CONNECTICUT VANKEE ATOMIC POWER COMPANY

HADDAM NECK PLANT

362 INJUN HOLLOW ROAD . EAST HAMPTON, CT 06424-3099

April 30, 1999

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Haddam Neck Plant Annual Radiological Environmental Operating Report

In accordance with the requirements of the Haddam Neck Technical Specifications, Section 6.9.1.6 and the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual, an implementing document of the Haddam Neck Technical Specifications, two (2) copies of the Annual Radiological Environmental Operating Report are herewith submitted.

If you should have any questions, please contact Mr. G. P. van Noordennen at (860) 267-3938.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY

Russell A. Mellor

Vice President - Operations and Decommissioning

C00/

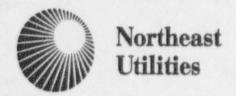
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ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

HADDAM NECK STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

JANUARY 1, 1998 - DECEMBER 31, 1998

DOCKET NO. 50-213 LICENSE NO. DPR-61

Prepared for the

CONNECTICUT YANKEE ATOMIC POWER COMPANY Haddam, Connecticut

By the

NORTHEAST NUCLEAR ENERGY COMPANY Waterford, Connecticut

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1. SUMMARY

The radiological environmental monitoring program for the Haddam Neck Station was continued for the period January through December 1998, in compliance with the Technical Specifications and the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual (REMODCM). This annual report was prepared for the Connecticut Yankee Atomic Power Company (CYAPC) by the Safety Analysis Branch of the Nuclear Engineering Department of Northeast Nuclear Energy Company (NNECO). Sample collection and preparation and gamma exposure mate measurements were performed by the Production Operations Services Laboratory (POSL). Laboratory analyses were performed by Duke Engineering and Services Environmental Laboratory (DESEL).

Thermoluminescent dosimeters (TLDs) were used to measure direct gamma exposure in the vicinity of the station and as far away as 12.5 miles. Radiochemical and radiological counting analyses of samples were performed to detect the presence of any station related radioactivity. Samples included air particulates collected on filters, milk, cow and goat feed (hay), broad leaf vegetation, well water, fruits, vegetables, river water, bottom sediment should be an always and fish. In evaluating the results of these analyses it is necessary to consider the variability of natural and man-made sources of radioactivity, distribution in the environment and uptake in environmental media. This variability is dependent on many factors including station release rates, past spatial variability of radioactive fall it from nuclear weapons tests and on-going edistribution of the fallout, contribution from cosmically produced radioactivity, ground water dynamics, soil characteristics, farming practices, and feed type. Significant variations in measured levels of radioactivity and be caused by any one of these factors. Therefore, these factors need to be considered in order to properly explain any variations in radiation detected and to distinguish between natural and station related radioactivity.

Haddam Neck is permanently shutdown. Primary activities at the Haddam Neck station are now focused on decommissioning. Even though the station is no longer generating power, decommissioning activities included processing and discharging of liquids containing radioactivity and releasing of airborne radioactivity. However, the levels of radioactivity released are significantly lower than releases during plant operation. The radiological monitoring of the environment through this program will continue to assure the health and safety of the public and workers are maintained at all times.

The predominant radioactivity detected by the monitoring program was that from outside sources, such as fallout from nuclear weapons tests and naturally occurring radionuclides. As typical of previous years, station related radioactivity was observed at some of the on-site gamma monitoring locations. The only other observation of station effects was tritium in well water at the on-site location.

As usual, Cesium-137 and Strontium-90 were measured in both cow and goat milk. These levels are a result of nuclear weapons testing in the 1960s and not the result of station decommissioning operations. This can be concluded because insufficient quantities of these isotopes have been released by the station to account for the measured concentrations. Higher levels of Cesium-137 and Strontium-90 were detected prior to initial plant operation and have been declining since the ban on nuclear weapons testing in the 1960s.

The radiation dose (dose equivalent commitment) to the general public from the station's discharges has been evaluated by two methods. One method utilizes measurements of station's discharges and conservative transport models and the other utilizes the measured concentrations of radioactivity in the environmental media.

The maximum whole body dose (station boundary) that could occur to a member of the general public was calculated to be 0.2 millirem. The average dose to a member of the public residing within 50 miles of the station is 0.00065 millirem. These doses are 0.8 percent and 0.0026 percent of the standard as set by the Environmental Protection Agency on the maximum allowable dose to an individual of the general public. The standards of the Environmental Protection Agency are a small fraction (less than 10 percent) of the 284 mrem per year normal Connecticut resident background radiation (NCRP94) and are designed to be inconsequential in regard to public health and safety. Station related doses are a small fraction of these standards and of the variation in natural background in Connecticut. They pose insignificant public health consequences.

2. PROGRAM DESCRIPTION

2.1. Sampling Schedule, Types, and Locations

The sample locations and the sample types and frequency of analysis are given in Tables 2-1 and 2-2 and Figures 2.1 and 2.2. The program as described here includes both required samples as specified in the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual and any extra samples.

Table 2-1 Environmental Monitoring Program Sampling Types and Locations

Location Number*	Location Name	Direction & Distance From Release Point	Sample Types
1-1	On-site - Mouth of Discharge Canal	1.1 Mi, ESE	TLD
2-1	Haddam-Park Rd.	0.8 Mi, S	TLD
3-I	Haddam-Jail Hill Rd.	0.8 Mi, WSW	TLD
4-I	Haddam-Ranger Rd.	1.8 Mi, SW	TLD, Air Particulate
5-1	On-site-Injun Hollow Rd.	0.4 Mi, NW	TLD, Air Particulate
6-1	On-site-Substation	0.5 Mi, NE	TLD, Air Particulate, Vegetation
7-1	Haddam	1.8 Mi, SE	TLD, Air Particulate
8-1	East Haddam	3.1 Mi, ESE	TLD, Air Particulate
9-1	Higganum	4.3 Mi, WNW	TLD, Air Particulate
10-I	Hurd Park Rd.	2.8 Mi, NNW	TLD
11-C	Middletown	9.0 Mi, NW	TLD
12-C	Deep River	7.1 Mi, SSE	TLD
13-C	North Madison	12.5 Mi, SW	TLD, Air Particulate
14-C	Colchester	10.5 Mi, NE	TLD
15-1	On-site Wells	0.5 Mi, ESE**	Well Water
16-C	Well-State Highway Dept. E. Haddam	2.8 Mi, SE	Well Water
17-C	Beyond 10 Miles	Beyond 10 Miles	Fruits & Vegetables
18-I	Site Boundary	0.4 Mi, NW	Vegetation
19-1	Cow Location #1	6.5 Mi, ENE	Milk
20-I	Cow Location #2	8.0 Mi, NE	Milk
21-1	Cow Location #3	11.0 Mi, SE	Milk
22-C	Cow Location #4	11.0 Mi, ENE	Milk
23-C	Goat Location #1	16.0 Mi, NNE	Milk
24-1	Goat Location #2	3.6 Mi, SSE	Milk
25-I	Within 10 Miles	Within 10 Miles	Fruits & Vegetables
26-1	CT River-Near Intake	1.0 Mi, WNW	Fish
27-C	CT River-Higganum Light	4.0 Mi, WNW	Shellfish
28-1	CT River-E. Haddam Bridge	1.8 Mi, SE	Bottom Sediment, River Water
28-X	CT River-E. Haddam Bridge	1.8 Mi, SE	Shellfish
29-1	Vicinity of Discharge	Within 0.3 Miles	Bottom Sediment, Fish
30-C	CT River - Middletown	9.0 Mi, NW	River Water, Bottom Sediment
		7.6 Mi, NW	Fish
31-1	Mouth of Salmon River	0.8 Mi, ESE	Shellfish
40-X	Near Intake Structure	0.1 Mi, SSW	TLD
41-X	Picnic Area	0.3 Mi, WNW	TLD
42-X	Environmental Trail	0.1 Mi, NW	TLD
43-X	Moodus - Rts 149 & 151	2.5 Mi, ENE	TLD
44-X	Shailerville, Horton Rd.	1.0 Mi, SE	TLD
45-X	Old Waste Gas Sphere Fence	0.1 Mi, E	TLD
46-X	Discharge Canal Fence	0.2 Mi, SE	TLD
47-X	Info Center	0.1 Mi, WNW	TLD

^{*} Key: 1 - Indicator C - Control X - Extra - sample not required

*The release points are the stack for terrestrial locations and the end of the discharge canal for aquatic locations.

^{**} New wells at 0.4 miles SE may be used as a replacement for this location.

Table 2-2 Technical Specification Sampling Frequency & Type of Analysis

	Exposure Pathway and/or Sample	Number of Locations	Sampling & Collection Frequency	Type of Analysis
1a.	Gamma Exposure - Environmental TLD	14	Monthly	Gamma Dose - Monthly
1b.	Gamma Exposure - Accident TLD	25	Quarterly ²	N/A [‡]
2.	Airborne Particulate	7	Continuous sampler - weekly filter change	Gross Beta - Weekly Gamma Spectrum - Quarterly on composite (by location), and on individual filter if gross beta is greater than 10 times the mean of the weekly control station's gross beta results
3.	Vegetation	4	One sample near middle & one near end of growing season	Gamma Isotopic or each sample
4.	Milk	6	Monthly	Gamma Isotopic on each sample - Monthly Sr-89 and Sr-90 - Quarterly
4a.	Pasture Grass	6	Sample as necessary to substitute for unavailable milk	Gamma Isotopic
5.	Well Water	2	Quarterly	Gamma Isotopic and Tritium on each composite
6.	Bottom Sediment	3	Semiannually	Gamma Isotopic
7.	River Water	2	Quarterly Sample - Indicator is continuous composite; Background is composite of six weekly grab samples	Quarterly - Gamma Isotopic and Tritium
8.	Fish (edible portion) - bullheads and, when available, perch or other edible fish	3	Quarterly	Gamma Isotopic - Quarterly
9.	Shellfish	2	Quarterly	Gamma Isotopic - Quarterly

^{*} Accident monitoring TLDs to be dedosed at least quarterly

Figure 2.1 Haddam Neck Station Sample Stations

Figure 2.2 Haddam Neck Station Inner Sample Stations

2.2. Samples Collected During Report Period

The following table summarizes the number of samples of each type collected during the present reporting period:

Sample Type	Number of Technical Specification Required Samples	Number of Technical Specification Required Samples Analyzed	Number of Extra Samples Analyzed
Gamma Exposure - Environmental TLD	168	168	96
Air Particulates	364	364	0
Dairy Milk	48	44*	0
Goat Milk	24	18*	0
Pasture Grass	**	0*	3***
Well Water	8	8	8
Fruit & Vegetables	8	8	0
Broad Leaf Vegetation	4	4	9
River Water	8	8	0
Bottom Sediment	6	6	0
Fish	24	24	0
Shellfish	8	8	4
Total All Types	670	660	120

- * Due to sample unavailability, less than required number of samples were obtained.
- ** Sample as necessary, during the months of April through December, to substitute for unavailable milk.
- *** Three of ten unavailable milk samples occurred during the months when a pasture grass sample is required as a substitute. Hay was collected in lieu of pasture grass due to unavailability of grass.

3. RADIOCHEMICAL RESULTS

3.1. Summary Table

In accordance with the Radiological Effluent Monitoring Manual (REMM), Section F.1, a summary table of the radiochemical and radiological analyses results has been prepared and is presented in Table 3-1. All analysis results are summarized including analysis results of extra, non-required samples.

In the determination of the mean, the data was handled as recommended by the Health and Safety Laboratory, Idaho and NUREG/CR-4007 (Sept. 1984): all valid data, including negative values and zeros were used in the determination of the mean (see Part 3.2).

A more detailed analysis of the data is given in Section 4.0 where a discussion of the variations in the data explains many aspects that are not evident in the Summary Table because of the basic limitation of data summaries.

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SLAWARY
COMNECTICUT VANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JAMUARY - DECEMBER 1998

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROCRAM SUMMARY
COMNECTICUT YANKEE ATCHIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JAMUARY - DECEMBER 1998

C5-137 18 (-1.5 · 2.9) 6 (NIES NE (-1.5 · 2.2) (-3.4 · 1.6)	MEDIUM OR PATHUAY	AMALYSIS AND TOTAL NUMBER OF AMALYSES	LOWER LIMIT OF	LOCATIONS APERN	LOCATION #,	LOCATION WITH RIGHEST ANNUAL MEAN OCATION #, MEAN	LOCATIONS	WRW Y
CS-137 18	SAMPLED	GAMMA 32,12	(LLD) (A) 15	(RANGE)(B -0.3	AND DIRECTION LOC # 20 8 MILES NE	(RANGE)(B	RANGE)(8 -0.6	0
LA-140 70 (-4 - 3) 110C# 22C (-1.8 - 4.) (-2 - 4) (-		CS-137	18	0.	=	0.	0.	0
LK SR 4, 4 (-5.1 - 4.0) 11 MILES ENE (-1.8 - 4.1) (-1.8 - 4.1) SR-89 (0.8 - 4.7) 3.6 MILES SSE (0.8 - 4.7) (-2.4 - 8.6) SR-90 (4.6 - 9.0) 3.6 MILES SSE (4.6 - 9.0) (0.6 - 5.1) LODINE 10, 8 15 (-2.3 - 4.30) 16 MILES WHE (-2.5 - 2.4) (-2.5 - 2.4) GAWRA 10, 8 15 (-2.3 - 2.1) 16 MILES WHE (-2.5 - 2.4) (-2.5 - 2.4) CS-137 18 (-3.5 - 4.30) 16 MILES WHE (-2.5 - 11.4) (-2.5 - 11.4) BA-140 70 (-6 - 1) 16 MILES WHE (-6.8 - 3.7) (-6.8 - 3.7) CAMMA 1, 2 0.06 0.036 100 # 236 (-0.036) (-0.036) (-0.019)		BA-140	DZ.	0.	LOC # 22C	2	- 2 -	0
SR-90 SR-90		LA-140	ю	-5.1 -	LOC # 22C 11 MILES ENE	5.	5.	0
SR-90 (4.6 - 9.0) 3.6 MILES SSE (4.6 - 9.0) (0.6 - 5.1) 100 ME 10	DAT MILK PCI/L)	4, 68-89	:	9.	1.6 WILES SSE	1 00	0	0
100 INE 10, 8 1		SR-90	:		10C # 24 3.6 Miles sse	(4.6 - 9.9)	0	0
CS-137 18 4.0 LOC#23C (-2.5 - 2.4) (-2.5 - 2.4) (-2.5 - 2.4) CS-137 18 4.0 LOC#23C (-2.5 - 11.4) (-2.5 - 11.4) (-2.5 - 11.4) (-2.5 - 11.4) BA-140 70 (-6 - 1) 16 MILES NNE (-6 - 3) (-6.8 - 3.7) LA-140 25 -2.0 LOC#23C (-6.8 - 3.7) (-6.8 - 3.7) CAMPMA 1, 2 0.06 0.036 LOC#20 (0.036 - 0.036) (-0.020 - 0.018)			1	26.0	1 5	.3.51	0.50	0
CS-137 18 (1.3 - 11.3) 16 MILES NNE (2.5 - 11.4) (2.5 - 11.4) BA-140 70 (-6 - 1) 15 MILES NNE (-6 - 3) (-6 - 3) LA-140 25 (-6.8 - 1.1) 16 MILES NNE (-6.8 - 3.7) (-6.8 - 3.7) GAMMA 1, 2 0.06 0.036 LOC# 20 (0.036 - 0.036) (-0.0200.019 1-131		10,	15	0.1	1 5	-2.5 -	0.2	0
140 70 (-6-1) 16 MILES NNE (-6-3) (-6-3) 140 25 (-6.8-1) 16 MILES NNE (-6.8-3.7) (-6.8-3.7) 1, 2 0.06 (0.036 LOC # 20 (0.036 - 0.018)		CS-137	18	4.	2	2.5 -	15.	0
LA-140 25 -2.0 LOC# 23C -0.3 -0.3 (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7) (-6.8 - 3.7)		BA-140	202	٠.	1 5	0. 9.	٠.	0
GAMPMA 1, 2 0.06 0.036 LOC # 20 0.036 -0.019 I-131 (0.036 - 0.036) 8 MILES NE (0.036 - 0.036) (-0.0200.018)		LA-140	82	-6.8	=	0.3	0.3	0
	ASTURE RASS PC1/6)	1,	90.0		3	0.036 - 0.036)	(-0.0200.018)	0

TABLE 3-1
ENVIRONHENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POMER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

MEDIUM OR PATRANT SAMPLED	TOTAL MUMBER OF ANALYSES PERFORMED CS-134	OF DETECTION (4.) 0.06	LOCATIONS REAN (RANGE)(B) -0.017	LOCATION #1 PT	OCATION #, MEAN DISTANCE RANGE;(8) LOC # 23C -0.011	LOCATIONS MEAN (RANGE)(B) -0.011	MIN (C)
	CS-137	0.08	0.000 - 0.000)	1 3	036	1 32	0
	84-140	:	0.012	LOC # 20 8 MILES NE	0.012 (0.012)	-0.046	0
	LA-150	;	0.014 - 0.014)	LOC # 20 8 MILES NE	(0.014 - 0.014)	-0.053	0
GROUNDWATER (°CI/L)	GAMMA 12, 4 MM-54	\$	-0.5	LOC # 15 0.5 MILES ESE	(-2.3 - 2.3)	(-2.0 - 0.5)	0
	85-00	15	(-2.0 - 1.7)	LOC # 15 0.5 MILES ESE	(-2.0 - 1.7)	.1.9	0
	FE-59	30	(-4.6 - 2.9)	LOC # 16C 2.8 MILES SE	(-0.6 - 5.9)	1.5	0
	09-03	5	-0.2	10C # 16C 2.8 MILES SE	(-0.7 - 1.6)	(-0.7 - 1.6)	0
	ZN-65	30	1.9 (-6.0 - 8.4)	LOC # 16C 2.8 MILES SE	3.9 (-7.7 - 18.8)	3.9 (-7.7 - 18.8)	0
	2R-95	30	(-4.6 - 3.4)	10C # 16C 2.8 MILES SE	(-9.6 - 2.1)	(-0.6 - 2.1)	0
	26-8N	15	(-3.8 - 0.7)	1.0C # 16C 2.8 MILES SE	(-2.4 - 1.4)	(-2.4 - 1.4)	0
	1-131	;	0- 0- (1)	10C # 16C 2.8 MILES SE	3 (-1 - 9)	3 (-1 - 9)	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATONIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

PATHWAY SAMPLED	ANALYSIS AND TOTAL MUMBER OF ANALYSES PERFORMED CS-134	DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS HEAH (RANGE)(B)	LOCATION WITH R LOCATION #, DISTANCE AND DIRECTION	LOCATION WITH MIGHEST ANNUAL MEAN COCATION #, MEAN M	LOCATIONS NEAN (RANGE)(B)	MRW (C)
	3	2	(-3.0 - 1.1)	0.5 MILES ESE	(1-3.0 - 1.1)	(-1.2 - 0.9)	•
	CS-137	81	(-0.5 - 2.1)	LOC # 15 0.5 MILES ESE	(-0.5 - 2.1)	(-2.40.2)	0
	BA-140	09	(5 -4- 5)	10C # 15 0.5 MILES ESE	(5 . %-)	(.5 . 3)	0
	LA-140	53	(9 - 5 - 6)	10C # 15 0.5 MILES ESE	(9 - 5 -)	(-6 - 3)	0
	TRITIUM 12, 4 H-3	2000	432 (215 - 633)	LOC # 15 0.5 MILES ESE	432 (215 - 633)	(0 . 63)	0
FRUITS AND VEGETABLES (PCI/G)	GAMMA 4, 4 BE-7	·	(0.05 - 0.51)	LOC # 25	(0.05 - 0.51)	(0.00 - 0.35)	0
	K-40	;	(0.89 - 4.05)	LOC # 17C >10 MILES	2.72 (0.50 - 5.58)	(0.50 · 5.58)	0
	MN-54	:	-0.006	10C # 17C	-0.004	-0.004	0
	85-00	:	(-0.006 - 0.006)	LOC # 17C >10 MILES	0.002 (-0.016)	0.002	0
	09-00	·	0.009 (0.024)	LOC # 25	(0.000 - 0.024)	-0.005	0
	ZR-95	:	(0.003 - 9.022)	LOC # 25	0.012	-0.006	0
	NB-95	;	(0.001 - 0.017)	LOC # 25 <10 MILES	0.010 (0.0017)	0.006	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMMECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JAMJARY - DECEMBER 1998

PATHWAY SAMPLED	ANALYSIS AND TOTAL NUMBER OF AMALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS MEAN (PANGE)(B)	LOCATION #, LOCATION #, DISTANCE AND DIRECTION	LOCATION #1, MIGHEST ANNUAL MEAN LOCATION #, MEAN DISTANCE (RANGE)(B)	LOCATIONS LOCATIONS MEAN (RANGE)(B	MS (B)
	RU-103	;	(-0.002 - 0.013)	10C # 25	0.006 (-0.002 - 0.013)	-0.005 (-0.015 - 0.0	0.0173
	1-131	0.06 (6)	-0.005	LOC # 17C >10 MILES	0.017	(-0.020 - 0.051)	5
	CS-134	90.0	0.000	LOC # 25 <10 MILES	0.000 (-0.015)	-0.008	6
	CS-137	0.08	-0.003	10C # 17C >10 MILES	-0.002	-0.902	-
	RA-226	:	(-0.089 - 0.221)	LOC # 17C >10 MILES	0.377	(-0.106 - 0.767)	-
	TH-228	;	0.029	10C # 25 <10 MILES	0.029	(-0.024 - 3.034)	-
BROADLEAF VEGETATION (PCI/6)	GAMMA 13, BE-7	;	(0.39 - 2.41)	LOC # 18 0.4 MILES NU	1.39 (0.39 - 2.41)		
	K-40	:	3.06	10C # 6 0.5 MILES NE	3.57 (1.40 - 6.50)	(. ; .)	1
	MN-54	:	-0.000	LOC # 18 0.4 MILES NW	0.002		1 -
	85-03	;	-0.003	LOC # 18 0.4 MILES NU	-0.003		
	09-03	:	(-6.012 - 6.009)	LOC # 18 0.4 MILES NW	0.001		1
	ZR-95	:	0.001	LOC # 18 0.4 MILES NW	0.003		

TABLE 3-1
ENVIRONHENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JAMUARY - DECEMBER 1998

NB-95	MEDIUM OR PATHMAY SAMPLED	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS NEAN (RANGE)(B)	LOCATION #, LOCATION #, DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN OCATION #, MEAN DISTANCE DISTANCE (RANGE)(8)	CONTROL LOCATIONS MEAN (RANGE)(8)	# OF KRRM (C)
1-131 0.06 0.0004 0.5 MILES NA (-0.003 ()) (-0.015 - 0.009) 0.5 MILES NA (-0.003 - 0.006) ()) (-0.017 - 0.009) 0.5 MILES NA (-0.003 - 0.005) ()) () () () () () () () () () () () () () (N8-95	:	Jen I	LOC # 6 0.5 MILES NE	12		0
1-131 0.06		RU-103	;	100	LOC # 6 0.5 MILES NE	-		0
CS-134 0.06 (-0.011 - 0.028) 0.4 MILES MA (-0.011 - 0.011) () CS-137 0.08 (-0.014 LOC # 18 (-0.032 - 0.992) () RA-2260.025 LOC # 18 (-0.026 - 0.257) () TH-228 (-0.050 - 0.457) 0.4 MILES MA (-0.035 - 0.257) () TH-228 (-0.105 - 0.257) 0.5 MILES ME (-0.105 - 0.257) () MM-54 15 (-0.15 - 0.9) 0.0 MILES ME (-0.105 - 0.257) () CO-58 15 (-1.0 - 0.9) 1.8 MILES SE (-0.3 - 1.6) (-0.2 - 0.4) TE-59 30 (-1.3 - 1.1) 9.0 MILES MA (-3.8 - 2.1) (-3.8 - 2.1) CO-60 15 (-0.1 - 0.1) 9.0 MILES MA (-0.2 - 0.3) (-0.2 - 0.3)		1-131	90.0	1 2	LOC # 18 0.4 MILES NU	1 2		0
C5-137 0.08		CS-134	0.06	(-0.011 - 0.028)	LOC # 18 0.4 MILES NW	-		0
TH-228 0.025 0.457) 0.4 MILES NW (-0.206 - 0.222) () TH-228 0.040 1.0C # 6 (-0.105 - 0.257) () CAMPIN 4, 4 (-10.105 - 0.257) 0.5 MILES NE (-0.105 - 0.257) () MN-54 15 (-0.3 - 1.6) 1.6 MILES NW (-16 - 72) (-16 - 72) CO-58 15 (-0.3 - 1.6) 1.8 MILES SE (-0.3 - 1.6) (-0.2 - 0.4) FE-59 30 (-1.3 - 1.1) 9.0 MILES NW (-3.8 - 2.1) (-3.8 - 2.1) CO-60 15 (-0.1 - 0.1) 9.0 MILES NW (-0.2 - 0.3) (-0.2 - 0.3)		CS-137	0.08		LOC # 18 0.4 MILES NW	122		0
TH-228 (-0.105 - 0.257) 0.5 MILES NE (-0.105 - 0.257) () (CAMBAN 4, 4 (-31 - 9) 9.0 MILES NU (-16 - 72) (-16 - 72) K-40 MN-54 15 (-0.3 - 1.6) 1.8 MILES SE (-0.3 - 1.6) (-0.2 - 0.4) CO-58 15 (-1.0 - 0.9) 1.8 MILES SE (-1.0 - 0.9) (-1.7 - 0.1) FE-59 30 (-1.3 - 1.1) 9.0 MILES NU (-3.8 - 2.1) (-3.8 - 2.1) CO-60 15 (-0.1 - 0.1) 9.0 MILES NU (-0.2 - 0.3) (-0.2 - 0.3)		RA-226	:	1 10	LOC # 18 0.4 MILES NW	800		0
GAMPIA 4, 4		TH-228	;		LOC # 6 0.5 MILES NE	. 055		0
15 (-0.3 - 1.6) 1.8 MILES SE (-0.3 - 1.6) (-0.2 - 0.4) 15 (-1.0 - 0.9) 1.8 MILES SE (-1.0 - 0.9) (-1.7 - 0.1) 30 (-1.31.1) 9.0 MILES NW (-3.8 - 2.1) (-3.8 - 2.1) 15 (-0.1 - 0.1) 9.0 MILES NW (-0.2 - 0.3) (-0.2 - 0.3)	ER WATER	GAMMA K-40		-16	10C # 30C	-	-	0
15 (-1.0 - 0.9) 1.8 MILES SE (-1.0 - 0.9) (-1.70.1) 30 (-1.31.1) 9.0 MILES NW (-3.8 - 2.1) (-3.8 - 2.1) 15 (-0.1 - 0.1) 9.0 MILES NW (-0.2 - 0.3) (-0.2 - 0.3)		MN-54	15	9.0	1.8 MILES SE	4.0	0	0
30 -1.2 LOC # 30C -1.1 (-3.8 - 2.1) (-3.8 - 2.1) (-3.8 - 2.1) (-3.8 - 2.1) (-3.8 - 2.1) (-3.8 - 2.1) (-0.1 - 0.1) 9.0 HILES NW (-0.2 - 0.3) (-0.2 - 0.3)		85-00	15	m	1.8 MILES SE	m.	0.	0
15 -0.0 LOC # 30C 0.1 0.1 (-0.1 0.1 (-0.2 - 0.3) (-0.2 - 0.3)		FE-59	30	(-1.31.1)	LOC # 30C 9.0 MILES NW	5.	-	0
		09-03	15	0	LOC # 30C 9.0 MILES NU	-	-	0

ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY CONNECTICUT YANKEE ATOMIC POWER COMPANY, NADOAM NECK PLANT DOCKET 50-213

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MEDIUM OR PATHMAY SAMPLED	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED 7N-45	DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS MEAN (RANGE)(B)	LOCATION WITH H LOCATION W, DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN ECATION #, DISTANCE DISTANCE (RANGE)(8)	LOCATIONS MEAN (RANGE)(B)	NRW (C)
		3	(-1.3 - 1.4)	9.0 MILES NW	(-1.2 - 4.8)	(-1.2 - 4.8)	•
	56-42	30	(-4.0 - 5.3)	1.8 MILES SE	(-4.0 - 5.3)	(-1.0 - 1.0)	0
	MB-95	15	(-1.6 - 1.8)	10C # 30C 9.0 MILES NW	(0.2 - 1.7)	(0.2 - 1.7)	0
	1-131	·	31 (16 - 56)	LOC # 28	31 (16 - 56)	(11 - 9-)	0
	CS-134	15	(-0.7 - 0.2)	10C # 30C	(-0.7 - 0.8)	(-0.7 - 0.8)	0
	CS-137	18	(-0.5 - 0.1)	LOC # 30C 9.0 MILES NW	(-1.0 - 1.6)	(-1.0 - 1.6)	6
	BA-140	(H) 09		10C # 30C	(-3 - 6)	(-3 - 6)	0
	LA-140	15 (H)	.9 -7)	LOC # 30C 9.0 MILES NW	(9 - 4-)	(9 - 4 - 9)	0
	TRITIUM 4, 4	2000	274 (177 - 379)	1.8 MILES SE	274 (177 - 379)	. 136 49)	0
SOTTON SEDIMENT (PCI/G)	GAMPSA 4, 2 K-40	:	(8.9 - 11.5)	LOC # 30C 9.0 MILES NU	10.8	10.8	0
	MN-54	ı	0.00 (-0.02)	LOC # 29 0 MILES N/A	(0.01 - 0.02)	(-0.02 - 0.02)	0
	85-00	ı	0.00 (-0.02 - 0.01)	LOC # 28 1.8 MILES SE	(0.00 - 0.01)	0.00 (-0.01 - 0.02)	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

28-95	MEDIUM OR PATHWAY SAMPLED	AMALYSIS AND TOTAL NUMBER OF AMALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS MEAN (RANGE)(B)	LOCATION #1TH HI LOCATION #, DISTANCE AND DIRECTION	LOCATION #, MEMEST ANNUAL MEAN OCATION #, MEAN DISTANCE MEAN (RANGE)(B)	CONTROL LOCATIONS MEAN (RANGE)(B)	NRM (C)
1-131 -0.03 1.00 # 29 (-0.05 - 0.05) (-0.05 - 0		99-03	:	*	10C # 29	60	(0.00 - 0.03)	0
HB-950.03 - 1.00 # 29		ZR-95	·	0	LOC # 29 0 MILES W/A	1 6	-0.02	0
CS-134 0.15 (-0.07 - 0.00) 9.0 MILES MA (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.00) (-0.02 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.01 - 0.01) (-0.02 - 0.01) (-0.04 - 0.12) (-0.06 - 0.12) (-0.04 - 0.13) (-0.06 - 0.13) (-0.03 - 0.03) (-0.01 - 0.00) (-0.01 - 0.01) (-0.01 - 0.00) (-0.01 - 0.01) (-0.01 - 0.00) (-0.01 - 0.		NB-95	·	.0.01	LOC # 29 0 MILES W/A		-0.04	0
CS-134 0.15		1-131	;	411	0.9 WILES NW	-0.01	-0.01	0
CS-137 0.18 (0.06 - 0.16) 10C # 29 (0.08 - 0.16) (0.06 - 0.16) 0 MILES M/A (0.08 - 0.16) (0.06 - 0.16) (0.06 - 0.16) (0.06 - 0.16) (0.06 - 0.16) (0.08 - 0.16) (0.06 - 0.16) (0.08 - 0.16) (0.08 - 0.16) (0.08 - 0.16) (0.08 - 0.16) (0.08 - 0.16) (0.08 - 0.16) (0.08 - 0.16) (0.08 - 0.17) (0.08 - 0.17) (0.08 - 0.17) (0.08 - 0.17) (0.08 - 0.17) (0.08 - 0.17) (0.08 - 0.18) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.17) (0.09 - 0.09 - 0.09 (0.09 - 0.09) (0.09		CS-134	0.15	0.0	LOC # 30C	m	(0.01 - 0.01)	0
1.52 10C # 29 2.03 0.076 0.077 0.054 0.011 0.056 0.056 0.056 0.056 0.056 0.056 0.056 0.057 0.059 0.059 0.056 0.058 0.059 0.0		CS-137	0.18	W	LOC # 29 0 MILES N/A		(0.04 - 0.16)	0
8. 4 0.062 LOC # 28 (0.62 - 0.69) (0.42 - 0.06 (0.05 - 0.06) (0.42 - 0.06 (0.06 - 0.07) (0.42 - 0.07) (0.06 - 0.07) (0.42 - 0.07) (0.06 - 0.07) (0.07 - 0.07)		RA-226	:	5.	LOC # 29 0 MILES N/A	1 0	(0.76 - 1.22)	0
GANMA 8, 4 0.04 LOC # 28 0.08 -0.17) (-0.01 -0.0 0.08		TH-228	:	122	1.8 MILES SE	1 28	(0.42 - 0.88)	0
(-0.1 - 0.4) (**MILES MNW (**0.1 - 0.4) (**0.1 - 0.0) (**0.1 - 0.0) (**0.1 - 0.0) (**0.1 - 0.0) (**0.1 - 0.0) (**0.1 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0) (**0.0 - 0.0)	SHELLFISH (PCI/G)	60	:		1.8 MILES SE	1 26 1	(-0.21 - 0.03)	0
0.03 LOC # 31 0.11 -0.06 (-0.05) 0.8 MILES ESE (-0.03 - 0.25) (-0.06 - 0.05) 0.00 LOC # 28 0.01 0.01 (-0.05) (-0.01 - 0.03) (-0.01 - 0.		K-40	:		LOC & 27C	***	(0.1 - 0.4)	0
0.13 0.00 LOC # 28 0.01 0.01 0.07 (-0.02 - 0.03) 1.8 MILES SE (-0.01 - 0.03) (-0.01 -		CR-51	:	6 1	LOC # 31 0.8 MILES ESE	1.0	-0.02	0
		95-NM	0.13		LOC # 28 1.8 MILES SE	(-0.01 - 0.03)	0.00	0

TABLE 3-1
ENVIRCHMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
CONNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

MEDIUM OR PATHMAY SAMPLED

MRN (C)	0	0	0	0	0	0	0	0	0	0	0	0
LOCATIONS MEAN (RANGE)(B)	(-0.01 - 0.02)	(-0.04 - 0.01)	(-0.01 - 0.01)	-0.00 (-0.05)	(-0.01 - 0.03)	(-0.010.00)	(-0.02 - 0.03)	(-0.09 - 0.29)	(0.00 - 0.01)	(-0.01 - 0.04)	(-0.04 - 0.01)	0.00 (-0.01)
LOCATION #, DISTANCE MEAN (RANGE)(B)	(-0.01 - 0.02)	(-0.03 - 0.05)	(-0.02 - 0.02)	-0.09	(-0.01 - 0.03)	0.00	0.00 (-0.03)	(0.05 - 0.17)	(0.00 - 0.01)	(-0.01 - 0.04)	-0.00 - 0.01)	0.00 (-0.01 - 0.02)
LOCATION #, DISTANCE AND DIRECTION	LOC # 27C	10C # 31 0.8 MILES ESE	1.8 MILES SE	LOC # 27C	LOC # 27C	10C # 31 0.8 MILES ESE	LOC # 27C 4 MILES WHY	10C # 28 1.8 MILES SE	LOC # 27C	LOC # 27C	LOC # 31 0.8 MILES ESE	1.8 MILES SE
LOCATIONS MEAN (RANGE)(8)	(-0.03 - 0.01)	(-0.03 - 0.65)	-0.00 - 0.02)	-0.02	(-0.01 - 0.03)	(-0.01 - 0.01)	(-0.02 - 0.01)	(-0.21 - 0.17)	-0.00 (-0.02)	-0.06	(-0.02 - 0.01)	-0.00 (-0.02)
DETECTION (LLD) (A)	0.13	0.26	0.13	0.26		:	:	:	; .	:	0.13	0.15
TOTAL NUMBER OF ANALYSES PERFORMED		FE-59	09-00	ZN-65	28-95	K8-95	RU-103	RU-106	AG-110M	1-131	CS-134	CS-137

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

MEDIUM OR	ANALYSIS AND TOTAL NUMBER	DETECTION	LOCATIONS LOCATIONS	LOCATION #,	LOCATION WITH HIGHEST ANNUAL MEAN	LOCATIONS	CHIS
SAMPLE	PERFORMED	(LLD) (A)	(RANGE)(B)	AND DIRECTION	(RANGE)(B)	MEAN (RANGE)	(8)
	RA-226	:	(-0.26 - 0.80)	1.8 MILES SE	(-0.26 - 0.80)	(0.00 0.19	0.31)
	TH-228	:	(0.09 - 0.32)	10C # 31 0.8 MILES ESE	(0.09 - 0.32)	(0.09 - 0	0.23)
FISH (ALL TYPES) (PCI/G)	GAMMA 16, 8 BE-7		.0.01 - 0.17)	LOC # 29 0 MILES H/A	(-0.07 - 0.17)	(-0.12 - 0	0.11)
	к-40	:	3.4 (2.6 - 4.0)	LOC # 26 1 MILES UNW	3.5 (3.0 - 4.0)	3.4	4.2)
	CR-51	:	0.06	LOC # 26 1 MILES WWW	(-0.04 - 0.29)	-0.05	0.03)
	MK-54	0.13	0.00 (-0.02)	LOC # 29 0 MILES N/A	(0.00 - 0.02)	0.00	0.01)
	85-00	0.13	-0.00	10C # 29 0 MILES H/A	(-0.01 - 0.01)	0.00	0.02)
	FE-59	0.26	-0.01	LOC # 29 0 MILES N/A	-0.01	-0.02	0.02)
	09-00	0.13	(-0.02 - 0.02)	LOC # 26 1 MILES SAW	(-0.01 - 0.02)	0.00 (-0.00-)	0.043
	2N-65	0.26	-0.01	LOC # 26 1 MILES WAW	-0.00 (-0.04)	-0.02	0.00)
	ZR-95	:	-0.00	LOC # 30C 7.6 MILES NW	(-0.01 - 0.63)	(-0.01 - 0.01	0.03)
	NB-95	;	-0.00	LOC # 26 1 MILES WAY	-0.00	-0.01	(2)

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMMECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
BOCKET 50-213
JANUARY - DECEMBER 1998

WRW (C)	0	0	0	0	0	0	0	0
LOCATIONS MEAN	(RANGE)(B) 0.01 (-0.00 - 0.02)	(-6.10 - 0.19)	(-0.03 - 0.01)	(-0.03 - 0.15)	-0.00 - 0.013	(-0.01 - 0.03)	(-0.77 - 0.68)	-0.00
LOCATION WITH HIGHEST AMBUAL MEAN OCATION #, MEAN MEAN	(RANGE)(B) 0.01 (-0.00 - 0.02)	0.05 (-3.05 - 0.24)	(-0.02 - 0.02)	0.02	-0.00 - (-0.02)	0.02	0.20 (-0.97 - 0.52)	0.02 (-0.02)
LOCATION WITH HE LOCATION #, DISTANCE	LOC # 30C 7.6 MILES NW	LOC # 26 1 MILES WAW	LOC # 29 0 MILES H/A	10C # 30C 7.6 HILES WW	LOC # 26 1 MILES WAW	LOC # 29 0 MILES N/A	1 MILES WWW	LOC # 29 0 MILES N/A
ALL INDICATOR LOCATIONS MEAN	(-0.03 - 0.01)	(-0.07 - 0.24)	-0.00	-0.01	-0.00	(-0.01 - 0.04)	(-0.30 - 0.66)	0.02
DETECTION	(10) (4)	;	:	;	0.13	0.15	:	:
TOTAL NUMBER OF ANALYSES	RU-103	RU-106	AG-110M	1-131	CS-134	CS-137	RA-226	TH-228
SATHWAY	SAMPLED							

NOTES FOR TABLE 3-1

A. For gamma measurements the (Minimum Detectable Level) MDL's \simeq LLD + 2.33. For all others, MDL = 2 x (the standard deviation of the background). These MDL's are based on the absence of large amounts of interfering activity (excluding naturally occurring radionuclides). Deviations by about factors of 3 to 4 can occur.

