COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HEALTH

DIVISION OF RADIOLOGICAL HEALTH
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Office (804) 864-8150 Fax (804) 864-8165

2011

ENVIRONMENTAL RADIATION PROGRAM

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

- Newport News Shipbuilding

- 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 include:

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
(804) 864-8150

You are invited to submit any comments or questions regarding this report to the 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 2011

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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, Lynchburg, Virginia
(4) Newport News Shipbuilding (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 July, are within normal expected levels.

This report represents a compilation of all samples collected between January 1, 2011 and December 31, 2011.

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 five major nuclear facilities in Virginia. These sites include: 1) North Anna Nuclear Power Station (Louisa County) 2) Surry Nuclear Power Station (Surry County) 3) Babcock & Wilcox naval nuclear fuel facility (Lynchburg) 4) Newport News shipbuilding and 5) Norfolk Naval Shipyard, (Portsmouth)

The objectives of this radiological monitoring program are:
(1) To detect and measure radioactive releases during routine operations.
(2) To detect and measure radioactive releases during abnormal events.
(3) To measure concentration of radioactive effluents in the environment - particularly in human exposure pathways.
(4) To provide an independent means of verification of reports provided by the facilities.

These objectives are achieved through continuous sampling of air and ambient radiation, as well as, periodic sampling of water, milk, vegetation, fish, shellfish, etc.
A brief description of each sampling regime follows:

ENVIRONMENTAL SAMPLES COLLECTED BY VDH-DRH STAFF:

1) 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 collect any radioactive particulates. All stations except the control station duplicate sampling sites used by Dominion's environmental sampling program. At Babcock & Wilcox also has one air sampler located on site. This air pump is equipped with air particulate filters and runs approximately 168 hours per week with an average flow rate of 55 cubic feet per hour.

The power station air samples are collected on a quarterly basis. The air particulate filter is analyzed for a gross beta activity and the charcoal filters are analyzed for gamma activity with special emphasis on I-131 retention.

The Babcock & Wilcox particulate samples are also collected on a quarterly basis and undergo gross alpha analysis.

2) SURFACE WATER

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

Two surface water samples are also collected from the James River at Babcock & Wilcox on an annual basis. One collection site 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 Newport News Shipbuilding (NNSB) and on the Elizabeth River at the Norfolk Naval Shipyard (NNSY) to ensure that shipyard operations result in minimal radioactive effluents. These samples are collected by shipyard personnel working in conjunction with VDH-DRH staff. VDH-DRH delivers their split samples to DCLS in Richmond for analysis. Samples are counted for gross beta activity and several gamma emitting isotopes of interest. Data is based on activity per liter.

3) SILT

Each sample consists of one kilogram of bottom sediment which should be an indicator of the possible deposition of radioactive material through the water column.

Silt is also 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 Newport News Shipbuilding (NNSB) on the James River. These samples are collected by shipyard personnel working in conjunction with VDH-DRH staff. VDH-DRH delivers their split samples to DCLS in Richmond for analysis.

Silt samples are counted for gross beta activity and several gamma emitting isotopes of interest. Data is based on activity per unit of dry weight.

4) SOIL

Two soil samples are collected on an annual basis 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. Samples undergo uranium separation followed by alpha analysis.

5) 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 by VDH-DRH staff at harvest (when available). 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 also collected on an annual basis at Babcock & Wilcox. These consist of one kilogram of grass from the ballfield at the eastern site boundary and a similar sample collected from the 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 undergo uranium separation followed by alpha analysis.

6) 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 sites surrounding North Anna Power Station and fourteen sites surrounding Surry Power Station. One control TLD station is located at Pocahontas State Park. Several sample locations at each plant duplicate those used by Dominion's TLD environmental sampling program. The TLD's are read quarterly for net gamma exposure during their time in the field, resulting in a millirem/quarter reading.

ENVIRONMENTAL SAMPLES COLLECTED BY OTHERS:

1) FISH

Freshwater fish samples are collected annually in Lake Anna near the North Anna Power Station. Each sample consists of approximately one kilogram of flesh from catfish, sunfish, bass or bluegill. All fish samples are counted for gamma activity with data based on wet weight of the sample. To date, Dominion personnel have conducted this sampling, but VDH-DRH personnel may soon be asked to accompany/assist them to provide better verification.

2) MILK

Raw milk samples are collected quarterly from a dairy near each of the nuclear power stations. 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 collected by VA Dept. of Agriculture personnel and analyzed for gross gamma activity and also for individual isotopes of interest which include Strontium-89, Sr-90, and Iodine-131,

3) SHELLFISH

Marine shellfish can be another indicator of incorporation of radioactivity within the food chain. A sample is collected annually (when available) approximately 0.5 mile off the mouth of the Surry power station discharge canal which is in the tidal portion of James River. Samples consisting of one kilogram of flesh are collected by VDH Dept. of Shellfish Sanitation staff and analyzed for gamma activity.

4) SOIL/SILT

A soil sample is collected bi-annually by Dominion staff from the lake shoreline near the waste water treatment plant which is located approximately 1.1 miles SSE from North Anna Power station. A sediment sample is collected by VDH Dept. of Shellfish Sanitation staff annually approximately 0.5 mile off the mouth of the Surry power station discharge canal which is in the tidal portion of James River. Silt samples are counted for gross beta activity and several gamma emitting isotopes of interest. Data is based on activity per unit of dry weight.

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.

