

## 7.0 HISTORICAL DATA TABLES

### Sample Statistics from Previous Environmental Sampling

The mean, minimum value and maximum value were calculated for selected sample mediums and isotopes.

#### Special Considerations:

1. Sample data listed as 1969 was taken from the NINE MILE POINT, PREOPERATION SURVEY, 1969 and ENVIRONMENTAL MONITORING REPORT FOR NIAGARA MOHAWK POWER CORPORATION NINE MILE POINT NUCLEAR STATION, NOVEMBER, 1970.
2. Sample results listed as 1974 and 1975 were taken from the respective Annual Radiological Environmental Operating Reports for Nine Mile Point Unit 1 Nuclear Station. Sample results listed as 1986 through the current year were taken from the respective Nine Mile point Nuclear Power Station Annual Radiological Environmental Operating Reports.
3. Only measured values were used for statistical calculations.

TABLE 7-1

HISTORICAL ENVIRONMENTAL SAMPLE DATA  
SHORELINE SEDIMENT (CONTROL)<sup>(a)</sup>

YEAR	Cs-137 (pCi/g (dry))			Co-60 (pCi/g (dry))		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1979 <sup>(b)</sup>	0.22	0.22	0.22	LLD	LLD	LLD
1980	0.07	0.09	0.08	LLD	LLD	LLD
1981	LLD	LLD	LLD	LLD	LLD	LLD
1982	0.05	0.05	0.05	LLD	LLD	LLD
1983	LLD	LLD	LLD	LLD	LLD	LLD
1984	LLD	LLD	LLD	LLD	LLD	LLD
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	LLD	LLD	LLD	LLD	LLD	LLD
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	0.03	0.03	0.03	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	LLD	LLD	LLD
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	LLD	LLD	LLD
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

(a) Control location was at an area beyond the influence of the site (westerly direction).

(b) Sampling was initiated in 1979. Sampling was not required prior to 1979.

**TABLE 7-2**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
SHORELINE SEDIMENT (INDICATOR) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/g (dry))			Co-60 (pCi/g (dry))		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1985 <sup>(b)</sup>	LLD	LLD	LLD	LLD	LLD	LLD
1986	LLD	LLD	LLD	LLD	LLD	LLD
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	0.25	0.34	0.30	LLD	LLD	LLD
1990	0.28	0.28	0.28	LLD	LLD	LLD
1991	0.11	0.16	0.14	LLD	LLD	LLD
1992	0.10	0.16	0.13	LLD	LLD	LLD
1993	0.17	0.49	0.33	LLD	LLD	LLD
1994	0.08	0.39	0.24	LLD	LLD	LLD
1995	0.16	0.17	0.16	LLD	LLD	LLD
1996	0.13	0.18	0.16	LLD	LLD	LLD
1997	0.13	0.18	0.16	LLD	LLD	LLD
1998	0.07	0.07	0.07	LLD	LLD	LLD
1999	0.06	0.09	0.08	LLD	LLD	LLD
2000	0.06	0.08	0.07	LLD	LLD	LLD
2001	0.06	0.07	0.07	LLD	LLD	LLD
2002	0.05	0.05	0.05	LLD	LLD	LLD
2003	0.04	0.05	0.05	LLD	LLD	LLD
2004	0.04	0.04	0.04	LLD	LLD	LLD
2005	0.06	0.09	0.08	LLD	LLD	LLD
2006	0.06	0.06	0.06	LLD	LLD	LLD
2007	0.04	0.04	0.04	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

(a) Location was offsite at Sunset Beach (closest location with recreational value).

(b) Sampling initiated in 1985 as required by Technical Specifications requirements.

**TABLE 7-3**  
**HISTORICAL ENVIRONMENTAL SAMPLE DATA**  
**FISH (CONTROL) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/g (wet))		
	MIN.	MAX.	MEAN
1976	1.2	1.2	1.2
1977	0.13	0.13	0.13
1978	0.04	0.20	0.09
1979	0.03	0.06	0.04
1980	0.03	0.11	0.06
1981	0.028	0.062	0.043
1982	0.027	0.055	0.046
1983	0.041	0.057	0.049
1984	0.015	0.038	0.032
1985	0.026	0.047	0.034
1986	0.021	0.032	0.025
1987	0.017	0.040	0.031
1988	0.023	0.053	0.033
1989	0.020	0.033	0.029
1990	0.025	0.079	0.043
1991	0.016	0.045	0.030
1992	0.019	0.024	0.022
1993	0.023	0.041	0.032
1994	0.012	0.035	0.024
1995	0.014	0.020	0.016
1996	0.014	0.018	0.016
1997	0.019	0.043	0.031
1998	0.013	0.013	0.013
1999	LLD	LLD	LLD
2000	0.021	0.021	0.021
2001	LLD	LLD	LLD
2002	LLD	LLD	LLD
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	LLD	LLD	LLD
2012	LLD	LLD	LLD

(a) Control location was at an area beyond the influence of the site (westerly direction).

TABLE 7-4

HISTORICAL ENVIRONMENTAL SAMPLE DATA  
FISH (INDICATOR) <sup>(a)</sup>

YEAR	Cs-137 (pCi/g (wet))		
	MIN.	MAX.	MEAN
1976	0.5	3.9	1.4
1977	0.13	0.79	0.29
1978	0.03	0.10	0.08
1979	0.02	0.55	0.10
1980	0.03	0.10	0.06
1981	0.03	0.10	0.06
1982	0.034	0.064	0.048
1983	0.033	0.056	0.045
1984	0.033	0.061	0.043
1985	0.018	0.044	0.030
1986	0.009	0.051	0.028
1987	0.024	0.063	0.033
1988	0.020	0.074	0.034
1989	0.020	0.043	0.035
1990	0.024	0.115	0.044
1991	0.021	0.035	0.027
1992	0.013	0.034	0.026
1993	0.021	0.038	0.030
1994	0.011	0.028	0.020
1995	0.016	0.019	0.018
1996	0.014	0.016	0.015
1997	0.015	0.017	0.016
1998	0.021	0.021	0.021
1999	0.016	0.018	0.017
2000	LLD	LLD	LLD
2001	LLD	LLD	LLD
2002	0.016	0.016	0.016
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	LLD	LLD	LLD
2012	LLD	LLD	LLD

(a) Indicator locations are in the general area of the NMP1 and J. A. FitzPatrick cooling water discharge structures.

**TABLE 7-5**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
SURFACE WATER (CONTROL) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/liter)			Co-60 (pCi/liter)		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1976	(b)	(b)	(b)	(b)	(b)	(b)
1977	(c)	(c)	(c)	(c)	(c)	(c)
1978	LLD	LLD	LLD	(c)	(c)	(c)
1979	2.5	2.5	2.5	LLD	LLD	LLD
1980	LLD	LLD	LLD	LLD	LLD	LLD
1981	LLD	LLD	LLD	1.4	1.4	1.4
1982	LLD	LLD	LLD	LLD	LLD	LLD
1983	LLD	LLD	LLD	LLD	LLD	LLD
1984	LLD	LLD	LLD	LLD	LLD	LLD
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	LLD	LLD	LLD	LLD	LLD	LLD
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	LLD	LLD	LLD	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	LLD	LLD	LLD
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	LLD	LLD	LLD
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

- (a) Location was the City of Oswego Water Supply for 1976 – 1984, and the Oswego Steam Station inlet canal for 1985 – 2012.
- (b) No gamma analyses performed (not required).
- (c) Data showed instrument background results.

**TABLE 7-6**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
SURFACE WATER (INDICATOR) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/liter)			Co-60 (pCi/liter)		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1976	(b)	(b)	(b)	(b)	(b)	(b)
1977	(c)	(c)	(c)	(c)	(c)	(c)
1978	LLD	LLD	LLD	(c)	(c)	(c)
1979	LLD	LLD	LLD	LLD	LLD	LLD
1980	LLD	LLD	LLD	LLD	LLD	LLD
1981	LLD	LLD	LLD	LLD	LLD	LLD
1982	0.43	0.43	0.43	1.6	2.4	1.9
1983	LLD	LLD	LLD	LLD	LLD	LLD
1984	LLD	LLD	LLD	LLD	LLD	LLD
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	LLD	LLD	LLD	LLD	LLD	LLD
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	LLD	LLD	LLD	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	LLD	LLD	LLD
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	LLD	LLD	LLD
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

- (a) Location was the J. A. FitzPatrick inlet canal.
- (b) No gamma analyses performed (not required).
- (c) Data showed instrument background results.

**TABLE 7-7**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
SURFACE WATER TRITIUM (CONTROL) <sup>(a)</sup>**

YEAR	TRITIUM (pCi/liter)		
	MIN.	MAX.	MEAN
1976	440	929	652
1977	300	530	408
1978	215	490	304
1979	174	308	259
1980	211	290	257
1981	211	328	276
1982	112	307	165
1983	230	280	250
1984	190	220	205
1985	230	370	278
1986	250	550	373
1987	140	270	210
1988	240	460	320
1989	180	660	373
1990	260	320	290
1991	180	200	190
1992	190	310	242
1993	160	230	188
1994	250	250	250
1995	230	230	230
1996	LLD	LLD	LLD
1997	LLD	LLD	LLD
1998	190	190	190
1999	220	510	337
2000	196	237	212
2001	LLD	LLD	LLD
2002	LLD	LLD	LLD
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	LLD	LLD	LLD
2012	LLD	LLD	LLD

(a) Control location is the City of Oswego drinking water for 1976 – 1984, and the Oswego Steam Station inlet canal for 1985 – 2012.