The LLD at a confidence level of 95% is the smallest concentration of radioactive material in a sample that will be detected with a 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 S_b}{E * V * 2.22 * Y * \exp(-\lambda \Delta t)}$$

where

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

 S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 is the number of transformation per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

λ is the radioactive decay constant for the particular radionuclide

 Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting

It should be recognized that LLD is a defined a priori (before the fact) limit representing the capability of a measurement system and not an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these a priori LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

- B. Analytical results are handled as recommended by HASL ("Reporting of Analytical Results from HASL," letter by Leo B. Higginbotham) and NUREG/CR-4007 (Sept. 1984). Negative values were used in the determination of mean.
- C. Nonroutine reported measurements (NRM's). These are results of samples that exceed the report levels of Table E-2 of the Radiological Effluent Monitoring Manual.
- D. First number is the number of indicator measurements, the second is the number of control measurements.
- E. Assuming 270 m³
- F. Assuming 1080 m3
- G. LLD for leafy vegetables.
- H. LLD from the end of the sample period.

3.2. Data Tables

The data reported in this section are strictly counting statistics. The reported error is two times the standard deviation (2σ) of the net activity. Unless otherwise noted, the overall error (counting, sample size, chemistry, errors, etc.) is estimated to be 2 to 5 times that listed. Results are considered positive when the measured value exceeds 1.5 times the listed 2σ error (i.e., the measured value exceeds 3σ).

Because of counting statistics, negative values, zeros and numbers below the Minimum Detectable Level (MDL) are statistically valid pieces of data. For the purposes of this report, in order to indicate any background biases, all the valid data are presented. In instances where zeros are listed after significant digits, this is an artifact of the computer data handling program.

Data are given according to sample type as indicated below.

- 1. Gamma Exposure Rate
- 2. Air Particulates, Gross Beta Radioactivity
- 3. Air Particulates, Weekly I-131*
- 4. Air Particulates, Gamma Isotopic
- 5. Air Particulates, Quarterly Strontium*
- 6. Soil*
- 7. Milk Dairy Farms
- 8. Milk Goat Farms
- 9. Pasture Grass**
- 10. Well Water
- 11. Reservoir Water*
- 12. Fruits & Vegetables
- 13. Broad Leaf Vegetation
- 14. River Water
- 15. Bottom Sediment
- 16. Shellfish
- 17. Fish

^{*} This type of sampling or analysis was not performed, therefore there is no table.

^{**} Pasture grass was not available, therefore feed (hay) was collected as a substitute

TABLE 1 MONTHLY GAMMA EXPOSIRE RATE (UR/HR) *

LOCATIONS

110	1.	.2				-						
-	9.0	8.6	8.7	8.6	9.0	9.0	9.3	9.2	9.5	8.9	9.1	
	0.	-	9-	-		0.	۲.		0.	0.	-	•
10	9.2	0.0	8.7	6.9	8.9	8.9	8.6	8.8	9.1	8.8	8.8	
	0.	0.	0.	0.	-	0	0.	-		-	*	
0	7.7	7.4	7.4	7.6	7.7	7.5	7.7	7.6	8.0	7.5	7.8	
	-	.2	-	.2	-	.2		۲.	-	2.	0	,
60	8.6	8.6	8.6	0.0	8.6	0.6	8.7	9.5	0.1	8.9	8.9	0
	0.	15.	-	.2		-	0.	-	-	0.	0.	
7	7.1	6.6	7.0	6.8	7.3	6.8	7.4	6.9	7.7	7.0	7.4	
	-	-	-	2.		-	•	-	-	-	0.	
9	7.1	6.9	6.8	7.2	7.1	7.1	7.1	7.4	7.5	7.3	7.1	
	-	-	0.	-		0.	0.	-	0.	-	2.	
2	8.0	7.8	8.0	4.7	8.3	8.1	8.5	8.4	8.9	8.3	8.5	
	.2	-:	.2	0.	2.	0.	.2	0.	-	-	0.	•
4	9.9	6.9	9.9	6.9	6.8	7.1	6.9	7.3	7.1	7.1	7.0	4
	0.	0.		0.	2.	-	-	-	-	•	-	•
m	7.5	7.5	7.3	7.8	7.3	7.7	7.7	8.1	60	7.8	7.8	4
	0.	.3	0.	.2	0.	-		.2	0.	2	-	•
2	7.0	6.9	6.9	7.0	7.0	7.0	7.3	7.6	2.6	7.1	7.3	20
	.2	0.	-	0.	.2	0.	0,	**	.2	-		0
-	7.2	7.2	7.1	7.2	7.4	7.4	7.7	7.7	7.9	7.4	7.5	7 2
ER 100	80	90	50	86	98	86	96	96	98	98	38	200

ERICO	120		130	2	-	140	4	×0%	4	×13	4	42x	4	43X	4	X99	4	45x	3	16K	4	X.
86	7.4	0	6.8	-	8.7	-	7.2	1		1	1		-			1	9.6	-	7.2		7.00	1.
86		-	6.5		8.6		7.2										9.7		7.1		7.9	
98		2	6.9	0.	8.6		6.7										9.3		6.9		7.6	
98			6.7	2.	8.8		7.2										9.7		7.2		60	
86		2	6.8		9.2		7.1										9.8		7.1		8.2	2
98			6.8	.2	8.7		7.3										6.6		7.3		8.0	
96			6.9	0.	9.2		7.1										6.6		7.4		8.4	
98		0	7.0	-	9.1		7.5										10.2		7.7		8.8	
86		-	7.2	-	9.4		7.4										10.3		7.8		6.7	
96		-	6.7	5.	8.7		7.6										9.8		7.4		8.5	
86		0.	6.9	-	9.1	0.	7.2	r.	7.3	1	10.1	-	8.6	0. 5	7.6		10.1	-	7.5	-	8.3	
30			4 8														-		-			

^{*} VALUES LISTED ARE THE AVERAGE OF TWO TLDS. ERRORS LISTED ARE 1 SIGMA.

TABLE 2 AIR PARTICULATES GROSS BETA RADIOACTIVTY (PCI/M3)

LOCATIONS

	130	(+/-) 0.004 0.003 0.004 0.003	0.004	0.003 0.003 0.003 0.003	0.003 0.004 0.004	0.003 0.003 0.004 0.003	0.004 0.003 0.003 0.005	
	-	0.018	0.027 0.026 0.024 0.007	0.008 0.014 0.021 0.009	0.013 0.026 0.022 0.017	0.016 0.006 0.018 0.018	0.020 0.007 0.008 0.013 0.013	
		0.004	0.004	0.003 0.003 0.003 0.003	0.003	0.003 0.003 0.004 0.003	0.004 0.003 0.003 0.003	
	0	0.021	0.024 0.027 0.023 0.009	0.012 0.016 0.023 0.011	0.013 0.025 0.024 0.018	0.009 0.019 0.019	0.010 0.010 0.008 0.014	
S N O		(+/-) 0.004 0.004 0.003	0.004	0.003 0.003 0.003 0.003	0.003	0.004	0.003 0.004 0.004 0.004	
OCATION	60	0.019	0.025 0.024 0.022 0.010	0.010 0.015 0.023 0.013	0.013 0.022 0.022 0.016	0.014 0.010 0.019	0.017 0.010 0.013 0.013	
0 7		0.004	0.00%	0.004 0.003 0.003 0.004	0.003	0.003	0.004 0.003 0.004 0.004	
	7	0.021	0.023	0.012 0.013 0.022 0.015	9.014 0.023 0.024 0.016	0.013 0.022 0.015	0.007 0.010 0.015 0.018	
		0.00%	0.004	0.003 0.004 0.004 0.004	0.003	0.003	0.004 0.004 0.004 0.004	
	9	0.019	0.024	0.008 0.015 0.022 0.013	0.023	0.013 0.008 0.017 0.017	0.025 0.006 0.007 0.016	
		0.004	0.00%	0.003 0.003 0.003 0.004	0.003	0.004	0.00% 0.003 0.00% 0.00%	
	20	0.021 0.010 0.023 0.012	0.023	0.008 0.014 0.021 0.013	0.016	0.016	0.008 0.008 0.008 0.015	
		0.003	0.004	0.003 0.004 0.003 0.003	0.003	0.004 0.003 0.004 0.003	0.004 0.004 0.004 0.004	
	*	0.021 0.012 0.023 0.013	0.025 0.025 0.024 0.012	0.017 0.023 0.014 0.030	0.012 0.023 0.025	0.016 0.009 0.022 0.017	0.026 0.011 0.017 0.017	
PERIOD	ENDING	JANUS JAN12 JAN26	FEB02 FEB09 FEB17 FEB23	MARG2 MAR 16 MAR 23 MAR 23	APR 13 APR 20 APR 27	MAY11 MAY11 MAY18 MAY26	JUN08 JUN15 JUN22 JUN29	

SAMPLE DATES MAY VARY BY A COUPLE OF DAYS.

TABLE 2 AIR PARTICULATES GROSS BETA RADIOACTIVTY (PCI/M3)

	130	0.003	0.00%	0.003	0.003	0.003	0.00%	0.004	0.003	0.003	0.003	0.00%	0.004	0.003	0.00%	0.003	0.004	0.004	0.002	
		0.012	0.022	0.018	0.014	0.027	0.024	0.027	0.024	6.017	0.010	0.021	0.015	0.012	0.031	0.020	0.032	0.028	0.040	
		0.003	0.00	0.004	0.003	0.003	0.00%	0.004	0.003			0.00%	0.003	0.003	0.004	0.003	0.004	0.004	0.002	
	6	0.013	0.020	0.020	0.019	0.027	0.030	0.027	0.027	0.018	0.013	0.022	0.018	0.007	0.035	0.022	0.037	0.029	0.044	
S = C		0.003	0.004	0.004	0.003	0.003	0.004	0.00%	0.004	0.003	0.003	0.00%	0.00%	0.003	0.00%	0.00%	0.004	0.00%	0.005	
CATE	60	0.014	0.021	0.024	0.016	0.027	0.024	0.026	0.023	0.016	0.014	0.022	0.015	0.010	0.031	0.026	0.034	0.028	0.036	
6 3		0.00%	0.00%	0.00%	0.004	0.003	0.094	0.004	0.004	0.003	0.003	0.00%	9.000	6.003	0.00%	0.00%	0.004	0.00%	0.004	
	-	0.014	0.021	0.025	0.019	0.030	0.029	0.028	0.026	0.016	0.014	0.022	0.017	0.013	0.036	0.026	0.037	0.030	0.039	
		0.00%	0.00%	0.004	0.00%	0.003	0.004	0.004	0.004	0.003	0.003	0.00%	6.004	0.003	0.004	0.004	0.004	0.004	0.004	
	9	0.013	0.025	0.023	0.013	0.025	0.031	0.026	0.028	0.015	0.016	0.019	0.018	0.011	0.033	0.025	0.035	0.028	0.036	
		0.004	0.00%	0.004	0.003	0.003	0.004	0.004	0.00%	0.003	0.003	0.003	900.0	0.003	0.00%	0.00%	0.604	0.00%	0.004	
	2	0.016	0.024	0.024	0.015	0.027	0.026	0.028	0.028	0.017	0.010	0.020	0.016	0.010	0.032	0.029	0.029	0.026	0.038	
	-	0.00%	0.00%		0.004	0.003	0.00%	0.004	0.064	0.003	0.003	0.00%	0.00%	0.003	0.004	0.004	0.004	9.00%	0.004	
	*	0.011	0.023	0.026	0.016	0.029	0.020	0.026	0.059	0.018	0.012	0.020	0.016	0.010	0.036	0.027	0.043	0.027	0.039	
PER1CED	ENDING	JUL 13			AUG24		SEP16		SEP28	0000		OCT26		MOV09				DEC 14		

SAMPLE DATES MAY VARY BY A COUPLE OF DAYS.

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TABLE 4A AIR PARTICULATES GANNA SPECTRA - GTR 1 (PC1/M3)

ANALYSES

RU-103	0.0026 0.0028 0.0025 0.0020 0.0019 0.0018
E.	-0.0010 -0.0010 -0.0020 0.0000 0.0009 -0.0010
NB-95	0.0027 0.0027 0.0026 0.0026 0.0028 0.0022
- SW	-0.0020 -0.0010 0.0016 0.0003 -0.0010 0.0000
33	(+/-) 0.0019 0.0024 0.0023 0.0018 0.0018
ZR-95	0.0007 0.0009 0.0002 0.0003 0.0004 -0.0010
09-00	(+/-) 0.0003 0.0006 0.0009 0.0006 0.0004 0.0010
8	0.0000 0.0000 0.0001 0.0000 0.0000 0.0003
	(*/-) 0.033 0.032 0.033 0.033 0.035
36	0.063 0.046 0.063 0.085 0.127 0.081
LOCATION	42000000

CE-141		(-/+)						7200 0 0054	
			0.000	0.000	ט טט ט	FOO 0-	0 000	0.0000	0.000
8A-140		(+/-)	0.0341	0.0529	5170 0	0.0730	0.0208	0.0220	0.0448
BA	*****		0.0038	0.0439	0.0138	-0.0130	-0.9110	-0.0120	0.0020
137		(-/+)	0.000%	900000	0.0006	0.0008	0.0005	0.0008	900000
CS-137								0.0000	
134		(-/+)	0.0007	0.0007	0.0007	0.0006	0.0007	900000	0.0007
CS-134			0.0000	0.0005	0.0000	0.0001	0.0001	0.0005	0.0000
901		(-/+)	0.0076	0.0076	0.0077	0.0073	0.0068	0.0084	0.0078
-BR			-0.0020	-0.0060	0.0015	-0.0020	0.0011	-0.0040	0.000.0
LOCATION			7	2	9	1	80	6	130

TABLE 48 AIR PARTICULATES GAMMA SPECTRA - GTR 2 (PC1/M3)

MALYSES

RU-103	*******	(+/-)	0.0018	0.0014	0.0017	0.0020	0.0018	0.0014	0.0014
BR.	*****		0.0000	0.00G	0.0008	-0.0010	0.0011	0.0003	0.0004
28	******	(+/-)	0.0018	0.0018	0.0022	0.0025	0.0032	0.0026	0.0018
NB-95			0.0000	0.0008	0.0016	6.0016	-0.0010	-0.0030	-0.0010
8	*******	(-/+)	0.0022	0.0026	0.0020	0.0015	0.0029	0.0007	0.0019
28-95			0.0000	0.0025	-0.0010	0.0000	-0.0010	0.0000	-0.0010
09		(-/+)	0.0007	0.0006	0.0007	0.0008	0.0008	0.0011	0.0007
09-03			0.0003	0.0000	0.000%	0.0000	0.000%	0.0003	0.0000
BE-7		(-/+)	0.032	0.028	0.031	0.031	0.036	0.032	0.031
38			0.092	0.103	0.102	0.093	0.093	0.117	0.098
LOCATION			*	2	9	7	60	0	130

CE-141		(-/+)							0.0001 0.0021
	:		0	-0-	0	0	0	0	0
8A-140		(+/+)	0.0167	0.0191	0.0164	0.0183	0.0142	0.0105	0.0181
8	******		0.0034	0.0032	0.0000	0.0048	-0.0100	-0.0050	-0.0030
CS-137			-	-	_	0.0004	_	_	_
S			0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
CS-134	*******	(-/+)	0.0007	0.0008	900000	0.0005	0.0007	0.0007	0.0007
S			0.0002	0.0003	0.0000	0.0000	0.0000	0.0000	0.0006
RU-106	******	(-/+)	0.0071	0.0075	0.0078	0.0000	0.0061	0.0075	0.0052
RU			-0.0020	-0.0010	0.0025	0.0011	0.0001	0.0000	0.0000
LOCATION			*	2	9	1	80	0	32:

TABLE 4C AIR PARTICULATES GAMMA SPECTRA - GTR 3 (PC1/N3)

ANALYSES

RU-103		(+/-)	0.0017	0.0020	0.0019	0.0021	0.0022	0.0006	0.0020
R	*****		0.0000	0.0019	0.0013	0.0013	0.0010	0.0000	0.0003
8		(-/+)	0.0022	0.0018	0.0025	0.0026	0.0022	0.0023	0.0026
NB-95			0.0001	0.000%	-0.0020	0.0000	-0.0010	0.0013	0.0009
88		(-/+)	0.0022	0.0020	0.0033	0.0032	0.0024	0.0019	0.0013
ZR-95			0.0000	0.0000	0.0035	0.0006	0.0002	-0.0010	0.0003
09	* * * * * * * * *	(-/-)	0.0000	0.0005	0.0005	0.0005	900000	0.0005	600000
09-03			0.0006	0.0000	0.0000	0.0000	0.0002	0.0000	0.0003
-7		(-/+)	0.036	0.032	0.037	0.036	0.038	0.031	0.034
38			0.107	0.093	0.118	0.097	0.126	0.088	0.112
OCATION			4	2	9	2	60	6	130

CE-141	(+/-)	0.0020	9.0020	0.0021	0.0025	0.0021	0.0019
3	0000 0	0.0011	0.0003	0.0000	0.0003	0.0000	9.0008
34-140	(+/-)	0.0152	0.0102	0.0114	0.0099	0.0177	0.0194
BA-	7110 0	0.0000	-0.0050	-0.0060	-0.0050	0.0079	0.0058
137	(+/-)	0.0006	0.0009	0.0008	0.0006	0.0008	0.0007
CS-137	0.000	0.0000	0.0000	0.0000	0.0000	0.000	0.0000
35	(+/-)	0.0005	0.000,0	9000.0	0.0008	0.0007	0.0007
CS-134		0.0000					
96	(+/-)	9.0079	8900.0	7900.0	0.0070	7900.0	0.0077
RU-106	0.0000	0.0066	0.0000	-0.0010	0.0021	0.0044	-0.0070
LOCATION	,	2	9	1	80	0	130

TABLE 40
AIR PARTICULATES
GAMM SPECTRA - GTR 4
(PCI/M3)

ANALYSES

RU-103		0.0000 0.0019						
MB-95	(-/+)	6.0027	0.0022	0.0030	0.0030	0.6322	0.0021	0 0050
50		0.0002	0.0000	0.0010	-0.0010	0.0013	0.0000	O GOTA
95	(-/+)	0.0015	0.0013	0.0028	0.0033	0.0016	0.0026	מצניט ט
28-95		0.0000	0.0000	0.0000	6.0022	9.0004	0.750	טטטט ט
09	(-/+)	0.0010	0.0007	0.0010	0.0000	0.0007	0.0004	0 0012
09-00		0.0000	0.0002	0.0003	0.0000	0.0002	0.000	0 0005
-7	(-/+)	0.028	0.032	0.033	0.033	0.025	0.031	0.035
BE		0.071	0.100	0.076	0.084	0.070	0.100	0.063
LOCATION		,	2	9	7	60	0	136

LOCATION	-UN	106	S	CS-134	S	CS-137	B.A.	8A-149	3	CE-141

		(-/+)		(+/-)		(+/-)		(+/-)		(+/-)
4	-0.0030	0.0048	9.6002	0.0009	0.0000	0.0006	0.0088	0.0198	0.0008	0.0021
2	0.0000	0.0036	0.0001	900000	0.0000	0.0005	0.0062	0.0207	0.0002	0.0020
9	0.0000	0.0053	0.0003	0.0007	0.0001	900000	-0.0100	0.0253	0.0003	0.0025
1	0.0041	0.0077	0.0000	0.0006	0.0003	5.0008	0.0056	0.0187	-0.0010	0.0028
60	-0.0020	0.0063	0.0000	0.0007	0.0000	0.0006	-0.0020	0.0192	0.0000	0.0020
6	0.0000	0.0052	0.0000	9000.0	0.0000	900000	-0.0030	0.0184	-0.0010	0.0018
130	0,00.0-	0.0104	0.0000	0.0008	0.0003	0.0007	-0.0090	0.0238	0.0006	0.0033

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Pos	mil	-
-	×	5
BLE	RY	IJGJ
17	men.	2
	S	

				34 40	2	101-1	10	13-136	20	12-131	36	BA-140	0	LA-140	0
-			(+/+)		(-/+)		(+/-)		(+/+)		(-/+)		(+/+)		(-/+)
0.	01/07/08					-3.42	4.97	0.1	2.7	0.0	3.6	-	9		4.4
0	02/10/98					-0.70	4.21	-1.7	2.2	3.0	2.8	2	3		4.0
10	03/10/98	0.7	2.8	0.2	6.0	1.04	7.43	-0.1	3.2	9.0-	4.3	-	9		6.5
6	04/07/98					0.61	5.36	1.0	5.9	0.5	3.2	-	*		5.1
0	05/13/98					1.73	8.16	1.1	3.1	2.8	3.1	**	2		5.8
0	06/10/98	3.3	2.8	9.0	1.1	-1.62	4.85	0.6	2.5	0.2	3.0	-	4		40
0	67/08/98					-1.46	5.23	9.6	2.5	-0.8	3.6	0-	*		4.7
0	08/18/98					2.57	5.40	-0.2	2.1	1.0	2.9				2
0	86/60/60	-0.3	3.6	0.0	1.0	-0.70	6.76	-1.0	3.1	1.6	3.0		2		2
	10/07/98					-2.72	7.33	-2.1	3.7	9.0	6.0	14	9		2
0	11/10/98					1.02	6.58	9.0-	2.5	3.0	3.0	^	4		6.3
0	12/10/98	-0.5	5.5	1.7	1.0	-3.17	6.7	1.1.	2.2	0.8	5.6	i	m	.3.3	4.0
0	04/07/98 A					09'0	5.74	-	2	2.7	*	•	4	4	7 7
	N5.112.08					* 54	7 21		2.5	* *			, ,	9.0	
	04/10/08	. ×		. ,	.:	. K 15	1.34	2.0.	*	6.5		>-		0.2	0.0
	04/01/00	0.4	4.6	4.6	1.1	-3.43	4.63	5.4	6.0	2.4	5.5	-	2	-0.9	3.0
-	07/08/98					0.50	4.55	-0.4	2.2	5.3	3.8	2	m	1.8	3.0
0	08/18/98					-4.55	5.06	-1.5	2.3	9.1	8.4	-	2	1.5	3.9
0	86/60/60	-1.6	6.0	3.5	1.2	2.77	5.43	-0.1	2.7	8.0	4.0	۲.	*	-3.6	4.8
0	10/07/98					-5.30	7.42	2.2	3.5	4.7	4.0	-5	9	-2.3	6.4
20	11/10/98 A	1.4	5.7	4.8	-	-3.78	3.90	-0.2	1.	5.9	3.2	2	2	5.6	4.0
-	01/07/98					-3.87	6.30	0.2	2.7	7 :	3.7		7		7
	02/10/98					0 70	2 68	0.0-	3.0		2 4	0-		, n.	M
	03/10/98	0.0	2.8	60	0.0	-6 no	7.90		2.5		200	. 4-		2.4.	2
***	06/107/98					-2.30	5.60	2.0	2.0	0.0	2 4			0.0	, w
	05/13/98					-0.65	7.27	.0.	2.0	0.0			. 2	7 0 7	2
	06/10/98	4.3	4.5	1.2	1.0	3.00	6.50	-2.2	2.2	-	2.5			0.7	
-	07/08/98	,				-0 3K	6.63		2.1	1.2	2 2				4 7
21	08/18/98					0.28	5.57	.1.5	2.5	1.7	3.3	. ^	, 4	2.0	6 3
-	80/00/00	-2.1	0 9	.0.		-0 08	6 43	-0 ×	4		2 2				7
	10/07/08			0.0	:	3 45	20.00	0.0	0.0		0.0				9.6
	00/00/00					6.13	5.30	.0.5	6.3	2.0.	6.0	7.	•	6.2.	3.4
	11/10/98					1.52	4.12	-1.5	1.6	5.0-	5.0	-	2	0.8	3.1

A: MILK AND PASTURE GRASS WERE UNAVAILABLE AT LOC. 20 IN JAN, FEB, MAR AND DEC. FEED TAKEN IN DEC.

9		(+/+)	0.1	4.4	8.7	4.4	6.7	4.2	5.1	3.6	3.6	3.7	3.3	3.2
LA-140			3.0	1.5	4.1	3.0	3.2	-1.2	3.9	0.5	0.0	1.9	.1.0	-0.5
		1-/+	60	*	80	3	9	9	4	2	2	~	~	M
8A-140		-	3	-	4	M	m	1-	2	0	0	2	-5	-0 3
4		(+/+)	5.3	3.3	3.9	3.0	4.1	2.7	3.3	3.0	3.4	3.5	2.3	2.2
CS-137					-1.1.									
4		(+/+)	3.7	2.8	3.6	2.7	3.8	2.2	3.3	2.1	5.6	3.4	1.00	1.9
CS-134	*******				-0.3									
		(-/+)	9.19	5.94	9.78	6.31	7.41	5.13	5.70	5.47	5.80	6.55	3.91	4.55
1-13					1.85									
		(+/+)			6.0			1.2			1.3			1.0
SR-90					1.0			2.5			3.6			1.9
۰		(-/+)			3.0			5.9			4.7			4.6
SR-89					2.1			3.5			0.1			9.0-
COLLECTION			01/07/98	02/10/98	03/10/98	04/07/98	05/13/98	06/10/98	07/07/98	08/18/98	86/50/60	10/07/98	11/10/98	12/10/98
LOCATION			322	322	222	222	222	222	222	222	225	220	222	222

A: MILK AND PASTURE GRASS WERE UNAVAILABLE AT LOC. 20 IN JAN, FEB, MAR AND DEC. FEFD TAKEN IN DEC.

GOAT'S MILK (PCI/L)

8A-140 LA-140	*******	(-/+)	5 -6.8	7 3.7	5 .3.2	3 -0.3	4 2.2	4 0.1	6 3.0	-1 4 -1.2 4.3	6.5	6 -0.3	7 -1.3	5 -6.8	3 -1.5 3.8	3 0.4	4 1.1	4 -2.1	3 0.5	
CS-137		_								7.1 3.0					1.5 3.2					
CS-134		(-/+)								0.7 1.6					-2.3 2.1					
1-131		(+/-)					0.13 5.66			0.95 5.54				-	-1.28 4.26					
SR-90	* * * * * * * * * * * * * * * * * * * *	-																		
SR-89	***********	(-/+)	-0.1 2.7			8.6 6.4			-2.4 5.6	-2.3 6.2	1.8 3.0			2.9 4.5			4.7 5.8			27 80
COLLECTION			03/10/98 A	04/07/98	05/13/98	06/10/98	85/80/29	08/18/98	86/60/60	10/07/98 8	03/10/98 0	96/10/98	05/13/98	06/10/98	86/80/10	08/18/98	86/60/60	10/07/98	11/10/98	12/10/08
LOCATION			23C	230	230	235	235	230	230	230	22	54	72	52	92	54	54	5%	24	26

A: GOAT MILK AND PASTURE GRASS WERE UNAVAILABLE FROM CONTROL LOC. 23C IN JAN. AND FEB.

B: GOAT MILK AND PASTURE GRASS WERE UNAVAILABLE IN MOV AND DEC AT LOC. 23C. FEED SAMPLED INSTEAD.

D: GOAT MILK AND PASTURE GRASS WERE UNAVAILABLE IN JAN AND FEB AT LOC. 24.

PASTURE GRASS * (PCI/G WET WI.)

65	(-/+)	0.055	0.09%	RU-106	(-/+)	0.211	0.263	131	(-/+)	0.050	0.030
FE-59		0.027	0.045	-UR		-0.023	-0.077	CE-141		-0.050	0.037
28	(+/+)	0.022	0.026	RU-103	(-/+)	9.054	0.026	LA-140	(-/+)	0.054	0.053
85-00		0.002	0.007	.03		0.015	0.021	5		0.016	-0.067
24	(-/-)	0.021	0.028	8	(-/+)	0.029	0.035	BA-140	(-/+)	0.047	0.046
34 - S4		-0.006	0.001	N8-95		-0.004	-0.004	BA-		0.012	-0.058
51	(-/-)	0.22	0.24	8	(-/+)	0.038	0.047	137	(-/+)	0.023	0.031
CR-51		0.12	-0.06 0.15	28-95		0.019	0.006	CS-137		0.000	0.042
	(-/-)	9.64	1.11		(-/+)	970.0	0.081	134	(-/+)	0.022	0.029
07-X		8.20	10.88	S9-NZ		0.054	0.081	CS-134		-0.017	0.001
	(-/-)	0.33	0.43	98	(-/+)	0.022	0.032	F.	(-/+)	0.069	0.058
BE-7		0.95	1.47	09-03		0.007	0.005	1-131		0.036	-0.020
COLLECTION		12/10/98 A	11/10/98 A 12/10/98 A	COLLECTION		12/10/98 A	11/10/98 A 12/10/98 A	COLLECTION		12/10/98 A	11/10/98 A 12/10/98 A
LOCATION		82	230	LOCATION		02	32	LOCATION		50	230

^{*} SAMPLES TAKEN AS A SUBSTITUTE FOR UNAVAILABLE MILK.
PASTURE GRASS IS REGUIRED AS A SUBSTITUTE DURING THE MONTHS OF APR THROUGH DEC. IF PASTURE GRASS IS
UNAVAILABLE, DIRECTIONS SINCE MID-YEAR NAVE BEEN TO SAMPLE SOME OTHER ALTERNATIVE FEED SUPPLY.
A: PASTURE GRASS WAS UNAVAILABLE AS A GOAT MILK SUBSTITUTE, HAY WAS SAMPLED INSTEAD.

PASTURE GRASS * (PCI/G WET ST.)

822		(+/+)	0.104	0.130	0.00%
TH-228			0.063	0.057 0.130	6.133
922		(-/+)	-0.507 0.808	0.732	0.745
144 RA-226			-0.507	-0.057	1.120
		(-/+)	0.097	0.107	0.093
771-30			0.006	0.046 0.107	0.018
_			*	*	K.
COLLECTION			12/10/98 A	11/10/98 A	12/10/98
LGCATION	*******		92	232	252

^{*} SAMPLES TAKEN AS A SUBSTITUTE FOR UNAVAILABLE MILK.
PASTURE GRASS IS REQUIRED AS A SUBSTITUTE DURING THE MONTHS OF APP THROUGH DEC. IF PASTURE GRASS IS
UNAVAILABLE, DIRECTIONS SINCE MID-YEAR HAVE BEEN TO SAMPLE SOME OTHER ALTERNATIVE FEED SUPPLY.
A: PASTURE GRASS WAS UNAVAILABLE AS A GOAT MILK SUBSTITUTE, HAY WAS SAMPLED INSTEAD.

1998	
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8:																		
PAGE 3-29	59-N2	(-/-)	10.1	2.9	5.2	11.6	5.6	3.5	5.4	13.4	4.4	8.5	4.1	4.0	16.7	17.0	16.3	8.8
	-N2		5.0	8.4	.3.6	3.7	-6.0	0.3	-1.3	4.5	4.6	5.2	-1.0	2.3	0.1	18.8	-7.7	4.6
	0	(-/-)	2.0	1.6	2.4	2.8	2.0	1.5	3.2	2.3	2.3	3.8	2.7	2.1	2.4	2.3	3.4	1.7
	09-00		-0.3	0.5	0.0	9.5	-1.0	-0.1	0.5	-9.7	1.3	-0.5	-1.3	-0.3	1.6	9.0	9.0	-0.7
	0	(+/-)	5.1	4.6	7.9	6.0	6.1	4.6	8.9	7.1	5.0	9.3	5.7	5.0	6.1	5.7	6.5	3.7
	FE-59		0.8	1.0	2.1	5.9	-3.5	-1.0	0.4-	5.6	1.9	-1.3	-2.7	0.7	-0.6	9.0	5.9	0.1
		(-/+)	2.0	1.6	2.2	2.3	2.5	1.7	3.0	2.3	2.0	3.1	2.8	1.7	8.8	2.3	2.8	1.6
10 ATER	85-03		6.0	-0.6	-0.4	6.0	1.7	0.7	-2.0	-0.2	-1.5	-0.3	0.7	6.0	-2.2	-3.0	8.0-	-1.6
TABLE 10 WELL WATER (PCI/L)	,	(-/+)	1.8	3.4	2.0	2.1	1.7	1.6	2.4	2.3	2.0	3.1	2.4	1.0	2.3	2.4	2.6	1.4
	45-MM		9.0	-1.9	-0.1	-2.3	-0.7	9.0	9.0	-1.1	6.0-	2.3	-1.0	6.0-	0.5	-2.0	9.0	6.0-
	-	(-/-)	21	15	2	54	22	17	22	27	5%	31	22	92	28	56	33	11
	CR-51		6-	6	40	14	-	2	0	-12	33	.5	m	12	17	-20	2	7
		(-/+)	35	23	3%	33	28	35	42	32	27	9%	43	35	31	53	61	22
9661	K-40		-23	-3	69	-5	-35	37	m	-7-	28	51	18	0	.5	20	-10	9
	DATE		1/30/98	2/17/98	3/12/98	4/13/98	5/06/98	86/80/9	7/13/98	8/18/98	86/70/6	9/05/98	1/02/98	12/07/98	03/12/98	6/08/98	86/90/6	2/07/98
CONNECTION YANKEE	LOCATION		15 0	15 0	15 0.	15 04	15 00	15 04	15 0	15 00	15 0	15 11	15 1	15 1	160 03			

COMMECTI	COMMECTICUT YANKEE 1998	1998					TABL	TABLE 10 WELL MATER						•	AGE 3
	COLLECTION	*					(PC)	5							
LOCATION	DATE	ZR.	- 38	-BN	95	RU-	103	RU	106	1-131	31	CS-134	134	·SO	CS-137
			(+/+)		(-/-)		(-/+)		(-/+)		(-/-)		(+/+)		(-/*)
15	01/30/98	-0.2	3.5	-1.3	2.4	0.0	2.2	0	19	۴.	2	-0.9	2.0	-0.5	2.3
15	02/17/98	-1.3	2.3	-2.2	1.0	-0.8	1.7	9-	16	-	3	-0.2	1.5	0.2	1.7
15	03/12/98	9.4-	6.0	0.7	2.7	**	2.5	15	23	M	9	0.0	2.3	6.0	2.3
15	04/13/98	-0.8	6.0	9.0	4.6	-1.6	2.4	3	19		*	-3.0	7.2	-0.2	2.5
15	05/06/98	-2.9	4.2	-0.3	5.9	-2.9	2.5	1.	19	s,	1	1.1	2.5	0.7	2.3
15	86/80/90	-0.2	3.1	6.0-	2.1	6.0-	5.0		18	0	4	9.6	1.6	2.1	1.8
15	07/13/98	-1.5	5.6	-3.8	3.6	-1.3	2.8	-10	22		2	0.2	2.3	-0.3	3.2
15	08/18/98	0.8	3.7	-1.6	6.8	9.0-	2.7	15	22	-5	9	0.5	2.4	1.6	2.8
15	86/50/60	2.1	3.6	-0.6	2.3	9.5	2.3	2	18	4	9	0.3	2.1	1.2	2.5
15	10/05/98	3.4	6.1	-2.1	4.1	0.4-	2.8	2	22	M	9	-0.5	2.3	1.6	2.9
15	11/02/98	-2.7	4.5	-0.5	5.6	.2.0	2.7	9.	23	-	*	9.0	2.3	1.9	2.8
15	12/07/98	5.6	3.8	-2.1	2.1	-0.5	1.9	٥	16	.3	4	F. F.	2.0	1.0	2.2
160	03/12/98	2.1	4.0	1.4	6.4	-2.6	2.8	-18	20	-	1	6.0	2.3	-2.4	2.4
160	86/80/90	-0.2	4.0	-2.4	5.9	-1.3	5.4		20	4	2	-1.2	2.1	1.1.	2.4
160	86/70/60	9.0-	6.0	9.0	7.0	0.7	3.5	-21	23	٥	1	-0.2	3.6	-0.2	3.1
160	12/07/98	1.3	2.5	1.3	2.4	F	1.7	0	13		9	-0.7	1.6	.1.	40

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STATES OF		
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Statement of		ENGINEE

		1-/+	222	228	234	206	199	218	212	226	182	184	211	502	213	200	161	201
	8-3		417	633	433	420	614	541	358	009	456	215	271	231	0	20	52	63
	28	(-/-)	7.6	5.8	9.6	9.6	7.8	6.2	11.0	8.5	8.7	16.3	6.6	8.1	0.6	8.5	10.8	5.3
(7)	TH-228													5.0	4.4	-1.2	-11.0	6.8
(PCI)	81-214	(3/1)	62.6	39.5	71.7	61.4	83.1	46.1	71.7	60.2	0.09	71.7	93.3	0.89	76.6	61.7	70.4	40.7
	- 100		-18.2	-11.2	9.09-	58.4	53.8	1.6	18.1	40.5	-53.8	73.9	30.1	-51.5	-36.7	-29.8	148.8	18.8
	A-140	(-/+)	4.2	2.8	5.6	3.4	5.7	3.3	0.9	4.7	4.2	0.9	4.2	2.3	5.4	4.7	5.5	3.3
	LA-		9.0	6.0-	5.7	9.0	1.1.	0.3	0.7	3.0	1.0	6.4-	0.3	-2.0	-6.0	5.9	-6.1	2.3
	A-140	(-/-)	*	2	2	3	2	3	5	4	4	2	*	2	2	4	*	n
	BA-1			-	2	*		0		*	-	9-	0	-5	'n	2	.5	2
COLLECTION	DATE		01/30/98	02/17/98	03/12/98	06/13/98	05/06/98	86/80/90	07/13/98	08/18/98	86/70/60	10/05/98	11/02/98	12/07/98	03/12/98	86/80/90	86/70/50	12/07/98
	LOCATION		15	15	15	15	15	15	15	15	15	15	5	15	395	160	160	160

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	RE.	-
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TAB	46	3/
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	ane	0.
	33	14
	FRE	
	Min.	