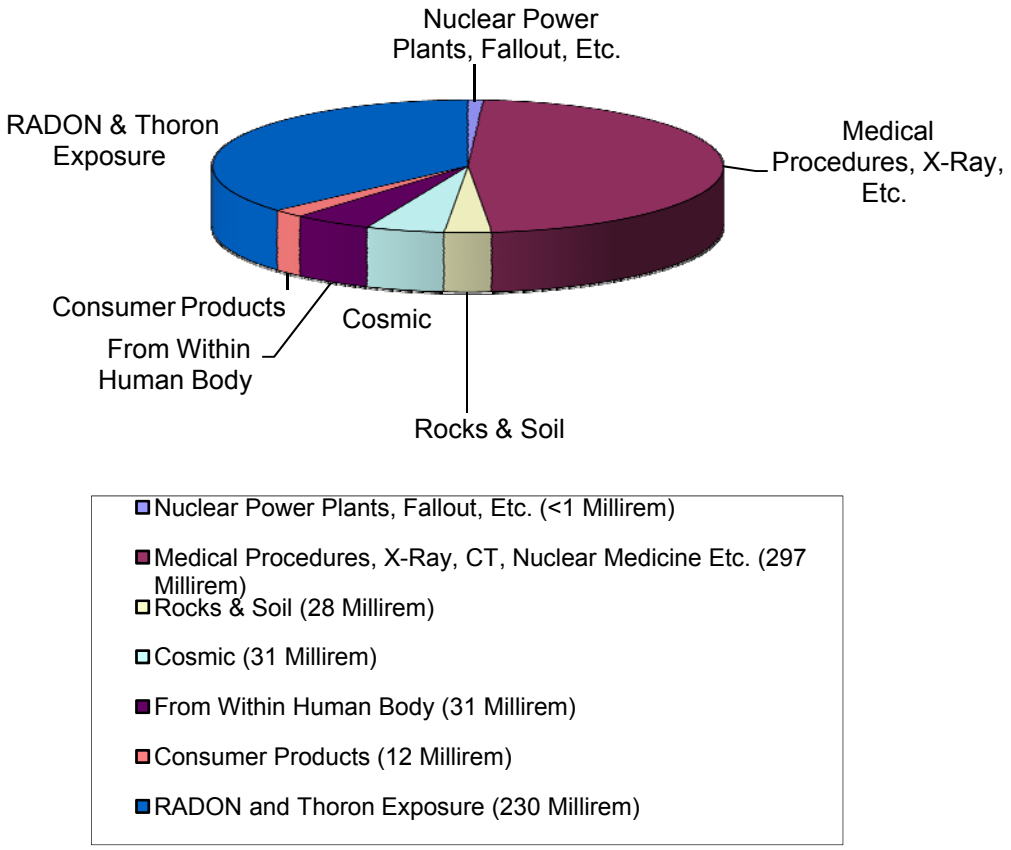
Background radiation levels were most altered by residual fallout from nuclear weapons testing. The United States ceased atmospheric testing following adoption of the 1963 Nuclear Test Ban Treaty. Only long-lived fallout radionuclides remain.

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.S.A.

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North Anna and Surry Nuclear Power Stations & Other Selected Locations

Virginia Department of Health

AIR PARTICULATE

January 1, 2011 through December 31, 2011

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Location	Station	Date Start		Stop	Gross Beta Activity pCi/meter3		
Surry Power Station	A-20	01/06/11	-	01/13/11	0.03	+/-	0.01
Surry Power Station	A-20	03/31/11	-	04/07/11	0.04	+/-	0.01
Surry Power Station	A-20	07/07/11	-	07/14/11	0.05	+/-	0.01
Surry Power Station	A-20	10/4/11	-	10/11/11	0.11	+/-	0.02

Virginia Department of Health

AIR PARTICULATE

January 1, 2011 through December 31, 2011

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Location	Station	Date Start		Date Stop	Gross Beta Activity pCi/meter3		
Pocahontas State Park	A-40	01/05/11	-	01/12/11	0.06	+/-	0.01
Pocahontas State Park	A-40	03/28/11	-	04/11/11	0.10	+/-	0.02
Pocahontas State Park	A-40	07/07/11	-	07/14/11	0.09	+/-	0.02
Pocahontas State Park	A-40	10/5/11	-	10/12/11	0.19	+/-	0.03

Virginia Department of Health

AIR PARTICULATE

January 1, 2011 through December 31, 2011

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Location	Station	Date Start		Date Stop	Gross Beta Activity pCi/meter3		
Lousia County – Route 700	A-88	01/05/11	-	01/12/11	0.04	+/-	0.01
Lousia County – Route 700	A-88	03/30/11	-	04/06/11	0.06	+/-	0.01
Lousia County – Route 700	A-88	07/06/11	-	07/13/11	0.16	+/-	0.02
Lousia County – Route 700	A-88	10/5/11	-	10/12/11	0.14	+/-	0.02