**TABLE 7-8**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
SURFACE WATER TRITIUM (INDICATOR) <sup>(a)</sup>**

YEAR	TRITIUM (pCi/liter)		
	MIN.	MAX.	MEAN
1976	365	889	627
1977	380	530	455
1978	377	560	476
1979	176	276	228
1980	150	306	227
1981	212	388	285
1982	194	311	266
1983	249	560	347
1984	110	370	280
1985	250	1200 <sup>(b)</sup>	530
1986	260	500	380
1987	160	410	322
1988	430	480	460
1989	210	350	280
1990	220	290	250
1991	250	390	310
1992	240	300	273
1993	200	280	242
1994	180	260	220
1995	320	320	320
1996	LLD	LLD	LLD
1997	160	160	160
1998	190	190	190
1999	180	270	233
2000	161	198	185
2001	LLD	LLD	LLD
2002	297	297	297
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	LLD	LLD	LLD
2012	LLD	LLD	LLD

(a) Indicator location is the FitzPatrick inlet canal.

(b) Suspect sample contamination. Recollected samples showed normal levels of tritium.

**TABLE 7-9****HISTORICAL ENVIRONMENTAL SAMPLE DATA  
GROUNDWATER TRITIUM (CONTROL) <sup>(a)</sup>**

YEAR	TRITIUM (pCi/liter)		
	MIN.	MAX.	MEAN
2005	<854	<854	<854
2006 <sup>(b)</sup>	<447	<825	<636
2007	<442	<445	<444
2008	<427	<439	<431
2009	<411	<418	<415
2010	<172	<410	<341
2011	<408	<424	<415
2012	<363	<499	<420

(a) Control well locations (2) are upland wells located south of protected area.

(b) Required LLD changed to 500 pCi/l from 1000 pCi/l

**TABLE 7-10**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
GROUNDWATER MONITORING WELLS TRITIUM (INDICATOR) <sup>(a)</sup>**

YEAR	TRITIUM (pCi/liter)		
	MIN.	MAX.	MEAN
2005	<854	<871	<863
2006 <sup>(b)</sup>	<462	<933	<823
2007	<440	<461	<445
2008	<427	<439	<433
2009	<406	<424	<413
2010	<287	611 <sup>(c)</sup>	<384
2011	<407	<428	<414
2012	<314	<499	<395

- (a) Indicator locations are down gradient wells located in the owner control area.  
 (b) Required LLD changed to 500 pCi/l from 1000 pCi/l  
 (c) Re-sample tritium concentration = <268 pCi/l

**TABLE 7-10a**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
NMP2 STORM DRAIN TRITIUM (INDICATOR) <sup>(a)</sup>**

YEAR	TRITIUM (pCi/liter)		
	MIN.	MAX.	MEAN
2005	<854	<871	<863
2006 <sup>(b)</sup>	<667	<933	<850
2007	<440	<461	<447
2008	<415	<446	<432
2009	<406	<424	<413
2010	<289	446 <sup>(c)</sup>	<408
2011	<407	<428	<414
2012	<298	908 +/- 208	<417

- (a) NMP2 depression cone system.  
 (b) Required LLD changed to 500 pCi/l from 1000 pCi/l  
 (c) Re-sample tritium concentration = <420 pCi/l

**TABLE 7-11**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
AIR PARTICULATE GROSS BETA (CONTROL) <sup>(a)</sup>**

YEAR	GROSS BETA (pCi/m <sup>3</sup> )		
	MIN.	MAX.	MEAN
1977	0.001	0.484	0.125
1978	0.01	0.66	0.16
1979	0.010	0.703	0.077
1980	0.009	0.291	0.056
1981	0.016	0.549	0.165
1982	0.011	0.078	0.033
1983	0.007	0.085	0.024
1984	0.013	0.051	0.026
1985	0.013	0.043	0.024
1986	0.008	0.272	0.039
1987	0.009	0.037	0.021
1988	0.008	0.039	0.018
1989	0.007	0.039	0.017
1990	0.003	0.027	0.013
1991	0.006	0.028	0.014
1992	0.006	0.020	0.012
1993	0.007	0.022	0.013
1994	0.008	0.025	0.015
1995	0.006	0.023	0.014
1996	0.008	0.023	0.014
1997	0.006	0.025	0.013
1998	0.004	0.034	0.014
1999	0.010	0.032	0.017
2000	0.006	0.027	0.015
2001	0.006	0.034	0.016
2002	0.008	0.027	0.016
2003	0.004	0.032	0.015
2004	0.008	0.032	0.016
2005	0.008	0.034	0.019
2006	0.007	0.033	0.016
2007	0.008	0.028	0.016
2008	0.007	0.031	0.015
2009	0.006	0.032	0.016
2010	0.004	0.026	0.014
2011	0.008	0.034	0.018
2012	0.005	0.025	0.016

(a) Locations used for 1977 - 1984 were C off-site, D1 off-site, D2 off-site, E off-site, F off-site, and G off-site. Control location R-5 off-site was used for 1985 - 2012 (formerly C offsite location).

**TABLE 7-12**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
AIR PARTICULATE GROSS BETA (INDICATOR) <sup>(a)</sup>**

YEAR	GROSS BETA (pCi/m <sup>3</sup> )		
	MIN.	MAX.	MEAN
1977	0.002	0.326	0.106
1978	0.01	0.34	0.11
1979	0.001	0.271	0.058
1980	0.002	0.207	0.044
1981	0.004	0.528	0.151
1982	0.001	0.113	0.031
1983	0.002	0.062	0.023
1984	0.002	0.058	0.025
1985	0.010	0.044	0.023
1986	0.007	0.289	0.039
1987	0.009	0.040	0.021
1988	0.007	0.040	0.018
1989	0.007	0.041	0.017
1990	0.005	0.023	0.014
1991	0.007	0.033	0.015
1992	0.005	0.024	0.013
1993	0.005	0.025	0.014
1994	0.006	0.025	0.015
1995	0.004	0.031	0.014
1996	0.006	0.025	0.013
1997	0.001	0.018	0.010
1998	0.002	0.040	0.015
1999	0.009	0.039	0.017
2000	0.005	0.033	0.015
2001	0.004	0.037	0.016
2002	0.006	0.026	0.016
2003	0.005	0.035	0.015
2004	0.003	0.037	0.016
2005	0.007	0.040	0.018
2006	0.005	0.035	0.015
2007	0.007	0.028	0.016
2008	0.004	0.030	0.016
2009	0.006	0.032	0.016
2010	0.005	0.030	0.016
2011	0.007	0.034	0.018
2012	0.004	0.031	0.016

(a) Locations used for 1977 - 1984 were D1 onsite, D2 onsite, E onsite, F onsite, G onsite, H onsite, I onsite, J onsite, and K onsite as applicable. 1985 – 2012 locations were R-1 offsite, R-2 offsite, R-3 offsite, and R-4 offsite.

**TABLE 7-13**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
AIR PARTICULATES (CONTROL) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/m <sup>3</sup> )			Co-60 (pCi/m <sup>3</sup> )		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1977	0.0002	0.0112	0.0034	0.0034	0.0347	0.0172
1978	0.0008	0.0042	0.0018	0.0003	0.0056	0.0020
1979	0.0008	0.0047	0.0016	0.0005	0.0014	0.0009
1980	0.0015	0.0018	0.0016	LLD	LLD	LLD
1981	0.0003	0.0042	0.0017	0.0003	0.0012	0.0008
1982	0.0002	0.0009	0.0004	0.0004	0.0007	0.0006
1983	0.0002	0.0002	0.0002	0.0007	0.0007	0.0007
1984	LLD	LLD	LLD	0.0004	0.0012	0.0008
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	0.0075	0.0311	0.0193	LLD	LLD	LLD
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	LLD	LLD	LLD	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	LLD	LLD	LLD
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	LLD	LLD	LLD
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

(a) Locations included composites of C, D1, E, F, and G offsite air monitoring locations for 1977 - 1984. Sample location included only R-5 air monitoring location for 1985 - 2012.

TABLE 7-14

HISTORICAL ENVIRONMENTAL SAMPLE DATA  
AIR PARTICULATES (INDICATOR) <sup>(a)</sup>

YEAR	Cs-137 (pCi/m <sup>3</sup> )			Co-60 (pCi/m <sup>3</sup> )		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1977	0.0001	0.0105	0.0043	0.0003	0.0711	0.0179
1978	0.0003	0.0026	0.0016	0.0003	0.0153	0.0023
1979	0.0003	0.0020	0.0010	0.0003	0.0007	0.0005
1980	0.0005	0.0019	0.0011	0.0016	0.0016	0.0016
1981	0.0002	0.0045	0.0014	0.0002	0.0017	0.0006
1982	0.0001	0.0006	0.0004	0.0003	0.0010	0.0005
1983	0.0002	0.0003	0.0002	0.0003	0.0017	0.0007
1984	LLD	LLD	LLD	0.0007	0.0017	0.0012
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	0.0069	0.0364	0.0183	LLD	LLD	LLD
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	LLD	LLD	LLD	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	LLD	LLD	LLD
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	0.0048	0.0048	0.0048
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

(a) Locations included composites of D1, D2, E, F, G, H, I, J, and K onsite air monitoring locations for 1977 - 1984. Locations included R-1 through R-4 air monitoring locations for 1985 - 2012.

**TABLE 7-15**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
AIR RADIOIODINE (CONTROL) <sup>(a)</sup>**

YEAR	IODINE-131 (pCi/m <sup>3</sup> )		
	MIN.	MAX.	MEAN
1976	0.01	5.88	0.60
1977	0.02	0.82	0.32
1978	0.03	0.04	0.03
1979	LLD	LLD	LLD
1980	LLD	LLD	LLD
1981	LLD	LLD	LLD
1982	0.039	0.039	0.039
1983	LLD	LLD	LLD
1984	LLD	LLD	LLD
1985	LLD	LLD	LLD
1986	0.041	0.332	0.151
1987	LLD	LLD	LLD
1988	LLD	LLD	LLD
1989	LLD	LLD	LLD
1990	LLD	LLD	LLD
1991	LLD	LLD	LLD
1992	LLD	LLD	LLD
1993	LLD	LLD	LLD
1994	LLD	LLD	LLD
1995	LLD	LLD	LLD
1996	LLD	LLD	LLD
1997	LLD	LLD	LLD
1998	LLD	LLD	LLD
1999	LLD	LLD	LLD
2000	LLD	LLD	LLD
2001	LLD	LLD	LLD
2002	LLD	LLD	LLD
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	0.034 <sup>(b)</sup>	0.093 <sup>(b)</sup>	0.055 <sup>(b)</sup>
2012	LLD	LLD	LLD

(a) Locations D1 off-site, D2 off-site, E off-site, F off-site, and G off-site used for 1976 - 1984. Location R-5 off-site used for 1985 – 2012.

