About the Contamination

On January 7, 2010, there was a report of tritium in groundwater at Vermont Yankee, which told officials that there was an underground leak of radioactive material. Radioisotopes had contaminated the environment, which was confirmed by soil testing. Although the soil at Vermont Yankee was contaminated with radioactive materials, there is no known exposure or risk to the public.

Soil Analysis

Soil was collected for analysis, and the results showed the following radioisotopes in the soil:

- Strontium-90
- Cesium-137
- Zinc-65
- Manganese-54
- Cobalt-60

The Advanced Off-Gas (AOG) pipe was the source of the leak. The soil samples were taken from various locations and depths below the excavation area outside the Advanced Off-Gas (AOG) pipe tunnel.



Vermont Yankee Nuclear Power Plant Soil Sampling Sites

Laboratory Results & Analyses

The Vermont Department of Health and Vermont Yankee performed separate laboratory analyses on the soil samples.

Laboratory analyses for soil samples collected March 17, 2010 at locations along the Vermont Yankee Advanced Off-Gas Pipe Tunnel leak pathway								
Sample Location		VT	VDH-contracted Lab Results (pCi/kg)					
AOG Reference Site Number	Depth	Mn-54	Со-60	Zn-65	Cs-137	Sr-90		
1	surface	339	4550	884	980	TBD		
1	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td>173</td><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>173</td><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>173</td><td>TBD</td></lld<>	173	TBD		
2	surface	146	1860	401	1030	TBD		
2	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>TBD</td></lld<>	TBD		
3	surface	165	2520	615	4080	TBD		
3	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>TBD</td></lld<>	TBD		
4	surface	85	821	382	628	TBD		
-	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>TBD</td></lld<>	TBD		
5	surface	75	472	139	446	TBD		
5	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>TBD</td></lld<>	TBD		
6	surface	<lld< td=""><td>170</td><td><lld< td=""><td>326</td><td>TBD</td></lld<></td></lld<>	170	<lld< td=""><td>326</td><td>TBD</td></lld<>	326	TBD		
Ŭ	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td>884</td><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>884</td><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>884</td><td>TBD</td></lld<>	884	TBD		
7	surface	<lld< td=""><td>652</td><td>315</td><td>1080</td><td>TBD</td></lld<>	652	315	1080	TBD		
,	2ft below surface	163	1160	535	733	TBD		
Q	surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td>544</td><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>544</td><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>544</td><td>TBD</td></lld<>	544	TBD		
0	2ft below surface	<lld< td=""><td>298</td><td><lld< td=""><td>951</td><td>TBD</td></lld<></td></lld<>	298	<lld< td=""><td>951</td><td>TBD</td></lld<>	951	TBD		
9	surface	<lld< td=""><td>145</td><td><lld< td=""><td>1020</td><td>TBD</td></lld<></td></lld<>	145	<lld< td=""><td>1020</td><td>TBD</td></lld<>	1020	TBD		
9	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td>149</td><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>149</td><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>149</td><td>TBD</td></lld<>	149	TBD		
10	surface	65	458	137	326	TBD		
10	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>TBD</td></lld<>	TBD		
11	surface	142	1830	499	1670	TBD		
11	2ft below surface	<lld< td=""><td><lld< td=""><td><lld< td=""><td>38</td><td>TBD</td></lld<></td></lld<></td></lld<>	<lld< td=""><td><lld< td=""><td>38</td><td>TBD</td></lld<></td></lld<>	<lld< td=""><td>38</td><td>TBD</td></lld<>	38	TBD		
Note: <lld =="" b<="" td=""><td>elow the Lower Limit o</td><td>of Detection</td><td></td><td></td><td></td><td></td></lld>	elow the Lower Limit o	of Detection						

