

August 29, 1986

Re: Indian Point Unit Nos. 1 and 2  
Docket Nos. 50-3 and 50-247

SEMI-ANNUAL

EFFLUENT AND WASTE DISPOSAL REPORT

January 1, 1986 - June 30, 1986

FACILITY: Indian Point Station (Units 1 and 2)

LICENSEE: Consolidated Edison Company of New York, Inc.

This information is provided pursuant to 10 CFR 50.36a(a)(2), and employs certain guidance as set forth in Regulatory Guide 1.21, Revision 1. The numbered sections of this part of the report reference corresponding sections of the subject Regulatory Guide, pages 1.21-10 through 1.21-12. This Semi-Annual Effluent and Waste Disposal Report for Indian Point Units 1 and 2 covers discharges for the first and second quarters of 1986. The New York Power Authority, licensee of Indian Point Unit 3, has chosen to issue a separate semi-annual report.

A. Supplemental Information

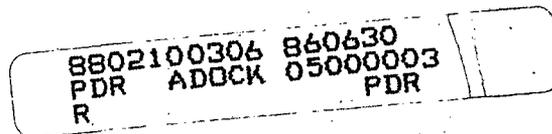
1. Regulatory Limits

Indian Point Units 1 and 2 are presently subject to radioactive waste release specifications that are set forth in Sections 3.9 and 4.10 of Appendix A to Facility Operating Licenses DPR-5 and DPR-26 entitled "Technical Specifications and Bases".

2. Maximum Permissible Concentrations

Liquid Effluents

All liquid discharges from Indian Point are made through a common discharge canal with a minimum of 100,000 gpm dilution water. The isotopic content, excluding tritium and dissolved noble gas, of continuous and batch mode discharges for each calendar quarter has been added, and a weighted average fraction of MPC has been calculated for this isotopic mixture. The percent of applicable limit reported in Table 2A of this document is the percent of MPC concentration of the time averaged diluted concentration for each calendar quarter.



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The tritium limit has been established in the same manner as the other isotopes in liquid effluents. A derived MPC of  $2 \times 10^{-4}$  uCi/ml for dissolved noble gases has been conservatively adopted for the swimming pathway.

3. Average Energy

The average energy ( $\bar{E}$ ) of the radionuclide mixture in releases of fission and activation gases for the first quarter was .039 Mev/Dis. for  $\bar{E}_\gamma$  and .153 Mev/Dis. for  $\bar{E}_\beta$ . The corresponding values for the second quarter were .085 Mev/Dis. and .166 Mev/Dis., respectively.

4. Measurements and Approximations of Total Radioactivity

a. Fission and Activation Gases

Analysis of effluent gases has been performed in compliance with the requirements of Table 4.10-3 of the Technical Specifications. In the case of isolated tanks (batch releases) the total activity discharged is based on an isotopic analysis of each batch and the volume of gas in that batch corrected to standard temperature and pressure.

Vapor containment ventilation discharges have been generally treated as batch releases. At least one complete isotopic concentration analysis of containment air is performed per week and this is applied to gross analysis of the ventilation air performed prior to each discharge. This information is combined with the volume of air in each discharge to calculate the radionuclide composition of these discharges.

The continuous discharges are based on the isotopic content determined from weekly samples of ventilation air. This information is combined with total air volume discharged by this route. The accumulation of batch and containment ventilation releases is then used to determine total discharges.

b&c. Iodines and Particulates

Iodine-131 and particulate releases are quantified by collecting a continuous sample of ventilation air on a potassium-iodide impregnated activated charcoal cartridge and a glass-fiber filter paper. These samples are obtained as required by Table 4.10-3 of the Technical Specifications, and the concentration of isotopes found by analysis of these samples is combined with the volume of air discharged during the sampling period to calculate the amount of activity discharged.

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For other iodine isotopes the ratio of each isotope to Iodine-131 is determined by a monthly 24 hour composite sample. This ensures the proper identification of the short-lived I-133 & I-135 isotopes.

d. Liquid Effluents

A sample of each batch discharge is taken and an isotopic analysis is performed in compliance with requirements specified in Table 4.10-1 of the Technical Specifications. This isotopic concentration data is combined with information of volume discharged to determine the amount of each isotope discharged in the period.

Samples of continuous discharges have been taken and analyzed in compliance with Table 4.10-1 of the Technical Specifications. This concentration data is combined with the volume discharged to calculate the total activity discharged.

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5. Batch Releases

1986

a. <u>Liquid</u>	<u>1st Qtr.</u>	<u>2nd Qtr.</u>
Number of Batch Releases	59	48
Total Time Period Batch Release (Minutes)	1.85E+4	1.36E+4
Maximum Time Period Batch Release (Minutes)	9.60E+2	4.60E+2
Average Time Period Batch Release (Minutes)	3.13E+2	2.84E+2
Minimum Time Period Batch Release (Minutes)	5.00	6.00E+1
Average Stream Flow (cubic feet/second)	*	*
b. <u>Gaseous</u>		
Number of Batch Release	48	9
Total Time Period Batch Release (Minutes)	6.20E+3	1.45E+4
Maximum Time Period Batch Release (Minutes)	1.28E+3	9.37E+3
Average Time Period Batch Release (Minutes)	129	2.66E+3
Minimum Time Period Batch Release (Minutes)	10	1.90E+1

6. ABNORMAL RELEASES

- a. Liquid - None
- b. Gaseous - One

\* Stream flow data from U.S. Department of Interior Geological Survey was not available prior to the issuance of this report. These values will be reported in an addendum when they become available.

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SEMI-ANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

B - GASEOUS EFFLUENTS

FIRST HALF - 1986

CONSOLIDATED EDISON CO. OF N.Y  
INDIAN POINT UNITS 1 & 2  
QUARTER 1 : START DATE 86010101  
QUARTER 2 : START DATE 86040101

DATE OF REPORT: AUG. 22, 1986  
PREPARED BY: CON EDISON  
END DATE 86033124  
END DATE 86063024

EFFLUENT AND WASTE DISPOSAL REPORT  
GASEOUS EFFLUENTS -- SUMMATION OF ALL RELEASES

-----  
: UNITS : QUARTER : QUARTER : EST. TOTAL :  
: : 1 : 2 : ERROR, % :  
-----

A. FISSION AND ACTIVATION GASES

-----  
: 1. TOTAL RELEASE : CI : 1.69E 03 : 4.67E 01 : 5.00E 01 :  
-----  
: 2. AVERAGE RELEASE :UCI/SEC: 2.18E 02 : 5.93E 00 :  
: RATE FOR PERIOD : : : :  
-----  
: 3. PERCENT OF TECHNICAL: % : NA : NA :  
: SPECIFICATION LIMIT : : : :  
-----

B. IODINES

-----  
: 1. TOTAL IODINE-131 : CI : 4.22E-04 : 2.25E-05 : 5.00E 01 :  
-----  
: 2. AVERAGE RELEASE :UCI/SEC: 5.43E-05 : 2.86E-06 :  
: RATE FOR PERIOD : : : :  
-----  
: PERCENT OF TECHNICAL: % : NA : NA :  
: SPECIFICATION LIMIT : : : :  
-----

C. PARTICULATES

-----  
: 1. PARTICULATES WITH : CI : 2.35E 00 : 2.00E 00 : 5.00E 01 :  
: HALF-LIVES >8 DAYS : : : :  
-----  
: 2. AVERAGE RELEASE :UCI/SEC: 3.03E-01 : 2.54E-01 :  
: RATE FOR PERIOD : : : :  
-----  
: 3. PERCENT OF TECHNICAL: % : NA : NA :  
: SPECIFICATION LIMIT : : : :  
-----  
: 4. GROSS ALPHA : CI : 0.00E 00 : 0.00E 00 :  
: RADIOACTIVITY : : : :  
-----

D. TRITIUM

-----  
: 1. TOTAL RELEASE : CI : 1.32E 00 : 2.77E-01 : 5.00E 01 :  
-----  
: AVERAGE RELEASE :UCI/SEC: 1.70E-01 : 3.52E-02 :  
: RATE FOR PERIOD : : : :  
-----  
: 3. PERCENT OF TECHNICAL: % : NA : NA :  
: SPECIFICATION LIMIT : : : :  
-----

EFFLUENT AND WASTE DISPOSAL REPORT

CONTINUOUS EFFLUENTS FOR ALL RELEASE POINTS

QUARTER 1 : START DATE 86010101    END DATE 86033124  
 QUARTER 2 : START DATE 86040101    END DATE 86063024  
 DATE OF REPORT: AUG. 22, 1986  
 PREPARED BY: CON EDISON

CONTINUOUS MODE                      BATCH MODE

-----  
 : NUCLIDES    : UNITS    : QUARTER    : QUARTER    : QUARTER    : QUARTER    :  
 : RELEASED    :            : 1            : 2            : 1            : 2            :  
 -----

1. FISSION AND ACTIVATION GASES

: H3	: CI	: 1.32E 00	: 2.39E-01	: 0.00E 00	: 3.83E-02	:
: AR41	: CI	: 0.00E 00	: 0.00E 00	: 2.04E-01	: 0.00E 00	:
: KR85M	: CI	: 0.00E 00	: 0.00E 00	: 1.87E-01	: 0.00E 00	:
: KR85	: CI	: 1.91E 00	: 0.00E 00	: 8.58E-01	: 5.02E-01	:
: KR87	: CI	: 8.27E-02	: 0.00E 00	: 8.44E-02	: 5.39E-01	:
: KR88	: CI	: 3.16E-01	: 1.48E-01	: 3.42E-01	: 1.02E 00	:
: XE131M	: CI	: 0.00E 00	: 0.00E 00	: 1.67E 00	: 1.35E 00	:
: XE133M	: CI	: 2.66E 00	: 0.00E 00	: 1.88E 00	: 1.84E-01	:
: XE133	: CI	: 1.47E 03	: 2.74E 01	: 1.50E 02	: 7.07E 00	:
: XE135M	: CI	: 0.00E 00	: 1.61E-01	: 8.59E-02	: 3.55E-01	:
: XE135	: CI	: 5.64E 01	: 4.55E 00	: 6.01E 00	: 2.78E 00	:
: TOTAL FOR	:	:	:	:	:	:
: PERIOD	: CI	: 1.53E 03	: 3.25E 01	: 1.62E 02	: 1.45E 01	:
: (ABOVE)	:	:	:	:	:	:

EFFLUENT AND WASTE DISPOSAL REPORT

SEMI-ANNUAL EFFLUENTS FOR ALL RELEASE POINTS

-----  
 QUARTER 1 : START DATE 86010101    END DATE 86033124  
 QUARTER 2 : START DATE 86040101    END DATE 86063024  
 DATE OF REPORT: AUG. 22, 1986  
 PREPARED BY: CON EDISON

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES	UNITS	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
RELEASED					

2. IODINES

I131	CI	4.22E-04	2.25E-05	0.00E 00	0.00E 00
I133	CI	5.99E-04	1.62E-04	0.00E 00	0.00E 00
TOTAL FOR PERIOD (ABOVE)	CI	1.02E-03	1.85E-04	0.00E 00	0.00E 00

3. PARTICULATES

C14	CI	2.00E 00	2.00E 00	0.00E 00	0.00E 00
CO58	CI	8.99E-07	0.00E 00	0.00E 00	0.00E 00
CO60	CI	3.41E-05	6.85E-07	0.00E 00	0.00E 00
CS137	CI	3.92E-05	2.03E-06	0.00E 00	0.00E 00
FE55	CI	2.11E-05	3.87E-06	0.00E 00	0.00E 00
NI63	CI	3.82E-06	1.00E-04	0.00E 00	1.36E-10
RB88	CI	0.00E 00	0.00E 00	3.55E-01	0.00E 00
H3	CI	2.14E-05	0.00E 00	0.00E 00	0.00E 00
NB95	CI	0.00E 00	1.76E-06	0.00E 00	0.00E 00
TOTAL FOR PERIOD (ABOVE)	CI	2.00E 00	2.00E 00	3.55E-01	1.36E-10