(b) I-131 concentration attributed to fallout from the Fukushima Daiichi Nuclear Station accident.



**TABLE 7-16**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
AIR RADIOIODINE (INDICATOR) <sup>(a)</sup>**

YEAR	IODINE-131 (pCi/m <sup>3</sup> )		
	MIN.	MAX.	MEAN
1976	0.01	2.09	0.33
1977	0.02	0.73	0.31
1978	0.02	0.07	0.04
1979	LLD	LLD	LLD
1980	0.013	0.013	0.013
1981	0.016	0.042	0.029
1982	0.002	0.042	0.016
1983	0.022	0.035	0.028
1984	LLD	LLD	LLD
1985	LLD	LLD	LLD
1986	0.023	0.360	0.119
1987	0.011	0.018	0.014
1988	LLD	LLD	LLD
1989	LLD	LLD	LLD
1990	LLD	LLD	LLD
1991	LLD	LLD	LLD
1992	LLD	LLD	LLD
1993	LLD	LLD	LLD
1994	LLD	LLD	LLD
1995	LLD	LLD	LLD
1996	LLD	LLD	LLD
1997	LLD	LLD	LLD
1998	LLD	LLD	LLD
1999	LLD	LLD	LLD
2000	LLD	LLD	LLD
2001	LLD	LLD	LLD
2002	LLD	LLD	LLD
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	0.021 <sup>(b)</sup>	0.11 <sup>(b)</sup>	0.055 <sup>(b)</sup>
2012	LLD	LLD	LLD

- (a) Locations used for 1976 - 1984 were D1 on-site, D2 on-site, E on-site, F on-site, G on-site, H on-site, I on-site, J on-site, and K on-site, as applicable. Locations used for 1985 - 2012 were R1 off-site, R-2 off-site, R-3 off-site, and R-4 off-site.
- (b) I-131 concentration attributed to fallout from the Fukushima Daiichi Nuclear Station accident.

TABLE 7-17

HISTORICAL ENVIRONMENTAL SAMPLE DATA  
 ENVIRONMENTAL TLD (CONTROL) <sup>(a)</sup>

YEAR	DOSE (mrem per standard month)		
	MIN.	MAX.	MEAN
1969	(b)	(b)	(b)
1970	6.0	7.3	6.7
1971	2.0	6.7	4.3
1972	2.2	6.2	4.4
1973	2.2	6.9	4.7
1974	2.7	8.9	5.6
1975	4.8	6.0	5.5
1976	3.2	7.2	5.4
1977	4.0	8.0	5.3
1978	3.3	4.7	4.3
1979	3.3	5.7	4.7
1980	3.8	5.8	4.9
1981	3.5	5.9	4.8
1982	3.8	6.1	5.1
1983	4.9	7.2	5.8
1984	4.7	8.2	6.2
1985	4.5 (4.4)*	7.6 (6.8)*	5.6 (5.4)*
1986	5.3 (5.5)*	7.5 (7.2)*	6.3 (6.3)*
1987	4.6 (4.6)*	6.6 (5.8)*	5.4 (5.2)*
1988	4.4 (4.8)*	6.8 (6.8)*	5.6 (5.4)*
1989	2.9 (2.9)*	6.4 (5.6)*	4.7 (4.6)*
1990	3.7 (3.7)*	6.0 (5.9)*	4.8 (4.6)*
1991	3.8 (3.8)*	5.4 (5.3)*	4.5 (4.3)*
1992	2.6 (2.6)*	5.0 (4.7)*	4.1 (3.9)*
1993	3.4 (3.4)*	5.6 (5.2)*	4.4 (4.3)*
1994	3.1 (3.1)*	5.0 (4.6)*	4.1 (3.9)*
1995	3.4 (3.4)*	5.7 (4.9)*	4.4 (4.2)*
1996	3.4 (3.4)*	5.6 (5.6)*	4.3 (4.2)*
1997	3.7 (3.9)*	6.2 (5.2)*	4.7 (4.6)*
1998	3.7 (3.7)*	5.6 (4.8)*	4.4 (4.2)*
1999	3.6 (3.7)*	7.1 (4.7)*	4.6 (4.4)*
2000	3.7 (3.7)*	7.3 (5.5)*	4.7 (4.3)*
2001	3.6 (3.9)*	5.4 (5.0)*	4.4 (4.4)*
2002	3.4 (3.4)*	5.5 (5.2)*	4.3 (4.1)*
2003	3.4 (3.4)*	5.5 (4.8)*	4.2 (4.2)*
2004	3.3 (3.3)*	5.9 (5.9)*	4.3 (4.5)*
2005	3.3 (3.4)*	5.1 (4.5)*	4.1 (4.0)*
2006	3.3 (3.3)*	5.3 (4.4)*	4.1 (4.0)*
2007	3.2 (3.2)*	5.8 (5.3)*	4.4 (4.3)*
2008	3.3(3.3)*	5.1(4.8)*	4.1(4.0)*
2009	3.2(3.2)*	4.8(4.2)*	3.9(3.7)*
2010	2.7(2.7)*	4.6(4.1)*	3.9(3.6)*
2011	2.6(2.6)*	5.5(4.7)*	4.0(3.8)*
2012	3.6(3.6)*	5.0(4.3)*	4.0(3.9)*

(a) TLD #8, 14, 49, 111 and 113 where applicable.  
 (b) Data not available.  
 (\*) TLD result based on the ODCM required locations (TLD #14 and 49).

**TABLE 7-18**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
ENVIRONMENTAL TLD (SITE BOUNDARY) <sup>(a)</sup>**

YEAR	DOSE (mrem per standard month)		
	MIN.	MAX.	MEAN
1985 <sup>(b)</sup>	4.1	12.6	6.2
1986	4.4	18.7	7.0
1987	4.4	14.3	6.1
1988	3.4	17.9	6.4
1989	2.8	15.4	5.9
1990	3.6	14.8	5.8
1991	3.2	16.7	5.7
1992	3.2	10.4	4.8
1993	3.3	11.6	5.3
1994	2.8	12.4	5.2
1995	3.5	9.6	5.4
1996	3.2	9.1	5.2
1997	3.5	10.2	5.9
1998	3.7	9.4	5.4
1999	3.3	12.3	5.8
2000	3.6	10.0	5.5
2001	3.6	10.3	5.7
2002	3.5	9.4	5.4
2003	3.2	8.9	5.4
2004	3.3	10.8	5.6
2005	3.4	9.2	5.5
2006	3.5	9.2	5.4
2007	3.2	9.0	5.6
2008	3.2	8.8	5.2
2009	3.1	11.7	5.4
2010	3.3	12.1	5.4
2011	3.1	11.6	5.5
2012	3.6	10.6	5.5

(a) TLD locations initiated in 1985 as required by the new Technical Specifications. Includes TLD numbers 7, 18, 23, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, and 87.

(b) Not required prior to 1985.

**TABLE 7-19**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
ENVIRONMENTAL TLD (OFF-SITE SECTORS) <sup>(a)</sup>**

YEAR	DOSE (mrem per standard month)		
	MIN.	MAX.	MEAN
1985 <sup>(b)</sup>	4.0	7.1	5.0
1986	4.6	8.6	6.0
1987	4.3	6.0	5.2
1988	3.8	7.0	5.3
1989	2.5	6.8	4.9
1990	3.6	6.3	4.7
1991	3.6	5.6	4.5
1992	2.9	5.0	4.1
1993	3.4	6.3	4.5
1994	3.0	5.1	4.0
1995	3.2	5.2	4.2
1996	3.2	5.3	4.2
1997	3.5	5.8	4.5
1998	3.5	5.0	4.2
1999	3.6	5.6	4.4
2000	3.4	6.6	4.5
2001	3.6	5.4	4.4
2002	3.1	5.3	4.2
2003	3.4	4.8	4.1
2004	3.2	6.7	4.4
2005	3.2	4.7	4.0
2006	3.3	4.4	4.0
2007	3.1	5.1	4.2
2008	3.2	4.5	3.8
2009	3.3	4.5	3.9
2010	3.0	4.4	3.9
2011	3.0	5.2	4.0
2012	3.5	4.6	4.0

(a) TLD locations initiated in 1985 as required by the new Technical Specifications. Includes TLD numbers 88, 89, 90, 91, 92, 93, 94, and 95.

(b) Not required prior to 1985.

