COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HEALTH

DIVISION OF RADIOLOGICAL HEALTH
109 Governor Street, Room 730 Richmond, Virginia 23218-2448
Office (804) 864-8150 Fax (804) 864-8165

2009

ENVIRONMENTAL RADIATION PROGRAM

ANNUAL REPORT

VDH VIRGINIA DEPARTMENT OF HEALTH
Protecting You and Your Environment

ACKNOWLEDGEMENTS

We would like to acknowledge the following organizations and agencies that contributed to the environmental surveillance program:

- Babcock & Wilcox

- Department of Agriculture and Consumer Services
  Dairy and Food Division

- Department of Conservation and Recreation
  Division of State Parks

- Department of Emergency Management
  Preparedness and Mitigation Division

- Department of General Services
  Division of Consolidated Laboratory Services

- Department of Health
  Division of Shellfish Sanitation

- Northrop Grumman Newport News Shipbuilding & Drydock Company

- Norfolk Naval Shipyard

- Dominion Virginia Power

PREFACE

The Division of Radiological Health conducts an extensive environmental monitoring program of radiological conditions around certain fixed nuclear facilities in the Commonwealth of Virginia to provide an independent assessment of each facility's compliance with applicable federal and state regulations. Each of these fixed nuclear facilities has it's own routine surveillance program. The objectives of a routine surveillance program includes :

a) Providing information useful In assessing the adequacy of protection of the public;
b) Meeting requirements of regulatory agencies;
c) Verifying radionuclide containment and plant waste management practices;
d) Meeting legal liability obligations; and
e) Providing public assurance and acceptance (NCRP,1976).

In addition to these stated objectives, the DRH has identified other objectives such as;

a) Maintenance of a database of background radionuclide levels and trends to assist with the assessment of other environmental data;
b) Identification of radiological releases not associated with the licensed facility; and
c) Maintenance of equipment and proficiency of capabilities used in emergency preparedness and response activities.

Part of this work is funded by the Virginia Department of Emergency Management.

This report is distributed to the licensee, as well as state and local agencies, which have a direct interest in the results. Single copies of this report are available by contacting:

Virginia Department of Health
Division of Radiological Health
109 Governor Street, Room 730
Richmond, Virginia 23219
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You are invited to submit any comments or questions regarding this report to the Division of Radiological Health.

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Leslie P. Foldesi, M.S., CHP
Director
Division of Radiological Health

NCRP (2006) National Council on Radiation Protection and Measurements, Environmental *Radiation Measurements,* NCRP Report No. 50, National Council on Radiation Protection and Measurements, Washington.

VIRGINIA DEPARTMENT OF HEALTH

ENVIRONMENTAL RADIATION SURVEILLANCE DATA ANNUAL REPORT 2009

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FOREWORD

The Division of Radiological Health conducts an extensive environmental radiological monitoring program around nuclear facilities in the Commonwealth of Virginia to determine compliance with applicable federal and state regulations and guidelines.

Sampling locations are primarily located around the two nuclear power stations in the Commonwealth of Virginia.

(1) North Anna power Station, Louisa County, Virginia
(2) Surry power Station, Surry County, Virginia

Sampling locations are also present at:

(3) Babcock & Wilcox Nuclear Operations Group, Lynchburg, Virginia
(4) Northrop Grumman Newport News
(Formerly Newport News Shipbuilding & Drydock Company)

(5) Norfolk Naval Shipyard, Portsmouth, Virginia

Samples are also collected at various control locations. This data can be compared to data for samples collected at plant environs. This provides a comparison between naturally occurring radiation and any radiological deposition resulting from nuclear power plant operation or radioactive fallout.

All State samples (with two exceptions) are analyzed by Consolidated Laboratories of the Commonwealth of Virginia.

All the data, with the exception of higher than normal tritium levels in the Surry Power Plant discharge canal during April, are within normal expected levels.

This report represents a compilation of all samples collected between January 1, 2009 and December 31, 2009.

Tritium, air particulate and radiogas analysis are performed by The Radiological Health Mobile Laboratory. Thermoluminescent dosimeter readings (ambient gamma exposure) are now calculated by Radiation Detection Company.

SAMPLING PROGRAM

The Division of Radiological Health maintains an environmental surveillance program with primary focus on the environs of the nuclear power facilities in Virginia. The objectives of this radiological monitoring program are:

(1) To detect and measure radioactive releases during routine nuclear power plant operation.

(2) To detect and measure radioactive releases during abnormal events occurring at nuclear facilities.

(3) To measure reconcentration of radioactive effluents in the environment particularly in human exposure pathways.

(4) To provide an independent means of verification of utility release reports.

These objectives are achieved through continuous sampling of air and ambient radiation, as well as, periodic sampling of water, milk, vegetation, fish, shellfish, etc. Details on sample locations and frequencies are outlined in Appendix III of this report.

A brief description of each sampling medium follows:

AIR PARTICULATE AND RADIOGAS

Stationary air samplers are utilized at the Surry Power Station, the North Anna Power Station, and one control location at Pocahontas State Park. Pumps run approximately 168 hours per week at an average flow rate of 40 cubic feet per hour. All samplers are continuously equipped with a charcoal filter. Air particulate filters are used at every sampling location to measure any radioactive particulates. All stations except the control station duplicate utility stations. At BWX Technologies, Inc there is one air sampler located on site. This air pump is equipped with air particulate filters and run approximately 168 hours per week with an average flow rate of 55 cubic feet per hour.

Each quarterly air particulate filter is analyzed for a gross beta activity.

Charcoal filters are analyzed quarterly for gamma activity with special emphasis on I-131 retention.

Samples obtained from Babcock & Wilcox undergo gross alpha analysis following each filter change.

FISH

Fish samples are collected annually in Lake Anna near the North Anna Power Station. Each sample consists of approximately one kilogram of flesh from either catfish, sunfish, bass or bluegill.

All fish samples are counted for gamma activity with data based on wet weight.

MILK

Raw milk samples are collected quarterly from a dairy near each reactor site. Each sample consists of one gallon of raw milk with no preservatives added. Raw milk is a primary indicator of radioiodine incorporation in the food chain.

All milk samples are counted for gamma activity and analyzed quarterly for Strontium-89 & 90 and are also radiochemically separated for I-131.

SHELLFISH

Shellfish are collected as a part of the environmental surveillance program around Surry Power Station. Samples consisting of one kilogram of flesh are collected annually approximately 0.5 mile off the mouth of the SPS discharge canal in the James River and are indicators of incorporation of radioactivity within the food chain.

All shellfish samples are counted for gamma activity with data based on activity per unit of wet weight.

SILT

Silt is collected annually from each nuclear power station's water discharge canal. Each sample consists of one kilogram of bottom sediment and is an indicator of radioactive deposition in sediment.

Silt is collected quarterly at Norfolk Naval Shipyard (NNSY) on the Elizabeth River to ensure that shipyard operations result in minimal radioactive effluents. Silt is also collected quarterly at Northrop Grumman Newport News Shipbuilding and Drydock Company (NGNNSBDDC) on the James River to ensure that NGNNSBDDC operations result in minimal radioactive deposition. NGNNSBDDC was formerly known as Newport News Shipbuilding & Drydock Company (NNSBDDC).

Silt samples are counted for gamma activity and gross beta activity with data based on activity per unit of dry weight.

SOIL

Two soil samples are collected at the Babcock & Wilcox facility. One sample site is located at a ballfield on the facility's eastern boundary and the other is a control location at the Department of Agriculture's Lynchburg Regional Animal Health Laboratory (LRAHL), located 5 miles southwest of the plant site, off Route 460. These samples are collected annually. Samples obtained undergo uranium separation followed by alpha analysis.

VEGETATION

Green leafy vegetation is collected from home gardens located near each nuclear power facility. Samples of one kilogram of kale, cabbage or turnip greens are collected annually at harvest. These samples would indicate incorporation of radioactivity in edible vegetation.