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C - LIQUID EFFLUENTS

FIRST HALF - 1986

CONSOLIDATED EDISON CO. OF N.Y  
INDIAN POINT UNITS 1 & 2  
QUARTER 1 : START DATE 86010101  
QUARTER 2 : START DATE 86040101

DATE OF REPORT: AUG. 22, 1986  
PREPARED BY: CON EDISON  
END DATE 86033124  
END DATE 86063024

EFFLUENT AND WASTE DISPOSAL REPORT  
LIQUID EFFLUENTS -- SUMMATION OF ALL RELEASES

-----  
: UNITS : QUARTER : QUARTER : EST. TOTAL :  
: : 1 : 2 : ERROR, % :  
-----

A. FISSION AND ACTIVATION PRODUCTS

-----  
: 1. TOTAL RELEASE (EXCL.: CI : 8.02E-01 : 1.53E 01 : 2.50E 01 :  
: TRIT., GASES, ALPHA) : : : : :  
-----  
: 2. AVERAGE DILUTED :UCI/ML : 3.82E-08 : 4.90E-09 :  
: CONC. DURING PERIOD : : : : :  
-----  
: 3. PERCENT OF : % : 2.60E-01 : 8.56E-02 :  
: MPC : : : : :  
-----

B. TRITIUM

-----  
: 1. TOTAL RELEASE : CI : 5.02E 01 : 3.84E 01 : 2.50E 01 :  
-----  
: 2. AVERAGE DILUTED :UCI/ML : 2.39E-06 : 1.23E-08 :  
: CONC. DURING PERIOD : : : : :  
-----  
: 3. PERCENT OF : % : 7.98E-02 : 5.19E-02 :  
: MPC : : : : :  
-----

C. DISSOLVED AND ENTRAINED GASES

-----  
: 1. TOTAL RELEASE : CI : 4.08E-01 : 0.00E 00 : 2.50E 01 :  
-----  
: 2. AVERAGE DILUTED :UCI/ML : 1.95E-08 : 0.00E 00 :  
: CONC. DURING PERIOD : : : : :  
-----  
: 3. PERCENT OF : % : 9.73E-03 : 0.00E 00 :  
: MPC : : : : :  
-----

D. GROSS ALPHA RADIOACTIVITY

-----  
: 1. TOTAL RELEASE : CI : 0.00E 00 : 0.00E 00 : 2.50E 01 :  
-----

-----  
E. VOLUME WASTE RELEASED : LITERS : 3.75E 06 : 9.48E 10 : 1.00E 01 :  
: (PRIOR TO DILUTION) : : : : :  
-----

-----  
F. VOLUME DILUTION WATER : LITERS : 2.10E 10 : 3.11E 12 : 1.00E 01 :  
: USED DURING PERIOD : : : : :  
-----

EFFLUENT AND WASTE DISPOSAL REPORT

LIQUID EFFLUENTS FOR ALL RELEASE POINTS

QUARTER 1 : START DATE 86010101    END DATE 86033124  
 QUARTER 2 : START DATE 86040101    END DATE 86063024  
 DATE OF REPORT: AUG. 22, 1986  
 PREPARED BY: CON EDISON

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES	UNITS	QUARTER 1	QUARTER 2	QUARTER 1	QUARTER 2
RELEASED					
H3	CI	0.00E 00	3.85E-01	5.02E 01	3.81E 01
CR51	CI	0.00E 00	0.00E 00	1.78E-01	1.77E-01
MN54	CI	0.00E 00	0.00E 00	7.73E-03	5.69E-03
FE55	CI	0.00E 00	1.09E-02	7.00E-03	1.49E-01
FE59	CI	0.00E 00	0.00E 00	1.46E-02	2.65E-03
PO58	CI	0.00E 00	2.59E-05	3.30E-01	2.71E-01
CO60	CI	0.00E 00	9.74E-03	1.19E-01	2.77E-01
NI63	CI	0.00E 00	3.60E-03	8.12E-03	7.42E-03
ZN65	CI	0.00E 00	0.00E 00	0.00E 00	2.20E-04
SR89	CI	0.00E 00	0.00E 00	9.64E-05	0.00E 00
SR90	CI	0.00E 00	0.00E 00	4.06E-05	0.00E 00
ZR95	CI	0.00E 00	0.00E 00	1.95E-03	1.35E-02
ZR97	CI	0.00E 00	0.00E 00	0.00E 00	8.80E-05
NB95	CI	0.00E 00	0.00E 00	7.93E-03	3.59E-02
RU103	CI	0.00E 00	0.00E 00	8.40E-05	4.52E-04
RU106	CI	0.00E 00	0.00E 00	0.00E 00	1.68E-03
AG110M	CI	0.00E 00	0.00E 00	7.83E-04	2.90E-02
E132	CI	0.00E 00	0.00E 00	1.09E-03	0.00E 00

EFFLUENT AND WASTE DISPOSAL REPORT

LIQUID EFFLUENTS FOR ALL RELEASE POINTS

-----  
 QUARTER 1 : START DATE 86010101    END DATE 86033124  
 QUARTER 2 : START DATE 86040101    END DATE 86063024  
 DATE OF REPORT:    AUG. 22, 1986  
 PREPARED BY: CON EDISON

		CONTINUOUS MODE		BATCH MODE	
NUCLIDES	UNITS	QUARTER	QUARTER	QUARTER	QUARTER
RELEASED		1	2	1	2

LIQUID EFFLUENTS (CONTD)

I131	CI	0.00E 00	0.00E 00	1.24E-02	0.00E 00
I132	CI	0.00E 00	0.00E 00	6.07E-04	0.00E 00
CS134	CI	0.00E 00	2.48E-04	4.23E-03	1.33E-04
CS137	CI	0.00E 00	1.41E 01	4.01E-02	1.35E-02
BA140	CI	0.00E 00	0.00E 00	4.44E-03	0.00E 00
LA140	CI	0.00E 00	0.00E 00	3.60E-02	0.00E 00
CE141	CI	0.00E 00	0.00E 00	2.85E-05	0.00E 00
CE144	CI	0.00E 00	0.00E 00	0.00E 00	2.83E-04
C057	CI	0.00E 00	0.00E 00	1.41E-05	1.93E-04
SB125	CI	0.00E 00	0.00E 00	1.99E-02	1.07E-01
C060	CI	0.00E 00	0.00E 00	0.00E 00	1.81E-02
SB124	CI	0.00E 00	0.00E 00	7.99E-03	1.97E-02
TOTAL FOR					
PERIOD	CI	0.00E 00	1.45E 01	5.10E 01	3.92E 01
(ABOVE)					

EFFLUENT AND WASTE DISPOSAL REPORT

LIQUID EFFLUENTS FOR ALL RELEASE POINTS

-----  
QUARTER 1 : START DATE 86010101    END DATE 86033124  
QUARTER 2 : START DATE 86040101    END DATE 86063024  
DATE OF REPORT:    AUG. 22, 1986  
PREPARED BY: CON EDISON

CONTINUOUS MODE				BATCH MODE			
NUCLIDES	UNITS	QUARTER	QUARTER	QUARTER	QUARTER	QUARTER	QUARTER
RELEASED		1	2	1	2	1	2
XE133	CI	0.00E 00	0.00E 00	4.07E-01	0.00E 00		
XE131M	CI	0.00E 00	0.00E 00	1.52E-03	0.00E 00		
XE133M	CI	0.00E 00	0.00E 00	3.06E-04	0.00E 00		

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D - SOLID WASTE

FIRST HALF - 1986

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Solid Radwaste Disposal Report

Solid Waste Shipped Offsite for Burial or Disposal (No irradiated fuel)

1. <u>Type of Waste</u>	<u>Units</u>	<u>6 Month Period</u>			<u>Estimated Total Error, %</u>
		<u>Class A</u>	<u>Class B</u>	<u>Class C</u>	
a. Spent Resins, sludges, etc.	m <sup>3</sup> Ci	25.4 42.443	10.506 198.172	- -	- 1.00E+2
b. DAW	m <sup>3</sup> Ci	196.645 2.686	- -	- -	- 1.00E+2
c. Irradiated components control rods, etc.	m <sup>3</sup> Ci	- -	- -	- -	- -

2. Estimate of major nuclide composition (by type of waste)

a. Co-58	28.43 %
Co-60	25.86 %
Cs-137	6.12 %
Fe-55	12.88 %
Cr-51	12.89 %
NI-63	7.79 %
Other (H3, C14, Cs 134 included)	6.03 %
b. Co-60	49.1 %
Ni-63	14.6 %
Cs-137	7.4 %
Fe-55	24.3 %
Other (Mn 54, Cs134, C14, H3 included)	4.6 %

3. Solid Waste Disposition

<u>Number of Shipments</u>	<u>Mode of Transportation</u>	<u>Destination</u>
18	Truck	Barnwell, S.C.

4. Solid Waste Containers

- a. 7 Fiberglass reinforced pressure vessels
- 0 Pressure vessels
- 7 High integrity containers
- 0 Carbon steel containers - cement used for solidification
  
- b. 651 Drums
- 19 Crates

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Solid Radwaste Disposal Report (Continued)

5. Waste Class

No irradiated fuel shipments

Container	Class A	Class B	Class C
Pressure Vessel	4	3	-
High Integrity Container	5	2	-
Steel Liners	-	-	-
Steel Drums	651	-	-
Steel Crates	19	-	-

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SEMI-ANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

E - RADIOLOGICAL IMPACT ON MAN

FIRST HALF - 1986

August 29, 1986

Re: Indian Point Unit Nos. 1 and 2  
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RADIOLOGICAL IMPACT EVALUATION

Doses from noble gas immersion, inhalation, ground deposition, and vegetation ingestion were evaluated for the nearest residence likely to be occupied in the critical sector for each pathway and were combined to provide a conservative determination of the maximum individual offsite radiation dose from these pathways. Doses were also evaluated for an individual ingesting milk and meat from a cow located about 8.9 miles to ESE. In all cases, these evaluations were performed using the models presented in Regulatory Guide 1.109.

All releases were evaluated using actual meteorological conditions existing during the release period.

During this report period an unplanned release, lasting approximately thirty minutes, occurred on June 25 as a result of a leak from the charging system. This result has been included in our calculations as a batch release and a conservative estimate of the isotopic information has been included in the appropriate tables.

Integrated doses for the population within 50 miles of Indian Point from gaseous effluents were computed based on the most current population data.

Dose calculations for liquid pathways to individuals and populations are computed for a year. The LADTAP II computer program that is utilized for these calculations incorporated the calculational model and parameters that are presented in Regulatory Guide 1.109.

The fish, invertebrate, algae, drinking, shoreline, swimming, and boating pathways are calculated for the adult, teenager, child, and infant. These calculations are performed for reasons such as estimating the population water consumption dose, the population recreation dose, and cost-benefit analysis.

NUREG-0017, "Calculation of Release of Radioactive Materials in Gaseous and Liquid effluents from Pressurized Water Reactors," assumes an annual release of 8.0 Ci/yr of Carbon-14. Therefore, to be consistent with NUREG-0017, a release of 4.0 Curies of Carbon-14 was assumed for the six month period in addition to the radioactive materials measured in Indian Point gaseous effluents.