	65-34	 (-/+)	0.080	0.085	0.045	0.067	0.085	0.000	0.045	0.048	
	32		0.021	0.022	0.00%	0.000	0.075	-0.072	-0.042	-0.031	
	85-00	 (-/+)	0.026	0.024	0.013	0.022	0 326	0.017	0.013	0.024	
	8			-0.001	-0.012	0.016	-0.002	0.006	0.005	-0.006	
	35-KM	 (-/+)	0.018	0.022	0.013	0.017	0.019	0.024	0.012	0.025	
	- NW		0.000	0.001	-0.009	-0.009	-0.002	0.004	-0.007	-0.018	
	51	 (-/-)	0.22	0.27	0.19	0.22	0.18	0.21	0.09	0.24	
	CR-51		0.07	-0.04	0.07	-0.03	-0.11	-0.06	-0.06	-0.02	
	0	 (-/+)	0.56	0.86	0.33	0.94	0.81	0.76	0.71	67.0	
	05-X		0.88	3.90	0.50	5.58	3.43	1.81	4.05	0.89	
	1	 (-/+)	0.20	0.20	0.14	0.24	0.36	0.17	0.24	0.21	
	BE-7		0.00	00.00	0.07	0.35	0,40	0.02	0.51	0.02	
	TYPE		STRAWBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAWBERRIES	BROCCOL I	APPLES	
COLLECTION	DATE		06/22/98	06/30/98	86/70/60	86/60/60	06/22/98	06/22/98	86/70/60	86/70/60	
	LOCATION		170	170	170	170	82	22	K	2	

RU-106	(-/+)	0.173	0.176	0.147	0.182	0.221	0.242	0.109	0.177
\$						-0.115			
RU-103	(-/+)	0.017	0.023	0.019	0.023	0.027	0.025	0.011	0.024
-UN		-0.014	-0.015	0.017	-0.009	0.012	0.013	0.001	-0.002
82	(-/+)	0.026	0.031	0.037	0.025	0.030	0.026	0.012	0.059
MB-95		0.000	-0.011	0.017	0.010	0.006	0.014	0.001	0.017
8	(-/+)	0.0%2	6.048	0.028	0.037	0.034	0.034	0.022	0.041
ZR-95	:	0.001	-0.028	0.002	-0.001	0.022	0.003	0.016	0.008
65	(-/-)	0.053	0.053	0.036	0.050	0.052	0.055	0.00.0	0.046
2N-65		-0.023	-0.021	0.017	0.008	0.020	-0.009	-0.003	-0.017
99	(-/+)	9.054	0.029	0.016	0.028	0.020	0.030	0.014	0.016
09-03		0.003	-0.018	-0.003	-0.003	0.002	0.024	900.0	0.000
TYPE		STRAMBERRIES	LETTUCE	APPLES	SHISS CHARD	LETTUCE	STRAMBERRIES	RROCCOL 1	APPLES
COLLECTION		06/22/98	06/30/98	09/04/98	86/60/60	06/22/98	06/22/98	86/90/60	85/70/60
LOCATION	:	175	170	170	170	22	22	23	22

(-/+)

CE-141

0.028 0.032 0.031 0.032

-0.003 -0.033 -0.031

		LA-140	 (-/-)	0.040	0.054	0.054	0.057	0.036	0.050	0.013	0.080
		-KA-		900.0	-0.031	0.027	-0.064	0.034	-0.010	-0.007	0.045
		8A-140	 (-/-)	0.035	0.047	0.047	0.049	0.031	0.043	0.011	0.070
		BA-		0.002	-0.027	0.024	-0.055	0.030	-0.008	-0.006	0.037
		137	 (+/+)	0.025	0.023	0.018	0.026	0.023	0.018	.313	0.027
E 12 EGETABLE ET WT.)		CS-137		0.011	-0.009	0.002	-0.012	0.008	-0.001	0.003	-0.021
FRUITS & VEGETABLE (PCI/G WET WT.)		34	 (-/+)	0.022	0.020	0.016	0.019	0.028	0.025	0.012	0.025
FRU		CS-134		-0.011	-0.019	900.0	-0.008	0.016	-0.012	-0.004	0.002
			 (-/+)	0,000	0.084	0.076	0.079	0.043	0.000	0.024	0.111
		1-131		0.051	0.002	-0.020	0.035	0.008	-0.000	-0.001	-0.017
1998		TYPE		STRAMBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAMBERRIES	BROCCOLI	APPLES
	COLLECTION	DATE		06/22/95	86/30/98	86/90/60	86/60/60	06/22/98	06/22/98	86/70/60	86/70/60
COMMECTICUT YANKEE		LOCATION				170		22	22	52	22

0.037 0.026 0.013 0.042

0.005

-	1H-228	 (-/+)	0.091	0.106	0.062	0.093	0.093	0.100	0.073	0.086
	H		-0.024	0.034	0.007	-0.006	-0.001	-0.012	0.133	-0.006
,	RA-226	 (-/+)	6.760	9.69.0	0.642	0.673	0.940	0.564	0.189	0.493
1	RA-		-0.106	0.463	0.384	0.767	-0.089	0.221	-0.071	-0.031
:	146	 (+/-)	0.110	0.109	0.077	960.0	0.128	0.094	0.039	0.118
1	CE-144		0.131	0.018	-0.046	990.0	-0.036	-0.026	-0.022	0.015
	TYPE		STRAWBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAMBERRIES	BROCCOL I	APPLES
COLLECTION	DATE		06/22/98	06/30/98	86/70/60	86/60/60	22/98	22/98	09/04/98	96/90
	LOCATION		170	170	170	170	82	22	22	22

BROADLEAF VEGETATION (PCI/G WET UT.)

65	(-/+)	0.024	0.057	0.029	0.031	0.068	0.061	0.075	970 0	0.00	0.000	0.007	0.00	9.005	0.035	RU-106		(-/-)	0.058	0.139	0.068	0.087	0.239	0.184	0.210	0.135	0.057	0.085	0.239	0.227	0.108
FE-59		-0.017	0.015	0.013	-0.010	0.017	-0.068	-0.033	C 70 0-	0000	0.000	0.000	0000	-0.030	0.005	5	:		-0.057	0.113	-0.004	0.050	0.184	-0.055	0.232	-0.071	-0.027	0.017	-0.065	0.020	-0.058
58	(-/+)	90.00	0.017	0.008	6.000	0.024	0.020	0.022	210 0	2000	0000	4.00.0	0.02	0.00	0.011	RU-103		(-/-)	0.007	0.015	0.008	0.010	0.027	0.020	0.023	0.014	900.0	600.0	0.028	0.029	0.012
85-00		-0.003	-0.610	-0.002	-0.006	-0.014	0.009	0.003	-n nok	000.0	00.00	0.00	0.0	-0.019	-0.004	5			0.000	-0.001	0.005	0.001	-0.004	900.0	0.005	0.000	0.003	-0.006	-0.018	0.000	-0.00%
24	(-/+)	0.005	0.015	6.007	600.0	0.025	0.020	0.021	0.012	0 000	00000	0.00	0.000	0.031	0.011	8		(-/+)	0.008	0.037	600.0	0.012	0.033	0.027	0.029	0.020	0.008	0.011	0.030	0.030	0.020
MN-54		-0.006	0.002	0.000	-0.010	-0.031	0.007	0.020	-0.004	0000	00000	0.000	0.000	0.0.0	-0.003	88-95			0.005	0.007	-0.004	0.000	-0.005	0.020	0.007	-0.001	-0.001	-0.006	0.007	-0.034	0.013
51	(-/-)	0.08	0.15	0.08	0.00	0.26	0.19	0.21	71.0	0 05	00.0	0.0	0 22	27.0	6.11	85		(-/+)	0.010	0.029	0.014	0.017	0.049	0.030	0.041	0.024	0.011	0.016	0.044	0.060	9.010
CR-51		-0.01	-0.11	-0.08	0.00	0.05	-0.04	0.19	30.0-	-0.01	0.0	0.00	0.06	0.00	0.00	28-92			-0.003	0.006	0.005	0.004	0.017	-0.015	-0.020	-0.019	0.005	0.000	-0.012	0.029	0.012
0	(-/+)	0.37	0.30	6.63	0.33	0.77	0.70	0.71	07.0	0 10	0 30	2000	0 87	0.00	0.33	8	******	(-/+)	0.018	0.034	0.023	0.021	0.132	0.043	0.056	0.032	6.014	0.022	0.055	0.062	0.024
N-40		3.82	2.43	04.	5.11	2.93	4.70	6.50	3.08	0 72	2 12	74 2	2 75	200	3.05	ZN-65	:		-0.017	-0.034	0.007	-0.008	0.042	-0.002	-0.041	-0.014	-0.009	-0.005	0.039	0.921	0.019
	(-/+)	0.16	0.0	0.0	0.16	0.47	0.26	0.31	0.17	0 10	180	0 47	0.58	0.40	0.20	3		(-/-)	0.008	0.014	0.007	0.011	0.026	0.022	0.027	0.014	0.007	0.010	0.028	0.034	0.011
7-38		1.37	20.0	6.30	1.12	1.29	0.61	1.28	0.45	01 0	1 66	2 48	1 83		1.82	9-03			0.001	0.000	0.005	0.000	-0.012	0.001	0.009	0.005	0.000	3.000	0.009	-0.012	0.002
COLLECTION		04/27/98	03/53/50	04/33/00	96/02/10	96/54/99	09/14/98	10/07/98	05/20/98	DK/22/08	07/20/08	08/26/08	00/14/08	00120100	10/01/08	COLLECTION DATE			04/27/98	05/20/98	06/22/29	07/20/98	08/24/98	09/14/98	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98
LOCATION		*0 *	0 4		0 .	0	9	9	18	18	18	18	18		100	LOCATION			9	9	9	9	9	9	9	18	18	18	13	18	18

TABLE 13 BROADLEAF VEGETATION (PCI/G WET WT.)

171	******	(-/+)	0.007	0.020	0.013	0.012	0.036	0.028	0.027	0.024	0.007	9.011	0.035	0.031	0.018
171-30			0.000	-0.007	0.005	0.005	-0.040	0.031	0.006	0.024	0.001	-0.001	-0.022	-0.004	-0.036
14-140		(-/+)	0.016	0.050	0.024	0.029	0.048	0.038	0.059	0.045	0.017	0.028	0.060	0.067	0.027
-SI	******		0.003	0.009	0.012	-0.011	-0.010	0.035	0.008	-0.011	-0.001	-0.010	-0.022	-0.029	-0.007
8A-140		(+/-)	0.013	0.043	0.021	0.025	0.042	0.033	0.051	0.039	0.015	0.025	0.052	0.058	0.023
BA-			0.002	0.008	0.011	-0.009	-0.009	0.031	0.007	-0.010	0.000	-0.009	-0.019	-0.025	-0.006
137		(-/-)	0.007	0.013	600.0	0.011	0.032	0.020	0.024	0.016	0.007	0.018	0.035	0.031	0.020
CS-137			-0.007	0.005	-0.002	0.015	-0.006	0.001	-0.018	0.013	0.00%	0.005	0.054	-0.024	0.053
CS-134		(-/+)	0.002	0.013	0.008	0.010	0.029	0.020	0.022	0.014	900.0	0.008	0.028	0.024	0.027
Ś			0.000	0.003	-0.005	-0.002	0.028	-0.009	-0.009	-0.011	0.005	0.001	0.002	0.005	0.011
31		(-/+)	0.018	0.073	0.031	0.033	0.051	990.0	0.063	0.076	0.021	0.035	0.046	0.061	0.032
1-131			-0.005	0.005	-0.009	-0.015	0.002	-0.035	0.021	0.056	-0.004	0.013	-0.006	-0.079	0.001
COLLECTION DATE			04/27/98	05/20/98	06/22/98	07/20/98	08/54/98	86/14/60	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	86/11/60	10/07/98
LOCATION			9	9	9	9	9	9	9	18	138	18	18	18	18

228		(-/+)	0.027	0.073	0.038	0.051	0.143	0.083	960.0	0.058	0.035	0.033	0.100	0.103	0.047
TH-228			-0.007	0.033	0.056	0.058	0.096	0.257	-0.105	0.028	0.027	-0.004	0.042	0.005	0.041
RA-226		(+/+)	0.177	0.371	0.263	0.256	0.933	0.654	0.607	0.459	0.092	0.235	0.895	0.746	6.415
RA-			0.125	-0.022	-0.019	0.128	-0.929	-0.275	0.457	-0.073	0.176	-0.083	0.176	0.222	-0.208
144		(-/-)	0.023	0.055	0.034	0.034	0.129	0.085	0.082	0.059	0.020	0.034	0.120	0.106	0.050
CE-144			-0.003	0.001	-0.026	-0.013	-0.075	0.037	-0.026	0.012	0.006	-0.015	0.048	0.037	0.000
COLLECTION	******		04/27/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	86/11/60	10/07/98
LOCATION			9	9	9	9	9	9	9	50	18	18	18	18	18

-	DC.	
48	显	
geo.	Pere	-
	*	1
and.		-
20	100	60
w.	W	ũ.
\$ec.	5	-
	Seen	
	830	

99	(+/+)	1.5	1.3	1.9	9.0	1.1	2.2	1.2	1.3	5	(4/-1	113	122	163	26	7	20	12	16	
09-00		0.0	-0.1	-0.1	0.1	-0.2	0.3	0.0	0.2	1-131		16	31	56	50	*	g-	2	9-	
65	(+/-)	7.1	8.6	6.6	5.9	3.2	7.9	4.7	6.8	90	(4/-1	 15	15	50	2	***	20	13	12	
FE-59		-1.2	-1.1	-1.3	-1.2	2.1	-3.8	-0.5	-2.4	RU-108		13	13	6-			^	-	-5	
80	(-/-)	2.1	2.3	2.7	6.8	1.3	2.2	1.4	1.4	103	(4/-)	 3.4	3.3	4.2	1.5	1.4	3.1	2.0	2.1	
82-00		-0.2	6.0	6.0-	-1.0	-0.3	-1.7	-0.1	4.0-	RU-103		8.4-	0.2	-3.6	1.0	6.1.	2.5	-1.4	-0.7	
75	(-/+)	1.5	1.5	1.9	0.5	1.0	2.3	1.2	1.3	8	(+/-)	3.2	3.8	5.0	1.4	1.5	3.6	2.3	2.1	
MN-54		0.3	0.2	1.6	-0.3	9.0	-0.2	-0.0	-0.2	56-8N		1.0	1.7	-1.6	0.1	0.2	1.7	6.2	6.0	
	(-/+)	77	77	57	16	16	30	21	22	8	(+/-)	3.9	3.9	3.9	1.5	2.1	2.5	2.7	3.2	
CR-51		-20	-56	-23	19	7	-31	9-	9-	28-95		5.3	0.4-	0.5	-1.3	9.0	-1.0	-0.3	1.0	
	(-/+)	52	22	32	10	20	44	21	32	10	(+/-)	5.5	3.7	4.1	1.3	2.2	6.0	6.0	5.3	
K-40		-13	-31	6-	-12	12	72	-16	2	2N-65		-0.5	1.4	-1.3	9.0-	8.0	1.3	-1.2	6.8	
COLLECTION		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/98	07/23/98	16/22/98	COLLECTION		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/78	07/23/98	10/22/98	
LOCATION		82	28	28	23	300	300	300	300	LOCATION	:	28	28	28	28	300	300	300	300	

TR-228

T YANKEE 19	8661				RIVE (P	TABLE 14 RIVER MATER (PCI/L)				
COLLECTION	8	CS-134	Ė	CS-137	A S	BA-140	5	LA-140	R.A.	RA-226
		(+/-)		(-/+)		(-/+)		(-/-)		-/+)
02/02/98	-0.6		-0.5	1.4		82				68.
05/04/98	0.2		0.1	1.5		92				50.
08/03/98	-0.7	2.0	-0.2	2.0		22				86.
11/02/98	-0.5		0.0-	9.0		=		12		10.
01/26/98	-0.7	1.0	-1.0	-1.0 1.1		-2 4			-2.3	37.
04/27/98	0.2		1.6	2.3		10				46.4
07/23/98	0.1		-0.8	1.2		9				58.
10/22/98	0.8		0.1	1.6		9		1		50.1

28 28 28 28 28 28 30c 30c 30c 30c 30c 30c

	(-/-)	671	427	780	470	477	462	404	677
#-3		184	177	357	379	-58	-345	-97	07-
COLLECTION		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/98	07/23/98	10/22/08
LOCATION		28	28	28	28	300	300	300	305

	2	
15	IMEN	5
HE	SED	DRY
TAB	104	9/1
	807	-

FE-59	(-/-)	0.00	0.10	0.05	RU-106	0.21
Ė		0.05	0.04	0.03	-DZ	0.06
85-03	(-/-)	0.03	0.03	0.02	RU-103	0.03
8		0.00	-0.02	-0.01	-U%	-0.01
PR-54	(-/-)	0.03	0.03	0.02	S (-)-	0.06
ř		-0.02	0.01	0.02	WB-95	-0.01
CR-51	(·/÷)	0.22	0.26	0.19	28-95	0.02
Š		0.00	-0.05	0.12	28	-0.03
01	(-/-)	2.5	2.3	2.1	(-/+)	0.17
07-X		9.0	11.5	13.6	. XZ	0.05
4	(-/+)	0.36	0.30	0.19	99	0.03
8E-7		0.78	0.36	0.05	09-03	-0.05
COLLECTION	* * * * * * * * * * * * * * * * * * * *	63/17/98	03/17/98	03/17/98	COLLECTION	03/17/98
LOCATION		92 93	22	300	LUCATION	28

0.27

0.06

0.03

0.01

0.06

-0.02 0.03 -0.93

0.08

0.06

0.07

0.04

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03/17/98 09/04/98 03/17/98 09/04/98

200

LOCATION	COLLECTION	AG-	1104		31	S	134	Ś	137	RA-	922	- T.	822	
	*********				*****	******								
			(-/+)	(-/+)	(-/+)		(-/+)	(-/+)	(-/+)	(-/+)	(+/+)	(-/+)	(-/+)	
	03/17/98	-0.00	0.03		0.04	-0.01	0.03	0.00	0.0%	16.0	0.87	0.69	0.16	
	86/70/60	-0.04	0.02		0.10	-0.00	0.04	0.07	90.0	1.04	0.83	0.62	0.20	
	03/17/98	-0.04	0.02		90.0	0.00	0.03	0.08	0.0%	2.24	1.29	0.61	0.18	
	86/70/60	0.05	90.0		0.14	0.01	0.02	0.16	0.11	1.82	1.97	0.57	0.27	
300	03/17/98	-0.00	0.03		0.03	0.01	0.02	0.04	90.0	0.76	0.99	0.42	0.11	
	86/70/60	0.03	0.05		0.11	0.01	0.04	0.16	0.08	1.22	1.87	0.88	0.24	

FE-59	0.060	0.076	0.051
E :	0.008	005	0.035
(-/+)	0.016 0.015 0.026 0.027	0.025 0.021 0.017 0.026	0.019
8 :	004 011 0.009 0.018	0.004	0.001
(+/+)	0.015 0.015 0.022 0.027	0.030 0.022 0.017 0.019	0.021 0.019 0.025
2	0.007	0.033	0.000
CR-51 (+/-)	0.198 0.165 0.231 0.302	0.280 0.182 0.163 0.259	0.250 0.170 0.199 0.324
8	019	0.167 58 707	0.023
6./-)	4.0	0.5	0.00
K-49	0.3	0.00	0.3
(-1-)	0.166 0.128 0.184 0.241	0.205 0.206 0.150 0.203	0.243 0.142 0.166 0.282
8E-7	0.031	0.174 0.126 0.062	0.072 086 022 0.028
DATE	02/04/98 05/12/98 08/10/98 11/06/98	05/12/98 05/12/98 08/10/98 11/06/98	02/04/98 05/12/98 08/10/98 11/06/98
LOCATION	£25.55 25.55	28x 28x 28x 28x	FEE

RU-106	0.159	0.278 0.215 0.163	0.248 0.201 0.296 0.296
a.	0.097	0.055 0.067 0.113 0.165	0.036 0.137 0.083
W-103	0.022 0.015 0.027	0.027 0.022 0.019 0.025	0.026 0.019 0.021 0.030
Da :	0.005	0.005	0.002
NB-95	0.023 0.022 0.021 0.036	0.030 0.024 0.038 0.038	0.037 0.034 0.024 0.042
EN :	006	0.008 0.000 0.012 003	0.006
(-/+)	0.028 0.028 0.053	0.035 0.035 0.032 0.046	0.030 0.033 0.031 0.035
28	010 003 0.027 0.013	0.026	0.013
(-/+)	0.035 0.097 0.062 0.048	0.052 0.034 0.043 0.038	0.057 0.092 0.049 0.070
N2 :	0.000	034	027
09-00	0.012 0.016 0.019 0.020	0.021 0.023 0.015	0.023 0.016 0.025 0.036
8	0.005	0.003	022 004 0.009
COLLECTION	02/04/98 05/12/98 08/10/98 11/06/98	02/04/98 05/12/98 08/10/98 11/06/98	02/04/98 05/12/98 08/10/98 11/06/98
LOCATION	275 275 275 275	28x 28x 28x 28x	FFFF

16	SH	15
this this	FIS	13
BE	=	3M 9/
-	SH	/13d
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TH-228	(-/-)	0.000	0.086	0.119	0.202	0.130	6.123	0.100	0.114	0.163	0.098	0.130	0.214
#	-	180	0.088	0.175	0.234	0.185	0.149	0.208	6.121	0.087	0.093	0.251	0.319
RA-226	(-/-)	0.648	0.522	0.80%	0.849	669.0	0.493	0.682	0.557	0.581	0.448	0.762	969.0
RA		000	0.307	0.196	0.273	256	0.803	0.450	0.071	0.098	0.015	0.331	0.170
751-53	(-/+)	0.016	0.022	0.027	0.025	0.032	0.018	0.020	0.029	0.020	0.018	0.019	0.038
S			005	002	0.00%	003	013	0.023	0.005	007	900	018	0.005
CS-134	(-/+)	0.019	0.016	0.020	0.035	0.028	0.024	0.017	0.025	0.024	0.018	0.019	0.031
S		0.012	007	002	044	012	007	017	0.000		010		90%
1:-131	(-/+)	0.000	0.029	0.053	0.085	0.081	0.041	0.032	0.075	0.063	0.028	0.046	6.073
Σ		010	900.	0.000	900.0	0.016	0.022	0.005	016	0.020	800	0.005	1,00.
1108	(+/+)	0.027	0.021	0.028	0.046	0.029	0.032	0.031	0.031	0.026	0.016	0.023	0.028
AG		0.005	900.0	0.008	0.013	022	0.003	0.003	700.	\$10	0.001	0.003	001
COLLECTION		02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98
LOCATION		275	275	275	272	28x	28x	28x	28x	31	31	31	31

TABLE 17A FISH-BULLHEADS (PCI/G WET WI.)

		-												
FE-59		(-/+)	0.068	0.052	0.049	0.054	0.041	0.061	0.065	0.070	0.048	0.061	0.052	0.095
H			0.006	022	634	0.023	012	036	050	0.010	039	620	100	003
85-00		(-/+)	0.021	0.016	0.016	0.017	0.011	0.022	0.023	0.023	0.015	0.023	0.017	0.025
8			0.011	0.000	007	0.002	013	0.005	0.009	003	003	900.	900.	0.00
45-MM		(-/+)	0.025	0.013	0.017	0.015	0.013	0.018	0.023	0.021	0.018	0.018	0.016	0.021
2			027	0.006	-,008	110	0.003						002	
-51		(-/+)	0.242	0.147	0.212	0.230	0.127	0.196	0.212	0.202	0.136	0.187	0.191	0.312
C#-51				0.050			0.116				114			
0		(-/+)	1.0	9.0	7.0	0.7	9.0	0.7	6.0	0.7	0.7	0.0	0.8	6.0
K-40			3.3	3.4	3.0	3.6	3.5	3.5	2.7	3.6	3.0	3.3	4.2	3.2
1		(-/-)	0.155	0.122	0.172	0.150	0.114	0.142	0.184	0.147	0.164	0.168	0.170	0.180
7-38			0.030	003	128	0.041			0.166				087	
N DATE	*****		01/07/98	36/110/98	07/02/98	10/09/98	86/20/10	04/10/98	07/02/98	10/00/08	01/08/98	04/13/98	86/90/10	10/00/08
OCATION.			92	56	92	56	82	52	50	8	300	300	300	300

N-106		(+/+)	0.209	0.155	0.173	0.174	0.123	0.166	0.210	0.192	0, 199	0.210	0.201	0.242
J. W.			0.241	050	0.071	0.116	0.024	0.015	0.134	015	0.017	0.110	103	051
RU-103		(-/-)	9.054	0.014	0.022	0.019	0.013	0.020	0.023	9.025	0.018	0.019	0.016	0.028
-DR					0.013				0.011		800	900		021
8		(-/+)	0.026	0.020	0.021	0.023	0.015	0.048	0.033	0.031	0.018	0.025	0.023	0.036
NB-95					0.013				010					027
56-82		(-/+)	0.041	0.028	0.028	0.035	0.024	0.034	0.040	0.040	0.032	0.043	0.036	0.052
-KZ			900*-	0.018	005	800	0.030	020	021	0.00%	0.009	0.026	0.000	011
65		(-/-)	770.0	0.035	0.048	0.044	0.029	0.119	0.051	9%0.0	0.033	0.053	0.041	0.075
2N-65			0.020	022	0.013	033	0.014	052	020	070	110	019	023	043
99		(-/-)	0.031	0.017	0.020	0.021	0.010	0.018	0.024	0.024	0.021	0.014	0.020	0.020
09-03	:		0.014	0.002	100	800.	900	000	0.016	012	022			
COLLECTION			01/07/98	04/10/98	07/02/98	10/09/98	01/07/98	04/10/98	07/02/98	10/09/98	01/08/98	04/13/98	86/90/10	10/09/98
LOCATION			56	92	92	92	82	62	62	62	300	300	300	300

PAGE 3-43

: 1	15	0	3	50	0			9	,	4		
TH-228	0.105	0.06	0.00	0.07	90 0	0.00	0.097	0.08	0.07	0.08	G. DR	0.101
=	0.043	012	031	0.033	7.00	0.033	0.030	0.001	0.00	0.046	- 00k	009
(+/-)	0.443	0.465	0.800	0.313	0.482	0.729	0.468	0.331	0.671	0.701	0.421	0.457
8	0.523						168					0.563
(-/+)	0.030	0.020	0.024	0.020	0.019	0.024	0.026	0.024	0.018	0.027	0.026	0.028
Ė	900.0	0.027	0.023	0.015	0.020	007	0.015	0.025				0.018
(-/-)	0.025	0.016	0.018	0.015	0.016	0.021	0.016	0.017	0.020	0.019	0.018	0.024
8	000		018	000			007					005
1-131	0.043	0.033	0.054	0.087	0.025	0.054	0.062	0.082	0.032	0.032	0.044	0.146
Σ	0.014		0.024	061			0.002		021	018	0.025	025
AG-110M	0.035	0.019	0.026	0.027	0.017	0.030	0.030	0.024	0.025	0.019	0.027	0.031
AG	0.018	010.	0.007	*10				021		970	012	000
DATE	86/70/10	04/01/00	01/02/98	10/09/98	01/07/98	04/10/98	07/02/98	10/00/08	01/08/98	04/13/98	86/90/10	10/09/98
LOCATION	92	92	97	97	82	2	2	82	300	300	300	300

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200	-
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Sec.	147
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	FISH-OTHER

				15			_							
FE-59		(-/+)	0.00	0.04	0.07	0.107	0.07	0.036	0.084	0.071	0.040	0.054	0.07	0.088
			-0.072	-0.007	0.011	0.000	0.018	0.034	-0.035	-0.00%	-0.010	0.021	-0.102	0.013
85-02		(-/+)	0.032	0.022	0.017	0.029	0.022	0.018	0.030	0.030	0.012	0.017	0.025	0.034
8			0.005	0.001	-0.008	-0.015	-0.002	0.000	0.011	0.00%	-0.009	-0.006	0.016	0.019
24		(-/+)	0.023	0.021	0.020	0.029	0.018	0.020	0.022	0.032	0.017	0.017	0.023	0.024
MH-54			0.005	0.018	-0.021	0.011	0.00%	0.006	0.00%	0.001	-0.010	0.006	0.010	0.067
51		(-/+)	0.35	0.14	0.19	0.34	0.15	0.17	0.25	0.37	0.12	0.15	0.20	0.28
CR-51			0.00	-0.04	0.14	0.11	0.13	0.01	90.0	6.03	-0.12	0.01	0.02	-0.14
0		(-/+)	96.0	0.72	6.87	1.20	0.84	0.64	0.93	0.89	0.56	0.73	0.89	1.06
07-X			3.50	3.91	3.99	3.67	3.59	2.60	3.80	3.03	2.62	3.37	3.69	3.98
1		(-/+)	0.25	0.16	0.19	0.24	0.18	0.14	0.18	0.23	0.00	0.13	0.18	0.25
7-38	:		-0.06	-0.10	0.02	-0.07	-0.04	-0.07	-0.04	-0.02	-0.06	0.11	-0.06	90.0
TYPE			OTHER	BASS	BASS	PERCH	PERCH	CARP	BASS	CARP	CARP	BASS	BASS	BASS
DATE			01/26/98 A	04/10/98	07/02/98	10/09/98	01/06/98	96/10//90	07/02/98	10/09/98	01/08/98	04/13/98	07/06/98	10/09/98
OCATION .			92	56	56	58	62	53	2	62	300	300	300	300

9	(-/+)	.212	190	.203	0.347	500	100	248	0.281	133	160	100	0.250
RU-106	9				-0.035 0	043	080	0.000	990				0.059 0
RU-103	(-/+)	0.031	0.019	0.020	0.045	0.019	0.017	0.023	0.031	6.012	0.015	0.022	0.027
5		-0.001	-0.013	-0.011	-0.025	0.014	-0.002	0.005	0.002	0.002	0.006	0.002	-0.001
26-8N	(-/+)	0.034	0.043	0.027	0.045	0.026	0.022	0.051	0.035	0.016	0.018	0.024	0.035
8E		-0.015	-0.016	0.002	-0.007	0.003	-0.615	-0.020	0.008	-0.009	-0.009	0.007	-0.020
2R-95	(-/+)	0.057	0.036	0.040	0.084	0.043	0.027	0.047	0.058	0.028	0.031	0.044	0.042
28.		0.021	0.000	0.010	-0.008	-0.007	0.002	0.006	-0.016	-0.012	0.011	0.032	0.022
59-NZ	(-/-)			0.065		0.050	0.042	0.073	0.051	0.032	0.040	0.058	0.064
HZ		0.024	0.039	-0.043	-0.028	0.00%	-0.003	-0.020	-0.030	-0.017	0.001	-0.053	-0.026
09-00	(-/+)	0.034	0.021	0.025	0.043	0.026	0.021	0.025	0.021	6.015	0.018	0.027	0.038
8		0.018	0.010	0.019	0.019	-0.019	0.003	0.014	0.012	0.00	6.011	0.000	0.037
TYPE		OTHER	BASS	BASS	PERCH	PERCH	CARP	BASS	CARP	CARP	BASS	BASS	BASS
COLLECTION		01/26/98 A	04/10/98	07/02/98	10/09/98	90/90/10	04/10/98	07/02/98	10/09/98	01/08/98	04/13/98	86/90/10	10/05/98
LOCATION		92	92	92	92	62	62	52	53	300	300	300	300

A: SAMPLE OF PIKE AND BASS.

PAGE 3-45	(+/-)	0.109 0.076 0.006 0.150	0.103 0.075 0.112 0.095	0.047 0.061 0.083
•	Ė	0.018 0.018 0.002 0.065	0.063 -0.013 0.020 0.052	-0.018 -0.001 -0.021
	RA-226 (+/-)	0.684 0.704 0.408 0.718	0.445	0.320 0.467
	RA-	-0.052 0.356 -0.042 -0.074	-0.207 -0.298 0.143	-0.222 0.037 0.559 0.679
	CS-137 (+/-)	0.032 0.028 0.033	0.036 0.022 0.028 0.030	0.025 0.019 0.025 0.027
	Ś	0.009 -0.012 0.040 -0.003	0.626 0.014 -0.002 0.034	0.025 -0.008 0.011 0.003
	134	0.022 0.021 0.022 0.029	0.016 0.026 0.028	0.017
TABLE 178 FISH-OTHER (PCI/G WET WT.)	CS-134	-0.002 -0.009 0.000	0.007 -0.020 -0.009 -0.016	0.002 0.014 -0.020 0.003
FISH-	E (-/s)	0.148 0.044 0.057 0.169	0.032 0.044 0.082 0.175	0.023 0.032 0.050 0.176
	1-131	-0.065 -0.008 0.030 0.061	0.000 -0.008 0.031 -0.063	0.014 0.022 0.022 0.146
	MO1 (-/+)	0.028 0.026 0.026 0.026	0.026 0.020 0.030 0.034	0.021 0.019 0.024 0.035
	AG-110M	-0.012 -0.008 -0.017 -0.012	0.016 -0.007 0.004 0.019	0.008 -0.002 -0.026 -0.017
1998	TYPE	OTHER BASS BASS PERCH	PERCH CARP BASS CARP	CARP BASS BASS BASS
T YANKEE 19	DATE	01/26/98 A 04/10/98 07/02/98 10/09/98	01/06/98 04/10/98 07/02/98 10/09/98	01/08/98 06/13/98 07/06/98 10/09/98
CONNECTICUT YANKEE	LOCATION	2222	2222	300

4. DISCUSSION OF RESULTS

This section summarizes the results of the analyses of environmental media sampled. NNECO has carefully examined the data throughout the year and has presented in this section all cases where station related radioactivity could be detected and compared the results with previous environmental surveillance data. The only impact observed from the station was tritium detected in on-site wells during 1998. Subsections describe each particular media or potential exposure pathway. Any dose commitments from station-related exposures is insignificant as explained in Section 5.

Naturally occurring nuclides such as Be-7, K-40, Ra-226 and Th-228 were detected in numerous samples. Be-7, which is produced by cosmic processes, was observed predominantly in airborne and vegetation samples. Ra-226 and Th-228 results were variable and were observed in broadleaf vegetation, river water (one barely positive Ra-226), river bottom sediment, shellfish, and fish (one barely positive Ra-226).

Cs-137 and Sr-90, present because of atmospheric nuclear weapons testing of years past, were observed at levels similar to those of past years.

4.1. Gamma Exposure Rate (Table 1)

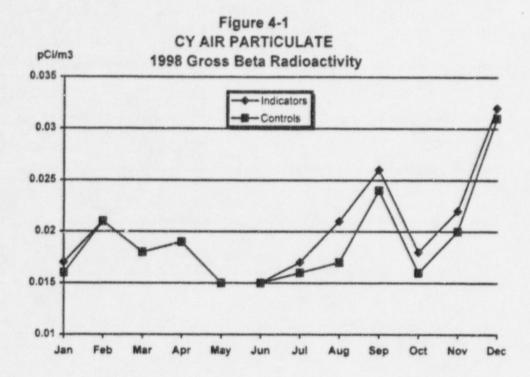
Gamma exposure from all sources of radioactivity is measured over periods of approximately one month using CaF_2 (Mn) thermoluminescent dosimeters (TLDs). These dosimeters are strategically placed at a number of on-site locations, as well as at inner and outer off-site locations. Glass bulb type TLDs such as these, are subject to inherent self-irradiation which has been experimentally measured for each dosimeter. The results, shown in Table 1 have been adjusted for this effect. The range of this correction for field dosimeters is $0.4~\mu\text{R/hr}$ to $2.8~\mu\text{R/hr}$, with a mean of approximately $1~\mu\text{R/hr}$.

No indications of plant related exposure were observed. The exposure rate measurements exhibit the same trends as those of past years. These measurements demonstrate the general variations in background radiation between the various on-site and off-site locations and include gamma exposure from all sources of radioactivity.

4.2. Air Particulate Gross Beta Radioactivity (Table 2)

Air is continuously sampled at seven inner ring and two outer ring locations by passing it through glass fiber particulate filters. These are collected weekly and analyzed for gross beta radioactivity. Results are shown on Figure 4-1 and Table 2.

Gross beta activity remained at levels similar to that seen over the last decade. Inner and outer ring monitoring locations showed no significant variation in measured activities. This indicates that any station contribution is not measurable.



4.3. Airborne lodine (Table 3)

Because the station permanently shutdown in 1996 all radioactive iodines, which have short half-lives, have decayed away. Therefore the requirement to sample airborne iodine has been removed from the Radiological Effluent Monitoring Manual (REMM) and no samples were collected in 1998.

4.4. Air Particulate Gamma (Table 4A-D)

The weekly air particulate filters are composited quarterly for gamma spectral analyses. The results, as shown in Tables 4A-4D, indicate the presence of naturally occurring Be-7, which is produced by cosmic processes. No positive results were observed for all the other isotopes. These analyses indicate the lack of station effects.

4.5. Air Particulate Strontium (Table 5)

Table 5 in past years was used to report the measurement of Sr-89 and Sr-90 in quarterly composited air particulate filters. These measurements are not required by the REMM and have been discontinued. Previous data has shown the lack of detectable station activity in this media. This fact, and the fact that milk samples are a much more sensitive indicator of fission product existence in the environment, prompted the decision for discontinuation.

