected only at Upper Three Runs and Fourmile Branch
Cs-137 activity not detected in non-edible pickerel

Tables and Figures

Radiological Fish Monitoring



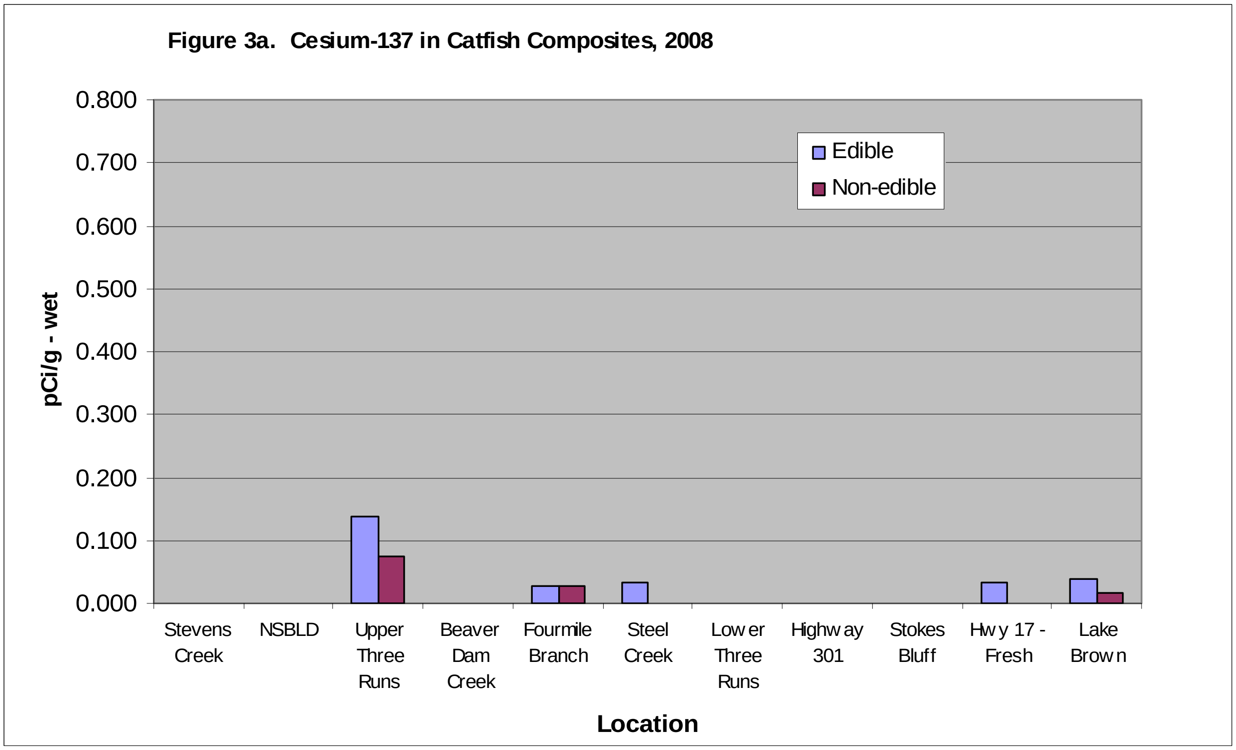
Note: Sampling at the Hwy. 17 location started in 2006



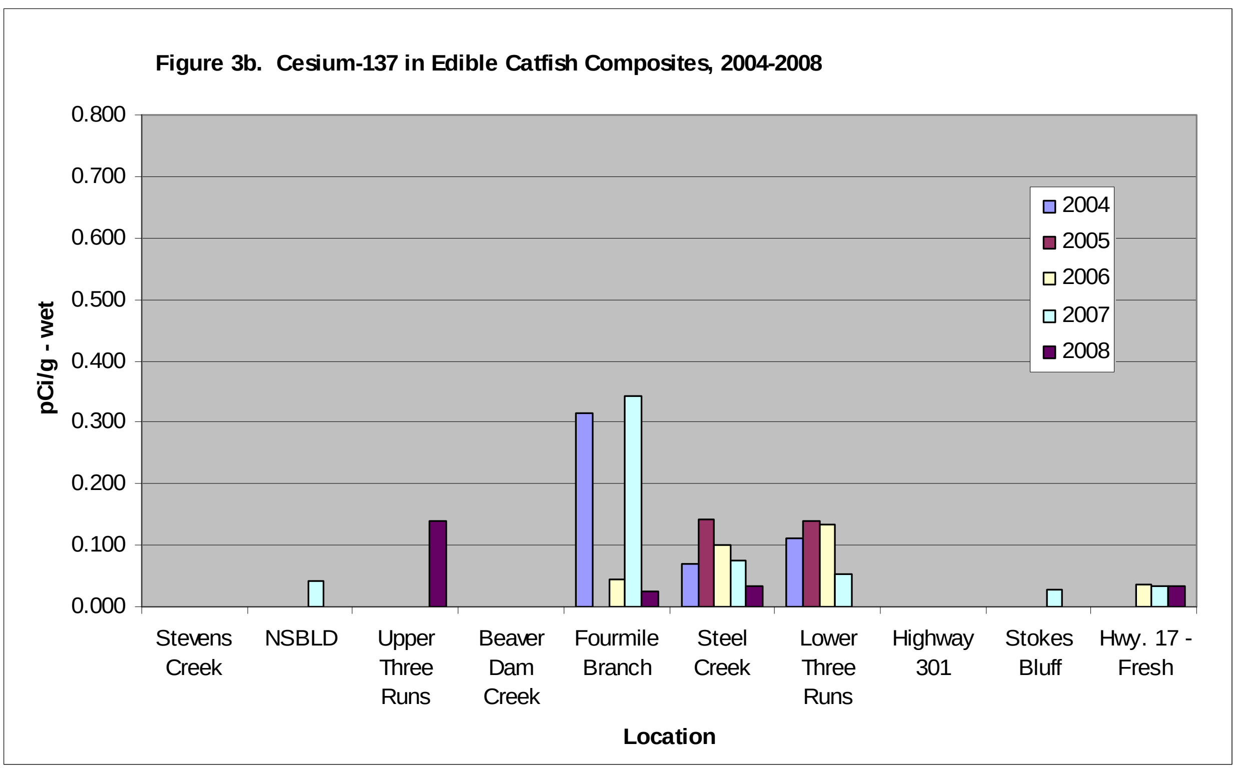
Note: Sampling at the Hwy. 17 location started in 2006

Tables and Figures

Radiological Fish Monitoring



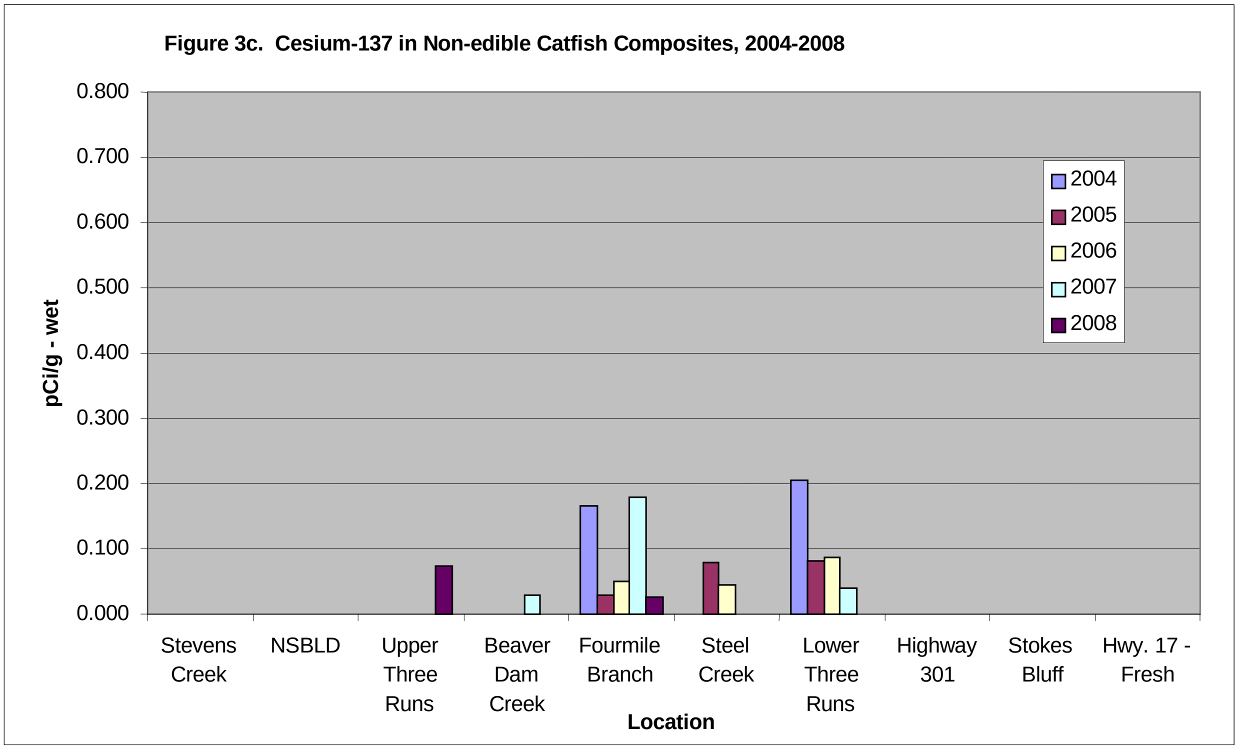
Note: No catfish collected from Stevens Creek



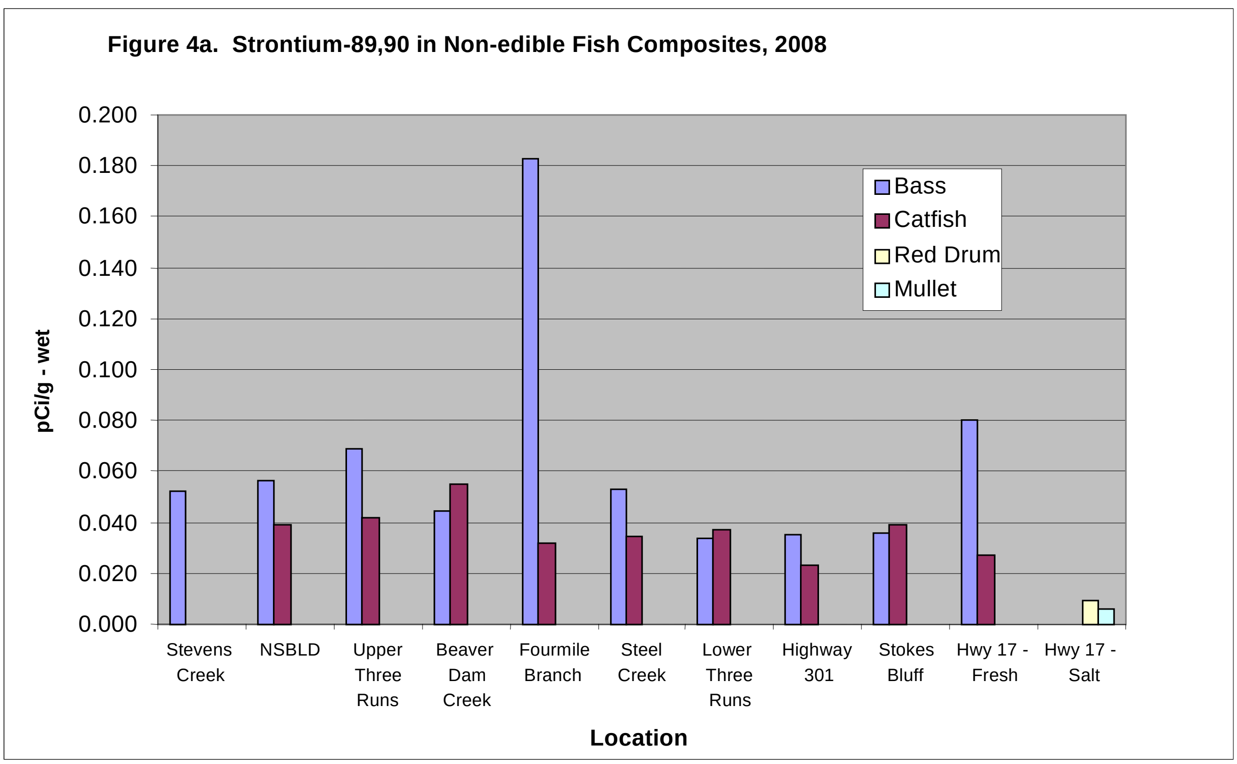
Note: Sampling at the Hwy. 17 location started in 2006

Tables and Figures

Radiological Fish Monitoring



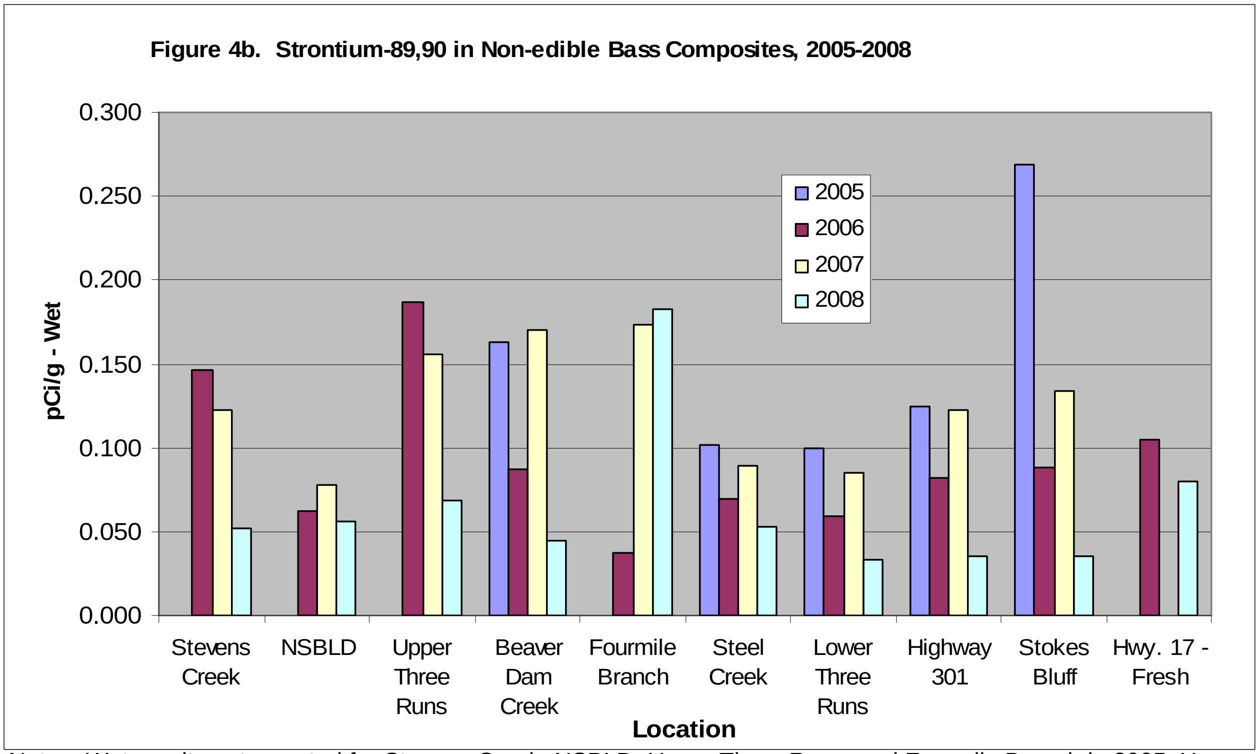
Note: Sampling at the Hwy. 17 location started in 2006



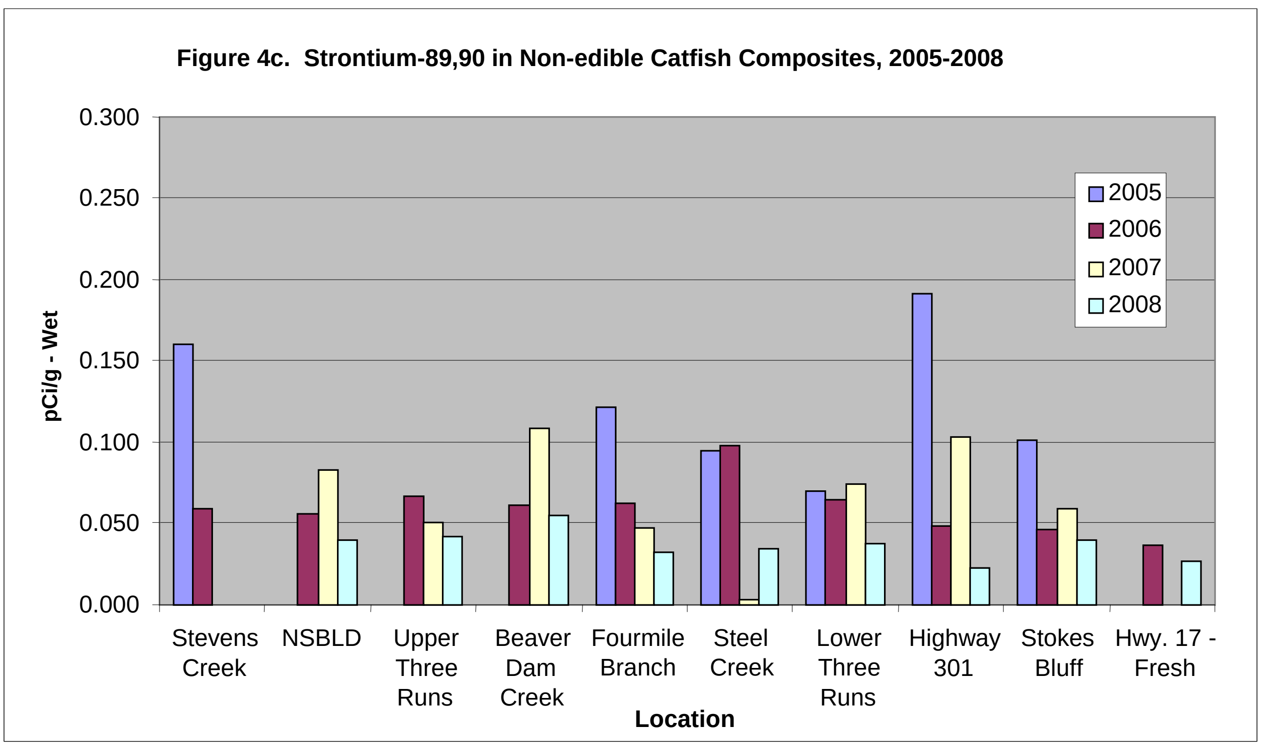
Note: Pickerel and Lake Brown catfish not analyzed for strontium; strontium not detected in seatrout

Tables and Figures

Radiological Fish Monitoring



Note: Wet results not reported for Stevens Creek, NSBLD, Upper Three Runs, and Fourmile Branch in 2005; Hwy. 17 not sampled in 2005, not analyzed in 2007



Note: Wet results not reported for Upper Three Runs and Beaver Dam Creek in 2005; Hwy. 17 not sampled in 2005, not analyzed in 2007; Stevens Creek not sampled in 2007 and 2008

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4.1.4 Data

Radiological Fish Monitoring

Notes:

1. **FM denotes Fish Monitoring project**
2. LLD - Lower Limit of Detection
3. MDA - Minimum Detectable Activity
4. MDC - Minimum Detectable Concentration
5. NSBLD - New Savannah Bluff Lock & Dam
6. Hwy. 301 - Savannah River at U.S. Highway 301
7. Hwy. 17 - Savannah River at U.S. Highway 17

Radiological Monitoring of Fish

2008 Tritium Data

Edible Samples	Location Description	Analyte	Collection Date	Result (pCi/L) in Extracted Water
Stevens	FMSV-2059A	Tritium Activity	4/22/2008	<LLD
Creek	FMSV-2059A	Tritium Confidence Interval	4/22/2008	NA
Bass	FMSV-2059A	Tritium LLD	4/22/2008	197

New Sav. Bluff	FMSV2028A	Tritium Activity	4/8/2008	<LLD
Lock & Dam	FMSV2028A	Tritium Confidence Interval	4/8/2008	NA
Bass	FMSV2028A	Tritium LLD	4/8/2008	197

New Sav. Bluff	FMSV2028C	Tritium Activity	4/8/2008	<LLD
Lock & Dam	FMSV2028C	Tritium Confidence Interval	4/8/2008	NA
Catfish	FMSV2028C	Tritium LLD	4/8/2008	197

Upper	FMSV-2011A	Tritium Activity	4/4/2008	<LLD
Three Runs	FMSV-2011A	Tritium Confidence Interval	4/4/2008	86
Bass	FMSV-2011A	Tritium LLD	4/4/2008	197

Upper 3 Runs	FMSV-2011AI	Tritium Activity	4/4/2008	<LLD
(Individual)	FMSV-2011AI	Tritium Confidence Interval	4/4/2008	NA
Bass	FMSV-2011AI	Tritium LLD	4/4/2008	197

Upper	FMSV-2011C	Tritium Activity	4/4/2008	278
Three Runs	FMSV-2011C	Tritium Confidence Interval	4/4/2008	94
Catfish	FMSV-2011C	Tritium LLD	4/4/2008	197

Upper	FMSV-2011E	Tritium Activity	4/4/2008	<LLD
Three Runs	FMSV-2011E	Tritium Confidence Interval	4/4/2008	NA
Chain pickerel	FMSV-2011E	Tritium LLD	4/4/2008	197

Beaver	FMSV-2013A	Tritium Activity	4/11/2008	<LLD
Dam Creek	FMSV-2013A	Tritium Confidence Interval	4/11/2008	NA
Bass	FMSV-2013A	Tritium LLD	4/11/2008	197

Beaver	FMSV-2013C	Tritium Activity	4/11/2008	<LLD
Dam Creek	FMSV-2013C	Tritium Confidence Interval	4/11/2008	NA
Catfish	FMSV-2013C	Tritium LLD	4/11/2008	197

Fourmile	FMSV-2015A	Tritium Activity	4/23/2008	240
Branch	FMSV-2015A	Tritium Confidence Interval	4/23/2008	93
Bass	FMSV-2015A	Tritium LLD	4/23/2008	197

Radiological Monitoring of Fish

2008 Tritium Data

Edible Samples	Location Description	Analyte	Collection Date	Result (pCi/L) in Extracted Water
Fourmile	FMSV-2015C	Tritium Activity	4/23/2008	507
Branch	FMSV-2015C	Tritium Confidence Interval	4/23/2008	103
Catfish	FMSV-2015C	Tritium LLD	4/23/2008	197

Steel	FMSV-2017A	Tritium Activity	4/16/2008	954
Creek	FMSV-2017A	Tritium Confidence Interval	4/16/2008	118
Bass	FMSV-2017A	Tritium LLD	4/16/2008	197

Steel	FMSV-2017C	Tritium Activity	4/16/2008	247
Creek	FMSV-2017C	Tritium Confidence Interval	4/16/2008	92
Catfish	FMSV-2017C	Tritium LLD	4/16/2008	197

Steel Creek	FMSV2017CI	Tritium Activity	4/16/2008	256
(Individual)	FMSV2017CI	Tritium Confidence Interval	4/16/2008	93
Catfish	FMSV2017CI	Tritium LLD	4/16/2008	197

Lower	FMSV-2020A	Tritium Activity	4/24/2008	436
Three Runs	FMSV-2020A	Tritium Confidence Interval	4/24/2008	101
Bass	FMSV-2020A	Tritium LLD	4/24/2008	197

Lower	FMSV-2020C	Tritium Activity	4/24/2008	406
Three Runs	FMSV-2020C	Tritium Confidence Interval	4/24/2008	101
Catfish	FMSV-2020C	Tritium LLD	4/24/2008	197

Hwy. 301	FMSV-118A	Tritium Activity	4/28/2008	300
Bass	FMSV-118A	Tritium Confidence Interval	4/28/2008	95
	FMSV-118A	Tritium LLD	4/28/2008	197

Hwy. 301	FMSV-118C	Tritium Activity	4/28/2008	373
Catfish	FMSV-118C	Tritium Confidence Interval	4/28/2008	97
	FMSV-118C	Tritium LLD	4/28/2008	197

Stokes	FMSV-355A	Tritium Activity	6/13/2008	279
Bluff	FMSV-355A	Tritium Confidence Interval	6/13/2008	95
Bass	FMSV-355A	Tritium LLD	6/13/2008	197

Stokes	FMSV-355C	Tritium Activity	6/13/2008	<LLD
Bluff	FMSV-355C	Tritium Confidence Interval	6/13/2008	NA
Catfish	FMSV-355C	Tritium LLD	6/13/2008	197

Radiological Monitoring of Fish

2008 Tritium Data

Edible Samples	Location Description	Analyte	Collection Date	Result (pCi/L) in Extracted Water
Hwy. 17 Freshwater Bass	FMSV-2090A	Tritium Activity	10/8/2008	215
	FMSV-2090A	Tritium Confidence Interval	10/8/2008	91
	FMSV-2090A	Tritium LLD	10/8/2008	197
Hwy. 17 Freshwater Catfish	FMSV-2090C	Tritium Activity	6/24/2008	<LLD
	FMSV-2090C	Tritium Confidence Interval	6/24/2008	NA
	FMSV-2090C	Tritium LLD	6/24/2008	197
Lake Brown (Barnwell) Catfish	FM-E2C	Tritium Activity	6/17/2008	<LLD
	FM-E2C	Tritium Confidence Interval	6/17/2008	NA
	FM-E2C	Tritium LLD	6/17/2008	197
Hwy 17 Saltwater Red drum	FMSV-2091A	Tritium Activity	11/25/2008	<LLD
	FMSV-2091A	Tritium Confidence Interval	11/25/2008	NA
	FMSV-2091A	Tritium LLD	11/25/2008	197
Hwy 17 Saltwater S. Seatrout	FMSV-2091C	Tritium Activity	11/25/2008	<LLD
	FMSV-2091C	Tritium Confidence Interval	11/25/2008	NA
	FMSV-2091C	Tritium LLD	11/25/2008	197
Hwy 17 Saltwater Mullet	FMSV-2091E	Tritium Activity	11/25/2008	300
	FMSV-2091E	Tritium Confidence Interval	11/25/2008	94
	FMSV-2091E	Tritium LLD	11/25/2008	197

Radiological Monitoring of Fish

2008 Gamma Data

Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Stevens	FMSV-2059A	K-40 Activity	4/22/2008	3.158
Creek	FMSV-2059A	K-40 Confidence Interval	4/22/2008	0.419
	FMSV-2059A	K-40 MDA	4/22/2008	0.161
Edible	FMSV-2059A	Co-60 Activity	4/22/2008	<MDA
Largemouth	FMSV-2059A	Co-60 Confidence Interval	4/22/2008	NA
Bass	FMSV-2059A	Co-60 MDA	4/22/2008	0.020
	FMSV-2059A	Cs-137 Activity	4/22/2008	<MDA
	FMSV-2059A	Cs-137 Confidence Interval	4/22/2008	NA
	FMSV-2059A	Cs-137 MDA	4/22/2008	0.019
	FMSV-2059A	Am-241 Activity	4/22/2008	<MDA
	FMSV-2059A	Am-241 Confidence Interval	4/22/2008	NA
	FMSV-2059A	Am-241 MDA	4/22/2008	0.022

Stevens	FMSV-2059B	K-40 Activity	4/22/2008	2.289
Creek	FMSV-2059B	K-40 Confidence Interval	4/22/2008	0.348
	FMSV-2059B	K-40 MDA	4/22/2008	0.175
Non-edible	FMSV-2059B	Co-60 Activity	4/22/2008	<MDA
Largemouth	FMSV-2059B	Co-60 Confidence Interval	4/22/2008	NA
Bass	FMSV-2059B	Co-60 MDA	4/22/2008	0.020
	FMSV-2059B	Cs-137 Activity	4/22/2008	<MDA
	FMSV-2059B	Cs-137 Confidence Interval	4/22/2008	NA
	FMSV-2059B	Cs-137 MDA	4/22/2008	0.019
	FMSV-2059B	Am-241 Activity	4/22/2008	<MDA
	FMSV-2059B	Am-241 Confidence Interval	4/22/2008	NA
	FMSV-2059B	Am-241 MDA	4/22/2008	0.021

New	FMSV-2028A	K-40 Activity	4/8/2008	3.677
Savannah	FMSV-2028A	K-40 Confidence Interval	4/8/2008	0.470
Bluff	FMSV-2028A	K-40 MDA	4/8/2008	0.171
Lock & Dam	FMSV-2028A	Co-60 Activity	4/8/2008	<MDA
	FMSV-2028A	Co-60 Confidence Interval	4/8/2008	NA
Edible	FMSV-2028A	Co-60 MDA	4/8/2008	0.019
Largemouth	FMSV-2028A	Cs-137 Activity	4/8/2008	<MDA
Bass	FMSV-2028A	Cs-137 Confidence Interval	4/8/2008	NA
	FMSV-2028A	Cs-137 MDA	4/8/2008	0.026
	FMSV-2028A	Pb-214 Activity	4/8/2008	0.247
	FMSV-2028A	Pb-214 Confidence Interval	4/8/2008	0.042
	FMSV-2028A	Pb-214 MDA	4/8/2008	0.038
	FMSV-2028A	Am-241 Activity	4/8/2008	<MDA
	FMSV-2028A	Am-241 Confidence Interval	4/8/2008	NA
	FMSV-2028A	Am-241 MDA	4/8/2008	0.023

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
New Savannah Bluff Lock & Dam Non-edible Largemouth Bass	FMSV-2028B	K-40 Activity	4/8/2008	2.289
	FMSV-2028B	K-40 Confidence Interval	4/8/2008	0.354
	FMSV-2028B	K-40 MDA	4/8/2008	0.133
	FMSV-2028B	Co-60 Activity	4/8/2008	<MDA
	FMSV-2028B	Co-60 Confidence Interval	4/8/2008	NA
	FMSV-2028B	Co-60 MDA	4/8/2008	0.024
	FMSV-2028B	Cs-137 Activity	4/8/2008	<MDA
	FMSV-2028B	Cs-137 Confidence Interval	4/8/2008	NA
	FMSV-2028B	Cs-137 MDA	4/8/2008	0.019
	FMSV-2028B	Pb-214 Activity	4/8/2008	0.084
	FMSV-2028B	Pb-214 Confidence Interval	4/8/2008	0.032
	FMSV-2028B	Pb-214 MDA	4/8/2008	0.034
	FMSV-2028B	Am-241 Activity	4/8/2008	<MDA
	FMSV-2028B	Am-241 Confidence Interval	4/8/2008	NA
	FMSV-2028B	Am-241 MDA	4/8/2008	0.022

New Savannah Bluff Lock & Dam Edible Channel Catfish	FMSV-2028C	K-40 Activity	4/8/2008	3.349
	FMSV-2028C	K-40 Confidence Interval	4/8/2008	0.426
	FMSV-2028C	K-40 MDA	4/8/2008	0.168
	FMSV-2028C	Co-60 Activity	4/8/2008	<MDA
	FMSV-2028C	Co-60 Confidence Interval	4/8/2008	NA
	FMSV-2028C	Co-60 MDA	4/8/2008	0.025
	FMSV-2028C	Cs-137 Activity	4/8/2008	<MDA
	FMSV-2028C	Cs-137 Confidence Interval	4/8/2008	NA
	FMSV-2028C	Cs-137 MDA	4/8/2008	0.023
	FMSV-2028C	Pb-214 Activity	4/8/2008	0.064
	FMSV-2028C	Pb-214 Confidence Interval	4/8/2008	0.032
	FMSV-2028C	Pb-214 MDA	4/8/2008	0.035
	FMSV-2028C	Am-241 Activity	4/8/2008	<MDA
	FMSV-2028C	Am-241 Confidence Interval	4/8/2008	NA
	FMSV-2028C	Am-241 MDA	4/8/2008	0.023

New Savannah Bluff Lock & Dam Non-edible Channel Catfish	FMSV-2028D	K-40 Activity	4/8/2008	1.849
	FMSV-2028D	K-40 Confidence Interval	4/8/2008	0.345
	FMSV-2028D	K-40 MDA	4/8/2008	0.148
	FMSV-2028D	Co-60 Activity	4/8/2008	<MDA
	FMSV-2028D	Co-60 Confidence Interval	4/8/2008	NA
	FMSV-2028D	Co-60 MDA	4/8/2008	0.020
	FMSV-2028D	Cs-137 Activity	4/8/2008	<MDA
	FMSV-2028D	Cs-137 Confidence Interval	4/8/2008	NA
	FMSV-2028D	Cs-137 MDA	4/8/2008	0.018
	FMSV-2028D	Am-241 Activity	4/8/2008	<MDA
	FMSV-2028D	Am-241 Confidence Interval	4/8/2008	NA
	FMSV-2028D	Am-241 MDA	4/8/2008	0.022