Vegetation is counted for gamma activity with data based on activity per unit wet weight.

Two vegetation samples are collected at Babcock & Wilcox. These consist of one kilogram of grass from the ballfield at the eastern site boundary and one control location at the Department of Agriculture's Lynchburg Regional Animal Health Laboratory (LRAHL), located 5 miles southwest of the plant site, off Route 460. These samples are collected annually and undergo uranium separation followed by alpha analysis.

SURFACE WATER

Surface water is collected quarterly at each nuclear power facility. One gallon samples of station discharge water and an upstream control are collected. These samples provide data on radioactive effluents.

Two surface water samples are collected from the James River at Babcock & Wilcox on an annual basis. One is located approximately 3 miles downstream of the Babcock & Wilcox plant near the ballfield at the eastern site boundary and the other is at a control location near Six Mile Bridge, which is approximately 1.5 miles upstream of the plant. Samples undergo uranium separation followed by alpha counting.

Surface water is also collected quarterly on the James River at Northrop Grumman Newport News Shipbuilding and Drydock Company (NGNNSBDDC) and on the Elizabeth River at the Norfolk Naval Shipyard (NNSY) to ensure that shipyard operations result in minimal radioactive effluents.

AMBIENT GAMMA EXPOSURE (TLD)

Ambient gamma exposure readings are collected using either Calcium fluoride or Lithium fluoride thermoluminescent dosimeters (TLD). There are twelve TLD sample stations surrounding North Anna Power Station and fourteen stations surrounding Surry Power Station. One control TLD station is located at Pocahontas State Park. Several stations at each site duplicate utility sampling stations.

The TLD's are read quarterly for net exposure during their time in the field, resulting in a millirem/quarter reading.

Sources of Radioactivity in the Environment

Radioactivity from natural sources is found everywhere. Naturally occurring radioactivity comes from the decay of primordial terrestrial sources such as uranium and thorium. Other sources are continually produced in our upper atmosphere through interactions of atoms with cosmic rays. These naturally occurring sources produce the background levels of radioactivity.

In the past century, environmental radiation levels have been influenced by human practices using or manufacturing radioactive materials. Such practices include the use of radioactive materials in the healing arts, uranium mining and milling operations, nuclear power generation, nuclear weapons manufacturing and testing, storage and disposal of nuclear weapons.

Background radiation levels were most altered by residual fallout from nuclear weapons testing. The United States ceased atmospheric testing following adoption of the 1963 Nuclear Test Ban Treaty. Only long-lived fallout radionuclides remain.

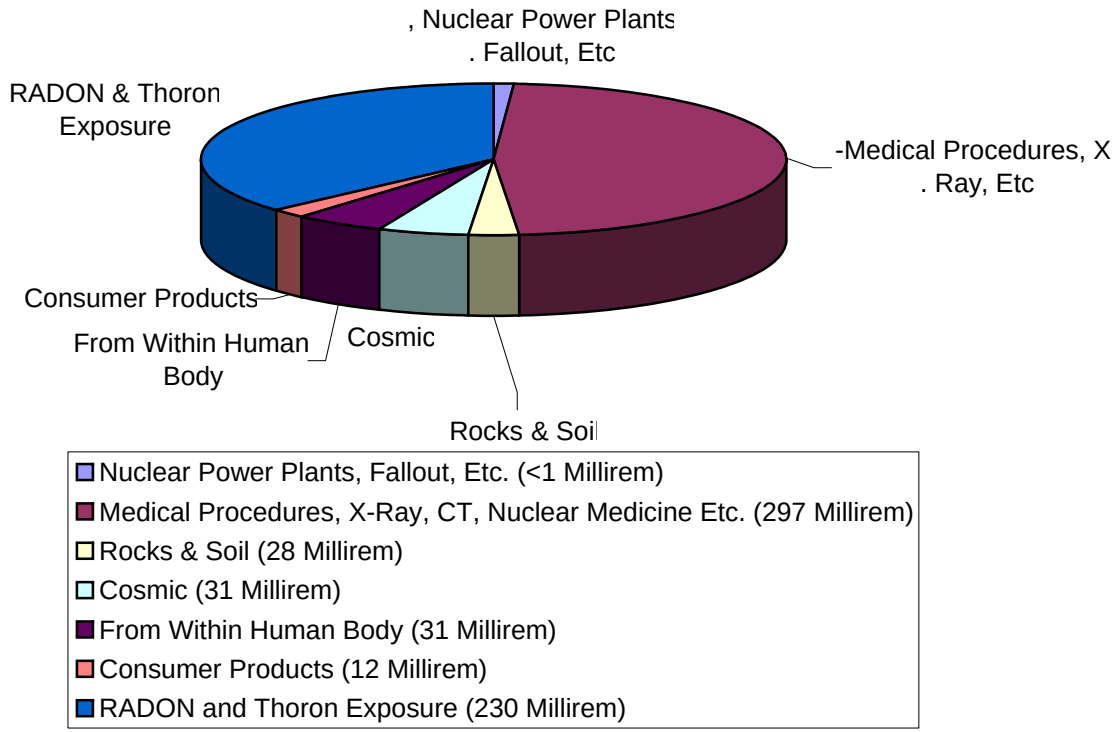
Doses to the Public

The primary source of natural radiation dose received by the general public is due to radon exposure (See Figure 1 next page). The average individual receives approximately 230 mrem/year from radon and less than 1 mrem/year from nuclear facilities. Another 81 mrem/year are received from other natural sources and approximately 297 mrem/year from medical procedures. The total average whole body dose nationwide is approximately 620 mrem/year.

Inherent in all standards for radiation control is the philosophy of limiting exposure to levels “AS LOW AS REASONABLY ACHIEVABLE” (ALARA). In practice, this philosophy continues to result in the very low average doses to the public from nuclear facilities cited earlier. The monitoring program maintained by the Division of Radiological Health continues to verify compliance to these standards.

FIGURE 1. SOURCES OF RADIATION EXPOSURE

Source: National Council on Radiation Protection & Measurement; Estimated Annual Dose of 620 Millirem for an Average Person in the U



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North Anna and Surry Nuclear Power Stations & Other Selected Locations

Virginia Department of Health

AIR PARTICULATE

January 1, 2009 through December 31, 2009

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Location	Station	Date Start	Date Stop	Gross Beta Activity pCi/meter3
Surry Power Station	A-20	1/7/09	1/14/09	0.03 +/- 0.01
Surry Power Station	A-20	4/2/09	4/16/09	0.02 +/- 0.01
Surry Power Station	A-20	7/8/09	7/15/09	0.02 +/- 0.01
Surry Power Station	A-20	10/6/09	10/13/09	0.03 +/- 0.01

Virginia Department of Health

AIR PARTICULATE

January 1, 2009 through December 31, 2009

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Location	Station	Date Start	Date Stop	Gross Beta Activity pCi/meter3
Pocahontas State Park	A-40	1/8/09	1/15/09	0.03 +/- 0.01
Pocahontas State Park	A-40	4/1/09	4/15/09	0.02 +/- 0.01
Pocahontas State Park	A-40	7/7/09	7/14/09	0.03 +/- 0.01
Pocahontas State Park	A-40	10/7/09	10/14/09	0.03 +/- 0.01

Virginia Department of Health

AIR PARTICULATE

January 01, 2009 through December 31, 2009

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Location	Station	Date Start		Date Stop	Gross Beta Activity pCi/meter3		
Louisa County Rt. 700	A-88	1/8/09	-	1/15/09	0.02	+/-	0.02
Louisa County Rt. 700	A-88	4/1/09	-	4/15/09	0.02	+/-	0.03
Louisa County Rt. 700	A-88	7/7/09	-	7/14/09	0.04	+/-	0.01
Louisa County Rt. 700	A-88	10/7/09	-	10/14/09	0.03	+/-	0.01