4.6. Soil (Table 6)

Soil samples are not required by the REMM.

4.7. Cow Milk (Table 7)

Analysis of milk samples is generally the most sensitive indicator of fission product existence in the terrestrial environment. This, in combination with the fact that consumption of milk is significant, results in this pathway usually being the most critical from the station release viewpoint. This pathway also shows measurable amounts of nuclear weapons testing fallout. Therefore, this media needs to be evaluated very carefully when trying to determine if there are any station effects.

Previous data over many years has shown the lack of station related strontium activity in this media. Therefore, the strontium analysis frequency is quarterly, rather than monthly. The monthly samples collected within each quarter from each sample location are composited and analyzed at the end of each quarter. Sr-90 was observed in nearly one half of all samples; the highest value observed was 4.8 pCi/l. Detailed analysis of previous data has concluded that these levels of Sr-90 are from weapons testing and are not station related (see Section 6.0 for details to this argument).

Cs-137 usually shows the same tendencies as Sr-90. Results for 1998 are similar to those seen for nearly the past two decades. Detailed analysis has concluded that these concentrations are most likely the result of fallout from previous nuclear weapons testing (see Section 6.0 for details).

Although not listed on Table 7, the only other nuclide detected by gamma spectrometry was naturally occurring K-40.

4.8. Goat Milk (Table 8)

Depending on the feeding habits, goat milk can be a more sensitive indicator than cow milk of fission products in the environment. This is due to the metabolism of these animals. Similar to the results of the cow milk samples, these show measurable amounts of nuclear weapons testing fallout.

Sr-90 and Cs 137 were observed in most samples. The levels observed are due to residual radioactivity in the environment from nuclear weapons testings in the 1960s. The variability in the results this year as well as in past years is caused by many factors, including feeding habits (amount of stored feed, etc.), soil characteristics, farming practices (tillage and quality of fertilization and land management), and feed type. For a complete discussion of the problem see Section 6.0.

4.9. Pasture Grass (Table 9)

When the routine milk samples are unavailable, samples of pasture grass are required as a replacement during the months of April through December. These samples may also be taken to further investigate the levels of radioactivity in milk. Directives since mid-year have been to sample feed (e.g., hay) if pasture grass is also unavailable. During the winter months and early spring, insufficient growth prohibits sampling of pasture grass as a replacement sample. Because of unavailability of pasture grass during November and December, feed (hay) was collected as a substitute for the pasture grass. No station effects were seen in the feed.

4.10. Well Water (Table 10)

Activity in this media results from either soluble station effluents permeating through the ground or the leaching of naturally occurring nuclides from the soil and rock. In 1998, samples of well water from the onsite stations (location 15) were taken monthly even though the requirements per the REMODCM are to sample quarterly. Because H-3 in station liquid effluents is the predominant radionuclide present, the higher sampling frequency was implemented to enhance program monitoring effectiveness. On-site wells (location 15) exhibited station related H-3 above background levels. This station effect results from the wells being located within an area influenced by the water in the discharge canal and H-3 having the ability to readily follow the flow of ground water. Off-site concentrations are much lower. This pathway does not result in any dose consequence since the water from these wells is used only in process streams at the station.

On-site H-3 levels detected in 1998 samples show a decrease compared to prior years. This is a trend that started back in cycle 17 (1992) due to replacing stainless steel clad fuel with zircaloy clad fuel. The levels of H-3 observed since permanent shutdown in July 1996 represent residual levels of tritium that remain in station process liquids and/or groundwater from beneath the site that are gradually dropping to natural background levels. Figure 4-2 shows the trend of H-3 measured in CY on-site wells since 1988. Of note in the figure is the highs and lows observed in measured levels of H-3. These swings are coincident with station operations. Higher H-3 levels are observed during periods when increased volumes of liquid processing occurred in preparation for station outages.

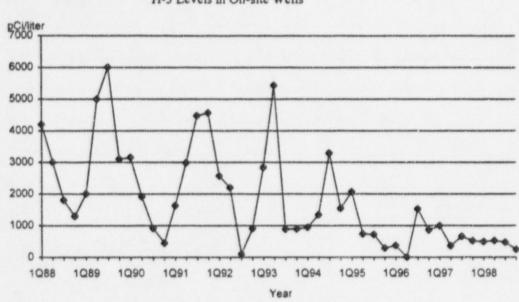


Figure 4-2
H-3 Levels in On-site Wells

4.11. Reservoir Water (Table 11)

Reservoir water samples are special samples not required by the REMM. Previous data has shown the lack of detectable station activity in this media. This fact and the extremely unlikely possibility of observing routine station effluents in this media has resulted in discontinuing these samples.

4.12. Fruits and Vegetables (Table 12)

This media did not show any station effects. Naturally occurring K-40 was detected in all samples and cosmically produced Be-7 was detected in one sample. Since there was no fresh fallout, no other nuclides were detected.

4.13. Broad Leaf Vegetation (Table 13)

Concentrations of Cs-137 seen in several of these samples are at levels comparable to past years and are due to fallout. To enhance program monitoring effectiveness, samples of broadleaf vegetation are collected monthly during the growing season, May - October, even though requirements are to collect twice a year. No station effects were observed in broadleaf samples.

4.14. River Water (Table 14)

These samples are collected on a quarterly basis; the sampling procedure is different at the control and indicator locations. Six weekly grab samples are taken within each quarter and composited for the control station (Middletown - location 30C). Continuous sampling, an automatic process of compositing a small volume of sample periodically over an entire quarter, is utilized at the indicator station (East Heddam Bridge - location 28).

Examination of the data shows there were no H-3 measurements that exceed 1.5 times the listed 2 σ error. Even though H-3 measurements at the indicator location (Loc. 28) appear significantly higher than the control location (Loc. 30C), the values reported are the effect of counting statistics. Although measurable levels of tritium above background have been detected in the past; there have been no positive indications of tritium in this media since 1994.

4.15. Bottom Sediment (Table 15)

There were positive indications of Cs-137 in several samples, including the control location. Because the indicator and control samples show similar levels, the source of this Cs-137 is from weapons fallout deposited in woodlands and washed out into water bodies. No indications of station related activity were observed in this sample media.

4.16. Shellfish (Table 16)

As in previous years, no station related activity was observed. This media is not a source of consumption.

4.17. Fish (Tables 17A and 17B)

4.17.1. Bullheads (Table 17A)

No station related activity was observed.

4.17.2. Perch and Other Types (Table 17B)

As observed in the past, there was no positive indication of radioactivity in this media from the station, including Cs-137. Even though the measured values at the indicator locations do not exceed 1.5 times the listed 20 error and are the effect of counting statistics, the results will be conservatively treated as a possible positive results in order to perform a dose consequence analysis in Section 5.0.

5. OFF-SITE DOSE EQUIVALENT COMMITMENTS

The off-site dose consequences (dose equivalent commitments) of the stations' radioactive liquid and airborne effluents have been evaluated using two methods. The first method utilizes the stations' measured radioactive discharges as input parameters into conservative models to simulate the transport mechanism through the environment to man. This results in the computation of the maximum doses to individuals and the 0 to 50 mile population dose. The results of these computations are submitted to the NRC in the Annual Radioactive Effluent Report written in accordance with the Radiological Effluent Monitoring Manual, Section F.2. The second method utilizes the actual measurements of the concentrations of radioactivity in various environmental media (e.g., milk, fish) and then computes the dose consequences resulting from the consumption of these foods.

The first method, which is usually conservative (i.e., computes higher doses than that which actually occur), has the advantage of approximating an upper limit to the dose consequences. This is important in those cases where the actual dose cannot be measured because they are so small as to be well below the capabilities of conventional monitoring techniques. For gaseous releases, extremely low concentrations of Cs-137 were released in 1998 for a short period of time. The only other station related activity observed in 1998 was H-3 in on-site well water. On-site well water is used for station processing and services, it is not a pathway for human consumption. Levels of Cs-137 observed in fish, although not plant related, were used to conservatively predict dose consequences as if the radioactivity were the result of station decommissioning operations.

Summarizing the data presented in Table 5.1:

MAXIMUM TOTAL INDIVIDUAL DOSES:

WHOLE BODY = 0.2 mrem (Adult)

LIVER = 0.27 mrem (Teen)

The average dose to an individual within 50 miles from the site using method 1 yields the following results for the period January - December 1998 for the average individual:

ANNUAL AVERAGE WHOLE BODY DOSE:

DUE TO AIRBORNE EFFLUENTS = 0.00002 mrem

DUE TO LIQUID EFFLUENTS = 0.00063 mrem

Thus, it can be seen that the average whole body dose to an individual is much less than the maximum whole body dose to an individual as shown in Table 5.1.

In order to provide perspective on the doses in Table 5.1, the standards for 1998 on the allowable maximum dose to an individual of the general public are given in 40CFR190 as 25 mrem whole body, 75 mrem thyroid, and 25 mrem any other organ. These standards are a fraction of the normal background radiation dose of 284 mrem per year and are designed to be inconsequential in regard to public health and safety. Station related doses are a small fraction of the standard as set by the Environmental Protection Agency and of the variation in natural background in Connecticut. Station related doses pose insignificant public health consequences.

TABLE 5.1 - COMPARISON OF DOSE CALCULATION METHODS HADDAM NECK STATION

1998 Annual Dose (millirem)

Pathway	Individual	Organ	Method 1 (1)	Method 200
Airborne Effluents				
External Gamma Dose	Max. Ind. (2)	Whole Body	0.00015	ND ⁽⁴⁾
2. Inhalation	Teen	Whole Body Liver	0.051 ⁽⁶⁾ 0.051 ⁽⁶⁾	NAD(3)
Liquid Effluents				
1. Fish Pathway only ⁽⁷⁾	* Adult Teen	Whole Body	0.15 ⁽⁷⁾ 0.082	<0.042 ⁽⁸⁾ <0.023
	* Adult	GI(LLI) ⁽⁵⁾	0.032	<0.009
	Teen Child	"	0.0058 0.0025	<0.0009
	Adult * Teen	Liver "	0.22 0.22	<0.064 <0.066
	Child	**	0.20	< 0.060

Notes:

- (1) Method I uses measured station discharges and meteorological data as input parameters to conservative transport to man models. Method 2 uses actual measured concentrations in environmental media.
- (2) Maximum individual The maximum individual dose is the dose to the most critical age group at the location of maximum concentration of station related activity. The dose to the average individual is much less than the maximum individual dose. The doses for inhalation and vegetable consumption assume that the individual resides at the point of maximum quarterly dose. Therefore, his residence is subject to variation for conservatism.
- (3) NAD No activity detected above the minimum detectable level.
- (4) ND Not Detectable The station effects at all off-site locations were so small that they could not be distinguished from fluctuations in natural background.
- (5) GI(LLI) Gastrointestinal Tract Lower Large Intestine.
- (6) Dose is primarily due to the release of tritium (H-3) in airborne effluents. Since tritium effects nearly all organs equally, the resulting dose to the whole body from inhaling tritium is the same.
- (7) The dose values listed for the fish pathway represent the liquid dose pathway to man that is calculated using Method 1 conservative computer models.
- (8) The dose values represent the dose consequences for eating fish with Cs-137 present from weapons fallout.

6. DISCUSSION

The evaluation of the effects of station operation on the environment requires the careful consideration of many factors. Those factors depend upon the media being affected. They include station release rates, effluent dispersion, fallout distribution from past nuclear weapons tests, redistribution of fallout dut to weathering and biotic activity, soil conditions (mineral content, pH, etc.), quality of fertilization, quality of land management (e.g., irrigation), pacturing habits of animals, and type of pasturage. Any of these factors could cause significant variations in the measured radioactivity. A failure to consider these factors could cause erroneous conclusions.

Consider, for example, the problem of deciphering the effect of station releases on the radioactivity measured in milk samples. This is an important problem because this product is widely consumed and fission products readily concentrate in this media. Some of these fission products, such as Sr-89 are relatively short-lived. Therefore they result from either station effluents, nuclear weapons tests or nuclear incidents (e.g. Chernobyl). The long-lived radionuclides of Sr-90 and Cs-137 are still remaining from the weapons testing era of the 1960's resulting in measurable amounts in milk samples. Distinguishing between this "background" of fallout activity and station effects is a difficult problem.

In reviewing the Sr-90 and Cs-137 measured in cow and goat milk in the areas around the Haddam Neck station, a casual observer could notice that in some cases the levels of these isotopes are higher at farms closer to the station than at those further away from the stations. The station's effluents might at first appear to be responsible. However, the following facts prove this conclusion wrong.

- (1) The station accurately measures the long-lived fission products Sr-90 and Cs-137 in their releases. Based on these measurements and proven models developed by the Nuclear Regulatory Commission, concentrations in the environment can be calculated. These calculations, generally conservative, show that insufficient quantities of Sr-90 and Cs-137 have been released from the stations to yield the measured concentrations in milk.
- (2) Although the shorter half-life isotopes of Sr-89 and Cs-134 have decayed away, their general absence in environmental samples in the past suggest that the isotopes of Sr-90 and Cs-137, presently seen in the environment, are not station related. Over the many years of station operation, Sr-89 has often been released in comparable quantity to Sr-90, as well as Cs-134 to Cs-137. Since the pairs of isotopes are chemically similar according to their elemental forms, comparable levels should have been detected in milk if Sr-90 and Cs-137 were station related. No station related Sr-89 or Cs-134 have ever been detected in milk samples, or in any other media. The only occurrences of detectable Cs-134 in milk resulted from the Chernobyl incident.
- (3) Since dairy milk sampling began in the 1960's, several years prior to station operation, the immediate station areas have always shown higher levels of weapons fallout related Sr-90 and Cs-137 (see Figures 6-1 and 6-2). The ratio of activity between the locations has not changed with station operation. All areas show the same significant decrease in radioactivity since the 1964 Nuclear Test Ban Treaty.
- (4) Local variability of Sr-90 and Cs-137 in milk is common throughout the United States. Due to the variability in soil conditions, pasturing methods, rainfall, etc., it is the rule rather than the exception. Therefore, it is not surprising that certain farms have higher levels of radioactivity than other farms. In fact, there are some cases where the farms further from the station have higher Sr-90 and Cs-137 values than the farms that are closer to the station (e.g., see pre-1984 Haddam Neck Goat Milk data.)

Based on these facts, it is concluded that station effluents are not responsible for variations of Sr-90 and Cs-137 in environmental samples. The cause must be one or more of the other variables.

Northeast Nuclear Energy Company has carefully examined the data throughout the year and has presented in this report all cases where station related radioactivity can be detected. An analysis of the potential exposure to the population from any station related activity has been performed and shows that in all cases the exposure is insignificant.

As in previous years, this data is being submitted to, and will be reviewed by the appropriate regulatory bodies such as the Nuclear Regulatory Commission, Environmental Protection Agency and Connecticut Department of Environmental Protection.

Figure 6-1 Strontium-90 in Milk

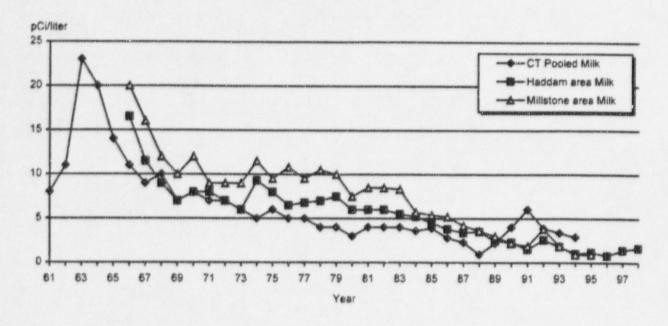
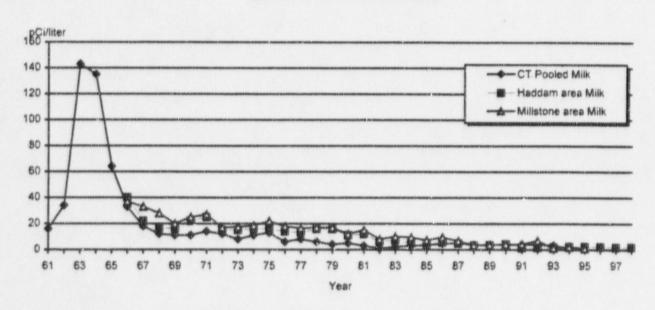


Figure 6-2 Cesium-137 in Milk



Dairy milk is no longer available in the Millstone area and CT Pooled milk has not been collected by the State of CT since 1994.

CY Start-up occurred:

July 24, 1967

MP1 Start-up occurred:

October 26, 1970

MP2 Start-up occurred:

October 17, 1975

MP3 Start-up occurred:

January 23, 1986

APPENDIX A

LAND USE CENSUS FOR 1998

TABLE A-1 (page 1 of 2)

Dairy Cows Within 15 Miles of Connecticut Yankee -December 1998

Direction	Distance	Name and Address	# of Cows
NNE	14 M	Allen Hills Hills Farm 527 Gilead Street Hebron, CT 06248	185
NNE	14 M	Edward Ellis Mapleleaf Farm, Inc. 768 Gilead Street Hebron, CT 06248	176
NNE	14 M	Gordon N. Rathburn Martin Road Hebron, CT 06248	36
NNE	14.5 M	Douglas Porter 14 Porter Rd. Hebron, CT 06248	140
NE	8 M	Elizabeth Gilman 178 Cato Corner Rd. Colchester, CT 06415	32
NE	14 M	Victor Botticello 302 Levita Road Lebanon, CT 06249	40
ENE	6.5 M	Robert Cone Grandpa Hill Farm Box 251 318 Old Colchester Tpke East Haddam, CT 06423	60
ENE	11 M	Richard Swider 475 New London Rd. Colchester, CT 06415	46
E	11.5 M	Eugene Wilczewski Salem Valley Farm Dairy 200 Darling Road Salem, CT 06415	45
E	14 M	Stuart Gadbois 40 Old Colchester Rd. Salem, CT 06415	225
SE	11 M	John Tiffany III Tiffany Farms 156 Sterling City Road Old Lyme, CT 06371	85

TABLE A-1 (page 2 of 2)

Dairy Cows Within 15 Miles of Connecticut Yankee - December 1998

Direction	Distance	Name and Address	# of Cows
wsw	8 M	Michael Dwyer 63 Grieb Rd.	30
		Wallingford, CT 06492	
wsw	8 M	Robert Raudat	44
		909 Durham Road	
		Killingworth, CT 06417	
wsw	11 M	Raymond Wimler	190
		533 Guilford Road	
		Durham, CT 06422	
WSW	14 M	John & Edward Cella	150
		Cella Brothers Farm	
		2 No. Brandford Street	
		Wallingford, CT 06492	
WSW	15 M	David & Kirsten Footit	140
		D & K Farm	
		81 School St.	
		Wallingford, CT 06492	
W	11.5 M	Tony Caltabiano	45
		Friendly Acres Dairy Farm	
		145 Parmalee Hill Road	
		Durham, CT 06422	
W	14 M	Walter Werbiski	21
		North Farms	
		1069 Farms Road	
		Wallingford, CT 06492	
W	14.5 M	Charles Greenback & Sons, Inc.	170
		182 Wallingford Rd.	
		Durham, CT 06422	
NW	13 M	Higgins Farm, Inc.	79
		837 Ridgewood Road	
		Middletown, CT 06457	
NW	15 M	Joan Bryck or Jean Backiel	51
		Riverside Farm	
		1160 France St.	
		Rocky Hill, CT 06067	

TABLE A-2 (page 1 of 1)

Dairy Goats Within 20 Miles of Connecticut Yankee - December 1998

Direction	Distance	Name and Address	Total Goats
NNE	12 M	Louise Sage 155 Reidy Hill Road Hebron, CT 06248	4
NNE	16 M	Joan Bowers 350 Wall Street Hebron, CT 06248	2
NNE	16 M	Kathy Waters Burnt Hill Road Hebron, CT 06248	70
SSE	3.6 M	Virginia Marshall Old County Road Haddam, CT 06438	6
SE	19.5 M	Mrs. John Mingo 69 Spithead Road Waterford, CT 06385	7
SE	15.8 M	George Scacciaferro 338 Boston Post Road East Lyme, CT 06333	2
S	11.5 M	Victor Trudeau 174 Horse Hill Road	5
w	15.3 M	Westbrook, CT 06498 Jim & Mary Hall Petlack 1000 North Farms Road Wallingford, CT 06492	12
WNW	19 M	Daniel Nitkowski 46 Firch Avenue Meriden, CT 06450	4
NNW	14 M	Dorothy Joba 171 Ferry Lane S. Glastonbury, CT 06073	10
NNW	15 M	Donald Reid 1654 Main Street Glastonbury, CT 06033	

^{*} UNABLE TO CONTACT AS OF THIS TIME.

TABLE A-3 (page 1 of 1)

1998 Resident Survey

conducted August 1998

	Downwind	Distance
Sector	Direction	(Meters)
A	N	1150
В	NNE	1780
C	NE.	1265
D	ENE	1710
E	E	1955
F	ESE	2740
G	SE	1410
Н	SSE	940
J	S	980
K	SSW	860
L	SW	940
M	WSW	1140
N	W	1360
P	WNW	660
Q	NW	750
R	NNW	1495

APPENDIX B

NNECO QA PROGRAM

INTRODUCTION

Northeast Nuclear Energy Company (NNECO) acting as the agent for the Connecticut Yankee Atomic Power Company (CYAPCO), maintains a quality assurance (QA) program as part of the radiological environmental monitoring program (REMP). The QA program consists of contractor appraisals, quality control samples, and quality control testing of environmental TLDs.

NNECO OA PROGRAM

Appraisals are conducted of the primary (Duke) radioanalysis contractor, of the Production Operations Support Laboratory (POSL), and of the NNECO Radiological Engineering Section (RES). A REMP evaluation form is completed for each appraisal and discrepancies are tracked on a separate form until corrective action is taken. The primary contractor, POSL, and RES are also audited by other organizations; the contractor by other customers, and POSL and RES by Northeast Utilities Nuclear Oversight Department.

There are two types of NNECO QA Program quality control samples - spikes and duplicates. Sample spikes are a check on the accuracy of results of the contractor's radioanalyses. Duplicate samples are a check of the contractor's precision or reproducibility of results. The number and type of NNECO QA Program quality control samples are given in Table 1. The results of the contractor's analyses of NNECO quality control samples must satisfy acceptance criteria in Procedure RAB B-3, "Quality Control of Radiological Environmental Monitoring Program Sample Analyses." An investigation is conducted of any result or trend which does not satisfy acceptance criteria.

There are two types QA Program tests of environmental TLDs - spikes and field comparisons. Spike testing involves the exposure of four TLDs each month. POSL readouts of the spiked TLDs are compared to the known radiation exposure. For field comparisons, QA TLDs of a different design from the REMP TLDs, are co-located with REMP TLDs at eight locations and processed at the Northeast Utilities Dosimetry Laboratory. Readings of the QA TLDs are compared to POSL's REMP TLD readings. The comparison results must satisfy acceptance criteria in NNECO Radiological Assessment Branch Procedure RAB B-2, "Quality Control of the Environmental TLD Monitoring Program." An investigation is conducted on any result or trend which does not satisfy acceptance criteria.

OTHER OA PROGRAMS

The NNECO QA Program is not the only QA Program which monitors REMP radioanalyses performance. Other programs include:

- Duke's internal QA program. In addition to the NNECO quality control samples the radioanalysis contractor has it's own quality control samples. In total, at least five percent of the contractor's sample analyses include quality control samples.
- 2. Duke's interlaboratary comparison program with an independent third party, Analytics, Inc. Results of the Analytics intercomparison are contained in Appendix C. Primary contractor participation in an interlaborary comparison program is required by station Technical Specifications. The Analytics comparison satisfies this requirement and is supplemented by the EPA Intercomparison Studies Program.

3. Duke's participation in EPA's Environmental Radioactivity Laboratory Intercomparison Studies Program. Duke participates in EPA's program because of their analyses of drinking water, not because of nuclear power station environmental sample analyses. However, some of the EPA intercomparison samples are also applicable to nuclear power environmental samples. Results of the EPA Intercomparison Studies Program are contained in Appendix C.

RESULTS OF NNECO OA PROGRAM FOR CONTRACTOR RADIOANALYSES

The NNECO QA Program indicated that Duke's environmental radiological analysis program was adequate in 1998. Of 103 analysis results on QA samples, 99 passed criteria, a 96% success rate.

There were two air particulate gamma analyses which exceeded the criterion of being within 20% of the spiked value - both I-131 sample spikes, one at minus 23% and one at minus 30%. Although three other I-131 spikes on filter passed criteria in 1998, an negative bias for results of I-131 on filter analyses has been noted. This bias is currently under investigation.

There was one gross beta air particulate analysis which exceeded the criterion of being within 20% of the spiked value at minus 27%. The failure occurred because of a change in the method of preparing the QC sample. This was corrected by reverting back to the previous method and four subsequent QC samples in 1998 were within the criterion.

There was one strontium in milk QC sample which exceeded the criterion of being within 30% of the spiked value at plus 58%. The cause of the failure was that the source was expired. It was discarded and a new source was ordered.

RESULTS OF NUSCO OA PROGRAM FOR ENVIRONMENTAL TLDS

Eleven of the monthly TLD spike tests satisfied procedural criteria. One TLD spike test failed low because of a personnel error in spiking the test TLDs. A corrective action was identified for preventing a repeat of the spike test personnel error. The corrective action was implemented effective with the November test.

All twelve of the field comparisons satisfied procedural criteria.

TABLE B-1 (page 1 of 1)

NUMBER OF QUALITY CONTROL SAMPLES 1998

BETWEEN THE THE TAXABLE PROPERTY OF THE PROPER	NUMBE	D OF ATTEMPT OF
SAMPLE TYPE	OC SAM	只是ACUPACE TO ACUPACION TO ACUPACION TO ACCUPACION TO ACCUPACION TO ACCUPACION TO ACCUPACION TO ACCUPACION TO A
TLDs - Field Compa	ison 12 ⁽²	528
- Spike	12 0	528
Milk - Strontium	5(4)	32(4)
Milk - Gamma	60 (5	800
Water - Gamma	60	576
Water - Tritium	3	32
Fish/Invertebrate - Gamma	3	2004
Fruits & Vegetation & Sediment -	Gamma 0	2079
Air Particulate - Gross	Beta 7	832
- Gamm	a 25	740

FOOTNOTES

- (1) Includes both Millstone and Haddam Neck
- (2) Each TLD field comparison sample is comprised of a set of 8 TLDs.
- (3) Each TLD spike sample is comprised of a set of 4 TLDs.
- (4) Sr-89 and Sr-90.
- (5) Gamma in water QA spikes are treated as milk surrogates.

TABLE B-2 (page 1 of 1)

RESULTS OF QUALITY CONTROL SAMPLE ANALYSES 1998

	5AM	PLETYPE		NUMBER PASS CRITERIA	NUMBER FAIL CRITERIA
TLDs -	Fiel	d Comparison		12	0
	Spil	ke		11	1
Milk - Strontiur	m			4 (i)	1
Water - Gamma	t ⁽²⁾			60	0
Water - Tritium				3	0
Oysters - Gamn	na (3)			3	0
Air Particulate	:	Gross Beta Gamma (4)		6 23	1 2
			TOTALS	TLDs: 23	TLDs: 1
FOOTNOTES				Samples: 99	Samples: 4

(1) Sr-89 or Sr-90.

APPENDIX C

SUMMARY OF INTERLABORATORY COMPARISONS

INTRODUCTION

This appendix covers the Intercomparison Program of the Duke Engineering and Services Environmental Laboratory (DESEL) as required by technical specifications for each Millstone unit. DESEL uses QA/QC samples provided by Analytics, Inc to monitor the quality of analytical processing associated with the Radiological Environmental Monitoring Program (REMP). The suite of Analytics QA/QC samples are designed to be comparable with the pre-1996 US EPA Interlaboratory Cross-Check Program. It was modified to more closely match the media mix presently being processed by DESEL. All intercomparison results received by DESEL on or before January 31, 1999 are included. Late results for 1998 will be reported in the annual report for 1999. DESEL also receives intercomparison samples from the US EPA because of their drinking water analysis program. Results from analyses of these samples are included where they are applicable to the REMP.

ACCEPTANCE CRITERIA

Intercomparison Program results are evaluated using two separate DESEL internal acceptance criteria. The first criterion concerns bias, which is defined as the deviation of any one result from the assumed known value. The second criterion concerns precision, which deals with the ability of the measurement to be faithfully replicated by comparison of an individual result with the mean of all results for a given sample set. A sample set is created by taking three aliquots from the same sample and submitting each as a blind replicate.

The bias criterion is defined as within 25% of the known value for Sr-89 or Sr-90 and within 15% of the known value for other radionuclides, or within two sigma of the known value. This bias criterion is applied to both the Analytics and the US EPA intercomparison sample results.

For Analytics intercomparison sample results, the precision criterion is defined as an overlap of the two sigma ranges for the three replicate analyses. US EPA samples have EPA supplied criteria of lower and upper control level within which the average of the three replicate samples must occur.

RESULTS (All results are extracted from References 1 and 2.)

For 1998, bias testing results for 72 individual environmental analyses of seven Analytics intercomparison samples are listed in the table on the following two pages. All of the analyses passed the bias criteria. Replicate sample results are not reported in References 1 and 2; however the references do report that, of the 72 environmental analyses for the seven samples there was only one result which failed the precision criterion. This was the low-level (LL) I-131 analysis for the third quarter water sample. DESEL issued CR 98-009 to investigate the failed precision test. The result of this investigation is not yet available.

Results of bias and precision testing on the US EPA intercomparison samples are contained in the table on Pages C-5 and C-6. Of 42 individual analyses of EPA samples, 40 passed the bias criteria, a 95% success rate. There were no failures of precision criteria for the EPA samples.

REFERENCES

- 1. DESEL Analytical Services Semi-Annual Quality Assurance Status Report, January-June 1998
- 2. DESEL Analytical Services Semi-Annual Quality Assurance Status Report, July-December 1998

TABLE C-1 (page 1 of 3)

ANALYTICS INTERCOMPARISON PROGRAM 1998

BIAS TESTING

WINDS STREET,		W. William Company of the Company of	BIAS TESTING		
QUARTER	MEDIA	NUCLIDE	KNOWN	ANALYSIS	RATIO
1st	Milk	Sr-89	53 pCi/L	55 pCi/L	1.04
		Sr-90	44	45	1.02
		Cr-51	201	204	1.01
		Mn-54	133	139	1.05
		Co-60	85	86	1.01
		Fe-59	95	100	1.05
		Zn-65	142	147	1.04
		I-131	82	84	1.02
		1-131 (LL)	82	83	1.01
		Cs-134	84	83	0.99
		Cs-137	161	171	1.06
		Ce-141	70	73	1.04
lst	Water	Beta	269 pCi/L	308 pCi/L	1.14
		Cr-51	167	171	1.02
		Mn-54	111	111	1.00
		Co-60	71	70	0.99
		Fe-59	79	82	1.04
		Zn-65	118	120	1.02
		I-131	90	90	1.00
		I-131 (LL)	90	92	1.02
		Cs-134	70	68	1.01
		Cs-137	134	136	1.02
		Ce-141	58	59	1.06
		Ra-226	53	56	1.02
		Ra-228	46	47	
2nd	Air Filter	Beta	212 pCi/filter	220 pCi/filter	1.04
		Sr-89	142	140	0.99
		Sr-90	51	49	0.96
		Cr-51	113	111	0.98
		Mn-54	91	96	1.05
		Co-60	124	116	0.94
		Fe-59	39	43	1.10
		Zn-65	105	114	1.09
		Cs-134	82	84	1.02
		Cs-137	61	62	1.02
		Ce-141	85	80	0.94
2nd	Water	H-3	6007 pCi/L	5697 pCi/L	0.95

TABLE C-1 (page 2 of 3)

ANALYTICS INTERCOMPARISON PROGRAM 1998

CHAPTED	Victoria	NICE WAY	V. S. Santa	NAME OF	
OUARTER	PROMOCE UNIVERSITY OF STREET	NUCLIDE	KNOWN	ANALYSIS	RATIO
2nd	Milk	Cr-51	132 pCi/L	128 pCi/L	0.97
		Mn-54	106	111	1.05
		Co-60	143	144	1.01
		Fe-59	45	46	1.02
		Zn-65	122	124	1.02
		I-131	67	71	1.06
		I-131 (LL)	67	67	1.00
		Cs-134	95	97	1.02
		Cs-137	70	74	1.06
		Ce-141	99	102	1.03
3rd	Milk	Sr-89	51 pCi/L	62 pCi/L	1.22
		Sr-90	81	72	0.89
		Cr-51	186	180	0.97
		Mn-54	74	77	1.04
		Co-60	148	146	0.99
		Fe-59	63	66	1.05
		Zn-65	195	201	1.03
		I-131	90	96	1.07
		I-131 (LL)	90	87	0.97
		Cs-134	82	80	0.98
		Cs-137	134	134	1.00
		Ce-141	146	145	0.99
3rd	Water	Sr-89	84 pCi/L	83 pCi/L	0.99
		Sr-90	51	47	0.92
		Beta	198	190	0.96
		Cr-51	165	172	1.04
		Mn-54	66	66	1.00
		Co-60	131	129	0.98
		Fe-59	55	59	1.07
		Zn-65	173	175	1.01
		I-131	79	82	1.04
		I-131 (LL)	79	78	0.99
		Cs-134	73	71	0.97
		Cs-137	119	117	0.98
		Ce-141	129	129	1.00
					1.00

TABLE C-1 (page 3 of 3)

ANALYTICS INTERCOMPARISON PROGRAM 1998

OUARTER	MEDIA	NUCLIDE	KNOWN	ANALYSIS	RATIO
4th	Milk	Cr-51	195 pCi/L	205 pCi/L	1.05
		Mn-54	80	83	1.04
		Co-58	52	56	1.08
		Co-60	94	96	1.02
		Fe-59	57	62	1.09
		Zn-65	141	144	1.02
		I-131	39	42	1.08
		I-131 (LL)	39	38	0.97
		Cs-134	100	102	1.02
		Cs-137	103	109	1.06
		Ce-141	98	103	1.05

TABLE C-2 (page 1 of 2)
U.S. EPA INTERLABORATORY COMPARISON STUDIES PROGRAM 1998

(all values in pCi/L)

THE RESIDENCE OF THE PARTY OF T		THE COMPTENDED BY COMPANY OF THE PARTY OF TH	(all value)	minimum virginia	TO A STREET, AND THE PARTY OF T	WEDGEST WAS DONNE TO MAKE THE
Date	Media	Nuclide 1	PA Known	Lower Control	Upper Control	Duke (b)
1/16/98	Water	Sr-90	32.0	23.3	40.7	28.42 29.26 27.50
2/6/98	Water	I-131LL	104.9	86.7	123.1	109.7 106.8 110.2
3/13/98	Water	H-3	2155	1551	2759	2147 2095 2044
4/21/98	Water	Sr-89	9.3	5.3	13.3	7.8 8.81 10.3
4/21/98	Water	Co-60	50.0	41.3	58.7	47.7 48.4 48.5
4/21/98	Water	Cs-134	22.0	13.3	30.7	21.3 21.7 20.6
4/21/98	Water	Cs-137	10.0	1.3	18.7	8.6 9.6 9.1
6/5/98	Water	Co-60	12.0	3.3	20.7	11.5 12.6 11.4
6/5/98	Water	Zn-65	104.0	86.7	121.3	105.3 106.6 99.9
6/5/99	Water	Cs-134	31.0	22.3	39.7	28.9 27.8 26.9
6/5/98	Water	Cs-137	35.0	26.3	43.7	34.9 36.3 34.1

TABLE C-2 (page 2 of 2)
U.S. EPA INTERLABORATORY COMPARISON STUDIES PROGRAM 1998

(all values in pCi/L)

Date	Media	Nuclide	TERA KONAVIII	Lower Control	Upper Control	Duke*
7/17/98	Water	Sr-89	21.0	12.3	29.7	20.1 20.3 22.0
7/17/98	Water	Sr-90	7.00	0	15.7	9.80 7.40 7.11
8/7/98	Water	H-3	17996	14873	21119	17656 17550 17446
9/11/98	Water	I-131	6.10	2.60	9.60	6.04 5.95 4.85

^{*} Same sample analyzed three times.





ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT

HADDAM NECK STATION RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

JANUARY 1, 1998 - DECEMBER 31, 1998

DOCKET NO. 50-213 LICENSE NO. DPR-61

Prepared for the

CONNECTICUT YANKEE ATOMIC POWER COMPANY Haddam, Connecticut

By the

NORTHEAST NUCLEAR ENERGY COMPANY Waterford, Connecticut

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1. SUMMARY

The radiological environmental monitoring program for the Haddam Neck Station was continued for the period January through December 1998, in compliance with the Technical Specifications and the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual (REMODCM). This annual report was prepared for the Connecticut Yankee Atomic Power Company (CYAPCO) by the Safety Analysis Branch of the Nuclear Engineering Department of Northeast Nuclear Energy Company (NNECO). Sample collection and preparation and gamma exposure rate measurements were performed by the Production Operations Services Laboratory (POSL). Laboratory analyses were performed by Duke Engineering and Services Environmental Laboratory (DESEL).

Thermoluminescent dosimeters (TLDs) were used to measure direct gamma exposure in the vicinity of the station and as far away as 12.5 miles. Radiochemical and radiological counting analyses of samples were performed to detect the presence of any station related radioactivity. Samples included air particulates collected on filters, milk, cow and goat feed (hay), broad leaf vegetation, well water, fruits, vegetables, river water, bottom sediment, shellfish, and fish. In evaluating the results of these analyses it is necessary to consider the variability of natural and man-made sources of radioactivity, distribution in the environment and uptake in environmental media. This variability is dependent on many factors including station release rates, past spatial variability of radioactive fallout from nuclear weapons tests and on-going redistribution of the fallout, contribution from cosmically produced radioactivity, ground water dynamics, soil characteristics, farming practices, and feed type. Significant variations in measured levels of radioactivity could be caused by any one of these factors. Therefore, these factors need to be considered in order to properly explain any variations in radiation detected and to distinguish between natural and station related radioactivity.

Haddam Neck is permanently shutdown. Primary activities at the Haddam Neck station are now focused on decommissioning. Even though the station is no longer generating power, decommissioning activities included processing and discharging of liquids containing radioactivity and releasing of airborne radioactivity. However, the levels of radioactivity released are significantly lower than releases during plant operation. The radiological monitoring of the environment through this program will continue to assure the health and safety of the public and workers are maintained at all times.