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Upper	FMSV-2011A	K-40 Activity	4/4/2008	3.175
Three	FMSV-2011A	K-40 Confidence Interval	4/4/2008	0.427
Runs	FMSV-2011A	K-40 MDA	4/4/2008	0.169
	FMSV-2011A	Co-60 Activity	4/4/2008	<MDA
Edible	FMSV-2011A	Co-60 Confidence Interval	4/4/2008	NA
Largemouth	FMSV-2011A	Co-60 MDA	4/4/2008	0.023
Bass	FMSV-2011A	Cs-137 Activity	4/4/2008	0.047
	FMSV-2011A	Cs-137 Confidence Interval	4/4/2008	0.021
	FMSV-2011A	Cs-137 MDA	4/4/2008	0.021
	FMSV-2011A	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011A	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011A	Am-241 MDA	4/4/2008	0.022

Upper	FMSV-2011B	K-40 Activity	4/4/2008	2.194
Three	FMSV-2011B	K-40 Confidence Interval	4/4/2008	0.344
Runs	FMSV-2011B	K-40 MDA	4/4/2008	0.131
	FMSV-2011B	Co-60 Activity	4/4/2008	<MDA
Non-edible	FMSV-2011B	Co-60 Confidence Interval	4/4/2008	NA
Largemouth	FMSV-2011B	Co-60 MDA	4/4/2008	0.018
Bass	FMSV-2011B	Cs-137 Activity	4/4/2008	<MDA
	FMSV-2011B	Cs-137 Confidence Interval	4/4/2008	NA
	FMSV-2011B	Cs-137 MDA	4/4/2008	0.025
	FMSV-2011B	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011B	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011B	Am-241 MDA	4/4/2008	0.020

Upper	FMSV-2011AI	K-40 Activity	4/4/2008	3.414
Three	FMSV-2011AI	K-40 Confidence Interval	4/4/2008	0.479
Runs	FMSV-2011AI	K-40 MDA	4/4/2008	0.199
	FMSV-2011AI	Co-60 Activity	4/4/2008	<MDA
Edible	FMSV-2011AI	Co-60 Confidence Interval	4/4/2008	NA
Largemouth	FMSV-2011AI	Co-60 MDA	4/4/2008	0.022
Bass	FMSV-2011AI	Cs-137 Activity	4/4/2008	<MDA
	FMSV-2011AI	Cs-137 Confidence Interval	4/4/2008	NA
Individual	FMSV-2011AI	Cs-137 MDA	4/4/2008	0.022
Fish	FMSV-2011AI	Pb-214 Activity	4/4/2008	0.105
	FMSV-2011AI	Pb-214 Confidence Interval	4/4/2008	0.035
	FMSV-2011AI	Pb-214 MDA	4/4/2008	0.036
	FMSV-2011AI	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011AI	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011AI	Am-241 MDA	4/4/2008	0.024

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Upper	FMSV-2011BI	K-40 Activity	4/4/2008	1.998
Three	FMSV-2011BI	K-40 Confidence Interval	4/4/2008	0.366
Runs	FMSV-2011BI	K-40 MDA	4/4/2008	0.159
	FMSV-2011BI	Co-60 Activity	4/4/2008	<MDA
Non-edible	FMSV-2011BI	Co-60 Confidence Interval	4/4/2008	NA
Largemouth	FMSV-2011BI	Co-60 MDA	4/4/2008	0.022
Bass	FMSV-2011BI	Cs-137 Activity	4/4/2008	<MDA
	FMSV-2011BI	Cs-137 Confidence Interval	4/4/2008	NA
Individual	FMSV-2011BI	Cs-137 MDA	4/4/2008	0.023
Fish	FMSV-2011BI	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011BI	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011BI	Am-241 MDA	4/4/2008	0.020

Upper	FMSV-2011C	K-40 Activity	4/4/2008	3.275
Three	FMSV-2011C	K-40 Confidence Interval	4/4/2008	0.447
Runs	FMSV-2011C	K-40 MDA	4/4/2008	0.157
	FMSV-2011C	Co-60 Activity	4/4/2008	<MDA
Edible	FMSV-2011C	Co-60 Confidence Interval	4/4/2008	NA
Channel	FMSV-2011C	Co-60 MDA	4/4/2008	0.021
Catfish	FMSV-2011C	Cs-137 Activity	4/4/2008	0.138
	FMSV-2011C	Cs-137 Confidence Interval	4/4/2008	0.026
	FMSV-2011C	Cs-137 MDA	4/4/2008	0.023
	FMSV-2011C	Pb-214 Activity	4/4/2008	0.053
	FMSV-2011C	Pb-214 Confidence Interval	4/4/2008	0.026
	FMSV-2011C	Pb-214 MDA	4/4/2008	0.034
	FMSV-2011C	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011C	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011C	Am-241 MDA	4/4/2008	0.024

Upper	FMSV-2011D	K-40 Activity	4/4/2008	2.150
Three	FMSV-2011D	K-40 Confidence Interval	4/4/2008	0.330
Runs	FMSV-2011D	K-40 MDA	4/4/2008	0.155
	FMSV-2011D	Co-60 Activity	4/4/2008	<MDA
Non-edible	FMSV-2011D	Co-60 Confidence Interval	4/4/2008	NA
Channel	FMSV-2011D	Co-60 MDA	4/4/2008	0.020
Catfish	FMSV-2011D	Cs-137 Activity	4/4/2008	0.075
	FMSV-2011D	Cs-137 Confidence Interval	4/4/2008	0.027
	FMSV-2011D	Cs-137 MDA	4/4/2008	0.018
	FMSV-2011D	Pb-214 Activity	4/4/2008	0.089
	FMSV-2011D	Pb-214 Confidence Interval	4/4/2008	0.031
	FMSV-2011D	Pb-214 MDA	4/4/2008	0.035
	FMSV-2011D	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011D	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011D	Am-241 MDA	4/4/2008	0.022

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Upper	FMSV-2011E	K-40 Activity	4/4/2008	3.091
Three	FMSV-2011E	K-40 Confidence Interval	4/4/2008	0.471
Runs	FMSV-2011E	K-40 MDA	4/4/2008	0.184
	FMSV-2011E	Co-60 Activity	4/4/2008	<MDA
Edible	FMSV-2011E	Co-60 Confidence Interval	4/4/2008	NA
Chain	FMSV-2011E	Co-60 MDA	4/4/2008	0.015
Pickerel	FMSV-2011E	Cs-137 Activity	4/4/2008	<MDA
	FMSV-2011E	Cs-137 Confidence Interval	4/4/2008	NA
	FMSV-2011E	Cs-137 MDA	4/4/2008	0.018
	FMSV-2011E	Am-241 Activity	4/4/2008	<MDA
	FMSV-2011E	Am-241 Confidence Interval	4/4/2008	NA
	FMSV-2011E	Am-241 MDA	4/4/2008	0.023

Beaver	FMSV-2013A	K-40 Activity	4/11/2008	3.427
Dam	FMSV-2013A	K-40 Confidence Interval	4/11/2008	0.443
Creek	FMSV-2013A	K-40 MDA	4/11/2008	0.125
	FMSV-2013A	Co-60 Activity	4/11/2008	<MDA
Edible	FMSV-2013A	Co-60 Confidence Interval	4/11/2008	NA
Largemouth	FMSV-2013A	Co-60 MDA	4/11/2008	0.019
Bass	FMSV-2013A	Cs-137 Activity	4/11/2008	<MDA
	FMSV-2013A	Cs-137 Confidence Interval	4/11/2008	NA
	FMSV-2013A	Cs-137 MDA	4/11/2008	0.018
	FMSV-2013A	Am-241 Activity	4/11/2008	<MDA
	FMSV-2013A	Am-241 Confidence Interval	4/11/2008	NA
	FMSV-2013A	Am-241 MDA	4/11/2008	0.021

Beaver	FMSV-2013B	K-40 Activity	4/11/2008	2.139
Dam	FMSV-2013B	K-40 Confidence Interval	4/11/2008	0.331
Creek	FMSV-2013B	K-40 MDA	4/11/2008	0.157
	FMSV-2013B	Co-60 Activity	4/11/2008	<MDA
Non-edible	FMSV-2013B	Co-60 Confidence Interval	4/11/2008	NA
Largemouth	FMSV-2013B	Co-60 MDA	4/11/2008	0.014
Bass	FMSV-2013B	Cs-137 Activity	4/11/2008	<MDA
	FMSV-2013B	Cs-137 Confidence Interval	4/11/2008	NA
	FMSV-2013B	Cs-137 MDA	4/11/2008	0.021
	FMSV-2013B	Am-241 Activity	4/11/2008	<MDA
	FMSV-2013B	Am-241 Confidence Interval	4/11/2008	NA
	FMSV-2013B	Am-241 MDA	4/11/2008	0.021

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Beaver	FMSV-2013C	K-40 Activity	4/11/2008	2.992
Dam	FMSV-2013C	K-40 Confidence Interval	4/11/2008	0.396
Creek	FMSV-2013C	K-40 MDA	4/11/2008	0.105
	FMSV-2013C	Co-60 Activity	4/11/2008	<MDA
Edible	FMSV-2013C	Co-60 Confidence Interval	4/11/2008	NA
Channel	FMSV-2013C	Co-60 MDA	4/11/2008	0.021
Catfish	FMSV-2013C	Cs-137 Activity	4/11/2008	<MDA
	FMSV-2013C	Cs-137 Confidence Interval	4/11/2008	NA
	FMSV-2013C	Cs-137 MDA	4/11/2008	0.020
	FMSV-2013C	Am-241 Activity	4/11/2008	<MDA
	FMSV-2013C	Am-241 Confidence Interval	4/11/2008	NA
	FMSV-2013C	Am-241 MDA	4/11/2008	0.021

Beaver	FMSV-2013D	K-40 Activity	4/11/2008	1.970
Dam	FMSV-2013D	K-40 Confidence Interval	4/11/2008	0.311
Creek	FMSV-2013D	K-40 MDA	4/11/2008	0.156
	FMSV-2013D	Co-60 Activity	4/11/2008	<MDA
Non-edible	FMSV-2013D	Co-60 Confidence Interval	4/11/2008	NA
Channel	FMSV-2013D	Co-60 MDA	4/11/2008	0.021
Catfish	FMSV-2013D	Cs-137 Activity	4/11/2008	<MDA
	FMSV-2013D	Cs-137 Confidence Interval	4/11/2008	NA
	FMSV-2013D	Cs-137 MDA	4/11/2008	0.022
	FMSV-2013D	Pb-214 Activity	4/11/2008	0.079
	FMSV-2013D	Pb-214 Confidence Interval	4/11/2008	0.028
	FMSV-2013D	Pb-214 MDA	4/11/2008	0.034
	FMSV-2013D	Am-241 Activity	4/11/2008	<MDA
	FMSV-2013D	Am-241 Confidence Interval	4/11/2008	NA
	FMSV-2013D	Am-241 MDA	4/11/2008	0.021

Fourmile	FMSV-2015A	K-40 Activity	4/23/2008	3.747
Branch	FMSV-2015A	K-40 Confidence Interval	4/23/2008	0.350
	FMSV-2015A	K-40 MDA	4/23/2008	0.094
Edible	FMSV-2015A	Co-60 Activity	4/23/2008	<MDA
Largemouth	FMSV-2015A	Co-60 Confidence Interval	4/23/2008	NA
Bass	FMSV-2015A	Co-60 MDA	4/23/2008	0.010
	FMSV-2015A	Cs-137 Activity	4/23/2008	0.167
	FMSV-2015A	Cs-137 Confidence Interval	4/23/2008	0.027
	FMSV-2015A	Cs-137 MDA	4/23/2008	0.011
	FMSV-2015A	Am-241 Activity	4/23/2008	<MDA
	FMSV-2015A	Am-241 Confidence Interval	4/23/2008	NA
	FMSV-2015A	Am-241 MDA	4/23/2008	0.059

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Fourmile	FMSV-2015B	K-40 Activity	4/23/2008	2.378
Branch	FMSV-2015B	K-40 Confidence Interval	4/23/2008	0.281
	FMSV-2015B	K-40 MDA	4/23/2008	0.107
Non-edible	FMSV-2015B	Co-60 Activity	4/23/2008	<MDA
Largemouth	FMSV-2015B	Co-60 Confidence Interval	4/23/2008	NA
Bass	FMSV-2015B	Co-60 MDA	4/23/2008	0.012
	FMSV-2015B	Cs-137 Activity	4/23/2008	0.094
	FMSV-2015B	Cs-137 Confidence Interval	4/23/2008	0.017
	FMSV-2015B	Cs-137 MDA	4/23/2008	0.011
	FMSV-2015B	Am-241 Activity	4/23/2008	<MDA
	FMSV-2015B	Am-241 Confidence Interval	4/23/2008	NA
	FMSV-2015B	Am-241 MDA	4/23/2008	0.061

Fourmile	FMSV-2015C	K-40 Activity	4/23/2008	3.602
Branch	FMSV-2015C	K-40 Confidence Interval	4/23/2008	0.356
	FMSV-2015C	K-40 MDA	4/23/2008	0.100
Edible	FMSV-2015C	Co-60 Activity	4/23/2008	<MDA
Channel	FMSV-2015C	Co-60 Confidence Interval	4/23/2008	NA
Catfish	FMSV-2015C	Co-60 MDA	4/23/2008	0.012
	FMSV-2015C	Cs-137 Activity	4/23/2008	0.026
	FMSV-2015C	Cs-137 Confidence Interval	4/23/2008	0.012
	FMSV-2015C	Cs-137 MDA	4/23/2008	0.011
	FMSV-2015C	Am-241 Activity	4/23/2008	<MDA
	FMSV-2015C	Am-241 Confidence Interval	4/23/2008	NA
	FMSV-2015C	Am-241 MDA	4/23/2008	0.058

Fourmile	FMSV-2015D	K-40 Activity	4/23/2008	2.164
Branch	FMSV-2015D	K-40 Confidence Interval	4/23/2008	0.277
	FMSV-2015D	K-40 MDA	4/23/2008	0.103
Non-edible	FMSV-2015D	Co-60 Activity	4/23/2008	<MDA
Channel	FMSV-2015D	Co-60 Confidence Interval	4/23/2008	NA
Catfish	FMSV-2015D	Co-60 MDA	4/23/2008	0.010
	FMSV-2015D	Cs-137 Activity	4/23/2008	0.027
	FMSV-2015D	Cs-137 Confidence Interval	4/23/2008	0.012
	FMSV-2015D	Cs-137 MDA	4/23/2008	0.011
	FMSV-2015D	Am-241 Activity	4/23/2008	<MDA
	FMSV-2015D	Am-241 Confidence Interval	4/23/2008	NA
	FMSV-2015D	Am-241 MDA	4/23/2008	0.055

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Fourmile	FMSV-2015E	K-40 Activity	4/23/2008	3.883
Branch	FMSV-2015E	K-40 Confidence Interval	4/23/2008	0.408
	FMSV-2015E	K-40 MDA	4/23/2008	0.111
Edible	FMSV-2015E	Co-60 Activity	4/23/2008	<MDA
Chain	FMSV-2015E	Co-60 Confidence Interval	4/23/2008	NA
Pickerel	FMSV-2015E	Co-60 MDA	4/23/2008	0.015
	FMSV-2015E	Cs-137 Activity	4/23/2008	0.480
	FMSV-2015E	Cs-137 Confidence Interval	4/23/2008	0.059
	FMSV-2015E	Cs-137 MDA	4/23/2008	0.015
	FMSV-2015E	Am-241 Activity	4/23/2008	<MDA
	FMSV-2015E	Am-241 Confidence Interval	4/23/2008	NA
	FMSV-2015E	Am-241 MDA	4/23/2008	0.078

Steel	FMSV-2017A	K-40 Activity	4/16/2008	3.833
Creek	FMSV-2017A	K-40 Confidence Interval	4/16/2008	0.384
	FMSV-2017A	K-40 MDA	4/16/2008	0.094
Edible	FMSV-2017A	Co-60 Activity	4/16/2008	<MDA
Largemouth	FMSV-2017A	Co-60 Confidence Interval	4/16/2008	NA
Bass	FMSV-2017A	Co-60 MDA	4/16/2008	0.014
	FMSV-2017A	Cs-137 Activity	4/16/2008	0.700
	FMSV-2017A	Cs-137 Confidence Interval	4/16/2008	0.081
	FMSV-2017A	Cs-137 MDA	4/16/2008	0.013
	FMSV-2017A	Am-241 Activity	4/16/2008	<MDA
	FMSV-2017A	Am-241 Confidence Interval	4/16/2008	NA
	FMSV-2017A	Am-241 MDA	4/16/2008	0.071

Steel	FMSV-2017B	K-40 Activity	4/16/2008	2.379
Creek	FMSV-2017B	K-40 Confidence Interval	4/16/2008	0.297
	FMSV-2017B	K-40 MDA	4/16/2008	0.124
Non-edible	FMSV-2017B	Co-60 Activity	4/16/2008	<MDA
Largemouth	FMSV-2017B	Co-60 Confidence Interval	4/16/2008	NA
Bass	FMSV-2017B	Co-60 MDA	4/16/2008	0.012
	FMSV-2017B	Cs-137 Activity	4/16/2008	0.463
	FMSV-2017B	Cs-137 Confidence Interval	4/16/2008	0.056
	FMSV-2017B	Cs-137 MDA	4/16/2008	0.012
	FMSV-2017B	Am-241 Activity	4/16/2008	<MDA
	FMSV-2017B	Am-241 Confidence Interval	4/16/2008	NA
	FMSV-2017B	Am-241 MDA	4/16/2008	0.067

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Steel	FMSV-2017C	K-40 Activity	4/16/2008	3.398
Creek	FMSV-2017C	K-40 Confidence Interval	4/16/2008	0.332
	FMSV-2017C	K-40 MDA	4/16/2008	0.083
Edible	FMSV-2017C	Co-60 Activity	4/16/2008	<MDA
Channel	FMSV-2017C	Co-60 Confidence Interval	4/16/2008	NA
Catfish	FMSV-2017C	Co-60 MDA	4/16/2008	0.010
	FMSV-2017C	Cs-137 Activity	4/16/2008	0.032
	FMSV-2017C	Cs-137 Confidence Interval	4/16/2008	0.011
	FMSV-2017C	Cs-137 MDA	4/16/2008	0.011
	FMSV-2017C	Am-241 Activity	4/16/2008	<MDA
	FMSV-2017C	Am-241 Confidence Interval	4/16/2008	NA
	FMSV-2017C	Am-241 MDA	4/16/2008	0.061

Steel	FMSV-2017D	K-40 Activity	4/16/2008	1.847
Creek	FMSV-2017D	K-40 Confidence Interval	4/16/2008	0.242
	FMSV-2017D	K-40 MDA	4/16/2008	0.098
Non-edible	FMSV-2017D	Co-60 Activity	4/16/2008	<MDA
Channel	FMSV-2017D	Co-60 Confidence Interval	4/16/2008	NA
Catfish	FMSV-2017D	Co-60 MDA	4/16/2008	0.011
	FMSV-2017D	Cs-137 Activity	4/16/2008	<MDA
	FMSV-2017D	Cs-137 Confidence Interval	4/16/2008	NA
	FMSV-2017D	Cs-137 MDA	4/16/2008	0.012
	FMSV-2017D	Am-241 Activity	4/16/2008	<MDA
	FMSV-2017D	Am-241 Confidence Interval	4/16/2008	NA
	FMSV-2017D	Am-241 MDA	4/16/2008	0.059

Steel	FMSV-2017CI	K-40 Activity	4/16/2008	3.386
Creek	FMSV-2017CI	K-40 Confidence Interval	4/16/2008	0.340
	FMSV-2017CI	K-40 MDA	4/16/2008	0.093
Edible	FMSV-2017CI	Co-60 Activity	4/16/2008	<MDA
Channel	FMSV-2017CI	Co-60 Confidence Interval	4/16/2008	NA
Catfish	FMSV-2017CI	Co-60 MDA	4/16/2008	0.012
	FMSV-2017CI	Cs-137 Activity	4/16/2008	0.026
Individual	FMSV-2017CI	Cs-137 Confidence Interval	4/16/2008	0.012
Fish	FMSV-2017CI	Cs-137 MDA	4/16/2008	0.011
	FMSV-2017CI	Pb-214 Activity	4/16/2008	0.056
	FMSV-2017CI	Pb-214 Confidence Interval	4/16/2008	0.022
	FMSV-2017CI	Pb-214 MDA	4/16/2008	0.021
	FMSV-2017CI	Am-241 Activity	4/16/2008	<MDA
	FMSV-2017CI	Am-241 Confidence Interval	4/16/2008	NA
	FMSV-2017CI	Am-241 MDA	4/16/2008	0.059

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Steel	FMSV-2017DI	K-40 Activity	4/16/2008	1.915
Creek	FMSV-2017DI	K-40 Confidence Interval	4/16/2008	0.237
	FMSV-2017DI	K-40 MDA	4/16/2008	0.099
Non-edible	FMSV-2017DI	Co-60 Activity	4/16/2008	<MDA
Channel	FMSV-2017DI	Co-60 Confidence Interval	4/16/2008	NA
Catfish	FMSV-2017DI	Co-60 MDA	4/16/2008	0.011
	FMSV-2017DI	Cs-137 Activity	4/16/2008	<MDA
Individual	FMSV-2017DI	Cs-137 Confidence Interval	4/16/2008	NA
Fish	FMSV-2017DI	Cs-137 MDA	4/16/2008	0.011
	FMSV-2017DI	Pb-214 Activity	4/16/2008	0.043
	FMSV-2017DI	Pb-214 Confidence Interval	4/16/2008	0.021
	FMSV-2017DI	Pb-214 MDA	4/16/2008	0.021
	FMSV-2017DI	Am-241 Activity	4/16/2008	<MDA
	FMSV-2017DI	Am-241 Confidence Interval	4/16/2008	NA
	FMSV-2017DI	Am-241 MDA	4/16/2008	0.060

Lower	FMSV-2020A	K-40 Activity	4/24/2008	3.187
Three	FMSV-2020A	K-40 Confidence Interval	4/24/2008	0.486
Runs	FMSV-2020A	K-40 MDA	4/24/2008	0.189
	FMSV-2020A	Co-60 Activity	4/24/2008	<MDA
Edible	FMSV-2020A	Co-60 Confidence Interval	4/24/2008	NA
Largemouth	FMSV-2020A	Co-60 MDA	4/24/2008	0.019
Bass	FMSV-2020A	Cs-137 Activity	4/24/2008	0.427
	FMSV-2020A	Cs-137 Confidence Interval	4/24/2008	0.053
	FMSV-2020A	Cs-137 MDA	4/24/2008	0.023
	FMSV-2020A	Pb-214 Activity	4/24/2008	0.181
	FMSV-2020A	Pb-214 Confidence Interval	4/24/2008	0.040
	FMSV-2020A	Pb-214 MDA	4/24/2008	0.039
	FMSV-2020A	Am-241 Activity	4/24/2008	<MDA
	FMSV-2020A	Am-241 Confidence Interval	4/24/2008	NA
	FMSV-2020A	Am-241 MDA	4/24/2008	0.025

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Lower	FMSV-2020B	K-40 Activity	4/24/2008	2.145
Three	FMSV-2020B	K-40 Confidence Interval	4/24/2008	0.342
Runs	FMSV-2020B	K-40 MDA	4/24/2008	0.161
	FMSV-2020B	Co-60 Activity	4/24/2008	<MDA
Non-edible	FMSV-2020B	Co-60 Confidence Interval	4/24/2008	NA
Largemouth	FMSV-2020B	Co-60 MDA	4/24/2008	0.022
Bass	FMSV-2020B	Cs-137 Activity	4/24/2008	0.248
	FMSV-2020B	Cs-137 Confidence Interval	4/24/2008	0.037
	FMSV-2020B	Cs-137 MDA	4/24/2008	0.020
	FMSV-2020B	Pb-214 Activity	4/24/2008	0.125
	FMSV-2020B	Pb-214 Confidence Interval	4/24/2008	0.039
	FMSV-2020B	Pb-214 MDA	4/24/2008	0.039
	FMSV-2020B	Am-241 Activity	4/24/2008	<MDA
	FMSV-2020B	Am-241 Confidence Interval	4/24/2008	NA
	FMSV-2020B	Am-241 MDA	4/24/2008	0.024

Lower	FMSV-2020C	K-40 Activity	4/24/2008	3.264
Three	FMSV-2020C	K-40 Confidence Interval	4/24/2008	0.517
Runs	FMSV-2020C	K-40 MDA	4/24/2008	0.162
	FMSV-2020C	Co-60 Activity	4/24/2008	<MDA
Edible	FMSV-2020C	Co-60 Confidence Interval	4/24/2008	NA
Channel	FMSV-2020C	Co-60 MDA	4/24/2008	0.024
Catfish	FMSV-2020C	Cs-137 Activity	4/24/2008	<MDA
	FMSV-2020C	Cs-137 Confidence Interval	4/24/2008	NA
	FMSV-2020C	Cs-137 MDA	4/24/2008	0.020
	FMSV-2020C	Am-241 Activity	4/24/2008	<MDA
	FMSV-2020C	Am-241 Confidence Interval	4/24/2008	NA
	FMSV-2020C	Am-241 MDA	4/24/2008	0.024

Lower	FMSV-2020D	K-40 Activity	4/24/2008	2.228
Three	FMSV-2020D	K-40 Confidence Interval	4/24/2008	0.362
Runs	FMSV-2020D	K-40 MDA	4/24/2008	0.157
	FMSV-2020D	Co-60 Activity	4/24/2008	<MDA
Non-edible	FMSV-2020D	Co-60 Confidence Interval	4/24/2008	NA
Channel	FMSV-2020D	Co-60 MDA	4/24/2008	0.023
Catfish	FMSV-2020D	Cs-137 Activity	4/24/2008	<MDA
	FMSV-2020D	Cs-137 Confidence Interval	4/24/2008	NA
	FMSV-2020D	Cs-137 MDA	4/24/2008	0.025
	FMSV-2020D	Pb-214 Activity	4/24/2008	0.145
	FMSV-2020D	Pb-214 Confidence Interval	4/24/2008	0.035
	FMSV-2020D	Pb-214 MDA	4/24/2008	0.038
	FMSV-2020D	Am-241 Activity	4/24/2008	<MDA
	FMSV-2020D	Am-241 Confidence Interval	4/24/2008	NA
	FMSV-2020D	Am-241 MDA	4/24/2008	0.023

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Highway 301	FMSV-118A	K-40 Activity	4/28/2008	3.292
	FMSV-118A	K-40 Confidence Interval	4/28/2008	0.410
Edible	FMSV-118A	K-40 MDA	4/28/2008	0.138
Largemouth	FMSV-118A	Co-60 Activity	4/28/2008	<MDA
Bass	FMSV-118A	Co-60 Confidence Interval	4/28/2008	NA
	FMSV-118A	Co-60 MDA	4/28/2008	0.019
	FMSV-118A	Cs-137 Activity	4/28/2008	0.071
	FMSV-118A	Cs-137 Confidence Interval	4/28/2008	0.023
	FMSV-118A	Cs-137 MDA	4/28/2008	0.018
	FMSV-118A	Am-241 Activity	4/28/2008	<MDA
	FMSV-118A	Am-241 Confidence Interval	4/28/2008	NA
	FMSV-118A	Am-241 MDA	4/28/2008	0.022

Highway 301	FMSV-118B	K-40 Activity	4/28/2008	2.085
	FMSV-118B	K-40 Confidence Interval	4/28/2008	0.355
Non-edible	FMSV-118B	K-40 MDA	4/28/2008	0.170
Largemouth	FMSV-118B	Co-60 Activity	4/28/2008	<MDA
Bass	FMSV-118B	Co-60 Confidence Interval	4/28/2008	NA
	FMSV-118B	Co-60 MDA	4/28/2008	0.018
	FMSV-118B	Cs-137 Activity	4/28/2008	<MDA
	FMSV-118B	Cs-137 Confidence Interval	4/28/2008	NA
	FMSV-118B	Cs-137 MDA	4/28/2008	0.019
	FMSV-118B	Am-241 Activity	4/28/2008	<MDA
	FMSV-118B	Am-241 Confidence Interval	4/28/2008	NA
	FMSV-118B	Am-241 MDA	4/28/2008	0.022

Highway 301	FMSV-118C	K-40 Activity	4/28/2008	3.314
	FMSV-118C	K-40 Confidence Interval	4/28/2008	0.517
Edible	FMSV-118C	K-40 MDA	4/28/2008	0.199
Channel	FMSV-118C	Co-60 Activity	4/28/2008	<MDA
Catfish	FMSV-118C	Co-60 Confidence Interval	4/28/2008	NA
	FMSV-118C	Co-60 MDA	4/28/2008	0.025
	FMSV-118C	Cs-137 Activity	4/28/2008	<MDA
	FMSV-118C	Cs-137 Confidence Interval	4/28/2008	NA
	FMSV-118C	Cs-137 MDA	4/28/2008	0.020
	FMSV-118C	Pb-214 Activity	4/28/2008	0.083
	FMSV-118C	Pb-214 Confidence Interval	4/28/2008	0.036
	FMSV-118C	Pb-214 MDA	4/28/2008	0.039
	FMSV-118C	Am-241 Activity	4/28/2008	<MDA
	FMSV-118C	Am-241 Confidence Interval	4/28/2008	NA
	FMSV-118C	Am-241 MDA	4/28/2008	0.024

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Highway 301	FMSV-118D	K-40 Activity	4/28/2008	2.065
	FMSV-118D	K-40 Confidence Interval	4/28/2008	0.307
Non-edible	FMSV-118D	K-40 MDA	4/28/2008	0.134
Channel	FMSV-118D	Co-60 Activity	4/28/2008	<MDA
Catfish	FMSV-118D	Co-60 Confidence Interval	4/28/2008	NA
	FMSV-118D	Co-60 MDA	4/28/2008	0.020
	FMSV-118D	Cs-137 Activity	4/28/2008	<MDA
	FMSV-118D	Cs-137 Confidence Interval	4/28/2008	NA
	FMSV-118D	Cs-137 MDA	4/28/2008	0.018
	FMSV-118D	Pb-214 Activity	4/28/2008	0.072
	FMSV-118D	Pb-214 Confidence Interval	4/28/2008	0.027
	FMSV-118D	Pb-214 MDA	4/28/2008	0.031
	FMSV-118D	Am-241 Activity	4/28/2008	<MDA
	FMSV-118D	Am-241 Confidence Interval	4/28/2008	NA
	FMSV-118D	Am-241 MDA	4/28/2008	0.022

Stokes	FMSV-355A	K-40 Activity	6/13/2008	2.968
Bluff	FMSV-355A	K-40 Confidence Interval	6/13/2008	0.483
	FMSV-355A	K-40 MDA	6/13/2008	0.180
Edible	FMSV-355A	Co-60 Activity	6/13/2008	<MDA
Largemouth	FMSV-355A	Co-60 Confidence Interval	6/13/2008	NA
Bass	FMSV-355A	Co-60 MDA	6/13/2008	0.022
	FMSV-355A	Cs-137 Activity	6/13/2008	<MDA
	FMSV-355A	Cs-137 Confidence Interval	6/13/2008	NA
	FMSV-355A	Cs-137 MDA	6/13/2008	0.022
	FMSV-355A	Am-241 Activity	6/13/2008	<MDA
	FMSV-355A	Am-241 Confidence Interval	6/13/2008	NA
	FMSV-355A	Am-241 MDA	6/13/2008	0.023

Stokes	FMSV-355B	K-40 Activity	6/13/2008	2.102
Bluff	FMSV-355B	K-40 Confidence Interval	6/13/2008	0.336
	FMSV-355B	K-40 MDA	6/13/2008	0.165
Non-edible	FMSV-355B	Co-60 Activity	6/13/2008	<MDA
Largemouth	FMSV-355B	Co-60 Confidence Interval	6/13/2008	NA
Bass	FMSV-355B	Co-60 MDA	6/13/2008	0.020
	FMSV-355B	Cs-137 Activity	6/13/2008	<MDA
	FMSV-355B	Cs-137 Confidence Interval	6/13/2008	NA
	FMSV-355B	Cs-137 MDA	6/13/2008	0.025
	FMSV-355B	Am-241 Activity	6/13/2008	<MDA
	FMSV-355B	Am-241 Confidence Interval	6/13/2008	NA
	FMSV-355B	Am-241 MDA	6/13/2008	0.023

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Stokes	FMSV-355C	K-40 Activity	6/13/2008	3.014
Bluff	FMSV-355C	K-40 Confidence Interval	6/13/2008	0.458
	FMSV-355C	K-40 MDA	6/13/2008	0.197
Edible	FMSV-355C	Co-60 Activity	6/13/2008	<MDA
White	FMSV-355C	Co-60 Confidence Interval	6/13/2008	NA
Catfish	FMSV-355C	Co-60 MDA	6/13/2008	0.024
	FMSV-355C	Cs-137 Activity	6/13/2008	<MDA
	FMSV-355C	Cs-137 Confidence Interval	6/13/2008	NA
	FMSV-355C	Cs-137 MDA	6/13/2008	0.025
	FMSV-355C	Am-241 Activity	6/13/2008	<MDA
	FMSV-355C	Am-241 Confidence Interval	6/13/2008	NA
	FMSV-355C	Am-241 MDA	6/13/2008	0.022