Sample Location Vermont Yankee Results (pC/kg) Wernont Yankee Results (pC/kg) (pC/kg) A06 Heference Depth Mn 54 Co-60 Zn-65 Cs-137 (*contractor Results (pC/kg) Sr-30 1 surface 553 5974 1308 1830 8220 2 surface 4743 48710 13760 11300 4700 2 below surface <lu0< td=""> 103 <lu0< td=""> 4.00 4700 2 below surface <lu0< td=""> 103 <lu0< td=""> 4.00 4700 3 surface 62 1706 300 397 2370 3 surface 62 1706 300 397 2370 4 surface <lu0< td=""> <lu0< td=""> LU0 <</lu0<></lu0<></lu0<></lu0<></lu0<></lu0<>	Laboratory analyses for soil samples collected March 17, 2010 at locations along the Vermont Yankee Advanced Off-Gas Pipe Tunnel leak pathway								
AGG Str. Number Depth Mn.54 Co-60 Zn.65 Cs-137 Conversion 2.2 and 2 were analyzed analyzed analyzed analyzed 1 surface 553 5974 1308 1830 8290 1 surface 4743 48710 13760 11800 4740 21 below surface <.00 113 .00 4740 4740 22 surface 618 6680 1503 2635 .00 397 2370 3 surface 62 1706 300 397 2370 .00	Samp	le Location		VY-contractor Results (pCi/kg)					
Proteiner Depth Mn:54 Co-60 Zn:65 Co-137 Condy sites 1.2 and 7 were site Number 1 1	AOG						Sr-90		
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$ \begin{array}{ c c c c c } \hline 103 & (10 $	1	curface	553	5974	1308	1830	8290		
$ \frac{1}{2t \ below surface} = (10 \ 103 \ (10 \ 100 $		surface	4743	48710	13760	11300			
		2ft below surface	< LLD	103	< LLD	< LLD	4740		
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$ \frac{2}{24 \text{ below surface}} = \frac{62}{2(106)} \frac{1706}{300} \frac{397}{397} \frac{2370}{2370} \frac{2370}{210} \frac{2770}{210$			618	6840	1503	2635	1		
$ \frac{211 \text{ below surface}}{211 \text{ below surface}} = \frac{410}{410} + 410$			62	1706	300	397	2370		
$ \frac{1}{3} = \frac{1}{3} + 1$		2ft below surface	< LLD	< LLD	< LLD	< LLD			
$ \frac{3}{21} = \frac{329}{3014} = \frac{642}{410} = \frac{10260}{410} = \frac{100}{410} =$		surface	< LLD	2667	897	4015			
$ \frac{5}{2t \text{ below surface}} = \frac{<10}{<10} < \frac{10}{<10} < \frac{10}{<10} < \frac{10}{<10} < \frac{10}{<10} < \frac{10}{<10} \\ < \frac{10}{<10} < \frac{10}{<10} < \frac{10}{<10} \\ < \frac{10}{<10} & \frac{10}{<10} \\ < \frac{10}{<10} \\ \\ < \frac{10}{<10} \\ \\ \\ \frac{10}{<10} \\ \\ \\ \frac{10}{<10} \\ \\ \\ $			329	3014	642	10260			
$ \frac{211 \text{ below surface}}{4} = \frac{<10}{133} + \frac{<10}{366} + \frac{<10}{100} + \frac{<100}{100} + <100$	5		< LLD	< LLD	< LLD	< LLD			
$ \begin{array}{ c c c c c } & 133 & 1087 & 366 & 656 \\ \hline 113 & 959 & 405 & 838 \\ \hline \hline 12t below surface & (1D & ($		2ft below surface	< LLD	< LLD	< LLD	< LLD			
$ \begin{array}{ c c c c c c } \hline \begin{tabular}{ c c c c } \hline \hline \begin{tabular}{ c c c c c } \hline \hline \begin{tabular}{ c c c c c } \hline \hline \begin{tabular}{ c c c c c c } \hline \hline \begin{tabular}{ c c c c c c c } \hline \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		surface	133	1087	366	656			
$\frac{1}{10} = \frac{2 \text{ft below surface}}{2 \text{ft below surface}} = (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < (10) < $			131	959	405	838			
$ \frac{210 \text{ below surface}}{10} \frac{<100}{100} \frac{<100}{100}$	-	Of halos and	< LLD	< LLD	< LLD	< LLD			
$ \begin{array}{c c c c c c } & & & & & & & & & & & & & & & & & & &$		21t below surface	< LLD	< LLD	< LLD	< LLD			
$ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $		surface	53	579	284	505			
$ \frac{5}{2t \text{ below surface}} \frac{196}{2958} \frac{702}{10000} \frac{10000}{10000} \frac{100000}{10000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{100000} \frac{100000}{1000000} \frac{100000}{1000000} \frac{100000}{1000000} \frac{100000}{1000000} \frac{100000}{10000000} \frac{100000}{100000000} \frac{1000000}{1000000000} \frac{10000000}{100000000000} \frac{100000000000}{100000000000000000000000$			87	456	< LLD	529			
$\frac{2 \text{tr below surface}}{2 \text{tr below surface}} = \frac{(1D) (1D) (1D) (1D) (1D) (1D) (1D)}{(1D) (1D) (1D) (1D) (1D) (1D) (1D)}$ $= \frac{2 \text{tr below surface}}{2 \text{tr below surface}} = (1D) (1D) (1D) (1D) (1D) (1D) (1D) (1D) $	5		196	2958	702	10000			
$ \frac{110 \text{ Clow surface}}{110 \text{ club}} < \frac{(10)}{(10)} < ($		Off balaw surface	< LLD	< LLD	< LLD	< LLD			