Virginia Department of Health

AMBIENT GAMMA EXPOSURE
(THERMOLUMINESCENT DOSIMETERS)

January 1, 2009 through December 31, 2009

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Location	Station	Quarter	Net Exposure Rate mR/Std. Qtr +/- 2 S.D.
Surry Power Station	D-20	1st	23.0 +/- 9.6
Surry Power Station	D-20	2nd	21.0 +/- 9.2
Surry Power Station	D-20	3rd	27.0 +/- 10.4
Surry Power Station	D-20	4th	24.0 +/- 9.8
North Anna Power Station	D-35	1st	26.0 +/- 10.2
North Anna Power Station	D-35	2nd	29.0 +/- 10.8
North Anna Power Station	D-35	3rd	34.0 +/- 11.7
North Anna Power Station	D-35	4th	29.0 +/- 10.8
Pocahontas State Park	D-40	1st	28.0 +/- 10.6
Pocahontas State Park	D-40	2nd	28.0 +/- 10.6
Pocahontas State Park	D-40	3rd	35.0 +/- 11.8
Pocahontas State Park	D-40	4th	28.0 +/- 10.6
Surry-Lebanon Baptist Church	D-41	1st	23.0 +/- 9.6
Surry-Lebanon Baptist Church	D-41	2nd	31.0 +/- 9.2
Surry-Lebanon Baptist Church	D-41	3rd	26.0 +/- 10.2
Surry-Lebanon Baptist Church	D-41	4th	23.0 +/- 9.6
Surry Lawnes Creek	D-42	1st	27.0 +/- 10.4
Surry Lawnes Creek	D-42	2nd	23.0 +/- 9.6
Surry Lawnes Creek	D-42	3rd	31.0 +/- 11.1
Surry Lawnes Creek	D-42	4th	*N/A
Surry Rt. 628	D-43	1st	22.0 +/- 9.4
Surry Rt. 628	D-43	2nd	21.0 +/- 9.2
Surry Rt. 628	D-43	3rd	23.0 +/- 9.6
Surry Rt. 628	D-43	4th	22.0 +/- 9.4
Jamestown	D-44	1st	28.0 +/- 10.6
Jamestown	D-44	2nd	28.0 +/- 10.6
Jamestown	D-44	3rd	32.0 +/- 11.3
Jamestown	D-44	4th	26.0 +/- 10.2
Newport News-Lee Hall	D-45	1st	27.0 +/- 10.4
Newport News-Lee Hall	D-45	2nd	38.0 +/- 12.3
Newport News-Lee Hall	D-45	3rd	42.0 +/- 13.0
Newport News-Lee Hall	D-45	4th	35.0 +/- 11.8
Louisa Co. Mineral	D-50	1st	27.0 +/- 10.4
Louisa Co. Mineral	D-50	2nd	27.0 +/- 10.4
Louisa Co. Mineral	D-50	3rd	33.0 +/- 11.5
Louisa Co. Mineral	D-50	4th	26.0 +/- 10.2
Louisa Co.-Wares Cross	D-51	1st	23.0 +/- 9.6
Louisa Co.-Wares Cross	D-51	2nd	20.0 +/- 8.9
Louisa Co.-Wares Cross	D-51	3rd	25.0 +/- 10.0
Louisa Co.-Wares Cross	D-51	4th	21.0 +/- 9.2
Spotsylvania-GH Church	D-52	1st	25.0 +/- 10.0
Spotsylvania-GH Church	D-52	2nd	27.0 +/- 10.4
Spotsylvania-GH Church	D-52	3rd	35.0 +/- 10.8
Spotsylvania-GH Church	D-52	4th	26.0 +/- 10.2
Spotsylvania Rt. 614	D-53	1st	24.0 +/- 9.8
Spotsylvania Rt. 614	D-53	2nd	22.0 +/- 9.4
Spotsylvania Rt. 614	D-53	3rd	28.0 +/- 10.6
Spotsylvania Rt. 614	D-53	4th	23.0 +/- 9.6

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AMBIENT GAMMA EXPOSURE
(THERMOLUMINESCENT DOSIMETERS)

January 1, 2009 through December 31, 2009

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Location	Station	Quarter	Net Exposure Rate mR/Std. Qtr +/- 2 S.D.
Louisa Co. Fred Hall	D-54	1st	23.0 +/- 9.6
Louisa Co. Fred Hall	D-54	2nd	19.0 +/- 8.7
Louisa Co. Fred Hall	D-54	3rd	28.0 +/- 10.6
Louisa Co. Fred Hall	D-54	4th	20.0 +/- 8.9
Naval Weapons Station I	D-73	1st	21.0 +/- 9.2
Naval Weapons Station I	D-73	2nd	19.0 +/- 8.7
Naval Weapons Station I	D-73	3rd	24.0 +/- 9.8
Naval Weapons Station I	D-73	4th	*N/A
Newport News-Fort Eustis	D-76	1st	23.0 +/- 9.6
Newport News-Fort Eustis	D-76	2nd	22.0 +/- 9.4
Newport News-Fort Eustis	D-76	3rd	28.0 +/- 10.6
Newport News-Fort Eustis	D-76	4th	22.0 +/- 9.4
Williamsburg Busch Gardens	D-77	1st	24.0 +/- 9.8
Williamsburg Busch Gardens	D-77	2nd	23.0 +/- 9.6
Williamsburg Busch Gardens	D-77	3rd	27.0 +/- 10.4
Williamsburg Busch Gardens	D-77	4th	28.0 +/- 10.6
Williamsburg Airport	D-78	1st	25.0 +/- 10.0
Williamsburg Airport	D-78	2nd	23.0 +/- 9.6
Williamsburg Airport	D-78	3rd	25.0 +/- 10.0
Williamsburg Airport	D-78	4th	20.0 +/- 8.9
Surry Scotland Wharf	D-79	1st	28.0 +/- 10.6
Surry Scotland Wharf	D-79	2nd	26.0 +/- 10.2
Surry Scotland Wharf	D-79	3rd	27.0 +/- 10.4
Surry Scotland Wharf	D-79	4th	21.0 +/- 9.2
Surry Bacon's Castle	D-80	1st	23.0 +/- 9.6
Surry Bacon's Castle	D-80	2nd	21.0 +/- 9.2
Surry Bacon's Castle	D-80	3rd	26.0 +/- 10.2
Surry Bacon's Castle	D-80	4th	21.0 +/- 9.2
Surry - Alliance	D-81	1st	22.0 +/- 9.4
Surry - Alliance	D-81	2nd	19.0 +/- 8.7
Surry - Alliance	D-81	3rd	26.0 +/- 10.2
Surry - Alliance	D-81	4th	20.0 +/- 8.9
Surry Hog Point	D-82	1st	25.0 +/- 10.0
Surry Hog Point	D-82	2nd	21.0 +/- 9.2
Surry Hog Point	D-82	3rd	26.0 +/- 10.2
Surry Hog Point	D-82	4th	22.0 +/- 9.4
Louisa Co. Rt. 685	D-84	1st	24.0 +/- 9.8
Louisa Co. Rt. 685	D-84	2nd	23.0 +/- 9.6
Louisa Co. Rt. 685	D-84	3rd	29.0 +/- 10.8
Louisa Co. Rt. 685	D-84	4th	23.0 +/- 9.6
Spotsylvania Rt. 713	D-85	1st	19.0 +/- 8.7
Spotsylvania Rt. 713	D-85	2nd	21.0 +/- 9.2
Spotsylvania Rt. 713	D-85	3rd	21.0 +/- 9.2
Spotsylvania Rt. 713	D-85	4th	19.0 +/- 8.7
Louisa Co. Bumpass	D-86	1st	25.0 +/- 10.0
Louisa Co. Bumpass	D-86	2nd	23.0 +/- 9.6
Louisa Co. Bumpass	D-86	3rd	28.0 +/- 10.6
Louisa Co. Bumpass	D-86	4th	24.0 +/- 9.8