Virginia Department of Health

AMBIENT GAMMA EXPOSURE

Thermoluminescent Dosimeters

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Location	Station	Quarter	Net Exposure Rate mR/Std Qtr +/- 2 S.D.		
Surry Power Station	D-20	1st	**27.16**	**+/-**	**10.42**
Surry Power Station	D-20	2nd	**27.00**	**+/-**	**11.31**
Surry Power Station	D-20	3rd	**30.91**	**+/-**	**11.12**
Surry Power Station	D-20	4th	**28.46**	**+/-**	**10.67**
North Anna Power Station	D-35	1st	**36.51**	**+/-**	**12.08**
North Anna Power Station	D-35	2nd	**32.00**	**+/-**	**11.31**
North Anna Power Station	D-35	3rd	**39.51**	**+/-**	**12.57**
North Anna Power Station	D-35	4th	**38.18**	**+/-**	**12.36**
Pocahontas State Park	D-40	1st	**38.23**	**+/-**	**12.37**
Pocahontas State Park	D-40	2nd	**29.00**	**+/-**	**10.77**
Pocahontas State Park	D-40	3rd	**42.95**	**+/-**	**13.11**
Pocahontas State Park	D-40	4th	**36.75**	**+/-**	**12.12**
Surry – Lebanon Baptist Church	D-41	1st	**25.79**	**+/-**	**10.16**
Surry – Lebanon Baptist Church	D-41	2nd	**26.00**	**+/-**	**10.20**
Surry – Lebanon Baptist Church	D-41	3rd	**27.28**	**+/-**	**10.45**
Surry – Lebanon Baptist Church	D-41	4th	**30.02**	**+/-**	**10.96**
Surry – Lawnes Creek	D-42	1st	**29.86**	**+/-**	**10.93**
Surry – Lawnes Creek	D-42	2nd	**29.00**	**+/-**	**10.77**
Surry – Lawnes Creek	D-42	3rd	**34.59**	**+/-**	**11.76**
Surry – Lawnes Creek	D-42	4th	**29.89**	**+/-**	**10.93**
Surry – Route 628	D-43	1st	**29.06**	**+/-**	**10.78**
Surry – Route 628	D-43	2nd	**25.00**	**+/-**	**10.00**
Surry – Route 628	D-43	3rd	**32.06**	**+/-**	**11.32**
Surry – Route 628	D-43	4th	**26.55**	**+/-**	**10.30**
Jamestown	D-44	1st	*	**+/-**	*
Jamestown	D-44	2nd	*	**+/-**	*
Jamestown	D-44	3rd	**38.75**	**+/-**	**12.45**
Jamestown	D-44	4th	**57.71**	**+/-**	**15.19**
Newport News - Lee Hall	D-45	1st	**45.28**	**+/-**	**13.46**
Newport News - Lee Hall	D-45	2nd	**38.00**	**+/-**	**12.33**
Newport News - Lee Hall	D-45	3rd	**38.26**	**+/-**	**12.37**
Newport News - Lee Hall	D-45	4th	**41.29**	**+/-**	**12.85**
Lousia County Mineral	D-50	1st	**29.53**	**+/-**	**10.87**
Lousia County Mineral	D-50	2nd	**29.00**	**+/-**	**10.77**
Lousia County Mineral	D-50	3rd	**33.27**	**+/-**	**11.54**
Lousia County Mineral	D-50	4th	**36.40**	**+/-**	**12.07**
Wares Cross Roads -Lousia	D-51	1st	**24.90**	**+/-**	**9.98**
Wares Cross Roads -Lousia	D-51	2nd	**23.00**	**+/-**	**9.59**
Wares Cross Roads -Lousia	D-51	3rd	**29.28**	**+/-**	**10.82**
Wares Cross Roads -Lousia	D-51	4th	**26.75**	**+/-**	**10.34**

- TLD badge was lost/stolen from sample location

Virginia Department of Health

AMBIENT GAMMA EXPOSURE

Thermoluminescent Dosimeters

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Location	Station	Quarter	Net Exposure Rate mR/Std Qtr +/- 2 S.D.		
Lousia County – Good Hope Church	D-52	1st	**31.19**	**+/-**	**11.17**
Lousia County – Good Hope Church	D-52	2nd	**28.00**	**+/-**	**10.58**
Lousia County – Good Hope Church	D-52	3rd	**38.46**	**+/-**	**12.40**
Lousia County – Good Hope Church	D-52	4th	**34.23**	**+/-**	**11.70**
Spotsylvania Route 614	D-53	1st	**26.78**	**+/-**	**10.35**
Spotsylvania Route 614	D-53	2nd	**25.00**	**+/-**	**10.00**
Spotsylvania Route 614	D-53	3rd	**32.21**	**+/-**	**11.35**
Spotsylvania Route 614	D-53	4th	**31.86**	**+/-**	**11.29**
Lousia County – Fred Hall	D-54	1st	**39.15**	**+/-**	**12.51**
Lousia County – Fred Hall	D-54	2nd	**23.00**	**+/-**	**9.59**
Lousia County – Fred Hall	D-54	3rd	**31.43**	**+/-**	**11.21**
Lousia County – Fred Hall	D-54	4th	**27.72**	**+/-**	**10.53**
Naval Weapons Station – 1	D-73	1st	**24.41**	**+/-**	**9.88**
Naval Weapons Station – 1	D-73	2nd	**24.00**	**+/-**	**9.80**
Naval Weapons Station – 1	D-73	3rd	**24.69**	**+/-**	**9.94**
Naval Weapons Station – 1	D-73	4th	**30.67**	**+/-**	**11.08**
Newport News – Fort Eustis	D-76	1st	**25.81**	**+/-**	**10.16**
Newport News – Fort Eustis	D-76	2nd	**27.00**	**+/-**	**10.39**
Newport News – Fort Eustis	D-76	3rd	**32.52**	**+/-**	**11.40**
Newport News – Fort Eustis	D-76	4th	**27.51**	**+/-**	**10.49**
Williamsburg – Busch Gardens	D-77	1st	**32.75**	**+/-**	**11.45**
Williamsburg – Busch Gardens	D-77	2nd	**25.00**	**+/-**	**10.00**
Williamsburg – Busch Gardens	D-77	3rd	**37.81**	**+/-**	**12.30**
Williamsburg – Busch Gardens	D-77	4th	**34.16**	**+/-**	**11.69**
Williamsburg – Airport	D-78	1st	**22.46**	**+/-**	**9.48**
Williamsburg – Airport	D-78	2nd	**25.00**	**+/-**	**10.00**
Williamsburg – Airport	D-78	3rd	**26.51**	**+/-**	**10.30**
Williamsburg – Airport	D-78	4th	**30.87**	**+/-**	**11.11**
Surry – Scotland Wharf	D-79	1st	**22.37**	**+/-**	**9.46**
Surry – Scotland Wharf	D-79	2nd	**23.00**	**+/-**	**9.59**
Surry – Scotland Wharf	D-79	3rd	**28.39**	**+/-**	**10.66**
Surry – Scotland Wharf	D-79	4th	**24.94**	**+/-**	**9.99**
Surry – Bacon's Castle	D-80	1st	**26.31**	**+/-**	**10.26**
Surry – Bacon's Castle	D-80	2nd	**24.00**	**+/-**	**9.59**
Surry – Bacon's Castle	D-80	3rd	**30.96**	**+/-**	**11.13**
Surry – Bacon's Castle	D-80	4th	**25.42**	**+/-**	**10.08**
Surry – Alliance	D-81	1st	**28.97**	**+/-**	**10.76**
Surry – Alliance	D-81	2nd	**25.00**	**+/-**	**10.00**
Surry – Alliance	D-81	3rd	**33.96**	**+/-**	**11.66**
Surry – Alliance	D-81	4th	**28.17**	**+/-**	**10.62**