Stokes	FMSV-355D	K-40 Activity	6/13/2008	2.133
Bluff	FMSV-355D	K-40 Confidence Interval	6/13/2008	0.345
	FMSV-355D	K-40 MDA	6/13/2008	0.134
Non-edible	FMSV-355D	Co-60 Activity	6/13/2008	<MDA
White	FMSV-355D	Co-60 Confidence Interval	6/13/2008	NA
Catfish	FMSV-355D	Co-60 MDA	6/13/2008	0.020
	FMSV-355D	Cs-137 Activity	6/13/2008	<MDA
	FMSV-355D	Cs-137 Confidence Interval	6/13/2008	NA
	FMSV-355D	Cs-137 MDA	6/13/2008	0.022
	FMSV-355D	Am-241 Activity	6/13/2008	<MDA
	FMSV-355D	Am-241 Confidence Interval	6/13/2008	NA
	FMSV-355D	Am-241 MDA	6/13/2008	0.021

Highway 17	FMSV-2090A	K-40 Activity	10/8/2008	3.400
Freshwater	FMSV-2090A	K-40 Confidence Interval	10/8/2008	0.348
	FMSV-2090A	K-40 MDA	10/8/2008	0.099
Edible	FMSV-2090A	Co-60 Activity	10/8/2008	<MDA
Largemouth	FMSV-2090A	Co-60 Confidence Interval	10/8/2008	NA
Bass	FMSV-2090A	Co-60 MDA	10/8/2008	0.010
	FMSV-2090A	Cs-137 Activity	10/8/2008	0.050
	FMSV-2090A	Cs-137 Confidence Interval	10/8/2008	0.012
	FMSV-2090A	Cs-137 MDA	10/8/2008	0.012
	FMSV-2090A	Am-241 Activity	10/8/2008	<MDA
	FMSV-2090A	Am-241 Confidence Interval	10/8/2008	NA
	FMSV-2090A	Am-241 MDA	10/8/2008	0.061

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Highway 17	FMSV-2090B	K-40 Activity	10/8/2008	2.244
Freshwater	FMSV-2090B	K-40 Confidence Interval	10/8/2008	0.274
	FMSV-2090B	K-40 MDA	10/8/2008	0.103
Non-edible	FMSV-2090B	Co-60 Activity	10/8/2008	<MDA
Largemouth	FMSV-2090B	Co-60 Confidence Interval	10/8/2008	NA
Bass	FMSV-2090B	Co-60 MDA	10/8/2008	0.011
	FMSV-2090B	Cs-137 Activity	10/8/2008	0.041
	FMSV-2090B	Cs-137 Confidence Interval	10/8/2008	0.013
	FMSV-2090B	Cs-137 MDA	10/8/2008	0.011
	FMSV-2090B	Am-241 Activity	10/8/2008	<MDA
	FMSV-2090B	Am-241 Confidence Interval	10/8/2008	NA
	FMSV-2090B	Am-241 MDA	10/8/2008	0.064

Highway 17	FMSV-2090C	K-40 Activity	6/24/2008	3.288
Freshwater	FMSV-2090C	K-40 Confidence Interval	6/24/2008	0.343
	FMSV-2090C	K-40 MDA	6/24/2008	0.101
Edible	FMSV-2090C	Co-60 Activity	6/24/2008	<MDA
White	FMSV-2090C	Co-60 Confidence Interval	6/24/2008	NA
Catfish	FMSV-2090C	Co-60 MDA	6/24/2008	0.010
	FMSV-2090C	Cs-137 Activity	6/24/2008	0.032
	FMSV-2090C	Cs-137 Confidence Interval	6/24/2008	0.016
	FMSV-2090C	Cs-137 MDA	6/24/2008	0.011
	FMSV-2090C	Pb-214 Activity	6/24/2008	0.054
	FMSV-2090C	Pb-214 Confidence Interval	6/24/2008	0.022
	FMSV-2090C	Pb-214 MDA	6/24/2008	0.023
	FMSV-2090C	Am-241 Activity	6/24/2008	<MDA
	FMSV-2090C	Am-241 Confidence Interval	6/24/2008	NA
	FMSV-2090C	Am-241 MDA	6/24/2008	0.065

Highway 17	FMSV-2090D	K-40 Activity	6/24/2008	2.078
Freshwater	FMSV-2090D	K-40 Confidence Interval	6/24/2008	0.265
	FMSV-2090D	K-40 MDA	6/24/2008	0.094
Non-edible	FMSV-2090D	Co-60 Activity	6/24/2008	<MDA
White	FMSV-2090D	Co-60 Confidence Interval	6/24/2008	NA
Catfish	FMSV-2090D	Co-60 MDA	6/24/2008	0.012
	FMSV-2090D	Cs-137 Activity	6/24/2008	<MDA
	FMSV-2090D	Cs-137 Confidence Interval	6/24/2008	NA
	FMSV-2090D	Cs-137 MDA	6/24/2008	0.011
	FMSV-2090D	Pb-214 Activity	6/24/2008	0.184
	FMSV-2090D	Pb-214 Confidence Interval	6/24/2008	0.025
	FMSV-2090D	Pb-214 MDA	6/24/2008	0.023
	FMSV-2090D	Am-241 Activity	6/24/2008	<MDA
	FMSV-2090D	Am-241 Confidence Interval	6/24/2008	NA
	FMSV-2090D	Am-241 MDA	6/24/2008	0.066

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Lake Brown, Barnwell Edible White Catfish	FME2C	K-40 Activity	6/17/2008	3.136
	FME2C	K-40 Confidence Interval	6/17/2008	0.320
	FME2C	K-40 MDA	6/17/2008	0.106
	FME2C	Co-60 Activity	6/17/2008	<MDA
	FME2C	Co-60 Confidence Interval	6/17/2008	NA
	FME2C	Co-60 MDA	6/17/2008	0.012
	FME2C	Cs-137 Activity	6/17/2008	0.037
	FME2C	Cs-137 Confidence Interval	6/17/2008	0.011
	FME2C	Cs-137 MDA	6/17/2008	0.011
	FME2C	Am-241 Activity	6/17/2008	<MDA
	FME2C	Am-241 Confidence Interval	6/17/2008	NA
	FME2C	Am-241 MDA	6/17/2008	0.064

Lake Brown, Barnwell Non-edible White Catfish	FME2D	K-40 Activity	6/17/2008	2.089
	FME2D	K-40 Confidence Interval	6/17/2008	0.262
	FME2D	K-40 MDA	6/17/2008	0.092
	FME2D	Co-60 Activity	6/17/2008	<MDA
	FME2D	Co-60 Confidence Interval	6/17/2008	NA
	FME2D	Co-60 MDA	6/17/2008	0.011
	FME2D	Cs-137 Activity	6/17/2008	0.017
	FME2D	Cs-137 Confidence Interval	6/17/2008	0.008
	FME2D	Cs-137 MDA	6/17/2008	0.013
	FME2D	Pb-212 Activity	6/17/2008	0.034
	FME2D	Pb-212 Confidence Interval	6/17/2008	0.012
	FME2D	Pb-212 MDA	6/17/2008	0.018
	FME2D	Pb-214 Activity	6/17/2008	0.116
	FME2D	Pb-214 Confidence Interval	6/17/2008	0.025
	FME2D	Pb-214 MDA	6/17/2008	0.023
	FME2D	Am-241 Activity	6/17/2008	<MDA
	FME2D	Am-241 Confidence Interval	6/17/2008	NA
	FME2D	Am-241 MDA	6/17/2008	0.063

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Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Highway 17	FMSV-2091A	K-40 Activity	11/25/2008	3.321
Saltwater	FMSV-2091A	K-40 Confidence Interval	11/25/2008	0.345
	FMSV-2091A	K-40 MDA	11/25/2008	0.119
Edible	FMSV-2091A	Co-60 Activity	11/25/2008	<MDA
Red Drum	FMSV-2091A	Co-60 Confidence Interval	11/25/2008	NA
	FMSV-2091A	Co-60 MDA	11/25/2008	0.012
	FMSV-2091A	Cs-137 Activity	11/25/2008	<MDA
	FMSV-2091A	Cs-137 Confidence Interval	11/25/2008	NA
	FMSV-2091A	Cs-137 MDA	11/25/2008	0.012
	FMSV-2091A	Pb-214 Activity	11/25/2008	0.270
	FMSV-2091A	Pb-214 Confidence Interval	11/25/2008	0.029
	FMSV-2091A	Pb-214 MDA	11/25/2008	0.023
	FMSV-2091A	Am-241 Activity	11/25/2008	<MDA
	FMSV-2091A	Am-241 Confidence Interval	11/25/2008	NA
	FMSV-2091A	Am-241 MDA	11/25/2008	0.073

Highway 17	FMSV-2091B	K-40 Activity	11/25/2008	2.294
Saltwater	FMSV-2091B	K-40 Confidence Interval	11/25/2008	0.271
	FMSV-2091B	K-40 MDA	11/25/2008	0.088
Non-edible	FMSV-2091B	Co-60 Activity	11/25/2008	<MDA
Red Drum	FMSV-2091B	Co-60 Confidence Interval	11/25/2008	NA
	FMSV-2091B	Co-60 MDA	11/25/2008	0.010
	FMSV-2091B	Cs-137 Activity	11/25/2008	<MDA
	FMSV-2091B	Cs-137 Confidence Interval	11/25/2008	NA
	FMSV-2091B	Cs-137 MDA	11/25/2008	0.011
	FMSV-2091B	Pb-214 Activity	11/25/2008	0.122
	FMSV-2091B	Pb-214 Confidence Interval	11/25/2008	0.021
	FMSV-2091B	Pb-214 MDA	11/25/2008	0.023
	FMSV-2091B	Am-241 Activity	11/25/2008	<MDA
	FMSV-2091B	Am-241 Confidence Interval	11/25/2008	NA
	FMSV-2091B	Am-241 MDA	11/25/2008	0.062

Radiological Monitoring of Fish

2008 Gamma Data

Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Highway 17	FMSV-2091C	K-40 Activity	11/25/2008	3.426
Saltwater	FMSV-2091C	K-40 Confidence Interval	11/25/2008	0.349
	FMSV-2091C	K-40 MDA	11/25/2008	0.095
Edible	FMSV-2091C	Co-60 Activity	11/25/2008	<MDA
Spotted	FMSV-2091C	Co-60 Confidence Interval	11/25/2008	NA
Seatrout	FMSV-2091C	Co-60 MDA	11/25/2008	0.013
	FMSV-2091C	Cs-137 Activity	11/25/2008	<MDA
	FMSV-2091C	Cs-137 Confidence Interval	11/25/2008	NA
	FMSV-2091C	Cs-137 MDA	11/25/2008	0.012
	FMSV-2091C	Pb-214 Activity	11/25/2008	0.173
	FMSV-2091C	Pb-214 Confidence Interval	11/25/2008	0.027
	FMSV-2091C	Pb-214 MDA	11/25/2008	0.025
	FMSV-2091C	Am-241 Activity	11/25/2008	<MDA
	FMSV-2091C	Am-241 Confidence Interval	11/25/2008	NA
	FMSV-2091C	Am-241 MDA	11/25/2008	0.069

Highway 17	FMSV-2091D	K-40 Activity	11/25/2008	2.265
Saltwater	FMSV-2091D	K-40 Confidence Interval	11/25/2008	0.274
	FMSV-2091D	K-40 MDA	11/25/2008	0.119
Non-edible	FMSV-2091D	Co-60 Activity	11/25/2008	<MDA
Spotted	FMSV-2091D	Co-60 Confidence Interval	11/25/2008	NA
Seatrout	FMSV-2091D	Co-60 MDA	11/25/2008	0.012
	FMSV-2091D	Cs-137 Activity	11/25/2008	<MDA
	FMSV-2091D	Cs-137 Confidence Interval	11/25/2008	NA
	FMSV-2091D	Cs-137 MDA	11/25/2008	0.013
	FMSV-2091D	Pb-214 Activity	11/25/2008	0.266
	FMSV-2091D	Pb-214 Confidence Interval	11/25/2008	0.029
	FMSV-2091D	Pb-214 MDA	11/25/2008	0.026
	FMSV-2091D	Am-241 Activity	11/25/2008	<MDA
	FMSV-2091D	Am-241 Confidence Interval	11/25/2008	NA
	FMSV-2091D	Am-241 MDA	11/25/2008	0.073

Radiological Monitoring of Fish

2008 Gamma Data

Station / Sample Type	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh weight
Highway 17	FMSV-2091E	K-40 Activity	10/8/2008	3.785
Saltwater	FMSV-2091E	K-40 Confidence Interval	10/8/2008	0.384
	FMSV-2091E	K-40 MDA	10/8/2008	0.137
Edible	FMSV-2091E	Co-60 Activity	10/8/2008	<MDA
Mullet	FMSV-2091E	Co-60 Confidence Interval	10/8/2008	NA
	FMSV-2091E	Co-60 MDA	10/8/2008	0.015
	FMSV-2091E	Cs-137 Activity	10/8/2008	<MDA
	FMSV-2091E	Cs-137 Confidence Interval	10/8/2008	NA
	FMSV-2091E	Cs-137 MDA	10/8/2008	0.015
	FMSV-2091E	Pb-212 Activity	10/8/2008	0.046
	FMSV-2091E	Pb-212 Confidence Interval	10/8/2008	0.015
	FMSV-2091E	Pb-212 MDA	10/8/2008	0.023
	FMSV-2091E	Pb-214 Activity	10/8/2008	0.435
	FMSV-2091E	Pb-214 Confidence Interval	10/8/2008	0.038
	FMSV-2091E	Pb-214 MDA	10/8/2008	0.027
	FMSV-2091E	Am-241 Activity	10/8/2008	<MDA
	FMSV-2091E	Am-241 Confidence Interval	10/8/2008	NA
	FMSV-2091E	Am-241 MDA	10/8/2008	0.078

Highway 17	FMSV-2091F	K-40 Activity	10/8/2008	2.519
Saltwater	FMSV-2091F	K-40 Confidence Interval	10/8/2008	0.275
	FMSV-2091F	K-40 MDA	10/8/2008	0.101
Non-edible	FMSV-2091F	Co-60 Activity	10/8/2008	<MDA
Mullet	FMSV-2091F	Co-60 Confidence Interval	10/8/2008	NA
	FMSV-2091F	Co-60 MDA	10/8/2008	0.011
	FMSV-2091F	Cs-137 Activity	10/8/2008	<MDA
	FMSV-2091F	Cs-137 Confidence Interval	10/8/2008	NA
	FMSV-2091F	Cs-137 MDA	10/8/2008	0.013
	FMSV-2091F	Pb-212 Activity	10/8/2008	0.070
	FMSV-2091F	Pb-212 Confidence Interval	10/8/2008	0.015
	FMSV-2091F	Pb-212 MDA	10/8/2008	0.021
	FMSV-2091F	Pb-214 Activity	10/8/2008	0.205
	FMSV-2091F	Pb-214 Confidence Interval	10/8/2008	0.027
	FMSV-2091F	Pb-214 MDA	10/8/2008	0.024
	FMSV-2091F	Am-241 Activity	10/8/2008	<MDA
	FMSV-2091F	Am-241 Confidence Interval	10/8/2008	NA
	FMSV-2091F	Am-241 MDA	10/8/2008	0.068

Radiological Monitoring of Fish

2008 Strontium Data

Non-edible Samples	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh Weight
Stevens	FMSV-2059B	Strontium-89,90	4/22/2008	0.052
Creek	FMSV-2059B	Strontium Uncertainty	4/22/2008	0.002
Bass	FMSV-2059B	Strontium MDA	4/22/2008	0.004

New Sav. Bluff	FMSV-2028B	Strontium-89,90	4/8/2008	0.056
Lock & Dam	FMSV-2028B	Strontium Uncertainty	4/8/2008	0.003
Bass	FMSV-2028B	Strontium MDA	4/8/2008	0.005

New Sav. Bluff	FMSV-2028D	Strontium-89,90	4/8/2008	0.039
Lock & Dam	FMSV-2028D	Strontium Uncertainty	4/8/2008	0.002
Catfish	FMSV-2028D	Strontium MDA	4/8/2008	0.003

Upper	FMSV-2011B	Strontium-89,90	4/4/2008	0.069
Three Runs	FMSV-2011B	Strontium Uncertainty	4/4/2008	0.003
Bass	FMSV-2011B	Strontium MDA	4/4/2008	0.006

Upper	FMSV-2011D	Strontium-89,90	4/4/2008	0.042
Three Runs	FMSV-2011D	Strontium Uncertainty	4/4/2008	0.003
Catfish	FMSV-2011D	Strontium MDA	4/4/2008	0.005

Beaver	FMSV-2013B	Strontium-89,90	4/11/2008	0.044
Dam Creek	FMSV-2013B	Strontium Uncertainty	4/11/2008	0.003
Bass	FMSV-2013B	Strontium MDA	4/11/2008	0.006

Beaver	FMSV-2013D	Strontium-89,90	4/11/2008	0.055
Dam Creek	FMSV-2013D	Strontium Uncertainty	4/11/2008	0.003
Catfish	FMSV-2013D	Strontium MDA	4/11/2008	0.004

Fourmile	FMSV-2015B	Strontium-89,90	4/23/2008	0.182
Branch	FMSV-2015B	Strontium Uncertainty	4/23/2008	0.005
Bass	FMSV-2015B	Strontium MDA	4/23/2008	0.006

Fourmile	FMSV-2015D	Strontium-89,90	4/23/2008	0.032
Branch	FMSV-2015D	Strontium Uncertainty	4/23/2008	0.002
Catfish	FMSV-2015D	Strontium MDA	4/23/2008	0.004

Radiological Monitoring of Fish

2008 Strontium Data

Non-edible Samples	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh Weight
Steel	FMSV-2017B	Strontium-89,90	4/16/2008	0.053
Creek	FMSV-2017B	Strontium Uncertainty	4/16/2008	0.002
Bass	FMSV-2017B	Strontium MDA	4/16/2008	0.004

Steel	FMSV-2017D	Strontium-89,90	4/16/2008	0.034
Creek	FMSV-2017D	Strontium Uncertainty	4/16/2008	0.002
Catfish	FMSV-2017D	Strontium MDA	4/16/2008	0.004

Lower	FMSV-2020B	Strontium-89,90	4/24/2008	0.034
Three Runs	FMSV-2020B	Strontium Uncertainty	4/24/2008	0.003
Bass	FMSV-2020B	Strontium MDA	4/24/2008	0.007

Lower	FMSV-2020D	Strontium-89,90	4/24/2008	0.037
Three Runs	FMSV-2020D	Strontium Uncertainty	4/24/2008	0.002
Catfish	FMSV-2020D	Strontium MDA	4/24/2008	0.004

Hwy. 301	FMSV-118B	Strontium-89,90	4/28/2008	0.035
Bass	FMSV-118B	Strontium Uncertainty	4/28/2008	0.002
	FMSV-118B	Strontium MDA	4/28/2008	0.004

Hwy. 301	FMSV-118D	Strontium-89,90	4/28/2008	0.023
Catfish	FMSV-118D	Strontium Uncertainty	4/28/2008	0.003
	FMSV-118D	Strontium MDA	4/28/2008	0.005

Stokes	FMSV-355B	Strontium-89,90	6/13/2008	0.036
Bluff	FMSV-355B	Strontium Uncertainty	6/13/2008	0.002
Bass	FMSV-355B	Strontium MDA	6/13/2008	0.003

Stokes	FMSV-355D	Strontium-89,90	6/13/2008	0.039
Bluff	FMSV-355D	Strontium Uncertainty	6/13/2008	0.002
Catfish	FMSV-355D	Strontium MDA	6/13/2008	0.003

Radiological Monitoring of Fish

2008 Strontium Data

Non-edible Samples	Location Description	Analyte	Collection Date	Result (pCi/g) Fresh Weight
Hwy. 17	FMSV-2090B	Strontium-89,90	10/8/2008	0.080
Freshwater	FMSV-2090B	Strontium Uncertainty	10/8/2008	0.005
Bass	FMSV-2090B	Strontium MDA	10/8/2008	0.006
Hwy. 17	FMSV-2090D	Strontium-89,90	6/24/2008	0.027
Freshwater	FMSV-2090D	Strontium Uncertainty	6/24/2008	0.002
Catfish	FMSV-2090D	Strontium MDA	6/24/2008	0.004
Lake Brown	FME2D	Strontium-89,90	6/17/2008	0.018
(Barnwell)	FME2D	Strontium Uncertainty	6/17/2008	0.001
Catfish	FME2D	Strontium MDA	6/17/2008	0.003
Hwy 17	FMSV-2091B	Strontium-89,90	11/25/2008	0.010
Saltwater	FMSV-2091B	Strontium Uncertainty	11/25/2008	0.002
Red drum	FMSV-2091B	Strontium MDA	11/25/2008	0.004
Hwy 17	FMSV-2091D	Strontium-89,90	11/25/2008	<MDA
Saltwater	FMSV-2091D	Strontium Uncertainty	11/25/2008	0.001
S. Seatrout	FMSV-2091D	Strontium MDA	11/25/2008	0.003
Hwy 17	FMSV-2091F	Strontium-89,90	10/8/2008	0.006
Saltwater	FMSV-2091F	Strontium Uncertainty	10/8/2008	0.001
Mullet	FMSV-2091F	Strontium MDA	10/8/2008	0.003

Radiological Monitoring of Fish

SCDHEC Historical Data, 2004-2008

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMB
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Tritium (pCi/L)	ND	ND	ND	ND	240
2007			ND	ND	ND	359	2,930
2006			504	269	385	232	2,920
2005			ND	ND	ND	ND	2,572
2004			ND	ND	ND	ND	2,865

Year	Sample Location		STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Tritium (pCi/L)	954	436	301	279	215
2007			183	518	396	477	ND
2006			2,287	474	454	265	368
2005			836	403	257	ND	NS
2004			3,442	526	2,425	227	NS

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMB
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Cs-137 (pCi/g wet)	ND	ND	0.047	ND	0.167
2007			ND	ND	0.129	0.117	0.052
2006			ND	ND	ND	0.069	0.206
2005			ND	ND	0.144	0.096	0.547
2004			ND	ND	0.061	0.076	0.086

Year	Sample Location		STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Cs-137 (pCi/g wet)	0.700	0.427	0.071	ND	0.050
2007			0.155	0.473	0.027	0.045	0.031
2006			0.198	0.391	ND	0.039	ND
2005			0.182	0.182	0.053	ND	NS
2004			0.225	0.566	ND	0.056	NS

Notes:
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STC - Steel Creek
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Stokes - Stokes Bluff

Radiological Monitoring of Fish

SCDHEC Historical Data, 2004-2008

Year			Stevens	NSBLD	UTR	BDC	FMB
	Sample Location		Stevens	NSBLD	UTR	BDC	FMB
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
	Sample Cut		Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Cs-137 (pCi/g wet)	ND	ND	ND	ND	0.094
2007			ND	ND	0.057	0.079	ND
2006			ND	ND	ND	ND	0.107
2005			ND	ND	0.084	0.042	0.314
2004			ND	ND	ND	0.044	0.058

Year			STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Location		STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Cs-137 (pCi/g wet)	0.463	0.248	ND	ND	0.041
2007			0.102	0.303	0.026	ND	ND
2006			0.081	0.192	ND	ND	ND
2005			0.113	0.122	ND	ND	NS
2004			0.171	0.284	ND	ND	NS

Year			Stevens	NSBLD	UTR	BDC	FMB
	Sample Location		Stevens	NSBLD	UTR	BDC	FMB
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
	Sample Cut		Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Sr-89,90 (pCi/g Wet)	0.052	0.056	0.069	0.044	0.182
2007			0.122	0.078	0.156	0.170	0.173
2006			0.146	0.063	0.187	0.087	0.038
2005			NR	NR	NR	0.163	NR
2004			NR	NR	NR	NR	NR

Year			STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Location		STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
	Species		Bass	Bass	Bass	Bass	Bass
2008	Radionuclide	Sr-89,90 (pCi/g Wet)	0.053	0.034	0.035	0.036	0.080
2007			0.089	0.085	0.123	0.134	NA
2006			0.070	0.059	0.082	0.088	0.105
2005			0.102	0.100	0.125	0.269	NS
2004			NR	NR	NR	NR	NS

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Radiological Monitoring of Fish

SCDHEC Historical Data, 2004-2008

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMB
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Tritium (pCi/L)	NS	ND	278	ND	507
2007			NS	ND	ND	233	2,010
2006			397	302	ND	469	1,779
2005			ND	ND	ND	ND	669
2004			ND	ND	377	282	3,761

Year	Sample Location		STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Tritium (pCi/L)	247	406	373	ND	ND
2007			1,120	484	621	396	273
2006			2,104	451	423	296	ND
2005			340	362	ND	ND	NS
2004			295	315	2042	228	NS

Year	Sample Location		Stevens	NSBLD	UTR	BDC	FMB
	Sample Station		SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Cs-137 (pCi/g wet)	NS	ND	0.138	ND	0.026
2007			NS	0.041	ND	ND	0.342
2006			ND	ND	ND	ND	0.043
2005			ND	ND	ND	ND	ND
2004			ND	ND	ND	ND	0.316

Year	Sample Location		STC	LTR	Hwy. 301	Stokes	Hwy. 17
	Sample Station		SV-2017	SV-2020	SV-118	SV-355	SV-2090
	Sample Cut		Edible	Edible	Edible	Edible	Edible
	Species		Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Cs-137 (pCi/g wet)	0.032	ND	ND	ND	0.032
2007			0.075	0.053	ND	0.028	0.035
2006			0.101	0.135	ND	ND	0.035
2005			0.143	0.140	ND	ND	NS
2004			0.071	0.111	ND	ND	NS

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Radiological Monitoring of Fish

SCDHEC Historical Data, 2004-2008

Year		Sample Location	Stevens	NSBLD	UTR	BDC	FMB
		Sample Station	SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
		Sample Cut	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
		Species	Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Cs-137 (pCi/g wet)	NS	ND	0.075	ND	0.027
2007			NS	ND	ND	0.028	0.178
2006			ND	ND	ND	ND	0.051
2005			ND	ND	ND	ND	0.028
2004			ND	ND	ND	ND	0.167

Year		Sample Location	STC	LTR	Hwy. 301	Stokes	Hwy. 17
		Sample Station	SV-2017	SV-2020	SV-118	SV-355	SV-2090
		Sample Cut	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
		Species	Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Cs-137 (pCi/g wet)	ND	ND	ND	ND	ND
2007			ND	0.039	ND	ND	ND
2006			0.045	0.088	ND	ND	ND
2005			0.078	0.082	ND	ND	NS
2004			ND	0.205	ND	ND	NS

Year		Sample Location	Stevens	NSBLD	UTR	BDC	FMB
		Sample Station	SV-2059	SV-2028	SV-2011	SV-2013	SV-2015
		Sample Cut	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
		Species	Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Sr-89,90 (pCi/g Wet)	NS	0.039	0.042	0.055	0.032
2007			NS	0.082	0.051	0.109	0.047
2006			0.059	0.056	0.067	0.061	0.063
2005			0.160	ND	NR	NR	0.122
2004			NA	NR	NR	NR	NR

Year		Sample Location	STC	LTR	Hwy. 301	Stokes	Hwy. 17
		Sample Station	SV-2017	SV-2020	SV-118	SV-355	SV-2090
		Sample Cut	Non-Edible	Non-Edible	Non-Edible	Non-Edible	Non-Edible
		Species	Catfish	Catfish	Catfish	Catfish	Catfish
2008	Radionuclide	Sr-89,90 (pCi/g Wet)	0.034	0.037	0.023	0.039	0.027
2007			0.003	0.074	0.103	0.059	NA
2006			0.097	0.065	0.048	0.046	0.036
2005			0.095	0.070	0.191	0.101	NS
2004			NR	NR	NR	NR	NS

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Radiological Monitoring of Fish

SCDHEC and DOE-SR Data Comparison

Table 1
Tritium Activity Levels in Edible Bass
pCi/g[1]

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<LLD
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	<LLD
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	<LLD
	DOE-SR	3	<MDC
Fourmile Branch	ESOP	1	0.24
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	0.95
	DOE-SR	3	0.15*
Lower Three Runs	ESOP	1	0.44
	DOE-SR	3	0.10*
Hwy. 301	ESOP	1	0.30
	DOE-SR	3	<MDC
Stokes Bluff	ESOP	1	0.28
	DOE-SR	3	0.15
Hwy. 17	ESOP	1	0.22
	DOE-SR	3	0.09**
Average[2]	ESOP	6	0.40
	DOE-SR	8	0.14
Standard Deviation[2]	ESOP	6	0.28
	DOE-SR	8	0.03

Table 2
Tritium Activity Levels in Edible Catfish
pCi/g[1]

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<LLD
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	0.28
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	<LLD
	DOE-SR	3	<MDC
Fourmile Branch	ESOP	1	0.51
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	0.25
	DOE-SR	3	0.09*
Lower Three Runs	ESOP	1	0.41
	DOE-SR	3	<MDC
Hwy. 301	ESOP	1	0.37
	DOE-SR	3	<MDC
Stokes Bluff	ESOP	1	<LLD
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	<LLD
	DOE-SR	3	0.09**
Average[2]	ESOP	5	0.36
	DOE-SR	2	0.11
Standard Deviation[2]	ESOP	5	0.10
	DOE-SR	2	0.03

Notes: [1]ESOP - per gram of water in fish tissue
DOE-SR data from SRNS 2009
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[2]Calculated using detections only
N/A - Not Applicable

Radiological Monitoring of Fish

SCDHEC and DOE-SR Data Comparison

Table 3
Cesium-137 Activity Levels in Edible Bass
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	0.05
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	<MDA
	DOE-SR	3	0.04**
Fourmile Branch	ESOP	1	0.17
	DOE-SR	3	0.06
Steel Creek	ESOP	1	0.70
	DOE-SR	3	0.08
Lower Three Runs	ESOP	1	0.43
	DOE-SR	3	<MDC
Hwy. 301	ESOP	1	0.07
	DOE-SR	3	0.03
Stokes Bluff	ESOP	1	<MDA
	DOE-SR	3	0.03**
Hwy. 17	ESOP	1	0.05
	DOE-SR	3	<MDC
Average[2]	ESOP	6	0.24
	DOE-SR	11	0.05
Standard Deviation[2]	ESOP	6	0.27
	DOE-SR	11	0.02

Table 4
Cesium-137 Activity Levels in Edible Catfish
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	0.14
	DOE-SR	3	0.09
Beaver Dam Creek	ESOP	1	<MDA
	DOE-SR	3	<MDC
Fourmile Branch	ESOP	1	0.03
	DOE-SR	3	0.02**
Steel Creek	ESOP	1	0.03
	DOE-SR	3	<MDC
Lower Three Runs	ESOP	1	<MDA
	DOE-SR	3	0.06*
Hwy. 301	ESOP	1	<MDA
	DOE-SR	3	0.02*
Stokes Bluff	ESOP	1	<MDA
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	0.03
	DOE-SR	3	0.04**
Average[2]	ESOP	4	0.06
	DOE-SR	9	0.06
Standard Deviation[2]	ESOP	4	0.05
	DOE-SR	9	0.03

Notes:
DOE-SR data from SRNS 2009
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[2]Calculated using detections only

Radiological Monitoring of Fish

SCDHEC and DOE-SR Data Comparison

Table 5
Cesium-137 Activity Levels in Non-edible Bass
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	<MDA
	DOE-SR	3	<MDC
Beaver Dam Creek	ESOP	1	<MDA
	DOE-SR	3	<MDC
Fourmile Branch	ESOP	1	0.09
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	0.46
	DOE-SR	3	0.05**
Lower Three Runs	ESOP	1	0.25
	DOE-SR	3	<MDC
Hwy. 301	ESOP	1	<MDA
	DOE-SR	3	0.02**
Stokes Bluff	ESOP	1	<MDA
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	0.04
	DOE-SR	3	<MDC
Average[2]	ESOP	4	0.21
	DOE-SR	2	0.04
Standard Deviation[2]	ESOP	4	0.19
	DOE-SR	2	0.01

Table 6
Cesium-137 Activity Levels in Non-edible Catfish
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	<MDA
	DOE-SR	3	<MDC
Upper Three Runs	ESOP	1	0.08
	DOE-SR	3	0.05*
Beaver Dam Creek	ESOP	1	<MDA
	DOE-SR	3	<MDC
Fourmile Branch	ESOP	1	0.03
	DOE-SR	3	<MDC
Steel Creek	ESOP	1	<MDA
	DOE-SR	3	<MDC
Lower Three Runs	ESOP	1	<MDA
	DOE-SR	3	0.03**
Hwy. 301	ESOP	1	<MDA
	DOE-SR	3	0.02*
Stokes Bluff	ESOP	1	<MDA
	DOE-SR	3	<MDC
Hwy. 17	ESOP	1	<MDA
	DOE-SR	3	0.03**
Average[2]	ESOP	2	0.05
	DOE-SR	6	0.04
Standard Deviation[2]	ESOP	2	0.03
	DOE-SR	6	0.02

Notes: DOE-SR data from SRNS 2009
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
[2]Calculated using detections only

Radiological Monitoring of Fish

SCDHEC and DOE-SR Data Comparison

Table 7
Strontium-89,90 Activity Levels in Non-edible Bass
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	0.06
	DOE-SR	3	0.08
Upper Three Runs	ESOP	1	0.07
	DOE-SR	3	0.10
Beaver Dam Creek	ESOP	1	0.04
	DOE-SR	3	0.10
Fourmile Branch	ESOP	1	0.18
	DOE-SR	3	0.13
Steel Creek	ESOP	1	0.05
	DOE-SR	3	0.11
Lower Three Runs	ESOP	1	0.03
	DOE-SR	3	0.06
Hwy. 301	ESOP	1	0.04
	DOE-SR	3	0.10
Stokes Bluff	ESOP	1	0.04
	DOE-SR	3	0.10
Hwy. 17	ESOP	1	0.08
	DOE-SR	3	0.07
Average^{2}	ESOP	9	0.07
	DOE-SR	27	0.09
Standard Deviation^{2}	ESOP	9	0.05
	DOE-SR	27	0.03

Table 8
Strontium-89,90 Activity Levels in Non-edible Catfish
pCi/g

Location	Agency	# of samples	Result
NSBLD	ESOP	1	0.04
	DOE-SR	3	0.08
Upper Three Runs	ESOP	1	0.04
	DOE-SR	3	0.06
Beaver Dam Creek	ESOP	1	0.06
	DOE-SR	3	0.08
Fourmile Branch	ESOP	1	0.03
	DOE-SR	3	0.11
Steel Creek	ESOP	1	0.03
	DOE-SR	3	0.08
Lower Three Runs	ESOP	1	0.04
	DOE-SR	3	0.09
Hwy. 301	ESOP	1	0.02
	DOE-SR	3	0.11
Stokes Bluff	ESOP	1	0.04
	DOE-SR	3	0.09
Hwy. 17	ESOP	1	0.03
	DOE-SR	3	0.09
Average^{2}	ESOP	9	0.04
	DOE-SR	27	0.09
Standard Deviation^{2}	ESOP	9	0.01
	DOE-SR	27	0.03

Notes: DOE-SR data from SRNS 2009
DOE-SR results are averages
* includes one result below MDC
** includes two results below MDC
^{2}Calculated using detections only
NA - Not Analyzed

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4.1.5 Summary Statistics

Radiological Fish Monitoring

Notes:

1. N – denotes number of samples
2. Tritium results (pCi/L) represent the activity level in the water distilled from the fish tissue.
3. Cs-137 results (pCi/g) represent the activity level in natural fish tissue.
4. Strontium results (pCi/g) represent the activity level in an aliquot of wet fish tissue.