$ \begin{array}{c c c c c c } & \begin{array}{c c c c c c c } & \begin{array}{c c c c c c c c } & \begin{array}{c c c c c c c c c } & \begin{array}{c c c c c c c c c c c c c c c c c c c $		210 Delow Surface	< LLD	< LLD	< LLD	< LLD			
$ \frac{1}{2} + 1$		surface	< LLD	248	214	336			
$ \frac{1}{2 \text{ft below surface}} = (10) (10) (10) (10) (10) (10) (10) (10) $	6	surface	< LLD	192	< LLD	312			
$\frac{110 \text{ elow surface}}{158} = (10) (10) (10) (10) (10) (10) (10) (10) $	Ů	2ft below surface	< LLD	< LLD	< LLD	694			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $			< LLD	< LLD	< LLD	983			
$\begin{array}{ c c c c c } \hline \begin{tabular}{ c c } \hline \bedin{tabular}{ c c } \hline \hline \bedin{tabular}{ c c } \hline \$		surface	158	799	670	1238	161		
$\frac{1}{2 \text{ft below surface}} = \frac{251 1311 578 774 152}{126 597 227 340}$ $= 8 \frac{3 \text{surface}}{2 \text{ft below surface}} = \frac{(1D (1D (1D (1D 1395)))}{(1D (1D 317 159 1135))}$ $= 9 \frac{3 \text{surface}}{2 \text{ft below surface}} = \frac{(1D 151 (1D 1082))}{(1D (1D 165 (1D 1089)))}$ $= 10 \frac{3 \text{surface}}{2 \text{ft below surface}} = \frac{(1D (1D (1D (1D 135)))}{(1D (1D (1D (1D 317 159))))}$ $= 10 \frac{3 \text{surface}}{2 \text{ft below surface}} = \frac{(1D (1D (1D (1D 135)))}{(1D (1D (1D $	_		425	2071	968	1084			
$\frac{2 \text{ft below surface}}{3 \text{ surface}} = \frac{126}{597} = \frac{227}{340} = \frac{340}{3 \text{ surface}} + \frac{340}$		2ft below surface	251	1311	578	774	152		
$8 \frac{1}{8} \frac{1}{8} \frac{1}{1} $			126	597	227	340	1		
8		surface	< LLD	< LLD	< LLD	455			
$\frac{8}{2 \text{ft below surface}} = \frac{(1D)}{2 \text{ft below surface}} = \frac{(1D)}{423} + \frac{159}{1135} = \frac{1135}{410} + \frac{110}{1082} + \frac{110}{410} + \frac{110}{1089} + \frac{110}{410} + \frac{110}{4$			< LLD	< LLD	< LLD	1395			
$\frac{2 \text{ft below surface}}{2 \text{ft below surface}} = \frac{100}{423} = \frac{100}{929}$ $\frac{2 \text{ft below surface}}{2 \text{ft below surface}} = \frac{2 \text{ft below surface}}{2 \text{ft below surface}} = 2 \text{ft below s$	8		< LLD	317	159	1135			
$\frac{1}{9} + \frac{1}{10} +$			¢LLD	423	< LLD	929			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			<110	151	<110	1082			
$9 \frac{2 \operatorname{ft} \operatorname{below} \operatorname{surface}}{2 \operatorname{ft} \operatorname{below} \operatorname{surface}} \xrightarrow{(\operatorname{LLD} (\operatorname{LLD} (L$		surface 2ft below surface	<110	101	<110	1002			
$\frac{2 \text{ft below surface}}{10} = \frac{2 \text{ft below surface}}{2 \text{ft below surface}} = 2 \text{ft belo$	9		<110	105	<110	1085			
$10 \begin{array}{c c c c c c c } \hline & (110) & ($			- 110	- 110	- 110	100	1		
$10 \qquad \qquad$		surface	<110	596	<110	202			
$\frac{10}{2 \text{ft below surface}} = \frac{10}{2 \text{ft below surface}} = \frac{10}{10} + \frac{100}{256} + \frac{100}{10} + \frac{100}$			- 115	195	- 110	352			
2ft below surface < LLD < LLD < LLD 11 surface 428 2450 925 2077 2ft below surface 428 2450 925 2077 2ft below surface 428 2450 925 2077 2ft below surface < LLD	10		<0.00	400	<0.0	202			
11 surface 428 2450 925 2077 21 256 1722 649 3750 2ft below surface <lld< td=""> <lld< td=""> 65 <lld< td=""> 258 <lld< td=""> 31</lld<></lld<></lld<></lld<>		2ft below surface	< LLD	<110	< LLD	<110			
surface 11 surface 1256 1722 649 3750 2ft below surface <lld< td=""> <lld< td=""> 65 <lld< td=""> 258 <lld< td=""> 31</lld<></lld<></lld<></lld<>			428	2450	925	2077			
11 210 1722 045 5750 2ft below surface <lld< td=""> <lld< td=""> 65 <lld< td=""> 258 <lld< td=""> 31</lld<></lld<></lld<></lld<>		surface	756	1722	6/0	3750			
2ft below surface <iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii< td=""><td>11</td><td></td><td>2.10</td><td>1/22</td><td>045</td><td>2730</td><td></td></iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii<>	11		2.10	1/22	045	2730			
Note: <11 D = Below the Lower Limit of Detection		2ft below surface	~110	200	~ 110	21			
	Note: <u d="B</td"><td>elow the Lower Limit o</td><td>of Detection</td><td>200</td><td></td><td>51</td><td></td></u>	elow the Lower Limit o	of Detection	200		51			