The predominant radioactivity detected by the monitoring program was that from outside sources, such as fallout from nuclear weapons tests and naturally occurring radionuclides. As typical of previous years, station related radioactivity was observed at some of the on-site gamma monitoring locations. The only other observation of station effects was tritium in well water at the on-site location.

As usual, Cesium-137 and Strontium-90 were measured in both cow and goat milk. These levels are a result of nuclear weapons testing in the 1960s and not the result of station decommissioning operations. This can be concluded because insufficient quantities of these isotopes have been released by the station to account for the measured concentrations. Higher levels of Cesium-137 and Strontium-90 were detected prior to initial plant operation and have been declining since the ban on nuclear weapons testing in the 1960s.

The radiation dose (dose equivalent commitment) to the general public from the station's discharges has been evaluated by two methods. One method utilizes measurements of station's discharges and conservative transport models and the other utilizes the measured concentrations of radioactivity in the environmental media.

The maximum whole body dose (station boundary) that could occur to a member of the general public was calculated to be 0.2 millirem. The average dose to a member of the public residing within 50 miles of the station is 0.00065 millirem. These doses are 0.8 percent and 0.0026 percent of the standard as set by the Environmental Protection Agency on the maximum allowable dose to an individual of the general public. The standards of the Environmental Protection Agency are a small fraction (less than 10 percent) of the 284 mrem per year normal Connecticut resident background radiation (NCRP94) and are designed to be inconsequential in regard to public health and safety. Station related doses are a small fraction of these standards and of the variation in natural background in Connecticut. They pose insignificant public health consequences.

2. PROGRAM DESCRIPTION

2.1. Sampling Schedule, Types, and Locations

The sample locations and the sample types and frequency of analysis are given in Tables 2-1 and 2-2 and Figures 2.1 and 2.2. The program as described here includes both required samples as specified in the Radiological Effluent Monitoring and Off-Site Dose Calculation Manual and any extra samples.

Table 2-1 Environmental Monitoring Program Sampling Types and Locations

Location Number		Direction & Distance	The state of the s
1-1	On-site - Mouth of Discharge Canal	From Release Point 1.1 Mi, ESE	Sample Types TLD
2-1	Haddam-Park Rd.	0.8 Mi, S	
3-1	Haddam-Jail Hill Rd.	0.8 Mi, WSW	TLD TLD
4-1	Haddam-Ranger Rd.		
5-1	On-site-Injun Hollow Rd.	1.8 Mi, SW	TLD, Air Particulate
6-1	On-site-Substation	0.4 Mi, NW	TLD, Air Particulate
7-1	Haddam	0.5 Mi, NE	TLD, Air Particulate, Vegetation
8-I	East Haddam	1.8 Mi, SE	TLD, Air Particulate
9-1		3.1 Mi, ESE	TLD, Air Particulate
10-1	Higganum Hurd Park Rd.	4.3 Mi, WNW	TLD, Air Particulate
11-C	Middletown	2.8 Mi, NNW	TLD
11-C		9.0 Mi, NW	TLD
12-C	Deep River	7.1 Mi, SSE	TLD
	North Madison	12.5 Mi, SW	TLD, Air Particulate
14-C	Colchester	10.5 Mi, NE	TLD
15-1	On-site Wells	0.5 Mi, ESE**	Well Water
16-C	Well-State Highway Dept. E. Haddam	2.8 Mi, SE	Well Water
17-C	Beyond 10 Miles	Beyond 10 Miles	Fruits & Vegetables
18-I	Site Boundary	0.4 Mi, NW	Vegetation
19-1	Cow Location #1	6.5 Mi, ENE	Milk
20-I	Cow Location #2	8.0 Mi, NE	Milk
21-1	Cow Location #3	11.0 Mi, SE	Milk
22-C	Cow Location #4	11.0 Mi, ENE	Milk
23-C	Goat Location #1	16.0 Mi, NNE	Milk
24-I	Goat Location #2	3.6 Mi, SSE	Milk
25-1	Within 10 Miles	Within 10 Miles	Fruits & Vegetables
26-1	CT River-Near Intake	1.0 Mi, WNW	Fish
27-C	CT River-Higganum Light	4.0 Mi, WNW	Shellfish
28-I	CT River-E. Haddam Bridge	1.8 Mi, SE	Bottom Sediment, River Water
28-X	CT River-E. Haddam Bridge	1.8 Mi, SE	Shellfish
29-1	Vicinity of Discharge	Within 0.3 Miles	Bottom Sediment, Fish
30-C	CT River - Middletown	9.0 Mi, NW	River Water, Bottom Sediment
		7.6 Mi, NW	Fish
31-1	Mouth of Salmon River	0.8 Mi, ESE	Shellfish
10-X	Near Intake Structure	0.1 Mi, SSW	TLD
11-X	Picnic Area	0.3 Mi, WNW	TLD
12-X	Environmental Trail	0.1 Mi, NW	TLD
13-X	Moodus - Rts 149 & 151	2.5 Mi, ENE	TLD
14-X	Shailerville, Horion Rd.	1.0 Mi, SE	TLD
15-X	Old Waste Gas Sphere Fence	0.1 Mi, E	TLD
46-X	Discharge Canal Fence	0.2 Mi, SE	TLD
47-X	Info Center	0.1 Mi, WNW	TLD

** New wells at 0.4 miles SE may be used as a replacement for this location.

^{*} Key: 1 - Indicator C - Control X - Extra - sample not required

[†]The release points are the stack for terrestrial locations and the end of the discharge canal for aquatic locations.

Table 2-2 Technical Specification Sampling Frequency & Type of Analysis

47	Exposure Pathway and/or Sample	Number of Locations	Sampling & Collection Frequency	Type of Analysis
1a.	Gamma Exposure - Environmental TLD	14	Monthly	Gamma Dose - Monthly
1b.	Gamma Exposure - Accident TLD	25	Quarterly [‡]	N/A [‡]
2.	Airborne Particulate	7	Continuous sampler - weekly filter change	Gross Beta - Weekly Gamma Spectrum - Quarterly on composite (by location), and on individual filter if gross beta is greater than 10 times the mean of the weekly control station's gross beta results
3.	Vegetation	4	One sample near middle & one near end of growing season	Gamma Isotopic on each sample
4.	Milk	6	Monthly	Gamma Isotopic on each sample - Monthly Sr-89 and Sr-90 - Quarterly
4a.	Pasture Grass	6	Sample as necestary to substitute for unavailable milk	Gamma Isotopic
5.	Well Water	2	Quarterly	Gamma Isotopic and Tritium on each composite
6.	Bottom Sediment	3	Semiannually	Gamma Isotopic
7.	River Water	2	Quarterly Sample - Indicator is continuous composite; Background is composite of six weekly grab samples	Quarterly - Gamma Isotopic and Tritium
8.	Fish (edible portion) - bullheads and, when available, perch or other edible fish	3	Quarterly	Gamma Isotopic - Quarterly
9.	Shellfish	2	Quarterly	Gamma Isotopic - Quarterly

[‡] Accident monitoring TLDs to be dedosed at least quarterly

Figure 2.1 Haddam Neck Station Sample Stations

Figure 2.2 Haddam Neck Station Inner Sample Stations

2.2. Samples Collected During Report Period

The following table summarizes the number of samples of each type collected during the present reporting period:

Sample Type	Number of Technical Specification Required Samples	Number of Technical Specification Required Samples Analyzed	Number of Extra Samples Analyzed
Gamma Exposure - Environmental TLD	168	168	96
Air Particulates	364	364	0
Dairy Milk	48	44*	0
Goat Milk	24	18*	0
Pasture Grass	**	0*	3***
Well Water	8	8	8
Fruit & Vegetables	8	8	0
Broad Leaf Vegetation	4	4	9
River Water	8	8	0
Bottom Sediment	6	6	0
Fish	24	24	0
Shellfish	8	8	4
Total All Types	670	660	120

- * Due to sample unavailability, less than required number of samples were obtained.
- ** Sample as necessary, during the months of April through December, to substitute for unavailable milk.
- *** Three of ten unavailable milk samples occurred during the months when a pasture grass sample is required as a substitute. Hay was collected in lieu of pasture grass due to unavailability of grass.

3. RADIOCHEMICAL RESULTS

3.1. Summary Table

In accordance with the Radiological Effluent Monitoring Manual (REMM), Section F.1, a summary table of the radiochemical and radiological analyses results has been prepared and is presented in Table 3-1. All analysis results are summarized including analysis results of extra, non-required samples.

In the determination of the mean, the data was handled as recommended by the Health and Safety Laboratory, Idaho and NUREG/CR-4007 (Sept. 1984): all valid data, including negative values and zeros were used in the determination of the mean (see Part 3.2).

A more detailed analysis of the data is given in Section 4.0 where a discussion of the variations in the data explains many aspects that are not evident in the Summary Table because of the basic limitation of data summaries.

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MOMITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POMER COMPANY, HADDAM NECK PLANT
DOCKET 50-213

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MEDIUM OR PATHUAY SAMPLED	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS MEAN (RANGE)(B)	LOCATION SITH H LOCATION S', DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN OCATION #, DISTANCE ## DISTANCE (RANGE)(8)	CONTROL LOCATIONS MEAN (RANGE)(8)	NRN (C)
CAMMA DOSE (UR/HR)	216, 48 (0)	1.5	(6.6 - 10.5)	LOC # 45 0.1 MILES E	(9.3 - 16.3)	8.0 (6.5 - 9.5)	0
AIR PARTICULATE AND TODINE	312, 52 BETA	0.01 (E)	0.020	LOC # 9	(0.307 - 0.044)	(0.006 - 0.040)	0
(PC1/N3)	GAHMA 24, 4 BE-7	;	0.092	LOC# 8 3.1 MILES ESE	0.104	0.096 (0.062 - 0.112)	0
	09-00	:	(0.000 - 0.001)	1.8 MILES SW	(0.000 - 0.001)	0.000 (0.001)	0
	ZR-95	ı	0.000 (-0.004)	LOC # 5 0.4 MILES NU	(0.000 - 0.003)	(-0.002 - 0.000)	0
	NB-95	:	(-0.003 - 0.062)	1.8 MILES SE	(-0.001 - 0.002)	0.000 (-0.001)	0
	RU-103	:	0.000 (-0.002)	LOC # 8 3.1 MILES ESE	(0.001 - 0.001)	(0.000 - 0.000)	0
	CS-134	0.05 (F)	0.000 (0.001)	LOC # 5 0.4 MILES MA	(0.000 - 0.001)	0.000 - 0.001)	0
	cs-137	90.0	0.000 - 0.000)	1.8 MILES SE	(0.000 - 0.000)	(0.000 - 0.000)	0
MILK (DAIRY) (PCI/L)	SR 11, 4	ı	1.3	100 # 21	1.9 (-2.1 - 4.8)	(-0.6 - 3.5)	0
	SR-90		(-0.6 - 4.8)	LOC # 20 8 MILES NE	(3.5 - 4.8)	(1.0 - 3.4)	0
	1001NE 32,12 1-131	-	.9.76	LOC # 21	(-6.00 - 3.09)	.4.46 - 4.71)	0

FABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
CONNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213

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MEDIUM OR PATHUAY SAMPLED	AMALYSIS AND TOTAL NUMBER OF AMERICA GAMMA 32, 12 CS-134	LOWER LIMIT OF DETECTION (LLD) (A) 15	ALL INDICATOR LOCATIONS MEAN (RANGE)(8) -0.3	LOCATION WITH H LOCATION #, DISTANCE AND DIRECTION LOC # 20 8 MILES NE	LOCATION WITH HIGHEST ANNUAL NEAN OCATION #, NEAN DISTANCE (RANGE)(B) LOC # 20 -0.1 MILES NE -1.5 - 2.2)	CONTROL LOCATIONS NEAN (RANGE)(B) -0.6 (-5.4 - 1.6)	# OF NRM (C)
	CS-137	81	1.9 . 1.5 . 9.3)	LOC # 20 8 MILES NE	5.9 (2.7 - 9.3)	(-1.1 - 3.7)	0
	8A-140	£	04 - 3)	LOC # 22C 11 MILES ENE	(-2 - 4)	(-2 - 4)	0
	LA-140	æ	(-5.1 - 4.0)	LOC # 22C	(-1.8 - 4.1)	(-1.8 - 4.1)	0
GOAT MILK (PCI/L)	SR 4, 4	:	(0.8 - 4.7)	LOC # 24 3.6 MILES SSE	2.6 (0.8 - 4.7)	0.9	0
	SR-90	:	(4.6 - 9.0)	10C # 24 3.6 MILES SSE	(4.6 - 9.0)	(0.6 - 5.1)	0
	IODINE 10, 8	-	-0.92	LOC # 23C 16 MILES NNE	0.50 (-3.51 - 1.57)	0.50	0
	GAMMA 10, 8 CS-134	15	(-2.3 - 2.1)	LOC # 23C 16 MILES NNE	(-2.5 - 2.4)	(-2.5 - 2.4)	0
	CS-137	18	(1.3 - 11.3)	10C # 23C 16 MILES MNE	(2.5 - 11.4)	5.7 (2.5 - 11.4)	0
	BA-140	R	(-6 - 1)	LOC # 23C 16 MILES NNE	(-6 - 3)	0- 0- 3)	0
	LA-140	23	(-6.8 - 1.1)	10C # 23C	(-6.8 - 3.7)	(-6.8 - 3.7)	0
PASTURE GRASS (PCI/G)	I-131	9.06	0.036 - 0.036)	LOC # 20 8 MILES NE	0.036 - 0.036)	-0.019	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

REDICH OR PATHWAY SAMPLED	TOTAL NUMBER OF ANALYSES PERFORMED CS-134	0F DETECTION (1.1.D) (A) 0.06	LOCATIONS MEAN (RANGE)(B) -0.017 (-0.0170.017)	LOCATION #, DISTANCE AND DIRECTION LOC # 23C 16 NILES NNE	DISTANCE MEAN DISTANCE MEAN	(RANGE)(B) (-0.024 - 9.001)	(C) O
	751-53	0.08	0.000 - 0.000)	LOC # 23C 16 MILES MME	0.036	0.036	0
	BA-140	:	(0.012 - 0.012)	LOC # 20 8 MILES NE	0.012 (0.012)	-0.046	0
	LA-140	·	(0.014 - 0.014)	LOC # 20 8 MILES NE	(0.014 - 0.014)	-0.053	0
GROUNDWATER (PCI/L)	GAMMA 12, 4 MN-54	15	(-2.3 - 2.3)	LOC # 15 0.5 MILES ESE	(-2.3 - 2.3)	(-2.0 - 0.5)	0
	85-00	15	(-2.0 - 1.7)	LOC # 15 0.5 MILES ESE	(-2.0 - 1.7)	(-3.00.8)	0
	FE-59	30	(-4.0 - 2.9)	LOC # 16C 2.8 MILES SE	(-0.6 - 5.9)	(-0.6 - 5.9)	0
	09-00	5	(-1.8 - 1.3)	LOC # 16C 2.8 MILES SE	(-0.7 - 1.6)	(-0.7 - 1.6)	0
	ZN-65	30	1.9 (-6.0 - 8.4)	LOC # 16C 2.8 MILES SE	3.9 (-7.7 - 18.8)	3.9 (-7.7 - 18.8)	0
	ZR-95	30	(-4.6 - 3.4)	LOC # 16C 2.8 MILES SE	(.0.6 - 2.1)	(-0.6 - 2.1)	0
	NB-95	15	(-3.8 - 0.7)	LOC # 16C 2.8 MILES SE	(-2.4 - 1.4)	(-2.4 - 1.4)	0
	1-131	:	(7 - 5-)	10C # 16C 2.8 MILES SE	3 (-1 - 9)	3 (-1 - 9)	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
CONNECTICUT YANKEE ATCHIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

PATHWAY SAMPLED	TOTAL NUMBER OF AMALYSES PERFORMED	DETECTION (LLD) (A)	LOCATIONS MEAN (RANGE)(B)	LOCATION WITH R LOCATION #, DISTANCE AND DIRECTION	LOCATION WITH RIGHEST ANNUAL MEAN LOCATION #, DISTANCE MEAN (RANGE)(B)	LOCATIONS LOCATIONS MEAN (RAKGE)(R)	WRW (C)
	134	2	(-3.0 - 1.1)	0.5 MILES ESE	(-3.0 - 1.1)	(-1.2 - 0.9)	0
	CS-137	81	(-0.5 - 2.1)	LOC # 15 0.5 MILES ESE	(-0.5 - 2.1)	(-2.40.2)	0
	BA-140	99	(5 - 4- 5)	LOC # 15 0.5 MILES ESE	(5 -4-)	(-5 - 3)	0
	LA-140	15	(-5 - 6)	10C # 15 0.5 MILES ESE	(9 - 5 - 6)	(-6 - 3)	0
	TRITTUM 12, 4 N-3	2000	432 (215 - 633)	10C # 15 0.5 MILES ESE	(215 - 633)	(0 - 93)	0
FRUITS AND VEGETABLES (PCI/G)	SAMMA 4, 4 BE-7	:	(0.05 - 0.51)	LOC # 25 <10 MILES	6.05 - 0.51)	(0.00 - 0.35)	0
	K-40	·	(0.89 - 4.05)	LOC # 17C	2.72 (0.50 - 5.58)	2.72	0
	MN-54	:	-9.006	LOC # 17C >10 MILES	-0.004	-9.004	0
	85-00	:	(-0.006 - 0.006)	LOC # 17C >10 MILES	(-0.012 - 0.016)	0.002	0
	09-00	:	0.009 - 0.024)	LOC # 25 <10 MILES	0.009 (0.006)	-0.005	0
	28-95	:	(0.003 - 0.022)	LOC # 25 <10 MILES	(0.003 - 0.022)	-0.036	0
	NB-95	:	(0.001 - 0.017)	LOC # 25	(0.001 - 0.017)	0.006	0

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FAULE 3-1
FNVIRGNMENTAL RADIOLOGICAL MONITORINE PROGRAM SUMMARY
CONNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM WECK PLANT
DOCKET 50-213
JAMUARY - DECEMBER 1998

MEDIUM OR	TOTAL NUMBER	LOWER LINIT	ALL INDICATOR	LOCATION WITH P	LOCATION # WITH HIGHEST ANNUAL MEAN	CONTROL	# OF
PATHWAY	C. AMALYSES PERFORMED	DETECTION (LLD) (A)	MEAN (RANGE)(B)	DISTANCE AND DIRECTION	MEAN (RANGE)(B)	MEAN (RANGE)(B)	(0)
	RU-103	:	(-0.002 - 0.013)	10C # 25 <10 MILES	(-0.002 - 0.013)	-0.005 (-0.015 - 0.017)	0
	1-131	0.06 (6)	(-0.017 - 0.008)	LOC # 17C >10 MILES	(-0.020 - 0.051)	0.017	0
	CS-134	99.0	(-0.012 - 0.016)	10C # 25 <10 MILES	(-0.012 - 0.016)	-0.008 (-0.019 - 0.006)	0
	CS-137	0.08	-0.003	10C # 17C	-0.002	(-0.012 - 0.011)	0
	RA-226	ı	(-0.089 - 0.221)	LOC # 17C >10 MILES	(-0.106 - 0.767)	(-0.106 - 0.767)	0
	TH-228	:	(-0.012 - 0.133)	LOC # 25 <10 MILES	(-0.012 - 0.133)	0.003	0
BROADLEAF VEGETATION (PCI/G)	GAMMA 13, BE-7	:	1.20	LOC # 18 0.4 MILES NW	1.39 (0.39 - 2.41)		0

GANNA 13.	:	1.20 (0.39 - 2.41)	LOC # 18 0.4 MILES NW	1.39 (0.39 - 2.41)	:			0
K-40	:	3.06 (0.72 - 6.50)	10C # 6 0.5 MILES NE	3.57 (1.49 - 6.50)	÷			0
MN-54	;	-0.000 (-0.031 - 0.020)	LOC # 18 0.4 MILES NU	0.002	j		_	0
85-00	:	-0.003	10C # 18 0.4 MILES NW	(-0.019 - 0.014)			_	0
09-00	:	0.001	LOC # 18 0.4 MILES NW	0.001 (-0.009)	Ċ		•	0
28-95	;	(-0.020 - 0.029)	LOC # 18 0.4 MILES NW	0.003	:		_	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
CONNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213

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MEDIUM OR PATHWAY SAMPLED	ANALYSIS AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION (LLD) (A)	ALL INDICATOR LOCATIONS MEAN (RANGE)(B)	LOCATION WITH H LOCATION #, DISTANCE AND DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN OCATION #, MEAN DISTANCE (DIRECTION (RANGE)(B)	CONTROL LOCATIONS MEAN (RANGE)(B)	WRW (C)
	HB-95	:	(-0.034 - 0.020)	10C # 6 0.5 MILES NE	(-0.005 - 0.020)		0
	RU-103	:	-0.001	10C # 6 0.5 MILES NE	0.001		0
	1-131	90.0	-0.00%	LOC # 18 0.4 MILES NW	-0.003		0
	CS-134	0.06	0.001	LOC # 18 0.4 MILES NW	(-0.011 - 0.011)	()	0
	CS-137	0.08	(-0.024 - 0.092)	LOC # 18 0.4 MILES MA	0.032		0
	RA-226	:	-0.025	LOC # 18 0.4 MILES NW	0.035		0
	TH-228	:	(-0.105 - 0.257)	LOC # 6 0.5 MILES NE	0.055 (-0.105 - 0.257)		0
(PCI/L)	GANNA 4, 4 K-40	:	.16 (-319)	LOC # 30C 9.0 MILES NA	18 (-16 - 72)	18 (-16 - 72)	0
	MN-54	15	(-0.3 - 1.6)	1.8 MILES SE	(-0.3 - 1.6)	(-0.2 - 0.4)	0
	85-00	15	(-1.0 - 0.9)	LOC # 28 1.8 MILES SE	(-1.0 - 0.9)	(-1.70.1)	0
	FE-59	30	(-1.31.1)	LOC # 30C 9.0 MILES NW	(-3.8 - 2.1)	(-3.8 - 2.1)	0
	09-00	15	(-0.1 - 0.1)	10C # 30C 9.0 PIES NW	(-0.2 - 0.3)	(-0.2 - 0.3)	0
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TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

MEDIUM OR PATHUAY SAMPLED	ANALYSIS AND TOTAL MIMBER OF ANALYSES PERFORMED	DETECTION	LOCATIONS NEAN	LOCATION WITH H LOCATION #, DISTANCE	LOCATION WITH HIGHEST ANNUAL MEAN LOCATION #, MEAN DISTANCE MEAN MODIFICATION	LOCATIONS NEAN	
and the same	ZN-65	30	(-1.3 - 1.4)	LOC # 30C 9.0 RILES NW	(*************************************	(RANGE)(B)	4.8)
	28-95	30	(-4.0 - 5.3)	LOC # 28 1.8 MILES SE	(-4.0 - 5.3)	(-1.0 - 1	1.0)
	NB-95	15	(-1.6 - 1.8)	10C # 30C 9.0 MILES NW	(0.2 - 1.7)	(0.2 - 1	1.7
	1-131	;	31 (16 - 56)	1.8 MILES SE	31 (16 - 56)	6 -6 - 1	1
	CS-134	15	(-0.7 - 0.2)	10C # 30C	(-0.7 - 0.8)	(-0.7 - 0.1	0.8)
	CS-137	18	(-0.5 - 0.1)	10C # 30C 9.0 MILES NW	.0.0 (-1.0 - 1.6)	(-1.0 - 1.	1.63
	BA-140	60 (H)	-8 (-11-)	10C # 30C	(-3 - 6)	(-3 - 6)	-
	LA-140	15 (H)	(-127)	10C # 30C 9.0 MILES NW	(9 - % -)	(9 - 4-)	-
	TRITIUM 4, 4	2000	(177 - 379)	LOC # 28	274 (177 - 379)	-136	(65-
BOTTOM SEDIMENT (PCI/G)	GAMMA 4, 2 K-40	:	(8.9 - 11.5)	LOC # 30C 9.0 MILES NW	10.8	10.8	
	MN-54	;	0.00	LOC # 29 0 MILES N/A	0.02	0.00	6
	85-00	ı	0.00	LOC # 28	(0.00 - 0.01)	(-0.01 - 0.02)	5

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, NADDAM NECK PLANT
DOCKET 50-213

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MEDIUM OR PATHMAY SAMPLED	TOTAL NUMBER OF ANALYSES OF SARTYSES PERFCRMED CO-60	DETECTION (LID) (A)	ALL INDICATORS LOCATIONS MEAN (RANGE)(B) 0.00 (-6.05 - 0.04)	LOCATION WITH HI LOCATION #, DISTANCE AND DIRECTION LOC # 29 C MILES N/A	LUCATION #, DISTANCE ND DIRECTION LOC # 29 C MILES N/A (0.02 - 0.04)	LOCATIONS MEAN (RANGE)(B) (0.01	8
	28-95		(-0.05 - 0.06)	LOC # 29 0 MILES N/A	0.05 (0.04 - 0.05)	-0.02	1 -
	NB-95	:	(-0.03 - 0.03)	LOC # 29 0 MILES N/A	(-0.02 - 0.03)	-0.04	-
	1-131	ı	(-0.03 - 70.0-)	LOC # 30C	(-0.020.00)	-0.01	
	cs-134	0.15	(-0.01 - 0.01)	LCC # 30C 9.0 MILES NW	(0.01 - 0.01)	(0.01 - 0.01)	-
	CS-137	0.18	(0.06 - 0.16)	LOC # 29 0 MILES N/A	(0.08 - 0.16)	(0.04 - 0.16)	
	RA-226	·	1.52	LOC # 29 0 MILES N/A	2.03	(6.76 - 1.22)	1
	TH-228	:	(0.57 - 0.69)	LOC # 28 1.8 MILES SE	(0.62 - 0.69)	0.65	
(PCI/G)	GANNA 8, 4, BE-7	:	(-0.09 - 0.17)	1.8 MILES SE	(-0.04 - 0.17)	-0.09	
	K-40	:	(-0.1 - 0.4)	LOC # 27C	(0.1 - 0.4)	(0.1 - 0.4)	
	CR-51	:	(-0.16 - 0.25)	LOC # 31 0.8 MILES ESE	(-0.03 - 0.25)	-0.02	
	MN-54	0.13	0.00 (-0.02)	LOC # 28	0.01	0.00	

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUMMARY
COMNECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JAMIARY - DECEMBER 1998

MEDIUM OR PATHMAY SAMPLED

NRW (C)	0	0	0	0	0	0	0	0	0	0	0	0
LOCATIONS	(RANGE)(B) 0.09 (-0.01 - 0.02)	(-0.04 - 0.01)	(-0.01 - 0.01)	-0.00 - (-0.04)	(-6.01 - 0.03)	(-0.010.00)	0.00 (-0.03)	(-0.09 - 0.29)	(0.00 - 0.01)	(-0.01 - 0.04)	(-0.04 - 0.05)	(-0.01 - 0.01)
LOCATION 8, MEAN MEAN	(RANGE)(B) 0.00 (-0.01 - 0.02)	(-0.03 - 0.05)	(-0.02 - 0.02)	-0.00 - (-0.04)	0.01 (-0.03)	(-0.01 - 0.01)	0.00 (-0.02 - 0.03)	0.00 - 0.17)	0.00 c 0.01)	(-0.01 - 0.04)	-0.00 (-0.02 - 0.01)	0.00 (-0.01 - 0.02)
LOCATION #, DISTANCE	AND DIRECTION LOC # 27C 4 MILES WNW	10C # 31 0.8 MILES ESE	1.8 MILES SE	LOC # 27C 4 MILES WWW	LOC # 27C 4 MILES WNW	10C # 31 0.8 MILES ESE	10C # 27C	1.8 Miles SE	LOC # 27C 4 MILES WWW	LOC # 27C	10C # 31 0.8 MILES ESE	LOC # 28
LOCATIONS	(*ANGE)(B) -0.01 (-0.03 - 0.01)	(-0.03 - 0.05)	-0.00	-0.02	0.00	0.00 (-0.01)	-0.00	(-0.21 - 0.17)	-0.00 (-0.00)	-9.00	(-0.02 - 0.01)	-0.00
DETECTION	0.13	0.26	0.13	0.26	:	:	:	:	:	:	0.13	0.15
TOTAL NUMBER OF ANALYSES	CO-58	FE-59	09-00	ZN-65	ZR-95	N8-95	RU-103	RU-108	AG-110M	1-131	CS-134	CS-137

TABLE 3-1
ENVIRONMENTAL RADIGLOGICAL MONITORING PROGRAM SUMMARY
COMMECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

NEDIUM OR TOTAL NUMBER OF PATHWAY OF ANALYSES DETECTION SAMPLED PERFORMED (LLD) (A) RA-226	TH-228	FISH GAMMA 16, 8 (ALL TYPES) BE-7 (PCI/G)	к-40	CR-51	MN-54 0.13	CO-58 0.13	FE-59 0.26	CO-60 0.13	ZN-65 0.26	ZR-95
W W W ON	0.18 0.18 (0.09 - 0.32)	-6.01	3.4 (2.6 - 4.0)	0.06	0.00 (-0.03)	-0.00	(-6.07 - 0.03)	(-0.02 - 0.02)	-0.01	-0.00 (-0.02)
LOCATION WITH HIL LOCATION #, DISTANCE AND DIRECTION LOC # 28	1.8 MILES SE 10C # 31 0.8 MILES ESE	LOC # 29 0 MILES N/A	LOC # 26 1 MILES WRIE	LOC # 26 1 MILES UNIV	LOC # 29 0 MILES N/A	LOC # 29 0 MILES K/A	LOC # 29 0 MILES N/A	LOC # 26 1 MILES UNH	LOC # 26 1 MILES WWW	LOC # 30C 7.6 MILES NW
2 00	(0.09 - 0.52)	(-0.07 - 0.17)	3.5	(-0.04 - 0.29)	0.01	0.00	(-0.05 - 0.03)	(-0.01 - 0.62)	-0.00 (-0.04)	(-0.01 - 0.03)
CONTROL LOCATIONS MEAN (RANGE)(8) 0.19	(0.00 - 0.31)	-0.01	3.4 (2.6 - 4.2)	-0.05	(-0.01 - 0.01)	(-0.01 - 0.02)	-0.02	0.00	-0.02	(-0.01 - 0.03)
NRW (C)	0	0	0	0	0	0	0	0	0	0

TABLE 3-1
ENVIRONMENTAL RADIOLOGICAL MONITORING PROGRAM SUPMARY
COMMECTICUT YANKEE ATOMIC POWER COMPANY, HADDAM NECK PLANT
DOCKET 50-213
JANUARY - DECEMBER 1998

OETECTION (LLD) (A)	1 9 5	(-0.03 - 0.01)	LOCATION #, DISTANCE AND DIRECTION LOC # 30C 7.6 MILES MA	CCATION #, NEAN CCATION #, NEAN DISTANCE (RANGE)(8) LCC # 30C 0.01 NILES NW (-0.90 - 0.02)	CONTROL LOCATIONS NEAN (RANGE)(B) 0.01 (-0.00 - 0.02)	MXM (C)
	0-0	0.04	LOC # 26 1 MILES UNV	(-0.05 - 0.24)	(-0.10 - 0.19)	0
	0-0	.0.00 - 0.02)	LOC # 29 0 MILES N/A	0.01	(-0.03 - 0.01)	0
	0-3	-0.01	LOC # 30C 7.6 MILES NU	0.02 (-0.03 - 0.15)	(-0.03 - 0.15)	0
0.13	0-1	-0.00 - 0.02)	LOC # 26 1 MILES WNU	-0.00 (-0.02)	-0.00	0
0.15	0-1	(-0.01 - 0.04)	LOC # 29 0 MILES N/A	0.02	0.02	0
	0-0	(-0.30 - 0.66)	LOC # 26 1 MILES WAN	0.20 (-0.07 - 0.52)	0.16	0
	0-1	0.02	LOC # 29 0 MILES N/A	0.02 (-0.02 - 0.06)	-0.00	0

NOTES FOR TABLE 3-1

A. For gamma measurements the (Minimum Detectable Level) MDL's ~ LLD + 2.33. For all others, MDL = 2 x (the standard deviation of the background). These MDL's are based on the absence of large amounts of interfering activity (excluding naturally occurring radionuclides). Deviations by about factors of 3 to 4 can occur.

The LLD at a confidence level of 95% is the smallest concentration of radioactive material in a sample that will be detected with a 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 \ S_b}{E * V * 2.22 * Y * \exp(-\lambda \Delta t)}$$

where

LLD is the lower limit of detection as defined above (as pCi per unit mass or volume)

 S_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute)

E is the counting efficiency (as counts per transformation)

V is the sample size (in units of mass or volume)

2.22 is the number of transformation per minute per picocurie

Y is the fractional radiochemical yield (when applicable)

a is the radioactive decay constant for the particular radionuclide

Δt is the elapsed time between sample collection (or end of the sample collection period) and time of counting

It should be recognized that LLD is a defined a priori (before the fact) limit representing the capability of a measurement system and not an a posteriori (after the fact) limit for a particular measurement.

Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these a priori LLDs unachievable. In such cases, the contributing factors will be identified and described in the Annual Radiological Environmental Operating Report.

- B. Analytical results are handled as recommended by HASL ("Reporting of Analytical Results from HASL," letter by Leo B. Higginbotham) and NUREG/CR-4007 (Sept. 1984). Negative values were used in the determination of mean.
- C. Nonroutine reported measurements (NRM's). These are results of samples that exceed the report levels of Table E-2 of the Radiological Effluent Monitoring Manual.
- D. First number is the number of indicator measurements, the second is the number of control measurements.
- E. Assuming 270 m³
- F. Assuming 1080 m3
- G. LLD for leafy vegetables.
- H. LLD from the end of the sample period.

3.2. Data Tables

The data reported in this section are strictly counting statistics. The reported error is two times the standard deviation (2σ) of the net activity. Unless otherwise noted, the overall error (counting, sample size, chemistry, errors, etc.) is estimated to be 2 to 5 times that listed. Results are considered positive when the measured value exceeds 1.5 times the listed 2σ error (i.e., the measured value exceeds 3σ).

Because of counting statistics, negative values, zeros and numbers below the Minimum Detectable Level (MDL) are statistically valid pieces of data. For the purposes of this report, in order to indicate any background biases, all the valid data are presented. In instances where zeros are listed after significant digits, this is an artifact of the computer data handling program.

Data are given according to sample type as indicated below.

- 1. Gamma Exposure Rate
- 2. Air Particulates, Gross Beta Radioactivity
- 3. Air Particulates, Weekly I-131*
- 4. Air Particulates, Gamma Isotopic
- 5. Air Particulates, Quarterly Strontium*
- 6. Soil*
- 7. Milk Dairy Farms
- 8. Milk Goat Farms
- 9. Pasture Grass**
- 10. Well Water
- 11. Reservoir Water*
- 12. Fruits & Vegetables
- 13. Broad Leaf Vegetation
- 14. River Water
- 15. Bottom Sediment
- 16. Shellfish
- 17. Fish
- * This type of sampling or analysis was not performed, therefore there is no table.
- ** Pasture grass was not available, therefore feed (hay) was collected as a substitute

TABLE 1 MONTHLY GAMMA EXPOSURE RATE (UR/HR) *

LOCATIONS

110		× Lindudoduitat
=	0.0000000000000000000000000000000000000	* * * * * * * * * * * * * * * * * * *
	0	404-44-444-
10	000000000000000000000000000000000000000	3 0-00-04-04-04
	0000000000000	25 87 87 80 80 80 80 80 80 80 80 80 80 80 80 80
0	7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.	24 5.00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
		# m = - 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
60	8 8 8 8 9 8 9 8 9 8 8 9 9 9 9 9 9 9 9 9	4
	00-0000-	200-1-100-10000000000000000000000000000
7	2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
		× 00-4×4
9		4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6
		2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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	M-4646464-66	
*	00.0000.000.000.000.000.000.000.000.00	2 0000000000000000000000000000000000000
	00-04	7 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
3	2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.	8 8 8 8 9 8 9 9 9 9 8 9 8
	0,00000000-0	
2	000000000000000000000000000000000000000	- 8 14 4 14 8 8 8 9 0 14 1 0 8
	NO0400-40	0-4-4-4-6-6-
- Barr	un-usarrossu	
PERIOD	**************************************	PER COD JAN 98 FEB 98 MAR 98 MAR 98 MAR 98 MAR 98 MAR 98 MAY 98 MAY 98 SEP 98 SEP 98 SEP 98 SEC 98 S
34	JAN FEB MAR AUG SEP OCT NOV DEC	JAN JAN FEB MAR APR JUL JUL AUG SEP OCT NOV

^{*} VALUES LISTED ARE THE AVERAGE OF TWO TLDS. ERRORS LISTED ARE 1 SIGMA.

TABLE 2 AIR PARTICULATES GROSS BETA RADIOACTIVTY (PCL/M3)

LOCATIONS

	35	(+/-) 0.004 0.003 0.004 0.004	0.004 0.003 0.003	0.003 0.003 0.003 0.003 0.004	0.003	0.003	0.004 0.003 0.003 0.003
		0.018	0.027 0.026 0.024 0.007	0.008 0.014 0.021 0.009	0.013 0.026 0.022 0.017	0.016 0.006 0.018 0.018	0.020 0.007 0.006 0.013 0.019
		(*/-) 0.00% 0.00% 0.00%	0.004	0.003	0.003	0.003	0.004 0.003 0.003 0.003
	0	0.021	0.024 0.027 0.023 0.009	0.012 0.016 0.023 0.011	0.013 0.025 0.024 0.018	0.014 0.009 0.019 0.019	0.025 0.010 0.008 0.014 0.021
N N N		0.004	0.004	0.003 0.003 0.003	0.003 0.003 0.004 0.004	0.004	0.003
E C C A I C A	60	0.019	0.025	0.010 0.015 0.023 0.013	0.013 0.022 0.022 0.016	0.014 0.010 0.019 0.015	0.017
2		0.004	0.004	0.004	0.003	0.003	0.004
	~	0.021 0.011 0.022 0.014	0.023	0.012 0.013 0.022 0.015	0.024	0.013 0.011 0.022 0.015	0.024 0.007 0.010 0.015 0.015
		0.00%	0.004	0.003 0.004 0.004 0.004	0.003	0.003	0.004
	*	0.010	0.026	0.008 0.015 0.022 0.013	0.014 0.023 0.023 0.017	0.008 0.017 0.017	0.025 0.006 0.007 0.016
	:	0.003	0.004	0.003 0.003 0.003 0.003	0.003	0.004	0.004 0.003 0.004 0.004
	5	0.021	0.023 0.026 0.024 0.008	0.008 0.014 0.021 0.013	0.024 0.023 0.019	0.014 0.010 0.016 0.017	0.008 0.008 0.008 0.015
	-	0.004	0.004 0.003 0.004 0.004	0.003 0.004 0.003 0.003	0.003	0.003	0.004 0.004 0.004 0.004
	3	0.021 0.012 0.023 0.013	0.025 0.025 0.024 0.012	0.017 0.023 0.024 0.030	0.012	0.016 0.009 0.022 0.017	0.011 0.011 0.017 0.019
PERIOD	END ING	JANOS JAN12 JAN26 JAN26	FEB02 FEB09 FEB17 FEB23	MARO2 MAR16 MAR23 MAR30	APR06 APR13 APR20 APR27	MAY11 MAY11 MAY26	JUN01 JUN08 JUN15 JUN22 JUN29

SAMPLE DATES MAY VARY BY A COUPLE OF DAYS.