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AMBIENT GAMMA EXPOSURE

Thermoluminescent Dosimeters

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Location	Station	Quarter	Net Exposure Rate mR/Std Qtr +/- 2 S.D.		
Surry – Hog Point	D-82	1st	**23.47**	**+/-**	**9.69**
Surry – Hog Point	D-82	2nd	**26.00**	**+/-**	**10.20**
Surry – Hog Point	D-82	3rd	**30.07**	**+/-**	**10.97**
Surry – Hog Point	D-82	4th	**26.91**	**+/-**	**10.37**
Lousia County – Route 685	D-84	1st	**25.97**	**+/-**	**10.19**
Lousia County – Route 685	D-84	2nd	**28.00**	**+/-**	**10.58**
Lousia County – Route 685	D-84	3rd	**32.19**	**+/-**	**11.35**
Lousia County – Route 685	D-84	4th	**32.84**	**+/-**	**11.46**
Spotsylvania – Route 713	D-85	1st	**29.98**	**+/-**	**10.95**
Spotsylvania – Route 713	D-85	2nd	**22.00**	**+/-**	**9.38**
Spotsylvania – Route 713	D-85	3rd	**33.09**	**+/-**	**11.51**
Spotsylvania – Route 713	D-85	4th	**27.61**	**+/-**	**10.51**
Lousia County – Bumpass	D-86	1st	**27.14**	**+/-**	**10.42**
Lousia County – Bumpass	D-86	2nd	**26.00**	**+/-**	**10.20**
Lousia County – Bumpass	D-86	3rd	**32.68**	**+/-**	**11.43**
Lousia County – Bumpass	D-86	4th	**27.92**	**+/-**	**10.57**
Spotsylvania – Levy	D-87	1st	**32.41**	**+/-**	**11.39**
Spotsylvania – Levy	D-87	2nd	**32.00**	**+/-**	**11.31**
Spotsylvania – Levy	D-87	3rd	**36.84**	**+/-**	**12.14**
Spotsylvania – Levy	D-87	4th	**32.59**	**+/-**	**11.42**
Lousia County – Route 700	D-88	1st	**33.06**	**+/-**	**11.50**
Lousia County – Route 700	D-88	2nd	**30.00**	**+/-**	**10.95**
Lousia County – Route 700	D-88	3rd	**36.86**	**+/-**	**12.14**
Lousia County – Route 700	D-88	4th	**34.79**	**+/-**	**11.80**
Lousia County – Aspen Hill	D-89	1st	**35.23**	**+/-**	**11.87**
Lousia County – Aspen Hill	D-89	2nd	**35.00**	**+/-**	**11.83**
Lousia County – Aspen Hill	D-89	3rd	**39.48**	**+/-**	**12.57**
Lousia County – Aspen Hill	D-89	4th	**36.33**	**+/-**	**12.05**
Radiological Health	Control 1	1st	**13.80**	**+/-**	**7.43**
Radiological Health	Control 1	2nd	**12.00**	**+/-**	**6.93**
Radiological Health	Control 1	3rd	**19.33**	**+/-**	**8.79**
Radiological Health	Control 1	4th	**25.64**	**+/-**	**10.13**
Radiological Health	Control 2	1st	**14.96**	**+/-**	**7.73**
Radiological Health	Control 2	2nd	**14.00**	**+/-**	**7.48**
Radiological Health	Control 2	3rd	**19.22**	**+/-**	**8.77**
Radiological Health	Control 2	4th	**26.64**	**+/-**	**10.32**

Note: During the 2nd quarter elevated readings occurred surrounding the Surry facility. Levels are within acceptable limits.

The only occurrence that we are aware of was a tornado impacting the region during that timeframe which did impact the earth, dispersing soil and debris airborne. We are monitoring the situation and are continuing our investigation.