**TABLE 7-20**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
ENVIRONMENTAL TLD (SPECIAL INTEREST) <sup>(a)</sup> <sup>(b)</sup>**

YEAR	DOSE (mrem per standard month)		
	MIN.	MAX.	MEAN
1985 <sup>(c)</sup>	3.9	6.8	5.3
1986	4.8	8.2	6.1
1987	3.5	6.0	5.1
1988	3.9	6.6	5.3
1989	2.1	7.0	4.8
1990	3.2	6.3	4.7
1991	2.9	5.6	4.4
1992	3.0	4.8	4.1
1993	3.2	5.8	4.5
1994	2.9	4.8	4.0
1995	3.4	4.9	4.3
1996	3.2	5.3	4.2
1997	3.5	5.4	4.5
1998	3.7	4.9	4.3
1999	3.6	5.5	4.4
2000	3.6	6.3	4.5
2001	3.8	5.0	4.3
2002	3.5	4.7	4.1
2003	3.4	5.0	4.2
2004	3.0	5.9	4.2
2005	3.4	4.7	3.9
2006	3.5	4.6	4.0
2007	3.0	5.1	4.2
2008	3.1	4.6	3.9
2009	3.1	4.5	3.8
2010	3.2	4.7	3.8
2011	2.9	4.9	4.0
2012	3.4	4.7	4.0

(a) TLD locations initiated in 1985 as required by the new Technical Specifications. TLD's included are numbers 15, 56, 58, 96, 97 and 98.  
 (b) TLD locations include critical residences and populated areas near the site.  
 (c) Not required prior to 1985.

**TABLE 7-21**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
ENVIRONMENTAL TLD (ON-SITE INDICATOR) <sup>(a)</sup>**

YEAR	DOSE (mrem per standard month)		
	MIN.	MAX.	MEAN
1969	(b)	(b)	(b)
1970	4.7	9.0	6.0
1971	1.5	7.7	4.7
1972	2.3	8.2	4.9
1973	3.0	24.4	6.6
1974	3.1	10.6	5.7
1975	4.6	16.0	7.3
1976	3.7	18.8	6.9
1977	3.0	15.3	5.7
1978	3.0	9.0	4.3
1979	2.7	8.3	4.3
1980	3.9	12.0	5.3
1981	4.1	11.8	5.8
1982	3.9	13.0	6.3
1983	5.0	16.5	6.9
1984	4.6	13.2	7.0
1985	4.7	15.9	6.3
1986	4.7	16.1	7.0
1987	4.0	11.4	5.8
1988	4.4	11.9	6.0
1989	2.7	14.5	6.0
1990	3.6	12.9	5.5
1991	3.2	11.6	5.1
1992	3.2	5.6	4.3
1993	3.1	13.6	5.2
1994	2.8	14.3	5.1
1995	3.5	28.6	6.2
1996	3.1	32.6	6.4
1997	3.5	28.8	7.7
1998	3.6	28.8	6.2
1999	3.3	28.4	6.6
2000	3.7	16.5	5.6
2001	3.8	14.5	5.6
2002	3.5	13.6	5.3
2003	3.2	12.9	5.3
2004	3.3	13.2	5.4
2005	3.4	14.1	5.4
2006	3.5	14.4	5.3
2007	3.2	14.8	5.6
2008	3.2	13.8	5.2
2009	3.1	13.6	4.9
2010	3.3	13.3	4.8
2011	3.1	13.0	5.1
2012	3.5	11.8	4.9

(a) Includes TLD numbers 3, 4, 5, 6, and 7 (1970 - 1973). Includes TLD numbers 3, 4, 5, 6, 7, 23, 24, 25, and 26 (1974 - 2011). Locations are existing or previous on-site environmental air monitoring locations.

(b) No data available.

**TABLE 7-22**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
ENVIRONMENTAL TLD (OFF-SITE INDICATOR) <sup>(a)</sup>**

YEAR	DOSE (mrem per standard month)		
	MIN.	MAX.	MEAN
1969	(b)	(b)	(b)
1970	5.0	8.0	6.7
1971	1.1	7.7	4.5
1972	1.8	6.6	4.4
1973	2.2	6.9	4.1
1974	2.4	8.9	5.3
1975	4.5	7.1	5.5
1976	3.4	7.2	5.2
1977	3.7	8.0	5.3
1978	2.7	4.7	3.7
1979	3.0	5.7	4.0
1980	3.1	5.8	4.6
1981	3.6	5.9	4.7
1982	4.0	6.2	5.2
1983	4.6	7.2	5.6
1984	4.6	8.2	6.1
1985	4.6	7.7	5.5
1986	5.0	7.6	6.1
1987	4.4	6.6	5.2
1988	4.2	6.6	5.4
1989	2.8	6.4	4.6
1990	3.8	6.0	4.8
1991	3.4	5.4	4.3
1992	3.1	5.2	4.1
1993	3.2	5.6	4.3
1994	3.0	5.0	4.1
1995	3.9	5.7	4.4
1996	3.3	5.5	4.1
1997	3.7	6.2	4.7
1998	3.9	5.6	4.4
1999	3.8	7.1	4.6
2000	3.8	7.3	4.6
2001	3.7	5.9	4.5
2002	3.6	5.5	4.4
2003	3.1	5.5	4.4
2004	3.2	6.5	4.5
2005	3.6	5.1	4.2
2006	3.9	5.3	4.2
2007	3.4	5.8	4.5
2008	3.3	5.1	4.1
2009	3.3	4.8	3.9
2010	3.5	4.6	3.8
2011	3.2	5.5	4.1
2012	3.6	5.0	4.1

(a) Includes TLD numbers 8, 9, 10, 11, 12, and 13 (off-site environmental air monitoring locations).  
(b) No data available.

**TABLE 7-23**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
MILK (CONTROL) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/liter)			I-131 (pCi/liter)		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1976	(b)	(b)	(b)	(b)	(b)	(b)
1977	(b)	(b)	(b)	(b)	(b)	(b)
1978	2.4	7.8	5.8	LLD	LLD	LLD
1979	LLD	LLD	LLD	LLD	LLD	LLD
1980	3.6	5.6	4.5	1.4	1.4	1.4
1981	3.9	3.9	3.9	LLD	LLD	LLD
1982	LLD	LLD	LLD	LLD	LLD	LLD
1983	LLD	LLD	LLD	LLD	LLD	LLD
1984	LLD	LLD	LLD	LLD	LLD	LLD
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	5.3	12.4	8.4	0.8	29.0	13.6
1987	LLD	LLD	LLD	LLD	LLD	LLD
1988	LLD	LLD	LLD	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	LLD	LLD	LLD	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	LLD	LLD	LLD
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	LLD	LLD	LLD
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

- (a) Location used was an available milk sample location in a least prevalent wind direction greater than ten miles from the site.
- (b) No data available (samples not required).



**TABLE 7-24**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
MILK (INDICATOR) <sup>(a)</sup>**

YEAR	Cs-137 (pCi/liter)			I-131 (pCi/liter)		
	MIN.	MAX.	MEAN	MIN.	MAX.	MEAN
1976	4.0	15.0	9.3	0.02	45.00	3.20
1977	11.0	22.0	17.1	0.01	49.00	6.88
1978	3.4	33.0	9.9	0.19	0.19	0.19
1979	3.2	53.0	9.4	LLD	LLD	LLD
1980	3.2	21.0	8.1	0.3	8.8	3.8
1981	3.5	29.0	8.6	LLD	LLD	LLD
1982	3.5	14.0	5.7	LLD	LLD	LLD
1983	3.3	10.9	7.2	LLD	LLD	LLD
1984	LLD	LLD	LLD	LLD	LLD	LLD
1985	LLD	LLD	LLD	LLD	LLD	LLD
1986	6.1	11.1	8.6	0.3	30.0	5.2
1987	5.5	8.1	6.8	LLD	LLD	LLD
1988	10.0	10.0	10.0	LLD	LLD	LLD
1989	LLD	LLD	LLD	LLD	LLD	LLD
1990	LLD	LLD	LLD	LLD	LLD	LLD
1991	LLD	LLD	LLD	LLD	LLD	LLD
1992	LLD	LLD	LLD	LLD	LLD	LLD
1993	LLD	LLD	LLD	LLD	LLD	LLD
1994	LLD	LLD	LLD	LLD	LLD	LLD
1995	LLD	LLD	LLD	LLD	LLD	LLD
1996	LLD	LLD	LLD	LLD	LLD	LLD
1997	LLD	LLD	LLD	0.50	0.50	0.50
1998	LLD	LLD	LLD	LLD	LLD	LLD
1999	LLD	LLD	LLD	LLD	LLD	LLD
2000	LLD	LLD	LLD	LLD	LLD	LLD
2001	LLD	LLD	LLD	LLD	LLD	LLD
2002	LLD	LLD	LLD	LLD	LLD	LLD
2003	LLD	LLD	LLD	LLD	LLD	LLD
2004	LLD	LLD	LLD	LLD	LLD	LLD
2005	LLD	LLD	LLD	LLD	LLD	LLD
2006	LLD	LLD	LLD	LLD	LLD	LLD
2007	LLD	LLD	LLD	LLD	LLD	LLD
2008	LLD	LLD	LLD	LLD	LLD	LLD
2009	LLD	LLD	LLD	LLD	LLD	LLD
2010	LLD	LLD	LLD	LLD	LLD	LLD
2011	LLD	LLD	LLD	LLD	LLD	LLD
2012	LLD	LLD	LLD	LLD	LLD	LLD

(a) Locations sampled were available downwind locations within ten miles with high radionuclide deposition potential.

**TABLE 7-25**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
FOOD PRODUCTS (CONTROL) <sup>(a)</sup>**

YEAR <sup>(b)(c)</sup>	Cs-137 (pCi/g (wet))		
	MIN.	MAX.	MEAN
1980	0.02	0.02	0.02
1981	LLD	LLD	LLD
1982	LLD	LLD	LLD
1983	LLD	LLD	LLD
1984	LLD	LLD	LLD
1985	LLD	LLD	LLD
1986	LLD	LLD	LLD
1987	LLD	LLD	LLD
1988	LLD	LLD	LLD
1989	LLD	LLD	LLD
1990	LLD	LLD	LLD
1991	LLD	LLD	LLD
1992	LLD	LLD	LLD
1993	0.007	0.007	0.007
1994	LLD	LLD	LLD
1995	LLD	LLD	LLD
1996	LLD	LLD	LLD
1997	LLD	LLD	LLD
1998	LLD	LLD	LLD
1999	LLD	LLD	LLD
2000	LLD	LLD	LLD
2001	LLD	LLD	LLD
2002	LLD	LLD	LLD
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	LLD	LLD	LLD
2012	LLD	LLD	LLD

- (a) Location was an available food product sample location in a least prevalent wind direction greater than ten miles from the site.
- (b) Data comprised of broadleaf and non-broadleaf vegetation (1980 – 1984, 2007 – 2009, 2011 & 2012).
- (c) Data comprised of broadleaf vegetation only (1985 – 2006 & 2010).