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RADIOLOGICAL IMPACT ON MAN

(Reference Regulatory Guide 1.21, Page 12)

A. Maximum Individual Doses

(1)	<u>Pathways</u> (Gaseous)	<u>Total Body</u> mRem	<u>Skin</u> mRem	<u>Thyroid</u> mRem	<u>Bone</u> mRem
a)	Noble Gas Immersion	3.43E-02	9.49E-02	N/A	N/A
b)	Inhalation***	2.77E-02	N/A	7.44E-03	5.11E-03
c)	Ground Deposition	5.25E-04	7.12E-04	N/A	N/A
d)	Milk Ingestion*	3.40E-02	N/A	3.61E-02	1.59E-01
e)	Meat Ingestion***	2.99E-03	N/A	2.99E-03	1.50E-02
f)	Vegetable Ingestion***	1.98E-01	N/A	1.98E-01	9.89E-01

(2) Pathways (Liquid)

a) All See Attached "LADTAP" printout  
Attachment I

- \* Infants are critical age group
- \*\* Adults are critical age group
- \*\*\* Children are critical age group

N/A = Not Applicable

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B. Population

(1) <u>Pathways</u> (Gaseous)	<u>Total Body</u> (man-rem)	<u>Thyroid</u> (man-thyroid rem)
(a) Noble Gas Immersion	1.9E+00	N/A
(b) Inhalation	2.4E-01	2.4E-01
(c) Ground Deposition	1.1E-02	N/A
(d) Totals	2.15E+00	2.4E-01

(2) Pathways (Liquid)

(a) All See attached "LADTAP" printout  
Attachment I

C. Average Doses to Individuals

(1) Pathways

(a) Liquid-Total Body	1.39E-04 mRem
(b) Gaseous-Total Body	1.06E-04 mRem

N/A = Not Applicable

C A T E G O R Y I D O S E S

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		1.82E-01	2.49E-01	1.63E-01	2.74E-05	8.46E-02	2.81E-02	7.13E-03
INVERTEBRATE		2.21E-03	3.11E-03	1.99E-03	5.31E-06	1.07E-03	3.49E-04	7.35E-04
ALGAE		2.17E-08	2.97E-08	1.95E-08	3.43E-11	1.01E-08	3.36E-09	1.42E-09
DRINKING		4.35E-13	5.98E-13	3.93E-13	9.76E-15	2.05E-13	7.06E-14	2.66E-14
SHORELINE	8.94E-04	7.66E-04	7.66E-04	7.66E-04	7.66E-04	7.66E-04	7.66E-04	7.66E-04
SWIMMING	0.0	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06
BOATING	0.0	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06
TOTAL	8.94E-04	1.85E-01	2.53E-01	1.66E-01	8.05E-04	8.64E-02	2.92E-02	8.63E-03

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	21.0	5.0	25.00	
INVERTEBRATE	5.0	5.0	25.00	
ALGAE	0.0	5.0	25.00	
DRINKING	0.0	500.0	112.00	
SHORELINE	50.0	5.0	1.00	
SWIMMING	50.0	5.0	1.00	
BOATING	100.0	5.0	1.00	

C A T E G O R Y I I D O S E S

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		1.95E-01	2.60E-01	9.04E-02	2.55E-05	8.83E-02	3.43E-02	5.32E-03
INVERTEBRATE		2.36E-03	3.23E-03	1.12E-03	5.08E-06	1.11E-03	4.24E-04	5.08E-04
ALGAE		3.05E-08	4.06E-08	1.42E-08	4.20E-11	1.38E-08	5.38E-09	1.41E-09
DRINKING		6.11E-13	8.16E-13	2.88E-13	1.12E-14	2.80E-13	1.11E-13	2.57E-14
SHORELINE	1.20E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03	1.03E-03
SWIMMING	0.0	6.68E-06	6.68E-06	6.68E-06	6.68E-06	6.68E-06	6.68E-06	6.68E-06
BOATING	0.0	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06
TOTAL	1.20E-03	1.98E-01	2.64E-01	9.26E-02	1.07E-03	9.05E-02	3.58E-02	6.86E-03

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	16.0	5.0	25.00	
INVERTEBRATE	3.8	5.0	25.00	
ALGAE	0.0	5.0	25.00	
DRINKING	0.0	500.0	112.00	
SHORELINE	67.0	5.0	1.00	
SWIMMING	100.0	5.0	1.00	
BOATING	100.0	5.0	1.00	

C A T E G O R Y I I I D O S E S

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.46E-01	2.35E-01	3.47E-02	2.62E-05	7.66E-02	2.76E-02	2.05E-03
INVERTEBRATE		3.08E-03	3.02E-03	4.78E-04	5.94E-06	9.92E-04	3.54E-04	1.77E-04
ALGAE		8.91E-05	8.53E-05	1.27E-05	1.00E-07	2.78E-05	1.00E-05	1.29E-06
DRINKING		1.78E-09	1.71E-09	2.62E-10	2.51E-11	5.62E-10	2.07E-10	2.61E-11
SHORELINE	2.50E-04	2.14E-04	2.14E-04	2.14E-04	2.14E-04	2.14E-04	2.14E-04	2.14E-04
SWIMMING	0.0	1.67E-06	1.67E-06	1.67E-06	1.67E-06	1.67E-06	1.67E-06	1.67E-06
BOATING	0.0	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06	3.34E-06
TOTAL	2.50E-04	2.49E-01	2.38E-01	3.54E-02	2.52E-04	7.79E-02	2.82E-02	2.45E-03

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	6.9	5.0	25.00	
INVERTEBRATE	1.7	5.0	25.00	
ALGAE	0.0	5.0	25.00	
DRINKING	0.0	500.0	112.00	
SHORELINE	14.0	5.0	1.00	
SWIMMING	25.0	5.0	1.00	
BOATING	100.0	5.0	1.00	

C A T E G O R Y I V D O S E S

PATHWAY	DOSE (MREM PER YEAR INTAKE)							
	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.84E-02	3.33E-02	2.36E-03	4.59E-06	8.93E-03	3.61E-03	1.42E-04
INVERTEBRATE		2.89E-04	3.46E-04	2.82E-05	8.23E-07	9.35E-05	3.74E-05	9.13E-06
ALGAE		1.42E-07	1.67E-07	1.20E-08	2.43E-10	4.47E-08	1.81E-08	1.25E-09
DRINKING		2.85E-12	3.34E-12	2.53E-13	5.46E-14	9.03E-13	3.72E-13	2.84E-14
SHORELINE	5.36E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05	4.60E-05
SWIMMING	0.0	6.68E-13	6.68E-13	6.68E-13	6.68E-13	6.68E-13	6.68E-13	6.68E-13
BOATING	0.0	1.67E-08	1.67E-08	1.67E-08	1.67E-08	1.67E-08	1.67E-08	1.67E-08
TOTAL	5.36E-05	2.87E-02	3.37E-02	2.43E-03	5.14E-05	9.07E-03	3.70E-03	1.97E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	0.5	5.0	25.00	
INVERTEBRATE	0.1	5.0	25.00	
ALGAE	0.0	5.0	25.00	
DRINKING	0.0	500.0	112.00	
SHORELINE	3.0	5.0	1.00	
SWIMMING	0.0	5.0	1.00	
BOATING	0.5	5.0	1.00	

\* \* \* SELECTED LOCATION \* \*

LOCATION IS DOWNSTREAM

C A T E G O R Y I D O S E S

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		1.30E-01	1.78E-01	1.17E-01	1.92E-05	6.04E-02	2.01E-02	5.08E-03
INVERTEBRATE		1.58E-03	2.22E-03	1.42E-03	3.65E-06	7.60E-04	2.49E-04	5.17E-04
ALGAE		1.55E-08	2.12E-08	1.39E-08	2.40E-11	7.20E-09	2.40E-09	9.82E-10
DRINKING		3.11E-11	4.27E-11	2.81E-11	8.73E-13	1.46E-11	5.04E-12	1.97E-12
SHORELINE	6.39E-04	5.47E-04	5.47E-04	5.47E-04	5.47E-04	5.47E-04	5.47E-04	5.47E-04
SWIMMING	0.0	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06
BOATING	0.0	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06
TOTAL	6.39E-04	1.32E-01	1.81E-01	1.19E-01	5.75E-04	6.17E-02	2.09E-02	6.15E-03

PATHWAY	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	21.0	7.0	31.00	
INVERTEBRATE	5.0	7.0	31.00	
ALGAE	0.0	7.0	31.00	
DRINKING	0.0	7.0	19.00	
SHORELINE	50.0	7.0	7.00	
SWIMMING	50.0	7.0	7.00	
BOATING	100.0	7.0	7.00	

LOCATION IS DOWNSTREAM

C A T E G O R Y I I D O S E S

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		1.39E-01	1.85E-01	6.46E-02	1.78E-05	6.31E-02	2.45E-02	3.79E-03
INVERTEBRATE		1.69E-03	2.30E-03	7.98E-04	3.49E-06	7.90E-04	3.03E-04	3.57E-04
ALGAE		2.18E-08	2.90E-08	1.01E-08	2.93E-11	9.87E-09	3.84E-09	9.75E-10
DRINKING		4.37E-11	5.83E-11	2.06E-11	1.02E-12	2.00E-11	7.93E-12	1.91E-12
SHORELINE	8.56E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04	7.33E-04
SWIMMING	0.0	4.77E-06	4.77E-06	4.77E-06	4.77E-06	4.77E-06	4.77E-06	4.77E-06
BOATING	0.0	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06
TOTAL	8.56E-04	1.42E-01	1.88E-01	6.61E-02	7.62E-04	6.46E-02	2.56E-02	4.89E-03

PATHWAY	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	16.0	7.0	31.00	
INVERTEBRATE	3.8	7.0	31.00	
ALGAE	0.0	7.0	31.00	
DRINKING	0.0	7.0	19.00	
SHORELINE	67.0	7.0	7.00	
SWIMMING	100.0	7.0	7.00	
BOATING	100.0	7.0	7.00	

LOCATION IS DOWNSTREAM

C A T E G O R Y I I I D O S E S

DOSE (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		1.75E-01	1.68E-01	2.48E-02	1.83E-05	5.47E-02	1.97E-02	1.47E-03
INVERTEBRATE		2.20E-03	2.16E-03	3.41E-04	4.08E-06	7.07E-04	2.53E-04	1.24E-04

ALGAE	6.37E-05	6.10E-05	9.07E-06	0.1E-08	1.98E-05	7.15E-06	8.93E-07
DRINKING	1.27E-07	1.22E-07	1.88E-08	2.31E-09	4.02E-08	1.48E-08	1.93E-09
SHORELINE	1.79E-04	1.53E-04	1.53E-04	1.53E-04	1.53E-04	1.53E-04	1.53E-04
SWIMMING	0.0	1.19E-06	1.19E-06	1.19E-06	1.19E-06	1.19E-06	1.19E-06
BOATING	0.0	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06	2.38E-06
TOTAL	1.79E-04	1.78E-01	1.70E-01	2.53E-02	1.79E-04	5.56E-02	2.01E-02

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	6.9	7.0	31.00	
INVERTEBRATE	1.7	7.0	31.00	
ALGAE	0.0	7.0	31.00	
DRINKING	0.0	7.0	19.00	
SHORELINE	14.0	7.0	7.00	
SWIMMING	25.0	7.0	7.00	
BOATING	100.0	7.0	7.00	

LOCATION IS DOWNSTREAM

C A T E G O R Y I V D O S E S

DOSE\_ (MREM PER YEAR INTAKE)