Virginia Department of Health

AMBIENT GAMMA EXPOSURE
(THERMOLUMINESCENT DOSIMETERS)

January 1, 2009 through December 31, 2009

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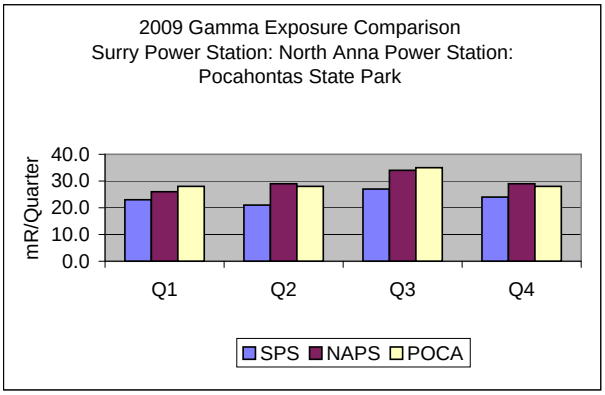
Location	Station	Quarter	Net Exposure Rate mR/Std. Qtr +/- 2 S.D.
Spotsylvania-Levy	D-87	1st	27.0 +/- 10.4
Spotsylvania-Levy	D-87	2nd	28.0 +/- 10.6
Spotsylvania-Levy	D-87	3rd	34.0 +/- 11.7
Spotsylvania-Levy	D-87	4th	28.0 +/- 10.6
Louisa Co. Rt. 700	D-88	1st	28.0 +/- 10.6
Louisa Co. Rt. 700	D-88	2nd	27.0 +/- 10.4
Louisa Co. Rt. 700	D-88	3rd	31.0 +/- 11.1
Louisa Co. Rt. 700	D-88	4th	27.0 +/- 10.4
Louisa Co. Aspen Hill	D-89	1st	29.0 +/- 10.8
Louisa Co. Aspen Hill	D-89	2nd	28.0 +/- 10.6
Louisa Co. Aspen Hill	D-89	3rd	36.0 +/- 12.0
Louisa Co. Aspen Hill	D-89	4th	30.0 +/- 11.0
Rad Health	Control 1	1st	14.0 +/- 7.5
Rad Health	Control 1	2nd	10.0 +/- 6.3
Rad Health	Control 1	3rd	14.0 +/- 7.5
Rad Health	Control 1	4th	11.0 +/- 6.6
Rad Health	Control 2	1st	15.0 +/- 7.8
Rad Health	Control 2	2nd	xN/A
Rad Health	Control 2	3rd	15.0 +/- 7.8
Rad Health	Control 2	4th	11.0 +/- 6.6

*N/A = TLD missing at time of collection
xN/A = data not available because this TLD used to substitute for lost D-84



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FISH

January 1, 2009 through December 31, 2009

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Location Name	Date	Isotope	pCi/gram
North Anna Lake Second Cooling Lagoon F-24 (Catfish)	4/8/2009	Ba	<0.01
		Cs-134	<0.01
		Cs-137	0.02 +/- 0.01
		Co-58	<0.01
		Co-60	<0.01
		I-131	<0.02
		Fe-59	<0.01
		Mn-54	<0.01
		Ru-106	<0.05
		Ag-110M	<0.01
		Zn-65	<0.01
		Nb-95	<0.01
North Anna Lake Second Cooling Lagoon F-24 (Catfish)	10/12/2009	Ba	<0.02
		Cs-134	<0.01
		Cs-137	0.01 +/- 0.01
		Co-58	<0.01
		Co-60	<0.01
		I-131	< 0.06
		Fe-59	<0.02
		Mn-54	<0.01
		Ru-106	<0.05
		Ag-110M	<0.01
		Zn-65	<0.01
		Nb-95	<0.01

Virginia Department of Health

MILK

January 1, 2009 through December 31, 2009

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Location Name	Date	Isotope	Results pCi/Liter	Location Name	Date	Isotope	Results pCi/Liter
Louisa County	N/C	Ba		Surry County	3/12/09	Ba	<5.0
Lakeside Dairy		Cs-134		Epps Dairy		Cs-134	<5.0
M-29		Cs-137		M-66		Cs-137	<4.0
		K-40*				K-40*	2.2+/-0.1
		I-131				I-131	0.0+/-0.2
		Sr-89				Sr-89	<4.0
		Sr-90				Sr-90	0.7+/-0.5
Louisa County	3/31/09	Ba	<5.0	Surry County	6/3/09	Ba	<6.0
Lakeside Dairy		Cs-134	<6.0	Epps Dairy		Cs-134	<5.0
M-29		Cs-137	<5.0	M-66		Cs-137	<6.0
		K-40*	2.1+/-0.1			K-40*	1.5+/-0.1
		I-131	0.0+/- 0.2			I-131	0.0+/-0.2
		Sr-89	<4.0			Sr-89	<4.0
		Sr-90	0.6+/-0.5			Sr-90	1.3+/-0.5
Louisa County	7/6/09	Ba	<8.0	Surry County	9/8/09	Ba	<6.0
Lakeside Dairy		Cs-134	<5.0	Epps Dairy		Cs-134	<5.0
M-29		Cs-137	<6.0	M-66		Cs-137	<6.0
		K-40*	1.4+/-0.1			K-40*	1.4+/-0.1
		I-131	0.1+/-0.1			I-131	0.0+/-0.2
		Sr-89	<4.0			Sr-89	<4.0
		Sr-90	0.7+/-0.5			Sr-90	0.5+/-0.5
Louisa County	N/C	Ba		Surry County	12/15/09	Ba	<6.0
Lakeside Dairy		Cs-134		Epps Dairy		Cs-134	<6.0
M-29		Cs-137		M-66		Cs-137	<6.0
		K-40*				K-40*	1.6+/-0.1
		I-131				I-131	0.2+/-0.2
		Sr-89				Sr-89	<4.0
		Sr-90				Sr-90	0.7+/-0.4

* = K-40 data reported in units of grams/liter

N/C = sample not collected

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RADIOGAS

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Location	Station	Date Start	Stop	I-131 Activity pCi/meter^3
Surry Power Station	C-20	01/07/09 -	01/14/09	<0.09
Surry Power Station	C-20	04/02/09 -	04/16/09	<0.05
Surry Power Station	C-20	07/08/09 -	07/15/09	<0.11
Surry Power Station	C-20	10/06/09 -	10/13/09	<0.11
Pocahontas State Park	C-40	01/08/09 -	01/15/09	<0.20
Pocahontas State Park	C-40	04/01/09 -	04/15/09	<0.10
Pocahontas State Park	C-40	07/07/09 -	07/14/09	<0.26
Pocahontas State Park	C-40	10/07/09 -	10/14/09	<0.23
Louisa County Rt. 700	C-88	01/08/09 -	01/15/09	<0.10
Louisa County Rt. 700	C-88	04/23/08 -	04/15/09	<0.05
Louisa County Rt. 700	C-88	07/07/09 -	07/14/09	<0.11
Louisa County Rt. 700	C-88	10/07/09 -	10/14/09	<0.12

Virginia Department of Health

SHELLFISH

January 1, 2009 through December 31, 2009

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Location	Date Collected	Distance & Direction	Activity : pCi/gram (wet wt.)	
R-17	10/2/2009	approx. 0.5 mi. from mouth of canal		N/A
James River Mouth of SPS Discharge Canal			Ba-140	
			Cs-134	< 0.01
			Cs-137	< 0.01
			Co-58	<0.06
			Co-60	< 0.01
			Fe-59	< 0.4
			I-131	N/A
			Mn-54	< 0.01
			Rh-106	<0.1
			Ag-110M	< 0.02
			Zn-65	< 0.04
			Zr-95	< 0.1