Soil Contamination Analysis

Laboratory analyses for soil samples collected February 26, 2010 at locations along the Vermont Yankee Advanced Off Gas Pipe Tunnel leak pathway										
Sample Location		VT Department of Health Results (pCi/kg)				VDH contracted Lab Results (pCi/kg)	tracted esults Vermont Yankee Results (pCi/Kg) /kg)			
AOG Reference Site Number	Depth	Mn 54	Co 60	Zn 65	Cs 137	Sr 90	Mn 54	Co 60	Zn 65	Cs 137
	surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
1 (approx)	2ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
	4ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
	6ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	88.8	< LLD	< LLD
2 (approx)	surface	54.5	295	86.0	292	TBD	78.6	294	< LLD	280
	2ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	56.3
	4ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
	6ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
	surface	170	757	455	778	TBD	149	876	394	748
7	2ft below surface	164	881	379	669	TBD	206	962	619	611
(approx)	4ft below surface	< LLD	183	< LLD	190	TBD	< LLD	< LLD	< LLD	1062
	6ft below surface	< LLD	< LLD	< LLD	1270	TBD	< LLD	308.0	231	311
SW Corner of area	4ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
	6ft below surface	< LLD	< LLD	< LLD	< LLD	TBD	< LLD	< LLD	< LLD	< LLD
NW corner of	4ft below surface	< LLD	< LLD	< LLD	692	TBD	< LLD	< LLD	< LLD	589
area	6ft below surface	< LLD	< LLD	< LLD	1110	TBD	< LLD	< LLD	< LLD	843
Note: <lld =="" b<="" td=""><td>elow the Lower Limit</td><td>of Detection</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></lld>	elow the Lower Limit	of Detection								

About the sampling and analyses

If nuclear fallout or weapons testing had been the cause of the radioisotope contamination, they would not have been found as deep in the ground as the sampling results showed. The radioisotopes were detected in higher amounts, deeper in the ground than what we would expect from either nuclear fallout or weapons testing. This is evidence that radioisotopes in addition to tritium washed out of the AOG pipe tunnel into the environment with the leaking nuclear reactor water.