TABLE 2 AIR PARTICULATES GROSS BETA RADIOACTIVITY (PCI/M3)

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	36	(-/+)	0.003	0.003	900.0	900.0	0.003	0.003	0.003	0.003	0.00%	0.00	0.00%	0.003	0.003	0.003	0.00%	0.00%	0.004	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.005
	-		0.013	0.017	0.022	0.018	0.012	0.014	0.024	0.027	0.024	0.020	0.027	0.024	0.017	0.010	0.017	0.021	0.015	0.012	0.031	0.020	0.024	0.032	0.028	0.023	0.040
	-	(+/+)	0.003	0.003	0.00%	900.0	0.00%	0.003	0.003	0.003	0.00%	0.003	0.004	0.003	0.003	0.003	0.004	0.004	0.003	0.003	0.00%	0.003	0.004	900.0	0.004	0.00%	0.005
•			0.016	0.020	0.020	0.020	0.023	0.019	0.025	0.027	0.030	0.020	0.027	0.027	0.018	0.013	0.024	0.022	0.018	0.007	0.035	0.022	0.036	0.037	0.050	0.027	0.044
	:	(-/+)	0.003	0.003	0.004	0.004	0.004	0.004	0.003	0.003	0.004	0.00%	0.00%	0.00%	0.003	0.003	0.00%	0.00%	0.004	0.003	0.004	0.003	0.004	0.004	0.004	0.004	0.002
	10	200	0.014	0.018	0.021	0.019	0.024	0.016	0.020	0.027	0.024	0.020	0.026	0.023	0.016	0.014	0.021	0.025	0.015	0.010	0.031	0.022	0.026	0.034	0.028	0.022	0.036
	-	(-/+)	0.003	0.003	0.00%	0.004	0.004	0.904	0.003	0.003	0.00%	0.003	0.004	0.00%	0.003	0.003	0.004	0.00%	0.004	0.003	0.004	0.003	0.004	0.004	0.00%	0.004	0.004
,	- !	7.00	0.015	0.019	0.021	0.017	0.025	0.019	0.019	0.030	0.026	0.039	0.028	0.026	0.016	0.014	0.020	0.022	0.017	0.013	0.036	0.022	0.026	0.037	0.030	0.025	0.039
	:	(+/-)	0.003	0.003	0.00%	0.004	0.004	0.004	0.003	0.003	0.004	0.004	0.00%	0.004	0.003	0.003	0.00%	0.004	0.004	0.003	0.004	0.00%	0.004	0.004	0.00%	0.00%	0.00%
•	•	500	0.013	0.017	0.055	0.023	0.026	0.013	0.022	0.625	0.031	0.019	0.026	0.028	0.015	0.014	0.023	9.019	0.018	0.011	0.033	0.023	0.025	0.035	0.028	0.020	0.036
		(+/-)	0.003	0.003	0.004	0.004	0.00%	0.003	0.003	0.003	0.00%	0.004	0.00%	0.004	0.003	0.003	0.004	0.003	0.00%	9.003	0.00%	0.003	0.004	0.004	0.00%	0.004	0.004
u		410 0	0.015	0.020	0.024	0.024	0.023	0.015	0.019	0.027	0.026	0.020	0.028	0.028	0.017	0.010	0.018	0.020	0.016	0.010	0.032	0.025	0.029	0.029	0.026	0.00	0.038
	:	(+/-)	0.003	0.003	0.004	0.004	0.00%	0.004	0.00%	0.003	0.00%	0.00%	0.004	0.00%	0.003	0.003	0.00%	0.004	0.004	0.003	0.004	0.003	0.00%	0.004	0.004	0.004	0.004
,	* :		0.016	0.021	0.023	0.021	0.026	0.016	0.024	0.029	0.025	0.020	0.026	0.029	0.018	0.012	0.021	0.020	0.016	0.010	0.036	0.023	0.027	0.043	0.027	0.020	0.039
PERIOD	EMDING	20	JUL 13	301.20	30127	AUG03	AUG10	AUG17	AUG24	SEPOT	SEP08	SEP14	SEP21	SEP28	OCT05	OCT 13	OCT 19	OCT26	HOV02	60AGN	9LACN	NOV23	NOV30	DEC07	DEET	DECEL	DELCO

SAMPLE DATES MAY VARY BY A COUPLE OF DAYS.

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TABLE 4A
AIR PARTICULATES
GAMMA SPECTRA - GTR 1
(PC1/M3)

ANALYSES

RU-103	 (+/-)	0.0026	0.0018	0.0025	0.0020	0.0019	0.0024	0.0018
-US		-0.0010	-0.0010	-0.0020	0.0000	0.0009	-0.0010	0.0000
88	 (-/+)	0.0019	0.0027	0.0041	0.0026	0.0029	0.0022	0.0027
56-8H		-0.0020	-0.0010	0.0016	0.0003	-0.0010	0.0000	-0.0010
35	 (-/+)	0.0019	0.0024	0.0023	0.0023	0.0018	0.0025	0.0018
ZR-95		0.0007	0.0009	0.0002	0.0003	0.000%	-0.0010	-0.0020
09	 (+/-)	0.0003	9000.0	6000.0	900000	0.000%	0.0010	0.0007
09-03		0.0000	0.0000	0.0001	0.0000	0.0000	0.0003	0.0000
-7	 (-/+)	0.033	0.032	0.032	0.033	0.037	0.035	0.034
96		0.083	0.046	0.063	0.085	0.127	0.081	0.110
LOCATION		9	2	9		80	6	130

CE-141		(+/-)	0.0024	0.0029	0.0028	0.0029	0.0027	0.0024	0.0025
8			0.0006	0.0000	0.0000	-0.0030	0.0028	0.0000	0.0000
8A-149		(+/+)							0.0448
8			0.0038	0.0439	0.0138	-0.0130	-0.0110	-0.0120	0.0020
CS-137		(+/-)	0.000%	900000	90000	0.0008	0.0005	0.0008	9000.0
SO	******		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CS-134		(-/+)	0.0007	0.0007	0.0007	900000	0.0007	0.0006	0.0007
S			0.0000	0.0005	0.0000	0.0001	0.0001	0.0005	0.0000
N-106		(-/+)	0.0076	0.0076	0.0077	0.0073	0.0068	0.0084	0.0078
RU			-0.0020	-0.0660	0.0015	-0.0020	0.0011	-0.0040	0.0000
LOCATION			*	2	9	1	6 0	8	130

TABLE 48
AIR PARTICULATES
GAMMA SPECTRA - GTR 2
(PCI/M3)

AMALYSES

RU-103		(+/-)	0.0018	0.0014	0.0017	0.0020	0.0018	0.0014	0.0014
RU			0.0000	0.0004	0.0008	-0.0010	0.0011	0.0003	0.000%
48-95	*******	(+/-)	0.0018	0.0018	0.0022	0.0025	0.0032	0.0026	0.0018
98			0.0000	0.0008	0.0016	0.0016	-0.0010	-0.0030	-0.0010
8	*******	(-/+)	0.0022	0.0026	0.0020	0.0015	0.0029	0.0007	0.0019
28-95			0.0000	0.0025	-0.0010	0.0000	-0.0010	0.0000	-0.0010
09-03	******	(+/-)	0.0007	9000.0	0.0007	0.0008	0.0008	0.0011	0.0007
03			0.0003	0.0000	0.0004	0.0000	0.0004	0.0003	0.0000
7-38		(-/+)	0.032	0.028	0.031	0.031	0.036	0.032	0.031
86			0.092	0.103	0.102	0.093	0.093	0.117	0.098
LOCATION			4	2	9	1	80	٥	130

CE-161	 (-/+)	0.0021	0.0018	0.0018	0.0022	0.0023	0.0015	0.0021
3		0.000	-0.0010	0.0004	0.0000	0.0006	0.0000	0.3001
BA-140	 (-/+)	0.0167	0.0191	0.0164	0.0183	0.0142	0.0105	0.0181
BA		0.0034	0.0032	0.0000	0.6048	-0.0100	-0.0050	-0.0030
CS-137	 (-/+)	0.0005	0.0005	0.0008	0.0004	0.0008	0.0007	0.0005
-S3		0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000
CS-134	 (-/-)	0.0007	0.0008	900000	0.0005	0.0007	0.0007	0.0007
-SJ		0.0005	0.0003	0.0000	0.0000	0.0000	0.0000	900000
901	 (-/+)	0.0071	0.0075	0.0078	0.0000	0.0061	0.0075	0.0052
RU-106		-0.0020	-0.0010	0.0025	0.0011	0.0001	0.0000	0.0000
LOCATION		*	2	9	7	80	0	130

TABLE 4C
ATR PARTICULATES
GAMMA SPECTRA - GTR 3
(PCI/M3)

ANALYSES

tu-103	0.0017 0.0020 0.0020 0.0021 0.0022 0.0006 0.0006
FILE	0.0000 0.0013 0.0013 0.0013 0.0000 0.0000
8	(+/-) 0.0022 0.0018 0.0025 0.0026 0.0023 0.0023
NB-95	0.0001 0.0004 -0.0020 0.0000 -0.0010 0.0013
\$	(+/-) 0.0022 0.0020 0.0033 0.0032 0.0024 0.0019
28-95	0.0000 0.0000 0.0035 0.0006 0.0002 -0.0010
99	(*/-) 0.0009 0.0005 0.0005 0.0006 0.0006
09-03	0.0006 0.0000 0.0000 0.0000 0.0000
	(+/-) 0.036 0.037 0.037 0.038 0.038
36	0.107 0.093 0.118 0.097 0.126 0.088
LOCATION	420000000000000000000000000000000000000

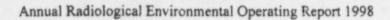
CE-141		(+/-)	ח חחרת	0 0000	0.0000	0.0020	0 0025	0 0023	0.0019
8			0 0000	0 0011	0 0001	0 0000	0.0003	0 0000	0.0003
8A-140	*******	(+/-)	0.0100	0.0152	0 0102	0.0116	0.000	0.0177	0.0194
- 8A			0.0115	0.0000	-0.0050	-0.0060	-0.0050	0.0070	0.0058
CS-137		(-/+)	0.0007	0.0006	0.0000	0.0008	0.0006	0.0008	0.0007
-S3			0.0000	0.0000	0.0000	0.000	0.0000	0.0000	0.0000
134		(-/+)	0.0010	0.0005	0.0000	0.0006	0.0008	0.0007	0.0007
CS-134			0.0000	0.0000	0.0000	0.0001	0.0005	0.0000	0.0000
. 901		(-/+)	0.0007	0.0079	0.0068	0.0067	0.0070	0.0067	0.0077
RU-106			0.0000	9900.0	0.0000	-0.0010	0.0021	0.0044	-0.0070
LOCATION			**	2	9	-	60	0	130

TABLE 4D
AIR PARTICULATES
GAMMA SPECTRA - GTR 4
(PC1/M3)

ANALYSES

RU-103	0.0019 0.0018 0.0023 0.0019 0.0017 0.0014
RU	0.0000 -0.0016 0.0005 0.0005 0.0010 0.0010
NB-95	(+/-) 0.0027 0.0022 0.0030 0.0030 0.0022 0.0021
NB.	0.0002 0.0000 -0.0010 -0.0010 0.00013 0.0000
8	(+/-) 0.0015 0.0013 0.0028 0.0033 0.0016 0.0024
28-95	0.0000 0.0000 0.0000 0.0022 0.0004 0.0010
09	(+/-) 0.0010 0.0007 0.0006 0.0007 0.0004 0.0012
09-00	0.0000 0.0003 0.0000 0.0000 0.0000 0.0000
	(+/-) 0.028 0.032 0.033 0.033 0.025 0.035
7-38	0.071 0.100 0.076 0.084 0.070 0.100
LOCATION	4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

CE-141	********	(+/+)	0.0021	0.0020	0.0025	0.0028	0.0020	0.0018	0.0031
33			0.0008	0.0002	0.0003	-0.0010	0.0000	-0.0010	0.0006
8A-140		(+/-)							0.0238
BA			0.0088	0.0062	-0.0100	0.0056	-0.0020	-0.0030	-0.0090
CS-137		(+/-)	0.0006	0.0005	900000	0.0008	0.0006	0.0006	0.0007
SO			0.000	0.000	0.0001	0.0003	0.0000	0.0000	0.0003
CS-134		(-/+)	6,000	9000.0	0.0007	0.0006	0.0007	900000	0.0008
SS			0.0002	0.0001	0.0003	0.0000	0.0000	0.0000	0.0000
N-106	******	(-/+)	0.0048	0.0036	0.0053	0.0077	0.0063	0.0052	0.0104
RU-			-0.0030	0.0000	0.0000	0.0041	-0.0020	0.0000	-0.0030
LOCATION			7	2	9	7	8	٥	130



Haddam Neck Station

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	*****		DK - NC		1-131		CS-134	35	CS-137	25	BA-140	0	LA-140	91
		(-/+)		(-/+)		(-/+)		(-/+)		(+/+)		(+/-)		(+/-)
01/01/08					-3.45	4.97	0.1	2.7	0.0	3.6	-	-4	-1.6	4.4
02/10/98					-0.70	4.21	-1.7	2.5	3.0	2.8	2	~	1.8	4.0
03/10/98	0.7	2.8	0.2	6.0	1.04	7.43	-0.1	3.2	9.0-	4.3		9	1.0	6.5
04/07/98					0.61	5.36	1.0	5.9	0.5	3.2	-	*	.1.6	5.
05/13/98					1.73	8.16	1.1	3.1	2.8	3.1		2	-1.6	5.8
86/11/90	3.3	2.8	9.0	1.1	-1.62	4.85	9.0	2.5	0.5	3.0	-	9	1.1	6.8
86/80/10					-1.46	5.23	9.0	2.5	-0.8	3.6	0-	9	.0.1	6.7
08/18/98					2.57	5.40	-0.2	2.1	1.0	2.0			. 2.4	10
85/60/60	-0.3	3.6	0.0	1.0	-6.70	6.76	-1.0	2.5	1.6	3.0			-2.0	·
10/07/98					-2.72	7.33	.2.1	3.7	9.0	0.3	19-	4	. 5.	
11/10/98					1.02	85.9	-0.A	2.1	3.0	40		-4	2 5	4
2/10/98	-0.5	5.2	1.7	1.0	-3.47	4.79		2.2	0.8	5.6	i	m	-3.3	4.0
04/07/98 A					0.60	5.74	7	2.8	7.2	3.6	7	4	-0.6	4.4
05/13/98					1.56	7.34	-0.2	3.6	2.3	4.7		5	-2.6	2
86/10/98	6.7	4.7	4.2	1.1	-5.45	4.65	9.0	2.0	5.9	3.5	-		6.0-	20
86/80/10					0.50	4.55	-0.4	2.2	9.3	3.8	2	3	1.8	3.8
08/18/98					-4.55	5.06	-1.5	2.3	9.1	4.8	-	2	1.5	3.0
86/60/60	-1.6	4.0	3.5	1.2	2.77	5.41	-0.1	2.7	8.0	4.0	.3	3	-3.6	4.8
10/07/98					-5.30	7.42	2.2	3.5	4.7	4.0	-5	9	-2.3	6.4
11/10/98 A	-1.4	5.7	4.8	-:	-3.78	3.90	-0.2	1.7	5.9	3.2	2	m	5.6	6.0
96/20/10					-3.87	6.29	0.5	2.7	1.6	3.7	-	4	1.3	4.3
02/10/98					0.70	5.68	6.0-	3.0	-1.2	2.6	0-	-	9.0-	3.8
03/10/98	6.0	2.8	1.8	6.0	-6.00	7.90	-1.	2.3	-1.2	2.8	7-	2	-4.5	5.5
04/07/98					-2.29	5.69	5.9	5.9	0.0	3.3	0	5	0.2	5.3
05/13/98					-0.65	7.27	-0.8	5.9	0.0	3.8	M	4	6.0	5.1
06/10/98	4.1	4.5	1.2	1.0	3.09	4.50	-2.2	2.2	1.8	2.5		2	0.7	3.1
86/80/10					-0.36	4.68	1.8	2.1	1.2	2.2		2	1.0	3.7
86/18/98					0.28	5.57	-1.5	2.1	1.7	3.2	2	4	2.2	4.8
86/60/60	-2.1	6.9	-0.6	1.3	-0.08	6.42	-0.6	3.6	1.1	3.8		4	1.5	6.3
10/07/98					2.15	5.58	-0.5	2.5	-0.2	2.6	2.		-2.4	3.0
11/10/98					1.52	4.12	-1.3	1.6	-0.4	2.0	-	2	0.8	3
12/10/08				9										

A: MILK AND PASTURE GRASS WERE UNAVAILABLE AT LOC. 20 IN JAN, FEB, MAR AND DEC. FEED TAKEN IN DEC.

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		(-/*	0.1	6.6	5.7	4.4	6.7	4.2	5.1	3.4	3.6	3.4	3.3	3.2
LA-146	********		3.0	1.5	4.1	3.9	3.2	-1.2	3.9	6.5	0.0	1.0	-1.8	-0.5
	****	1-/+	40	4	80	*	9	*	4	3	M	2	M	3
BA-140														-0 3
4		(+/+)	5.3	3.3	3.9	3.0	6.1	2.7	3.3	3.0	3.4	3.7	2	2.2
CS-13			1.6	0.5	-1.1	2.3	9.0	3.7	0.3	9.0	-0.5	0.0	2.5	1.0
4		(+/+)	3.7	2.8	3.6	2.7	3.8	2.2	3.3	2.1	2.6	3.4	1.8	1.9
rs-134									0.7					
		(-/+)	9.19	5.94	9.78	4.31	7.41	5.13	5.70	5.47	5.80	6.55	3.91	4.55
1-131									0.26					
0		(-/-)			0.0			1.2			1.3			1.0
SR-90														
0:		(-/+)			3.0						4.7			4.6
SR-RS					2.1			3.5			0.1			9.0-
COLLECTION			01/07/18	02/10:36	03/10/98	04/07/98	05/13/98	86/10/98	07/07/98	08/18/98	86/60/60	10/07/98	11/10/98	12/10/98
LOCATION			222	222	222	222	225	222	222	222	222	222	222	222

A: MILK AND PASTURE GRASS WERE UNAVAILABLE AT LOC. 20 IN JAN, FEB, MAR AND DEC. FEED TAKEN IN DEC.

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07	(-/+)	5.3	7.7	5.0	# N	4.7	6.3	6.5	4.3	6.8	4.5	7.6	5.7	3.8	3.9	5.1	6.6	3.7	4.4
LA-140		-6.8	3.7	.3.2	-0.3	2.2	0.1	3.0	-1.2	-6.5	.0.3	.1.3	.6.8	-1.5	9.0	1.	.2.1	0.5	-3.6
	1-1	S	1	un	M	2	7	9		9	4	1	2	m	*	3	*	201	4
8A-140	•	9-	2	۴.	0-	2	0	M	7	9-	0-	-	9-	-	0	-	-2	0	
4	(+/+)	6.3	5.5	6.6	3.2	3.6	2.6	6.1	3.0	4.4	3.1	4.2	3.9	3.2	5.0	3.9	3.2	4.3	4.4
CS-137		11.4	3.1	9.6	3.0	24	2.5	6.9	7.1	5.7	1.3	2.5	2.2	1.5	11.3	5.5	1.7	4.9	3.5
25	(+/+)	5.6	4.7	4.2	2.2	3.0	2.5	3.6	1.6	5.4	2.3	2.7	5.9	2.1	2.3	3.1	2.2	2.1	5.6
£1-53		1.2	2.4	0.2	-0.3	-2.5	-1.8	1.7	0.7	.1.0	9.0	1.7	-0.3	-2.3	9.0	.1.3		0.3	2.1
31	(-/+)	6.82	8.15	6.76	4.22	5.66	4.22	7.13	5.54	9.13	4.88	6.93	7.56	4.26	5.37	5.32	9.65	4.72	6.45
1-131		1.57	-3.51	1.44	1.53	0.13	1.18	0.70	0.95	-3.39	-0.37	-3.55	4.30	-1.28	-3.37	-2.76	1.90	-1.05	1.32
9	(-/+)	6.0			1.0			1.2	1.1	1.0			1.2			1.3			1.6
SR-90		5.4			9.0			5.1	3.5	9.9			4.6			0.6			8.6
	(+/+)	2.7			6.4			5.6	6.2	3.0			4.5			5.8			6.5
SR-R		-0.1			8.6			-2.4	.2.3	1.8	•		5.9			6.7			0.8
DATE		03/10/98 A	86/10/90	05/13/98	06/10/98	07/08/98	08/18/98	86/60/60	10/07/98 8	03/10/98 0	86/10/%	05/13/98	86/10/90	07/08/98	08/18/98	86/60/60	10/07/98	11/10/98	12/10/98
LOCATION							235	235	230	5%	5%	54	24	92	5%	92	52	24	56

A: GOAT MILK AND PASTURE GRASS WERE UNAVAILABLE FROM CONTROL LOC. 23C IN JAN. AND FEB. 8: GOAT MILK AND PASTURE GRASS WERE UNAVAILABLE IN NOV AND DEC AT LOC. 23C. FEED SAMPLED INSTEAD. D: GOAT MILK AND PASTURE GRASS WERE UNAVAILABLE IN JAN AND FEB AT LOC. 24.

PASTURE GRASS * (PC://G WET NT.)

95	(-/+)	0.065	0.094	RU-106	(-/+)	0.211	0.263	141	(-/+)	0.050	0.030
FE-59		0.027	0.045	-Na		-0.023	-0.077	CE-141		-0.050	0.037
238	(-/+)	0.022	0.026	RU-103	(-/+)	0.024	0.026	LA-140	(-/+)	0.054	0.053
85-03		0.002	0.007	-Da		0.015	0.021	5		0.014	-0.067
*	(-/+)	0.021	0.028	8	(-/+)	0.529	0.035	BA-140	(-/+)	0.047	0.046
75-NM		-0.006	0.001	26-8N		-0.004	-0.004	-A8		0.012	-0.058
15	(-/+)	0.22	0.24	8	(-/÷)	0.038	0.047	CS-137	(-/+)	0.023	0.031
CR-51		0.12	0.15	28-95		0.019	0.000	-53		9.000	0.042
0	(-/+)	9.64	1.11	59	(-/+)	9%0.0	0.081	CS-134	(-/+)	0.022	0.029
07-X		8.20	11.75	59-WZ		0.054	0.017	·S		-0.017	0.091
	(-/+)	0.33	0.43	99	(-/+)	0.022	0.032	13.	(+/+)	0.069	0.058
8E-7		0.95	1.47	09-03		0.007	0.005	1-131		0.036	-0.020
COLLECTION		12/10/98 A	11/16/98 A 12/16/98 A	COLLECTION		12/10/98 A	11/10/98 A 12/10/98 A	COLLECTION		12/10/98 A	11/10/98 A 12/10/98 A
LOCATION		50	235	LOCATION		02	235	LOCATION		20	23C 73C

^{*} SAMPLES TAKEN AS A SUBSTITUTE FOR UNAVAILABLE MILK.
PASTURE GRASS IS REGUIRED AS A SUBSTITUTE DURING THE MONTHS OF APR THROUGH DEC. IF PASTURE GRASS IS
UNAVAILABLE, DIRECTIONS SINCE MID-YEAR HAVE BEEN TO SAMPLE SOME OTHER ALTERNATIVE FEED SUPPLY.
A: PASTURE GRASS WAS UNAVAILABLE AS A GOAT MILK SUBSTITUTE, HAY WAS SAMPLED INSTEAD.

PASTURE GRASS * (PCI/G WET WT.)

TH-228 (+/-)	0.104	0.130
ž.	0.063 0.104	0.057
RA-226 (+/-)	0.808	0.732
RA-	-0.507 0.808	-0.057
CE-144 (+/-)	260.0	0.107
8	0.006 0.097	0.046
	**	**
DATE	12/10/98 A	11/10/98 A 12/10/98 A
LOCATION	92	235

* SAMPLES TAKEN AS A SUBSTITUTE FOR UNAVAILABLE MILK.
PASTURE GRASS IS REQUIRED AS A SUBSTITUTE DURING THE MONTHS OF APR THROUGH DEC. IF PASTURE GRASS IS
UNAVAILABLE, DIRECTIONS SINCE MID-YEAR HAVE BEEN TO SAMPLE SOME OTHER ALTERNATIVE FEED SUPPLY.
A: PASTURE GRASS PAS UNAVAILABLE AS A GOAT MILK SUBSTITUTE, HAY WAS SAMPLED INSTEAD.

PKSE 3-29	59-N2	(-/+)												6.0	16.7	17.0	16.3	80.00
	2		5.0	8.4	-3.4	3.7	-6.0	0.3	-1.3	4.5	4.6	5.2	-1.0	2.3	0.1	18.8	-7.7	4.6
	09-00	(-/+)	2.0	1.6	2.4	2.8	2.0	1.5	3.2	2.3	2.3	3.8	2.7	2.1	2.4	2.3	3.4	1.7
	8		-0.3	0.5	0.0	0.5	.1.8	-0.1	0.5	-0.7	1.3	-0.5	-1.3	-0.3	1.6	9.0	0.6	-0.7
	FE-59	(-/+)	5.1	4.6	6.2	6.0	6.1	4.6	8.9	7.1	5.0	9.3	5.7	5.0	6.1	5.7	6.5	3.7
	FE		0.8	1.0	2.1	5.9	-3.5	-1.0	0.4-	5.6	1.9	-1.3	-2.7	0.7	-0.6	0.6	5.9	0.1
	85-03	(-/+)	2.0	1.6	2.5	2.3	2.5	1.7	3.0	2.3	2.0	3.1	2.8	1.7	8.8	2.3	2.8	1.6
TABLE 10 WELL WATER (PCI/L)	8		6.0	9.0-	9.0-	6.0	1.7	0.7	-2.0	-0.2	-1.5	-0.3	0.7	6.0	-2.2	-3.0	-0.8	-1.6
WELL (PCI	25	(-/-)	1.8	1.6	2.0	2.1	1.7	1.4	2.4	2.3	2.0	3.1	2.4	1.8	2.3	2.4	2.6	1.6
	PR - 54		9.0	-1.9	-0.1	-2.3	-0.7	9.0	9.0	-1.1	-0.9	2.3	-1.8	6.0-	0.5	-2.0	9.0	6.0-
	51	(-/+)	12	15	22	58	22	17	22	27	54	31	22	20	28	56	33	11
	CR-51		6-	6	, 00	14		2	0	-12	33	.5	2	12	17	-20	2	-
	0	(-/+)	35	22	34	33	28	35	42	32	27	9%	43	35	31	56	41	23
1996	07-X		-23	.3	65	-5	-35	37	m	1.	28	21	60	0	è.	53	-19	9
	DATE		01/30/98	02/17/98	03/12/98	04/13/98	05/06/98	86/80/90	07/13/98	08/18/98	85/70/60	10/05/98	11/02/98	12/07/98	03/12/98	86/90/90	86/70/60	12/07/98
COMMECTICUT YANKEE	LOCATION		15	15	15	15	15	15	15	15	15	15	15	15	160	160	391	160

PAGE 3-30	1	6-/-	2,3	1.7	2.3	2.5	2.3	1.8	3.2	2.8	2.5	5.9	2.8	2.2	2.4	2.4	3.1	1.0
PAG	CS-137		-0.5	0.2	6.0	-0.2	0.7	2.1	-0.3	1.6	1.2	1.4	1.9	7.0	-2.6	-1.7	-0.2	-1.3
	134	(-/-)	2.0	1.5	2.3	7.2	2.5	1.6	2.3	2.4	2.1	2.3	2.3	5.0	2.3	2.1	3.0	1.4
	CS-134		6.0-	-0.2	0.0	-3.0	1.1	9.0	0.2	0.5	6.3	-0.2	9.0	-1.3	6.0	-1.2	-0.2	-0.7
		(-/-)	2	3	9	3	1	-3	2	9	9	9	9	4	7	2	1	4
	1-131			-	3			0	-	-5	*	3	-	٠,	-	4	6	-
	901	(-/+)	19	16	23	19	19	18	22	22	18	22	22	16	92	20	23	13
E 10 MATER	RU-106		0	9-	15	. 3	1.	-	-10	15	3	2	9-	6	-18	-	-21	0
WELL WATER (PCI/L)	103	(-/+)	2.2	1.7	2.5	2.4	2.5	2.0	2.8	2.7	2.3	2.8	2.7	1.9	2.8	2.4	3.2	1.7
	RU-103		0.0	-0.8		-1.6	-2.9	6.0-	.1.3	-0.6	0.5	0.4-	-2.0	-0.5	-2.6	-1.3	0.7	-1.3
	8	(-/-)	2.4	1.8	2.7	4.6	5.9	2.1	3.6	4.8	2.3	4.1	5.6	2.1	6.4	5.9	7.0	3.3
	NB-95		-1.3	-2.2	0.7	9.0	-0.3	-0.9	-3.8	-1.6	-0.6	-2.1	-0.5	-2.1	1.4	-2.4	9.0	1.3
	8	(-/+)	3.5	2.3	4.0	0.4	4.2	3.1	5.6	3.7	3.6	6.1	4.5	3.8	6.9	6.0	6.0	2.5
1998	28-95		-0.2	-1.3	-4.6	-0.8	-2.9	-0.2	-1.5	0.8	2.1	3.4	-2.7	5.6	2.1	-0.2	9.0-	1.3
T YANKEE	DATE		11/30/98	12/11/98	13/12/98	113/98	15/06/98	86/08/98	17/13/98	8/18/98	96/10/6	0/05/98	1/02/98	12/07/98	03/12/98	86/80/98	86/70/66	2/07/98
COMMECTICUT YANKEE 1998	LOCATION		15 0	15 0	15 6	15 6	15 0	15 0	15 0	15 6	15 6	15	15	15 1			160	

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WELL WATER (PCI/L)

	(-/+)	222	228	234	506	199	218	212	226	182	184	211	502	213	200	161	200
		417	633	433	420	614	541	358	009	456	215	172	231	0	50	24	20
******	(+/+)	7.6	5.8	9.6	9.6	7.8	6.2	11.0	8.5	8.7	14.3	6.6	8.1	0.6	8.5	10.8	2 2
		9.6	3.0	-1.9	10.0	0.0	-6.1	3.2	-3.3	7.7	6.2	5.6	5.0	4.4	-1.2	-11.0	4 8
	(+/+)	62.6	39.5	71.7	61.4	83.1	46.1	71.7	60.2	0.09	71.7	93.3	0.89	76.6	61.7	70.4	2 07
		-18.2	-91.2	-60.4	58.4	53.8	1.6	18.1	40.5	-53.8	73.9	30.1	-51.5	-36.7	-29.8	148.8	12 2
	(-/+)	4.2	2.8	5.6	3.6	5.7	3.3	6.0	4.7	4.2	6.0	4.2	2.3	5.4	4.7	5.5	2 2
		9.0	6.0-	5.7	9.0	-1.7	0.3	1.0	3.0	1.0	6.4-	0.3	-2.0	-6.0	5.9	-6.1	2 4
	(-/+)	4	2	15	2	2	*	10	*		5	3	~	2	4	2	*
		-		5			0	-	2		9-	0	-5	÷	2	r.	2
		01/30/98	02/17/98	03/12/98	04/13/98	86/90/50	96/99/98	07/13/98	08/18/98	86/90/60	10/05/98	11/02/98	12/07/98	03/12/98	86/80/90	99/04/98	12/07/CR
		15	15	15	15	15	15	15	15	15	15	15	15	160	160	39:	165
		(-/+) (-/+) (-/+)	(+/-) (+/-) (+/-) (+/-) (+/-)	(+/-) (+/) (+/) (+/) (+/) (+/) (+/	(+/-) (+/-)	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 03/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/96 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 -1 5 -1.7 5.7 53.8 83.1 0.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 06/08/98 0 3 0.3 3.3 1.6 46.1 -4.1 6.2 541	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 06/08/98 0 3 0.3 3.3 1.6 46.1 -4.1 6.2 541 07/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 06/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358 06/16/98 3 4 3.0 4.7 40.5 60.2 -3.3 8.5 600	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 06/18/98 0 3 0.3 3.3 1.6 46.1 -4.1 6.2 541 07/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358 08/18/98 3 4 3.0 4.7 40.5 60.2 -3.3 8.5 600 09/04/98 1 4 1.0 4.2 -53.8 60.0 1.7 8.7 456	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -91.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 05/13/96 -1 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 05/05/98 -1 5 5.7 5.8 60.4 11.7 1.0 9.6 420 05/05/98 0 3 0.3 3.3 1.6 46.1 4.1 6.2 541 07/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358 09/04/98 1 4 3.0 4.7 40.5 60.2 -3.3 8.5 600 10/05/98 4 5 -4.9 6.0 73.9 71.7 4.2 14.3 215	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 03/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 -1 5 -1.7 5.7 58.4 61.4 10.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 05/06/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358 08/18/98 3 4 5.0 4.7 40.5 60.2 -3.3 8.5 600 10/05/98 -4 5 -4.9 6.0 73.9 71.7 4.2 14.3 215 11/02/98 0 4 0.3 4.2 30.1 93.5 5.6 9.9 271	(+/-) (+/) (+/) (+/	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 03/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 04/13/98 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420 05/06/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 06/03/98 0 3 0.3 3.3 1.6 46.1 -4.1 6.2 541 07/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358 08/18/98 3 4 3.0 4.7 40.5 60.2 -3.3 8.5 600 09/04/98 1 4 3.0 4.7 40.5 60.2 -3.3 8.5 600 11/02/98 0 4 5 -4.9 6.0 73.9 71.7 4.2 14.3 215 11/02/98 -2 2 2.2.0 2.3 -51.5 68.0 5.0 8.1 231	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/96 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 420 05/12/98 1 3 0.6 3.4 58.4 61.4 10.0 9.6 420 05/13/98 1 5 0.7 6.0 18.1 71.7 5.7 53.8 83.1 0.0 7.8 614 05/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 358 09/13/98 1 4 3.0 4.7 6.0 18.1 71.7 3.2 11.0 358 11/02/98 0 4 5 -4.9 6.0 73.9 71.7 4.2 14.3 575 11/02/98 -4 5 -4.9 6.0 73.9 71.7 4.2 14.3 275 11/02/98 -2 2 -2.0 2.3 -51.5 63.0 5.0 8.1 231 12/07/98 -5 5 -6.0 5.4 -36.7 76.6 4.4 9.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	01/30/98 1 4 0.6 4.2 -18.2 62.6 9.6 7.6 417 02/17/98 -1 2 -0.9 2.8 -11.2 39.5 3.0 5.8 633 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 433 05/12/98 5 5 5.7 5.6 -60.4 71.7 -1.9 9.4 420 05/13/98 -1 5 -1.7 5.7 53.8 83.1 0.0 7.8 614 05/13/98 1 5 0.7 6.0 18.1 71.7 3.2 11.0 5.6 00 09/13/98 3 4 5.0 4.7 6.0 18.1 71.7 3.2 11.0 556 09/13/98 -4 5.0 4.7 6.0 73.8 60.0 1.7 8.7 656 11.0 5

FRUITS & VEGETABLES (PC1/G WET MT.)