Summary Statistics

Radiological Fish Monitoring

Tritium Levels (pCi/L) in Savannah River Fish, 2008

Edible	N (ND)	Average	Standard Deviation	Median	Maximum	Minimum
Bass	6 (4)	404	280	290	954	215
Catfish	5 (4)	362	104	373	507	247
Pickerel	0 (1)					

Non-detections (ND) excluded from computations
Tritium not detected at Stevens Creek
Tritium reported as activity in the water extracted from fish tissue

Cesium-137 Levels (pCi/g - Wet) in Savannah River Fish, 2008

Edible	N (ND)	Average	Standard Deviation	Median	Maximum	Minimum
Bass	6 (3)	0.244	0.266	0.119	0.700	0.047
Catfish	4 (5)	0.057	0.054	0.032	0.138	0.026
Pickerel	1 (1)				0.480	
Non-edible						
Bass	4 (5)	0.212	0.190	0.171	0.463	0.041
Catfish	2 (7)	0.051	0.034	0.051	0.075	0.027
Pickerel	0 (2)					

Non-detections (ND) excluded from computations
Cs-137 not detected at Stevens Creek
Pickerel collected only at Upper Three Runs and Fourmile Branch

Strontium-89,90 Levels (pCi/g - Wet) in Savannah River Fish, 2008

Non-edible	N (ND)	Average	Standard Deviation	Median	Maximum	Minimum
Bass	9 (0)	0.065	0.047	0.053	0.182	0.034
Catfish	9 (0)	0.036	0.009	0.009	0.055	0.023

Non-detections (ND) excluded from computations
Stevens Creek excluded from computations

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4.2 Radiological Game Animal Monitoring Adjacent to SRS

4.2.1 Summary

Since the initiation of nuclear testing, concern has grown over the accumulation of radionuclides in the environment. The Savannah River Site (SRS) has historically been a nuclear weapons material production, separation, and research facility located along the Savannah River within Aiken, Allendale, and Barnwell counties of South Carolina. The operation of production reactors, waste storage sites and other nuclear facilities at SRS has resulted in the release of cesium-137 (Cs-137) to the environment for the past 50 years. As part of the environmental monitoring program, the Department of Energy - Savannah River (DOE-SR) investigates a variety of mammalian species for the presence of contaminants. Of all of the mammalian species investigated, white-tailed deer and feral hogs have shown the highest potential for a human exposure pathway for Cs-137 (Haselow 1991).

DOE-SR has annual hunts open to members of the general public to control the site's deer and feral hog population and to reduce animal vehicle accidents. Before any animal is released to a hunter, SRS personnel monitor Cs-137 levels for exposure limit considerations, to ensure established administrative dose limits are not exceeded. DOE-SR does not collect game animal samples within the SCDHEC study area and off-site hunter doses are based on DOE-SR models. Therefore, no direct comparisons could be made between ESOP and DOE-SR data.

The precise ranging behavior of individual deer and hogs on the SRS is unknown. White-tailed deer and feral hogs have access to a number of contaminated areas on the SRS; and, consequently, are a vector for the redistribution of contaminants, primarily Cs-137, to off-site locations. Consumption of these wildlife species can result in the transfer of contaminants to humans. Cs-137 is of concern because of its relatively long physical half-life of 30 years, and its availability to game animals and associated health risk to humans.

Cs-137 is readily incorporated into the human body because of its similarity to potassium-40 (K-40) in physiological processes (Davis 1963). Cs-137 concentrates in animal skeletal muscles, which are selectively consumed by hunters (Brisbin 1975). Cs-137 is an important radionuclide because of its relatively long physical half-life of 30 years and its associated health risks (Haselow 1991). Cs-137 emits both beta and gamma radiation, contributing to both internal and external radiation exposure, which may be associated with gastrointestinal, genetic, hemopoietic, and central nervous system damage (Bond 1965). Because of these concerns, Cs-137 will be the only isotope discussed in this report.

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) conducts independent non-regulatory oversight of game animal monitoring activities at the SRS. The game animal project addresses concerns of potentially contaminated white-tailed deer and feral hogs migrating off the SRS and can provide valuable information concerning the potential off-site exposure to Cs-137 by analyzing samples collected off-site. SCDHEC analyzed muscle tissue collected in 2008 for Cs-137 from 51 deer collected from area hunters via hunting clubs, plantations, and Crackerneck Wildlife Management Area within a five-mile study area adjacent to the SRS. Additionally, 10 tissue samples were collected and analyzed from a background location 120 miles northeast of the SRS in the McBee, South Carolina area. Cesium-137 data ranged from less than the minimum detectable activity (MDA) to 4.60 picocuries per gram (pCi/g) for deer within the five-mile study area adjacent to the SRS. Cesium-137 data ranged from 1.91 to 10.59 pCi/g for deer at the 120-mile background location. Sample size, location, and collection dates were dependent on the participating hunters. ESOP was not able to obtain any hog samples from hunters in 2008.

Results and Discussion

Cs-137

Cesium-137 and the naturally occurring isotopes K-40, lead-212, lead-214, and radium-226 were the only isotopes detected in game samples collected in 2008. Naturally occurring isotopes will not be discussed in this report. Cesium-137 concentrations from deer collected in the SRS perimeter study area are shown in (Map 15, Section 4.2.2). Analytical results are listed under each zone in Section 4.2.4.

Routine operations at the SRS have released Cs-137 to the regional environment surrounding the SRS. The most significant releases occurred during the early years of site operation when Cs-137 was released to seepage basins and site streams. The SRS facilities that have documented Cs-137 releases are the production reactors, separation areas, liquid waste facilities, solid waste disposal facility, central shops, heavy water rework facility, and the Savannah River Laboratory. A number of other facilities handled material containing Cs-137, but releases, if any are not documented.

A total of 61 deer samples were collected. Fifty-one samples were collected within five miles of the SRS perimeter. Ten deer background samples were collected 120 miles northeast of the SRS. ESOP compared Cs-137 activities to DOE-SR results.

ESOP and DOE-SR Data Comparison

Cesium-137 activities from the 51 SCDHEC perimeter samples ranged from less than the MDA to 4.60 pCi/g, with an average of 0.72 (± 0.83) pCi/g (Section 4.2.5). All SCDHEC hunt zone averages were within one standard deviation of the overall perimeter average. Results from the 10 background samples ranged from 1.91 pCi/g to 10.59 pCi/g, with an average of 4.59 (± 2.45) pCi/g. DOE-SR reported an approximate field measurement range of 1 pCi/g to 12.65 pCi/g with an average of 2.40 pCi/g from 432 deer harvested on the SRS in 2008 (SRNS 2009). The DOE-SR field average was within three standard deviations of the SCDHEC average. Average perimeter, background, and DOE-SR on-site Cs-137 levels for the past five years (Section 4.2.5) are indicated in Figure 1 (Section 4.2.3).

Statistical Analysis

The 2008 perimeter Cs-137 average result, 0.72 pCi/g, is within two standard deviations of the background average 4.59 (± 2.45) pCi/g. The 2004 to 2008 SCDHEC yearly off-site Cs-137 average activity, 1.04 (± 0.41) pCi/g, is within two standard deviations of the DOE-SR on-site average of 2.82 (± 1.44) pCi/g. The five-year Cs-137 averages between SCDHEC and DOE-SR may differ for various reasons. The DOE-SR data is acquired in the field by using a portable sodium iodide detector while SCDHEC data are analytical results. Also, the SCDHEC data present challenges for direct comparisons to DOE-SR data because the perimeter area is heavily baited with corn. Therefore, the uptake of Cs-137 by these animals will be reduced based on the increased K-40 levels in the corn from fertilizers (Heckman and Kamprath 1992).

Conclusions/Recommendations

Although Cs-137 was deposited on the SRS from site operations, levels found in the study area and background location are likely results of global aboveground nuclear weapons testing (Haselow 1991). DOE-SR does not collect game animal samples within the SCDHEC study area and off-site hunter doses are based on DOE-SR models. Therefore, no direct comparisons could be made between ESOP and DOE-SR data.

Age, sex, body weight, soil type, diet and collection location may affect the Cs-137 activities found in white-tailed deer and hogs (Haselow 1991). The differences in average activities indicated in Figure 1 (Section 4.2.3) are probably a combination of one or more of the above factors. A hunter consuming deer from SRS, the study area, or background locations would most likely ingest a portion of the activity associated with these animals. Refer to the ESOP Critical Pathway Dose report for a better understanding of the contamination found in game versus other food sources.

A portion of the elevated Cs-137 activity found in deer harvested in hunt zones five and six (Figure 2, Section 4.2.3) may be attributed to historic SRS operations. These operations released known Cs-137 contamination to Steel Creek, Par Pond, and Lower Three Runs, their floodplains, and the Savannah River swamp, all of which impact hunt zones four, five, six and seven. Further research may be needed to help determine why elevated Cs-137 activities are found in other hunt units.

Attention was focused on trying to determine background levels for the SRS deer herd in 2008. SCDHEC is currently working with the USEPA, DOE-SR, and Eastern Illinois University in an effort to achieve this. Investigators from Eastern Illinois University are using SCDHEC game animal data for a comparison of Cs-137 body burdens in SRS deer. ESOP will continue to work with all involved parties until a scientific determination of SRS background levels are determined.

ESOP will continue to monitor Cs-137 levels in deer within the established study area and backgrounds locations, with additional efforts on collecting feral hog samples in the coming years.

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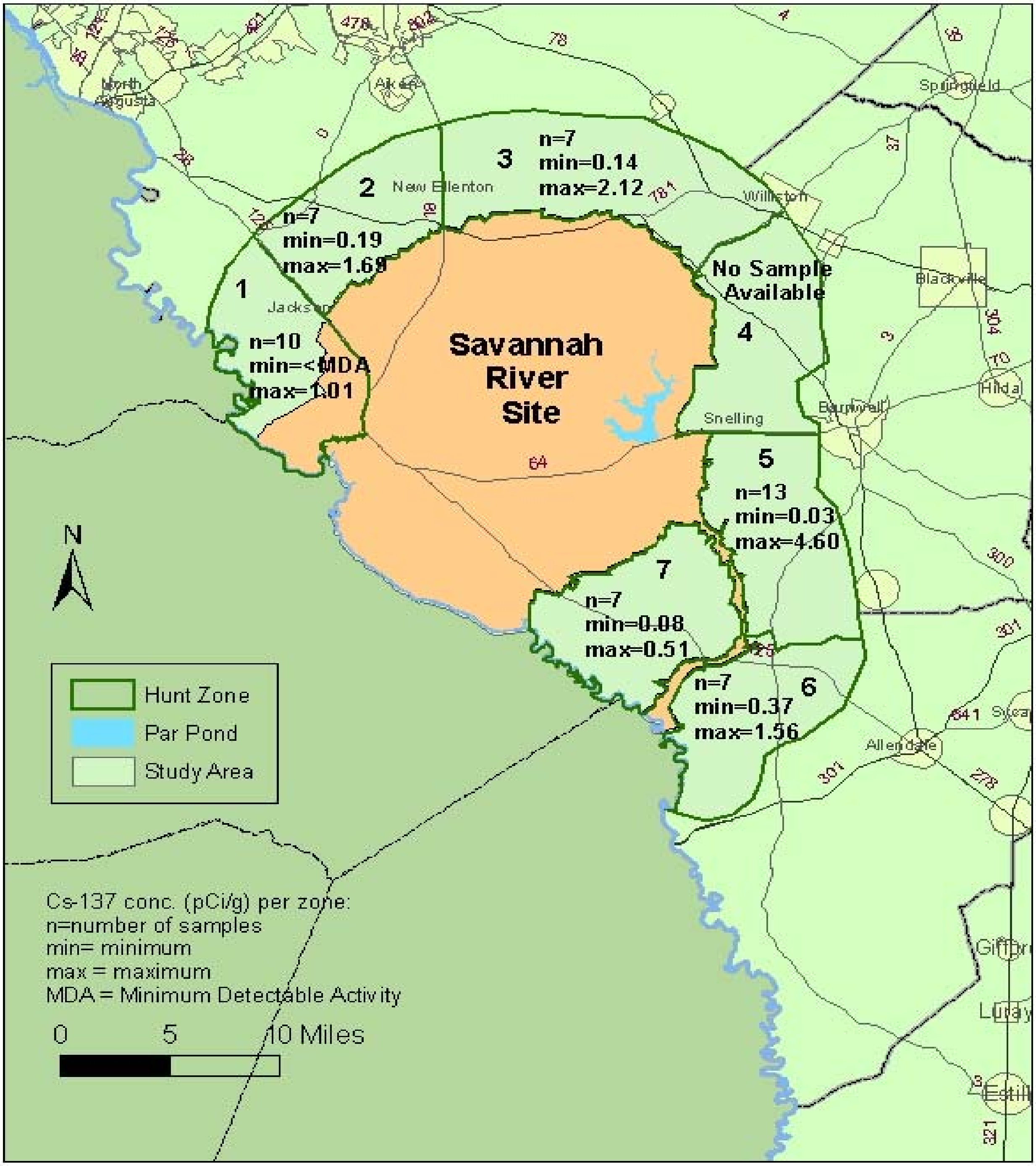
4.2.2

Map. 15 Cesium-137 Ranges In Game Animals Adjacent to SRS



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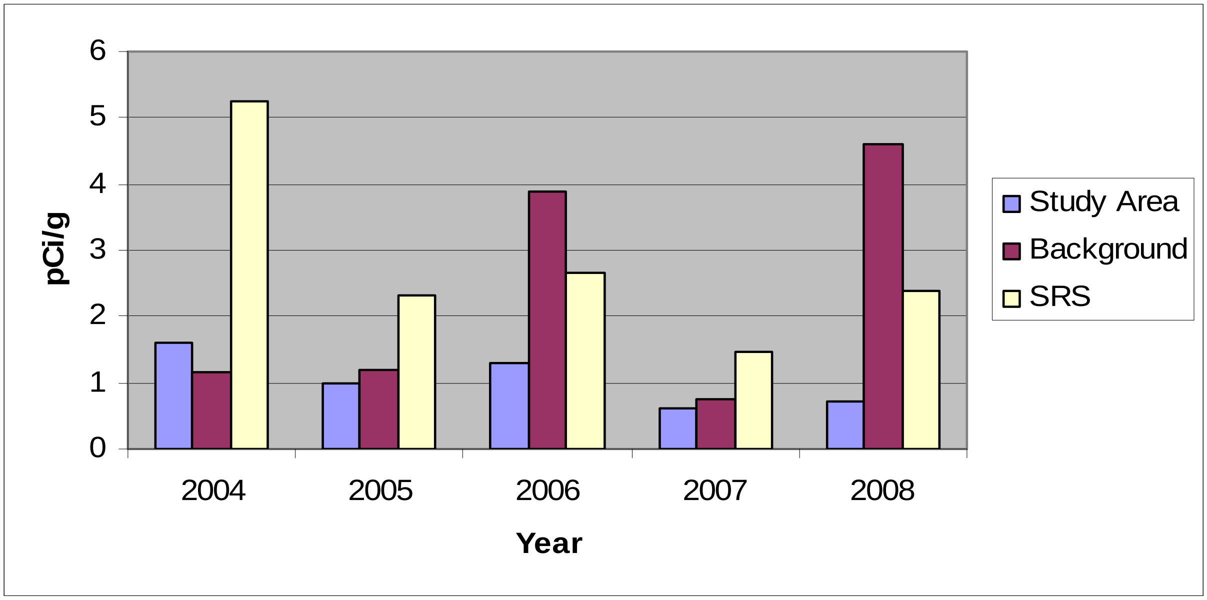
4.2.3 Tables and Figures

Radiological Game Animal Monitoring Adjacent to SRS

Figure 1. Average Cs-137 Concentration In Deer, 2004-2008



Background Locations
2004 - 2005 = Francis Marion National Forest. Hellhole Wildlife Management Area
2006 - 2008 = Carolina Sandhills National Wildlife Refuge

Figure 2. SCDHEC Hunt Zone Average Cs-137 Concentration In Deer, 2008

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4.2.4 Data

Radiological Game Animal Monitoring Adjacent to SRS

Notes:

1. MDA - Minimum Detectable Activity
2. Sig - Sigma

Radiological Game Animal Monitoring Adjacent to SRS Project Data

2008 Perimeter Cs-137 Data

Sample Location		Zone-1	Zone-1	Zone-1	Zone-1	Zone-1	Zone-1
Sample Date		10/17/2008	10/17/2008	10/17/2008	10/17/2008	10/17/2008	10/17/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Buck	Buck
Weight	Pounds	60	145	115	125	100	115
Cesium-137	(pCi/g) wet	0.69	0.06	0.24	0.68	<MDA	0.09
Uncertainty	(+/- 2sig)	0.09	0.02	0.04	0.08	NA	0.02
MDA	(pCi/g) wet	0.03	0.02	0.02	0.02	0.02	0.02

Sample Location		Zone-1	Zone-1	Zone-1	Zone-1
Sample Date		10/17/2008	10/17/2008	10/17/2008	10/17/2008
Species		Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Doe
Weight	Pounds	145	100	125	85
Cesium-137	(pCi/g) wet	0.06	1.01	<MDA	0.05
Uncertainty	(+/- 2sig)	0.02	0.12	NA	0.02
MDA	(pCi/g) wet	0.02	0.03	0.02	0.02

Sample Location		Zone-2	Zone-2	Zone-2	Zone-2	Zone-2	Zone-2
Sample Date		9/24/2008	9/20/2008	11/11/2008	11/11/2008	11/11/2008	11/11/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Buck	Buck
Weight	Pounds	180	100	130	180	175	150
Cesium-137	(pCi/g) wet	1.69	0.38	0.34	0.19	0.22	0.77
Uncertainty	(+/- 2sig)	0.16	0.06	0.04	0.03	0.03	0.08
MDA	(pCi/g) wet	0.03	0.03	0.02	0.02	0.02	0.01

Sample Location		Zone-2
Sample Date		11/11/2008
Species		Deer
Sex		Buck
Weight	Pounds	125
Cesium-137	(pCi/g) wet	0.25
Uncertainty	(+/- 2sig)	0.03
MDA	(pCi/g) wet	0.02

Sample Location		Zone-3	Zone-3	Zone-3	Zone-3	Zone-3	Zone-3
Sample Date		9/22/2008	9/24/2008	9/6/2008	12/4/2008	12/4/2008	12/15/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Buck	Doe
Weight	Pounds	120	180	100	170	135	85
Cesium-137	(pCi/g) wet	0.66	0.23	2.12	1.85	0.36	0.14
Uncertainty	(+/- 2sig)	0.08	0.05	0.20	0.18	0.04	0.02
MDA	(pCi/g) wet	0.03	0.03	0.03	0.01	0.01	0.02

Sample Location		Zone-3
Sample Date		12/15/2008
Species		Deer
Sex		Doe
Weight	Pounds	90
Cesium-137	(pCi/g) wet	0.47
Uncertainty	(+/- 2sig)	0.05
MDA	(pCi/g) wet	0.01

Radiological Game Animal Monitoring Adjacent to SRS Project Data

2008 Perimeter Data

Sample Location		Zone-5	Zone-5	Zone-5	Zone-5	Zone-5	Zone-5
Sample Date		9/18/2008	9/26/2008	8/20/2008	8/15/2008	9/12/2008	9/18/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Buck	Buck	Buck	Buck	Doe
Weight	Pounds	140	110	130	140	125	85
Cesium-137	(pCi/g) wet	0.18	1.59	0.36	2.42	1.66	1.84
Uncertainty	(+/- 2sig)	0.04	0.15	0.06	0.23	0.16	0.19
MDA	(pCi/g) wet	0.02	0.03	0.03	0.04	0.03	0.04

Sample Location		Zone-5	Zone-5	Zone-5	Zone-5	Zone-5	Zone-5
Sample Date		9/20/2008	10/22/2008	10/11/2008	11/6/2008	11/8/2008	11/8/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Doe	Doe	Buck	Buck
Weight	Pounds	135	100	110	110	155	120
Cesium-137	(pCi/g) wet	0.20	4.60	0.29	0.45	1.21	0.03
Uncertainty	(+/- 2sig)	0.04	0.45	0.04	0.05	0.12	0.01
MDA	(pCi/g) wet	0.02	0.03	0.01	0.01	0.01	0.02

Sample Location		Zone-5
Sample Date		11/8/2008
Species		Deer
Sex		Buck
Weight	Pounds	150
Cesium-137	(pCi/g) wet	0.37
Uncertainty	(+/- 2sig)	0.05
MDA	(pCi/g) wet	0.01

Sample Location		Zone-6	Zone-6	Zone-6	Zone-6	Zone-6	Zone-6
Sample Date		11/28/2008	11/28/2008	11/28/2008	11/28/2008	11/28/2008	11/28/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Doe	Doe	Buck	Buck	Buck	Buck
Weight	Pounds	95	60	175	140	100	145
Cesium-137	(pCi/g) wet	0.42	1.56	0.62	0.97	0.48	0.37
Uncertainty	(+/- 2sig)	0.05	0.13	0.06	0.09	0.05	0.04
MDA	(pCi/g) wet	0.02	0.02	0.02	0.02	0.02	0.02

Sample Location		Zone-6
Sample Date		11/28/2008
Species		Deer
Sex		Buck
Weight	Pounds	120
Cesium-137	(pCi/g) wet	0.86
Uncertainty	(+/- 2sig)	0.08
MDA	(pCi/g) wet	0.02

Sample Location		Zone-7	Zone-7	Zone-7	Zone-7	Zone-7	Zone-7
Sample Date		11/1/2008	10/23/2008	10/23/2008	10/23/2008	10/23/2008	10/23/2008
Species		Deer	Deer	Deer	Deer	Deer	Deer
Sex		Doe	Buck	Buck	Doe	Buck	Doe
Weight	Pounds	100	160	50	55	70	85
Cesium-137	(pCi/g) wet	0.30	0.27	0.50	0.51	0.28	0.36
Uncertainty	(+/- 2sig)	0.06	0.04	0.10	0.07	0.06	0.06
MDA	(pCi/g) wet	0.04	0.02	0.05	0.04	0.04	0.03

Sample Location		Zone-7
Sample Date		10/23/2008
Species		Deer
Sex		Doe
Weight	Pounds	100
Cesium-137	(pCi/g) wet	0.08
Uncertainty	(+/- 2sig)	0.02
MDA	(pCi/g) wet	0.02

Radiological Game Animal Monitoring Adjacent to SRS Project Data

2008 Background Data

Sample Location		Background	Background	Background	Background	Background
Sample Date		11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Buck	Buck
Weight	Pounds	116	83	132	164	149
Cesium-137	(pCi/g) wet	3.01	4.64	6.30	4.32	1.91
Uncertainty	(+/- 2sig)	0.29	0.45	0.60	0.41	0.19
MDA	(pCi/g) wet	0.02	0.03	0.02	0.02	0.02

Sample Location		Background	Background	Background	Background	Background
Sample Date		11/7/2008	11/7/2008	11/7/2008	11/7/2008	11/7/2008
Species		Deer	Deer	Deer	Deer	Deer
Sex		Buck	Doe	Buck	Doe	Buck
Weight	Pounds	97	40	78	93	165
Cesium-137	(pCi/g) wet	3.89	5.09	3.22	10.59	2.92
Uncertainty	(+/- 2sig)	0.37	0.48	0.31	1.00	0.28
MDA	(pCi/g) wet	0.02	0.03	0.02	0.03	0.02

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4.2.5 Summary Statistics

Radiological Game Animal Monitoring Adjacent to SRS

Notes:
1. N - Number of Samples
2. Std.Dev. - Standard Deviation
3. Min - Minimum
4. Max - Maximum
5. MDA - Minimum Detectable Activity
6. Average, Std.Dev., and Median calculated using detections only
7. NA - Not Available

Radiological Game Animal Monitoring Adjacent to SRS Summary Statistics

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Background Locations
2004 - 2005 - Francis Marion National Forest. Hellhole Wildlife Management Area
2006 - 2008 - Carolina Sandhills National Wildlife Refuge

Cs-137 concentration (pCi/g wet weight) in deer collected in 2008

	N	Average	Std. Dev.	Median	Min.	Max
Study Area	51	0.72	0.83	0.38	<0.02	4.60
Background	10	4.59	2.45	4.11	1.91	10.59

Cs-137 concentration (pCi/g wet weight) in deer collected in 2008 SCDHEC Hunt Zones

Hunt Zone	N	Average	Std. Dev.	Median	Min.	Max
Zone 1	10	0.36	0.38	0.17	<0.02	1.01
Zone 2	7	0.55	0.54	0.34	0.19	1.69
Zone 3	7	0.83	0.81	0.47	0.14	2.12
Zone 5	13	1.17	1.29	0.45	0.03	4.60
Zone 6	7	0.75	0.42	0.62	0.37	1.56
Zone 7	7	0.33	0.15	0.30	0.08	0.51

Cs-137 concentration (pCi/g wet weight) in deer collected from 2004 - 2008

	Year	N	Average	Std.Dev	Median	Min.	Max.
Study Area	2004	50	1.60	1.10	1.31	0.07	4.56
Background	2004	15	1.16	0.63	1.18	0.34	2.44
SRS	2004	817	5.26	NA	NA	1.00	48.30
Study Area	2005	66	0.98	0.87	0.70	< MDA	4.32
Background	2005	15	1.19	0.38	1.25	0.48	1.60
SRS	2005	215	2.32	NA	NA	1.00	8.10
Study Area	2006	68	1.29	1.05	0.85	< MDA	3.90
Background	2006	60	3.90	1.38	3.86	1.17	7.02
SRS	2006	324	2.65	NA	NA	1.00	9.05
Study Area	2007	65	0.62	0.61	0.36	< MDA	3.30
Background	2007	20	0.75	0.58	0.57	0.15	2.09
SRS	2007	388	1.46	NA	NA	1.00	8.70
Study Area	2008	51	0.72	0.83	0.38	<MDA	4.60
Background	2008	10	4.59	2.45	4.11	1.91	10.59
SRS	2008	432	2.40	NA	NA	1	12.65
Study Area	2004 -' 08	300	1.04	0.41	0.98	< MDA	4.60
Background	2004 -' 08	120	2.32	1.78	1.19	0.15	10.59
SRS	2004 -' 08	2176	2.82	1.44	2.40	1.00	48.30

5.1 Critical Pathway Dose

5.1.1 Summary

The Environmental Surveillance and Oversight Program (ESOP) of the South Carolina Department of Health and Environmental Control (SCDHEC) monitored the Savannah River Site (SRS) and perimeter areas under an Agreement in Principle with the United States Department of Energy (USDOE). Atmospheric pathway (APW) and liquid pathway (LPW) discharges from the SRS were monitored by the Department of Energy – Savannah River (DOE-SR) contractor Savannah River Nuclear Solutions (SRNS), environmental monitoring section. DOE-SR and SCDHEC used data from these monitoring activities to calculate the potential radiation dose to the surrounding public. SCDHEC implemented a Radionuclide Dose Calculation Project and a Critical Pathway Project to calculate the potential exposure or dose to the public within 50-miles of an SRS center-point. These two reports were combined into one report starting in 2007. Historical missions and data in previous years reports, primarily the SRS Environmental Reports (1999-2007), the Risk Assessment Corporation report (Till 2001) and the Centers for Disease Control study (CDC 2004) helped to establish the SCDHEC (1999-2008) Critical Pathway Dose report basis. Radionuclide dose or potential exposure to the public was calculated from radionuclide concentration activities found in various media that may impact the public (Section 5.1.3). A comparison of similar SCDHEC and DOE-SR media resulted in an evaluation of both programs based on averages and standard deviations (Section 5.1.1). Summary statistics (Section 5.1.4), and tables and figures (Section 5.1.2) illustrate the trends and central tendencies in the critical pathway dose. The critical pathway dose is now presented on a non-scenario (Section 5.1.2, Table 1), scenario (Section 5.1.2, Table 2), and individual optional scenario (Section 5.1.2, Table 1) basis allowing readers to select scenarios or specific exposures that impact their individual lifestyle choices. The SCDHEC maximum exposed individual (MEI) was a subsistence and survivalist type of individual who resided in the downriver swamp area below all SRS contributions to the Savannah River and received the MEI dose based on the single highest detection per radionuclide per media collected in the environment.

The 2008 non-scenario media calculations were represented on an average exposed individual (AEI) basis and as a single highest detection exposure (MAX) per media basis above the average background (Section 5.1.2, Table 1). Radiation exposures to a single highest detection greater than background from each radionuclide exposure per media were assigned to the SCDHEC MEI. This MEI (4.663 mrem) basis provides a limit based on potential dose detections. However, the true MEI may be higher since not all dose potential was collected and measured. This is the reason for calculating the MEI based on the single highest detection per radionuclide per media at the maximum exposure rate (protective). This MEI dose is due mostly to single maximum food detections (from MAX column) that are consumed by one individual (the highest dose from deer, fish, vegetables or mushrooms, etc.). Typical exposures on a non-scenario basis should be closer to the AEI media totals. This MEI is theoretical since a single individual could not be at all locations where and when all maximums occurred and sustain that exposure at a constant rate throughout the year.

Each media radionuclide dose above background excluding naturally occurring radioactive material (NORM) was considered as part of a different critical pathway lifestyle with contributions through the inhalation, ingestion, and direct exposure routes. The typical perimeter dose exposure greater than background would occur on an average exposed individual or AEI (1.893 mrem) basis (Section 5.1.2, Table 1). The SRS perimeter study area total exposure may be viewed either on an AEI (1.893 mrem) or MAX detection (4.663 mrem) basis that excludes probable NORM. The SCDHEC total for applicable MAX (assigned to the MEI) is based on the total of the highest possible exposure from environmental media (MAX column) plus all other dose detected by DOE-SR and not sampled by SCDHEC that has the potential to impact the public (Section 5.1.2, Table 3).

Thus, the reader should not assume that the MEI dose applies to them except on an optional specific scenario basis that is discussed after the scenario basis section. Both AEI and MAX (maximum detections used for the MEI calculation) media calculations were categorized into two primary exposure pathways (atmospheric and liquid pathways) that were subdivided into other more specialized exposure routes (inhalation, ingestion, and direct exposure) by media. These results are given under the critical pathway and statistical sections.

Four basic AEI and two MAX scenarios were developed based on SCDHEC data alone, which calculate a dose relative to public exposure activities (Section 5.1.2, Table 2). See the results section 2.0 for the six scenario details for 2008. The basic scenario results for 1999-2008 are given in the summary statistics Section 5.1.4 and Section 5.1.2, Table 2. The alpha-beta dose assumptions are now replaced by observed maximum detections (single highest detections per radionuclide per media) that provide a measured (not assigned) upper bound of potential dose and protective buffer for public dose calculations.