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FISH

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Location Type of fish	Date of Report	Isotope	pCi/gram
North Anna 2nd Cooling Lagoon F-24 (Catfish)	4/24/2011	Ba	<0.01
		Cs-134	<0.01
		Cs-137	<0.01
		Co-58	<0.01
		Co-60	<0.01
		I-131	<0.01
		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 2nd Cooling Lagoon F-24 (Catfish)	10/12/2011	Ba	<0.02
		Cs-134	<0.01
		Cs-137	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

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Milk

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Lousia County - Lakeside Dairy M-29

1st Quarter Date:3/3/2011		2nd Quarter Date:3/31/2011	
Isotope	**Results - pCi/liter**	**Isotope**	**Results - pCi/liter**
Ba	<7	Ba	<6
Cs-134	<6	Cs-134	<6
Cs-137	<6	Cs-137	<6
K-40*	1.6 +/- 0.1	K-40*	1.4 +/- 0.1
I-131	0.0 +/- 0.1	I-131	1.6 +/- 0.3
Sr-89	<4	Sr-89	<4
Sr-90	0.3 +/- 0.1	Sr-90	0.6 +/- 0.7
3rd Quarter Date: N/A		4th Quarter Date:11/8/11	
Isotope	**Results - pCi/liter**	**Isotope**	**Results - pCi/liter**
Ba		Ba	<6
Cs-134		Cs-134	<6
Cs-137		Cs-137	<6
K-40*		K-40*	1.6 +/- 0.1
I-131		I-131	0.0 +/- 0.2
Sr-89		Sr-89	<4
Sr-90		Sr-90	0.2 +/- 0.4

Surry County - Epps Dairy M-66

1st Quarter Date:3/1/2011		2nd Quarter Date:4/14/2011	
Isotope	**Results - pCi/liter**	**Isotope**	**Results - pCi/liter**
Ba	<6	Ba	<6
Cs-134	<6	Cs-134	<5
Cs-137	<6	Cs-137	<4
K-40*	1.6 +/- 0.1	K-40*	1.6 +/- 0.1
I-131	0.0 +/- 0.3	I-131	5.4 +/- 0.2
Sr-89	<4	Sr-89	<4
Sr-90	0.3 +/- 0.4	Sr-90	0.9 +/- 0.7
3rd Quarter Date: 9/7/2011		4th Quarter Date: 12/07/2011	
Isotope	**Results - pCi/liter**	**Isotope**	**Results - pCi/liter**
Ba	<7	Ba	<5
Cs-134	<6	Cs-134	<6
Cs-137	<4	Cs-137	<4
K-40*	1.5 +/- 0.1	K-40*	1.5 +/- 0.1
I-131	0.0 +/- 0.2	I-131	0.2 +/- 0.2
Sr-89	<4	Sr-89	<4
Sr-90	0.6 +/- 0.6	Sr-90	0.3 +/- 0.4

*K-40 data is reported in units of grams/liter
N/A = not collected

Virginia Department of Health

Radiogas

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Location	Station	Date Start		Date Ended	I-131 Activity pCi/meter^3
Surry Power Station	C-20	01/06/11	-	01/13/11	< 0.01
Surry Power Station	C-20	03/31/11	-	04/07/11	0.37 +/- 0.10
Surry Power Station	C-20	07/07/11	-	07/14/11	< 0.1
Surry Power Station	C-20	10/4/11	-	10/12/11	<0.11
Pocahontas State Park	C-40	01/05/11	-	01/12/11	< 0.01
Pocahontas State Park	C-40	03/28/11	-	04/11/11	0.92 +/- 0.15
Pocahontas State Park	C-40	07/07/11	-	07/14/11	< 0.09
Pocahontas State Park	C-40	10/5/11	-	10/12/11	< 0.11
Lousia County Rt. 700	C-88	01/05/11	-	01/12/11	< 0.01
Lousia County Rt. 700	C-88	03/30/11	-	04/06/11	0.56 +/- 0.10
Lousia County Rt. 700	C-88	07/06/11	-	07/13/11	< 0.1
Lousia County Rt. 700	C-88	10/5/11	-	10/12/11	< 0.11

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SHELLFISH

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Location	Date collected	Distance & Direction	Isotope	Activity pCi/gram (wet weight)
Route 17 James River Mouth of Surry Power Station Discharge Canal	N/C	Approx. 0.5 mile From mouth Of canal	Ba-140 Cs-134 Cs-137 Co-58 Co-60 Fe-59 I-131 Mn-54 Rh-106 Ag-110M Zn-65 Zr-95	

N/C = sample not collected

Virginia Department of Health

SILT

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Location	Date collected	Gross Beta pCi/gram of Silt
James River	3/15/2011	27.6 +/- 5.5
Pier 1	5/24/2011	25.5 +/- 5.1
Newport News Shipyard	9/20/2011	30.5 +/- 5.3
S-15A	11/15/2011	27.6 +/- 4.8
James River	3/16/2011	25.2 +/- 5.4
Shipway 11	5/24/2011	25.4 +/- 5.0
Newport News Shipyard	9/20/2011	22.9 +/- 4.9
S-16	11/15/2011	31.1 +/- 4.7

SILT

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Elizabeth River – Dry Dock #8
Norfolk Naval Shipyard S-18

Quarter	Date collected	Gamma Activity – pCi/gram (wet)				Gross Beta pCi/gram (DRY)	Gross Alpha pCi/gram (DRY)
		Cs-134	Cs-137	Co-58	C0-60		
1st	3/15/2011	<1.0	<0.03	<0.01	<0.01	29.4 +/- 5.6	17.7 +/- 8.7
2nd	5/24/2011	<0.01	0.03	<0.01	<0.01	26.8 +/- 5.1	16.7 +/- 7.7
3rd	9/20/2011	<0.01	0.02	<0.01	<0.01	27.3 +/- 5.2	15.6 +/- 8.1
4th	11/15/2011	<0.01	0.02	<0.01	<0.01	23.4 +/- 4.4	7.8 +/- 3.9