	FE-59		(-/+)	0.080	0.085	0.045	0.067	0.085	0.000	0.045	0.048
	FE						0.000		-0.072	-0.042	-0.031
	85-03		(-/+)	0.026	0.026	0.013	0.022	9.00	0.017	0.013	0.054
	8			0.00%	-0.601	-0.012	0.016	-0.002	0.006	0.005	-0.006
	95-NM		(-/+)	0.018	0.022	0.013	0.017	0.010	0.026	0.012	0.022
	-NH			0.000	0.001	-0.009	-0.009	-0.002	0.00	-0.007	-0.018
	51		(-/+)	0.22	0.27	0.19	0.22	0.18	0.21	0.00	0.24
	CR-51			0.07	-0.04	0.07	-0.03	-0.11	-0.06	-0.06	-0.05
	0		(-/-)	0.56	0.86	0.33	96.0	0.81	0.76	0.71	67.0
	07-X			0.88	3.90	0.50	5.58	3.43	1.03	4.05	0.89
	1		(-/-)	0.20	0.20	0.14	0.24	0.36	0.17	0.24	0.21
	BE-7			0.00	0.00	0.07	0.35	0.40	0.02	0.51	0.02
	TYPE			STRABBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAMBERRIES	BROCCOLI	APPLES
COLLECTION	DATE			86/22/98	06/30/98	86/96/60	86/60/60	06/22/98	06/22/98	86/90/60	86/90/60
	LOCATION	********		175	175	175	170	10	22	13	23

RU:-106	(-/+)	0.173	0.176	0.147	0.182	0.221	0.242	0.109	0.177
J.		-0.022	0.061	0.051	0.034	-0.115	0.207	-0.014	-0.121
RU-103	(-/+)	0.017	0.023	0.019	0.023	0.027	0.025	0.011	0.024
-Ba		-0.014	-0.015	0.017	-0.009	9.012	0.013	0.001	-0.002
26-8N	(-/+)	0.026	0.031	0.037	0.025	0.030	0.626	0.012	0.059
-GM		0.009	-0.011	0.017	0.010	0.006	0.014	0.001	0.017
8	(-/+)	0.042	0.048	0.028	0.037	0.034	0.034	0.022	0.041
ZR-95		0.001	-0.028	0.002	-0.001	0.022		0.016	
29-NZ	(-/+)	0.053	0.053	0.036	0.050	0.052	0.055	0.040	0.0%
-NZ		-0.023	-0.021	0.017	0.008	0.020	-0.009	-0.003	-0.017
09-03	(-/+)	0.024	0.029	0.016	0.028	0.020	0.030	0.014	0.016
83		0.003	-0.018	-0.003	-0.003	0.002	0.024	0.008	0.000
TYPE		STRAMBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAMBERRIES	BROCCOL 1	APPLES
COLLECTION		06/22/98	06/30/98	86/70/60	86/60/60	06/22/98	06/22/98	96/90/60	86/70/60
LOCATION		170	175	17.	170	22	22	22	23

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	CE-141	(-/-)	0.028	0.032	0.031	0.032	0.037	0.026	0.013	0.042
	CE.		-6.003	-0.033	-0.031	0.002	0.001	0.005	-0.004	-0.932
	LA-140	(-/-)	0.040	0.054	0.054	0.057	0.036	0.050	0.013	0.080
	LA-		900.0	-0.031	0.027	-0.064	0.034	-0.010	-0.007	0.042
	8A-140	(-/-)	0.035	0.047	0.047	0.049	0.031	0.043	0.011	0.070
	- WE		0.002	-0.027	0.024	-0.055	0.030	-0.008	900.0-	0.037
	137	(-/+)	0.025	0.023	0.018	0.026	0.023	0.018	0.013	0.027
E1 MI.)	CS-137		0.011	-0.009	0.005	-0.012	0.008	-0.001	0.003	-0.021
(PLI/6 MEI MI.	134	(-/=)	0.022	0.020	0.016	910.0	0.028	0.025	0.012	0.025
	CS-134		-0.011	-0.019	900.0	-0.008	0.016	-0.012	-0.004	0.002
	31	(-/+)	0.000	0.084	9.076	0.079	0.043	0.040	0,024	0.111
	1-131		0.051	0.005	-0.020	0.035	0.008	-0.009	-0.001	-0.017
	TYPE		STRAMBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAMBERRIES	BROCCOL.I	APPLES
COSTECTION	DATE		06/22/98	06/30/98	86/90/60	86/60/60	06/22/98	06/22/98	86/50/60	86/90/60
	LOCATION		17.	170	170	170	22	22	52	52

14.228	222		(-/+)	0.001	0.106	0.062	0.093	0.093	0.100	0.073	0.086
10.				.024	0.034	0.007	-0.006	-0.001	-0.012	0.133	-0.006
98.734	650		(-/+)	0.760	969.0	0.642	0.673	0.940	0.564	0.189	0.493
90	12		-0.106	0.463	0.384	9.767	-0.089	0.221	-0.071	-0.031	
771	***		(-/+)	0.110	0.109	0.077	960.0	0.128	0.094	0.039	0.118
5	771-30		0.131	0.018	-0.046	0.046	-0.036	-0.026	-9.022	0.015	
TVDE				STRAMBERRIES	LETTUCE	APPLES	SWISS CHARD	LETTUCE	STRAMBERRIES	BROCCOLI	APPLES
COLLECTION	DING			06/22/98	06/30/98	86/90/60	86/60/60	06/22/98	06/22/98	86/10/60	86/70/60
1 OCATION				170	170	170	170	82	22	22	22

BROADLEAF VEGETATION (PCI/G NET WI.)

65	 (-/+)	0.024	0.057	6.029	0.031	0.068	0.061	0.075	0.044	0.021	0.029	0.057	0.082	0.035
FE-59		-0.017	0.015	0.013	-0.010	0.017	-0.068	-0.033			0.023			
58	 (-/+)	900.0	0.017	0.008	60000	0.024	0.020	0.022	0.013	900.0	0.009	0.027	0.023	0.011
65-00		-0.003	-0.010	-0.002	-0.006	-0.014	0.009	0.003	-0.006	0.001	-0.004	0.034	-0.019	-0.004
54	 (-/+)	0.002	0.015	9.007	6.000	0.025	0.020	0.021	0.012	0.006	0.008	0.022	0.031	0.011
MM-54		-0.006	0.005	0.000	-0.010	-0.031	0.007	0.020	-0.004	0.000	0.005	900.0	0.010	-0.003
51	 (-/+)	90.0	0.15	0.08	0.00	0.26	0.19	0.21	0.14	0.02	0.00	0.22	0.25	0.11
CR-51		-0.01	-0.11	-0.08	0.00	0.05	-0.04	0.19	-0.04	-0.01	0.03	-0.02	0.05	0.00
0	 (./.)	0.37	0.56	0.25	0.33	0.77	0.70	0.71	69.0	9.19	67.5	0.79	0.87	0.33
K-40		3.82	2.45	1.40	3.11	2.93	4.7	6.50	3.08	0.72	2.12	3.14	2.71	3.05
1	 (-/+)	9.16	0.25	0.13	0.16	0.47	0.26	9.31	0.17	0.10	0.18	0.47	0.48	0.20
1-38		1.37	1.00	0.56	1.12	1.29	0.61	1.28	9.45	0.39	1.46	2.41	1.81	1.82
DATE		94/27/98	05/20/98	06/22/98	07/20/98	08/54/98	99/14/98	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98
LOCATION		9	9	9	9	9	9	9	18	60	40	18	18	81

N-106	 (-/+)	0.058	0.139	0.068	0.087	0.239	0.184	0.210	0.135	0.057	0.085	0.239	0.227	0.108
-SR		-0.057	0.113	-0.004	0.050	0.184	-0.055	0.232	-0.071	-0.027	0.017	-0.065	0.020	-0.058
RU-103	 (-/+)	0.007	0.015	0.008	0.010	0.027	0.020	0.023	0.014	0.006	0.009	0.028	0.029	0.012
-DA		0.000	-0.001	0.002	0.001	-0.004	900.0	0.005	0.000	0.003	-0.006	-0.018	0.000	-0.004
8	 (-/+)	0.008	0.031	0.009	0.012	0.033	0.027	0.029	0.020	0.008	0.011	0.030	0.030	0.020
N8-95		0.005	0.007	-0.004	0.000	-0.005	0.020	0.007	-0.001	-0.001	-0.006	0.007	-0.034	0.013
82	 (+/-)	0.010	0.029	0.014	0.017	0.049	0.030	0.041	0.024	0.011	0.016	0.044	0.060	0.019
28-95		-0.003	900.0	0.005	0.004	0.017	-0.015	-0.020	-0.019	6.005	0.000	-0.012	0.029	0.012
65	 (-/+)	0.018	0.034	0.023	0.021	0.132	0.043	0.056	0.032	0.014	0.022	0.055	0.062	0.024
59-NZ		-0.017	-0.034	0.007	-0.008	0.042	-0.002	-0.041	-0.014	-0.009	-0.005	0.039	0.021	0.019
99	 (·/·)	0.008	0.014	0.007	0.011	0.026	0.022	0.027	6.014	0.007	0.010	0.028	0.034	0.011
09-03		0.001	0.000	0.005	0.000	-0.012	0.001	0.009	0.002	0.000	0.000	600.0	-0.012	0.002
COLLECTION		04/27/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98
LOCATION		9	9	9	9	9	9	9	18	138	13	18	100	138

141		(-/+)	0.007	0.020	0.013	0.012	0.036	0.028	0.027	6.024	0.067	0.011	0.035	0.031	0.018	
5	******		0,000	-0.007	0.005	0.005	-0.040	0.031	0.00	0.024	0.001	-0.001	-0.022	-0.004	-0.036	
140		(-/+)	0.014	0.050	0.024	0.029	0.048	0.038	0.059	0.045	0.017	0.028	0.060	0.067	0.027	
LA			0.003	0.000	0.012	-0.011	-0.010	0.035	0.008	-0.011	-0.001	-0.010	-0.022	-0.029	-0.007	
140		(+/+)	0.013	0.043	0.021	0.025	0.042	0.033	0.051	0.039	0.015	0.025	0.052	0.058	0.023	
BA-			0.005	0.008	0.011	-0.009	-0.009	0.031	0.007	-0.010	0.000	-0.009	-0.019	-0.025	-0.006	
137		(-/+)	0.007	0.013	600.0	0.011	0.032	0.020	0.024	0.016	0.007	0.018	0.035	0.031	0.020	
-SO			-0.007	0.005	-0.002	0.015	-0.006	0.001	-0.018	0.013	0.004	0.092	0.054	-0.024	0.053	
134		(-/+)	0.002	0.013	0.008	0.010	0.029	0.020	0.022	9.014	900.0	0.008	0.028	0.024	0.027	
-53																
11		(-/+)	0.018	0.073	0.031	0.033	0.051	990.0	0.063	0.076	0.021	0.035	0.046	0.061	0.032	
1-1			-0.005	0.005	-0.009	-0.015	0.002	-0.035	0.021	0.056	-0.004	0.013	-0.006	-0.079	0.001	
DATE			04/27/98	05/20/98	06/22/98	07/20/98	08/24/98	86/11/60	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98	
LOCATION			9	9	9	9	9	9	9	18	18	18	60	18	18	
	LOCATION DATE 1-131 CS-134 CS-137 BA-140 LA-140 CE-141	CS-134 CS-137 BA-140	CS-134 CS-137 BA-140 LA-140 CE-14 +/-) (+/-) (+/-) (+/-) (+/-) (+/-)	(*/-) (*/-)	(*/-) (*/-)	(*/-) (*/-)	(*/-) (*/-)	(*/-) (*/-)	(*/-) (*/-)	(*/-) (*/-)	(+/-) (+/-)	(+/-) (+/-)	(+/-) (+/-)	(*/-) (*/-)	(*/-) (*/-)	(*/-) (*/-)

	(+/+)	0.027	0.073	0.038	0.051	0.143	0.083	960.0	0.058	0.035	0.033	0.100	0.103	0.047
		-0.007	0.033	0.056	0.058	0.096	0.257	-0.105	0.028	0.027	-0.004	0.042	0.005	0.041
	(-/+)	0.177	0.371	0.263	0.256	0.933	0.654	0.607	0.459	0.092	0.235	0.895	0.746	0.415
******		0.125	-0.022	-0.019	0.128	-0.929	-0.275	0.457	-0.073	0.176	-0.083	0.176	0.222	-0.208
	(-/+)	0.023	0.055	0.034	0.034	0.129	0.085	0.082	0.059	0.020	0.034	0.120	0.106	0.050
		-0.003	0.001	-0.026	-0.013	-0.075	0.037	-0.026	0.012	900.0	-0.015	0.048	0.037	0.000
		04/27/98	05/20/98	06/22/98	07/20/98	08/24/98	86/51/60	10/07/98	05/20/98	06/22/98	07/20/98	08/24/98	09/14/98	10/07/98
		9	9	9	9	9	9	9	18	18	18	130	18	13
		(-/+)	-0.003 0.023 0.125 0.177 -0.007	-0.003 0.023 0.125 0.177 -0.007 0.001 0.955 -0.022 0.371 0.033	(+/-) (+/-) (+/-) -0.003 0.023 0.125 0.177 -0.007 0.001 0.955 -0.022 0.371 0.033 -0.026 0.034 -0.019 0.263 0.056	(+/-) (+/-) (+/-) -0.003 0.023 0.125 0.177 -0.007 0.001 0.955 -0.022 0.371 0.033 -0.026 0.034 -0.019 0.266 0.056 -0.013 0.034 0.128 0.256 0.058	(+/-) (+/-) (+/-) -0.003 0.023 0.125 0.177 -0.007 0.001 0.055 -0.022 0.371 0.033 -0.026 0.034 -0.019 0.263 0.056 -0.013 0.034 0.128 0.263 0.056 -0.075 0.129 -0.929 0.933 0.996	(+/-) (+/-) (+/-) -0.003 0.023 0.125 0.177 -0.007 0.001 0.055 -0.022 0.371 0.033 -0.026 0.034 -0.019 0.263 0.056 -0.015 0.034 0.128 0.256 0.058 -0.075 0.129 -0.929 0.933 0.096 0.037 0.085 -0.275 0.654 0.257	(+/-) 0.125 0.177 -0.007 -0.022 0.371 0.033 -0.019 0.263 0.056 0.128 0.256 0.058 -0.929 0.933 0.096 -0.275 0.657 0.257 0.457 0.607 -0.105	04/27/98 -0.003 0.023 0.125 0.177 -0.007 05/20/98 -0.001 0.055 -0.022 0.371 0.033 06/22/98 -0.026 0.034 -0.019 0.263 0.056 07/20/98 -0.013 0.034 0.128 0.256 0.058 08/24/98 -0.075 0.129 -0.929 0.933 0.096 09/14/98 0.037 0.085 -0.275 0.654 0.257 10/07/98 -0.026 0.085 -0.275 0.654 0.257	04/27/98 -0.003 0.023 0.125 0.177 -0.007 05/20/98 -0.003 0.023 0.125 0.177 -0.007 05/22/98 -0.026 0.034 -0.019 0.263 0.056 07/20/98 -0.013 0.034 0.128 0.256 0.058 08/24/98 -0.013 0.034 0.128 0.256 0.058 09/14/96 0.037 0.085 -0.275 0.654 0.257 10/07/98 0.012 0.059 -0.073 0.457 0.607 -0.105 05/20/98 0.012 0.059 -0.073 0.459 0.028	(+/-) (+/-) (+/-) (+/-) (+/-) (+/-) (+/-) (+/-) (+/-) (+/-) (-/-)	04/27/98 -0.003 0.023 0.125 0.177 -0.007 05/20/98 0.001 0.055 -0.022 0.371 0.033 06/22/98 -0.013 0.024 0.037 0.035 0.022 0.371 0.033 06/22/98 -0.013 0.034 0.019 0.256 0.058 0.049 0.049 0.056 0.056 0.056 0.056 0.056 0.056 0.056 0.057 0.056 0.056 0.057 0.057 0.056 0.056 0.057	(+/-) (+/-) (+/-) (+/-) (-/-)

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	500	

99	(-/-)	1.5	1.3	1.0	9.0	-	2.2	1.2	1.3		(+/+)	113	122	163	28	1	20	12	14
09-03		0.0	-0.1	-0.1	0.1	-0.2	0.3	0.0	0.5	1-131		16	31	26	50	ř.	11	1	9.
0	(-/+)	7.1	8.6	0.0	5.9	3.2	7.9	4.7	8.8	90	(-/+)	15	15	18	2	=	20	13	12
FE-59		-1.2	-1.1	-1.3	-1.2	2.1	-3.8	-0.5	-2.4	RU-106		13	13	6-	7	0	2	-	-5
80	(-/+)	2.1	2.3	2.7	0.8	1.3	2.2	1.4	1.4	03	(-/+)	3.4	3.3	4.2	1.5	1.4	3.1	2.0	2.1
85-03		-0.2	6.0	6.0-	-1.0	-0.3	-1.7	-0.1	-0.4	RU-103		6.4	0.2	-3.4	1.0	-1.9	2.5	-1.4	-0.7
4	(-/-)	1.5	5.5	1.9	0.5	1.0	2.3	1.2	1.3	80	(-/-)	3.2	3.8	5.0	1.4	1.5	3.6	2.1	2.1
MN-54		0.3	0.2	1.6	-0.3	9.0	-0.2	-0.0	-0.2	26-8#			1.7	-1.6	0.1	0.2	1.7	0.2	6.0
	(-/-)	44	44	57	16	14	30	21	22	10	(-/+)	3.9	3.9	3.9	1.5	2.1	M. W.	2.7	3.2
CR-51		-20	-26	-23	19	7	-31	9-	9-	28-95		5.3	0.4-	0.5	-1.3	9.0	-1.0	-0.3	1.0
	(-/+)	56	22	32	10	92	77	21	32	50	(-/+)	5.5	3.7	4.1	1.3	2.2	6.0	6.0	5.3
K-40		.13	-31	6-	-12	12	72	-16	m	2N-65		-0.5	1.4	-1.3	9.0-	0.8	1.3	-1.2	8.8
COLLECTION		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/98	07/23/98	10/22/98	COLLECTION		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/98	07/23/98	10/22/98
LOCATION		92	82	28	28	30	300	300	300	LOCATION		82	28	28	82	300	300	300	300

TH-228	(-/-)								
-H		3.4	1.5	3.5	1.4	-0.9	7.3	-2.3	3.9
927	(-/+)	68.0	50.5	86.5	19.9	37.1	46.6	58.0	50.0
RA-226		5.7	-57.1	-21.0	-7.2	-2.3	70.3	-48.8	-38.4
051	(-/+)	28	28	52	12	4	11	9	1
LA-140		6-	-10	1-	-12	.3	9	m	4-
071	(-/+)	22	55	52	=	9	10	9	9
BA-140		1-	8-	9-		-5	9	2	.3
37	(-/-)	1.4	1.5	2.0	9.6	1.1	2.3	1.2	1.6
CS-137		-0.5	0.1	-0.2	-0.0	-1.0	1.6	-0.8	0.1
35	(-/+)	1.5	1.4	2.0	0.5	1.0	22		1.5
CS-134		9.0-	0.5	-0.7	-0.2	-0.7	0.5	0.1	0.8
COLLECTION		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/98	07/23/98	10/22/98
LOCATION		822	28	28	28	300	300	300	300

		(-/+)	471	427	480	670	477	452	707	642
¥.		,	184	177	357	379	-58	-342	-97	07-
COLLECTION	*********		02/02/98	05/04/98	08/03/98	11/02/98	01/26/98	04/27/98	07/23/98	10/22/08
LOCATION	*******		28	28	28	28	300	300	300	300

PAGE 3-38

FE-59	(-/+)	0.00	0.10	0.05	106	(./.)	0.21	0.06 0.27 0.12 0.48	0.25
Ė		-0.04	0.0%	0.03	5		0.00	0.06	0.12
88	(-/+)	0.03	0.03	0.02	RU-103	(-/+)	0.03	0.03	0.03
85-00		9.00	-0.02	-0.01	- RU-		0.01	-0.01	0.01
MH-54	(-/±)	0.03	0.03	0.02	8	(-/+)	0.04	0.0%	0.05
2		-0.02	0.01	-0.02	88		10	63	63
23	CR-5	0.22	0.26	0.19	8	(-/+)	0.05	0.06 0.05 -0.0	0.00
5		-0.06	-0.05	0.12	-82		-0.03	0.06	-0.01
	1:	20.	2.3	1.1				0.07	
K-4		9.0	11.5	13.6	ZN-		0.05	0.00	0.03
	(-/-)	0.36	0.30	0.19	09-03	(-/+)	0.03	0.03	0.03
5E-7		0.78	0.36	-0.05	8		-0.05	0.05	0.00
COLLECTION		03/17/98 09/04/98	03/17/98 09/04/98	03/17/98	COLLECTION		03/17/98 09/04/98	03/17/98 09/04/98	03/17/98
LOCATION		888	22	30C 30C	LOCATION		28	22	300

,	-3	66	11	10	14	95	14
-59	(+)	0.0	0	0.	0	0.0	0
FE-59		0.05	-0.04	9.04	-9.14	0.03	-0.00
85-03	(-/-)	0.03	0.04	0.03	0.0%	0.05	0.04
8		0.00	0.01	0.02	0.01	0.01	0.05
54	(-/+)	0.03	0.0%	0.03	90.0	0.05	0.0%
;		0-	0	0	0	0	0-
CR-51	(+/+)	0.22	0.41	0.26	0.57	0.19	0.48
Š		-0.06	0.41	-0.05	0.20	0.12	-0.02
0	(-/+)	1.5	1.9	1.4	2.3	1.1	5.1
N-40		8.9	0.6	9.6	11.5	8.1	13.6
	(-/+)	0.36	0.40	0.30	0.50	0.19	19.0
8E-7		0.78	0.10	9.36	9.11	-0.05	0.56
COLLECTION			86/70/60		86/100/60		
LOCATION		28	28	82	&	300	300

901		(-/+)	0.21	0.29	0.27	0.48	0.25	0.43
-BR			90.0	-0.14	0.06 0.27	0.12	0.12	0.0%
103		(-/+)	0.03	90.0	0.03	0.02	0.03	0.04
-52			0.01	-0.01	-0.01 0.03	-0.03	0.01	0.01
MB-6			-0.01	-0.03	-0.02 0.04	0.03	-0.03	-0.06
-82			-0.03	-0.05	0.00	0.04	-0.01	-0.03
55		(-/+)	0.17	0.07	0.02	0.11	0.13	0.27
7-HZ	(-/+)		0.02	-0.05	-0.04	90.0	0.03	90.0
8			0.01	-0.05	0.05	0.04	00.0	0.03
COLLECTION			03/17/98	86/90/60	93/17/98	09/04/98	03/17/98	09/04/98
LOCATION			28	28	82	53	300	300

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	MEN	
	W	-
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TABL	w	40
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	801	Par.
	89	*

822		(-/+)	0.16	0.20	0.18	0.27	0.11	0.24
Ė			69.0	0.62	0.61 0.18	0.57	0.42	0.88
525		(-/+)	0.87	0.83	1.29	1.97	0.99	1.37
RA-			0.97	1.04	2.24 1.29	1.82	0.76	1.22
137		(+/+)	0.0%	90.0	0.0%	0.11	90.0	0.08
Ś			0.0	0.07	0.08 0.04	0.16	0.04	9.16
134		(-/+)	0.03	0.04	0 03	0.02	0.05	0.04
Ś			-0.01	-0.00	0.00 0 03	0.01	0.01	0.01
31		(-/+)	0.00	0.10	.01 0.04	0.14	0.03	0.11
-			00.00	-0.06	-0.01	-0.07	-0.00	-0.02
110M		(-/-)	0.03	0.02	0.05	90.0	0.03	0.02
AG-	1		-0.00	-0.04	-0.0% 0.05	0.02	-0.00	0.03
COLLECTION	***************************************		03/17/98	09/04/93	03/17/98	09/04/98	03/17/98	86/10/60
LOCATION	*******		92	28	62	62	300	300

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4000	2440
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MUSEZ	man

TABLE 16 SHELLFISH (PCI/G WET NT.)

FE-59		(-/+)	0,060	0.037	0.051	0.084	0.076	0.051	0.044	0.054	0.074	0.051	0.050	0.091
#			0.008	0.000	016	041	005	0.014	024	008	0.035	0.048	0.000	032
85-03	:	(-/-)	0.016	0.015	0.026	0.027	0.025	0.021	0.017	9.926	0.019	0.015	0.019	0.025
8			*00*	011	0.009	0.018	0.004	0.004	007	900.0	0.001	020	900	026
MW-54		(-/+)	0.015	0.015	0.022	0.027	0.030	0.022	0.017	0.019	0.021	0.019	0.017	0.025
N. S.			0.007	0.005	008	0.007	0.033	0.001	0.011	007	021	0.000	900.0	900.0
CR-51	:	(-/+)	0.198	0.165	0.231	0.305	0.280	0.182	0.163	0.259	0.250	0.170	0.199	0.324
8			019	100	056	023	0.167	158	107	1.071	0.023	0.181	927	0.247
0		(-/+)	9.0	9.0	0.5	0.5	9.0	0.5	9.0	0.3	9.0	0.3	9.0	9.6
05-X			0.3	0.3	7.0	0.1	0.1	0.3	6.4	-0.1	0.1	0.3	0.3	-0.1
1		(-/+)	0.166	0.128	0.184	0.241	0.205	0.200	0.150	0.203	0.243	0.142	0.166	0.282
7-38					-,142				0.062		220	980		028
COLLECTION			02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98
LOCATION			275	275	272	275	28x	28x	28x	28x	31	31	31	31

RU-106		(+/-)	0.159	0.167	0.246	0.284	0.278	0.215	0.163	0.310	0.248	0.201	3.194	0.290
3			0.097	760	023	0.291	0.055	0.067	0.113	0.165	210	0.036	0.137	0.083
RU-103		(-/+)	0.022	0.015	0.027	0.033	0.027	0.022	0.019	0.025	0.026	0.019	0.021	0.030
38	:		023	900.0	003	0.035	010	011		600				900.
8		(-/+)	0.023	0.022	0.021	0.036	0.030	0.024	0.038	0.034	0.037	0.034	0.024	0.042
NB-95			*00*-	900	013	007				003	900.0	0.012	007	007
28-95		(-/-)	0.029	0.028	0.053	0.051	0.039	0.035	0.032	0.046	0.030	0.033	0.031	0.035
28.					0.027		0.026	002	00	0.00%				662
ZN-65		(+/-)	0.035	0.097	0.062	0.048	0.052	0.034	0.043	0.038	0.057	0.092	0.049	0.070
.N.2			0.000						015					0.027
09-03		(-/+)	0.012	0.016	0.019	0.020	0.021	0.023	0.015	0.029	0.023	0.016	0.025	0.036
8			0.005			*00.			0.003		022			0.000
COLLECTION			02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/15/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98
LOCATION			27C	275	275	275	28X	28x	28x	28x	31	31	31	31

TABLE 16	SHELLFISH	(PCI/6 WET WT.)

TH-228		(-/-)	0.600	0.086	0.119	0.202	0.130	0.123	0.100	0.114	0.163	0.098	0.130	0.214
¥			0.180	0.088	0.175	0.234	0.185	0.149	0.208	0.121	0.087	0.093	0.251	0.319
RA-226		(-/+)	0.648	0.522	0.808	0.849	0.690	0.493	0.682	0.557	0.581	0.448	0.762	969.0
RA			0.000	0.307	0.196	0.273	256	0.803	0.450	0.071	860.0	0.015	0.331	0.170
CS-137		(-/+)	0.016	0.022	0.027	0.025	0.032	0.018	0.020	0.029	0.020	0.018	0.019	0.038
55			0.007	005	002	0.00%			0.023					0.002
CS-134	******	(-/+)	0.019	0.016	0.020	0.035	0.028	0.024	0.017	0.925	0.024	0.018	0.019	0.031
Ė					002				017				0.010	
1-131		(-/+)	0.050	0.029	0.053	0.085	0.081	0.041	0.032	0.075	0.063	0.028	0.046	0.073
Ξ			010	800	0.040	900.0	0.016	0.022	0.002	016	0.020	800	0.005	041
AG-110M		(-/+)	0.027	0.021	0.028	0.046	0.029	0.032	0.031	0.031	0.026	0.016	0.023	0.028
AG-					0.008		022	003	0.003	900	+10		0.003	
COLLECTION			02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98	02/04/98	05/12/98	08/10/98	11/06/98
LOCATION			275	275	275	275	28x	28x	28x	28x	31	31	31	31

COMMECTICUT YANKEE 1998

26 01/07/98 26 01/07/98 26 01/07/98 26 01/07/98 26 01/07/98 26 01/07/98 29 07/02/98					(PCI/	(PCI/G MET WT.)						
	6	BE-7	K-40	9	8	CR-51	¥	195-MM	8	85-00	Æ	FE-59
					:						:	
		(./.)		(-/+)		(-/+)		(-/+)		(-/+)		(-/+)
	0.030	0.155	3.3	1.0	0.290	0.242	027	0.025	0.011	0.021	0.00	0.068
	003	0.122	3.4	9.0	0.059	0.147	0.006	0.013	0.000	0.016	022	0.052
	128	0.172	3.0	0.7	0.073	0.212	008	0.017	007	0.016	034	0.049
	0.041	0.150	3.6	0.7	0.124	0.230	011	0.015	0.005	0.017	0.623	0.054
	012	0.114	3.5	9.0	0.116	9.127	0.003	0.013	013	0.011	012	0.061
	056		3.5	1.0	147	0.196	0.001	0.018	0.002	0.022	036	0.061
	0.166		2.7	6.0	0.017	0.212	0.019	0.023	0.009	0.023	050	0.065
	0.114		3.4	1.0	025	0.202	0.012	0.021	003	0.023	0.010	0.070
300 01/08/98	027	0.164	3.0	0.7	114	0.136	0.001	0.018	003	0.015	039	0.048
	121	0.168	3.3	6.0	0.032	0.187	0.008	0.018	900	0.023	029	0.061
	087	0.170	4.2	0.8	087	0.191	002	0.016	006	0.017	001	0.052
	0.102	0.180	3.2	0.0	0.029	0.312	614	0.021	0.000	0.025	003	0.095

90	 (-/+)	500	155	173	0.174	123	166	210	0.192	190	210	201	0.242
RU-106					0.116 0.				015 0.				051 0.
N-103	 (-/+)	0.024	0.014	0.022	0.019	0.013	0.020	0.023	0.022	0.018	0.019	9.016	0.028
-D&			0.011					0.011		0.008	900.0	0.002	0.921
KB-95	 (-/+)	0.026	0.020	0.021	0.023	0.015	0.048	0.033	0.031	0.018	0.025	0.023	0.036
88		0.008	0.00%	0.013	005	0.001	005	010	020	700.	600.	0.619	027
ZR-95	 (-/+)	0.041	0.028	0.028	0.035	0.026	0.034	0.00	0.040	0.032	0.043	0.036	0.052
ZR		006	0.018	005	008	0.030	020	021	0.004	0.009	0.026	0.000	011
ZN-65	 (-/+)	0.077	0.035	0.048	0.0%	0.029	0.119	0.051	9,000	0.033	0.053	0.041	0.075
NZ ZW		0.620	022	0.013	033	0.014	052	020	070	110	019	023	043
09-00	 (+/+)	0.031	0.017	0.020	0.021	0.010	0.018	0.024	0.024	0.021	0.014	0.020	0.029
8		0.014	0.002	100	008	900.0	0.000	0.016	0.012	022	600	0.000	6.005
COLLECTION		01/07/98	04/10/98	07/02/98	10/09/98	01/07/98	04/10/98	07/02/98	10/09/98	01/08/98	04/13/98	86/90/20	10/09/98
LOCATION		92	92	36	56	62	56	53	53	300	300	300	30c

 0.002 0.062 037 0.082 021 0.032 018 0.032 0.025 0.044 025 0.146

PAGE 3-46	65		(-/+)	0.000	0.045	0.070	0.107	0.071	0.036	0.094	0.071	0.040	0.056	0.070	0.088
Z	FE-59			-0.072	-0.007	0.011	0.000	0.018	0.034	-0.035	-0.004	-0.010	0.021	-0.102	0.013
	58		(-/-)	0.032	0.022	0.017	0.029	0.022	0.018	0.030	0.030	0.012	0.017	0.025	0.034
	85-00			0.002	0.001	-0.008	-0.015	-0.002	0.000	0.011	0.004	-0.009	-0.096	0.016	0.019
	54		(-/+)	0.023	0.021	0.020	0.029	0.018	0.920	0.022	0.032	0.017	0.017	0.023	0.054
	95-No			0.002	0.018	-0.021	0.011	0.004	900.0	0.00%	0.001	-0.010	900.0	0.010	0.007
	51		(-/+)	0.35	0.14	0.19	0.34	0.15	0.17	0.25	0.37	0.12	0.15	0.20	0.28
FISH-OTHER PCI/G WET WT.)	CR-51			0.00	-0.04	0.14	0.11	0.13	0.01	9.00	0.03	-0.12	0.01	0.05	-0.14
FISH- (PCI/G	0		(-/-)	0.94	0.72	0.87	1.20	0.84	99.0	0.93	0.89	0.56	0.73	0.89	1.06
	05-X			3.50	3.91	3.99	3.67	3.59	2.60	3.80	3.03	2.62	3.37	3.69	3.98
	1		(-/-)	0.25	0.16	0.19	0.24	0.18	0.14	0.18	0.23	0.00	0.13	9.18	0.25
	BE-7	:		-0.06	-6.10	0.03	-0.07	-0.04	-0.07	-0.04	-0.05	-0.06	0.11	-0.06	0.04
905	TYPE							PERCH	CARP	BASS	CARP	CARP	BASS	BASS	BASS
CONNECTICUT YANKEE 1998	DATE			01/26/98 A	04/10/98	07/02/98	10/09/98	01/06/98	04/10/98	07/02/98	10/09/98	01/08/98	04/13/98	07/06/98	10/09/98
CONNECTICA	LOCATION						92	82	2	53	&	300	300	300	300

RU-106	 (-/+)	0.212	0.190	0.203	0.347	0.200	0.100	0.248	0.281	0.133	0.169	0.199	0.250
-S		-0.024	0.031	0.070	-0.035	0.043	0.080	0.000	-0.066	-0.029	0.119	0.187	0.059
RU-103	 (-/+)	0.031	9.019	0.020	0.045	0.019	0.017	0.023	0.031	0.012	0.015	0.022	0.027
Ē		-0.001	-0.013	-0.011	-0.025	0.614	-0.002	0.002	0.005	0.005	0.00	0.005	-0.001
8	 (-/+)	0.034	0.043	0.027	6.045	9.026	0.922	0.051	0.035	0.016	0.018	0.024	0.035
NB-95		-0.015	-0.016	0.005	-0.007	0.003	-0.015	-0.020	0.008	-0.009	-0.009	0.007	-0.020
28-95	 (+/+)	0.057	0.036	0.040	0.084	0.043	0.027	0.047	0.058	0.028	0.031	0.044	0.042
28.		0.021	0.000	0.010	-0.008	-0.007	0.005	0.006	-0.016	-3.012	0.011	0.032	0.022
59-N2	 (-/+)	0.061	0.136	0.065	0.054	0.620	0.042	0.073	0.051	0.032	0.040	0.058	0.064
NZ		0.024	0.039	-0.043	-0.028	0.00%	-0.003	-0.020	-0.030	-0.017	0.001	-0.053	-0.026
09-03	 (-/+)	0.034	0.021	0.025	0.043			0.025		0.015	0.018	0.027	0.038
8		0.018	0.010	0.019	0.019	-0.019	0.003	0.014	0.012	0.00%	0.011	0.000	0.037
TYPE		OTHER	BASS	BASS	PERCH	PERCH	CARP	BASS	CARP	CARP	BASS	BASS	BASS
COLLECTION		01/26/98 A	04/10/98	07/02/98	10/09/98	01/06/98	04/10/98	07/02/98	19/09/98	01/08/98	04/13/98	96/90/10	10/09/98
LOCATION						62							

A: SAMPLE OF PIKE AND BASS.

LOCATION

	8A-226		(-/+)	0.684	0.704	0.408	0.718	0.445	0.450	0.708	0.545	0.332	0.320	0.408	0.467
	RA-			-0.052	6.356	-0.042	-0.074	-0.207	-0.298	0.143	0.143	-0.222	0.037	0.559	0.679
TABLE 178 FISH-OTHER (PCI/G WET MI.)	CS-137		(-/+)	0.032	0.028	0.033	0.038	0.036	0.022	9.028	0.030	0.025	0.019	0.025	0.027
	Ė			0.000	-0.012	0.0%0	-0.003	9.026	0.014	-0.005	0.034	0.025	-0.008	0.011	0.003
	13%	*****	(-/+)	0.022	0.021	0.022	0.029	0.016	0.016	0.026	0.028	0.017	0.017	0.022	0.022
	CS-134			-0.002	-0.009	0.000	0.001			-0.009		0.005	0.014	-0.020	0.003
	31		(-/-)	0.148	0.044	0.057	0.169	0.032	9.044	0.082	0.175	0.023	0.032	0.050	0.176
	1-131			-0.065	-0.008	0.030	0.061	0.000	-0.008	0.031	-0.063	-0.014	0.022	0.022	0.146
	104	******	(-/+)	0.028	0.026	0.026	0.040	0.024	0.020	0.030	0.034	0.021	0.019	0.024	0.035
	AG-110M	AG-1		-0.012	-0.008	-0.017	-0.012	0.016	-0.007	0.00%	0.019	0.008	-0.002	-0.026	-0.017
1998	TYPE	***********		OTHER	BASS	BASS	PERCH	PERCH	CARP	BASS	CARP	CARP	BASS	BASS	BASS
CUT YANKEE	DATE			01/26/98 A	04/10/98	07/02/98	10/09/98	86/90/10	04/10/98	95/20/20	10/09/98	86/80/10	04/13/98	86/90/10	10/09/98

2222 2222 2222

0.109 0.086 0.086 0.150

0.018 0.002 0.065

(-/+)

TH-228

0.103

0.063 -0.013 0.020 0.052

0.061

-0.018 -0.001 -0.021

A: SAMPLE OF PIKE AND BASS.

4. DISCUSSION OF RESULTS

This section summarizes the results of the analyses of environmental media sampled. NNECO has carefully examined the data throughout the year and has presented in this section all cases where station related radioactivity could be detected and compared the results with previous environmental surveillance data. The only impact observed from the station was tritium detected in on-site wells during 1998. Subsections describe each particular media or potential exposure pathway. Any dose commitments from station-related exposures is insignificant as explained in Section 5.

Naturally occurring nuclides such as Be-7 K-40, Ra-226 and Th-228 were detected in numerous samples. Be-7, which is produced by cosmic processes, was observed predominantly in airborne and vegetation samples. Ra-226 and Th-228 results were variable and were observed in broadleaf vegetation, river water (one barely positive Ra-226), river bottom sediment, shellfish, and fish (one barely positive Ra-226).

Cs-137 and Sz-90, present because of atmospheric nuclear weapons testing of years past, were observed at levels similar to those of past years.

4.1. Gamma Exposure Rate (Table 1)

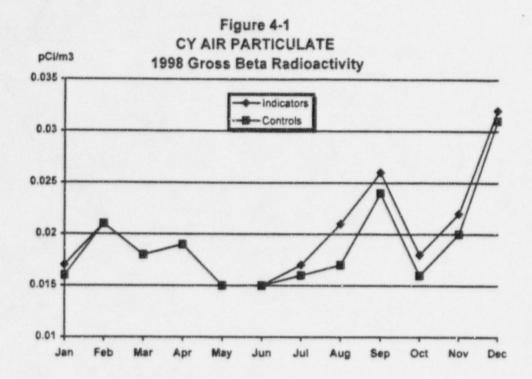
Gamma exposure from all sources of radioactivity is measured over periods of approximately one month using CaF_2 (Mn) thermoluminescent dosimeters (TLDs). These dosimeters are strategically placed at a number of on-site locations, as well as at inner and outer off-site locations. Glass bulb type TLDs such as these, are subject to inherent self-irradiation which has been experimentally measured for each dosimeter. The results, shown in Table 1 have been adjusted for this effect. The range of this correction for field dosimeters is $0.4 \, \mu R/hr$ to $2.8 \, \mu R/hr$, with a mean of approximately 1 $\mu R/hr$.