Another leak was discovered by Vermont Yankee on May 28, 2010. Soil testing that was done immediately after the discovery detected the strontium-90, cesium-137, zinc-65, manganese-54, and cobalt-60, as well as a number of other radioisotopes that decay quickly and are no longer detectable within hours or days: chromium-51, cobalt-58, zinc-69, niobium-95, rhodium-105, barium-140, lanthanum-140 (all metals), and xenon-131 (a noble gas).

The results of the May 28th sample analysis showed that the concentrations of strontium-90 and cesium-137 found in soil samples taken from the excavation area near the AOG pipe tunnel were much higher than would be expected from fallout.

On March 17 and 18, soil was sampled and cesium-137 was found at as much as 75 times higher than what would be expected in surface soils.

Analysis by Vermont Yankee of concrete mud and construction debris in the AOG pipe tunnel also confirmed the presence of cesium-137.

As part of its ongoing environmental surveillance, the Vermont Department of Health tested soil samples from two sites in the state that were not associated with Vermont Yankee. The results of the analysis confirmed cesium-137 at concentrations consistent with past nuclear fallout. In 2008, cesium-137 was measured at 86 and at 168 picocuries per kilogram (pCi/kg).

More testing is underway. At the request of the Health Department, samples of mud and construction debris from within the tunnel were also taken for analysis. Samples are being analyzed by the Department of Health Laboratory. Samples will also be analyzed by an independent laboratory hired under contract with the Health Department for "hard to detect" radionuclides such as strontium-90, iron-55 and nickel-63.

About Strontium-90 and Cesium-137

Strontium-90 and cesium-137 are both radioactive isotopes, which means they have an unstable nucleus that give off radiation in the form of alpha, beta, and gamma rays when they break down. They are products of nuclear fission and do not occur naturally in the environment.

The "half-life" is the length of time it takes for a substance to reduce to one-half of its original concentration by decaying. Strontium-90 has a half-life of 29 years, and cesium-137 has a half-life of 30 years. This means in 29 years, the concentration of strontium-90 will be half of what it was originally, and in 30 years the concentration of cesium-137 will reduce by half.

Strontium-90 is considered one of the more hazardous radionuclides associated with nuclear reactors. It is a moderately strong beta emitter. Its radiation can pass through the human body, but can be stopped by a layer of wood, aluminum, or thick clothing. In the body, strontium-90 behaves much like calcium, and tends to

concentrate in the bones, teeth, and bone marrow. Strontium-90 is linked to bone cancer, cancer of the soft tissue near bone, and leukemia.

Cesium-137 is a strong gamma emitter. Its radiation can pass through the human body and will be stopped only by a lead shield or several feet of concrete.

About Zinc-65, Manganese-54, Cobalt-60

Zinc-65, manganese-54 and cobalt-60 are all corrosion products that are produced when steel components in the nuclear reactor corrode. Tiny amounts of the corroded metals circulate in the reactor water, and may be released during re-fueling or maintenance operations.

All three of these isotopes give off radiation and decay over time. The "half life" is the length of time it takes to reduce to one-half of its original concentration by decaying. Zinc-65 has a half life of 244 days. Manganese-54 has a half life of 313 days. Cobalt-60 has a half life of 5.3 years.

Cobalt-60 is a strong gamma emitter. Its radiation can pass through the human body, and can only be stopped only by a lead shield or several feet of concrete.

For More Information:

Contact the Department of Health Environmental Health Division Call: 800 439-8550 OR 802 863-7220 http://www.healthvermont.gov/environment/radiological.com

About Radionuclides Agency for Toxic Substances & Disease Registry (ATSDR)

About Strontium: <u>Radioisotope Brief – Strontium-90</u> ATSDR <u>Radionuclide Basics – Strontium-90</u> Environmental Protection Agency

About Cesium: <u>Radioisotope Brief – Cesium-137</u> ATSDR <u>Radionuclide Basics – Cesium-137</u> Environmental Protection Agency

About Cobalt:

Radioisotope Brief – Cobalt-60 ATSDR Radionuclide Basics – Cobalt-60 Environmental Protection Agency