Elizabeth River – Dry Dock #4
Norfolk Naval Shipyard S-19

Quarter	Date collected	Gamma Activity – pCi/gram (wet)				Gross Beta pCi/gram (DRY)	Gross Alpha pCi/gram (DRY)
		Cs-134	Cs-137	Co-58	C0-60		
1st	3/15/2011	<1.0	<0.03	<0.01	<0.01	31.1 +/- 5.7	14.2 +/- 7.2
2nd	5/24/2011	<0.01	0.03	<0.01	<0.01	24.8 +/- 5.2	15.1 +/- 7.9
3rd	9/20/2011	<0.01	0.03	<0.01	<0.01	27.5 +/- 5.2	22.5 +/- 9.9
4th	11/15/2011	<0.01	0.02	<0.01	<0.01	33.0 +/- 4.8	18.6 +/- 8.1

Elizabeth River – Wet slip #1
Norfolk Naval Shipyard S-20

Quarter	Date collected	Gamma Activity – pCi/gram (wet)				Gross Beta pCi/gram (DRY)	Gross Alpha pCi/gram (DRY)
		Cs-134	Cs-137	Co-58	C0-60		
1st	3/15/2011	<1.0	<0.03	<0.01	<0.01	34.4 +/- 5.8	14.3 +/- 7.7
2nd	5/24/2011	<0.01	0.03	<0.01	<0.01	32.5 +/-5.5	16.3 +/- 8.2
3rd	09/20/2011	<0.01	0.03	<0.01	<0.01	26.6 +/-5.2	19.9 +/- 8.8
4th	11/15/2011	<0.01	0.03	<0.01	<0.01	29.8 +/- 4.8	17.5 +/- 7.7

Virginia Department of Health

SILT

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Location	Date collected	Distance & Direction	Activity pCi/gram (dry weight)		
			Cs-134	Cs-137	Co-60
James River Surry Power Station Discharge Canal S-17	10/31/11	0.5 miles NNW	<0.01	0.25 +/- 0.01	0.01
North Anna Power Waste Treatment Shoreline Soil S-24	04/18/11	1.1 mile SSE	<0.01	0.08 +/- 0.01	<0.01
North Anna Power Waste Treatment Shoreline Soil S-24	10/10/11	1.1 mile SSE	<0.01	0.04 +/- 0.01	<0.01

Virginia Department of Health

SURFACE WATER

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James River – Pier 1
Newport News Shipyard W-15A

Qtr	Date collected	Gamma Activity – pCi/liter						Gross Beta
		Ba-140	Cs-137	I-131	Mn-54	Zn-65	Zr95/Nb95	
1st	3/15/2011	<8	<6	<11	<6	<12	<10	154 +/- 12.5
2nd	5/24/2011	<6	<6	<7	<5	<12	<10	93.7 +/- 35.0
3rd	09/20/2011	<6	<4	<7	<5	<12	<10	158.5 +/- 41.5
4th	11/15/2011	<10	<6	<17	<5	<11	<11	143.7 +/- 40.9

James River – Shipway #11
Newport News Shipyard W-16

Qtr	Date collected	Gamma Activity – pCi/liter						Gross Beta
		Ba-140	Cs-137	I-131	Mn-54	Zn-65	Zr95/Nb95	
1st	3/15/2011	<6	<6	<7	<5	<12	<10	143 +/- 12.9
2nd	5/24/2011	<6	<6	<8	<5	<12	<10	87.4 +/- 37.3
3rd	09/20/2011	<6	<6	<6	<5	<11	<9	182.9 +/- 45.0
4th	11/15/2011	<12	<4	<19	<5	<12	<10	128.6 +/- 40.8

N/A = not collected

Virginia Department of Health
SURFACE WATER

January 1, 2011 through December 31, 2011

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Elizabeth River – Dry Dock #4
Norfolk Naval Shipyard W-37

Qtr	Date collected	Gamma Activity – pCi/liter						Gross Beta	Gross Alpha
		Ba-140	Cs-137	I-131	Mn-54	Zn-65	Zr95/Nb95		
1st	3/15/2011	<8	<6	<10	<5	<12	<10	183 +/- 12.8	12.1 +/- 14.3
2nd	5/24/2011	<8	<6	<11	<5	<11	<10	198.7 +/- 40.5	0.0 +/- 31.6
3rd	09/20/2011	<8	<6	<10	<5	<12	<10	195.9 +/- 43.6	41.2 +/- 77.3
4th	11/15/2011	<6	<6	<7	<5	<11	<9	186.9 +/- 43.7	13.4 +/- 43.7

Elizabeth River – Wet Slip #1
Norfolk Naval Shipyard W-38

Qtr	Date collected	Gamma Activity – pCi/liter						Gross Beta	Gross Alpha
		Ba-140	Cs-137	I-131	Mn-54	Zn-65	Zr95/Nb95		
1st	3/15/2011	<8	<6	<12	<5	<12	<11	165 +/- 12.8	0.0 +/- 15.8
2nd	5/24/2011	<9	<6	<13	<5	<12	<11	165.3 +/- 40.9	0.0 +/- 42.5
3rd	09/20/2011	<7	<6	<9	<5	<11	<10	158.8 +/- 41.1	0.0 +/- 67.0
4th	11/15/2011	<8	<4	<11	<5	<12	<10	158.0 +/- 40.8	11.7 +/- 38.8