No indications of plant related exposure were observed. The exposure rate measurements exhibit the same trends as those of past years. These measurements demonstrate the general variations in background radiation between the various on-site and off-site locations and include gamma exposure from all sources of radioactivity.

4.2. Air Particulate Gross Beta Radioactivity (Table 2)

Air is continuously sampled at seven inner ring and two outer ring locations by passing it through glass fiber particulate filters. These are collected weekly and analyzed for gross beta radioactivity. Results are shown on Figure 4-1 and Table 2.

Gross beta activity remained at levels similar to that seen over the last decade. Inner and outer ring monitoring locations showed no significant variation in measured activities. This indicates that any station contribution is not measurable.



4.3. Airborne lodine (Table 3)

Because the station permanently shutdown in 1996 all radioactive iodines, which have short half-lives, have decayed away. Therefore the requirement to sample airborne iodine has been removed from the Radiological Effluent Monitoring Manual (REMM) and no samples were collected in 1998.

4.4. Air Particulate Gamma (Table 4A-D)

The weekly air particulate filters are composited quarterly for gamma spectral analyses. The results, as shown in Tables 4A-4D, indicate the presence of naturally occurring Be-7, which is produced by cosmic processes. No positive results were observed for all the other isotopes. These analyses indicate the lack of station effects.

4.5. Air Particulate Strontium (Table 5)

Table 5 in past years was used to report the measurement of Sr-89 and Sr-90 in quarterly composited air particulate filters. These measurements are not required by the REMM and have been discontinued. Previous data has shown the lack of detectable station activity in this media. This fact, and the fact that milk samples are a much more sensitive indicator of fission product existence in the environment, prompted the decision for discontinuation.

4.6. Soil (Table 6)

Soil samples are not required by the REMM.

4.7. Cow Milk (Table 7)

Analysis of milk samples is generally the most sensitive indicator of fission product existence in the terrestrial environment. This, in combination with the fact that consumption of milk is significant, results in this pathway usually being the most critical from the station release viewpoint. This pathway also shows measurable amounts of nuclear weapons testing fallout. Therefore, this media needs to be evaluated very carefully when trying to determine if there are any station effects.

Previous data over many years has shown the lack of station related strontium activity in this media. Therefore, the strontium analysis frequency is quarterly, rather than monthly. The monthly samples collected within each quarter from each sample location are composited and analyzed at the end of each quarter. Sr-90 was observed in nearly one half of all samples; the highest value observed was 4.8 pCi/l. Detailed analysis of previous data has concluded that these levels of Sr-90 are from weapons testing and are not station related (see Section 6.0 for details to this argument).

Cs-137 usually shows the same tendencies as Sr-90. Results for 1998 are similar to those seen for nearly the past two decades. Detailed analysis has concluded that these concentrations are most likely the result of fallout from previous nuclear weapons testing (see Section 6.0 for details).

Although not listed on Table 7, the only other nuclide detected by gamma spectrometry was naturally occurring K-40.

4.8. Goat Milk (Table 8)

Depending on the feeding habits, goat milk can be a more sensitive indicator than cow milk of fission products in the environment. This is due to the metabolism of these animals. Similar to the results of the cow milk samples, these show measurable amounts of nuclear weapons testing fallout.

Sr-90 and Cs-137 were observed in most samples. The levels observed are due to residual radioactivity in the environment from nuclear weapons testings in the 1960s. The variability in the results this year as well as in past years is caused by many factors, including feeding habits (amount of stored feed, etc.), soil characteristics, farming practices (tillage and quality of fertilization and land management), and feed type. For a complete discussion of the problem see Section 6.0.

4.9. Pasture Grass (Table 9)

When the routine milk samples are unavailable, samples of pasture grass are required as a replacement during the months of April through December. These samples may also be taken to further investigate the levels of radioactivity in milk. Directives since mid-year have been to sample feed (e.g., hay) if pasture grass is also unavailable. During the winter months and early spring, insufficient growth prohibits sampling of pasture grass as a replacement sample. Because of unavailability of pasture grass during November and December, feed (hay) was collected as a substitute for the pasture grass. No station effects were seen in the feed.

4.10. Well Water (Table 10)

Activity in this media results from either soluble station effluents permeating through the ground or the leaching of naturally occurring nuclides from the soil and rock. In 1998, samples of well water from the onsite stations (location 15) were taken monthly even though the requirements per the REMODCM are to sample quarterly. Because H-3 in station liquid effluents is the predominant radionuclide present, the higher sampling frequency was implemented to enhance program monitoring effectiveness. On-site wells (location 15) exhibited station related H-3 above background levels. This station effect results from the wells being located within an area influenced by the water in the discharge canal and H-3 having the ability to readily follow the flow of ground water. Off-site concentrations are much lower. This pathway does not result in any dose consequence since the water from these wells is used only in process streams at the station.

On-site H-3 levels detected in 1998 samples show a decrease compared to prior years. This is a trend that started back in cycle 17 (1992) due to replacing stainless steel clad fuel with zircaloy clad fuel. The levels of H-3 observed since permanent shutdown in July 1996 represent residual levels of tritium that remain in station process liquids and/or groundwater from beneath the site that are gradually dropping to natural background levels. Figure 4-2 shows the trend of H-3 measured in CY on-site wells since 1988. Of note in the figure is the highs and lows observed in measured levels of H-3. These swings are coincident with station operations. Higher H-3 levels are observed during periods when increased volumes of liquid processing occurred in preparation for station outages.

pCi/liter 5000 5000 4000 3000 2000 1000 0 1093 1088 1089 1090 1091 1092 1094 1Q95 1096 1Q97 1098 Year

Figure 4-2
H-3 Levels in On-site Wells

4.11. Reservoir Water (Table 11)

Reservoir water samples are special samples not required by the REMM. Previous data has shown the lack of detectable station activity in this media. This fact and the extremely unlikely possibility of observing routine station effluents in this media has resulted in discontinuing these samples.

4.12. Fruits and Vegetables (Table 12)

This media did not show any station effects. Naturally occurring K-40 was detected in all samples and cosmically produced Be-7 was detected in one sample. Since there was no fresh fallout, no other nuclides were detected.

4.13. Broad Leaf Vegetation (Table 13)

Concentrations of Cs-137 seen in several of these samples are at levels comparable to past years and are due to fallout. To enhance program monitoring effectiveness, samples of broadleaf vegetation are collected monthly during the growing season, May - October, even though requirements are to collect twice a year. No station effects were observed in broadleaf samples.

4.14. River Water (Table 14)

These samples are collected on a quarterly basis; the sampling procedure is different at the control and indicator locations. Six weekly grab samples are taken within each quarter and composited for the control station (Middletown - location 30C). Continuous sampling, an automatic process of compositing a small volume of sample periodically over an entire quarter, is utilized at the indicator station (East Haddam Bridge - location 28).

Examination of the data shows there were no H-3 measurements that exceed 1.5 times the listed 2 σ error. Even though H-3 measurements at the indicator location (Loc. 28) appear significantly higher than the control location (Loc. 30C), the values reported are the effect of counting statistics. Although measurable levels of tritium above background have been detected in the past; there have been no positive indications of tritium in this media since 1994.

4.15. Bottom Sediment (Table 15)

There were positive indications of Cs-137 in several samples, including the control location. Because the indicator and control samples show similar levels, the source of this Cs-137 is from weapons fallout deposited in woodlands and washed out into water bodies. No indications of station related activity were observed in this sample media.

4.16. Shellfish (Table 16)

As in previous years, no station related activity was observed. This media is not a source of consumption.

4.17. Fish (Tables 17A and 17B)

4.17.1. Bullheads (Table 17A)

No station related activity was observed.

4.17.2. Perch and Other Types (Table 17B)

As observed in the past, there was no positive indication of radioactivity in this media from the station, including Cs-137. Even though the measured values at the indicator locations do not exceed 1.5 times the listed 2 σ error and are the effect of counting statistics, the results will be conservatively treated as a possible positive results in order to perform a dose consequence analysis in Section 5.0.

5. OFF-SITE DOSE EQUIVALENT COMMITMENTS

The off-site dose consequences (dose equivalent commitments) of the stations' radioactive liquid and airborne effluents have been evaluated using two methods. The first method utilizes the stations' measured radioactive discharges as input parameters into conservative models to simulate the transport mechanism through the environment to man. This results in the computation of the maximum doses to individuals and the 0 to 50 mile population dose. The results of these computations are submitted to the NRC in the Annual Radioactive Effluent Report written in accordance with the Radiological Effluent Monitoring Manual, Section F.2. The second method utilizes the actual measurements of the concentrations of radioactivity in various environmental media (e.g., milk, fish) and then computes the dose consequences resulting from the consumption of these foods.

The first method, which is usually conservative (i.e., computes higher doses than that which actually occur), has the advantage of approximating an upper limit to the dose consequences. This is important in those cases where the actual dose cannot be measured because they are so small as to be well below the capabilities of conventional monitoring techniques. For gaseous releases, extremely low concentrations of Cs-137 were released in 1998 for a short period of time. The only other station related activity observed in 1998 was H-3 in on-site well water. On-site well water is used for station processing and services, it is not a pathway for human consumption. Levels of Cs-137 observed in fish, although not plant related, were used to conservatively predict dose consequences as if the radioactivity were the result of station decommissioning operations.

Summarizing the data presented in Table 5.1:

MAXIMUM TOTAL INDIVIDUAL DOSES:

WHOLE BODY = 0.2 mrem (Adult)

LIVER = 0.27 mrem (Teen)

The average dose to an individual within 50 miles from the site using method 1 yields the following results for the period January - December 1998 for the average individual:

ANNUAL AVERAGE WHOLE BODY DOSE:

DUE TO AIRBORNE EFFLUENTS = 0.00002 mrem

DUE TO LIQUID EFFLUENTS = 0.00063 mrem

Thus, it can be seen that the average whole body dose to an individual is much less than the maximum whole body dose to an individual as shown in Table 5.1.

In order to provide perspective on the doses in Table 5.1, the standards for 1998 on the allowable maximum dose to an individual of the general public are given in 40CFR190 as 25 mrem whole body, 75 mrem thyroid, and 25 mrem any other organ. These standards are a fraction of the normal background radiation dose of 284 mrem per year and are designed to be inconsequential in regard to public health and safety. Station related doses are a small fraction of the standard as set by the Environmental Protection Agency and of the variation in natural background in Connecticut. Station related doses pose insignificant public health consequences.

TABLE 5.1 - COMPARISON OF DOSE CALCULATION METHODS HADDAM NECK STATION

1998 Annual Dose (millirem)

Pathway	Individual	Organ	Method 1 (1)	Method 2 ⁽¹⁾
Airborne Effluents				
External Gamma Dose	Max. Ind. (2)	Whole Body	0.00015	ND ⁽⁴⁾
2. Inhalation	Teen	Whole Body Liver	0.051 ⁽⁶⁾ 0.051 ⁽⁶⁾	NAD ⁽³⁾
Liquid Effluents				
1. Fich Pathway only ⁽⁷⁾	* Adult	Whole Body	0.15(7)	<0.042(8)
	Teen Child	"	0.082 0.032	<0.023 <0.009
	* Adult	GI(LLI) ⁽⁵⁾	0.0078	< 0.0012
	Teen	"	0.0058	< 0.0009
	Child	"	0.0025	<0.0004
	Adult	Liver	0.22	< 0.064
	* Teen	44	0.22	< 0.066
	Chila	"	0.20	< 0.060

Notes:

- (1) Method 1 uses measured station discharges and meteorological data as input parameters to conservative transport to man models. Method 2 uses actual measured concentrations in environmental media.
- (2) Maximum individue. The maximum individual dose is the dose to the most critical age group at the location of maximum concentration of station related activity. The dose to the average individual is much less than the maximum individual dose. The doses for inhalation and vagetable consumption assume that the individual resides at the point of maximum quarterly dose. Therefore, his residence is subject to variation for conservatism.
- (3) NAD No activity detected above the minimum detectable level.
- (4) ND Not Detectable The station effects at all off-site locations were so small that they could not be distinguished from fluctuations in natural background.
- (5) GI(LLI) Gasorointestinal Tract Lover Large Intestine.
- (6) Dose is primarily due to the release of tritium (H-3) in airborne effluents. Since tritium effects nearly all organs equally, the resulting dose to the whole body from inhaling tritium is the same.
- (7) The dose values listed for the fish pathway represent the liquid dose pathway to man that is calculated using Method 1 conservative computer models.
- (8) The dose values represent the dose consequences for eating fish with Cs-137 present from weapons fallout.

6. DISCUSSION

The evaluation of the effects of station operation on the environment requires the careful consideration of many factors. Those factors depend upon the media being affected. They include station release rates, effluent dispersion, fallout distribution from past nuclear weapons tests, redistribution of fallout dut to weathering and biotic activity, soil conditions (mineral content, pH, etc.), quality of fertilization, quality of land management (e.g., irrigation), pasturing habits of animals, and type of pasturage. Any of these factors could cause significant variations in the measured radioactivity. A failure to consider these factors could cause erroneous conclusions.

Consider, for example, the problem of deciphering the effect of station releases on the radioactivity measured in milk samples. This is an important problem because this product is widely consumed and fission products readily concentrate in this media. Some of these fission products, such as Sr-89 are relatively short-lived. Therefore they result from either station effluents, nuclear weapons tests or nuclear incidents (e.g. Chernobyl). The long-lived radionuclides of Sr-90 and Cs-137 are still remaining from the weapons testing era of the 1960's resulting in measurable amounts in milk samples. Distinguishing between this "background" of fallout activity and station effects is a difficult problem.

In reviewing the Sr-90 and Cs-137 measured in cow and goat milk in the areas around the Haddam Neck station, a casual observer could notice that in some cases the levels of these isotopes are higher at farms closer to the station than at those further away from the stations. The station's effluents might at first appear to be responsible. However, the following facts prove this conclusion wrong.

- (1) The station accurately measures the long-lived fission products Sr-90 and Cs-137 in their releases. Based on these measurements and proven models developed by the Nuclear Regulatory Commission, concentrations in the environment can be calculated. These calculations, generally conservative, show that insufficient quantities of Sr-90 and Cs-137 have been released from the stations to yield the measured concentrations in milk.
- (2) Although the shorter half-life isotopes of Sr-89 and Cs-134 have decayed away, their general absence in environmental samples in the past suggest that the isotopes of Sr-90 and Cs-137, presently seen in the environment, are not station related. Over the many years of station operation, Sr-89 has often been released in comparable quantity to Sr-90, as well as Cs-134 to Cs-137. Since the pairs of isotopes are chemically similar according to their elemental forms, comparable levels should have been detected in milk if Sr-90 and Cs-137 were station related. No station related Sr-89 or Cs-134 have ever been detected in milk samples, or in any other media. The only occurrences of detectable Cs-134 in milk resulted from the Chernobyl incident.
- (3) Since dairy milk sampling began in the 1960's, several years prior to station operation, the immediate station areas have always shown higher levels of weapons fallout related Sr-90 and Cs-137 (see Figures 6-1 and 6-2). The ratio of activity between the locations has not changed with station operation. All areas show the same significant decrease in radioactivity since the 1964 Nuclear Test Ban Treaty.
- (4) Local variability of Sr-90 and Cs-137 in milk is common throughout the United States. Due to the variability in soil cor ditions, pasturing methods, rainfall, etc., it is the rule rather than the exception. Therefore, it is not surprising that certain farms have higher levels of radioactivity than other farms. In fact, there are some cases where the farms further from the station have higher Sr-90 and Cs-137 values than the farms that are closer to the station (e.g., see pre-1984 Haddam Neck Goat Milk data.)

Based on these facts, it is concluded that station effluents are not responsible for variations of Sr-90 and Cs-137 in environmental samples. The cause must be one or more of the other variables.

Northeast Nuclear Energy Company has carefully examined the data throughout the year and has presented in this report all cases where station related radioactivity can be detected. An analysis of the potential exposure to the population from any station related activity has been performed and shows that in all cases the exposure is insignificant.

As in previous years, this data is being submitted to, and will be reviewed by the appropriate regulatory bodies such as the Nuclear Regulatory Commission, Environmental Protection Agency and Connecticut Department of Environmental Protection.

Figure 6-1 Strontium-90 in Milk

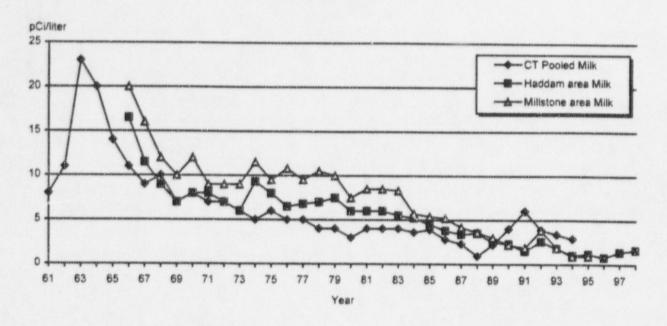
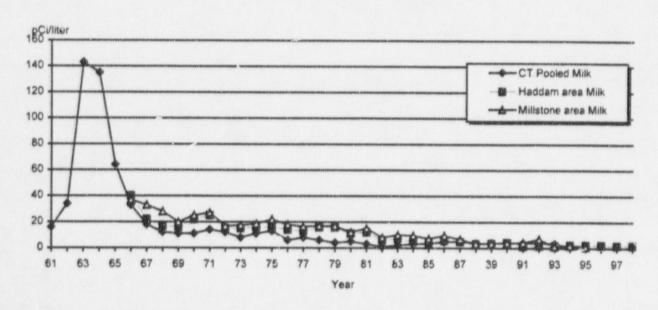


Figure 6-2 Cesium-137 in Milk



Dairy milk is no longer available in the Millstone area and CT Pooled milk has not been collected by the State of CT since 1994.

CY Start-up occurred: July 24, 1967
MP1 Start-up occurred: October 26, 1970
MP2 Start-up occurred: October 17, 1975
MP3 Start-up occurred: January 23, 1986

APPENDIX A

LAND USE CENSUS FOR 1998

TABLE A-1 (page 1 of 2)

Dairy Cows Within 15 Miles of Connecticut Yankee -December 1998

Direction	Distance	Name and Address	# of Cows
NNE	14 M	Allen Hills Hills Farm 527 Gilead Street Hebron, CT 06248	185
NNE	14 M	Edward Ellis Mapleleaf Farm, Inc. 768 Gilead Street Hebron, CT 06248	176
NNE	14 M	Gordon N. Rathburn Martin Road Hebron, CT 06248	36
NNE	14.5 M	Douglas Porter 14 Porter Rd. Hebron, CT 06248	140
NE	8 M	Elizabeth Gilman 178 Cato Corner Rd. Colchester, CT 06415	32
NE	14 M	Victor Botticello 302 Levita Road Lebanon, CT 06249	40
ENE	6.5 M	Robert Cone Grandpa Hill Farm Box 251 318 Old Colchester Tpke East Haddam, CT 06423	60
ENE	11 M	Richard Swider 475 New London Rd. Colchester, CT 06415	46
E	11.5 M	Eugene Wilczewski Salem Valley Farm Dairy 200 Darling Road Salem, CT 06415	45
E	14 M	Stuart Gadbois 40 Old Colchester Rd. Salem, CT 06415	225
SE	11 M	John Tiffany III Tiffany Farms 156 Sterling City Road Old Lyme, CT 06371	85

TABLE A-1 (page 2 of 2)

Dairy Cows Within 15 Miles of Connecticut Yankee - December 1998

Direction	Distance	Name and Address	# of Cows
WSW	8 M	Michael Dwyer 63 Grieb Rd. Wallingford, CT 06492	30
WSW	8 M	Robert Raudat 909 Durham Road Killingworth, CT 06417	44
WSW	11 M	Raymond Wimler 533 Guilford Road Durham, CT 06422	190
wsw	14 M	John & Edward Cella Cella Brothers Farm 2 No. Brandford Street Wallingford, CT 06492	150
WSW	15 M	David & Kirsten Footit D & K Farm 81 School St. Wallingford, CT 06492	140
W	11.5 M	Tony Caltabiano Friendly Acres Dairy Farm 145 Parmalee Hill Road Durham, CT 06422	45
W	14 M	Waiter Werbiski North Farms 1069 Farms Road Wallingford, CT 06492	21
W	14.5 M	Charles Greenback & Sons, Inc. 182 Wallingford Rd. Durham, CT 06422	170
NW	13 M	Higgins Farm, Inc. 837 Ridgewood Road Middletown, CT 06457	79
NW	15 M	Joan Bryck or Jean Backiel Riverside Farm 1160 France St. Rocky Hill, CT 06067	51

TABLE A-2 (page 1 of 1)

Dairy Goats Within 20 Miles of Connecticut Yankee - December 1998

Direction	Distance	Name and Address	Total Goats
NNE	12 M	Louise Sage 155 Reidy Hill Road Hebron, CT 06248	4
NNE	16 M	Joan Bowers 350 Wall Street Hebron, CT 06248	2
NNE	16 M	Kathy Waters Burnt Hill Road Hebron, CT 06248	70
SSE	3.6 M	Virginia Marshall Old County Road Haddam, CT 06438	6
SE	19.5 M	Mrs. John Mingo 69 Spithead Road Waterford, CT 06385	7
SE	15.8 M	George Scacciaferro 338 Boston Post Road East Lyme, CT 06333	2
S	11.5 M	Victor Trudeau 174 Horse Hill Road	5
W	15.3 M	Westbrook, CT 06498 Jim & Mary Hall Petlack 1000 North Farms Road Wallingford, CT 06492	12
WNW	19 M	Daniel Nitkowski 46 Firch Avenue Meriden, CT 06450	4
NNW	14 M	Derothy Joba 171 Ferry Lane S. Glastonbury, CT 06073	10
NNW	15 M	Donald Reid 1654 Main Street Glastonbury, CT 06033	•

^{*} UNABLE TO CONTACT AS OF THIS TIME.

TABLE A-3 (page 1 of 1)

1998 Resident Survey

conducted August 1998

	Downwind	Distance
Sector	Direction	(Meters)
A	N	1150
В	NNE	1780
C	NE	1265
D	ENE	1710
E	E	1955
F	ESE	2740
G	SE	1410
н	SSE	940
J	S	980
K	SSW	860
L	SW	940
M	WSW	1140
N	W	1360
P	WNW	660
Q	NW	750
R	NNW	1495

APPENDIX B

NNECO QA PROGRAM

INTRODUCTION

Northeast Nuclear Energy Company (NNECO) acting as the agent for the Connecticut Yankee Atomic Power Company (CYAPCO), maintains a quality assurance (QA) program as part of the radiological environmental monitoring program (REMP). The QA program consists of contractor appraisals, quality control samples, and quality control testing of environmental TLDs.

NNECO OA PROGRAM

Appraisals are conducted of the primary (Duke) radioanalysis contractor, of the Production Operations Support Laboratory (POSL), and of the NNECO Radiological Engineering Section (RES). A REMP evaluation form is completed for each appraisal and discrepancies are tracked on a separate form until corrective action is taken. The primary contractor, POSL, and RES are also audited by other organizations; the contractor by other customers, and POSL and RES by Northeast Utilities Nuclear Oversight Department.

There are two types of NNECO QA Program quality control samples - spikes and duplicates. Sample spikes are a check on the accuracy of results of the contractor's radioanalyses. Duplicate samples are a check of the contractor's precision or reproducibility of results. The number and type of NNECO QA Program quality control samples are given in Table 1. The results of the contractor's analyses of NNECO quality control samples must satisfy acceptance criteria in Procedure RAB B-3, "Quality Control of Radiological Environmental Monitoring Program Sample Analyses." An investigation is conducted of any result or trend which does not satisfy acceptance criteria.

There are two types QA Program tests of environmental TLDs - spikes and field comparisons. Spike testing involves the exposure of four TLDs each month. POSL readouts of the spiked TLDs are compared to the known radiation exposure. For field comparisons, QA TLDs of a different design from the REMP TLDs, are co-located with REMP TLDs at eight locations and processed at the Northeast Utilities Dosimetry Laboratory. Readings of the QA TLDs are compared to POSL's REMP TLD readings. The comparison results must satisfy acceptance criteria in NNECO Radiological Assessment Branch Procedure RAB B-2, "Quality Control of the Environmental TLD Monitoring Program." An investigation is conducted on any result or trend which does not satisfy acceptance criteria.

OTHER OA PROGRAMS

The NNECO QA Program is not the only QA Program which monitors REMP radioanalyses performance. Other programs include:

- Duke's internal QA program. In addition to the NNECO quality control samples the radioanalysis contractor has it's own quality control samples. In total, at least five percent of the contractor's sample analyses include quality control samples.
- 2. Duke's interlaboratary comparison program with an independent third party, Analytics, Inc. Results of the Analytics intercomparison are contained in Appendix C. Primary contractor participation in an interlaborary comparison program is required by station Technical Specifications. The Analytics comparison satisfies this requirement and is supplemented by the EPA Intercomparison Studies Program.

3. Duke's participation in EPA's Environmental Radioactivity Laboratory Intercomparison Studies Program. Duke participates in EPA's program because of their analyses of drinking water, not because of nuclear power station environmental sample analyses. However, some of the EPA intercomparison samples are also applicable to nuclear power environmental samples. Results of the EPA Intercomparison Studies Program are contained in Appendix C.

RESULTS OF NNECO OA PROGRAM FOR CONTRACTOR RADIOANALYSES

The NNECO QA Program indicated that Duke's environmental radiological analysis program was adequate in 1998. Of 103 analysis results on QA samples, 99 passed criteria, a 96% success rate.

There were two air particulate gamma analyses which exceeded the criterion of being within 20% of the spiked value - both I-131 sample spikes, one at minus 23% and one at minus 30%. Although three other I-131 spikes on filter passed criteria in 1998, an negative bias for results of I-131 on filter analyses has been noted. This bias is currently under investigation.

There was one gross beta air particulate analysis which exceeded the criterion of being within 20% of the spiked value at minus 27%. The failure occurred because of a change in the method of preparing the QC sample. This was corrected by reverting back to the previous method and four subsequent QC samples in 1998 were within the criterion.

There was one strontium in milk QC sample which exceeded the criterion of being within 30% of the spiked value at plus 58%. The cause of the failure was that the source was expired. It was discarded and a new source was ordered.

RESULTS OF NUSCO OA PROGRAM FOR ENVIRONMENTAL TLDS

Eleven of the monthly TLD spike tests satisfied procedural criteria. One TLD spike test failed low because of a personnel error in spiking the test TLDs. A corrective action was identified for preventing a repeat of the spike test personnel error. The corrective action was implemented effective with the November test.

All twelve of the field comparisons satisfied procedural criteria.

TABLE B-1 (page 1 of 1)

NUMBER OF QUALITY CONTROL SAMPLES 1998

551- HA/4-	SAMPL	E TYPE	NUMBER OF OC SAMPLES	NUMBER OF ROUTINE ANALYSES(1)
TLDs -	Field	d Comparison	12 (2)	528
	Spik	e	12 (3)	528
Milk - Strontium			5 ⁽⁴⁾	32(4)
Milk - Gamma			60 (5)	800
Water - Gamma			60	576
Water - Tritium			3	32
Fish/Invertebrate	- Gamm	а	3	2004
Fruits & Vegetat	ion & Se	diment - Gamma	0	2079
Air Particulate		Gross Beta	7	832
		Gamma	25	740

FOOTNOTES

- (1) Includes both Millstone and Haddam Neck
- (2) Each TLD field comparison sample is comprised of a set of 8 TLDs.
- (3) Each TLD spike sample is comprised of a set of 4 TLDs.
- (4) Sr-89 and Sr-90.
- (5) Gamma in water QA spikes are treated as milk surrogates.

TABLE B-2 (page 1 of 1)

RESULTS OF QUALITY CONTROL SAMPLE ANALYSES

	SAM	Равтурв,	NUMBER PASS CRITERIA	NUMBER FAIL CRITERIA
TLDs -	Fiel	d Comparison	12	0
	Spil	ke	11	1
Milk - Strontium	1		4 (1)	1
Water - Gamma	(2)		60	0
Water - Tritium			3	0
Oysters - Gamm	a (3)		3	0
Air Particulate	:	Gross Beta Gamma ⁽⁴⁾	6 23	1 2
		TOTALS	TLDs: 23	TLDs: 1
FOOTNOTES			Samples: 99	Samples: 4

⁽¹⁾ Sr-89 or Sr-90.

APPENDIX C

SUMMARY OF INTERLABORATORY COMPARISONS

INTRODUCTION

This appendix covers the Intercomparison Program of the Duke Engineering and Services Environmental Laboratory (DESEL) as required by technical specifications for each Millstone unit. DESEL uses QA/QC samples provided by Analytics, Inc to monitor the quality of analytical processing associated with the Radiological Environmental Monitoring Program (REMP). The suite of Analytics QA/QC samples are designed to be comparable with the pre-1996 US EPA Interlaboratory Cross-Check Program. It was modified to more closely match the media mix presently being processed by DESEL. All intercomparison results received by DESEL on or before January 31, 1999 are included. Late results for 1998 will be reported in the annual report for 1999. DESEL also receives intercomparison samples from the US EPA because of their drinking water analysis program. Results from analyses of these samples are included where they are applicable to the REMP.

ACCEPTANCE CRITERIA

Intercomparison Program results are evaluated using two separate DESEL internal acceptance criteria. The first criterion concerns bias, which is defined as the deviation of any one result from the assumed known value. The second criterion concerns precision, which deals with the ability of the measurement to be faithfully replicated by comparison of an individual result with the mean of all results for a given sample set. A sample set is created by taking three aliquots from the same sample and submitting each as a blind replicate.

The bias criterion is defined as within 25% of the known value for Sr-89 or Sr-90 and within 15% of the known value for other radionuclides, or within two sigma of the known value. This bias criterion is applied to both the Analytics and the US EPA intercomparison sample results.

For Analytics intercomparison sample results, the precision criterion is defined as an overlap of the two sigma ranges for the three replicate analyses. US EPA samples have EPA supplied criteria of lower and upper control level within which the average of the three replicate samples must occur.

RESULTS (All results are extracted from References 1 and 2.)

For 1998, bias testing results for 72 individual environmental analyses of seven Analytics intercomparison samples are listed in the table on the following two pages. All of the analyses passed the bias criteria. Replicate sample results are not reported in References 1 and 2; however the references do report that, of the 72 environmental analyses for the seven samples there was only one result which failed the precision criterion. This was the low-level (LL) I-131 analysis for the third quarter water sample. DESEL issued CR 98-009 to investigate the failed precision test. The result of this investigation is not yet available.

Results of bias and precision testing on the US EPA intercomparison samples are contained in the table on Pages C-5 and C-6. Of 42 individual analyses of EPA samples, 40 passed the bias criteria, a 95% success rate. There were no failures of precision criteria for the EPA samples.

REFERENCES

- 1. DESEL Analytical Services Semi-Annual Quality Assurance Status Report, January-June 1998
- 2. DESEL Analytical Services Semi-Annual Quality Assurance Status Report, July-December 1998

TABLE C-1 (page 1 of 3)

ANALYTICS INTERCOMPARISON PROGRAM 1998

BIAS TESTING

OUARTER	MEDIA	NUCLIDE	KNOWN	ANALYSIS	RAПО
1st	Milk	Sr-89	53 pCi/L	55 pCi/L	1.04
		Sr-90	44	45	1.02
		Cr-51	201	204	1.01
		Mn-54	133	139	1.05
		Co-60	85	86	1.01
		Fe-59	95	100	1.05
		Zn-65	142	147	1.04
		I-131	82	84	1.02
		I-131 (LL)	82	83	1.01
		Cs-134	84	83	0.99
		Cs-137	161	171	1.06
		Ce-141	70	73	1.04
1st	Water	Beta	269 pCi/L	308 pCi/L	1.14
		Cr-51	167	171	1.02
		Mn-54	111	111	1.00
		Co-60	71	70	0.99
		Fe-59	79	82	1.04
		Zn-65	118	120	1.02
		1-131	90	90	1.00
		I-131 (LL)	90	92	1.02
		Cs-134	70	68	1.01
		Cs-137	134	136	1.02
		Ce-141	58	59	1.06
		Ra-226	53	56	1.02
		Ra-228	46	47	
2nd	Air Filter	Beta	212 pCi/filter	220 pCi/filter	1.04
		Sr-89	142	140	0.99
		Sr-90	51	49	0.96
		Cr-51	113	111	0.98
		Mn-54	91	96	1.05
		Co-60	124	116	0.94
		Fe-59	39	43	1.10
		Zn-65	105	114	1.09
		Cs-134	82	84	1.02
		Cs-137	61	62	1.02
		Ce-141	85	80	0.94
2nd	Water	H-3	6007 pCi/L	5697 pCi/L	0.95

TABLE C-1 (page 2 of 3)

ANALYTICS INTERCOMPARISON PROGRAM 1998

OUARTER	MEDIA	NUCLIDE	KNOWN	ANALYSIS	RATIO
2nd	Milk	Cr-51	132 pCi/L	128 pCi/L	0.97
		Mn-54	106	111	1.05
		Co-60	143	144	1.01
		Fe-59	45	46	1.02
		Zn-65	122	124	1.02
		I-131	67	71	1.06
		I-131 (LL)	67	67	1.00
		Cs-134	95	97	1.02
		Cs-137	70	74	1.06
		Ce-141	99	102	1.03
3rd	Milk	Sr-89	51 pCi/L	62 pCi/L	1.22
		Sr-90	81	72	0.89
		Cr-51	186	180	0.97
		Mn-54	74	77	1.04
		Co-60	148	146	0.99
		Fe-59	63	66	1.05
		Zn-65	195	201	1.03
		I-131	90	96	1.07
		I-131 (LL)	90	87	0.97
		Cs-134	82	80	0.98
		Cs-137	134	134	1.00
		Ce-141	146	145	0.99
3rd	Water	Sr-89	84 pCi/L	83 pCi/L	0.99
		Sr-90	51	47	0.92
		Beta	198	190	0.96
		Cr-51	165	172	1.04
		Mn-54	66	66	1.00
		Co-60	131	129	0.98
		Fe-59	55	59	1.07
		Zn-65	173	175	1.01
		I-131	79	82	1.04
		I-131 (LL)	79	78	0.99
		Cs-134	73	71	0.97
		Cs-137	119	117	0.98
		Ce-141	129	129	1.00

TABLE C-1 (page 3 of 3)

ANALYTICS INTERCOMPARISON PROGRAM 1998

DUARTER	MEDIA	NUCLIDE	KNOWN	ANALYSIS	RATIO
4th	Milk	Cr-51	195 pCi/L	205 pCi/L	1.05
		Mn-54	80	83	1.04
		Co-58	52	56	1.08
		Co-60	94	96	1.02
		Fe-59	57	62	1.09
		Zn-65	141	144	1.02
		I-131	39	42	1.08
		I-131 (LL)	39	38	0.97
		Cs-134	100	102	1.02
		Cs-137	103	109	1.06
		Ce-141	98	103	1.05

TABLE C-2 (page 1 of 2)
U.S. EPA INTERLABORATORY COMPARISON STUDIES I ROGRAM 1998

(all values in pCi/L)

PARKET STATEMENT	PROFESSIONAL REPORT OF THE PERSON NAMED IN	(all values	in pcvL)	6 PRESIDENCE TRANSPORTED TO THE PROPERTY OF TH	
Media	Nuclide	EPA Known	Lower Control	Upper Control	Duke (b)
Water	Sr-90	32.0	23.3	40.7	28.42 29.26 27.50
Water	1-131LL	104.9	86.7	123.1	109.7 106.8 110.2
Water	H-3	2155	1551	2759	2147 2095 2044
Water	Sr-89	9.3	5.3	13.3	7.8 8.81 10.3
Water	Co-60	50.0	41.3	58.7	47.7 48.4 48.5
Water	Cs-134	22.0	13.3	30.7	21.3 21.7 20.6
Water	Cs-137	10.0	1.3	18.7	8.6 9.6 9.1
Water	Co-60	12.0	3.3	20.7	11.5 12.6 11.4
Water	Zn-65	104.0	86.7	121.3	105.3 106.6 99.9
Water	Cs-134	31.0	22.3	39.7	28.9 27.8 26.9
Water	Cs-137	35.0	26.3	43.7	34.9 36.3 34.1
	Water	Water I-131LL Water H-3 Water Sr-89 Water Co-60 Water Cs-134 Water Cs-137 Water Co-60 Water Co-60 Water Cs-137	Media Nuclide EPA Known Water Sr-90 32.0 Water I-131LL 104.9 Water H-3 2155 Water Sr-89 9.3 Water Co-60 50.0 Water Cs-134 22.0 Water Cs-137 10.0 Water Co-60 12.0 Water Zn-65 104.0 Water Cs-134 31.0	Water Sr-90 32.0 23.3 Water I-131LL 104.9 86.7 Water H-3 2155 1551 Water Sr-89 9.3 5.3 Water Co-60 50.0 41.3 Water Cs-134 22.0 13.3 Water Cs-137 10.0 1.3 Water Co-60 12.0 3.3 Water Zn-65 104.0 86.7 Water Cs-134 31.0 22.3	Media Nuclide FPA Known Lower Control Upper Control Water Sr-90 32.0 23.3 40.7 Water 1-131LL 104.9 86.7 123.1 Water H-3 2155 1551 2759 Water Sr-89 9.3 5.3 13.3 Water Co-60 50.0 41.3 58.7 Water Cs-134 22.0 13.3 30.7 Water Cs-137 10.0 1.3 18.7 Water Co-60 12.0 3.3 20.7 Water Zn-65 104.0 86.7 121.3 Water Cs-134 31.0 22.3 39.7

TABLE C-2 (page 2 of 2)
U.S. EPA INTERLABORATORY COMPARISON STUDIES PROGRAM 1998

(all values in pCi/L)

MARK VINE MANAGEMENT AND ADDRESS OF	POSTE A SUSTAINERS ASSESSMENT	CONTRACTOR THE CONTRACTOR OF T	COLL LOS COLOS	and the property of the second	Mort and County Transport State of the County	
Date	Media	Nuclide	EPA Known	Lower Control	Upper Control	Duke*
7/17/98	Water	Sr-89	21.0	12.3	29.7	20.1 20.3 22.0
7/17/98	Water	Sr-90	7.00	0	15.7	9.80 7.40 7.11
8/7/98	Water	H-3	17996	14873	21119	17656 17550 17446
9/11/98	Water	I-131	6.10	2.60	9.60	6.04 5.95 4.85

^{*} Same sample analyzed three times.