PATHWAY	SKIN	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH		2.03E-02	2.38E-02	1.69E-03	3.21E-06	6.38E-03	2.58E-03	1.01E-04
INVERTEBRATE		2.06E-04	2.47E-04	2.01E-05	5.64E-07	6.67E-05	2.67E-05	6.41E-06
ALGAE		1.02E-07	1.19E-07	8.55E-09	1.70E-10	3.19E-08	1.29E-08	8.62E-10
DRINKING		2.03E-10	2.39E-10	1.81E-11	5.15E-12	6.45E-11	2.66E-11	2.09E-12
SHORELINE	3.83E-05	3.28E-05	3.28E-05	3.28E-05	3.28E-05	3.28E-05	3.28E-05	3.28E-05
SWIMMING	0.0	4.77E-13	4.77E-13	4.77E-13	4.77E-13	4.77E-13	4.77E-13	4.77E-13
BOATING	0.0	1.19E-08	1.19E-08	1.19E-08	1.19E-08	1.19E-08	1.19E-08	1.19E-08
TOTAL	3.83E-05	2.05E-02	2.40E-02	1.74E-03	3.66E-05	6.48E-03	2.64E-03	1.41E-04

	USAGE (KG/YR,HR/YR)	DILUTION	TIME(HR)	SHOREWIDTH FACTOR=0.2
FISH	0.5	7.0	31.00	
INVERTEBRATE	0.1	7.0	31.00	
ALGAE	0.0	7.0	31.00	
DRINKING	0.0	7.0	19.00	
SHORELINE	3.0	7.0	7.00	
SWIMMING	0.0	7.0	7.00	
BOATING	0.5	7.0	7.00	

\* \* \* FISH CONSUMPTION POPULATION DOSES  
MAN-REM

SPORT HARVEST

-----DOSE (MAN-REM)-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	CATEGORY I	7.60E+04	4.63E-01	6.33E-01	4.15E-01	4.23E-05	2.15E-01	7.14E-02	1.75E-02
FISH	CATEGORY II	8.87E+03	7.59E-02	1.01E-01	3.52E-02	6.01E-06	3.44E-02	1.34E-02	2.00E-03
FISH	CATEGORY III	6.14E+03	1.53E-01	1.47E-01	2.17E-02	9.90E-06	4.79E-02	1.72E-02	1.24E-03
FISH	TOTAL	9.10E+04	6.92E-01	8.81E-01	4.72E-01	5.82E-05	2.97E-01	1.02E-01	2.07E-02

LOCATION                    DILUTION    CATCH    TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 1.68E+02 HR    POPULATION=1.55E+04  
7.00E+00    9.10E+04    1.68E+02

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) CATEGORY I=6.90E+00    CATEGORY II=5.20E+00    CATEGORY IV=2.20E+00

\* \* \* FISH CONSUMPTION POPULATION DOSES \* \* \*  
MAN-REM

COMMERCIAL HARVEST

-----DOSE (MAN-REM)-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	CATEGORY I	9.94E+07	2.13E+00	2.92E+00	1.91E+00	1.52E-04	9.90E-01	3.29E-01	7.92E-02
FISH	CATEGORY II	1.16E+07	3.50E-01	4.66E-01	1.62E-01	2.16E-05	1.58E-01	6.16E-02	9.08E-03
FISH	CATEGORY III	8.04E+06	7.07E-01	6.77E-01	1.00E-01	3.55E-05	2.21E-01	7.94E-02	5.65E-03
FISH	TOTAL	1.19E+08	3.19E+00	4.06E+00	2.17E+00	2.10E-04	1.37E+00	4.70E-01	9.39E-02

LOCATION                    DILUTION    CATCH    TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 2.40E+02 HR    POPULATION=2.03E+07  
7.00E+00    1.55E+05    2.40E+02

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) CATEGORY I=6.90E+00    CATEGORY II=5.20E+00    CATEGORY IV=2.20E+00

NEPA DOSES

NOTE--TOTAL NEPA DOSE INCLUDES SPORT CATCH

-----DOSE (MAN-REM)-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
FISH	CATEGORY I	2.05E+05	1.25E+00	1.71E+00	1.12E+00	9.86E-05	5.81E-01	1.93E-01	4.67E-02
FISH	CATEGORY II	2.40E+04	2.05E-01	2.73E-01	9.51E-02	1.40E-05	9.29E-02	3.61E-02	5.36E-03
FISH	CATEGORY III	1.66E+04	4.15E-01	3.97E-01	5.86E-02	2.30E-05	1.29E-01	4.66E-02	3.33E-03
FISH	TOTAL	2.46E+05	1.87E+00	2.38E+00	1.27E+00	1.36E-04	8.03E-01	2.76E-01	5.54E-02

\* \* \* INVERTEBRATE CONSUMPTION POPULATION DOSES \* \* \*  
MAN-REM

SPORT HARVEST

-----DOSE (MAN-REM)-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
INVER	CATEGORY I	8.33E+03	2.58E-03	3.63E-03	2.32E-03	2.69E-06	1.22E-03	4.08E-04	6.94E-04
INVER	CATEGORY II	9.68E+02	4.22E-04	5.76E-04	1.99E-04	3.86E-07	1.95E-04	7.58E-05	7.26E-05
INVER	CATEGORY III	6.97E+02	8.87E-04	8.68E-04	1.37E-04	7.00E-07	2.81E-04	1.02E-04	4.09E-05
INVER	TOTAL	1.00E+04	3.89E-03	5.08E-03	2.66E-03	3.77E-06	1.70E-03	5.86E-04	8.08E-04

LOCATION                    DILUTION    CATCH    TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 1.68E+02 HR    POPULATION=1.17E+04  
7.00E+00    1.00E+04    1.68E+02

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) CATEGORY I=1.00E+00    CATEGORY II=7.50E-01    CATEGORY IV=3.30E-01

\* \* \* INVERTEBRATE CONSUMPTION POPULATION DOSES \* \* \*  
MAN-REM

COMMERCIAL HARVEST

-----DOSE (MAN-REM)-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
INVER	CATEGORY I	1.44E+07	1.94E-03	2.73E-03	1.74E-03	1.41E-06	9.17E-04	3.06E-04	5.00E-04
INVER	CATEGORY II	1.67E+06	3.17E-04	4.33E-04	1.50E-04	2.01E-07	1.46E-04	5.70E-05	5.22E-05
INVER	CATEGORY III	1.21E+06	6.66E-04	6.52E-04	1.02E-04	3.57E-07	2.10E-04	7.66E-05	2.95E-05
INVER	TOTAL	1.73E+07	2.92E-03	3.82E-03	2.00E-03	1.97E-06	1.27E-03	4.40E-04	5.81E-04

LOCATION                    DILUTION    CATCH    TIME(HR)-INCLUDES FOOD PROCESSING TIME OF 2.40E+02 HR    POPULATION=2.03E+07  
7.00E+00    1.00E+03    2.40E+02

AVERAGE INDIVIDUAL CONSUMPTION (KG/YR) CATEGORY I=1.00E+00    CATEGORY II=7.50E-01    CATEGORY IV=3.30E-01

NEPA DOSES

NOTE--TOTAL NEPA DOSE INCLUDES SPORT CATCH

-----DOSE (MAN-REM)-----

PATHWAY	AGE GROUP	USAGE	BONE	LIVER	TOTAL BODY	THYROID	KIDNEY	LUNG	GI-LLI
INVER	CATEGORY I	9.17E+03	2.84E-03	4.00E-03	2.55E-03	2.87E-06	1.35E-03	4.48E-04	7.61E-04
INVER	CATEGORY II	1.07E+03	4.64E-04	6.34E-04	2.19E-04	4.12E-07	2.14E-04	8.34E-05	7.95E-05
INVER	CATEGORY III	7.67E+02	9.75E-04	9.55E-04	1.50E-04	7.48E-07	3.08E-04	1.12E-04	4.48E-05
INVER	TOTAL	1.10E+04	4.28E-03	5.59E-03	2.92E-03	4.03E-06	1.87E-03	6.44E-04	8.85E-04



\* \* \* RECREATION POPULATION DOSES \* \* \*

LOCATION- DOWNSTREAM

DILUTION=0.70E+01

TRANSIT TIME=0.40E+01 HR

SWF=0.2

DOSE(MAN-REM)

PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
SHORELINE	TOTAL POPUL	1.66E+07	2.12E-01	1.82E-01	1.82E-01

LOCATION- 0.200

DILUTION=0.70E+01

TRANSIT TIME=0.40E+01 HR

DOSE(MAN-REM)

PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
SWIMMING	TOTAL POPUL	1.66E+07	0.0	7.91E-04	7.91E-04

LOCATION- 0.200

DILUTION=0.70E+01

TRANSIT TIME=0.40E+01 HR

DOSE(MAN-REM)

PATHWAY	AGE GROUP	USAGE	SKIN	TOTAL BODY	THYROID
BOATING	TOTAL POPUL	1.66E+07	0.0	3.96E-04	3.96E-04

\* \* \* DOSE TO BIOTA \* \* \*

MRADS PER YEAR

DILUTION= 7.00E+00

TRANSIT TIME= 4.00E+00 HR

	INTERNAL	EXTERNAL	TOTAL
FISH	3.96E-01	4.80E-01	8.76E-01
INVERTEBRATE	3.01E-02	9.59E-01	9.89E-01
ALGAE	1.07E-01	4.18E-04	1.07E-01
MUSKRAT	2.11E+00	3.20E-01	2.43E+00
RACCOON	8.03E-02	2.40E-01	3.20E-01
HERON	1.23E+01	3.20E-01	1.27E+01
DUCK	1.93E+00	4.80E-01	2.41E+00

\* \* COST-BENEFIT ANALYSIS \* \* \*

NUCLIDE	RELEASE CI/YR	MAN-REM DOSE		MAN-REM PER CURIE	
		TOTAL BODY	THYROID	TOTAL BODY	THYROID
1H 3	8.87E-01	1.27E-05	1.27E-05	1.43E-05	1.43E-05
25MN 54	1.34E-04	8.80E-05	2.26E-05	6.57E-01	1.68E-01
26FE 55	1.67E-03	2.68E-05	4.86E-10	1.60E-02	2.91E-07
27CO 58	6.01E-03	4.01E-04	3.15E-04	6.66E-02	5.25E-02
27CO 60	4.06E-03	1.05E-02	1.03E-02	2.58E+00	2.53E+00
28NI 63	1.91E-04	1.48E-05	0.0	7.76E-02	0.0
38SR 89	9.64E-07	4.35E-08	2.25E-11	4.51E-02	2.34E-05
38SR 90	4.06E-07	2.20E-06	9.96E-13	5.43E+00	2.45E-06
53I 131	1.24E-04	1.13E-06	2.59E-04	9.13E-03	2.09E+00
53I 132	6.07E-06	3.11E-10	3.11E-10	5.13E-05	5.13E-05
55CS 134	4.62E-05	1.49E-03	3.75E-05	3.23E+01	8.12E-01
55CS 137	1.42E-01	2.82E+00	1.72E-01	1.99E+01	1.21E+00
56BA 140	4.44E-05	2.71E-07	2.04E-07	6.10E-03	4.58E-03
57LA 140	3.60E-04	8.56E-07	8.56E-07	2.38E-03	2.38E-03
58CE 144	2.83E-06	2.46E-08	2.41E-08	8.68E-03	8.52E-03
58CE 141	2.85E-07	6.22E-10	6.21E-10	2.18E-03	2.18E-03
24CR 51	3.55E-03	3.09E-06	2.95E-06	8.70E-04	8.31E-04
26FE 59	1.72E-04	2.74E-05	7.18E-06	1.60E-01	4.17E-02
30ZN 65	2.20E-06	5.90E-06	2.03E-07	2.68E+00	9.21E-02
40ZR 95	1.55E-04	5.49E-06	5.49E-06	3.54E-02	3.54E-02
40ZR 97	8.80E-07	5.35E-09	5.35E-09	6.08E-03	6.08E-03
41NB 95	4.38E-04	1.16E-05	8.23E-06	2.64E-02	1.88E-02
44RU 103	5.36E-06	8.01E-08	7.88E-08	1.49E-02	1.47E-02
44RU 106	1.68E-05	1.01E-06	9.94E-07	6.03E-02	5.91E-02
47AG 110M	2.98E-04	1.27E-04	1.27E-04	4.26E-01	4.25E-01
52TE 132	1.09E-05	1.89E-06	2.22E-06	1.74E-01	2.04E-01
TOTAL		2.83E+00	1.83E-01		