Elizabeth River – Dry Dock #8
Norfolk Naval Shipyard W-39

Qtr	Date collected	Gamma Activity – pCi/liter						Gross Beta	Gross Alpha
		Ba-140	Cs-137	I-131	Mn-54	Zn-65	Zr95/Nb95		
1st	3/15/2011	<7	<6	<8	<5	<12	<10	164 +/- 12.9	0.0 +/- 11.3
2nd	5/24/2011	<10	<6	<14	<6	<12	<11	182.3 +/- 42.5	0.0 +/- 58.7
3rd	09/20/2011	<8	<6	<11	<5	<11	<10	183.7 +/- 44.6	26.9 +/- 78.9
4th	11/15/2011	<6	<6	<7	<5	<11	<10	160.6 +/- 42.2	7.2 +/- 54.5

GB = GROSS BETA (pCi/L)
GA= GROSS ALPHA (pCi/L)

Virginia Department of Health

SURFACE WATER

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Surry Power Station – Discharge Canal - W-19

Qtr	Date collected	Gamma Activity – pCi/liter									GB	+/-	BS	H3
		Ba-140	Cs-134	Cs-137	Co-58	Co-60	I-131	Mn-54	Zn-65	Zr/Nb95				
1st	01/10/2011	<8	<5	<6	<5	<5	<10	<5	<11	<10	110.9*	38.9		1652
2nd	03/11/2011	<7	<5	<4	<6	<5	<9	<5	<12	<10	29.7	3.0		<220
3rd	07/07/2011	<11	<6	<4	<6	<5	<15	<5	<13	<11	76.3	6.3		1727
4th	10/04/2011	<8	<6	<4	<6	<5	<11	<3	<11	<10	69.9	35.5		<229

North Anna River - W-27

Qtr	Date collected	Gamma Activity – pCi/liter									GB	+/-	BS	H3
		Ba-140	Cs-134	Cs-137	Co-58	Co-60	I-131	Mn-54	Zn-65	Zr/Nb95				
1st	01/11/2011	<6	<5	<6	<5	<5	<7	<5	<11	<10	2.6	0.8		450
2nd	03/11/2011	<8	<5	<6	<6	<5	<9	<6	<12	<10	2.5	1.0		<220
3rd	07/06/2011	<17	<6	<6	<6	<5	<31	<5	<12	<12	4.0	1.0		2477
4th	10/05/2011	<8	<5	<6	<5	<5	<10	<5	<11	<10	61.3	5.0		1276

North Anna Power Station – Discharge Canal - W-33

Qtr	Date collected	Gamma Activity – pCi/liter									GB	+/-	BS	H3
		Ba-140	Cs-134	Cs-137	Co-58	Co-60	I-131	Mn-54	Zn-65	Zr/Nb95				
1st	01/10/2011	<11	<5	<6	<6	<5	<19	<5	<11	<11	2.3	3.4		3829
2nd	03/11/2011	<7	<5	<6	<5	<5	<8	<5	<12	<10	2.5	1.0		3378
3rd	07/06/2011	<14	<6	<6	<6	<5	<24	<5	<13	<12	2.7	0.2		3378
4th	10/05/2011	<6	<5	<6	<5	<5	<7	<5	<11	<12	4.2	3.2		2177

James River - Scotland Wharf - W-79

Qtr	Date collected	Gamma Activity – pCi/liter									GB	+/-	BS	H3
		Ba-140	Cs-134	Cs-137	Co-58	Co-60	I-131	Mn-54	Zn-65	Zr/Nb95				
1st	01/11/2011	<7	<5	<5	<5	<5	<9	<5	<11	<10	37.5	34.7		<231
2nd	03/11/2011	<8	<5	<6	<6	<5	<10	<5	<12	<11	5.1	2.4		<220
3rd	07/07/2011	<17	<6	<6	<6	<5	<31	<5	<12	<12	36.5	5.5		225
4th	10/04/2011	<9	<5	<6	<5	<5	<12	<5	<12	<10	10.6	32.1		<229

NDC = No Detectable counts

* = routine release from SPS Rad-waste facility in progress at time of sample

Virginia Department of Health

VEGETATION

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Location	Date collected	Type	Isotope	Results pCi/Gram (wet weight)
Surry County Private garden V-96B	N/C		I-131 Cs-134 Cs-137	
Lousia County Private Garden V98B	N/C		I-131 Cs-134 Cs-137	

N/C = sample not collected

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF HEALTH

DIVISION OF RADIOLOGICAL HEALTH
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BABCOCK & WILCOX

Virginia Department of Health
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AIR PARTICULATE COMPOSITE SAMPLES

January 1, 2011 through December 31, 2011

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Eastern Site Boundary – Ball field **A-101**

Quarter	Date Start		Stop	Gross Alpha Activity pCi/meter3		
1st	02/03/2011	-	02/10/2011	0.001	+/-	0.001
2nd	04/20/2011	-	04/27/2011	0.001	+/-	0.001
3rd	08/03/2011	-	08/09/2011	0.001	+/-	0.001
4th	10/6/2011	-	10/13/2011	0.002	+/-	0.001

Virginia Department of Health

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SOIL

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Location	Date	Distance & Direction	Type	Alpha Activity pCi/gram		
Eastern Site Boundary Ball field **S-101**	06/22/2011	Site Boundary	Soil	0.9	+/-	0.4
Near 6 mile bridge control S-101A	06/22/2011	1.5 miles upstream	Soil	1.0	+/-	0.4