The third dose estimate option allows the individual to develop their own specific scenario by substituting specific media MAX values into the general non-scenario dose total for the AEI (Section 5.1.2, Table 1). This individual optional personal scenario calculation basis is illustrated in the food pathway discussion and cannot be greater than 4.663 mrem for SCDHEC data in 2008 based on the selected media MAX in Section 5.1.2, Table 1. Additional dose is added for the first time by SCDHEC for edible mushrooms that bioconcentrate cesium-137 (Cs-137). A survey of bolete fungi that are generally edible adds 1.767 mrem of MAX dose exposure as part of the SCDHEC MAX dose (a survivalist) total of 4.663 mrem. Other media dose observed by DOE-SR (28.794 mrem) that was not sampled or detected by SCDHEC may also be added to the optional total dose, if applicable to the individual (Section 5.1.2, Table 3). The total MEI dose from SCDHEC and DOE-SR combined gave a total MEI estimate of 33.457 mrem in 2008.

The All-Sources (all dose detections) liquid (LPW) pathway (59.325 %) was dominant on an AEI basis in 2008, but the atmospheric pathway (57.37 %) was dominant over the 1999-2008 year period (Section 5.1.2, Table 1, Table 6). The Perimeter (applicable dose only) atmospheric pathway was also dominant in 2008 on a MAX basis. However, note from the drop in percentage of the liquid pathway on a MAX basis (compare AEI and MEI column media results) that most higher detections for particular radionuclides occurred in the atmospheric pathway (increased on a single highest detection basis). The Section 5.1.2, Table 1 exposure route percentage calculations were calculated as an AEI% of the perimeter dose.

The food ingestion dose pathway (98.31 % of the 2008 non-scenario dose on an AEI basis) contributed the greatest dose to the public during 2008, primarily from game animal, fish, and bolete fungi consumption exposure to cesium-137 (Cs-137, 92.57 % for all media in 2008) (Section 5.1.2, Table 1 and Section 5.1.4, Table 1). Note from Section 5.1.4, Table 1 that Cs-137 was 65.61 % of the dose overall since 1999. The increasing importance of Cs-137 dose appears to increase on a proportional basis as new wild food sources are sampled for dose (note hog and fungi dose additions in Section 5.1.2, Table 3). Strontium-89/90 (Sr-89/90) dose contributions occurred in both atmospheric and liquid pathways (3.93 % in 2008 and 3.47 % total since 1999)(Section 5.1.4, Table 1, total all strontium).

The second highest dose pathway was due to liquid ingestion exposure (1.268 %), primarily from tritium (3.39 % for all media in 2008 and 3.00 % since 1999)(Section 5.1.2, Table 1 and Section 5.1.4, Table 1). Cesium-137, Sr-89/90, and tritium percentages generally increased on a proportional basis due to changing media and dose considerations since 1999. Most other dose specific radionuclides may or may not be detected in particular years. Cesium-137, Sr-89/90, and tritium are expected to continue declining toward a baseline if this is only legacy dose. However, some radionuclide dose, e.g. tritium, may increase slightly (low energy beta) on a proportional basis as new nuclear reactor facilities are added.

The direct exposure pathway (0.37 %) was third, primarily due to Cs-137 in riverbank soil deposited from stream sediments (Section 5.1.2, Table 1 and Section 5.1.3, Data). The air inhalation pathway was fourth (0.053 % of dose), primarily due to tritium. The typical sportsman food (deer, hog, fish) contributed 1.079 mrem to the AEI dose or 2.524 mrem to the MAX dose in 2008, and averaged 11.25 (± 11.09) mrem with a median of 8.21 mrem from 1999 through 2008 (Section 5.1.2, Tables 1 and 4). Compare this to the non-sportsman typical food (vegetables and milk) dose average for the same time period or 0.08 (± 0.08) mrem and 0.05 mrem median. Sportsman food contributed the highest MAX dose in 2008 (2.52 mrem), bolete fungi second (1.767 mrem), and the smallest food dose to the public was from local vegetables and milk (0.108 mrem)(Section 5.1.2, Table 4). The scenario averages for 1999-2008 that include all other dose plus food are discussed in Section 5.1.1, 1999-2008 Statistics.

The main non-NORM radionuclide dose contributions from 1999 through 2008 were 16.04 mrem from Cs-137, 0.85 mrem from strontium-89 and Sr-90 (Sr-89/90), and 0.73 mrem from tritium (Section 5.1.4, Table 1). These SCDHEC field collections represent accumulated dose and not yearly dose releases, which was one of the main reasons for differences in dose estimations by SCDHEC and DOE-SR (see dose critique in Section 5.1.1).

The SCDHEC 2008 MAX exposure from the airborne pathway (0.002 mrem) and liquid consumption pathway (0.202 mrem, mostly tritium) was within the respective 10 mrem and 4 mrem DOE limits (Section 5.1.2, Table 1). An MEI dose potential excluding NORM (33.457 mrem) was calculated from SCDHEC and DOE-SR combined data, and was within the 100-mrem yearly DOE dose limit. Most SCDHEC detected dose represented accumulated dose over many years and yet was within the yearly air, liquid, and facility public dose release limits (Section 5.1.2, Table 3).

Results and Discussion

Section 5.1.3 contains the dose data tables from which all other tables and figures are derived. The 2008 data results are discussed under the following headings in section 5.1.1: the 2008 non-scenario basis, scenario basis, the individual optional personal scenario, the 2008 added dose basis, the DOE-SR and SCDHEC comparisons, critical pathways, 1999-2008 statistical summary, and dose critique. The statistical summary covers the 1999-2008 period, whereas the other headings except critical pathways discuss only 2008 data. The critical pathways were analyzed both on a millirem of exposure basis and percentage of dose basis.

The 2008 Non-Scenario Basis

Only specific radionuclide (speciated) doses were included in the estimated dose for 2008. The use of detections only in determining averages above background per radionuclide per media (AEI), the calculation of dose based on the single highest detection (MAX) for each radionuclide/media, and conservative consumption references provided a protective dose estimate. The SCDHEC MEI was based on the total of all MAX detections plus any detections by DOE-SR not sampled by SCDHEC. These two elevated dose bases (AEI and MEI) were used because they were completely measured and protective without the inclusion of screening value assumptions for alpha and beta. The assumption of alpha as Pu-239 and beta as Sr-90 more than doubles the calculated dose without evidence for that assumption in speciated data, and was discontinued in 2008.

The All-Sources Dose

An All-Sources Dose Upper Bound and a Perimeter Dose total are given at the bottom of Section 4.0, Table 1 for the AEI and MAX column totals. The All-Sources Dose Upper Bound totals for AEI (1.925 mrem) and MAX (4.720 mrem) are not the applicable totals, because each drinking water source dose would require proportioning of consumption rates, if there were more than one drinking water source. The All-Sources Upper Bound dose total is not an achievable dose based on temporal and location conflicts, the same consumption factor for all water sources (not proportioned out), and the fact that single MAX detections are treated as if they occurred at unvarying concentration activities throughout the entire year. The Perimeter Dose total is an applicable dose potential estimate.

The Perimeter Dose

Since only one drinking water maximum could be added to the final perimeter dose total, the highest dose was used (underlined in Section 5.1.2, Table 1) instead of proportioning each water source. The AEI air inhalation (0.001 mrem), food ingestion (1.861 mrem), and direct exposure (0.007 mrem) totals were added to the highest drinking water dose (0.019 mrem) and the swimming ingestion dose (0.005 mrem) to obtain the Perimeter Dose results. The theoretical assumption is that the MEI always received the maximum dose despite the high improbability. The AEI and MAX applicable Perimeter Dose totals used only the highest single drinking water source (underlined in Section 5.1.2, Table 1) on an AEI and MAX basis respectively.

The SCDHEC MAX non-scenario perimeter total was simply all available dose based on the single highest detections per media at maximum consumption rates for a period of one year (4.663 mrem). The perimeter AEI dose total (most realistic) was 1.893 mrem in 2008 (AEI) and no individual dose should exceed the MAX dose total (4.663 mrem) on a non-scenario basis. The exception is the addition of DOE-SR additional dose for media not measured by SCDHEC. To calculate a personal scenario different from those described above: add the sum of any applicable MAX column media dose detections to the perimeter AEI column dose total, then subtract the corresponding AEI column dose to determine a personal scenario dose potential. Leave out or subtract any media dose for which there was no exposure. Note the 1.893 mrem AEI perimeter dose is approximately the same dose attributed to watching TV for two years; and the 4.663 mrem perimeter MAX dose is similar to the dose typically received from a coast-to-coast and return airplane flight (2.5 mrem times 2) and less than the dose received from NORM by living in a brick house (7 mrem) for one year (SCDHEC 2006b). Also, compare this dose to the AEI NORM average dose exposure received by all individuals living in the United States (300 mrem) (Section 5.1.2, Figure 2).

The 2008 Scenario Basis

Four critical pathway basic scenarios (the AEI Public, AEI Farmer, AEI Sportsman, and AEI Survivalist) were developed in 2008 as estimates for the general public dose potential based on lifestyle activities (Section 5.1.2, Table 2). The following calculations come from the AEI column in Section 5.1.2, Table 1. The AEI Public scenario dose (0.068 mrem) was based on the non-scenario AEI dose potential from air (0.001 mrem), the AEI highest public water supply (0.018 mrem), the AEI milk (0.003 mrem), and the AEI edible vegetation (0.046 mrem)(Section 5.1.2, Table 1). The AEI Farmer scenario dose (0.066 mrem) was based on adding the highest AEI dose from groundwater (0.014 mrem) in place of the public water supply (0.018 mrem) to the AEI air, edible vegetation, and milk dose, and added AEI soil ground shine (0.002 mrem) dose. Resuspended soil inhalation was 0.00 mrem and did not increase the Farmer Scenario dose. The AEI Sportsman dose (1.163 mrem) was based on adding the AEI fish (1.079 mrem) plus additional AEI soil (0.001 mrem) and AEI sediment (0.002 mrem) ingestion, and game animal AEI dose (0.000 mrem) to the farmer dose. Also, add the highest AEI surface water (0.019 mrem) dose (sportsman may boil surface water for consumption in the field) in place of the highest AEI groundwater dose (0.014 mrem). Then add recreational AEI swimming ingestion dose (0.005 mrem), riverbank shine (0.003 mrem), and AEI sediment dose from wading barefoot (0.002 mrem) to give a total of 1.163 mrem for the AEI Sportsman. Resuspended riverbank sediment, swimming immersion, and boating were all 0.00 mrem and did not increase the Sportsman Scenario dose. The AEI Survivalist dose (1.893 mrem) was based on adding the remaining dose (resident swamp dweller was 0.00 mrem and AEI bolete fungi dose was 0.730 mrem) to the AEI sportsman dose (1.163 mrem). The AEI Survivalist Scenario dose was equal to the AEI perimeter dose (1.893 mrem) since the survivalist received all dose detections greater than background.

Two additional MAX scenario basis averages were developed to represent the highest potential exposures for the MAX Sportsman and the MAX Survivalist. The MAX Sportsman Scenario dose (2.896 mrem) substitutes all the MAX dose for the respective AEI dose in the sportsman scenario. The MAX Survivalist Scenario (4.663 mrem) dose was based on all dose detection maximums in column two. The MAX Survivalist dose was greater than the Sportsman dose due primarily to the highest bolete fungi dose, 1.767 mrem, in place of the AEI fungi dose. The MAX Survivalist dose was equal to the MAX perimeter dose. The ten-year summary (1999-2008) is given in Section 4.0, Table 2 and the Summary Statistics section (Section 6.0, Table 2).

The Optional Individual Personal Scenario

The public can estimate their potential dose based on activities that involve exposure to one or more media not covered by these scenarios provided their personal scenario dose calculation does not exceed 4.663 mrem. If a lifestyle is different from one of the given scenarios, each individual can add one or more MAX column media dose detections (Section 5.1.2, Table 1) to the perimeter AEI column dose total and subtract the corresponding media AEI column dose to calculate their own maximum dose potential.

For example, a member of the general public who received deer meat for consumption, but did not hunt, may add the deer maximum (0.760 mrem) to the Perimeter AEI Dose total to obtain a dose of 2.653 mrem and then subtract the corresponding media AEI dose average for deer (0.00). The result can be checked by adding the MAX minus AEI difference in the last column to the scenario. Thus, by adding deer meat from the local area to the general diet, the non-scenario dose potential would increase from 1.893 mrem (AEI) to a maximum of 2.653 mrem for the worst-case deer consumption personal scenario. This would be a specific personal dose versus the highest MAX overall dose detections of 4.663 mrem (MEI) based on SCDHEC data alone.

Likewise, if someone consumed wild bolete mushrooms in 2008, then a maximum of 1.767 mrem could be added and subtract the corresponding AEI dose (0.730 mrem) to obtain the potential maximum dose exposure (see The 2008 Added Dose Basis section) (Botsch 1999). Any dose observed by DOE-SR that was not sampled by SCDHEC (Section 5.1.2, Table 3) may also be added to the optional total dose, if applicable to the individual. For example, an onsite deer hunter could add 13.00 mrem of potential dose (SRNS 2009, Table 6-4). The grand total for any personal scenario dose cannot exceed the SCDHEC plus DOE-SR total (33.457 mrem) given in Section 5.1.2 of Table 3.

The 2008 Added Dose Basis

Section 4.0, Table 3 includes data from Table 6-4 data of the SRS Environmental Report (SRNS 2009) that can be added to give a total offsite potential dose of 20.457 mrem or combined onsite and offsite dose potential of 33.457 mrem for the SCDHEC MEI estimate. The addition of dose detections not sampled by SCDHEC or greater than SCDHEC detections from other environmental programs helped to extend the MEI dose estimate on a definable basis.

A mushroom consumer potential dose was added in 2008 although the boletes sampled by SCDHEC were not identified to the species level. All boletes sampled were generally edible (Lincoff 1981). Bolete fungi mixed samples were collected in 2008 since SCDHEC past detections for non-edible vegetation gave the highest Cs-137 activity in mixed fungi that contained boletes. The 2008 bolete mushrooms were high for Cs-137 on a mixed-sample quadrant average basis (1.172 mrem) and sample-type basis (1.767 mrem in quadrant E24, Long Branch Quadrant, NE of Par Pond). Boletes were confirmed as bioconcentrators of Cs-137 (Botsch 1999, Kalac 2001, Lincoff 1999, Rommelt 1990,Yoshida 1998). A consumption factor of 3.65 kg/yr was used to calculate dose for edible boletes in 2008 (Botsch 1999). Therefore, the potential dose above background from consuming wild mushrooms (boletes) was added as a caution for the mushroom consumer and the SCDHEC MEI (survivalist). Dose calculations based on the AEI and MAX above background indicated a potential dose of 0.730 mrem/yr or 1.767 mrem/yr respectively for the 50-mile study perimeter. The 2008 bolete fungi dose was well below the 1998 food protective action guideline of 500 mrem to the whole body (USDHHS 1998). The 2008 bolete fungi MAX (1.767 mrem) was almost identical to the fish MAX (1.764 mrem) in 2008. This increases the MAX dose for non-scenario food consumption to 4.402 mrem, if the consumer also ate bolete mushrooms from within the study area in 2008 (Section 5.1.2, Table 1). The SCDHEC MEI total potential dose (4.663 mrem) including bolete fungi was less than the dose received by living in a brick home for one year (7 mrem) (Section 5.1.2, Figure 2)(SCDHEC 2006c). Note that the non-scenario food MAX dose was 94.56 % of the total dose in 2008, if fungi were included. This was below the 98.31 % for food on an AEI basis due to high maximums in non-food media. Regardless of the basis used, sportsman food and bolete fungi consumption are the dominant pathway contributors to dose. Other food media (vegetables and milk) contributed only 0.04 % of the food potential dose.

The DOE-SR and SCDHEC Comparisons

All applicable dose from the two programs (SCDHEC and DOE) is added to calculate the combined MEI estimate (Section 5.1.2, Table 3). The present SCDHEC MEI represents a potential exposure based on single highest detections per radionuclide per media, and is a survivalist type of individual who receives most of the dose exposure through a wild game (or sportsman) pathway and as a wild mushroom consumer. The SCDHEC MEI estimate is inflated and represents a potential dose accumulated over several years found in environmental samples. The inflation details are discussed in the dose critique section of this paper. The SCDHEC AEI dose is more relevant to actual potential exposure than the MAX or total MEI dose (low probability), and the calculation factors are still protective (conservative). The addition of and comparison to DOE-SR dose estimates may be directly relevant (onsite deer also represent accumulated dose), while other samples may come from yearly release estimates or measurements that do not necessarily result in depositions within the 50-mile study area. Thus, a total of the SCDHEC and DOE-SR measured and estimated dose (computer modeling) differences represents an inflated total potential dose or MEI that is very conservative. For example, the DOE-SR dose is potentially inflated due to the treatment of unknown alpha as Pu-239 and unknown beta as Sr-90. The SCDHEC public scenario basis (0.07 mrem in 2008) is the most relevant dose for the general public and is much lower than low probability scenarios that include bioconcentrators of dose (maximums) such as deer (0.760 mrem), fish (1.764 mrem), or fungi (1.767 mrem)(Section 5.1.2, Table 1).

A comparison was made in the following subsections to dose estimate values published by DOE-SR. DOE-SR yearly radionuclide releases are not directly comparable to field measurements that include accumulated dose from past releases. Most comparisons were based on Table 6-4 of the Savannah River Site Environmental Report for 2008 (SRNS 2009). This comparison assisted in evaluating the 2008 DOE-SR environmental monitoring program and the SCDHEC ESOP environmental monitoring program. The study area detections of dose represent accumulated and decayed dose from all area sources including historical (atomic bomb test fallout, Chernobyl, domestic). No detected dose by SCDHEC was strictly assignable to DOE-SR alone, but was considered of potential DOE-SR origin if within the 50-mile study area and greater than background.

The close agreement on the MEI between the two monitoring programs was due primarily to Cs-137 occurrence in bioconcentrators of dose in the sportsman food pathway and not to correspondence between releases and detected dose in media.

The SCDHEC and DOE-SR Atmospheric Pathway Comparison

Not all SRS dose releases result in depositions within the sample area, as evidenced by the inhalation pathway detections noted in the following paragraph, which are far less than SRS releases. Also, many years of cumulative dose depositions contribute to the dose detections in any given year and make potential dose releases by DOE-SR versus SCDHEC detections not directly comparable. The detected exposure in millirem is a more meaningful indicator of dose to the public versus percentages.

Four comparable SCDHEC and DOE-SR media pathway dose results (air, liquid, soil, food) were totaled and compared for 2008 in Section 5.1.2, Table 5. SCDHEC detected less air inhalation dose (0.002 mrem MAX) than estimated by DOE-SR releases (0.017 mrem), because all releases were not detected and were not necessarily deposited within the study area. The air pathway difference between SCDHEC and DOE-SR was due to dose based primarily on field measurements versus atmospheric releases and dose modeling, respectively. Few atmospheric releases resulted in dose detections offsite of SRS within the 50-mile study area perimeter. The DOE-SR pathways most affected by atmospheric releases in 2008 were the terrestrial sportsman food pathway (26.40 mrem)(hunter, hog, deer) and the hunter soil exposure pathway (2.90 mrem) compared to the airborne contributions to the cow milk pathway alone (0.0387 mrem)(SRNS 2009, Table 6-4).

SCDHEC atmospheric pathway maximum dose detections in 2008 came mostly from the food and soil media. Inhalation (0.002 mrem) had the smallest dose detections, terrestrial food (0.760+0.105+0.003+1.767 or 2.635 mrem) was highest, and dose from soil was minor (0.001+0.009 or 0.010 mrem)(Section 4.0, Table 1). SCDHEC only monitors offsite dose, and terrestrial food did not include an onsite hunter dose (13.00 mrem for DOE-SR)(SRNS 2009, Table 6-4)(Section 5.1.2, Table 3). Also, SCDHEC did not receive any hog samples for dose determination in 2008. However, SCDHEC did monitor the edible bolete fungi (1.767 mrem) and DOE-SR did not.

A comparison of atmospheric dose maximums (DOE-SR irrigation, goat milk, cow milk, and sportsman pathways) that were monitored by both DOE-SR and SCDHEC programs (inhalation, offsite deer, edible vegetation, milk) gave totals of 5.816 mrem and 0.870 mrem respectively (Section 5.1.2, Table 5). The prime difference between the two estimates was due to a much lower background for Cs-137 in DOE-SR deer data, and an unusually high background occurring in the SCDHEC McBee area background in 2008 (4.85 mrem). Previous years SCDHEC background study areas averaged 1.06 mrem in the Bowman area and 1.08 mrem in the Francis Marion area (both in the lower coastal plain region) for Cs-137 in deer. The McBee area (upper coastal plain) was 0.79 mrem in 2007, but spiked in 2006 at 4.39 mrem and at 4.85 mrem in 2008 for an average of 3.34 mrem. It is not known if this higher background in the McBee area was due to natural factors such as the abundance of bolete mushrooms (bioconcentrators of Cs-137) consumed by deer during the high background years, legacy spot depositions of Cs-137 in the area by fallout from nuclear weapons testing in the 1950's and 1960's, or variation in weather patterns that affect atmospheric depositions at a distance from potential sources. Also, the SCDHEC MAX deer dose from 2000 to 2008 averaged 8.45 (± 6.47 mrem) with a median of 6.91 mrem, and the AEI deer dose was 0.31 (± 0.48 mrem) with a median of 0.08 mrem (Section 5.1.3, Table 2). The DOE-SR onsite deer dose is declining toward the MAX dose levels for offsite deer dose (Section 5.1.2, Figure 8). This may indicate that maximums in the deer Cs-137 activity concentration are a result of the legacy dose maximums and their respective decay rate. If no further additions are being added to the Cs-137 population, then future years should show a continuing decline toward the offsite deer average dose of 0.31 mrem.

Most of the dose estimate from either DOE-SR or SCDHEC was due to atmospheric deposits and bioaccumulation. Approximately 98.70 % of the DOE-SR dose in Table 6-4 came primarily from the food subpathway within the atmospheric pathway (SRNS 2009). The SCDHEC food pathway dose was 98.31 % of the detected dose (Section 5.1.2, Table 1). The DOE-SR total for committed dose (release modeling and field measurements) in 2008 was 29.90 mrem (SRNS 2009, Table 6-4) compared to the SCDHEC maximum perimeter dose detection estimate of 4.663 mrem, which combined with DOE-SR differences (28.794 mrem) in specific media estimates and additions gave an overall estimate for the SCDHEC MEI of 33.457 mrem (Section

5.1.2, Tables 1 and 3). Both MEI estimates contain low probability sportsman food estimates, and the SCDHEC estimate was higher due to the inclusion of bolete fungi (1.767 mrem maximum) as a survivalist food (Section 5.1.2, Table 1). If the fungi dose is subtracted, leaving 31.69 mrem (SCDHEC combined dose) compared to 29.90 mrem (DOE-SR), then both estimates are very close mostly due to Cs-137 detections in wild food sources. This close agreement on the MEI between the two monitoring programs was due primarily to Cs-137 occurrence in bioconcentrators of dose in the sportsman food pathway and not to correspondence between releases and detected dose in media. Both total MEI estimates were very similar despite the differences in dose factors and monitoring method considerations. Both environmental program MEI estimates indicated that the MEI in 2008 was less than the 100-mrem DOE-SR Order 5400.5 all-pathway yearly dose standard despite the contributions from bioaccumulation.

The MAX limit of available dose or upper bound for the 2008 MEI atmospheric dose was based on exposure to the total of the single highest maximums per media for the entire year (2.647 mrem), (Section 5.1.2, Table 1). The addition of an upper bound calculation illustrates that the MEI atmospheric exposure could not be greater than 2.647 mrem for any scenario in 2008 based on SCDHEC sampled media MAX detections, which is well under the DOE-SR air limit for dose to the public (10 mrem/yr.). Note that atmospheric pathway samples contain depositions accumulated over many years and not inhalation in a single year. Thus, this value is not directly comparable to the DOE-SR 10-mrem yearly air dose release limit for the atmospheric pathway. However, it is important that accumulated or bioconcentrated dose is less than the yearly atmospheric release limit for DOE-SR. The atmospheric pathway and liquid pathway upper bound calculations illustrate that the DOE-SR 100 mrem limit was not exceeded for both pathways combined (2.647 mrem atmospheric upper bound plus 2.073 mrem liquid upper bound equals 4.720 mrem) on a field detections basis. The All-Sources upper bound (4.720 mrem) includes extra water dose not assigned to the Perimeter Dose and is therefore greater than the 4.663 mrem perimeter dose maximum.

The SCDHEC and DOE-SR Liquid Pathway Comparison

SCDHEC detected soil exposure dose (0.031 mrem) for the sportsman was less than the estimated DOE-SR (3.180 mrem) combined soil dose due to the sampling of riverbank soil and forest soils versus swamp sediments, respectively (Section 5.1.2, Table 5). A comparison of liquid ingestion and aquatic food media (fish) categories with DOE-SR gave different maximums. The SCDHEC survivalist who is a camper and boils water for consumption would receive the highest liquid potential dose consumption at Steel Creek Boat Landing for tritium (0.20 mrem) compared to 0.09 mrem for the DOE-SR maximum (includes plant Vogtle contributions). This landing location is unique in that it is not far downstream from the Steel Creek mouth. The SCDHEC fish dose MAX value was 1.764 mrem and the DOE-SR Creek-mouth Fisherman dose was 0.11 mrem (SRNS 2009, Table 6-4). This difference may be partially explained by the fact that SCDHEC determines the fish MAX dose based on the sum of the highest dose per radionuclide in fish and not per fish, since the survivalist is assumed to eat all fish. The rest of the difference was a consumption factor of 48.2 kg/yr for the SCDHEC survivalist versus 19 kg/yr for the DOE-SR fisherman. Most of this liquid pathway difference (1.654 mrem MAX) was due to Cs-137 in fish (highest in bass at Fourmile Creek)(Section 5.1.3, Data Tables). The SCDHEC AEI dose applies to the average potential exposure rather than the highly improbable MAX based on single highest detections. Ingestion of dose uptake after bioconcentration of Cs-137 in fish is the dominant route of exposure to the public via the food pathway that is of liquid pathway origin.

The DOE-SR liquid medium contributes to the food, surface water, groundwater, and sediment exposure pathways (Section 5.1.2, Figure 1). Cesium-137, tritium, unknown alpha, Pu-238, nonvolatile beta, Sr-90, and I-129 (in that order) account for the majority of the total potential committed dose to the MEI from DOE-SR liquid releases in 2008 (SRNS 2009). The DOE-SR liquid releases percent of dose potential in 2008 was 43 % for fish consumption, 57 % for water consumption, and <1 % for the shoreline, swimming, and boating.

The SCDHEC nonsportsman single highest dose in public water supplies was tritium (0.041 mrem), which averaged 0.02 mrem in 2008 and averaged 0.03 (± 0.02 mrem) with a median of 0.03 mrem from 1999-2008 (Section 5.1.2, Table 1)(Section 5.1.4, Table 2). The DOE-SR 2008 measured tritium levels at the downstream water supply locations in 2008 were 0.03 mrem at Chelsea and 0.04 mrem at Purrysburg and Savannah for an average of 0.037(± 0.006 mrem) with a median of 0.040 mrem (SRNS 2009). The SRS plus plant Vogtle maximum tritium contribution to drinking water dose was calculated as 0.05 mrem. This is within the SCDHEC expected first standard deviation and the minor differences are attributable to temporal and location factors.

The SCDHEC order of MAX detected radionuclide dose in the 2008 liquid pathway excluding assigned NORM was Cs-137 in bass fish (1.686 mrem), tritium in water (0.202 mrem), and Sr-89/90 (0.075 mrem) in bass (Section 5.0, Data Tables). The bioconcentrated radionuclides, primarily Cs-137 in the food pathway, were the major contributors to the liquid pathway dose.

The All-Pathway SCDHEC and DOE-SR Comparison

The All-Pathway dose basically represents exposure from the airborne and liquid pathways for the general public who are not subject to increased exposure from other activity (e.g., not farmer, sportsman, or mushroom consumer). Section 5.1.2, Table 3 includes DOE-SR and SCDHEC primary dose calculations in 2008 from the combined liquid and airborne pathway, from the sportsman, and other pathways (SRNS 2009). The liquid and airborne pathways dose detections excluding the sportsman media near the site boundary were 0.12 mrem (DOE-SR) and 0.31 mrem MEI (SCDHEC). These differences were mainly due to differences in locations sampled and temporal factors. The single highest detections for SCDHEC that excluded sportsman media were tritium in surface water (0.20 mrem) and Sr-89/90 (0.099 mrem) in leafy vegetables. Thus, the general public received 0.31 mrem of liquid plus air dose in 2008, which excludes the sportsman dose and is typically far less than that received from watching TV (1 mrem), (Section 5.1.2, Figure 2). The DOE-SR 2008 All Pathway dose of 0.12 mrem was within one standard deviation of the SCDHEC 1999-2008 scenario dose to the public, which averaged 0.12 (± 0.09 mrem) with a median of 0.09 mrem (Section 5.1.2, Table 2). The median reduces the influence of outliers in a large environmental data set and may be a better indicator of the central tendency.

The DOE-SR air medium contributes to the plume, ground, inhalation, and food exposure pathways as shown in Section 5.1.2, Figure 1. The DOE-SR All-Pathway potential has not exceeded 0.28 mrem in the last ten years, which includes the liquid plus airborne pathways (Section 5.1.2, Table 8). Tritium (84.09 %), iodine-129 (I-129)(9.67 %), Pu-238 (1.54 %), Pu-239 (1.28 %), Pu-240 (1.07 %), and unspecified alpha (1.02 %) account for the majority of the total potential committed dose to the MEI from DOE-SR air releases in 2008 (SRNS 2009, MAXDOSE-SR MEI Dose Using Goat Milk Pathway).

The Food Pathway SCDHEC and DOE-SR Comparison

DOE-SR 2008 radionuclide releases were not directly comparable to SCDHEC dose detections in media, since some media may contain or bioconcentrate several years of dose releases. The food pathway has contributions from the liquid (primarily fish) and the atmospheric pathway (primarily wild food sources). The DOE-SR calculated dose to the food pathway from atmospheric releases was: vegetation (39.32 %), cow milk (12.34 %), and meat (4.84 %); which totals 56.50 % of the atmospheric releases in 2008 (SRNS 2009). The DOE-SR calculated dose to the inhalation pathway was 43.20 % of the atmospheric releases in 2008 (Section 5.1.2, Table 7). The DOE-SR calculated dose to the ground pathway was 0.30 % from atmospheric releases. The SCDHEC order of radionuclide detected dose in the 2008 atmospheric pathway excluding assigned NORM was mostly Cs-137 in deer, fish, and bolete fungi (92.57 %). Tritium (3.39 %) in water and Sr-89/90 (2.62 %) in leafy vegetables were most of the remaining dose (Section 5.1.3 Tables and Section 5.1.4, Table 1).

The DOE-SR comparable maximum food doses in 2008 were offsite MEI deer consumption (5.70 mrem), creek mouth fisherman (0.11 mrem), vegetable from irrigation pathway (0.088 mrem), and goat milk (0.011 mrem) for a total of 5.816 mrem of comparable food dose (SRNS 2009) versus 2.632 mrem total for the SCDHEC comparable food maximum dose (0.760+1.764+0.105+0.003 respectively)(Section 4.0, Table 5). DOE-SR also had a 7.70 mrem food dose for offsite hog consumption in 2008. SCDHEC did not collect hog samples in 2008. The 2008 MEI sportsman dose (deer and fish) for DOE-SR was 5.81 mrem versus 2.52 mrem for SCDHEC. Compare this to the 1999-2008 SCDHEC MAX Sportsman Food dose average (includes some hog dose) of 11.25 (± 11.09) mrem with a median of 8.21 mrem (Section 5.1.2, Table 4). Note that both DOE-SR (13.51 mrem) and SCDHEC (2.52 mrem) 2008 MAX offsite food dose estimates (deer, hog, fish) were within one standard deviation of the ten-year MAX sportsman food dose average for SCDHEC that includes hogs (3 years).