**TABLE 7-26**

**HISTORICAL ENVIRONMENTAL SAMPLE DATA  
FOOD PRODUCTS (INDICATOR) <sup>(a)</sup>**

YEAR <sup>(b)(c)</sup>	Cs-137 (pCi/g (wet))		
	MIN.	MAX.	MEAN
1976 - 1978	LLD	LLD	LLD
1979	0.004	0.004	0.004
1980	0.004	0.060	0.036
1981	LLD	LLD	LLD
1982	LLD	LLD	LLD
1983	LLD	LLD	LLD
1984	LLD	LLD	LLD
1985	0.047	0.047	0.047
1986	LLD	LLD	LLD
1987	LLD	LLD	LLD
1988	0.008	0.008	0.008
1989	0.009	0.009	0.009
1990	LLD	LLD	LLD
1991	0.040	0.040	0.040
1992	LLD	LLD	LLD
1993	LLD	LLD	LLD
1994	0.004	0.011	0.008
1995	0.010	0.012	0.011
1996	LLD	LLD	LLD
1997	0.012	0.012	0.012
1998	LLD	LLD	LLD
1999	0.008	0.008	0.008
2000	LLD	LLD	LLD
2001	LLD	LLD	LLD
2002	LLD	LLD	LLD
2003	LLD	LLD	LLD
2004	LLD	LLD	LLD
2005	LLD	LLD	LLD
2006	LLD	LLD	LLD
2007	LLD	LLD	LLD
2008	LLD	LLD	LLD
2009	LLD	LLD	LLD
2010	LLD	LLD	LLD
2011	LLD	LLD	LLD
2012	LLD	LLD	LLD

- (a) Indicator locations were available downwind locations within ten miles of the site and with high radionuclide deposition potential.
- (b) Data comprised of broadleaf and non-broadleaf vegetation (1976 – 1984, 2007 – 2009, 2011 & 2012).
- (c) Data comprised of broadleaf vegetation only (1985 – 2006 & 2010).

## **8.0 QUALITY ASSURANCE / QUALITY CONTROL PROGRAM**

### **8.1 PROGRAM DESCRIPTION**

The Offsite Dose Calculation Manuals (ODCM), for Nine Mile Point Unit 1 (NMP1) and Nine Mile Point Unit 2 (NMP2), Part II, Section 4.0 requires that the licensee participate in an Interlaboratory Comparison Program. The Interlaboratory Comparison Program shall include sample media for which samples are routinely collected and for which comparison samples are commercially available. Participation in an Interlaboratory Comparison Program ensures that independent checks on the precision and accuracy of the measurement of radioactive material in the environmental samples are performed as part of the Quality Assurance Program for environmental monitoring. To fulfill the requirement for an Interlaboratory Comparison Program, the James A. FitzPatrick Nuclear Power Plant (JAFNPP) Environmental Laboratory has engaged the services of Eckert & Ziegler Analytics, Incorporated in Atlanta, Georgia.

Eckert & Ziegler Analytics supplies sample media as blind sample spikes, which contain certified levels of radioactivity unknown to the analysis laboratory. These samples are prepared and analyzed by the JAF Environmental Laboratory using standard laboratory procedures. Eckert & Ziegler Analytics issues a statistical summary report of the results. The JAFNPP Environmental Laboratory uses predetermined acceptance criteria methodology for evaluating the laboratory's performance.

The JAFNPP Environmental Laboratory also analyzes laboratory blanks. The analysis of laboratory blanks provides a means to detect and measure radioactive contamination of analytical samples. The analysis of analytical blanks also provides information on the adequacy of background subtraction. Laboratory blank results are analyzed using control charts.

## 8.2 PROGRAM SCHEDULE

<b>SAMPLE MEDIA</b>	<b>LABORATORY ANALYSIS</b>	<b>SAMPLE PROVIDER ECKERT &amp; ZIEGLER ANALYTICS</b>
Water	Gross Beta	3
Water	Tritium	5
Water	I-131	3
Water	Mixed Gamma	4
Air	Gross Beta	3
Air	I-131	4
Air	Mixed Gamma	2
Milk	I-131	3
Milk	Mixed Gamma	3
Soil	Mixed Gamma	1
Vegetation	Mixed Gamma	2
<b>TOTAL SAMPLE INVENTORY</b>		<b>33</b>

## 8.3 ACCEPTANCE CRITERIA

Each sample result is evaluated to determine the accuracy and precision of the laboratory's analysis result. The sample evaluation method is discussed below.

### 8.3.1 SAMPLE RESULTS EVALUATION

Samples provided by Eckert & Ziegler Analytics are evaluated using what is specified as the NRC method. This method is based on the calculation of the ratio of results reported by the participating laboratory (QC result) to the Vendor Laboratory Known value (reference result).

An Environmental Laboratory analytical result is evaluated using the following calculation:

The value for the error resolution is calculated.

$$\text{The error resolution} = \frac{\text{Reference Result}}{\text{Reference Results Error (1 sigma)}}$$

Using the appropriate row under the Error Resolution column in Table 8.3.1 below, a corresponding Ratio of Agreement interval is given.

The value for the ratio is then calculated.

$$\text{Ratio of Agreement} = \frac{\text{QC Result}}{\text{Reference Result}}$$

If the value falls within the agreement interval, the result is acceptable.

**TABLE 8.3.1**

<b>ERROR RESOLUTION</b>	<b>RATIO OF AGREEMENT</b>
< 4	No Comparison
4 to 7	0.5 to 2.0
8 to 15	0.6 to 1.66
16 to 50	0.75 to 1.33
51 to 200	0.8 to 1.25
>200	0.85 to 1.18

This acceptance test is generally referred to as the “NRC” method. The acceptance criteria are contained in Procedure S-ENVSP-12, Environmental Surveillance Program Quality Assurance/Quality Control Program and EN-CY-102, Laboratory Analytical Control. The NRC method generally results in an acceptance range of approximately  $\pm 25\%$  of the Known value when applied to sample results from the Eckert & Ziegler Analytics Interlaboratory Comparison Program. This method is used as the procedurally required assessment method and requires the generation of a deviation from QA/QC program report when results are unacceptable.

## 8.4 PROGRAM RESULTS SUMMARY

The Interlaboratory Comparison Program numerical results are provided on Table 8-1.

### 8.4.1 ECKERT & ZIEGLER ANALYTICS QA SAMPLES RESULTS

Thirty-three QA blind spike samples were analyzed as part of Eckert & Ziegler Analytics 2012 Interlaboratory Comparison Program. The following sample media were evaluated as part of the comparison program.

- Air Charcoal Cartridge: I-131
- Air Particulate Filter: Mixed Gamma Emitters, Gross Beta
- Water: I-131, Mixed Gamma Emitters, Tritium, Gross Beta
- Soil: Mixed Gamma Emitters
- Milk: I-131, Mixed Gamma Emitters
- Vegetation: Mixed Gamma Emitters

The JAFNPP Environmental Laboratory performed 135 individual analyses on the 33 QA samples. Of the 135 analyses performed, 133 were in agreement using the NRC acceptance criteria for a 98.5 % agreement ratio. The two (2) analyses not in agreement are discussed below.

There were two (2) non-conformities in the 2012 program.

#### **Eckert & Ziegler Analytics Sample E-10086, Water Gross Beta Corrective Action No. CR-JAF-2012-05041**

The JAF Environmental Lab result for the Eckert & Ziegler Analytics QA sample E-10086, water gross beta, was not in agreement with the known value. JAF reported an average value of 87.4 pCi/L when the known value was 285 pCi/L.

Three aliquots of the sample were prepared and 3 results were generated along with the mean which was reported. The sampling volume was not adjusted for the 3 aliquots. The incorrect sample volume was used to calculate the activity.

The volume used in the calculation of the activity was incorrectly entered as 0.5 L when the correct volume should have been 0.166 L. If the correct volume had been used, the activity would have been  $87.4 * 3 = 262.2$  pCi/L. The corrected activity would then have been in agreement with the known value.

Guidance was added to the Lab Policy Manual for calculating gross beta concentrations when more than 1 aliquot of the sample is taken.

**Eckert & Ziegler Analytics Sample E-10274, Water Gross Beta  
Corrective Action No. CR-JAF-2013-00770**

The JAF Environmental Lab result for the Eckert & Ziegler Analytics QA sample E-10274, water gross beta, was not in agreement with the known value. JAF reported an average value of 190.6 pCi/L when the known value was 251 pCi/L. The error resolution is 59.7 which equates to a ratio of agreement of 0.8 to 1.25. The JAF / known value was 0.76. The sample was analyzed on another instrument with an average result of 187.9 pCi/L.

The vendor was contacted and suggested recommendations have been examined and have not accounted for the discrepancy in the result.

JAF result performed on the previous Eckert & Ziegler water gross beta sample was in excellent agreement with the known value.