Alpha * - Uranium Separation Followed by Alpha Counting

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SURFACE WATER

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Location	Date	Distance & Direction	Alpha Activity pCi/gram		
James River Shoreline Near Ball field at eastern site boundary W-101	06/22/2011	Approx. 3 miles downstream	0.2	+/-	0.2
James River Shoreline Near six mile Bridge "control" W-102	06/16/2011	Approx 1.5 Miles upstream	0.0	+/-	0.2

Virginia Department of Health

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VEGETATION

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Location	Date	Type	Distance & Direction	Alpha Activity pCi/gram		
eastern site boundary Ball field V-101	06/22/2011	Vegetation	Approx. 3 miles downstream	0.3	+/-	0.3
James River Near 6 mile bridge “control” V-102A	06/22/2011	Vegetation	1.5 miles upstream	0.2	+/-	0.2

Alpha * - Uranium Separation
Followed by Alpha Counting

COMMONWEALTH OF VIRGINIA

DEPARTMENT OF HEALTH

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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 solids such as Silt, Vegetation, Fish etc., as provided by
HpGe Detector – 1000 minute count time

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/Kilogram
Cs-134	5
Cs-137	6
Co-58	5
Co-60	5
I-131	7
Ru/Rh-106	50
Zn-65	12
Zr-95	10
Ba/La-140	8
Ag-110m	10
Mn-54	6
Fe-59	11

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 liquids such as Water, Milk, etc, as provided by HPGE detector – 1000 minute count time

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

VDH-DRH Mobile Incident Command Vehicle

Charcoal Canister provided by HPGE detector - 100 minute count time

Required Sample Size: 300 m^3

Actual LLD is determined at the time of analysis and varies with decay time, background radiation, sample size, etc.

Isotope*	LLD, pCi/m^3
I-131 in Charcoal Canister	0.01

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 = 23.9%
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	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 GROSS BETA COUNTING

Consolidated Laboratories (DCLS)
&
VDH-DRH Mobile Incident Command Laboratory (MICL)

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

Matrix*	LLD	Weight or Volume Required
Air Particulate (MICL)	0.003 pCi/m3	300 m3
Surface Water (DCLS)	34.7 pCi/L	10 ml
Saline Water (DCLS)	40.8 pCi/Liter	10 ml
Silt/Soil (DCLS)	5.7 pCi/gram	100 mg
Fish (DCLS)	0.046 pCi/gram	1000 grams

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

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 per minute to picocuries
- 4.65 = 95% Confidence Factor

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

Consolidated Laboratories (DCLS)
&
VDH-DRH Mobile Incident Command Laboratory (MICL)

For: Air Particulate, Surface/Saline Water, Silt/Soil.

Matrix*	LLD	Weight or Volume Required
Air Particulate (MICL)	0.001 pCi/m^3	286 m^3
Surface Water (DCLS)	45.0 pCi/liter	10 ml
Saline Water (DCLS)	45.0 pCi/liter	10 ml
Silt/Soil (DCLS)	11.0 pCi/gram	100 mg

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

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: 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

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

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

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

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) FOR TRITIUM ANALYSIS

VDH-DRH Mobile Incident Command Laboratory (MICL)

For: surface water

Minimum Required Sample Volume: 50 ml
Sample Aliquot = 6 ml

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

where: R_{Bkg} = Background rate (CPM)
T = Background Counting Time = 60 minutes
E = Counter Efficiency = 65%
V = Sample Volume or Size
4.66 = 95% Confidence Factor

LLD = 225 pCi/L

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF HEALTH

DIVISION OF RADIOLOGICAL HEALTH
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APPENDIX II

SAMPLING LOCATIONS

Surry Power Station 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 Quarters	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 (when available)		
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 (when available)		
* V-96B Surry County	Edible Vegetation	Annually

*** VDH-DRH samples split with or duplicated by Dominion Power**

North Anna Power Station 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	Bi-annually
Soil		
* S-24 NAPS shoreline soil near waste treatment plant	Soil	Bi-annually
Surface Water		
* W-27 North Anna River - Route 522	Surface Water	Quarterly
* W-33 North Anna Discharge Canal	Surface Water	Quarterly
Vegetation (when available)		
* V-98C Louisa County	Edible Vegetation	Annually

***VDH-DRH samples split with or duplicated by Dominion Power**

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 - NNSB - Pier 1	Silt	Quarterly
S-16	James River - NNSB- 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	Quarterly
	Surface Water		
W-15	James River - NNSB- Pier 1	Surface Water	Quarterly
W-16	James River - NNSB- 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

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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 Virginia Department of Emergency Management (VDEM) 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 specific types of radiological incidents – including 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. Plans are also being developed to respond to possible radiological terrorist attacks which may include detonation of either a radiological dispersion device (RDD aka “dirty bomb”), an improvised nuclear device (IND) or a military grade nuclear warhead.

When responding to any radiological emergency, the primary tasks of VDH-DRH are to locate, identify, and predict the impact of any radioactive materials released to the environment. Based on the predicted or known impact, VDH then recommends appropriate measures to protect the public. DRH would also be tasked with helping to supervise the cleanup of radiological contamination and ensuring the proper disposal of radioactive waste. A VDH-DRH duty officer maintains 24-hour coverage to provide initial assessment/assistance for local responders and may also initiate the mobilization/deployment of other trained staff to respond to a radiological emergency when needed.

Under the provisions of current Federal Emergency Management Agency regulations, the DRH conducts or participates in periodic drills that are designed to provide 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 radiological 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 VDEM have elected to participate in each exercise as fully as possible.