NOTE ON AGE GROUP:

- CATEGORY I (17 YEARS OLD OR OLDER)
- CATEGORY II (11 TO 17 YEARS OLD)
- CATEGORY III (1 TO 11 YEARS OLD)
- CATEGORY IV (0 TO 1 YEAR OLD)

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Jan - March 1986

STABILITY CLASS: A

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	7.	49.	20.	0.	0.	0.	76.
NNE	3.	7.	0.	0.	0.	0.	10.
NE	7.	2.	0.	0.	0.	0.	9.
ENE	1.	0.	0.	0.	0.	0.	1.
E	2.	0.	0.	0.	0.	0.	2.
ESE	2.	1.	0.	0.	0.	0.	3.
SE	6.	4.	0.	0.	0.	0.	10.
SSE	12.	21.	0.	0.	0.	0.	33.
S	8.	18.	6.	0.	0.	0.	32.
SSW	7.	11.	7.	0.	0.	0.	25.
SW	2.	2.	1.	0.	0.	0.	5.
WSW	0.	0.	0.	0.	0.	0.	0.
W	4.	6.	5.	1.	0.	0.	16.
WNW	0.	29.	13.	0.	0.	0.	42.
NW	4.	35.	16.	0.	0.	0.	55.
NNW	12.	33.	7.	0.	0.	0.	52.
<b>VARIABLE</b>							
Total	77.	218.	75.	1.	0.	0.	371.
Periods of calm (hours):	0						
Hours of missing data:	0						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Jan - March 1986

STABILITY CLASS: B

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	5.	14.	8.	0.	0.	0.	27.
NNE	2.	1.	0.	0.	0.	0.	3.
NE	3.	0.	0.	0.	0.	0.	3.
ENE	3.	0.	0.	0.	0.	0.	3.
E	3.	0.	0.	0.	0.	0.	3.
ESE	1.	0.	0.	0.	0.	0.	1.
SE	0.	0.	0.	0.	0.	0.	0.
SSE	2.	1.	0.	0.	0.	0.	3.
S	4.	5.	2.	0.	0.	0.	11.
SSW	3.	5.	0.	0.	0.	0.	8.
SW	1.	0.	0.	0.	0.	0.	1.
WSW	1.	0.	0.	0.	0.	0.	1.
W	0.	0.	1.	0.	0.	0.	1.
WNW	3.	6.	6.	0.	0.	0.	15.
NW	2.	9.	8.	0.	0.	0.	19.
NNW	5.	8.	1.	0.	0.	0.	14.
<b>VARIABLE</b>							
Total	38.	49	26.	0.	0.	0.	113.
Periods of calm (hours):	0						
Hours of missing data:	0						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Jan - March 1986

STABILITY CLASS: C

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	4.	7.	3.	0.	0.	0.	14.
NNE	7.	6.	0.	0.	0.	0.	13.
NE	3.	0.	0.	0.	0.	0.	3.
ENE	3.	0.	0.	0.	0.	0.	3.
E	1.	0.	0.	0.	0.	0.	1.
ESE	3.	0.	0.	0.	0.	0.	3.
SE	3.	2.	0.	0.	0.	0.	5.
SSE	1.	4.	0.	0.	0.	0.	5.
S	2.	2.	0.	0.	0.	0.	4.
SSW	0.	3.	0.	0.	0.	0.	3.
SW	1.	0.	0.	0.	0.	0.	1.
WSW	2.	0.	0.	0.	0.	0.	2.
W	1.	0.	1.	0.	0.	0.	2.
WNW	3.	8.	3.	0.	0.	0.	14.
NW	2.	10.	13.	0.	0.	0.	25.
NNW	4.	10.	3.	0.	0.	0.	17.
<b>VARIABLE</b>							
Total	40.	52.	23.	0.	0.	0.	115.
Periods of calm (hours):	0						
Hours of missing data:	0						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Jan - March 1986  
 STABILITY CLASS: D  
 ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	128.	109.	40.	0.	0.	0.	277.
NNE	62.	23.	2.	0.	0.	0.	87.
NE	29.	1.	0.	0.	0.	0.	30.
ENE	17.	0.	0.	0.	0.	0.	17.
E	11.	0.	0.	0.	0.	0.	11.
ESE	7.	0.	0.	0.	0.	0.	7.
SE	11.	0.	0.	0.	0.	0.	11.
SSE	13.	12.	0.	0.	0.	0.	25.
S	17.	23.	2.	0.	0.	0.	42.
SSW	5.	3.	5.	0.	0.	0.	13.
SW	0.	0.	0.	0.	0.	0.	0.
WSW	9.	0.	0.	0.	0.	0.	9.
W	6.	9.	2.	0.	0.	0.	17.
WNW	11.	31.	18.	1.	0.	0.	61.
NW	22.	81.	45.	1.	0.	0.	149.
NNW	54.	64.	30.	0.	0.	0.	148.
<b>VARIABLE</b>							
Total	402.	356.	144.	2.	0.	0.	904.
Periods of calm (hours):	6						
Hours of missing data:	0						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Jan - March 1986  
 STABILITY CLASS: E  
 ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	71.	13.	20.	0.	0.	0.	84.
NNE	67.	8.	0.	0.	0.	0.	75.
NE	49.	3.	0.	0.	0.	0.	52.
ENE	14.	0.	0.	0.	0.	0.	14.
E	20.	0.	0.	0.	0.	0.	20.
ESE	7.	0.	0.	0.	0.	0.	7.
SE	14.	2.	0.	0.	0.	0.	16.
SSE	12.	12.	0.	0.	0.	0.	24.
S	19.	14.	1.	0.	0.	0.	34.
SSW	7.	6.	1.	0.	0.	0.	14.
SW	5.	2.	0.	0.	0.	0.	7.
WSW	0.	0.	0.	0.	0.	0.	0.
W	9.	1.	0.	0.	0.	0.	10.
WNW	16.	4.	0.	0.	0.	0.	20.
NW	13.	6.	1.	0.	0.	0.	20.
NNW	37.	5.	0.	0.	0.	0.	42.
<b>VARIABLE</b>							
Total	360.	76.	3.	0.	0.	0.	439.
Periods of calm (hours):	8						
Hours of missing data:	0						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Jan - March 1986

STABILITY CLASS: F

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	28.	1.	0.	0.	0.	0.	29.
NNE	61.	3.	0.	0.	0.	0.	64.
NE	19.	2.	0.	0.	0.	0.	21.
ENE	3.	0.	0.	0.	0.	0.	3.
E	10.	0.	0.	0.	0.	0.	10.
ESE	4.	0.	0.	0.	0.	0.	4.
SE	3.	0.	0.	0.	0.	0.	3.
SSE	9.	0.	0.	0.	0.	0.	9.
S	4.	3.	0.	0.	0.	0.	7.
SSW	1.	0.	0.	0.	0.	0.	1.
SW	1.	0.	0.	0.	0.	0.	1.
WSW	4.	0.	0.	0.	0.	0.	4.
W	1.	0.	0.	0.	0.	0.	1.
WNW	2.	1.	0.	0.	0.	0.	3.
NW	0.	0.	0.	0.	0.	0.	0.
NNW	8.	0.	0.	0.	0.	0.	8.
<b>VARIABLE</b>							
Total	158.	10.	0.	0.	0.	0.	168.
Periods of calm (hours):		1					
Hours of missing data:		0					

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD:

Jan - March 1986

STABILITY CLASS:

G

ELEVATION:

10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	5.	0.	0.	0.	0.	0.	5.
NNE	10.	1.	0.	0.	0.	0.	11.
NE	3.	2.	0.	0.	0.	0.	5.
ENE	1.	0.	0.	0.	0.	0.	1.
E	2.	0.	0.	0.	0.	0.	2.
ESE	2.	0.	0.	0.	0.	0.	2.
SE	0.	0.	0.	0.	0.	0.	0.
SSE	1.	0.	0.	0.	0.	0.	1.
S	0.	0.	0.	0.	0.	0.	0.
SSW	1.	0.	0.	0.	0.	0.	1.
SW	2.	0.	0.	0.	0.	0.	2.
WSW	1.	0.	0.	0.	0.	0.	1.
W	3.	0.	0.	0.	0.	0.	3.
WNW	0.	0.	0.	0.	0.	0.	0.
NW	1.	0.	0.	0.	0.	0.	1.
NNW	0.	0.	0.	0.	0.	0.	0.
<b>VARIABLE</b>							
Total	32.	3.	0.	0.	0.	0.	35.
Periods of calm (hours):	0						
Hours of missing data:	0						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: A

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	7.	69.	31.	2.	0.	0.	109.
NNE	2.	4.	10.	0.	0.	0.	16.
NE	0.	2.	1.	0.	0.	0.	3.
ENE	0.	2	1.	0.	0.	0.	3.
E	0.	0.	0.	0.	0.	0.	0.
ESE	1.	0.	0.	0.	0.	0.	1.
SE	2.	4.	0.	0.	0.	0.	6.
SSE	7.	30.	2.	0.	0.	0.	39.
S	7.	43.	12.	0.	0.	0.	62.
SSW	0.	10.	6.	0.	0.	0.	16.
SW	1.	15.	1.	0.	0.	0.	17.
WSW	1.	5.	0.	0.	0.	0.	6.
W	3.	13.	0.	0.	0.	0.	16.
WNW	1.	9.	2.	0.	0.	0.	12.
NW	2.	20.	16.	0.	0.	0.	38.
NNW	4.	39.	11.	0.	0.	0.	54.
<b>VARIABLE</b>							
Total	38.	265.	93.	2.	0.	0.	398.
Periods of calm (hours):	0						
Hours of missing data:	13 (Total for the second quarter 1986)						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: B

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1.	24.	4.	2.	0.	0.	31.
NNE	1.	6.	5.	0.	0.	0.	12.
NE	1.	1.	2.	0.	0.	0.	4.
ENE	0.	2.	0.	0.	0.	0.	2.
E	1.	0.	0.	0.	0.	0.	1.
ESE	0.	0.	0.	0.	0.	0.	0.
SE	2.	1.	0.	0.	0.	0.	3.
SSE	2.	6.	0.	0.	0.	0.	8.
S	2.	11.	1.	0.	0.	0.	14.
SSW	1.	2.	1.	0.	0.	0.	4.
SW	3.	1.	0.	0.	0.	0.	4.
WSW	0.	1.	0.	0.	0.	0.	1.
W	3.	1.	0.	0.	0.	0.	4.
WNW	1.	2.	2.	0.	0.	0.	5.
NW	1.	6.	2.	0.	0.	0.	9.
NNW	1.	6.	0.	0.	0.	0.	7.

## VARIABLE

Total 20. 70. 17. 2. 0. 0. 109.