The food difference between the two agency averages was primarily dependent upon the highest deer or hog dose in previous years, but this changed to mushrooms and fish in 2008 for SCDHEC. A high background for SCDHEC sampled deer in the McBee area (4.85 mrem) was the main reason for the difference in the deer dose in 2008. The 2008 nonsportsman milk (0.011 mrem) and edible vegetation (0.088 mrem, irrigation theoretical pathway) food MAX dose was 0.099 mrem for DOE-SR (SRNS 2009) versus 0.108 mrem for SCDHEC (Section 5.1.2, Tables 1 and 5). Compare this to the SCDHEC ten-year AEI for nonsportsman food 0.08 (± 0.08 mrem) with a median of 0.05 mrem (Section 5.1.2, Table 4). The 2008-year DOE-SR nonsportsman food (0.099 mrem) and the SCDHEC nonsportsman food dose (0.108 mrem) were within one standard deviation of the 1999-2008 AEI SCDHEC nonsportsman food average of 0.08 (± 0.08) mrem with a median of 0.05 mrem (Section 5.1.2, Table 4). A single nontypical SCDHEC vegetation detection of 0.099 mrem in 2008 came from Sr-89/90 in mustard greens and illustrates the influence of a single extreme on an MEI. The rest was tritium (0.006 mrem). Unknown variables cause fluctuation in the deer dose, but weather and related forage availability may have played a role, especially in bioconcentrators (e.g., mushrooms). Deer tracks among bolete fungi that were mostly missing the caps with scattered pieces nearby were observed in 2008 at an Audubon preserve. The highest known bioconcentrators of Cs-137 are mostly bolete fungi that fruit primarily in August and September (Botsch 1999, Kalac 2001). Deer and other animals that consume boletes could potentially receive the highest dose from boletes no later than October in the most productive years. Inclusion of the single worst-case or MEI deer dose (0.760 mrem) instead of the AEI deer dose (0.00 mrem) in 2008 resulted in a very different dose (2.653 mrem with MAX deer dose versus 1.893 mrem with AEI dose) that could occur only for the individual (not necessarily a hunter) who ate the most contaminated deer sampled (Section 5.1.2, Table 1). However, SCDHEC adds the single worst-case deer consumption by a single hunter to all other media detected dose (nonscenario basis) as protective for the potential worst-case minority (4.663 mrem), the survivalist, who may consume all of the maximally contaminated deer, fish, and mushrooms (Section 5.1.2, Table 5). All food maximums together would add 4.399 mrem of potential dose to the MAX nonfood dose of 0.256 mrem (Section 5.1.2, Table 1) for a total of 4.663 mrem for the SCDHEC MEI detections.

The DOE-SR potential dose from irrigation pathways (0.098 mrem) was 0.088 mrem for vegetables, 0.0077 mrem for milk, and 0.0026 mrem for meat. This is an increase in dose compared to the cow milk MEI air pathway (0.0152 mrem for vegetables, 0.00477 mrem for milk, and 0.00187 mrem for meat) (SRNS 2009). The greatest influence was an increase in vegetable dose from the irrigation pathway (approximately 0.073 mrem). Cesium-137 was the only gamma source detected in food products (collards, pecans, peanuts) in 2008. Strontium-89/90 was detected in collards and beef. Uranium-234 (U-234) and U-238 were detected in collards and beef. Americium-241 (Am-241) was detected in collards, peanuts, and pecans. Tritium was detected only in beef and milk. Gross alpha was detected in collards. Gross beta was detected in all food products (SRNS 2009).

Only tritium (0.006 mrem) in soybeans and watermelon, and Sr-89/90 (0.099 mrem) in mustard greens, cabbage, turnips, and collards were detected in SCDHEC edible vegetation samples. Cesium-137 detections in edible bolete fungi contributed the highest potential dose (1.767 mrem) to the minority wild mushroom consumer, whether deer or human. SCDHEC does not sample food media within DOE-SR.

The MEI dose potential (33.457 mrem) from SCDHEC and DOE-SR combined and the DOE-SR total MEI estimate of 29.90 mrem confirms that the MEI and public under any scenario was not exposed to a dose greater than the DOE-SR dose limit of 100 mrem/yr. DOE-SR monitors individual hunters on the SRS to ensure that they do not exceed the DOE 100 mrem standard (WSRC 2003). Thus, both programs appear to be sampling the same dose population despite differences in locations, methods, and analyses. Section 5.1.2, Table 8 statistics derived from DOE-SR release dose estimates reveal that the overall dose to the onsite hunter (13.00 mrem) was similar to the offsite hunter (13.40 mrem) in 2008.

Critical Pathways

The AEI Public dose pathway contributions in 2008 were 73.53 % from atmospheric and 26.47 % from liquid. The AEI Farmer dose pathway contributions were 78.79 % from atmospheric and 21.21 % from liquid. The AEI Sportsman dose pathway contributions were 4.56 % from atmospheric and 95.44 % from liquid. The AEI Survivalist dose pathway contributions were 41.36 % from atmospheric and 58.64 % from liquid. The low atmospheric pathway contribution to the sportsman pathway was due to a high deer background for Cs-137 resulting in zero deer dose above background. These pathway percentages shift dramatically on a maximum detection basis with atmospheric detection maximums increasing while the liquid pathway maximums decreased in contributions to the MEI. The MAX Sportsman dose pathway contributions were 30.39 % from atmospheric and 69.61 % from liquid. The MAX Survivalist dose pathway contributions were 56.77 % from atmospheric and 43.23 % from liquid. Most of the increased dose to the MEI from the atmospheric pathway was due to wild food maximums primarily from Cs-137 bioconcentration. The ten year (1999-2008) atmospheric dose was 57.37 % and the liquid pathway dose was 42.63 % (Section 5.1.2, Table 6). All dose detections discussed in the following sections can be assigned to one of the following subpathways: food or ingestion, inhalation, direct exposure, public water supply, and the untreated water supply.

The Atmospheric Pathway

The atmospheric pathway contributed dose to the individual through the inhalation of air and resuspended soil, ingestion of food and game, and direct exposure routes. The potential dose to the MEI from the SRS atmospheric releases is reviewed in the SRS annual Environmental Reports. The National Emission Standards for Hazardous Air Pollutants (NESHAP) for all radionuclide air pollutants in 2008 is 0.04 mrem for the MEI effective dose equivalent for the MAXDOSE-SR code estimate (SRNS 2009). This is 0.4 % of the 10 mrem/yr United States Environmental Protection Agency (USEPA) standard. The atmospheric pathway contributed accumulated dose to the individual through the inhalation, ingestion (cow milk, vegetation, rainwater, and meat), and direct exposure routes.
The ESOP AEI non-scenario detected dose potential from the atmospheric pathway (APW) media excluding NORM totaled 0.783 mrem in 2008 (Section 5.1.2, Table 1). The MAX column contributions to the MEI atmospheric pathway were 2.647 mrem. The addition of any maximums from the sportsman category of media from Section 5.1.2, Table 1 drastically changes the dose and percentages for radionuclides and pathways. An example of dose assigned as NORM comes from natural areas that may be farmed and the soil dust resuspended and inhaled (Section 5.1.3, Air and Soil Data). This potential was not backed up by air station filter detections in 2008 soil samples either on an average (0.002 mrem) or maximum (0.009 mrem) basis. The air potential dose from inhalation was 0.002 mrem maximum from tritium and 0.000 from Cs-137. The native soil samples cannot be taken directly from plowed fields due to the influence of fertilizers and other chemicals added by the farmer. Also, soil samples were not taken from disturbed areas such as roadbed or construction areas due to the influence of deposited non-native material.

The 2008 critical pathway data summary excluding NORM indicated that the liquid pathway may dominate in some years (59.33% on an AEI basis), but overall (1999-2008) the atmospheric pathway is dominant at 57.37% of the total ten year dose (Section 5.1.2, Table 1 and Table 6). The percent contributions to the perimeter AEI dose in 2008 were 0.05 % inhalation, 99.58 % ingestion, and 0.37 % direct exposure (Section 5.1.2, Table 1). However, the MAX ingested food dose, sportsman and nonsportsman was 4.402 mrem or 94.56% of the total MEI dose (4.402/4.663*100%). The highest single detections in 2008 were in fungi, fish, deer, vegetables, and milk media.

The 2008 AEI atmospheric pathway dose was 40.675% of the AEI perimeter dose (Section 5.1.2, Table 1). Exposure from all AEI food detections subject to the atmospheric pathways was 98.310% (1.861/1.893*100) of the AEI perimeter dose. The AEI exposure detections in drinking water sources were 1.268% (0.024/1.893*100). The atmospheric direct exposure pathway was

0.370% (0.007/1.893*100) of the AEI dose. The inhalation pathway was only 0.053% (0.001/1.893*100) of the AEI perimeter dose (Section 5.1.2, Table 1). Thus, the food subpathway dominated public exposure within the atmospheric pathway both on an average (AEI) and single highest detection (MAX) basis.

Most exposure occurred as a result of the ingestion of wild food sources containing Cs-137 (deer, hog, and mushrooms) from the atmospheric pathway, and fish from the liquid pathway.

The Liquid Pathway

The liquid pathway contributed dose to the individual through the ingestion of fish, water (public water supplies, groundwater, surface water), direct exposure routes, and the inhalation (e.g., resuspension of dried riverbank sediment) pathway. Riverbank sediments are an example of a media that can impact both atmospheric (through inhalation of resuspended dry sediments) and liquid pathways (through ingestion and direct contact) dependent on how the exposure occurred. The SCDHEC AEI detected dose potential from the liquid pathway (LPW) was 59.33% of the 2008 dose (Section 5.1.2, Table 1). The highest detected dose from the MAX liquid pathway in 2008 was mostly from Cs-137 in fish (1.764 mrem in bass), tritium in Savannah River surface water near SRS (0.202 mrem), tritium in well water (0.015 mrem), and Cs-137 (0.017 mrem) in riverbank shine (Section 5.1.2, Table 1). The importance of AEI versus MAX basis calculations was illustrated by a shift in the dominant fish Cs-137 contamination. Pickerel was highest with 1.067 mrem under the AEI basis, while bass was highest with 1.686 mrem under the MAX (for MEI) basis (Section 5.1.3 Data). The SCDHEC MEI ate all fish and the dose was assigned based on the highest detections per radionuclide and not on a fish-type basis.

The 2008 critical pathway data summary excluding NORM indicated that the liquid pathway may dominate in some years (59.33% on an AEI basis), but overall (1999-2008) the liquid pathway contributed 42.63% of the total ten year dose (Section 5.1.2, Tables 1 and 6). Food ingestion was also dominant in the liquid pathway, mostly due to Cs-137 ingestion in fish. The dose from untreated water supplies (0.92 mrem), such as the consumption of untreated boiled river water at boat landings, was the next highest potential exposure from the liquid pathway (5.62%, primarily tritium 1999-2008). Direct exposure was third (3.28%) in the liquid pathway (0.53 mrem), and was mostly Cs-137. The Savannah River public water supplies (0.47 mrem) accounted for only 2.90% of the 1999-2008 exposure, and was also mostly due to tritium.

The LPW all-sources limit or upper bound (MAX row) for the liquid dose potential based on exposure to the single highest media maximums for the entire year was 2.073 mrem (Section 5.1.2, Table 1). The addition of an upper bound calculation illustrates that the MEI liquid exposure could not be greater than 2.073 mrem for any scenario in 2008 based on sample media maximum detections, which is well under the DOE-SR liquid dose limit to the public (4 mrem). This is not directly comparable to the DOE-SR liquid pathway dose limit for the upper bound total was due primarily to single maximum detections that were bioaccumulated in fish over several years and included all water dose (not proportioned by consumption rates).

The Food Pathway

The 2008 SCDHEC MAX food pathway dose for deer was 0.760 mrem, fish 1.764 mrem, edible vegetation 0.105 mrem, milk 0.003 mrem, and edible bolete mushrooms 1.767 mrem (Section 5.1.2, Table 1). Bolete fungi, deer, vegetables, and milk were the primary media affected by the atmospheric pathway. The added potential dose from bolete mushrooms was all Cs-137 (1.767 mrem) and applied only to wild mushroom consumers. Fish (1.764 mrem) was the primary food media affected by the liquid pathway, and was a close second to dose from bolete fungi. The

SCDHEC 2008-year MAX deer dose was third in rank from Cs-137 (0.760 mrem). Consuming Savannah River water at boat landings was fourth (0.202 mrem). Vegetables were fifth (0.105 mrem) mostly due to Sr-89/90 in mustard greens. Milk was the least contaminated food media with only 0.003 mrem. The food MAX in 2008 was 94.56% of the perimeter potential dose (4.402/4.663*100%). The all food percent contribution whether on an AEI instead of a MAX basis was still the dominant contributor to dose. The addition of 1.767 mrem for the wild bolete mushroom consumer (deer or human) becomes the dominant dose in 2008 for the food pathway of the SCDHEC MAX Survivalist, and the fungi dose was all Cs-137.

1999-2008 Statistics

Percent of dose changes with scenario or optional dose considerations. Therefore, only the AEI percentages are given in this section as a basis for 1999-2008 comparisons (Section 5.1.2, Table 2 and Section 5.1.4, Table 2). Most exposure, irregardless of the basis of comparison, occurred as a result of exposure to wild food sources containing Cs-137 in deer, hog, and mushrooms in the atmospheric pathway, and fish in the liquid pathway (Section 5.1.2, Figures 3, 4, 5, 6, 7). The median may be a more accurate central tendency indicator than the AEI for large amounts of data due to the influence of extremes in averages. Also, the AEI data were inflated to begin with due to the averaging of detections only (LLD data not included).

The average, standard deviation, and medians of radionuclide dose were summarized for ten years of SCDHEC samples (1999-2008) on an AEI basis by media, exposure scenarios, and dominant critical pathway categories (Section 5.1.2, Tables 2 and 6, and Section 5.1.4, Table 2). Section 5.1.2, Table 6 and Figure 3 shows the total ten-year millirem dose and percent of dose on a pathway and subpathway basis. This critical pathway basis of comparison for SCDHEC detected dose results from accumulated releases of radionuclides that were deposited outside of SRS and within 50-miles of an SRS center-point. This table and figure illustrate the dominance of the atmospheric pathway dose (57.37%) over the liquid pathway (42.63%) on an AEI dose basis. The food subpathway (87.80%) was the dominant route of exposure. The SCDHEC fish dose was 33.60 % of the AEI detections for the period 1999-2008, and was 1.079 mrem in 2008 (Section 5.1.4, Table 2 and Section 5.1.2, Table 1). This food ingestion pathway (FP) was the primary contributor to dose (14.33 mrem), the nonpotable drinking water pathway (NPDW) second (0.92 mrem or 5.62%), the direct exposure pathway (DXP) third (0.53 mrem or 3.28%), the public water systems pathway (PWSDW) fourth (0.47 mrem or 2.90%), and the direct inhalation pathway (IP) fifth (0.07 mrem or 0.40%).

The 1999-2008 AEI dose per radionuclide including some potential NORM detections indicated that exposure to Cs-137 resulted in the highest total dose (16.04 mrem) with an average of 0.55 (± 0.94) mrem/yr and a median of 0.21 mrem/yr for 65.61% of the total dose during that period (Section 5.1.4, Table 1). Tritium was second highest for the non-NORM radionuclides (0.73 mrem) with an average of 0.01 (± 0.01) mrem/yr and a median of 0.01 mrem/yr for 3.00% of the total dose during that period. Strontium-89/90 was third (0.63 mrem) with an average of 0.07 (± 0.09) mrem/yr and a median of 0.01 mrem/yr for 2.57% of the total dose during that period. Speciated strontium-89 and Sr-90 add 0.21 mrem and 0.01 mrem respectively for a combined strontium dose of 0.85 mrem or 3.48% of all dose detections. Thus, total strontium would replace tritium as the second highest dose contributor. All other non-NORM radionuclides were less than 1% of the dose exposure for the period 1999-2008.

NORM radionuclides for the period 1999-2008 were led by radium-226 (Ra-226) (4.85 mrem) with an average of 0.61 (± 0.54) mrem/yr and a median of 0.66 mrem/yr for 19.86% of the total dose detections during that period (Section 5.1.4, Table 1). Lead-214 (Pb-214) was second for NORM (0.51 mrem) with an average of 0.09 (± 0.06) mrem/yr and a median of 0.09 mrem/yr for 2.09% of the total dose detections during that period. Actinium-228 (Ac-228) was third (0.50 mrem) with an average of 0.10 (± 0.04) mrem/yr and a median of 0.11 mrem/yr for 2.04% of the total dose detections during that period. Lead-212 (Pb-212) was fourth (0.24 mrem) with an average of 0.06 (± 0.02) mrem/yr and a median of 0.06 mrem/yr for 1.00% of the total dose detections during that period. All other NORM radionuclides were less than 1% of the dose potential for the period 1999-2008.

The SCDHEC AEI detected media dose trends during 1999-2008 were: hog at 1.53 (± 1.87) mrem, median 0.97 mrem; bolete fungi (0.73 mrem in 2008); fish at 0.55 (±0.31) mrem, median 0.44 mrem; deer at 0.31 (± 0.48) mrem, median 0.08 mrem; surface water at boat landings 0.06 (± 0.03) mrem, median 0.06 mrem; milk at 0.06 (± 0.08) mrem, median 0.02 mrem; untreated groundwater wells (DNRGW) at 0.04 (± 0.06) mrem, median 0.01 mrem; soil at 0.04 (± 0.08) mrem, median 0.01 mrem; Savannah River public water systems (PWSRW) at 0.03 (± 0.02) mrem, median 0.03 mrem; edible vegetation at 0.03 (± 0.05) mrem, median 0.01 mrem; groundwater public water systems (PWSGW) at 0.02 (± 0.02) mrem, median 0.01 mrem; sediments at 0.02 (±0.05) mrem, median 0.00 mrem; rainwater and air, both 0.01 (±0.01) mrem, median 0.01 mrem (Section 5.1.4, Table 2 and Figure 7). Note that on an AEI basis for 1999-2008 the prime contributors to dose were hog, fungi, fish, and deer in that order. The fish AEI dose was higher than the deer average for all years except 2002 and 2004.

The order changes on a single highest dose basis to deer, hog, fish, and fungi for the same period. However, the results may be skewed due to fewer sample years for hogs and fungi. This was illustrated by the DOE-SR comparison for hogs in the previous section. The MAX deer (2000-2008) average was 8.45 (± 6.47) mrem with a 6.91 mrem median. The MAX hog dose (2000-2002) average for the years collected was 7.08 (± 8.81) mrem, and 4.29 mrem median (Section 5.1.4, Table 2). The MAX deer dose was always higher than the MAX fish dose in any year except 2008. However, Cs-137 was always the major contributor to dose across all four media (hog, deer, fish, and bolete fungi).

Four basic AEI scenarios were developed based on SCDHEC data alone, which calculate a dose relative to public exposure activities (Section 5.1.2, Table 2). The basic scenario results for 1999-2008 were: the general public 0.12 mrem average, ± one standard deviation of (0.09), with a median of 0.09 mrem; the farmer, 0.20 (± 0.25) mrem with a median of 0.09 mrem; and the average sportsman, 1.49 (± 1.51) mrem with a median of 1.08 mrem (Section 5.1.2 Table 2). The average survivalist was added in 2008 and includes bolete fungi consumption as a minority group (1.89 mrem in 2008).

Two MAX scenarios based on single highest detections were the maximally exposed sportsman, 11.45 (± 11.01) mrem with a median of 8.36 mrem, and the maximally exposed survivalist, 4.663 mrem in 2008 (Section 5.1.2, Table 2).

Tables 1 and 2 in Section 5.1.4 (SCDHEC 2008F) were based on all AEI dose detections instead of the MAX calculations (estimates of low probability). Cesium-137 in mostly game animal, fish, and fungi (92.57 %), Sr-89/90 (2.62 % plus 1.31 % or 3.93 %) in leafy vegetables and fish, and tritium (3.39 %) in mostly water sources represent all dose detections greater than 1 %. The SCDHEC radionuclide detection ten-year percentages were Cs-137 (65.61 %), Sr-89/90 (2.57 % plus 0.85 % plus 0.05 % or 3.47 %), and tritium (3.00 %), and were in the same order even with the inclusion of potential NORM. Most of the dose in the environment may come from legacy dose instead of current releases from DOE-SR. The DOE-SR Cs-137 release calculation for the Goat Milk Pathway (air) in 2008 was only 0.000129 mrem and 0.03 mrem via the liquid pathway (SRNS 2009). Thus, the dose detected in various media that was greater than 0.030129 mrem had to come from previous years dose accumulations or bioconcentrations of legacy dose, which may or may not have come from DOE-SR.

Dose Critique

All dose was summarized by average, standard deviation, and median. The median may be a better indicator of the central tendency in environmental media dose compared to average dose for large sample numbers due to: 1- the decrease in influence by the extremes; 2- the added conservancy present in selected dose factors; 3- the addition of dose based on maximums such as hog and deer worst-case game animal consumption; 4- the use of "detections only" for statistical analyses when many sample results were less than the detection limit; 5- the assignment of the higher dose to dual radionuclide determinations (e.g., the assignment of dose based on Sr-90 when the detection is for Sr-89/90); 6 –the use of 0.00 mrem as background for <MDA data averages; and 7 – the influence or potential of false positives (WSRC 2003a). The NORM averages and maximums are not included in the dose estimates since this dose is part of the 300-mrem expected NORM for the study area. The yearly dose averages greater than background were based on SCDHEC detections only and are inflated since most sample results were less than the minimum detectable activity (MDA). The justification for selecting higher source consumption levels was due to the consideration of the SCDHEC MEI as a survivalist type who consumed natural media at a greater than typical rate. The basis for both considerations was to be protective of the public and environment. The inclusion of alpha and beta assumed dose in the past was excessive and not supported by media radionuclide species detections. The inclusion of calculations based on a single highest maximum detection for each radionuclide/media was a more definable basis for establishing the upper bound rather than the dose assumption of unknown alpha as Pu-239 and unknown beta as Sr-90.

The 2007 Critical Pathway Dose Report noted that 38.50 % of the dose was assigned and represents a potential dose overestimate that may in fact be NORM detections. Also, 44.25% of the detected dose above background was potentially from SRS, if all NORM potentials were excluded. However, the 2008 SCDHEC dose calculations were still protective due to the use of detections only in determining dose, the calculation of a maximum dose for the MEI based on a single maximum detection for each radionuclide/media, and the use of very conservative consumption rates.

Average dose (AEI) was given prominence as protective for general dose considerations, and the reader should be aware that the AEI dose estimate was conservative or biased high due to the use of detections only and the use of very conservative consumption rates for the SCDHEC AEI. All detected dose above background was assigned either to the AEI, MEI, or NORM dose dependent on assignable cause that was based on knowledge of environmental sources, media, and locations

(Section 5.1.2, Table 1 and Section 5.1.3 Data Tables). For example, the potential dose in resuspended soils was not assigned as farmer inhalation, if not detected by air samplers (see atmospheric pathway section). The SCDHEC MEI was primarily a sportsman scenario because most potential dose was found in game animals and fish. However, the wild mushroom consumer potential dose would add significant additional dose to the survivalist. The MEI would consume the single highest maximum detections/radionuclide/media and defines a limit of possible dose. This was done since SCDHEC sampling was limited and does not necessarily include the true MEI exposure (due to undetected dose) for the exceptional individual who may receive the MEI dose that is resident in the 50-mile perimeter study area. Thus, the dose limiting factors were biased high to be protective of the public and the environment, but realistic or limiting in that only measured radionuclide specific values were used.

Only specific radionuclide (speciated) doses were included in the estimated dose for 2008. The use of detections only, the calculation of dose based on a single maximum for each radionuclide/media, and high consumption levels provide an elevated dose basis that is protective without the inclusion of screening value assumptions for alpha and beta. SCDHEC field detection dose accumulations and DOE-SR releases were not directly comparable and yet the potential MEIs calculated from both programs were close primarily due to the dominance of Cs-137 in the wild food pathway.

This project used dose instead of risk so that direct comparisons of dose magnitude can be made with data published in the SRS Environmental Reports. The USEPA and SCDHEC both use risk calculations when determining clean-up levels at Comprehensive Environmental Resource Compensation and Liability Act (CERCLA) and Resource Conservation Recovery Act (RCRA) sites. DOE-SR radionuclide releases for a particular year are not directly comparable to SCDHEC yearly-detected dose in some media due to accumulation or biomagnification factors that may occur over many years.

Conclusions and Recommendations

The survivalist MEI scenario should include all potential dose as a worst-case scenario. The SCDHEC detected worst-case dose potential that excludes the South Carolina background was 4.663 mrem in 2008. A preliminary survey of bolete fungi indicated that edible fungi should be monitored for dose to the MEI. The SCDHEC MEI total potential dose was based on single highest maximum detections in 2008 (4.663 mrem) that included bolete fungi of general edibility, and was less than the dose received by living in a brick home for one year (7 mrem) (Section 5.1.2, Figure 2). Additional dose added primarily for DOE-SR onsite estimates for sportsmen increased the total offsite potential dose to 20.457 mrem and the combined onsite and offsite dose potential to 33.457 mrem for the MEI. This improbable MEI potential confirmed that the DOE-SR 100 mrem dose standard to the public was not exceeded in 2008 despite contributions from other years dose and bioaccumulations. The close agreement on the total MEI potential dose between the SCDHEC (33.457 mrem) and DOE-SR (29.90 mrem) environmental monitoring program estimates was due primarily to the Cs-137 occurrence in bioconcentrators of dose in the sportsman food pathway and not to correspondence between releases and detected dose in media.

The SCDHEC 2008 MAX perimeter atmospheric (2.647 mrem) and liquid (2.016 mrem) dose estimates based on single maximum dose detections per applicable media were well within the respective 10 mrem and 4 mrem DOE limits. Inhalation was 0.053% of the dose to the critical pathway, ingestion was 99.578%, and direct exposure was 0.370% in 2008.

Four dose scenario estimates were calculated based on SCDHEC data from 1999 to 2008 as an average exposed individual (AEI). The AEI Sportsman who was not the MEI was exposed to 1.163 mrem of dose in 2008 and averaged 1.49 (±1.51) mrem with a median of 1.08 mrem for 1999-2008. The AEI Farmer, who was not a hunter, but inhaled, ingested, or received direct exposure from soil, received a dose of 0.07 mrem in 2008 and averaged 0.20 (±0.25) mrem with a median of 0.09 mrem from 1999-2008. A minority category, the AEI Survivalist (1.89 mrem) who was a wild mushroom consumer (new in 2008), adds to the sportsman dose because boletes in general are bioconcentrators of Cs-137. The AEI Public who was not a sportsman or wild mushroom consumer, and was not exposed to swamp soils received less than 0.07 mrem of dose in 2008 and averaged 0.12 (±0.09) mrem with a median of 0.09 mrem from 1999-2008 (Section 5.1.2, Table 2). The general public AEI dose is the dose that applies to most people within the study area. The MAX Sportsman substitutes maximum sports food dose for AEI dose and was 2.90 mrem in 2008, and averaged 11.45 (±11.01) mrem with a median of 8.36 mrem from 1999-2008. The MAX Survivalist adds only edible mushroom dose to the MAX Sportsman dose in 2008 and was 4.66 mrem.

Most of the 1999-2008 AEI dose was the result of atmospheric pathway deposits (57.37% or 9.37 mrem) and the balance was from the liquid pathway or route (42.63% or 6.96 mrem)(Section 5.1.2, Table 6). The sportsman subpathway contributed the greatest dose to the public from 1999 through 2008 primarily through wild food ingestion dose (87.80% or 14.33 mrem) from hog, deer, fish, and fungi media containing cesium-137. The second highest dose subpathway was due to untreated water supply subpathway consumption (5.62% or 0.92 mrem), primarily from tritium. The direct exposure subpathway was the third major pathway (3.28% of dose or 0.53 mrem), primarily from Cs-137 in Savannah River bank soil at public boat landings. Potable public water supply sources were fourth (2.90% or 0.47 mrem) due to tritium, and inhalation was fifth (0.40% or 0.07 mrem), primarily from tritium. Cesium-137 and Sr-89/90 were the main contributors of dose, primarily through the wild food pathway, and tritium was the primary contributor to dose in the surface water pathway.

The SCDHEC Critical Pathway Dose Project will continue to monitor the MEI dose trends. SCDHEC expanded the Environmental Surveillance Oversight Program (ESOP) in 2004 by adding random SRS perimeter and South Carolina background samples to improve statistical comparisons. ESOP has increased sampling near the perimeter of SRS and in closer proximity to SRS tank farms, basins and seepage areas to ensure an early warning for any contaminant making its way to the SRS streams. New media sampling will be added in the future if needed. Bolete fungi sampling was started in 2008 to address the concern for Cs-137 bioconcentration in edible fungi.

Potential atmospheric and liquid release concerns that may play a relatively larger role in the dose to the surrounding public in the future may include the following:

- Releases of Am-241, plutonium and uranium radionuclides from the Mixed Oxide Fuel Fabrication Facility (MFFF) through the air and surface water environmental mediums (Duke, COGEMA, Stone, & Webster 1998);
- A high concentration of tritium predicted by computer models migrating from the Old Radioactive Waste Burial Ground (ORWBG) to Upper Three Runs (WSRC 2001) and/or the Savannah River;
- Radionuclides such as carbon-14 (C-14), I-129, neptunium-237 (Np-237) and technetium-99 (Tc-99) may be an ORWBG contaminant to monitor in the future because

- of their long half-lives;
- And potential dose from the new Mixed Oxide (MOX) facility operations.

These findings indicated that environmental monitoring programs should focus on bioconcentrators of dose, especially within the sportsman food and wild mushroom consumer subpathways, in addition to the primary inhalation, ingestion, and direct exposure routes from the atmospheric and liquid pathways. The down-gradient wells, surface water, sediments, plants, and animals should be carefully monitored for any signs of the contaminants that are present at tank farms, basins, and seepage areas. Early detection is paramount to protecting the public and the environment if a release to offsite streams or groundwater occurs. Increased background and SRS perimeter sampling by SCDHEC started in 2004, and should improve the evaluation of background and perimeter concentrations. SCDHEC will continue to monitor the SRS and adjacent area for the primary radionuclide contributors to dose associated with DOE-SR operations.

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5.1.2 Tables and Figures

2008 Critical Pathway Dose

Table 2. Dose Scenarios and MEI Estimates

Scenarios in Millirem of Exposure	2008	1999-2008		
SCDHEC Scenarios	**Avg.**	**Avg.**	**SD**	**Median**
AEI Public[1]	0.07	0.12	0.09	0.09
AEI Farmer[2]	0.07	0.20	0.25	0.09
AEI Sportsman[3]	1.16	1.49	1.51	1.08
AEI Survivalist[4] (same as Table 1 AEI Perimeter Dose Total)	1.89	NA	NA	NA
MAX Sportsman[5]	2.90	11.45	11.01	8.36
MAX Survivalist[6] (same as Table 1 MAX Perimeter Dose Total)	4.66	NA	NA	NA
MEI[7] - All dose potential (a nonscenario maximum) and not considered achievable.	33.46	NA	NA	NA

Notes: AEI means average (greater than background) exposed individual.

1 – The nonsportsman public who is only exposed to the milk, air, edible vegetation, and the highest public water supply dose.

2 – The farmer scenario adds the sediments, soil, and highest well water dose in place of the public water supply dose to the public dose. The farmer is treated as a nonsportsman.

3 – The average sportsman scenarion adds the average game (deer, hog, fish) to the public dose and uses the highest public, private, or river water source dose.

4 - The average survivalist adds all AEI dose detections.

5 – Substitutes the highest deer, hog, fish (MAX) dose in #3 (AEI Sportsman) above.

6 - Adds all MAX dose detections.

7 - The MEI is a single maximum exposed individual who receives all SCDHEC maximums irregardless of scenario and improbability of exposure, and includes all relevant dose additions from DOE-SR media (Section 4, Table 3).
The 1999-2008 average does not apply (NA) due to differences in dose considerations and sampling media before 2008.

Tables and Figures

Table 3. 2008 MEI All-Pathway and Survivalist Potential Dose Comparisons to DOE-SR (mrem)

Pathway	Media Comparison Additional Dose	DOE-SR[1]	SCDHEC[2]	Add to SCDHEC[3]
All-Pathway	Liquid plus Airborne[4]	0.120	0.312	NA
Sportsman	Onsite Hunter	13.000	**NS**	13.000
	Creek Mouth Fish	0.110	1.764	NA
	Offsite Hog	7.700	**NS**	7.700
	Offsite Deer	5.700	0.760	4.940
	Hunter Soil Exposure[5]	2.900	0.009	2.891
	Fisherman Soil Exposure[6]	0.280	0.017	0.263
	Other Pathway[7]	0.030	0.113	NA
Mushroom Consumer	Bolete Fungi[8]	NA	1.767	NA
Totals	**SCDHEC MEI**	NA	**4.663**	NA
	Total Difference to be added for MEI	NA	**28.794**	**28.794**
	SCDHEC plus DOE-SR MEI Additions[9]	NA	**33.457**	NA

Notes:
1 - Comparisons from DOE-SR data Table 6-4 (WSRC 2008)
2 - Maximums or single highest detection basis for all media per route of exposure
3 - MEI all-source dose additions. DOE-SR offsite dose is based on computer modeling that appears biased high.
4 - APW inhalation plus LPW water source ingestion (underlined in Table 1), vegetables, and milk.
5 - APW soil sources were from Creek Plantation (DOE-SR) and other soil and sediment (SCDHEC).
6 - LPW soil and sediment sources (location differences).
7 - Soil and sediment ingestion and recreational sources
8 - Bolete fungi dose from Cs-137 bioconcentration averaged 0.73 mrem > background and maximum was 1.760 mrem.
9 - Biased high primarily due to single maximums (SCDHEC), assigned dose (DOE-SR), and released dose basis.
Not all released dose results in exposure, and explains why field measurements do not detect all dose released.