N/A = could not get accurate count due to long delay prior to receipt

Virginia Department of Health

SILT

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Location	Date Collected	Gross Beta pCi/Gram of Silt
James River	3/24/09	29.7 +/- 4.9
Pier 1	5/19/09	31.2 +/- 4.9
NGNNSBDDC	8/13/09	29.1 +/- 4.3
S-15A	10/21/09	21.1 +/- 3.9
James River	3/24/09	26.4 +/- 4.7
Shipway 11	5/19/09	33.6 +/- 4.9
NGNNSBDDC	8/13/09	27.9 +/- 4.4
S-16	10/21/09	29.0 +/- 4.2

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SILT

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Location	Date Collected	Gamma Activity pCi/Gram (Wet) Cs-134	Cs-137	Co-58	Co-60	Gross Beta pCi/Gram (dry
Elizabeth River	03/24/09	<0.01	0.03 +/- 0.01	<0.01	<0.01	31.7 +/- 4.9
Drydock #8	05/19/09	<0.01	0.03 +/- 0.01	<0.01	<0.01	30.2 +/- 4.9
NNSY	08/13/09	<0.01	0.02 +/- 0.01	<0.01	<0.01	31.5 +/- 4.6
S-18	10/21/09	<0.01	0.03 +/- 0.01	<0.01	<0.01	31.2 +/- 4.5
Elizabeth River	03/24/09	<0.01	0.02 +/- 0.01	<0.01	<0.01	30.9 +/- 4.9
Drydock #4	05/19/09	<0.01	0.03 +/- 0.01	<0.01	<0.01	31.1 +/- 4.8
NNSY	08/13/09	<0.01	0.01 +/- 0.01	<0.01	<0.01	20.8 +/- 4.0
S-19	10/21/09	<0.01	0.01 +/- 0.01	<0.01	<0.01	30.4 +/- 4.6
Elizabeth River	03/24/09	<0.01	0.03 +/- 0.01	<0.01	<0.01	29.7 +/- 4.9
Wetslip #1	05/19/09	<0.01	0.03 +/- 0.01	<0.01	<0.01	29.8 +/- 4.8
NNSY	08/13/09	<0.01	0.02 +/- 0.01	<0.01	<0.01	33.5 +/- 4.7
S-20	10/21/09	<0.01	0.02 +/- 0.01	<0.01	<0.01	23.9 +/- 3.9

Virginia Department of Health

SILT

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Location	Date Collected	Distance & Direction	Activity pCi/Gram (dry wt.) Cs-134	Cs-137	Co-60
James River SPS Discharge Canal S-17	10/02/09	0.5 Miles NNW	<0.05	0.36 +/- 0.01	0.03 +/- 0.01
NAPS Waste Treatment Shoreline Soil S-24	04/07/09	1.1 Miles SSE	<0.01	0.01 +/- 0.01	<0.01
NAPS Waste Treatment Shoreline Soil S-24	10/21/09	1.1 Miles SSE	<0.01	0.02 +/- 0.01	<0.01

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SURFACE WATER

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Location	Station	Date Collected	Gamma Activity pCi/L						Beta Activity		
			Ba-140	Cs-137	I-131	Mn-54	Zn 65	Zr-95/Nb-95			
									BS (pCi/L)	**SS (pCi/L)**	**GB (p/Ci/L**
James River -	W - 15A	03/24/09	<6	<6	<6	<5	<11	<9	2.7 +/- 1.3	0.1 +/- 0.3	
Pier 1	W - 15A	05/19/09	<5	<5	<6	<5	<11	<9	2.6 +/- 1.4	0.2 +/- 0.3	
NGNNSBDDC	W - 15A	08/15/09	<8	<4	<10	<5	<13	<11	3.5 +/- 1.4	0.3 +/- 0.3	
	W - 15A	10/21/09	<7	<6	<9	<5	<11	<10			216.5+/-13.5
									BS (pCi/L)	**SS (pCi/L)**	**GB (p/Ci/L**
James River -	W - 16	03/24/09	<8	<6	<11	<5	<11	<10	2.1 +/- 1.3	0.0 +/- 0.3	
Shipway 11	W - 16	05/19/09	<12	<6	<21	<5	<12	<11	1.4 +/- 1.2	0.3 +/- 0.3	
NGNNSBDDCC	W - 16	08/13/09	<6	<6	<8	<5	<13	<10	2.3 +/- 1.3	0.2 +/- 0.2	
	W - 16	10/21/09	<9	<4	<13	<5	<12	<10			241.3+/-14.7

N/A = not analyzed

BS = BASIC SULFIDES
SS = SUSPENDED SOLIDS
GB = GROSS BETA

Virginia Department of Health

SURFACE WATER

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Location	Station	Date Collected	Gamma Activity pCi/L						Beta Activity		
			Ba-140	Cs-137	I-131	Mn-54	Zn 65	Zr-95/Nb-95	BS (pCi/L)	SS (pCi/L)	GB (p/Ci/L)
Elizabeth River	W - 37	03/24/09	<9	<6	<13	<5	<11	<10	1.0+/- 1.2	0.1 +/- 0.3	
Dry Dock 4	W - 37	05/19/09	<13	<6	<26	<6	<12	<11	1.8+/- 1.2	0.3 +/- 0.3	
NNSY	W - 37	08/13/09	<10	<6	<15	<5	<12	<11	7.7 +/- 1.3	0.3 +/- 0.4	
	W - 37	10/21/09	<11	<6	<16	<5	<12	<11			137.4+/-13.4
									BS (pCi/L)	SS (pCi/L)	GB (p/Ci/L)
Elizabeth River	W - 38	03/24/09	<11	<6	<17	<5	<10	<10	1.9 +/- 1.3	0.4 +/- 0.3	
Wet Slip 1	W - 38	05/19/09	<12	<4	<19	<5	<12	<11	3.4 +/- 1.3	0.2 +/- 0.3	
NNSY	W - 38	08/13/09	<8	<6	<18	<5	<12	<11	5.3 +/- 1.3	0.2 +/- 0.3	
	W - 38	10/21/09	<10	<6	<18	<5	<12	<11			234.9+/-14.6
									BS (pCi/L)	SS (pCi/L)	GB (p/Ci/L)
Elizabeth River	W - 39	03/24/09	<11	<6	<20	<5	<12	<10	1.8 +/- 1.2	0.1 +/- 0.3	
Dry Dock 8	W - 39	05/19/09	<16	<6	<33	<6	<13	<12	1.1 +/- 1.3	0.2 +/- 0.3	
NNSY	W - 39	08/13/09	<8	<6	<11	<5	<12	<10	1.8+/- 1.3	0.3 +/- 0.3	
	W - 39	10/21/09	<12	<6	<19	<5	<12	<11			199.6+/-13.0

SS = SUSPENDED SOLIDS
BS = BASIC SULFIDES
GB = GROSS BETA

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SURFACE WATER

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Location	Station	Date Collected	Gamma Activity pCi/L Ba140	Cs134	Cs137	Co58	Co60	I131	Mn54	Zn65	Zr/Nb95	H3	Gross Beta	B
SPS	W-19	Jan-09	<12	<6	<6	<6	<5	<20	<6	<13	<11	<238	26.2 +/- 9.7	
Discharge	W-19	Apr-09	<11	<5	<5	<6	<5	<17	<5	<11	<10	*36486 +/- 384		2.1 +
Canal	W-19	Jul-09	<12	<5	<6	<6	<5	<19	<5	<12	<11	225 +/- 30		3.4+/
	W-19	Oct-09	<10	<5	<6	<6	<5	<14	<6	<12	<11	601 +/- 52	122.4 +/- 11.8	
North Anna	W-27	Jan-09	<14	<6	<6	<6	<5	<23	<5	<12	<11	<238	2+/-0.2	
River	W-27	Apr-09	<15	<5	<5	<6	<5	<28	<5	<11	<11	<238	2+/- 1	
	W-27	Jul-09	<8	<5	<6	<5	<5	<11	<5	<12	<10	1051 +/- 66	3+/-1	
	W-27	Oct-09	<7	<5	<6	<5	<5	<10	<5	<12	<10	2252 +/- 99	3+/-1	
NAPS	W-33	Jan-09	<12	<6	<6	<6	<5	<20	<5	<12	<11	4505 +/- 138	3+/-1	
Discharge	W-33	Apr-09	<11	<5	<5	<6	<5	<22	<5	<11	<11	5405 +/- 138	7+/-5	
Canal	W-33	Jul-09	<16	<5	<6	<6	<5	<35	<5	<13	<12	3453 +/- 123	4+/-3	
	W-33	Oct-09	<8	<5	<4	<6	<5	<12	<5	<12	<10	4054 +/- 133	5+/-4	
James River	W-79	Jan-09	<13	<6	<6	<6	<5	<23	<6	<12	<11	<238	5.5 +/- 3.6	
Scotland	W-79	Apr-09	<9	<5	<5	<5	<5	<16	<5	<11	<10	<228		0.8+
Wharf	W-79	Jul-09	<13	<5	<6	<6	<5	<23	<5	<12	<11	<219		2.2+
	W-79	Oct-09	<12	<5	<6	<6	<5	<18	<5	<12	<11	751 +/- 60	95.0 +/- 11.5	