Periods of calm (hours): 0

Hours of missing data: \* See 1st page (Stability Class A, Apr - June, 1986)

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: C

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	6.	10.	4.	0.	0.	0.	20.
NNE	4.	7.	4.	0.	0.	0.	15.
NE	0.	2.	0.	0.	0.	0.	2.
ENE	1.	0.	0.	0.	0.	0.	1.
E	1.	0.	0.	0.	0.	0.	1.
ESE	0.	0.	0.	0.	0.	0.	0.
SE	2.	0.	0.	0.	0.	0.	2.
SSE	6.	3.	0.	0.	0.	0.	9.
S	7.	11.	0.	0.	0.	0.	18.
SSW	1.	4.	3.	0.	0.	0.	8.
SW	2.	1.	1.	0.	0.	0.	4.
WSW	0.	1.	0.	0.	0.	0.	1.
W	3.	4.	0.	0.	0.	0.	7.
WNW	0.	3.	0.	0.	0.	0.	3.
NW	0.	1.	1.	0.	0.	0.	2.
NNW	3.	5.	1.	0.	0.	0.	9.
<b>VARIABLE</b>							
Total	36.	52.	14.	0.	0.	0.	102.
Periods of calm (hours):	0						
Hours of missing data:	*						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: D

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	28.	67.	20.	13.	5.	0.	133.
NNE	34.	44.	22.	0.	0.	0.	100.
NE	45.	24.	2.	0.	0.	0.	71.
ENE	32.	8.	0.	0.	0.	0.	40.
E	18.	0.	0.	0.	0.	0.	18.
ESE	14.	2.	0.	0.	0.	0.	16.
SE	23.	5.	0.	0.	0.	0.	28.
SSE	20.	41.	0.	0.	0.	0.	61.
S	24.	37.	3.	0.	0.	0.	64.
SSW	16.	11.	1.	0.	0.	0.	28.
SW	6.	3.	0.	0.	0.	0.	9.
WSW	7.	6.	0.	0.	0.	0.	13.
W	3.	4.	0.	0.	0.	0.	7.
WNW	2.	18.	2.	0.	0.	0.	22.
NW	1.	15.	3.	0.	0.	0.	19.
NNW	4.	21.	10.	0.	0.	0.	35.
<b>VARIABLE</b>							
Total	277.	306.	63.	13.	5.	0.	664.
Periods of calm (hours):	0						
Hours of missing data:	*						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: E

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	37.	41.	7.	0.	0.	0.	85.
NNE	44.	32.	7.	0.	0.	0.	83.
NE	72.	15.	0.	0.	0.	0.	87.
ENE	47.	3.	1.	0.	0.	0.	51.
E	15.	0.	0.	0.	0.	0.	15.
ESE	12.	0.	0.	0.	0.	0.	12.
SE	26.	2.	0.	0.	0.	0.	28.
SSE	37.	28.	0.	0.	0.	0.	65.
S	35.	39.	0.	0.	0.	0.	74.
SSW	15.	19.	1.	0.	0.	0.	35.
SW	6.	3.	0.	0.	0.	0.	9.
WSW	4.	2.	0.	0.	0.	0.	6.
W	7.	7.	1.	0.	0.	0.	15.
WNW	5.	7.	0.	0.	0.	0.	12.
NW	1.	10.	0.	0.	0.	0.	11.
NNW	9.	13.	3.	0.	0.	0.	25.
<b>VARIABLE</b>							
Total	372.	221.	20.	0.	0.	0.	613.
Periods of calm (hours):		1					
Hours of missing data:		*					

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: F

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	13.	1.	0.	0.	0.	0.	14.
NNE	48.	7.	0.	0.	0.	0.	55.
NE	59.	16.	0.	0.	0.	0.	75.
ENE	25.	0.	0.	0.	0.	0.	25.
E	18.	0.	0.	0.	0.	0.	18.
ESE	5.	0.	0.	0.	0.	0.	5.
SE	5.	1.	0.	0.	0.	0.	6.
SSE	8.	0.	0.	0.	0.	0.	8.
S	12.	3.	0.	0.	0.	0.	15.
SSW	6.	0.	0.	0.	0.	0.	6.
SW	1.	0.	0.	0.	0.	0.	1.
WSW	0.	0.	0.	0.	0.	0.	0.
W	1.	0.	0.	0.	0.	0.	1.
WNW	1.	0.	0.	0.	0.	0.	1.
NW	3.	0.	0.	0.	0.	0.	3.
NNW	1.	0.	0.	0.	0.	0.	1.
<b>VARIABLE</b>							
Total	206.	28.	0.	0.	0.	0.	234.
Periods of calm (hours):	0						
Hours of missing data:	*						

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

TABLE 4A

HOURS AT EACH WIND SPEED AND DIRECTION <sup>a</sup>

PERIOD OF RECORD: Apr - June 1986

STABILITY CLASS: G

ELEVATION: 10 Meter

Wind Direction	Wind Speed (mph) at 10m Level						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	3.	1.	0.	0.	0.	0.	4.
NNE	13.	0.	0.	0.	0.	0.	13.
NE	12.	0.	0.	0.	0.	0.	12.
ENE	1.	0.	0.	0.	0.	0.	1.
E	3.	0.	0.	0.	0.	0.	3.
ESE	1.	0.	0.	0.	0.	0.	1.
SE	0.	0.	0.	0.	0.	0.	0.
SSE	0.	0.	0.	0.	0.	0.	0.
S	2.	0.	0.	0.	0.	0.	2.
SSW	1.	0.	0.	0.	0.	0.	1.
SW	0.	0.	0.	0.	0.	0.	0.
WSW	0.	0.	0.	0.	0.	0.	0.
W	0.	0.	0.	0.	0.	0.	0.
WNW	0.	0.	0.	0.	0.	0.	0.
NW	0.	0.	0.	0.	0.	0.	0.
NNW	2.	0.	0.	0.	0.	0.	2.
<b>VARIABLE</b>							
Total	38.	5.	0.	0.	0.	0.	43.
Periods of calm (hours):		0					
Hours of missing data:		*					

<sup>a</sup> In the table, record the total number of hours of each category of wind direction for each calendar quarter. Provide similar tables separately for each atmospheric stability class and elevation.

August 29, 1986

Re: Indian Point Unit Nos. 1 and 2  
Docket Nos. 50-3 and 50-247

SEMI-ANNUAL EFFLUENT AND WASTE DISPOSAL REPORT

F-REPORTABLE CHANGES

TO THE PROCESS CONTROL PROGRAM (PCP)

OFFSITE DOSE CALCULATION MANUAL (ODCM)

AND RADIOACTIVE WASTE SYSTEMS

G-REPORTABLE ITEMS

FIRST HALF - 1986

August 29, 1986

Re: Indian Point Unit Nos. 1 and 2  
Docket Nos. 50-3 and 50-247

Reportable Changes

A. Process Control Program

Section 6.14.1 of the Indian Point Unit #2 Technical Specifications addresses licensee initiated changes to a Process Control Program (PCP). During the 1st half of 1986, NP Radwaste made changes to its PCP program by revising EH&S Procedure No. EH&S-SQ-4.007 entitled Process Control Program.

These changes were made in response to an NRC inspection on January 6-10, 1986 which resulted in Inspection Report 50-247/86-01 Appendix A dated April 16, 1986. This inspection concluded that Quality Control responsibilities of EH&S personnel responsible for radioactive material were not adequately specified, that EH&S personnel were not trained in responsibilities of Quality Control, and EH&S implementing procedures did not adequately discuss the role of EH&S personnel in the QC of LLRW Shipments.

In response to this violation a number of actions were taken including revising the PCP. Those changes related to the PCP are summarized as follows:

- o Now requires Radwaste Supervisor and QA Engineer to fully review the vendors PCP in the field and in the office and to sign off EH&S-SQ-4.007 Attachment 8.1 upon completion.
- o Requires that the vendor demonstrate that the final waste form generated at Indian Point #2 falls within the range of waste characteristics presented in the vendors 10 CFR 61 Waste Form Topical Report.
- o Notify QA/QC inspector to enable them to do surveillance of PCP test solidification. Notification in Procedure EH&S-SQ-4.000 Shipment Final QA Inspection Documented.

These changes will improve the overall conformance of the solidification or dewatered product by insuring that the selected vendor provides all services and procedures to ensure that a final waste product meets 10 CFR 61 form requirements, 10 CFR 20.311 QC requirements, and the overall QA requirements of 10 CFR 71. This has been achieved in this revision by redefining Radwaste QC functions and QA's quality assurance functions.

This change was Revision 1 to EH&S-SQ-4.007 and was reviewed and approved by SNSC on April 29, 1986.

August 29, 1986

Re: Indian Point Unit Nos. 1 and 2  
Docket Nos. 50-3 and 50-247

B. Offsite Dose Calculation Manual

In reference to the reportable changes to the Offsite Dose Calculation Manual and pursuant to Indian Point Unit 2 technical specifications 6.15.2 (1A, B, and C), the following information is submitted. The rationale for the change is totally editorial. Copies of changes are attached as per 6.15.2 (1A). It has been determined that the changes will not reduce the accuracy or reliability of dose calculations or set point determinations as per 6.15.2 (1B). The copies have been stamped, approved, revised, and dated by SNSC, as per 6.15.2 (1C).

C. Radioactive Waste Systems

For the period reported there were no major changes made to any of the radioactive waste systems.

Reportable Items

A. Radioactive Liquid Effluent Monitoring Instrumentation

The steam generator blowdown effluent line flow rate measurement device has been inoperable for greater than 30 days and is being reported pursuant to Indian Point 2 Technical Specification 3.9.A.2.C. Prior to the issuance of the radiological effluent technical specifications, Amendment 90 to Indian Point Facility Operating License No. DPR-26 on June 20, 1984, the provisions to measure steam generator blowdown flow had been disconnected to establish sampling connections outside containment. Engineering has been underway to provide this capability. This new flow measurement equipment is expected to be operable by the end of the 1987 Refueling Outage.

B. Radioactive Gaseous Effluent Monitoring Instrumentation

The waste gas hold-up system explosive oxygen recorder (ALARM) monitor, table 3.9-2.2B of Indian Point 2 Technical Specifications has been out of service and inoperable. This recorder is obsolete equipment. It is being replaced by new instrumentation and should be in service by June of 1987, under Project #IP-30783.

INDIAN POINT STATION

TECHNICAL SUPPORT DEPARTMENT

CHEMISTRY SECTION

Procedure No. IPC - S - 039

Rev. No. 2

Title: Offsite Dose Calculation Manual (ODCM)

Directed to: Chemistry Manager (✓)  
Nuclear Supervisor (✓)  
Chemistry Supervisors (✓)  
Assoc. Chemical Analyst (✓)  
Sr. Production Tech's. ( )  
Production Tech's. ( )  
Jr. Production Tech's. ( )

INFORMATION  
COPY ONLY

Nuclear Eng / NUS 10/83  
Written By / Date

RN Redman 7/3/84  
Reviewed By / Date

Rev 3  
**APPROVED**  
SNSC #1021  
Date 5/13/86  
Alice Dayer

Previously reviewed by SNSC prior to  
Gen. Mgr. or Section / Date  
submission

Frutz 849 LR 7/3/84  
SNSC Review / Date

pages 7, 8, 16, 19, 20,  
21 & Table  
4.1

J. Dyer  
5/14/86

[Signature]  
Section Approval / Date

INDIAN POINT UNIT NO. 2

OFFSITE DOSE CALCULATION MANUAL (ODCM)

1.3 Determination of Setpoint for Radioactive Liquid Effluent Monitors

Technical Specification 3.9.A.2(a) requires that the radioactive liquid effluent monitors be operable and set to initiate an alarm or trip in the event that the limits of Technical Specification 3.9.A.1(a) are approached. The alarm and trip setpoints shall be determined and adjusted by the following method.