Tables and Figures

Table 4. Sportsman versus Nonsportsman Food Comparison

	2008		1999-08 mrem		
2008 AEI Food Categories	**Total mrem**	**Media**	**Avg.**	**SD**	**Median**
Sportsman	1.08	Fish,Deer,Hog	1.28	1.57	0.85
Nonsportsman Public Food	0.05	Veg and Milk	0.08	0.08	0.05
MAX Sportsman Food	**2.52**	**Fish,Deer,Hog**	**11.25**	**11.09**	**8.21**
AEI All-Food Ttl[1] (excluding boletes)	**1.13**	**2008 Food[3]**	**AEI**	**MAX**	**% of MEI[4]**
Substitute MAX Deer for AEI Deer	1.89	2008 Boletes	0.730	1.767	37.89
Substitute MAX Fish for AEI Fish	1.82	2008 Sportsman	1.079	2.524	54.13
Add MAX Bolete to 2008 AEI[2]	2.90	2008 Public	0.049	0.108	2.32
All Food Totals[1]			**1.858**	**4.399**	94.34

Notes:
1 - The All-Food total is based on the AEI values from Section 4.0, Table 1.
2- Bolete maximum dose (1.767 mrem) above background added to the all-food AEI total (1.13 mrem).
3 - All food radionuclide detections (nonNORM) on an AEI and MAX basis.
4 - % of MEI is on a MAX basis.

Table 5. SCDHEC and DOE-SR Media Dose Pathway Maximums

Environmental Monitors - 2008	**SCDHEC**				**DOE-SR (1)**			
Pathways - - - - - - - Media and Dose[2]	**Air**	**Liquid**	**Soil**	**Food**	**Air**	**Liquid**	**Soil**	**Food**
Water		0.202				0.079		
Inhalation	0.002				0.017			
Combined Soil[3]			0.031				3.180	
Swimming		0.029				0.000		
Boating		0.000				0.000		
Milk				0.003				0.011
Edible Vegetation				0.105				0.088
Creek Mouth Fish				1.764				0.110
Offsite Deer				0.760				5.700
Totals	0.002	0.231	0.031	2.632	0.017	0.079	3.180	5.909
Avg	0.002	0.077	0.031	0.658	0.017	0.026	3.180	1.477
SD	NA	0.109	NA	0.810	NA	0.046	NA	2.816
Median	0.002	0.029	0.031	0.433	0.017	0.000	3.180	0.099
2006 MEI Comparison	**Pathways**				**Summary Statistics**			
Totals	**Air**	**Liquid**	**Soil**	**Food**	**Totals**	**Avg[4]**	**SD[5]**	**Median**
SCDHEC	0.002	0.231	0.031	2.632	2.896	**0.724**	*1.276*	0.131
DOE-SR	0.017	0.079	3.180	5.909	9.185	**2.296**	*2.825*	1.630
Averages of Programs	0.010	0.155	1.606	4.270	6.040	1.510	2.050	0.880
Standard Deviation	0.011	0.107	2.227	2.317	4.447	1.112	1.095	1.060
% of standard[6]	**0.170**	**5.775**						

Notes:
1. Used DOE-SR maximum source estimates of dose to the MEI from liquid, goat, irrigation, and sportsman pathways the Savannah River Site Environmental Report for 2008, SRNS-STI-2009-00190.
2. These media are not directly comparable due to media dose factors and release data versus field accumulations over several years, but do illustrate potential variance levels.
3. The combined soil reflects dose from surface and riverbank soil (SCDHEC), swamp and Steel Creek soils (DOE-
4. Avg is average.
5. Sd is standard deviation.
6. % is percent of EPA and DOE air (10 mrem) and liquid (4 mrem) standards using highest result, SCDHEC or DOE

Tables and Figures

Table 7. 1999-2008 DOE-SR Percent of Total Dose to the MEI for Atmospheric and Liquid Releases

MEI from Atmospheric Releases (MAXIGASP-SR Code) Percent of Total Dose										
DOE-SR	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Plume	0.1	0.4	0.5	0.2	0.4	0.0	0.0	0.0	0.0	0.00
Ground	1.0	1.7	0.7	2.1	1.7	1.6	2.3	6.4	3.8	0.30
Inhalation	48.3	45.7	42.6	41.0	33.5	43.4	42.7	41.6	41.1	43.20
Vegetation	44.4	41.9	44.1	44.5	51.9	39.4	40.7	46.3	39.6	39.32
Cow Milk	4.6	7.3	9.0	9.1	9.6	11.3	10.3	1.5	10.9	12.34
Meat	1.7	2.9	3.2	3.2	2.9	4.4	4.0	4.3	4.6	4.84

Cow Milk Pathway			
1999-2008	**Avg**	**SD**	**Median**
Plume	0.2	0.2	0.1
Ground	2.2	1.8	1.7
Inhalation	42.3	3.8	42.7
Vegetation	43.2	3.9	43.0
Cow Milk	8.6	3.3	9.4
Meat	3.6	1.0	3.6

MEI from Liquid Releases Percent of Total Dose										
	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Fish	61.0	45.8	40.2	42.5	55.4	47.0	59.0	59.0	51.0	43.0
Water	38.5	53.9	59.5	57.2	44.2	53.0	41.0	41.0	49.0	57.0
Shoreline	0.4	0.3	0.3	0.3	0.4	<1	<1	<1	<1	<1
Swimming	0.0	0.0	0.0	0.0	0.0	<1	<1	<1	<1	<1
Boating	0.0	0.0	0.0	0.0	0.0	<1	<1	<1		

Potential MEI Dose from the Liquid Releases			
1999-2008	**Avg**	**SD**	**Median**
Fish	50.4	7.8	49.0
Water	49.4	7.7	51.0
Shoreline	0.3	0.1	0.3
Swimming	0.0	0.0	0.0
Boating	0.0	0.0	0.0

Notes:

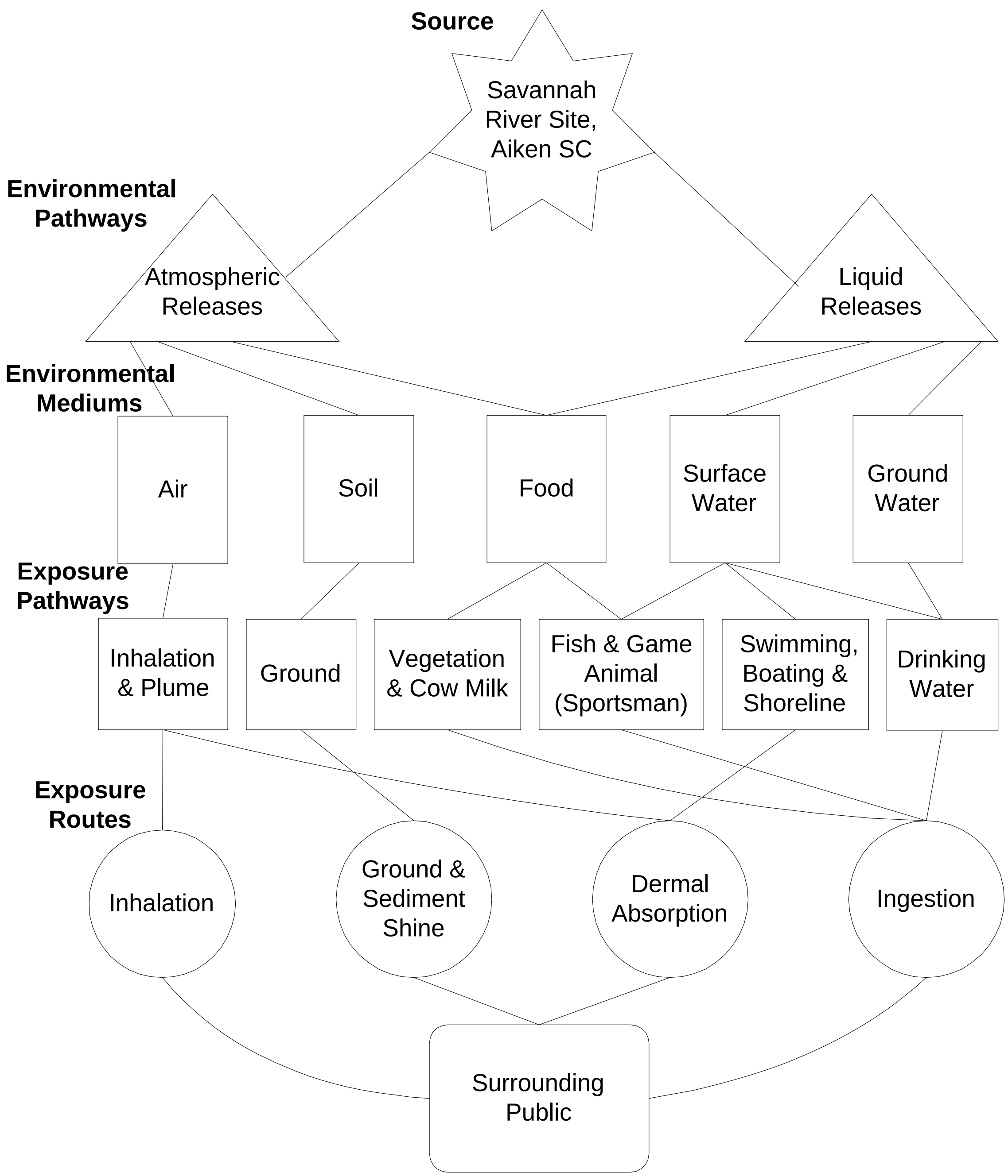
1 - See the list of acronyms for abbreviation definitions.

2 - Data accumulated from the DOE-SR SRS Environmental Reports for the listed years.

Tables and Figures

Figure 1. DOE-SR Critical Pathways and Dose Media

SRS Exposure Pathway



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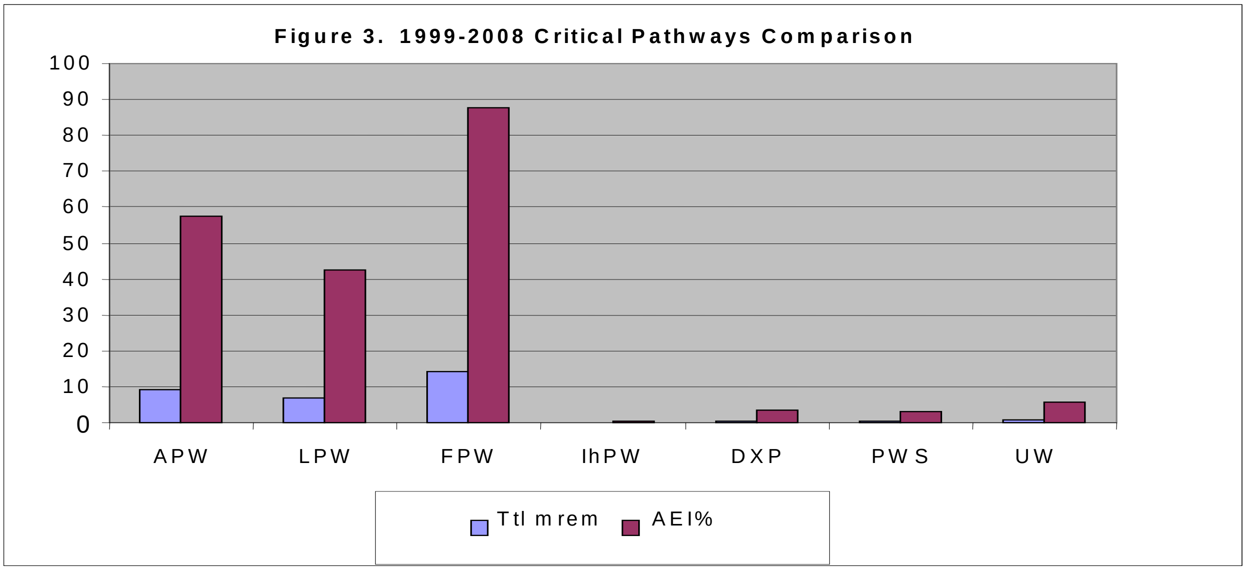


Notes:
1 – APW is the atmospheric pathway or air plus deposition dose.
2 – LPW is the liquid pathway or water dose.
3 – FPW is the food subpathway.
4 – IhPW is the inhalation subpathway.
5 – DXP is the direct exposure subpathway.
6 – PWS is the public water systems drinking water subpathway.
7 – UW is the nonpotable or untreated drinking water pathway.
8 - Does not include alpha, beta, or beta-gamma since they are nonspecific screening values.

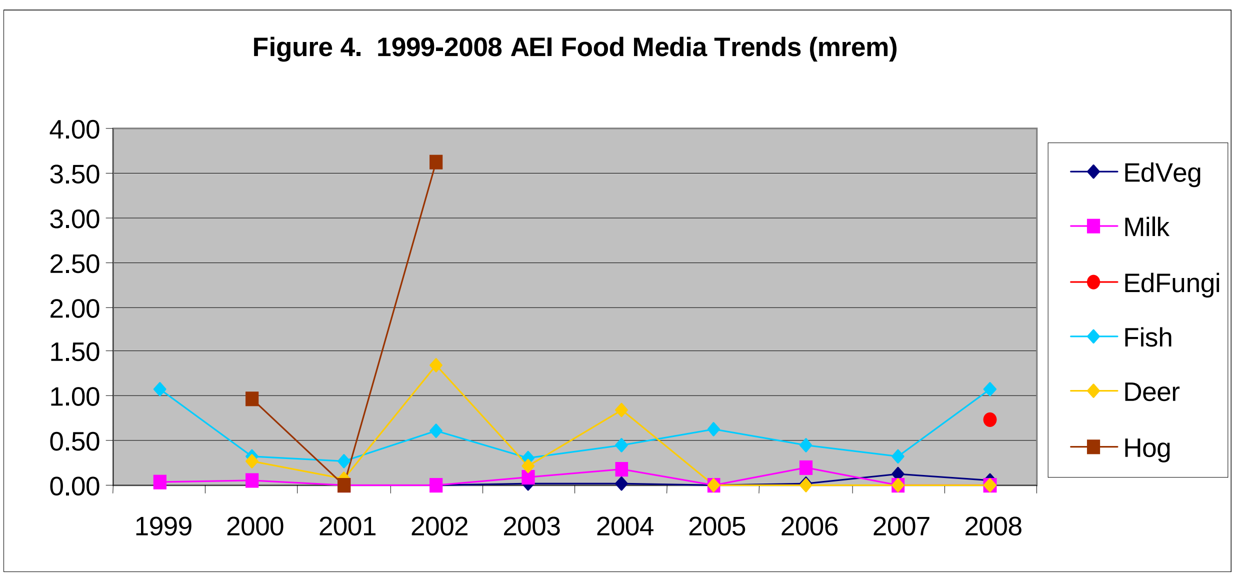


Figure 5. 1999-2008 AEI Versus MAX Dose Trends in Food Media (mrem)

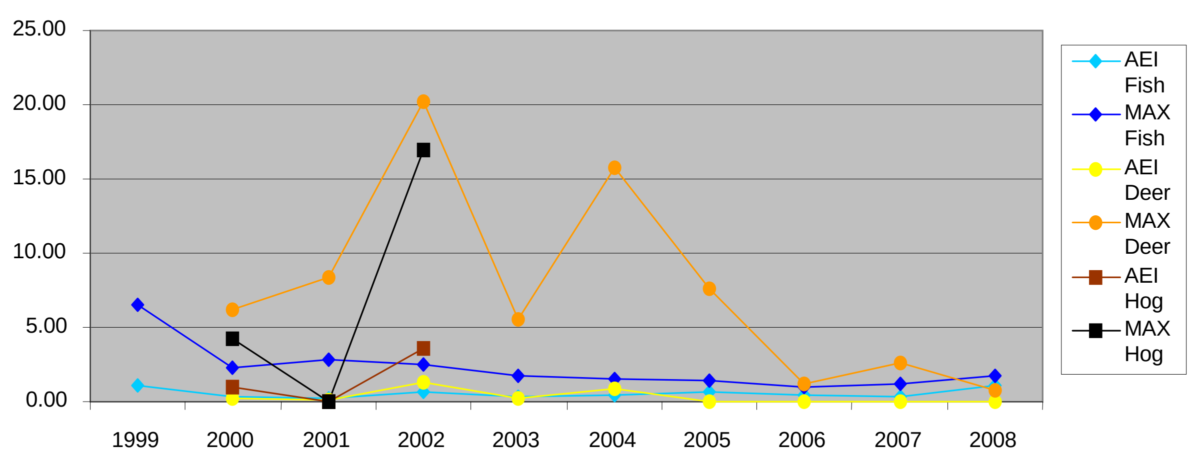
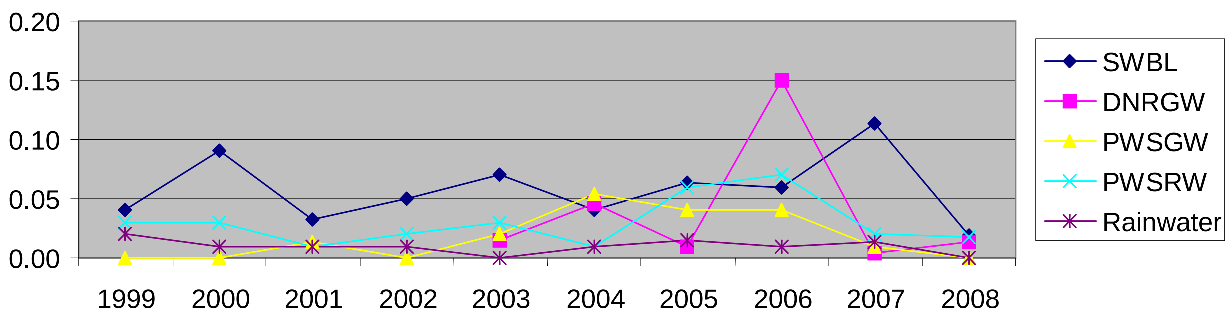
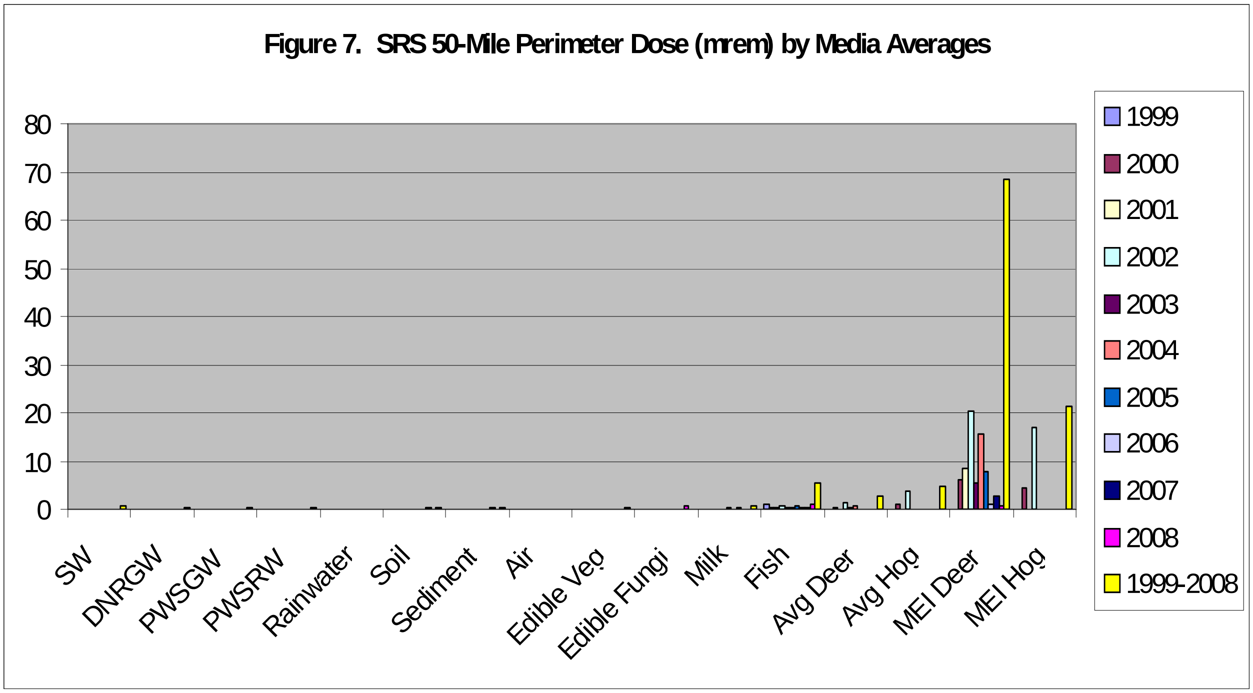


Figure 6. AEI Water Consumption Dose Trends (mrem)



Tables and Figures



Notes:
1. The 1999-2008 bars are the totals of the yearly averages greater than background.

TOC

5.1.3 Data

Critical Pathway Dose

Notes:

1 – The following "Average Dose" data tables subtract an average background activity from the average activity of the listed radionuclide found in a media.

2 – The "Single Highest Dose" data tables subtract the average background from the single highest maximum for a particular radionuclide found in a media.

3 – The resultant net activity is multiplied by a consumption rate and dose factors from USEPA FGR sources to obtain the dose result for a particular radionuclide and media source. The 2006 Dose Report and 2007 Critical Pathway Dose plan explain how these calculations result in a dose estimate in millirem per year.

4 – The last column gives the resultant dose that was assigned to the maximum exposed individual.

5 – The subtotal column exposure per radionuclide columns show other dose of interest; for example, NORM dose totals not assigned to the MEI. Alpha, beta, and beta-gamma dose is no longer included since these are screening values with assigned dose based on a maximum.

6 – See the list of acronyms, radionuclides, and units for abbreviation definitions.

7 – Note that some tables are continued on a second page where the dose assigned to the MEI and NORM are totaled to represent typical dose from water (liquid pathway), soil and air (atmospheric pathway), and food (ingestion pathway) media.

8 - Section 4, Table 1 places the dose from media sources into applicable critical pathway categories. There are many crossover pathways; for example liquid dose can result in both direct exposure to the swimmer and water ingestion. Specific knowledge of the science, radionuclides, media, locations, and supporting media are required to properly assign dose as NORM or nonNORM.

9 – Examples of factors affecting dose assignment are discussed as needed.

10 – Calculations by SCDHEC are to three decimal places in millirem determinations and rounded as needed for appropriate comparisons to DOE-SR data.

2008 Average Dose Detections in Food Media

Project	Isotope	Activity			MCR	Dose	Summaries		MEI
Media		Avg	Bkg	Net		mrem	NonNorm Basis		Dose
Potential Dose from Fish Ingestion							Avg	Totals	NonNORM
Fish		pCi/g	pCi/g	pCi/g	kg/yr	mrem	avg/rad	by Fish	Basis
Bass	**H-3**	**4.040E-01**	**0.000E+00**	**0.404**	48.2	**0.001**	**H-3**	**Bass**	
	Cs-137	**2.436E-01**	**0.000E+00**	**0.244**	48.2	**0.587**	**0.001**	**0.596**	
	Sr-89/90	**6.550E-02**	**5.200E-02**	**0.014**	48.2	**0.008**	**Cs-137**	**Catfish**	
	K-40	3.412E+00	2.624E+00	**0.789**	48.2	0.707	**0.562**	**0.044**	
	Pb-214	1.780E-01	0.000E+00	**0.178**	48.2	0.005	**Sr-89/90**	**Pickerel**	
	Bass NORM plus nonNORM dose average					0.262	**0.006**	**1.067**	
Catfish	**H-3**	**3.620E-01**	**0.000E+00**	**0.362**	48.2	**0.001**	**Red Drum**	**Mullet**	
	Cs-137	**5.100E-02**	**3.750E-02**	**0.014**	48.2	**0.033**	**0.006**	**0.001**	
	Sr-89/90	**3.640E-02**	**1.840E-02**	**0.018**	48.2	**0.010**	**Sea Trout**	**All Fish Ttl**	
	K-40	3.206E+00	2.613E+00	**0.593**	48.2	0.531	**0.000**	**1.714**	
	Pb-214	6.200E-02	0.000E+00	**0.062**	48.2	0.002	**Highest Isotopes Total of**		**1.079**
	Catfish NORM plus nonNORM dose average					0.115	**nonNORM in Fish**		
Pickerel	**H-3**	**Not analyzed for tritium.**					NORM Basis		
	Cs-137	**4.802E-01**	**3.750E-02**	**0.443**	48.2	**1.067**	Avg	Totals	
	K-40	3.117E+00	0.000E+00	**3.117**	48.2	2.793	avg/rad	by Fish	
	Pickerel NORM plus nonNORM dose average					1.930	K-40	Bass	
Mullet	**H-3**	**3.000E-01**	**0.000E+00**	**0.3**	48.2	**0.001**	1.734	0.712	
	Sr-89/90	**6.000E-03**	**5.950E-03**	**5E-05**	48.2	**0.000**	Pb-212	Catfish	
	K-40	3.785E+00	0.000E+00	**3.785**	48.2	3.392	0.101	0.533	
	Pb-212	4.600E-02	0.000E+00	**0.046**	48.2	0.101	Pb-214	Pickerel	
	Pb-214	4.350E-01	0.000E+00	**0.435**	48.2	0.013	0.007	2.793	
	Mullet NORM plus nonNORM dose average					0.701	Red Drum	Mullet	
Red Drum	**Sr-89/90**	**9.550E-03**	**0.000E+00**	**0.00955**	48.2	**0.0055**	2.984	3.506	
	K-40	3.321E+00	0.000E+00	3.321	48.2	2.9762	Sea Trout	All Fish Ttl	
	Pb-214	2.700E-01	0.000E+00	0.27	48.2	0.0081	3.075	13.605	
	Red Drum NORM plus nonNORM dose average					0.997			
Sea Trout	K-40	3.426E+00	0.000E+00	3.426	48.2	3.0703			
	Pb-214	1.730E-01	0.000E+00	0.173	48.2	0.0052			
	Sea Trout NORM plus nonNORM dose average					1.538			
				Highest NORM Isotopes in Mullet				3.506	
Potential Dose from Milk Ingestion							**Ttl Highest Isotopes**		
Milk Ingestion		**pCi/g**	**pCi/g**	**pCi/g**	**kg/yr**	**mrem**	**H-3**	**Cow Ttl**	**0.003**
Cow	**H-3**	**2.180E-01**	**0.000E+00**	**0**	230	**0.000**	**0.000**	**0.0026**	
	Sr-89/90	**9.400E-04**	**0.000E+00**	**0.001**	230	**0.003**	**Sr-89/90**	NonNORM	
	Cow milk nonNORM dose avg					**0.0013**	**0.003**	0.000	
Potential Dose from Game Animal Ingestion									
Game Animal		**Study Area Average**		**Bkg Average**			**Avg Deer Dose**		**0.000**
Ingestion		**mrem**		**mrem**		**mrem**			
Avg Deer	**Cs-137**	**8.500E-01**		**4.850**		0.000			
Potential Dose from Edible Vegetation							**NonNorm Basis Ttls**		
Type	**Isotope**	**pCi/g**	**pCi/g**	**pCi/g**	**kg/yr**	**mrem**	**MEI VEG Dose**		**0.046**
Leafy	**Sr-89/90**	**5.100E-02**	**0.000E+00**	0.051	73	**0.045**	**H-3**	**0.001**	
	Be-7	1.127E+00	0.000E+00	1.127	73	0.011	**Sr-89/90**	**0.045**	
	K-40	4.848E+00	2.982E+00	1.866	73	2.533			
	Pb-214	1.730E-01	0.000E+00	0.173	73	0.008			
	Leafy vegetables NORM plus nonNORM average					0.649			
Fruit	**H-3**	**3.830E-01**	**3.530E-01**	0.030	276	**0.001**	NORM Basis Ttls		
	K-40	5.595E+00	1.951E+00	3.644	276	18.699	Leafy Ttl	2.551	
	Pb-214	1.550E-01	2.270E-01	0.000	276	0.000	Fruit Ttl	18.699	
	Vegetable fruits NORM plus nonNORM average					6.233			
Boletes [5]	Cs-137	5.340E+00	1.340E+00	4.000	3.650	0.730	**nonNORM in Fungi**		**0.730**
							Total NORM		34.855
							Total nonNORM		**1.857**
							All Detected Dose		36.712

Table notes:
1 - Bold denotes NonNORM isotope or radionuclide activity.
2 - Nonbold denotes NORM activity.
3 - Underlined data is the highest detection per isotope contributing to the stated MEI value.
4 - Fish total dose is based on adding the highest values per each radionuclide regardless of fish species.
5 - Bolete fungi are generally edible and therefore their potential dose was added.

2008 Single Highest Dose Detections in Food Media

Project	Isotope	Activity			MCR	Dose	Summaries		MEI
Media		Avg	Bkg	Net		mrem	NonNORM Basis		Dose
Potential Dose from Fish Ingestion						by	Avg	Totals	NonNORM
Fish	Isotope	pCi/g	pCi/g	pCi/g	kg/yr	mrem	avg/rad	by Fish	Basis
Bass	H-3	9.540E-01	0.000E+00	0.954	48.200	0.003	H-3	Bass	
	Cs-137	6.995E-01	0.000E+00	0.700	48.200	1.686	0.002	1.764	
	Sr-89/90	1.825E-01	5.200E-02	0.131	48.200	0.075	Cs-137	Catfish	
	K-40	3.833E+00	2.624E+00	1.210	48.200	1.084	0.999	0.266	
	Pb-214	2.470E-01	0.000E+00	0.247	48.200	0.007	Sr-89/90	Pickerel	
	Bass NORM plus nonNORM dose average					0.571	0.033	1.067	
Catfish	H-3	5.070E-01	0.000E+00	0.507	48.200	0.002	Red Drum	Mullet	
	Cs-137	1.384E-01	3.750E-02	0.101	48.200	0.243	0.006	0.004	
	Sr-89/90	5.480E-02	1.840E-02	0.036	48.200	0.021	Sea Trout	All Fish	
	K-40	3.602E+00	2.613E+00	0.990	48.200	0.887	0.000	3.107	
	Pb-214	8.300E-02	0.000E+00	0.083	48.200	0.003	Highest Isotopes Total		1.764
	Catfish NORM plus nonNORM dose average					0.231	NORM Basis		
Pickerel	Cs-137	4.802E-01	3.750E-02	0.443	48.200	1.067	Avg	Totals	
	K-40	3.883E+00	0.000E+00	3.883	48.200	3.480	avg/rad	by Fish	
	Pickerel NORM plus nonNORM dose average					2.273	K-40	Bass	
Mullet	H-3	3.000E-01	0.000E+00	0.300	48.200	0.001	2.481	1.091	
	Sr-89/90	6.000E-03	0.000E+00	0.006	48.200	0.003	Pb-212	Catfish	
	K-40	3.785E+00	0.000E+00	3.785	48.200	3.392	0.101	0.889	
	Pb-212	4.600E-02	0.000E+00	0.046	48.200	0.101	Pb-214	Pickerel	
	Pb-214	4.350E-01	0.000E+00	0.435	48.200	0.013	0.007	3.480	
	Mullet NORM plus nonNORM dose average					0.702		Mullet	
Red Drum	Sr-89/90	9.550E-03	0.000E+00	0.00955	48.2	0.006		3.506	
	K-40	3.321E+00	0.000E+00	3.321	48.2	2.976		Red Drum	
	Pb-214	2.700E-01	0.000E+00	0.27	48.2	0.008		2.990	
	Red Drum NORM plus nonNORM dose average					0.997	All Fish	Sea Trout	
Sea Trout	K-40	3.426E+00	0.000E+00	3.426	48.2	3.070	15.032	3.075	
	Pb-214	1.730E-01	0.000E+00	0.173	48.2	0.005	Ttl Highest Isotopes		
	Sea Trout NORM plus nonNORM dose average					1.538	NORM	3.594	
Milk Ingestion Dose		pCi/g	pCi/g	pCi/g	kg/yr	mrem	Milk nonNORM Dose		0.003
Cow	H-3	2.180E-01	0.000E+00	0.000	230.000	0.000			
	Sr-89/90	1.080E-03	0.000E+00	0.001	230.000	0.003			
	Cow milk nonNORM dose average					0.0015			
Potential Dose from Game Animal Ingestion									
Game Animal		Study Area Average		Bkg Average			MEI Deer Dose		0.760
Ingestion	Isotope	mrem		mrem		mrem			
	Maximally Exposed Individual (MEI) Deer Hunter								
MEI Deer	Cs-137	5.610E+00		4.850		0.760			
Potential Dose from Edible Vegetation							NonNORM Basis Ttls		0.105
Type	Isotope	pCi/g	pCi/g	pCi/g	kg/yr	mrem	H-3	0.006	
Leafy	Sr-89/90	1.130E-01	0.000E+00	0.113	73.000	0.099	Sr-89/90	0.099	
	Be-7	1.355E+00	0.000E+00	1.355	73.000	0.013	NonNORM	0.105	
	K-40	9.499E+00	2.982E+00	6.517	73.000	8.845			
	Pb-214	2.730E-01	0.000E+00	0.273	73.000	0.012	NORM Basis Ttls		
	Leafy vegetables NORM plus nonNORM average					2.242	Leafy Ttl	8.870	
Fruit	H-3	6.730E-01	3.530E-01	0.320	276.000	0.006	Fruit Ttl	79.431	
	K-40	1.743E+01	1.951E+00	15.479	276.000	79.431	Veg NORM dose		
	Pb-214	1.690E-01	2.270E-01	0.000	276.000	0.000	88.302		
Notes:	Vegetabel fruits NORM plus nonNORM average					26.479			
Boletes[5]	Cs-137	1.102E+01	1.340E+00	9.680	3.650	1.767	NonNORM Basis Ttls		1.767
							Total Food NORM		91.896
							Total Food nonNORM		4.399
							All Detected Dose Total		96.295

1 - Bold denotes NonNORM isotope or radionuclide activity.
2 - Nonbold denotes NORM activity.
3 - Underlined data is the highest detection per isotope contributing to the stated MEI value.
4 - Fish total dose is based on adding the highest values per each radionuclide regardless of fish species.
5 - Bolete fungi are generally edible and therefore their potential dose was added.