NDC = No Detectable counts

* = routine release from SPS Radwaste facility in progress at time of sample

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VEGETATION

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Location Name	Date	Type	Isotope	State Results pCi/Gram (wet wt.)
Surry County Garden V-96B	N/A	Collard Greens	I-131	N/A
			Cs-134	N/A
			Cs-137	N/A
Louisa County Garden V-98B	N/A	Collard Greens	I-131	N/A
			Cs-134	N/A
			Cs-137	N/A

N/A = no garden sample available/collected due to drought and lack of access

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AIR PARTICULATE COMPOSITE SAMPLES

January 1, 2009 through December 31, 2009

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Location Name	Date Start		Stop	Gross Alpha pCi/meter3		
Eastern Site	01/07/09	-	01/14/09	<0.001	+/-	N/A
Boundary	04/01/09	-	04/08/09	<0.001	+/-	N/A
Ballfield	07/29/09	-	08/05/09	0.001	+/-	0.001
A-101	10/07/09	-	10/14/09	<0.001	+/-	N/A

NA = not applicable

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SOIL

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Location Name	Distance & Direction	Type	Date	Alpha * pCi/Gram		
Eastern Site Boundary-Ballfield S-101	Site Boundary	Soil	6/3/2009	0.8	+/-	0.4
LRAHL Bldg. Off Rt. 460 control S-102	5 Miles SW	Soil	6/3/2009	2.2	+/-	0.6

Alpha * - Uranium Separation Followed by Alpha Counting

LRAHL = Lynchburg Regional Animal Health Laboratory

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SURFACE WATER

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Location Name	Distance & Direction	Date	pCi/Liter Alpha *
from James River shoreline near Ballfield at eastern site boundary W-101	approx. 3 mi. downstream from plant	6/3/2009	0.4 +/- 0.2
from James River shoreline near Six Mile Bridge control W-102	approx. 1.5 mi. upstream from plant	6/3/2009	0.6 +/- 0.3

Alpha * - Uranium Separation
Followed by Alpha Counting

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VEGETATION

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Location Name	Distance & Direction	Type	Date	Alpha * pCi/Gram
Eastern Site Boundary-Ballfield V-101	Site Boundary	Vegetation	6/3/2009	0.4 +/- 0.4
LRAHL Bldg. Off RT 460 control V-102	5 Miles SW	Vegetation	6/3/2009	0.1 +/- 0.5

Alpha * - Uranium Separation
Followed by Alpha Counting

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APPENDIX I

LOWER LIMITS OF DETECTION "LLD"

LOWER LIMITS OF DETECTION
"LLD"

Definition: **"Lower Limit of Detection"** – The smallest amount or concentration of a radioactive or nonradioactive element that can be reliably detected in a sample.

All radioactive measurements for samples are reported with an uncertainty. The uncertainty arises for a number of reasons including imperfections in the apparatus or procedure, human error and counting uncertainty. The counting uncertainty arises because radioactive decay is a random process. This means that if one counts the radioactive decay of a sample several times, each for a fixed time, one will find that the measured number of decays varies randomly. However, these random answers all cluster near an average value. It is usually assumed that the counting uncertainty is the dominant uncertainty. The uncertainties that are reported are the counting uncertainties only. The interpretation of this is that we are 95% confident that the true concentration in the sample lies somewhere between the measured concentration minus the counting uncertainty and the measured concentration plus the counting uncertainty.

One consequence of the uncertainties in a measurement of radioactivity is that it is not possible to determine a zero concentration of a radioisotope. Rather, when the uncertainty is such that one cannot distinguish between the sample and background counting rates, we report that the sample radioactivity is less than some concentration. This minimum concentration is termed the Lower Limit of Detection (LLD). Practical sample size, counting time, and background radiation all combine to determine the LLD. The LLD for most radioisotopes is at least several orders of magnitude (factors of ten) less than the standards for a level of a concern that has been set by the state or federal government.

CONDITIONS

Consolidated Laboratories

LLD values apply to samples analyzed immediately after collection with no decay corrections used in the calculations. Decay corrections normally required during sample processing may result in significant increases in the LLD's for the short-lived isotopes.

Gamma isotopic analysis is performed with a 4" X 4" Sodium Iodide (Tl) detector and a high purity Germanium detector.

Gross alpha, beta, Sr-89, and Sr-90 LLD's were based on variable averages normally encountered in sample processing. The LLD may vary from sample to sample depending on self-absorption corrections, counting efficiency, background changes, counting time and recovery yields. Fish values will depend on the wet to ash weight ratio of the collected sample.

The lower limits of detection for all analysis were calculated using the methods found on the following pages:

LOWER LIMITS OF DETECTION (LLD's) FOR GAMMA COUNTING
Consolidated Laboratories

For Tissue, Silt, Vegetation, etc., as provided by SPECTRAN-F V2 Technical Reference Manual using the HpGe Detector

Required Sample Size: 1 Kilogram

NOMINAL LLD's for selected isotopes are given below. Actual LLD's are determined at the time of analysis, and vary with decay time, background radiation, sample size, etc.

Isotope*	LLD, pCi/Liter
Cs-134	0.0046
Cs-137	0.0041
Co-58	0.0041
Co-60	0.0048
I-131	0.0049
Ru/Rh-106	0.0370
Zn-65	0.0093
Zr-95	0.0075
Ba/La-140	0.0150
Ag-110m	0.0046
Mn-54	0.0039
Fe-59	0.0083

Canberra's Spectran-F Software calculates LLD using the following relationships:

$$* \text{LLD} = \text{LD}^* \frac{e^{(.693*Td/T\square)}}{T * Y * e * V * 0.037}$$

where: Td = Decay Time
T□ = Half-Life
T = Count Time
Y = Yield of the gamma ray in question
e = Detector efficiency at the energy of gamma ray in question
V = Sample size
0.037= Conversion factor: gammas/second to picocuries

and: $LD = k^2 = 2*LC$

Where: LC is the weakest signal the instrument can detect as a peak.

and: k is a constant which depends on the desired confidence limit for the result. (At the 95% confidence level, k= 1.645.)

LOWER LIMITS OF DETECTION (LLD's) FOR GAMMA COUNTING

Consolidated Laboratories

For Water, Milk, etc, as provided by GAMMA-M SOFTWARE CISE 551 Technical Reference Manual using the NaI Detector

Required Sample Size: 3.5 Liters

NOMINAL LLD's for selected isotopes are given below. Actual LLD's are determined at the time of analysis, and vary with decay time, background radiation, sample size, etc.