The alarm setpoint for the liquid effluent radiation monitors is derived from the concentration limit provided in 10CFR PART 20 Appendix B Table 2 Column 2 applied at the restricted area boundary where the discharge canal flows into the river. The alarm setpoint does not consider dilution, dispersion, or decay or radioactive material beyond the site boundary. That is the alarm setpoint is based on a concentration limit at the end of the discharge canal. The radiation monitoring and isolation points are located in each line through which radioactive waste effluent is eventually discharged into the discharge canal.

The alarm setpoint for each liquid effluent monitor is based upon measurement, according to Table 4.10-1 of R.E.T.S., of radioactivity in a batch of liquid to be released or in the continuous aqueous discharge. Alternately, the alarm setpoint may be based upon gross beta/gamma activity analysis of the liquid waste provided the unrestricted are MPC for unidentified emitters,  $1 \times 10^{-7}$  uCi/ml, is observed. (As it knows that I-129, Ra-226, and RA-228 are not present.)

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Date 1021, 5/13/86  
Rev 3

INDIAN POINT UNIT NO. 2

OFFSITE DOSE CALCULATION MANUAL (ODCM)

The maximum concentration of a batch prior to discharge is not to exceed  $1 \times 10^{-3}$  uCi/ml (not including H-3 and dissolved noble gases). Whether radioiodine and primary gamma emitters are identified prior to a batch release or not, the liquid rad-waste effluent line radiation monitor alarm setpoint is determined with the equation:

EQUATION I.3.1-2  $S_{\text{Batch}} = C_{\text{iBatch}}/f$

Where

$S_{\text{Batch}}$  = Radiation monitor alarm setpoint (cpm).

$C_{\text{iBatch}}$  = The total or gross beta/gamma activity measured in the batch sample (uCi/ml), not including H-3 and dissolved noble gases.

$f$  = Monitor calibration factor  
(uCi/ml / CPM)

Since the monitor calibration factor for the liquid release monitor is known to be  $1 \times 10^{-8}$  uCi/ml/CPM and the maximum concentration of a batch is  $1 \times 10^{-3}$  uCi/ml, the maximum value of  $S_{\text{Batch}}$  is 100,000 CPM. This shall be the maximum alarm setpoint and background will be kept below this level.

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OFFSITE DOSE CALCULATION MANUAL (ODCM)

If this method of determination of releases is used, the calculation should be made when changes in plant parameter are likely to induce significant changes in secondary water radioiodine concentrations. The calculated release shall be assumed at the latest calculated level until the next secondary water analysis is completed.

2.2 Determining the Total Body and Skin Dose Rates for Noble Gas Releases and Establishing Setpoints for Effluents Monitors

Technical Specification 3.9.B.1.a(i) limits the instantaneous dose rate from noble gases in airborne releases to less than 250 mrem/yr - total body, and less than 1500 mrem/yr - skin, for Unit 2. Technical Specification 3.9.B.2.a requires that the gaseous radioactive effluent monitoring instrumentation be operable with alarm/trip setpoints set to ensure that these dose rate limits are not exceeded. The results of the sampling and analysis program of Technical Specification Table 4.10-3 are used to demonstrate compliance with these limits.

The following calculational method is provided for determining the instantaneous dose rates to the total body and skin from noble gases in airborne releases. The alarm/trip setpoints are based on the dose rate calculations. The Technical Specification LCO's apply to all airborne releases on the site but all releases may be treated as if discharged from a single release point for ease of calculation and without unduly reducing the conservatism of the calculation. Only those noble gases appearing in Table 2-2 will be considered. The calculational methods are based on Sections 5.1 and 5.2 of NUREG-0133, Nov. 1978.

The equations are:

Total Body Dose Rate

EQUATION 2.2-1  $DR_{TB} = \sum_i K_i (\overline{X/Q}) \dot{Q}_i$

Skin Dose Rate

2.2.2  $DR_{SKIN} = \sum_i [L_i + 1.1 M_i] (\overline{X/Q}) \dot{Q}_i$

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SNSC *Alice Hayes*  
 DATE #1021, 5/13/86  
 Rev 3

INDIAN POINT UNITS NOS. 1 & 2

OFFSITE DOSE CALCULATION MANUAL (ODCM)

2.2.2 Setpoint Determination

2.2.2.1 Calculate activity by:

$$C = (R) (E)$$

C = uCi/cc

R = R-12 count rate (CMP)

E = Current monitor calibration factor for  
R-12 (uCi/cc/CPM)

2.2.2.2 Calculate discharge rate by:

$$K = 4.72E-4 (C) (F)$$

K = Discharge Rate (Ci/sec)

C = Activity from step 2.2.2.1

F = Containment pressure relief flow,  
nominally 1500 SCFM.

2.2.2.3 Calculate plant vent alarm setpoint by:

$$S = \frac{K}{(4.72E-4) (E) (F)}$$

S = Alarm set point (CPM)

K = Discharge rate from Step 2.2.2.2 (Ci/sec)

E = Calibration factor (uCi/cc/cpm)

F = Plant vent flow from annubars or R-27  
(SCFM)

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INDIAN POINT UNITS NO. 1 & 2

OFFSITE DOSE CALCULATION MANUAL (ODCM)

2.2.3 Total Body and Skin Nuclide Specific Dose Rate Calculations

Methods described herein need only be used if the actual release exceed the value of  $2.4 \times 10^4$  uCi/sec.

Total Body Dose Rate

EQUATION 2.2.3-1  $DR_{TB} = \sum_i DR_{TBi} = K_i (\bar{X}/Q) Q_i$

Where

$DR_{TB}$  Dose rate to the Total Body from all noble gas gamma radiation (mrem/sec).

$DR_{TBi}$  Dose rate to the Total Body from the *i*th nuclide noble gas gamma radiation (mrem/sec).

$K_i$  The Total Body dose factor due to gamma emissions from noble gas radionuclide '*i*', mrem-m<sup>3</sup>/uCi-sec.

$\bar{X}/Q$  Value of CHI over  $Q$  (Sec/m<sup>3</sup>) for the most limiting sector at the exclusion area boundary.

$Q_i$  Release rate of the *i*th nuclide in (uCi/Sec.).

Total Skin Dose Rate

EQUATION 2.2.3-2  $DR_{SKIN} = (L_i = 1.1 M_i) (\bar{X}/Q) Q_i$

Where

$DR_{SKIN}$  Dose rate to skin from all noble gas beta and gamma radiation (mrem/sec).

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*SNSC Alice Hayes*  
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 Rev 3

INDIAN POINT UNIT NO. 2

OFFSITE DOSE CALCULATION MANUAL (ODCM)

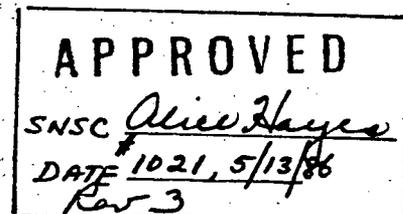
- DR<sub>SKIN</sub> = Dose rate to skin from the  $i^{\text{th}}$  nuclide noble gas beta and gamma radiation [mRem/sec].
- $L_i$  = The skin dose factor due to beta emissions from noble gas radionuclide 'i' [mrem-m<sup>3</sup>/uCi-sec.]
- $M_i$  = The air dose factor due to gamma emissions from noble gas radionuclide 'i' [mRad-m<sup>3</sup>/uCi-sec.]
- 1.1 = Conversion factor for  $M_i$  from mRad to mRem.
- $\overline{X/Q}$  = As defined above.
- $Q_i$  = As defined above.

The dose rate contribution of this release source shall be added to all other simultaneous gaseous release sources, if any, to determine overall Total Dose Rate to the Total Body and Skin from noble gas effluents.

2.3. Determining the Radioiodine and 8 Day Particulate Dose Rate to any Organ from Instantaneous Releases

Technical Specification 3.9.B.1.a (ü) limits the dose rate from radioiodines and particulates with half lives greater than 8 days to 750 mrem/yr to any organ for Unit 2. The following calculational method is provided for determining the dose rate from radioiodines and particulates. It is based on NUREG-0133, November, 1978; Sections 5.2.1, and 5.2.1.1 through 5.2.1.3.

The infant is the controlling age group for the contaminated forage/cow/milk pathway. There is no controlling age group for the ground plane deposition pathway. Children is the controlling age group for the inhalation pathway. These three pathways are the only ones considered for instantaneous releases. The long term (X/Q) Depleted and (D/Q) values are based on historical meteorological data. Only those nuclides that appear on Table G-4 will be considered. The equations are:



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*SNSC Aliens Hayes*  
 Date *1021, 5/13/86*  
*Rev 2*

Table 4.1

Indian Point Station

Environmental Sampling Station Point

Exposure Pathway/Sample: Direct Radiation

<u>RETS Sample Designations</u>	<u>Environmental Sample Station Point</u>	<u>Location</u>	<u>Distance</u>
DR1	57	Cortlandt Sanition Garage	2 mi - N
DR2	59	Old Pemart Ave.	1.8 mi - NNE
DR3	90	Charles Point	0.8 mi - NE
DR4	28	Lents Cove	0.5 mi - ENE
DR5	35	Broadway and Bleakley	0.4 mi - E
DR6	88	Sector Six Reuter Stokes Pole	0.5 mi - ESE
DR7	14	Water Meter House	0.3 mi - SE
DR8	3	Service Center Building	0.4 mi - SSE
DR9	34	SE Corner	0.6 mi - S
DR10	5	NYU Tower	0.8 mi - SSW
DR11	53	White Beach	0.9 mi - SW
DR12	74	Gays Hill Road South	1.5 mi - WSW
DR13	76	Gays Hill Road North	1.2 mi - W
DR14	78	Rt. 9W Pirates Cove	1.2 mi - WNW
DR15	80	Rt. 9W South of Ayers Road	1 mi - NW
DR16	82	Ayers Road	0.9 mi - NNW
DR17	58	Rt. 9D Garrison	5 mi - N
DR18	60	Gallows Hill Road	5 mi - NNE
DR19	62	Westbrook Drive	5 mi - NE
DR20	64	Pine Road - Cortlandt	4.8 mi - ENE
DR21	66	Croton Ave. - Cortlandt	5 mi - E
DR22	67	Colabaugh Pond Road Cortlandt	5 mi - ESE
DR23	69	Mt. Airy & Windsor Road	5 mi - SE
DR24	27	Croton Point	6.4 mi - SSE
DR25	71	Warren Ave. Haverstraw	4.8 mi - S
DR26	72	Railroad Ave. & 9W	4.6 mi - SSW
DR27	73	Willow Grove Road & Birch Drive	5 mi - SW
DR28	75	Palisades Pkwy Lake Welch Exit	5 mi - WSW
DR29	77	Palisades Parkway	4.2 mi - W
DR30	79	Anthony Wayne Park	4.5 mi - WNW
DR31	81	Palisades Parkway	4.7 mi - NW
DR32	83	Rt. 9W Fort Montgomery	4.8 mi - NNW
DR33	33	Hamilton St.	3 mi - NE
DR34	38	Furnace Dock	3.5 mi - SE
DR35	89	Highland Ave. & Sprout Brook	3 mi - NNE
DR36	61	Lower South & Bay St.	1.3 mi - NE
DR37	56	Verplanck	1.3 mi - SSW
DR38	29	Montrose Marina	1.6 mi - S
DR39	29	Grassy Point	3.3 mi - SSW
DR40	23	Roseton*	20 mi - N