8.4.2 NUMERICAL RESULTS TABLES

**TABLE 8-1**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gross Beta Analysis of Air Particulate Filter**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi ±1 sigma	REFERENCE LAB* pCi ±1 sigma	RATIO (1)
06/14/2012	E10151	FILTER	GROSS BETA	64 ± 1.0	61 ± 1.01	1.07 A
				66 ± 1.0		
				64 ± 1.0		
				Mean = 65 ± 0.6		
12/06/2012	E10362	FILTER	GROSS BETA	71 ± 0.9	66 ± 1.09	1.06 A
				68 ± 0.9		
				70 ± 0.9		
				Mean = 70 ± 0.5		
06/14/2012	E10189	FILTER	GROSS BETA	93 ± 1.2	84 ± 1.40	1.10 A
				94 ± 1.2		
				89 ± 1.1		
				Mean = 92 ± 0.7		

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Tritium Analysis of Water**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
03/15/2012	E10083	WATER	H-3	5601 ± 169.0 5215 ± 166.0 5352 ± 167.0 Mean = 5389 ± 96.6	4990 ± 83.40	1.08 A
06/14/2012	E10150	WATER	H-3	1001 ± 121.0 1040 ± 121.0 1066 ± 122.0 Mean = 1036 ± 70.1	964 ± 16.10	1.07 A
09/13/2012	E10269	WATER	H-3	918 ± 124.0 901 ± 124.0 915 ± 125.0 Mean = 911 ± 71.8	960 ± 16.00	0.95 A
12/06/2012	E10321	WATER	H-3	12011 ± 209.0 11938 ± 211.0 11994 ± 211.0 Mean = 11981 ± 121.4	12100 ± 202.00	0.99 A
12/06/2012	E10322	WATER	H-3	12023 ± 210.0 12054 ± 212.0 12004 ± 212.0 Mean = 12027 ± 122.0	12100 ± 202.00	0.99 A

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gross Beta Analysis of Water**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
03/15/2012	E10086	WATER	GROSS BETA	90 ± 1.4	285 ± 4.8	0.31 N
				88 ± 1.4		
				84 ± 1.3		
				Mean = 87 ± 0.8		
06/14/2012	E10156	WATER	GROSS BETA	257 ± 2.5	273 ± 4.6	0.94 A
				255 ± 2.5		
				257 ± 2.5		
				Mean = 256 ± 1.4		
09/13/2012	E10274	WATER	GROSS BETA	192 ± 2.0	251 ± 4.2	0.76 N
				191 ± 2.0		
				189 ± 2.0		
				Mean = 191 ± 1.2		

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**I-131 Gamma Analysis of Air Charcoal**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi ±1 sigma	REFERENCE LAB* pCi ±1 sigma	RATIO (1)
03/15/2012	E10013	AIR	I-131	90 ± 3.7	94.1 ± 1.57	0.96 A
				90 ± 3.8		
				90 ± 3.3		
				Mean = 90 ± 2.1		
06/14/2012	E10154	AIR	I-131	94 ± 2.6	97 ± 1.62	0.94 A
				92 ± 4.4		
				90 ± 2.5		
				Mean = 91 ± 1.6		
09/13/2012	E10267	AIR	I-131	96 ± 2.6	97.1 ± 1.62	0.98 A
				94 ± 2.7		
				96 ± 2.9		
				Mean = 95 ± 1.6		
09/13/2012	E10273	AIR	I-131	102 ± 2.8	96.8 ± 1.62	1.05 A
				101 ± 2.7		
				101 ± 2.6		
				Mean = 101 ± 1.5		

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.  
\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable  
U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Water**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
3/15/2012	E10084	WATER	Ce-141	198 ± 9.1	184 ± 3.07	1.06 A
				196 ± 8.2		
				186 ± 8.9		
				197 ± 8.2		
				Mean = 194 ± 4.3		
			Cr-51	189 ± 49.2	309 ± 5.16	0.91 A
				257 ± 39.7		
				362 ± 68.1		
				Mean = 282 ± 25.5		
			Cs-134	102 ± 7.1	106 ± 1.77	0.95 A
98 ± 5.8						
100 ± 2.6						
Mean = 101 ± 2.7						
Cs-137	103 ± 3.9	113 ± 1.88	0.98 A			
	111 ± 3.1					
	116 ± 1.5					
	Mean = 111 ± 1.5					
Co-58	95 ± 4.4	93 ± 1.56	1.03 A			
	92 ± 3.6					
	97 ± 2.4					
	Mean = 96 ± 1.8					
Mn-54	148 ± 4.6	138 ± 2.31	1.10 A			
	148 ± 3.7					
	157 ± 1.9					
	Mean = 152 ± 1.8					
Fe-59	118 ± 7.4	119 ± 1.99	1.06 A			
	130 ± 5.8					
	131 ± 4.8					
	Mean = 126 ± 3.0					
Zn-65	232 ± 9.5	235 ± 3.93	1.06 A			
	250 ± 7.5					
	257 ± 3.8					
	Mean = 250 ± 3.6					
Co-60	209 ± 3.9	197 ± 3.29	1.05 A			
	207 ± 3.1					
	209 ± 1.4					
	Mean = 207 ± 1.5					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.  
\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable  
U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Water**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
6/14/2012	E10188	WATER	Ce-141	110 ± 8.3	112 ± 1.87	1.01 A
				121 ± 9.6		
			Cr-51	118 ± 8.3	548 ± 9.14	1.00 A
				115 ± 9.3		
			Cs-134	100 ± 10.0	238 ± 3.97	0.95 A
				113 ± 4.1		
			Cs-137	515 ± 40.9	289 ± 4.82	0.98 A
				564 ± 50.5		
			Co-58	532 ± 41.1	126 ± 2.10	1.00 A
				553 ± 46.3		
			Mn-54	588 ± 52.7	180 ± 3.01	1.03 A
				550 ± 20.8		
			Fe-59	223 ± 12.0	174 ± 2.91	1.09 A
				217 ± 14.9		
			Zn-65	231 ± 10.4	484 ± 8.09	1.01 A
				225 ± 12.8		
I-131	234 ± 14.0	99 ± 1.66	0.93 A			
	226 ± 5.8					
I-131**	281 ± 7.1	99 ± 1.66	1.15 A			
	277 ± 8.6					
	298 ± 6.4					
	273 ± 7.3					
	282 ± 8.4					
	282 ± 3.4					
	118 ± 5.8					
	123 ± 6.9					
	131 ± 5.0					
	132 ± 5.8					
	127 ± 6.4					
	126 ± 2.7					
	182 ± 6.4					
	177 ± 7.5					
	200 ± 5.7					
	184 ± 6.6					
	182 ± 7.4					
	185 ± 3.0					
	192 ± 8.3					
	188 ± 10.0					
	190 ± 7.0					
	197 ± 8.5					
	179 ± 9.8					
	189 ± 3.9					
	312 ± 13.0					
	317 ± 15.7					
	293 ± 10.8					
	308 ± 13.2					
	298 ± 15.2					
	306 ± 6.1					
	485 ± 7.2					
	488 ± 8.6					
	493 ± 6.3					
	491 ± 7.5					
	486 ± 8.5					
	489 ± 3.8					
	116 ± 10.5					
	82 ± 12.2					
	101 ± 10.2					
	85 ± 11.5					
	78 ± 12.8					
	93 ± 5.7					
	112 ± 4.9					
	118 ± 4.6					
	114 ± 1.3					
	115 ± 2.3					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.  
\* Sample provided by Eckert & Ziegler Analytics, Inc.  
\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable  
U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Water**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
9/13/2012	E10270	WATER	Ce-141	166 ± 6.2	159 ± 2.65	1.04 A
				167 ± 7.1		
			Cr-51	170 ± 6.5	241 ± 4.02	1.12 A
				159 ± 7.7		
			Cs-134	Mean = 166 ± 3.4	105 ± 1.76	0.98 A
				269 ± 26.5		
			Cs-137	286 ± 31.2	169 ± 2.82	0.98 A
				300 ± 27.6		
			Co-58	225 ± 32.6	98 ± 1.63	1.00 A
				Mean = 270 ± 14.8		
			Mn-54	107 ± 7.6	190 ± 3.17	1.04 A
				106 ± 9.9		
			Fe-59	101 ± 8.4	147 ± 2.46	1.11 A
				96 ± 10.8		
Zn-65	Mean = 102 ± 4.6	187 ± 3.12	0.98 A			
	169 ± 4.9					
Co-60	158 ± 6.7	147 ± 2.46	1.05 A			
	175 ± 5.6					
I-131	159 ± 6.5	63 ± 1.06	1.07 A			
	Mean = 165 ± 3.0					
I-131**	95 ± 3.8	63 ± 1.06	1.08 A			
	102 ± 5.7					
	99 ± 4.4					
	95 ± 5.7					
	Mean = 98 ± 2.5					
	196 ± 5.3					
	208 ± 7.1					
	195 ± 6.0					
	194 ± 7.2					
	Mean = 198 ± 3.2					
	160 ± 5.4					
	161 ± 7.7					
	167 ± 6.5					
	166 ± 7.9					
	Mean = 164 ± 3.5					
	187 ± 8.3					
	191 ± 11.2					
	191 ± 9.6					
	166 ± 11.4					
	Mean = 184 ± 5.1					
	148 ± 3.5					
	170 ± 5.2					
	154 ± 4.2					
	148 ± 5.0					
	Mean = 155 ± 2.2					
	61.4 ± 3.6					
	69.2 ± 5.0					
	66.2 ± 4.0					
	72.3 ± 5.4					
	Mean = 67.3 ± 2.3					
	68 ± 0.9					
	68 ± 0.9					
	69 ± 0.9					
	Mean = 68 ± 0.5					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Water**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
12/6/2012	E10320	WATER	Ce-141	51 ± 6.0	53 ± 0.89	0.92 A
				54 ± 5.8		
				43 ± 7.2		
				47 ± 6.2		
			Mean = 49 ± 3.2			
			Cr-51	379 ± 33.0	362 ± 6.05	0.96 A
				382 ± 34.5		
				321 ± 38.3		
				311 ± 35.3		
			Mean = 348 ± 17.7			
			Cs-134	172 ± 9.2	173 ± 2.88	0.96 A
				159 ± 9.8		
				150 ± 12.4		
				180 ± 10.8		
			Mean = 165 ± 5.3			
			Cs-137	121 ± 4.3	122 ± 2.03	0.99 A
118 ± 4.5						
120 ± 5.7						
122 ± 5.1						
Mean = 120 ± 2.5						
Co-58	107 ± 4.1	103 ± 1.72	0.98 A			
	99 ± 4.6					
	95 ± 5.5					
	103 ± 4.8					
Mean = 101 ± 2.4						
Mn-54	134 ± 4.7	121 ± 2.01	1.06 A			
	134 ± 4.9					
	120 ± 6.0					
	127 ± 5.3					
Mean = 129 ± 2.6						
Fe-59	119 ± 5.4	121 ± 2.01	1.00 A			
	131 ± 6.1					
	109 ± 7.5					
	123 ± 6.8					
Mean = 121 ± 3.2						
Zn-65	205 ± 8.9	194 ± 3.24	1.03 A			
	201 ± 9.3					
	200 ± 12.2					
	197 ± 10.5					
Mean = 201 ± 5.2						
Co-60	185 ± 3.9	177 ± 2.96	1.05 A			
	182 ± 4.2					
	183 ± 5.3					
	193 ± 4.0					
Mean = 186 ± 2.2						
I-131	82.8 ± 8.1	73 ± 1.21	1.05 A			
	75.0 ± 8.1					
	74.3 ± 10.4					
	75.8 ± 9.3					
Mean = 77.0 ± 4.5						
I-131**	85 ± 1.6	73 ± 1.21	1.12 A			
	86 ± 1.8					
	75 ± 2.5					
	81 ± 2.2					
Mean = 81 ± 1.0						