Isotope*	LLD, pCi/Liter
Cs-134	7.3
Cs-137	7.6
Co-58	7.2
Co-60	12.0
I-131	7.9
Zn-65	21.0
Zr-95	15.0
Ba/La-140	10.0
Mn-54	7.8
Fe-59	19.0

Canberra's GAMMA-M Software calculates LLD using the following relationships:

$$* \text{LLD} = \text{LD}* \frac{e^{(.693*Td/T\square)}}{T * Y * e * V * 0.037}$$

where: Td = Decay Time
T□ = Half-Life
T = Count Time
Y = Yield of the gamma ray in question
e = Detector efficiency at the energy of gamma ray in question
V = Sample size
0.037= Conversion factor: gammas/second to picocuries

and: $LD = k^2 = 2*LC$

Where: LC is the weakest signal the instrument can detect as a peak.

and: k is a constant which depends on the desired confidence limit for the result. (At the 95% confidence level, k= 1.645.)

LOWER LIMITS OF DETECTION (LLD's) FOR GAMMA COUNTING
Consolidated Laboratories

For Air Particulate and Charcoal Canister, as provided by GAMMA-M Software CISE 551 Technical Reference Manual using the NaI Detector

Required Sample Size: 2300 m^3 (Air Particulate Composite)
Required Sample Size: 120 m^3 (Charcoal Canister)

NOMINAL LLD's for selected isotopes are given below. Actual LLD's are determined at the time of analysis, and vary with decay time, background radiation, sample size, etc.

Isotope*	LLD, pCi/m^3
Cs-134 in Air particulate Composite	0.002
Cs-137 in Air particulate Composite	0.002
I-131 in Charcoal Canister	0.050

Canberra's Gamma-M Software calculates LLD using the following relationships:

$$LLD = 4.65 * \frac{(R_b/T_s)^{1/2}}{Y * e * V * d * 2.22}$$

where:
- R_b = Background rate (CPM)
- T_s = Sample Count Time
- Y = Chemical Yield (Gamma ray abundance for I-131 @ 364KeV)
- e = Detector efficiency
- V = Sample size
- d = Decay Correction Factor
- 2.22 = Conversion factor: counts/minute to picocuries

LOWER LIMITS OF DETECTION (LLD's) FOR BETA COUNTING
Consolidated Laboratories

For Milk and Water (Radiochemical Analysis).

Matrix*	LLD	Weight or Volume Required
Sr-89/90 in Milk & Water:		
Sr-89	4.00 pCi/Liter	1000 ml
Sr-90	1.00 pCi/Liter	1000 ml
I-131 in Water	0.34 pCi/Liter	1000 ml
I-131 in Milk	0.36 pCi/Liter	1000 ml

$$LLD = 4.65^* \frac{\sqrt{p(Rb/Ts)}}{Y * e * V * d * 2.22}$$

where:
- Rb = Background rate (CPM)
- Ts = Sample Count Time
- Y = Chemical Yield
- e = Detector efficiency
- V = Sample size
- d = Decay Correction Factor
- 2.22 = Conversion factor: counts/minute to picocuries
- 4.65 = 95% Confidence Factor

LOWER LIMITS OF DETECTION (LLD's) FOR BETA COUNTING
Consolidated Laboratories

For Air Particulate, Surface and Ground Water, Saline Water, Silt, Soil, Fish.

Matrix*	LLD	Weight or Volume Required
Air particulate	0.01 pCi/m^3	120 m^3
Surface and Ground Water	0.82 pCi/Liter	500 ml
Saline Water (Surry Power Station)	49.00 pCi/Liter	10 ml
Suspended Solids/ Saline Water	0.54 pCi/Liter	1000 ml
Basic Sulfides in Saline Water	0.41 pCi/Liter	1000 ml
Silt/Soil	2.90 pCi/gram	200 mg
Fish	0.046 pCi/gram	1000 grams

$$LLD = 4.65^* \frac{\square\ \square(\sqrt{Rb/Ts})\ \square}{Y * e * V * d * 2.22}$$

where:
- Rb = Background rate (CPM)
- Ts = Sample Count Time
- Y = Chemical Yield
- e = Detector efficiency
- V = Sample size
- d = Decay Correction Factor
- 2.22 = Conversion factor: ~~counts/min~~ute to picocuries
- 4.65 = 95% Confidence Factor

LOWER LIMITS OF DETECTION (LLD's) FOR ALPHA COUNTING
Consolidated Laboratories

For Air Particulate, Surface and Ground Water, Saline Water, Silt and Soil.

Matrix*	LLD	Weight or Volume Required
Air Particulate	0.001 pCi/m^3	150 m^3
Surface and Ground Water	0.50 pCi/liter	500 ml
Saline Water: (SS & BS)		
Suspended Solids	0.23 pCi/liter	1000 ml
Basic Sulfides	0.23 pCi/liter	1000 ml
Silt/Soil	1.9 pCi/gram	100 mg

$$LLD = 4.65^* \frac{(2.71/Ts) + (\sqrt{(Rb/Ts)})}{Y * e * V * d * 2.22}$$

where:
- Rb = Background rate (CPM)
- Ts = Sample Count Time
- Y = Chemical Yield (Gamma ray abundance for I-131 @ 634 KeV)
- e = Detector efficiency
- V = Sample size
- d = Decay Correction Factor
- 2.22 = Conversion factor: counts/minute to picocuries
- 4.65 = 95% Confidence Factor
- 2.71 = Conversion factor used to compensate for low backgrounds encountered in Alpha counting

LOWER LIMITS OF DETECTION (LLD's) FOR ALPHA COUNTING
Consolidated Laboratories

For Water, Vegetation, Silt and Soil (Uranium Radiochemical Analysis).

Matrix*	LLD	Weight or Volume Required
Water	0.20 pCi/Liter	1000 ml
Vegetation	0.02 pCi/gram	1000 grams
Silt	0.02 pCi/gram	1000 grams
Soil	0.02 pCi/gram	1000 grams

$$LLD = 4.65^* \frac{(2.71/Ts) + (\pm\sqrt{(Rb/Ts)})}{Y * e * V * d * 2.22}$$

where: Rb = Background rate (CPM)
Ts = Sample Count Time
Y = Chemical Yield (Gamma ray abundance for I-131 @ 634 KeV)
e = Detector efficiency
V = Sample size
d = Decay Correction Factor
2.22 = Conversion factor: counts/minute to picocuries
4.65 = 95% Confidence Factor
2.71 = Conversion factor used to compensate for low backgrounds encountered in Alpha counting

LOWER LIMITS OF DETECTION (LLD's) FOR ALPHA COUNTING
Consolidated Laboratories

For Air Particulate and Waste Water (Fluorometric Uranium Analysis).

Matrix*	LLD	Weight or Volume Required
Air Particulate	2.00 E-09 ug/ml	1440 m^3
Waste Water	0.04 ug/Liter	1000 ml

$$LLD = 4.65^* \frac{(2.71/Ts) + (\sqrt{(Rb/Ts)})}{Y * e * V * d * 2.22}$$

where:
- Rb = Background rate (CPM)
- Ts = Sample Count Time
- Y = Chemical Yield (Gamma ray abundance for I-131 @ 634 KeV)
- e = Detector efficiency
- V = Sample size
- d = Decay Correction Factor
- 2.22 = Conversion factor: counts/minute to picocuries
- 4.65 = 95% Confidence Factor
- 2.71 = Conversion factor used to compensate for low backgrounds encountered in Alpha counting

LOWER LIMITS OF DETECTION FOR TRITIUM ANALYSES

Required Volume: 50 ml
Sample Aliquot: 8 ml

	APPROXIMATE LLD * COUNTING TIME
80 pCi/L	600 minutes
200 pCi/L	200 minutes
400 pCi/L	100 minutes
1000 pCi/L	20 minutes
5000 pCi/L	10 minutes

$$* \text{ LLD in pCi/L} = \frac{4.66(R_{Bkg}/T)^{1/2}}{2.22\ (V)\ (E)}$$

where: R_{Bkg} = Background rate (CPM)
T = Background Counting Time
E = Counter Efficiency
V = Sample Volume or Size
4.66 = 95% Confidence Factor