2008 Average Dose Detections in Water Media

Project	Isotope	Avg	Bkg	Net	MCR	Dose	Exposure Group		MEI
Water		Activity	Activity	Activity		mrem			Dose
Sources	Radionuclide Ingestion From Surface Water (SW) and Well							Totals	(mrem)
PWSRW(DW)		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.018**
SW	**H-3**	**6.04E+02**	**2.11E+02**	393.000	730	**0.018**	NORM/Unk		
Savannah River Public Water Supplies (PWS) Drinking Water (DW)							Avg	Totals	
PWS Savannah River Water (SRW) Average Dose All Rads						0.018	0.000	0.000	
Includes SRW from Chelsea, Beaufort Jasper, and City of Savannah minus North Augusta background.									
PWSGW(DW)		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.000**
GW	**H-3**	**2.40E+02**	**4.41E+02**	0.000	730	**0.000**	NORM/Unk		
Public Water Supplies with Groundwater (GW) Sources							Avg	Totals	
PWS Average Dose from Random and nonRandom Wells.						0.000	0.000	0.000	
DNRGW		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.014**
GW	**H-3**	**2.95E+02**	4.00E+00	291.000	730	**0.014**	NORM/Unk		
DNR Monitoring Wells (comparable to local untreated private wells)							Avg	Totals	
Department of Natural Resources (DNR) Ground Water Avg Dose						0.014	0.000	0.000	
Nonpotable		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.019**
SW	**H-3**	**7.70E+02**	**3.60E+02**	410.000	730	**0.019**	NORM/Unk		
Savannah River Boat Landings							Avg	Totals	
Average Dose from nonRandom Samples.						**0.019**	0.000	0.000	
Rainwater	**H-3**	**2.96E+02**	**3.67E+02**	0	730	0.000	**NonNORM……**		**0.000**
Represents dose that may accumulate in cisterns and used as drinking wat							NA	NA	
Streams and Savannah River Surface Water Samples Excluding PWSRW(DW)									
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.005**
Ingestion	**H-3**	**8.78E+03**	**3.60E+02**	**8.42E+03**	91	**0.005**	NORM/Unk		
Ingestion while swimming at Savannah River Site Creek Mouths							Avg	Totals	
Swimming Ingestion Average Dose from Swallowing Creek Water						0.005	0.000	0.000	
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.000**
Immersion	**H-3**	**8.78E+03**	**3.60E+02**	**8.42E+03**	91	0.000	NORM/Unk		
Direct exposure to the skin while swimming at SRS Creek Mouths.							Avg	Totals	
Average Dose from Skin Exposure to Creek Water						0.000	0.000	0.000	
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.000**
Boating	**H-3**	**8.78E+03**	**3.60E+02**	**8.42E+03**	192	0.000	NORM/Unk		
Direct exposure from SRS Creek Mouth Water while Boating							Avg	Totals	
Boating Average Dose from Skin Exposure to Creek Water						0.000	0.000	0.000	
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.000**
Resident	**H-3**	**8.78E+03**	**3.60E+02**	**8.42E+03**	4380	0.000	NORM/Unk		
Swamp House or Houseboat Dose Exposure to Water							Avg	Totals	
Swamp Resident Average Dose from Skin Exposure to Creek Wate						0.000	0.000	0.000	
Sediment Random plus Nonrandom at Creek Mouths									
Sediment Dose		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**NonNORM……**		**0.002**
Skin	**Cs-137**	**6.91E-01**	**2.84E-01**	0.00E+00	91	**0.000**			
Wading	**Eu-155**	**4.59E-01**	**0.00E+00**	4.59E-01	91	**0.000**			
Barefoot	**Pu-239**	**1.70E-02**	**0.00E+00**	1.70E-02	91	**0.000**			
to 1 cm	**Total Sr**	**4.02E-01**	**0.00E+00**	4.02E-01	91	**0.000**			
(centimeter)	**Zr-95**	**5.03E-01**	**0.00E+00**	5.03E-01	91	**0.002**			
sediment	Ac-228	1.31E+00	6.89E-01	6.17E-01	91	0.004			
depth	Be-7	8.95E-01	0.00E+00	8.95E-01	91	0.000			
	K-40	9.51E+00	6.87E+00	2.64E+00	91	0.007			
	Pb-212	1.19E+00	7.59E-01	4.34E-01	91	0.000	NORM/Unk		
	Pb-214	1.65E+00	6.42E-01	1.01E+00	91	0.000	Avg	Totals	
	Ra-226	3.83E+00	1.93E+00	1.90E+00	91	0.006	0.003	0.018	
Table notes:							Highest Isotopes Total		
1 - Bold denotes NonNORM isotope or radionuclide activity.							0.018		
2 - Nonbold denotes NORM activity.							Total NORM		0.018
3 - Underlined data is the highest detection per isotope contributing							Total nonNORM		**0.058**
to the stated MEI value.							All Detected Dose		0.076

2008 Single Highest Dose Detections in Water Media

Project	Isotope	MAX	Bkg	Net	MCR	Dose	Exposure Group		MEI
Water		Activity	Activity	Activity		mrem			Dose
Sources	Ingestion							Totals	(mrem)
PWSRW(DW)		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.041**
SW	**H-3**	**1.097E+03**	**2.110E+02**	8.860E+02	730	**0.041**	NORM/Unk		
Savannah River Public Water Supplies (PWS) Drinking Water (DW)							Avg	Totals	
PWS Savannah River Water Max Dose Radionuclide						0.041	0.000	0.000	
Includes SRW from Chelsea, Beaufort Jasper, and City of Savannah minus North Augusta background.									
PWSGW(DW) Ingestion		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.000**
GW	**H-3**	**3.270E+02**	4.410E+02	0.000E+00	730	0.000	NORM/Unk		
Public Water Supplies with Groundwater (GW) Sources							Avg	Totals	
PWS Average Dose from Random and nonRandom Wells.						0.000	0.000	0.000	
DNRGW		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.015**
GW	**H-3**	**3.210E+02**	**4.000E+00**	3.170E+02	730	**0.015**	NORM/Unk		
DNR Monitoring Wells (comparable to local untreated private wells)							Avg	Totals	
Department of Natural Resources (DNR) Ground Water Avg Dose						0.015	0.000	0.000	
Nonpotable		**pCi/L**	**pCi/L**	**pCi/L**	**L/yr**	**mrem**	**NonNORM……**		**0.202**
SW	**H-3**	**4.689E+03**	**3.600E+02**	4.329E+03	730	**0.202**	NORM/Unk		
Savannah River Boat Landings							Avg	Totals	
Average Dose from nonRandom Samples						0.202	0.000	0.000	
Rainwater	**H-3**	**3.790E+02**	**3.670E+02**	1.200E+01	730	**0.001**	**NonNORM……**		**0.001**
Represents dose that may acumulate in cisterns and used as drinking water.							NA	NA	
Streams and Savannah River Surface Water Samples Excluding PWSRW(DW)									
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.029**
Ingestion	**H-3**	**4.913E+04**	**0.000E+00**	**4.913E+04**	91	**0.029**	NORM/Unk		
Ingestion while swimming at Savannah River Creek Mouths							Avg	Totals	
Swimming ingestion Average Dose from Swallowing Creek Water						0.021	0.000	0.000	
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.000**
Immersion	**H-3**	**4.913E+04**	**0.000E+00**	**4.913E+04**	91	0.000	NORM/Unk		
Direct exposure to the skin while swimming at SRS Creek Mouths							Avg	Totals	
Average Dose from Skin Exposure to Creek Water						0.000	0.000	0.000	
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.000**
Boating	**H-3**	**4.913E+04**	**0.000E+00**	**4.913E+04**	192	0.000	NORM/Unk		
Direct exposure from SRS Creek Mouth Water while Boating							Avg	Totals	
Boating Average Dose from Skin Exposure to Creek Water						0.000	0.000	0.000	
Surface Water		**pCi/L**	**pCi/L**	**pCi/L**	**hrs/yr**	**mrem**	**NonNORM……**		**0.000**
Resident	**H-3**	**4.913E+04**	**0.000E+00**	**4.913E+04**	4380	0.000	NORM/Unk		
Swamp House or Houseboat Dose Exposure to Water							Avg	Totals	
Swamp Resident Average Dose from Skin Exposure to Creek Water						0.000	0.000	0.000	
Sediment Random plus Nonrandom at Streams and Creek Mouths									
Sediment Dose		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**nonNORM**		**0.002**
Skin	**Cs-137**	**3.726E+00**	**2.840E-01**	**3.442E+00**	91	**0.000**			
Wading	**Eu-155**	**4.590E-01**	**0.000E+00**	**4.590E-01**	91	**0.000**			
Barefoot	**Pu-239**	**1.700E-02**	**0.000E+00**	**1.700E-02**	91	**0.000**			
to 1 cm	**Total Sr**	**4.020E-01**	**0.000E+00**	**4.020E-01**	91	**0.000**			
	Zr-95	**5.030E-01**	**0.000E+00**	**5.030E-01**	91	**0.002**			
sediment	Ac-228	2.436E+00	6.890E-01	1.747E+00	91	0.010			
depth	Be-7	8.950E-01	0.000E+00	8.950E-01	91	0.000			
	K-40	1.894E+01	6.866E+00	1.207E+01	91	0.033			
	Pb-212	2.219E+00	7.590E-01	1.460E+00	91	0.001			
	Pb-214	1.326E+01	6.420E-01	1.262E+01	91	0.002			
	Ra-226	2.626E+01	1.931E+00	2.433E+01	91	0.078	NORM/Unk		
							Avg	Totals	
							0.023	0.124	
Table notes:							Highest Isotopes Total		
1 - Bold denotes NonNORM isotope or radionuclide activity.							0.124		
2 - Nonbold denotes NORM activity.							Total NORM		0.124
3 - Underlined data is the highest detection per isotope contributing							Total nonNORM		**0.290**
to the stated MEI value.							All Detected Dose		0.414

2008 Average Dose Detections in Soil and Air Media

Project	Isotope	Avg	Bkg	Net	MCR	Dose	Exposure Group		MEI
Surface		**Activity**	**Activity**	**Activity**		**mrem**			**Dose**
Soil								Totals	**Total**
Surface Soil & Riverbank Soil Random and Nonrandom Sample Detections									
Surface Soil		**pCi/g**	**pCi/g**	**pCi/g**	**mg/day**	**mrem**	**NonNORM……**		**0.001**
	Pb-212	1.300	1.000	0.300	100	0.000			
Ingestion	Pb-214	1.900	1.100	0.800	100	0.000	NORM/Unk		
	Ra-226	4.700	2.900	1.800	100	0.087	Avg	Totals	
	Ac-228	1.300	1.100	0.200	100	0.000	0.018	0.088	
	K-40	2.800	9.400	0.000	100	0.000			
	Cs-137	**0.800**	**0.300**	**0.500**	100	0.001			
	Eu-155	**0.500**	**0.500**	**0.000**	100	0.000			
Surface Soil Ingestion Average Dose All Isotopes						0.013			
Riverbank Soil		**pCi/g**	**pCi/g**	**pCi/g**	**mg/day**	mrem	**NonNORM……**		**0.002**
Boat	K-40	13.555	11.160	0.000	100	0.000			
Landings	Pb-212	1.399	1.343	0.056	100	0.000	NORM/Unk		
	Pb-214	1.150	1.278	0.000	100	0.000	Avg	Totals	
	Ra-226	2.464	2.619	0.000	100	0.000	0.000	0.000	
Sportsman	Ac-228	1.303	1.322	0.000	100	0.000			
Potential	**Cs-137**	**1.132**	**0.140**	**0.992**	100	**0.002**			
Riverbank Soil Ingestion Avg Dose All Isotopes at Boat Landing						0.000			
All Soil Ingestion Dose (NORM plus nonNORM)					Avg	0.006	Total	0.090	
Surface Soil		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**NonNORM……**		**0.002**
	Pb-212	1.300	1.000	0.300	4380	0.041			
Direct	Pb-214	1.900	1.100	0.800	4380	0.205	NORM/Unk		
Exposure	Ra-226	4.700	2.900	1.800	4380	0.011	Avg	Totals	
	Ac-228	1.300	1.100	0.200	4380	0.218	0.095	0.475	
	K-40	2.800	9.400	0.000	4380	0.000			
	Cs-137	**0.800**	**0.300**	**0.500**	4380	**0.002**			
	Eu-155	**0.500**	**0.500**	**0.000**	4380	**0.000**			
Surface Soil Direct Exposure Average Dose						0.068	TLD Building Control		
TLD[1]		**89.120**	**94.680**	**0.000**	**mrem**	0.000	104-mrem		
Riverbank Soil		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**NonNORM……**		**0.003**
	K-40	13.555	11.160	0.000	4380	0.000			
Direct	Pb-212	1.399	1.343	0.056	4380	0.014	NORM/Unk		
Exposure	Pb-214	1.150	1.278	0.000	4380	0.000	Avg	Totals	
	Ra-226	2.464	2.619	0.000	4380	0.000	0.003	0.014	
	Ac-228	1.303	1.322	0.000	4380	0.000			
	Cs-137	**1.132**	**0.140**	**0.992**	4380	**0.003**	**Page 1 Atmospheric**		
Potential **nonNORM** dose **average**.							**NORM total**		0.577
							nonNORM total		0.0080
Sportsman potential riverbank soil direct dose at **public boat landings**							0.014	0.014	

Sheet 1 of 2.

2008 Average Dose Detections in Soil and Air Media - continued

Project	Isotope	Avg	Bkg	Net	MCR	Dose	Exposure Group		MEI
Surface		Activity	Activity	Activity		mrem			Dose
Soil								Totals	Total
Soil Resuspension and Air Inhalation Dose									
Surface Soil Resusp		pCi/g	pCi/g	pCi/g	m3/yr	mrem	NonNORM……		0.000
	Pb-212	1.30E+00	1.00E+00	0.300	8000	0.000			
	Pb-214	1.90E+00	1.10E+00	0.800	8000	0.000			
	Ra-226	4.70E+00	2.90E+00	1.800	8000	0.012	NORM/Unk		
	Ac-228	1.30E+00	1.10E+00	0.200	8000	0.000	Avg	Totals	
	K-40	2.80E+00	9.40E+00	0.000	8000	0.000	0.002	0.012	
	Cs-137	**8.00E-01**	**3.00E-01**	**0.500**	8000	0.000			
	Eu-155	**5.00E-01**	**5.00E-01**	**0.000**	8000	0.000			
Surface Soil Resuspension Total Inhalation Avg Dose						0.002			
Riverbank Soil Resu		pCi/g	pCi/g	pCi/g	m3/yr	mrem	NonNORM……		0.000
	K-40	1.36E+01	1.12E+01	0.000	8000	0.000			
	Pb-212	1.40E+00	1.34E+00	0.056	8000	0.000	NORM/Unk		
	Pb-214	1.15E+00	1.28E+00	0.000	8000	0.000	Avg	Totals	
	Ra-226	2.46E+00	2.62E+00	0.000	8000	0.000	0.000	0.000	
	Ac-228	1.30E+00	1.32E+00	0.000	8000	0.000			
	Cs-137	**1.13E+00**	**1.40E-01**	**0.992**	8000	0.000			
Air Inhalation		pCi/m3	pCi/m3	pCi/m3	Avg	0.000	NonNORM……		0.001
Inhalation	**H-3**	**4.09E+00**	2.27E+00	**2**	8000	**0.001**			
							NORM/Unk		
							Avg	Totals	
Air Inhalation Avg Dose				0.001	Total Air	0.001	0.001	0.002	
							Page 2 Atmospheric		
							NORM total		0.014
							nonNORM total		0.001
							Total NORM		**0.591**
							Total nonNORM		**0.009**
							All Detected Dose		**0.600**

Sheet 2 of 2.

2008 Single Highest Dose Detections in Soil and Air Media

Project	Isotope	Avg	Bkg	Net	MCR	Dose	Exposure Group		MEI
Surface		Activity	Activity	Activity		mrem			Dose
Soil								Totals	Total
Surface Soil & Riverbank Soil Random and Nonrandom Sample Detections									
Surface Soil		**pCi/g**	**pCi/g**	**pCi/g**	**mg/day**	**mrem**	**NonNORM……**		**0.001**
	Pb-212	2.50E+00	1.00E+00	1.500	100	0.002			
Maximum	Pb-214	2.03E+01	1.10E+00	19.200	100	0.000			
Potential	Ra-226	4.78E+01	2.90E+00	44.900	100	2.173	NORM/Unk		
Ingestion	Ac-228	2.50E+00	1.10E+00	1.400	100	0.000	Avg	Totals	
Dose	K-40	1.23E+01	9.40E+00	0.000	100	0.000	0.435	2.176	
	Cs-137	**8.00E-01**	**3.00E-01**	**0.500**	100	**0.001**			
	Eu-155	**7.00E-01**	**5.00E-01**	**0.200**	100	**0.000**			
Upturned Soil NORM plus nonNORM Ingestion Average Dose						**0.311**			
Riverbank Soil		**pCi/g**	**pCi/g**	**pCi/g**	**mg/day**	mrem	**NonNORM……**		**0.002**
	K-40	1.87E+01	1.12E+01	7.570	100	0.005			
Maximum	Pb-212	1.69E+00	1.34E+00	0.345	100	0.001	NORM/Unk		
Potential	Pb-214	1.507	1.278	0.229	100	0.000	Avg	Totals	
Ingestion	Ra-226	3.161	2.619	0.542	100	0.026	0.006	0.032	
Dose	Ac-228	1.81E+00	1.32E+00	0.484	100	0.000			
	Cs-137	**1.13E+00**	**1.40E-01**	**0.992**	100	**0.002**			
verage soil ingestion maximum dose from NORM plus NonNOR						0.553			
Sportsman or Recreational potential riverbank soil ingestion dose at **public boat landings**.									
Surface Soil		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**NonNORM……**		**0.009**
	Pb-212	2.50E+00	1.00E+00	1.500	4380	0.204			
Direct	Pb-214	2.03E+01	1.10E+00	19.200	4380	4.910	NORM/Unk		
Exposure	Ra-226	4.78E+01	2.90E+00	44.900	4380	0.276	Avg	Totals	
	Ac-228	2.50E+00	1.10E+00	1.400	4380	1.529	1.384	6.919	
	K-40	1.23E+01	9.40E+00	0.000	4380	0.000			
	Cs-137	**8.00E-01**	**3.00E-01**	**0.500**	4380	**0.002**			
	Eu-155	**7.00E-01**	**5.00E-01**	**0.200**	4380	**0.007**			
Maxium Farming Potential Average Dose for Direct Soil						0.990	TLD Building Control		
TLD[1]		**8.91E+01**	**9.47E+01**	**0.000**	**mrem**	0.000	104 mrem		
Riverbank Soil		**pCi/g**	**pCi/g**	**pCi/g**	**hrs/yr**	**mrem**	**NonNORM……**		**0.017**
	K-40	1.87E+01	1.12E+01	7.570	4380	2.020			
Direct	Pb-212	1.69E+00	1.34E+00	0.345	4380	0.047	NORM/Unk		
Exposure	Pb-214	1.507	1.278	0.229	4380	0.059	Avg	Totals	
	Ra-226	3.161	2.619	0.542	4380	0.003	0.532	2.658	
	Ac-228	1.81E+00	1.32E+00	0.484	4380	0.529	See continued sheet.		
	Cs-137	**5.69E+00**	**1.40E-01**	**5.546**	4380	**0.017**	**Page 1 Atmospheric**		
Potential Riverbank Soil Direct Dose Average at Boat Landings.						0.446	**Sheet 1 of 2.**		
							NORM total		11.785
							nonNORM total		0.029

Sheet 1 of 2

2008 Single Highest Dose Detections in Soil and Air Media - continued

Project	Isotope	Avg	Bkg	Net	MCR	Dose	Exposure Group		MEI
Surface		Activity	Activity	Activity		mrem			Dose
Soil	Inhalation from Atmospheric Pathway							Totals	Total
Soil Resuspension and Inhalation Dose									
Surface Soil		**pCi/g**	**pCi/g**	**pCi/g**	**m3/yr**	**mrem**	**NonNORM……**		**0.000**
	Pb-212	2.500	1.000	1.500	8000	0.000			
	Pb-214	20.300	1.100	19.200	8000	0.000	NORM/Unk		
Inhalation	Ra-226	47.800	2.900	44.900	8000	0.309	Avg	Totals	
	Ac-228	2.500	1.100	1.400	8000	0.000	0.062	0.309	
	K-40	12.300	9.400	0.000	8000	0.000			
	Cs-137	**0.800**	**0.300**	**0.500**	8000	0.000			
	Eu-155	**0.700**	**0.500**	**0.200**	8000	0.000			
Surface Soil Resuspension Total Inhalation Average Dose									
Riverbank Soil		**pCi/g**	**pCi/g**	**pCi/g**	**m3/yr**	**mrem**	**NonNORM……**		**0.000**
	K-40	18.730	11.160	7.570	8000	0.000			
	Pb-212	1.688	1.343	0.345	8000	0.000	NORM/Unk		
	Pb-214	1.507	1.278	0.229	8000	0.000	Avg	Totals	
	Ra-226	3.161	2.619	0.542	8000	0.004	0.001	0.004	
	Ac-228	1.806	1.322	0.484	8000	0.000			
	Cs-137	**5.686**	**0.140**	**5.546**	8000	0.000			
Potential nonNORM dose average.									
Riverbank Soil Resuspension Inhalation Avg Dose					0.000793	0.004			
Air Inhalation		**pCi/m3**	**pCi/m3**	**pCi/m3**	**Avg**	**0.001**	**NonNORM……**		**0.002**
Inhalation	**H-3**	**6.918**	**2.270**	**4.648**	8000	0.002			
Pg 2 Soil and Air Dose Totals							NORM total		**0.313**
							nonNORM total		**0.003**
Pg 1 Soil and Air Dose Totals							NORM total		**11.785**
							nonNORM total		**0.029**
Total Soil and Air Dose							Total NORM		**12.098**
							Total nonNORM		**0.031**
							All Detected Dose		**12.129**

Sheet 2 of 2.

TOC

5.1.4 Summary Statistics

2008 Critical Pathway Dose

Table 2. The 1999-2008 AEI Media Statistics and MAX Game

Media	Totals	AEI %	Avg.	SD	Median
SWBL	0.58	3.55	0.06	0.03	0.06
DNRGW	0.24	1.46	0.04	0.06	0.01
PWSGW	0.18	1.08	0.02	0.02	0.01
PWSRW	0.30	1.82	0.03	0.02	0.03
Rainwater	0.10	0.61	0.01	0.01	0.01
Soil	0.35	2.16	0.04	0.08	0.01
Sediment	0.18	1.11	0.02	0.05	0.00
Air	0.07	0.40	0.01	0.01	0.01
EdVeg	0.21	1.29	0.03	0.05	0.01
Milk	0.57	3.49	0.06	0.08	0.02
EdFungi	0.73	4.47	0.73	NA	0.73
AEI Fish	5.49	33.60	0.55	0.31	0.44
AEI Deer	2.75	16.85	0.31	0.48	0.08
AEI Hog	4.59	28.12	1.53	1.87	0.97
Totals	16.32	100.00	1.63	1.49	1.14
MAX Deer	68.32	NA	8.45	6.47	6.91
MAX Hog	21.24	NA	7.08	8.81	4.29
MAX Fish	22.89	NA	2.35	1.69	1.77

Table 1. Average Dose (millirem) Rank by Radionuclide

1999-2008	**sum**	**%**	**avg**	**sd**	**median**	**2008**	**sum**	**%**	**avg**	**sd**	**median**
Total	**24.45**	**100.00**				**Total**	**1.83**	**100.00**			
Cs-137	16.04	65.61	0.55	0.94	0.21	Cs-137	1.70	92.57	0.85	1.19	0.85
Ra-226	4.85	19.86	0.61	0.54	0.66	H-3	0.06	3.39	0.01	0.01	0.00
H-3	0.73	3.00	0.01	0.01	0.01	Sr-89/90	0.05	2.62	0.02	0.03	0.02
Sr-89/90	0.63	2.57	0.07	0.09	0.01	Sr-89	0.02	1.31	0.02	NA	0.02
Pb-214	0.51	2.09	0.09	0.06	0.09	Zr-95	0.00	0.11	0.00	NA	0.00
Ac-228	0.50	2.04	0.10	0.04	0.11	Zn-65	0.00	0.00	NA	NA	NA
Pb-212	0.24	1.00	0.06	0.02	0.06	U-238	0.00	0.00	NA	NA	NA
Sr-89	0.21	0.85	0.05	0.08	0.02	U-235	0.00	0.00	NA	NA	NA
Ra-228	0.19	0.76	0.09	0.02	0.09	U-234	0.00	0.00	NA	NA	NA
U-234	0.15	0.61	0.15	NA	0.15	Th-234	0.00	0.00	NA	NA	NA
Eu-155	0.12	0.49	0.06	0.07	0.06	Tc-99	0.00	0.00	NA	NA	NA
Zn-65	0.07	0.30	0.07	NA	0.07	Sr-90	0.00	0.00	NA	NA	NA
U-238	0.06	0.25	0.01	0.01	0.01	Ra-228	0.00	0.00	NA	NA	NA
Th-234	0.06	0.23	0.03	0.02	0.03	Ra-226	0.00	0.00	NA	NA	NA
Am-241	0.04	0.16	0.04	NA	0.04	Pu-239/240	0.00	0.00	NA	NA	NA
U-235	0.03	0.11	0.01	0.00	0.01	Pu-239	0.00	0.00	NA	NA	NA
Sr-90	0.01	0.05	0.01	0.00	0.01	Pu-238	0.00	0.00	NA	NA	NA
Am-243	0.00	0.01	0.00	NA	0.00	Pb-214	0.00	0.00	NA	NA	NA
Pu-239/240	0.00	0.01	0.00	0.00	0.00	Pb-212	0.00	0.00	NA	NA	NA
Zr-95	0.00	0.01	0.00	NA	0.00	Eu-155	0.00	0.00	NA	NA	NA
Pu-238	0.00	0.00	0.00	NA	0.00	Ce-144	0.00	0.00	NA	NA	NA
Tc-99	0.00	0.00	0.00	NA	0.00	Am-243	0.00	0.00	NA	NA	NA
Pu-239	0.00	0.00	NA	NA	NA	Am-241	0.00	0.00	NA	NA	NA
Ce-144	0.00	0.00	0.00	NA	0.00	Ac-228	0.00	0.00	NA	NA	NA

Notes:

1 - Not directly comparable to Section 4.0 tables that exclude detections assigned as NORM and use only one drinking water source.

2 - Excludes alpha, beta, beta-gamma.

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TOC

Errata

From 2007 Report

The following information was reported incorrectly in the *Environmental Surveillance and Oversight Program Data Report for 2007*.

The 2007 Data Report included two tables in Chapter 2 with errors or omissions. Below are the corrected tables.

Table 1. Comparison of Tritium Analyses, DOE-SR and ESOP Data, 2007

DOE-SR DATA		Tritium			ESOP DATA		Tritium	
Station	**Date**	**pCi/g**	**+/- 1 sig**	**pCi /L[a]**	**Station**	**Date**	**pCi/L**	**+/- 2 sig**
D-Area	6/20/2007	<MDC			BWL-009 [b]	5/25/2007	1318	131
West Jackson	6/20/2007	<MDC			AKN-002	5/18/2007	589	107
Jackson	6/20/2007	<MDC			AKN-003 [b]	5/18/2007	513	105
Green Pond	6/20/2007	<MDC			AKN-004 [b]	5/2/2007	538	107
Talatha Gate	6/18/2007	0.112	0.025	533	AKN-005 [b]	5/18/2007	457	105
East Talatha	6/18/2007	<MDC			AKN-006 [b]	5/18/2007	1154	128
Windsor Road	6/18/2007	0.0646	0.022	308	AKN-007	5/2/2007	<LLD	
Darkhorse	6/18/2007	0.0749	0.023	357	BWL-001 [b]	5/2/2007	1127	127
Highway 21/167	6/18/2007	0.124	0.019	590	BWL-002 [b]	5/2/2007	1032	124
Barnwell Gate	6/18/2007	<MDC						
					BWL-003	5/2/2007	212	95
Patterson Mill Road [c]	6/20/2007	<MDC			BWL-004 [c]	5/18/2007	666	112
					ALD-001	5/18/2007	389	101
Allendale Gate [c]	6/20/2007	<MDC			BWL-006 [c]	5/18/2007	1113	127

Average	447	**Average**	759
Std Dev	136	**Std Dev**	367
Median	445	**Median**	628

This Table 1. replaces Table 1. found on page 263 of the ESOP 2007 Data Report

Errata

Table 2. Comparison of Gamma Analyses, DOE-SR and ESOP Data, 2007

DOE-SR DATA		Cs-137		ESOP DATA		Cs-137	
Location	**Date**	**pCi/g (dry)**	**+/- 1 sig**	**Station**	**Date**	**pCi/g (fresh)**	**+/- 2 sig**
D-Area	6/20/2007	<MDC		AKN-001[a]	5/18/2007	0.107	0.024
West Jackson	6/20/2007	<MDC		AKN-002[a]	5/18/2007	<MDA	
Jackson	6/20/2007	<MDC		AKN-003[a]	5/18/2007	0.774	0.073
Green Pond	6/20/2007	0.171	0.0451	AKN-003[a]	5/18/2007	0.774	0.073
Talatha Gate	6/18/2007	<MDC		AKN-008[a]	5/18/2007	0.872	0.083
East Talatha	6/18/2007	0.543	0.104	AKN-005[a]	5/18/2007	0.836	0.079
Windsor Road	6/18/2007	0.449	0.0639	AKN-006[a]	5/18/2007	0.149	0.025
Darkhorse	6/18/2007	<MDC		AKN-006[a]	5/18/2007	0.149	0.025
Highway 21/167	6/18/2007	0.237	0.0548				
Barnwell Gate	6/18/2007	0.308	0.0649	BWL-004[a]	5/18/2007	0.141	0.027
Patterson Mill Road[b]	6/20/2007	0.743	0.0917	BWL-004[b]	5/18/2007	0.141	0.027
				ALD-001[a]	5/18/2007	0.218	0.028
Allendale Gate[b]	6/20/2007	<MDC		BWL-006[b]	5/18/2007	0.917	0.084

Average	0.409	**Average**	0.502
Std Dev	0.213	**Std Dev**	0.375
Median	0.379	**Median**	0.496

This Table 2. replaces Table 2. f und on page 264 of the ESOP 2007 Data Report

Errata

Page 201 of Chapter 2 was repeated after page 202, omitting a table and page 203. Below is the table for page 203.

Summary Statistics (Detects Only)
2007 ESOP Surface Soil Metals Statistical Data for All Background Samples (>50 Miles)

	Average	St. Deviation	Median	Min	Max	No. of Detects	Total Sampled
Aluminum	7611.82	9163.34	2800	170	28000	11	11
Barium	35.82	34.25	14	6.6	100	9	11
Beryllium	0.42	0.09	0.415	0.35	0.48	2	11
Cadmium	8.18	4.57	7.9	2.2	15	5	11
Cobalt	6.04	3.23	4.9	2.4	10	5	11
Chromium	11.75	11.57	9.1	1	38	10	11
Copper	5.48	3.38	6	1	8.9	4	11
Iron	5933.91	6344.64	3400	73	20000	11	11
Mercury	N/A	N/A	N/A	N/A	N/A	0	11
Magnesium	486.93	677.58	300	9.2	2300	11	11
Manganese	99.62	93.77	68	1.6	280	11	11
Molybdenum	2.30	N/A	2.3	2.3	2.3	1	11
Nickel	5.72	2.27	5.3	3.2	9.2	5	11
Lead	13.05	7.37	10.65	5.3	22	6	11
Titanium	213.00	213.13	130	20	640	11	11
Vanadium	23.24	19.35	16	2.4	55	9	11
Zinc	14.07	12.18	8.2	3.3	39	9	11

Note: Units are in milligrams per kilogram (mg/kg).

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