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable

U=Unacceptable



**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Milk**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
3/15/2012	E10014	MILK	Ce-141	250 ± 10.6	260 ± 4.34	0.98 A
				272 ± 9.0		
				255 ± 10.1		
				243 ± 10.5		
			Mean = 255 ± 5.0			
			Cr-51	390 ± 43.3	436 ± 7.28	1.01 A
				495 ± 42.2		
				364 ± 48.9		
				514 ± 49.7		
			Mean = 441 ± 23.1			
			Cs-134	134 ± 8.1	149 ± 2.50	0.91 A
				142 ± 11.2		
				129 ± 14.0		
				140 ± 13.5		
Mean = 136 ± 6.0						
Cs-137	157 ± 7.7	159 ± 2.66	0.95 A			
	153 ± 6.0					
	157 ± 7.7					
	140 ± 6.9					
Mean = 152 ± 3.6						
Co-58	133 ± 7.8	132 ± 2.20	0.97 A			
	130 ± 6.0					
	127 ± 7.8					
	122 ± 8.0					
Mean = 128 ± 3.7						
Mn-54	204 ± 8.8	195 ± 3.26	1.06 A			
	214 ± 7.1					
	206 ± 8.6					
	203 ± 8.5					
Mean = 207 ± 4.1						
Fe-59	182 ± 11.5	168 ± 2.81	1.04 A			
	192 ± 9.1					
	161 ± 11.0					
	163 ± 10.9					
Mean = 175 ± 5.3						
Zn-65	312 ± 18.4	333 ± 5.56	0.97 A			
	326 ± 14.4					
	320 ± 18.0					
	329 ± 17.7					
Mean = 322 ± 8.6						
Co-60	273 ± 7.8	279 ± 4.65	0.99 A			
	279 ± 6.1					
	278 ± 7.6					
	273 ± 7.4					
Mean = 276 ± 3.6						
I-131	107 ± 13.8	93 ± 1.54	1.12 A			
	97.2 ± 10.2					
	90.9 ± 13.1					
	120 ± 13.7					
Mean = 104 ± 6.4						
I-131**	120 ± 7.1	93 ± 1.54	1.25 A			
	125 ± 6.5					
	105 ± 7.6					
	112 ± 7.1					
Mean = 116 ± 3.5						

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Milk**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)	
6/14/2012	E10152	MILK	Ce-141	81 ± 5.7	82 ± 1.37	0.97 A	
				83 ± 6.4			
				75 ± 7.8			
				81 ± 7.1			
			Mean = 80 ± 3.4	Cr-51	429 ± 31.4	402 ± 6.71	1.04 A
			411 ± 30.8				
			417 ± 38.5				
			414 ± 45.0				
			Mean = 418 ± 18.4	Cs-134	166 ± 6.0	174 ± 2.91	0.94 A
			164 ± 11.0				
			163 ± 12.7				
			159 ± 6.5				
			Mean = 163 ± 4.7	Cs-137	203 ± 6.2	212 ± 3.54	0.95 A
			203 ± 6.5				
198 ± 7.1							
202 ± 6.4							
Mean = 202 ± 3.3	Co-58	93 ± 4.7	92 ± 1.54	0.98 A			
92 ± 4.5							
90 ± 5.9							
88 ± 5.6							
Mean = 91 ± 2.6	Mn-54	140 ± 5.5	132 ± 2.21	1.04 A			
129 ± 5.6							
135 ± 6.5							
144 ± 6.0							
Mean = 137 ± 3.0	Fe-59	130 ± 6.4	128 ± 2.13	1.05 A			
127 ± 6.6							
142 ± 8.0							
137 ± 7.7							
Mean = 134 ± 3.6	Zn-65	207 ± 10.7	199 ± 3.33	1.02 A			
192 ± 11.0							
207 ± 12.7							
208 ± 11.5							
Mean = 204 ± 5.8	Co-60	370 ± 6.3	355 ± 5.93	1.02 A			
364 ± 6.4							
356 ± 7.3							
365 ± 6.5							
Mean = 364 ± 3.3	I-131	102 ± 4.4	100 ± 1.66	0.95 A			
100 ± 4.6							
88.4 ± 6.4							
89.9 ± 10.7							
Mean = 95.1 ± 3.5	I-131**	118 ± 5.0	100 ± 1.66	1.08 A			
99 ± 5.2							
104 ± 2.2							
109 ± 1.5							
Mean = 108 ± 1.9							

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Milk**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/liter ±1 sigma	REFERENCE LAB* pCi/liter ±1 sigma	RATIO (1)
9/13/2012	E10272	MILK	Ce-141	159 ± 7.5	164 ± 2.73	0.99 A
				174 ± 7.2		
			Cr-51	154 ± 8.1	248 ± 4.14	1.03 A
				164 ± 6.7		
			Cs-134	Mean = 163 ± 3.7	108 ± 1.81	0.94 A
				284 ± 33.2		
			Cs-137	258 ± 28.3	174 ± 2.91	0.92 A
				218 ± 33.2		
			Co-58	263 ± 26.0	100 ± 1.68	1.06 A
				Mean = 256 ± 15.2		
			Mn-54	99 ± 9.5	196 ± 3.27	1.02 A
				101 ± 9.3		
			Fe-59	105 ± 10.4	152 ± 2.53	1.06 A
100 ± 7.4						
Zn-65	Mean = 101 ± 4.6	192 ± 3.21	1.06 A			
	149 ± 6.3					
Co-60	161 ± 5.8	100 ± 2.53	1.02 A			
	159 ± 6.4					
I-131	173 ± 5.0	152 ± 2.53	0.96 A			
	Mean = 161 ± 3.0					
I-131**	104 ± 5.5	100 ± 1.66	1.06 A			
	100 ± 4.7					
	102 ± 5.6	100 ± 1.66	1.06 A			
	116 ± 4.2					
	Mean = 106 ± 2.5	100 ± 1.66	1.06 A			
	201 ± 7.1					
	193 ± 6.2	100 ± 1.66	1.06 A			
	197 ± 7.3					
	211 ± 5.5	100 ± 1.66	1.06 A			
	Mean = 201 ± 3.3					
	157 ± 7.9	100 ± 1.66	1.06 A			
	163 ± 6.7					
	154 ± 7.8	100 ± 1.66	1.06 A			
	168 ± 5.7					
	Mean = 161 ± 3.5	100 ± 1.66	1.06 A			
	186 ± 12.4					
	213 ± 10.5	100 ± 1.66	1.06 A			
	220 ± 11.5					
	198 ± 8.8	100 ± 1.66	1.06 A			
	Mean = 204 ± 5.4					
	155 ± 5.0	100 ± 1.66	1.06 A			
	150 ± 4.3					
	160 ± 5.0	100 ± 1.66	1.06 A			
	157 ± 3.6					
	Mean = 156 ± 2.3	100 ± 1.66	1.06 A			
	95.2 ± 5.4					
	95.4 ± 4.5	100 ± 1.66	1.06 A			
	94.1 ± 5.3					
	99.3 ± 4.2	100 ± 1.66	1.06 A			
	Mean = 96.0 ± 2.4					
	106 ± 1.1	100 ± 1.66	1.06 A			
	108 ± 1.3					
	102 ± 1.2	100 ± 1.66	1.06 A			
	105 ± 0.7					
	Mean = 105 ± 0.5	100 ± 1.66	1.06 A			