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APPENDIX II

SAMPLING LOCATIONS

SPS Sampling Locations

LOCATION	TYPE	FREQUENCY
Milk		
* M-66 Surry County - W.B. Epps Dairy	Raw	Quarterly
Air		
* A-20 Surry Power Station	Air Particulate	Quarterly
Charcoal Filter		
* C-20 Surry Power Station	Release Gas	Quarterly
Dosimeters		
*D-20 Surry Power Station	Gamma in Air	Quarterly
D-41 Surry Lebanon Baptist Church	Gamma in Air	Quarterly
D-42 Surry County - Lawnes Creek	Gamma in Air	Quarterly
D-43 Surry County - Route 628	Gamma in Air	Quarterly
*D-44 Jamestown	Gamma in Air	Quarterly
D-45 Newport News - Lee Hall	Gamma in Air	Quarterly
D-73 Naval Weapons Station - Enlisted Quarter	Gamma in Air	Quarterly
*D-76 Newport News - Fort Eustis	Gamma in Air	Quarterly
D-77 Williamsburg - Busch Gardens	Gamma in Air	Quarterly
D-78 Williamsburg - Williamsburg Airport	Gamma in Air	Quarterly
D-79 Surry County - Scotland Wharf	Gamma in Air	Quarterly
*D-80 Surry County - Bacon's Castle	Gamma in Air	Quarterly
*D-81 Surry County - Alliance	Gamma in Air	Quarterly
*D-82 Surry County - Hog Point	Gamma in Air	Quarterly
Shellfish		
R-17 James River - 1/2 Mile Off Discharge Canal	Clams	Annually
Silt		
S-17 James River - 1/2 Mile Off Discharge Canal	Silt	Annually
Surface Water		
* W-19 Surry Discharge Canal	Surface Water	Quarterly
* W-79 James River - Scotland Wharf	Surface Water	Quarterly
Vegetation		
* V-96B Surry County	Edible Vegetation	Annually

***Virginia and Virginia Power Duplicate Samples**

NAPS Sampling Locations

LOCATION	TYPE	FREQUENCY
Milk		
* M-29 Louisa County - Lakeside Dairy	Raw	Quarterly
Air		
* A-88 Louisa County Route 700	Air Particulate	Quarterly
Charcoal Filter		
* C-88 Louisa County Route 700	Release Gas	Quarterly
Dosimeters		
* D-35 NAPS	Gamma in Air	Quarterly
* D-50 Louisa County - Mineral	Gamma in Air	Quarterly
* D-51 Louisa County - Wares Crossroads	Gamma in Air	Quarterly
* D-52 Spotsylvania - Good Hope Church	Gamma in Air	Quarterly
D-53 Spotsylvania - Route 614	Gamma in Air	Quarterly
D-54 Louisa County - Frederick's Hall	Gamma in Air	Quarterly
D-84 Louisa County - Route 685	Gamma in Air	Quarterly
D-85 Spotsylvania Co. - Route 713	Gamma in Air	Quarterly
* D-86 Louisa County - Bumpass P.O.	Gamma in Air	Quarterly
* D-87 Spotsylvania Co. - Levy	Gamma in Air	Quarterly
* D-88 Louisa Co. - Rt. 700 (near station)	Gamma in Air	Quarterly
* D-89 Louisa County - Aspen Hill	Gamma in Air	Quarterly
Fish		
* F-24 North Anna Lake - Second Cooling Lagoon	Edible Fish	2/Year
Soil		
S-24 NAPS Waste Treatment shoreline soil	Soil	Annually
Surface Water		
* W-27 North Anna River - Route 522	Surface Water	Quarterly
* W-33 North Anna Discharge Canal	Surface Water	Quarterly
Vegetation		
* V-98C Louisa County	Edible Vegetation	Annually

***Virginia and Virginia Power Duplicate Samples**

Sampling Locations - Babcock & Wilcox

SAMPLE	LOCATION	TYPE	FREQUENCY
AIR			
A-101	Eastern Site Boundary Ballfield	Air	Quarterly
SURFACE WATER			
W-101	James River 3 mi. downstream of plant at eastern site boundary	Surface Water	Annually
W-102	James River 1.5 mi. upstream of plant at Six Mile Bridge control	Surface Water	Annually
SOIL			
S-101	Eastern Site Boundary Ballfield	Soil	Annually
S-102	LRAHL Bldg. Off Route 460 5 Miles S.W. Control	Soil	Annually
VEGETATION			
V-101	Eastern Site Boundary Ballfield	Grass	Annually
V-102	LRAHL Bldg. Off Route 460 5 Miles S.W. Control	Grass	Annually

Other Sampling Locations in VA

	LOCATION	TYPE	FREQUENCY
	Air		
A-40	Pocahontas State Park	Air Particulate	Quarterly
	Silt		
S-15A	James River - NGNNSBDDC Pier 1	Silt	Quarterly
S-16	James River - NGNNSBDDC Shipway 11	Silt	Quarterly
S-18	Elizabeth River - NNSY - Drydock #8	Silt	Quarterly
S-19	Elizabeth River - NNSY - Drydock #4	Silt	Quarterly
S-20	Elizabeth River - NNSY - Wet Slip #1	Silt	Quarterly
	Charcoal Filter		
C-40	Pocahontas State Park	Air Particulate	Quarterly
	Dosimeters		
D-40	Pocahontas State Park	Air Gamma	Changed 4/Year
	Surface Water		
W-15	James River - NGNNSBDDC Pier 1	Surface Water	Quarterly
W-16	James River - NGNNSBDDC Shipway 11	Surface Water	Quarterly
W-37	Elizabeth River - NNSY - Drydock #8	Surface Water	Quarterly
W-38	Elizabeth River - NNSY - Drydock #4	Surface Water	Quarterly
W-39	Elizabeth River - NNSY - Wet Slip #1	Surface Water	Quarterly

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HEALTH

DIVISION OF RADIOLOGICAL HEALTH
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APPENDIX III
EMERGENCY PREPAREDNESS

EMERGENCY PREPAREDNESS

The Division of Radiological Health (DRH) is one of the lead response agencies for emergencies involving the potential or actual release of radioactive materials. Overall state level emergency response is described in the Commonwealth of Virginia Radiological Emergency Response Plan (COVRERP), which is developed and maintained by the Department of Emergency Management (DEM) for the Commonwealth of Virginia. In addition to generic guidelines for responding to any major radiological emergency, the response procedures contain segments addressing response to several types of accidents. There are sections, which provide information needed for response to Licensee and Transportation accidents. Other sections contain background information and response guidance for accidents at fixed nuclear facilities.

Primary tasks of the Virginia Department of Health (VDH) and DRH in response to a radiological emergency, are to locate, identify, and predict the impact of any radioactive materials released to the environment. Based on the predicted or known impact, the VDH then recommends appropriate measures to protect the public. The DRH also supervises cleanup and ensures proper disposal of radioactive waste. A duty officer maintains 24-hour coverage for the DRH to ensure personnel are available at all times for coverage in case of a radiological emergency.

Under the provisions of current Federal Emergency Management Agency regulations, the DRH conducts or participates in periodic drills that are designed to provide needed team training and to test our emergency plan and procedures. The scope of these drills ranges from receiving and acknowledging simulated emergency communications to full-scale team deployment. In the latter case, the DRH personnel are presented with problems similar to those that might be encountered during an actual emergency.

Federal regulations for commercial nuclear power generating facilities stipulate that a full-scale exercise involving appropriate local government participation and testing all significant response elements must be conducted and evaluated every other year. Because there are two such facilities, Surry and North Anna Nuclear Power Stations, Commonwealth of Virginia agencies will perform exercise activities on a yearly basis, alternating between the sites each year. The VDH, DRH, and DEM have elected to participate in each exercise as fully as resources and local response organizations participation permit.