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Air Particulate Filter**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi ±1 sigma	REFERENCE LAB* pCi ±1 sigma	RATIO (1)
3/15/2012	E10085	FILTER	Ce-141	198 ± 7.0	184 ± 3.07	1.05 A
				198 ± 6.5		
				186 ± 6.3		
				Mean = 194 ± 3.8		
			Cr-51	276 ± 39.3	308 ± 5.14	1.00 A
				355 ± 41.1		
				292 ± 36.9		
				Mean = 308 ± 22.6		
			Cs-134	85 ± 7.9	106 ± 1.76	0.86 A
98 ± 8.5						
89 ± 7.9						
Mean = 91 ± 4.7						
Cs-137	118 ± 3.9	112 ± 1.88	1.03 A			
	118 ± 4.3					
	110 ± 4.0					
	Mean = 115 ± 2.3					
Co-58	95 ± 4.8	93 ± 1.56	1.06 A			
	105 ± 5.8					
	96 ± 4.8					
	Mean = 99 ± 3.0					
Mn-54	163 ± 4.9	138 ± 2.30	1.13 A			
	155 ± 5.4					
	148 ± 5.1					
	Mean = 155 ± 3.0					
Fe-59	132 ± 7.4	119 ± 1.98	1.10 A			
	130 ± 9.1					
	130 ± 8.4					
	Mean = 131 ± 4.8					
Zn-65	260 ± 10.1	235 ± 3.92	1.15 A			
	280 ± 12.0					
	272 ± 11.0					
	Mean = 271 ± 6.4					
Co-60	201 ± 4.1	197 ± 3.28	1.04 A			
	210 ± 4.8					
	206 ± 4.6					
	Mean = 206 ± 2.6					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.  
\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable  
U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Air Particulate Filter**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi ±1 sigma	REFERENCE LAB* pCi ±1 sigma	RATIO (1)
9/13/2012	E10271	FILTER	Ce-141	135 ± 3.2	132 ± 2.20	1.03 A
				136 ± 3.0		
				134 ± 3.2		
				141 ± 3.5		
				Mean = 137 ± 1.6		
			Cr-51	223 ± 14.7	200 ± 3.33	1.05 A
				195 ± 14.2		
				212 ± 16.2		
				206 ± 16.2		
				Mean = 209 ± 7.7		
Cs-134	83 ± 7.5	87 ± 1.45	0.94 A			
	78 ± 7.0					
	89 ± 7.7					
	77 ± 7.0					
	Mean = 82 ± 3.6					
Cs-137	139 ± 4.2	140 ± 2.34	1.01 A			
	139 ± 4.1					
	140 ± 4.6					
	145 ± 4.2					
	Mean = 141 ± 2.1					
Co-58	86 ± 3.7	81 ± 1.35	1.08 A			
	92 ± 3.7					
	87 ± 4.0					
	84 ± 3.5					
	Mean = 87 ± 1.9					
Mn-54	172 ± 5.0	157 ± 2.63	1.07 A			
	167 ± 4.6					
	168 ± 5.1					
	168 ± 4.6					
	Mean = 169 ± 2.4					
Fe-59	149 ± 5.6	122 ± 2.04	1.15 A			
	146 ± 5.1					
	135 ± 5.6					
	133 ± 5.0					
	Mean = 141 ± 2.7					
Zn-65	171 ± 8.3	155 ± 2.59	1.10 A			
	175 ± 8.0					
	173 ± 8.7					
	164 ± 7.6					
	Mean = 171 ± 4.1					
Co-60	126 ± 3.6	122 ± 2.04	1.03 A			
	124 ± 3.3					
	126 ± 3.7					
	128 ± 3.2					
	Mean = 126 ± 1.7					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

\*\* Result determined by Resin Extraction/Gamma Spectral Analysis.

A=Acceptable

U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Soil**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi /g±1 sigma	REFERENCE LAB* pCi/g ±1 sigma	RATIO (1)
6/14/2012	E10153	SOIL	Ce-141	0.161 ± 0.021	0.137 ± 0.002	1.19 A
				0.169 ± 0.021		
				0.165 ± 0.022		
				0.156 ± 0.019		
			Mean = 0.163 ± 0.010	0.671 ± 0.011	0.97 A	
			0.717 ± 0.106			
			0.699 ± 0.110			
			0.599 ± 0.111			
			0.600 ± 0.124			
			Mean = 0.654 ± 0.056	0.292 ± 0.005	0.97 A	
0.286 ± 0.032						
0.283 ± 0.036						
0.269 ± 0.029						
0.292 ± 0.035						
Mean = 0.283 ± 0.017	0.441 ± 0.007	0.97 A				
0.434 ± 0.021						
0.426 ± 0.023						
0.437 ± 0.019						
0.413 ± 0.021						
Mean = 0.428 ± 0.010	0.154 ± 0.003	0.96 A				
0.137 ± 0.016						
0.166 ± 0.018						
0.143 ± 0.015						
0.145 ± 0.018						
Mean = 0.148 ± 0.008	0.221 ± 0.004	0.94 A				
0.206 ± 0.017						
0.201 ± 0.020						
0.230 ± 0.017						
0.198 ± 0.018						
Mean = 0.209 ± 0.009	0.213 ± 0.004	1.14 A				
0.268 ± 0.022						
0.255 ± 0.026						
0.209 ± 0.023						
0.237 ± 0.026						
Mean = 0.242 ± 0.012	0.333 ± 0.006	0.97 A				
0.332 ± 0.031						
0.331 ± 0.035						
0.282 ± 0.029						
0.342 ± 0.033						
Mean = 0.322 ± 0.016	0.594 ± 0.010	0.98 A				
0.588 ± 0.018						
0.568 ± 0.020						
0.617 ± 0.018						
0.549 ± 0.019						
Mean = 0.581 ± 0.009						

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.  
\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable  
U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Vegetation**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/g ±1 sigma	REFERENCE LAB* pCi/g ±1 sigma	RATIO (1)
6/14/2012	E10155	VEG	Ce-141	0.195 ± 0.013	0.204 ± 0.003	0.95 A
				0.195 ± 0.014		
				0.191 ± 0.012		
				0.196 ± 0.014		
				Mean = 0.194 ± 0.007		
			Cr-51	0.926 ± 0.076	0.996 ± 0.017	0.96 A
				0.902 ± 0.082		
				1.040 ± 0.071		
				0.943 ± 0.087		
				Mean = 0.953 ± 0.040		
Cs-134	0.363 ± 0.030	0.432 ± 0.007	0.89 A			
	0.402 ± 0.034					
	0.397 ± 0.028					
	0.379 ± 0.027					
	Mean = 0.385 ± 0.015					
Cs-137	0.476 ± 0.016	0.525 ± 0.009	0.91 A			
	0.470 ± 0.019					
	0.472 ± 0.016					
	0.487 ± 0.014					
	Mean = 0.476 ± 0.008					
Co-58	0.222 ± 0.013	0.229 ± 0.004	1.02 A			
	0.251 ± 0.015					
	0.236 ± 0.012					
	0.221 ± 0.012					
	Mean = 0.233 ± 0.006					
Mn-54	0.323 ± 0.014	0.328 ± 0.005	0.96 A			
	0.317 ± 0.017					
	0.295 ± 0.014					
	0.323 ± 0.013					
	Mean = 0.315 ± 0.007					
Fe-59	0.325 ± 0.018	0.317 ± 0.005	1.01 A			
	0.323 ± 0.021					
	0.330 ± 0.018					
	0.303 ± 0.016					
	Mean = 0.320 ± 0.009					
Zn-65	0.451 ± 0.029	0.494 ± 0.008	1.01 A			
	0.486 ± 0.036					
	0.536 ± 0.030					
	0.513 ± 0.027					
	Mean = 0.497 ± 0.015					
Co-60	0.832 ± 0.017	0.881 ± 0.015	0.95 A			
	0.861 ± 0.020					
	0.831 ± 0.016					
	0.815 ± 0.014					
	Mean = 0.835 ± 0.008					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.  
\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable  
U=Unacceptable

**TABLE 8-1 (Continued)**  
**INTERLABORATORY INTERCOMPARISON PROGRAM**  
**Gamma Analysis of Vegetation**

DATE	SAMPLE ID NO.	MEDIUM	ANALYSIS	JAF ELAB RESULTS pCi/g ±1 sigma	REFERENCE LAB* pCi/g ±1 sigma	RATIO (1)
9/13/2012	E10268	VEG	Ce-141	0.388 ± 0.017	0.385 ± 0.006	1.00 A
				0.404 ± 0.018		
				0.368 ± 0.015		
				Mean = 0.387 ± 0.010		
			Cr-51	0.625 ± 0.075	0.583 ± 0.010	1.02 A
				0.576 ± 0.083		
				0.584 ± 0.067		
				Mean = 0.595 ± 0.043		
			Cs-134	0.262 ± 0.029	0.255 ± 0.004	1.00 A
0.258 ± 0.033						
0.243 ± 0.025						
Mean = 0.254 ± 0.017						
Cs-137	0.456 ± 0.019	0.410 ± 0.007	1.13 A			
	0.486 ± 0.020					
	0.447 ± 0.015					
	Mean = 0.463 ± 0.010					
Co-58	0.232 ± 0.014	0.236 ± 0.004	1.01 A			
	0.252 ± 0.016					
	0.230 ± 0.012					
	Mean = 0.238 ± 0.008					
Mn-54	0.497 ± 0.020	0.460 ± 0.008	1.08 A			
	0.491 ± 0.021					
	0.496 ± 0.016					
	Mean = 0.495 ± 0.011					
Fe-59	0.385 ± 0.023	0.357 ± 0.006	1.08 A			
	0.389 ± 0.024					
	0.384 ± 0.017					
	Mean = 0.386 ± 0.012					
Zn-65	0.464 ± 0.033	0.452 ± 0.008	1.02 A			
	0.451 ± 0.034					
	0.471 ± 0.026					
	Mean = 0.462 ± 0.018					
Co-60	0.389 ± 0.015	0.357 ± 0.006	1.07 A			
	0.392 ± 0.016					
	0.368 ± 0.011					
	Mean = 0.383 ± 0.008					

(1) Ratio = Reported/Eckert & Ziegler Analytics, Inc.

\* Sample provided by Eckert & Ziegler Analytics, Inc.

A=Acceptable

U=Unacceptable



## 8.5 REFERENCES

- 8.5.1 Radioactivity and Radiochemistry, The Counting Room: Special Edition, 1994 Caretaker Publications, Atlanta, Georgia.
- 8.5.2 Data Reduction and Error Analysis for the Physical Sciences, Bevington P.R., McGraw Hill, New York (1969).