\* Control Station Location

**APPROVED**  
 SNSE: *Alie Hayes*  
 DATE: *1/22, 5/13/86*  
*Rev 2*

Table 4.1 (Con'd)

Exposure Pathway/Sample: Airborne

RETS Designations	Environmental Sample Station Points	Location	Distance
A1	4	Algonquin Gas Line	0.25mi - SW
A2	91	Burnwill Gas Co.	0.8 mi - NE
A3	57	Cortlandt Sanition Garage	2 mi - N
A4	5	NYU Tower	0.8 mi - SSW
A5	23	*Roseton	20 mi - N

Exposure Pathways/Sample: Waterborne-Surface (Hudson River Water)

Wa1	9	Plant Inlet	N/A
Wa2	10	Discharge Canal	N/A

Exposure Pathway/Sample: Watherborne-Drinking

Wb1	7	Camp Field Resevior	3.5 mi - NE
-----	---	---------------------	-------------

Exposure Pathway/Sample: Sediment from Shoreline

Wc1	53	White Beach	0.9 mi - SW
Wc2	50	*Manitou Inlet	4.5 mi - NNW

\* Control Station Location

Exposure Pathway/Sample: Milk

There are no milch animals within 8 km distance of Indian Point; Therefore, no milk samples are taken

Exposure Pathway/Sample: Ingestion-Fish and Invertebrates

The RETS designate two required sample locations labeled Ib1 and Ib2. The downstream Ib1 location and samples will be chosen where it is likely to be affected by plant discharge. Ib2 will be a location upstream that is not likely to be affected by plant discharge. The following fish species are considered acceptable sample species:

- |               |                      |
|---------------|----------------------|
| Striped Bass  | Bluegill Sunfish     |
| White Perch   | Pumpkin Seed Sunfish |
| White Catfish | Blueback Herring     |
| American Eel  | Crabs                |

Exposure Pathways/Sample: Ingestion: Food Products & Broad Leaf Vegetation

As required by the RETS the locations for the samples will be as Follows:

- Ic1: 0-1 mile, SW to SSW Sectors
- Ic2: 1-3 mile, N to NE Sectors
- Ic3: Near Roseton

INDIAN POINT STATION - ENVIRONMENTAL SAMPLING STATION POINTS

Sample Station Points	RETS Desinations	Location/Distance	Sample Types
	A2	Standard Brands, 0.7 mi - ENE	Air Particulate
	A2	Standard Brands, 0.7 mi - ENE	Radioiodine
		Standard Brands, 0.7 mi - ENE	Direct Gamma
3	DR8	Service Center - SSE	Direct Gamma
4	A1	Algonquin Gas Line, 0.2 mi - SW	Air Particulate
4	A1	Algonquin Gas Line, 0.2 mi - SW	Radioiodine
5	A4	NYU Tower - 0.8 mi - SSW	Air Particulate
5	A4	NYU Tower - 0.8 mi - SSW	Radioiodine
5	DR10	NYU Tower - 0.8 mi - SSW	Direct Gamma
5	Ic1	NYU Tower - 0.8 mi - SSW	Broadleaf Vegetation
5		NYU Tower - 0.8 mi - SSW	Soil
6	Ic2	Camp Smith - 2.5 mi - NNE	Broadleaf Vegetation
6		Camp Smith - 2.5 mi - NNE	Soil
7	Wb1	Camp Field Reservoir 3.5 mi - NE	Drinking Water
	Wa1	Inlet Pipe to plant-onsite NE	Hudson River Water
10	Wa2	Discharge Canal, onsite SW	Hudson River Water
10		Discharge Canal, onsite SW	*H.R. Bottom Sediment Silt
14	DR7	Water Meter House-onsite SE	Direct Gamma
17		Off Verplanck, 1 mi - SSW	*H.R. Aquatic Vegetation
17		Off Verplanck, 1 mi - SSW	*H.R. Bottom Sediment Silt
17		Off Verplanck, 1 mi - SSW	*H.R. Shoreline Soil
20	DR38	Montrose Marina 1.6 mi - S	Direct Gamma
22		Lovett, 1.5 mi - WSW	Air Particulate
22		Lovett, 1.5 mi - WSW	Radioiodine
**23	A5	Roseton, 20 mi - N	Air Particulate
**23	A5	Roseton, 20 mi - N	Radioiodine
**23	DR40	Roseton, 20 mi - N	Direct Gamma
**23	lc3	Roseton, 20 mi - N	Broadleaf Vegetation
**23		Roseton, 20 mi - N	Fallout
**23		Roseton, 20 mi - N	Soil

**APPROVED**  
*SNSC Alice Hayes*  
 DATE 1021, 5/12/86  
 Rev 2

INDIAN POINT STATION - ENVIRONMENTAL SAMPLING STATION POINTS

Sample Station Points	RETS Designations	Location/Distance	Sample Types
25		Where available near site	Fish & Invertebrate
27		Croton Point, 6.4 mi - SSE	Air Particulate
27		Croton Point, 6.4 mi - SSE	Radioiodine
27	DR24	Croton Point, 6.4 mi - SSE	Direct Gamma
28	DR4	Lents Cove, 0.5 mi - ENE	Direct Gamma
28		Lents Cove, 0.5 mi - ENE	*H.R. Bottom Sediment Silt
28		Lents Cove, 0.5 mi - ENE	*H.R. Shoreline Soil
28		Lents Cove, 0.5 mi - ENE	*H.R. Aquatic Vegetation
29	DR39	Grassy Point, 3.3 mi - SSW	Direct Gamma
29		Grassy Point, 3.3 mi - SSW	Air Particulate
29		Grassy Point, 3.3 mi - SSW	Radioiodine
33	DR33	Hamilton St. 3 mi - NE	Direct Gamma
	DR9	SE Corner onsite, 0.6 mi - S	Direct Gamma
35	DR5	Bleakley Ave & Broadway, 0.4 mi - E	Direct Gamma
38	DR34	Furnace Dock Substation, 3.5 mi - SE	Direct Gamma
44		Peekskill Gas Holder, 1.7 mi - NE	Air Particulate
44		Peekskill Gas Holder, 1.7 mi - NE	Radioiodine
44		Peekskill Gas Holder, 1.7 mi - NE	Fallout
**50	Wc2	Manitou inlet, 4.5 mi - NNW	*H.R. Shoreline
53	Wc1	White Beach, 0.9 mi - SW	*H.R. Shoreline
53	DR11	White Beach, 0.9 mi - SW	Direct Gamma
56	DR37	Verplanck, 1.3 mi - SSW	Direct Gamma
57	A3	Cortlandt Sanitation Garage 2 mi - N	Air Particulate
57	A3	Cortlandt Sanitation Garage 2 mi - N	Radioiodine
58	DR17	Route 9D Garrison 5 mi - N	Direct Gamma
	DR2	Old Pemart Ave 1.8 mi - NNE	Direct Gamma

**APPROVED**  
*SNSC Alice Hayes*  
 DATE 10/21/5/13/86  
 Rev 2

INDIAN POINT STATION - ENVIRONMENTAL SAMPLING STATION POINTS

Sample Station Points	RETS Desinations	Location/Distance	Sample Types
60	DR18	Gallows Hill Rd, 5 mi - NNE	Direct Gamma
61	DR36	Lower South St. & Bay St, 1.3 mi - NE	Direct Gamma
62	DR19	Westbrook Drive, 5 mi - NE	Direct Gamma
64	DR20	Pine Rd. Cortlandt, 4.8 mi - ENE	Direct Gamma
66	DR21	Croton Ave. Cortlandt, 5 mi - E	Direct Gamma
67	DR22	Colabaugh Pond Rd. Cortlandt, 5 mi - ESE	Direct Gamma
69	DR23	Mt. Airy Rd & Windsor Rd, 5 mi - SE	Direct Gamma
71	DR25	Warren Ave Haverstraw, 4.8 mi - S	Direct Gamma
72	DR26	Railroad Ave & Rt 9W Haverstraw, 4.6 mi - SSW	Direct Gamma
	DR27	Willow Grove Rd & Birch Dr. 5 mi - SW	Direct Gamma
74	DR12	Gays Hill Rd South, 1.5 mi - WSW	Direct Gamma
75	DR28	Palisades Pkwy South Lake Welch Exit, 5 mi - WSW	Direct Gamma
76	DR13	Gays Hill Rd North 1.2 mi - W	Direct Gamma
77	DR29	Palisades Pkwy South 1 mi from gas station, 4.2 mi - W	Direct Gamma
78	DR14	Rt 9W @ Pirates Cove Rest., 1.2 mi - WNW	Direct Gamma
79	DR30	Anthony Wayne Park Ent North, 4.5 mi - WNW	Direct Gamma
80	DR15	Rt 9W South of Ayers Rd, 1 mi - NW	Direct Gamma
81	DR31	Palisades Pkwy South, 4.7 mi - NW	Direct Gamma
	DR16	Ayers Rd, 0.9 mi - NNW	Direct Gamma
83	DR32	Rt 9W Fort Montgomery 4.8 mi - NNW	Direct Gamma

**APPROVED**  
 SNSC: *Alice Hayes*  
 DATE: *10/24/5/13/85*  
*Rev 2*

INDIAN POINT STATION - ENVIRONMENTAL SAMPLING STATION POINTS

Sample Station Points	RETS Designations	Location/Distance	Sample Types
**84	_____	Cold Spring, 10.8 mi - N	*H.R. Aquatic Vegetation
**84	_____	Cold Spring, 10.8 mi - N	*H.R. Shoreline Soil
**84	_____	Cold Spring, 10.8 mi - N	*H.R. Bottom Sediment Silt
85	_____	Quality Control,	Drinking Water
88	DR6	Sector 6 Reuter Stokes Pole, Broadway, Buchanan 0.5 mi - ESE	Direct Gamma
89	DR35	Highland Ave & Sprout Brook Rd, 3 mi - NNE	Direct Gamma
90	DR3	Charles Point, 0.8 mi - NE	Direct Gamma
91	A2	Burnwell Gas Co., 0.8 mi - ENE	Air Particulate
91	A2	Burnwell Gas Co., 0.8 mi - ENE	Radioiodine
91	_____	Burnwell Gas Co., 0.8 mi - ENE	Direct Gamma

\* H.R. Denotes Hudson River

\*\* Control Station

\_\_\_\_\_ Denotes sampling being done in addition to minimum requirements specified in the RETS & ODCM.

\* This station added to take the place of Standard Brands Station #2 which has been closed down.

**APPROVED**  
SNSC *Alice Hayes*  
DATE *10/21/86*  
*Rev 2*



SHIPMENT FINAL QA INSPECTION

1.0 PURPOSE

- 1.1 To assure that Consolidated Edison's Indian Point Unit 2 is in compliance with all applicable plant procedural and administrative guidelines, State and Federal Regulations, and Burial Site Criteria with regards to the Classification, Form, Packaging, Loading, Transportation, Transfer, and Disposal of Radioactive materials.
- 1.2 This procedure is applicable to all radioactive materials shipments and shall be the final quality control inspection providing supervisory verification of compliance prior to vehicle or cask closure and subsequent departure.
- 1.3 A Radwaste Supervisor, and a QA/QC Representative shall be responsible for performance of this procedure.

2.0 DISCUSSION

- 2.1 The procedures below should have been completed, for the specified shipment type, prior to performing this procedure:

2.1.1 For Shipments of Radwaste:

- a. Procedure EHS 4.103 10 CFR Part 61 Classification (Reference 7.7).
- b. Procedure EHS 4.101 Preparation of Radwaste For Shipment (Reference 7.2).
- c. Procedure EHS 4.104 Classification of Radioactive Materials (Reference 7.9).
- d. Procedure EHS 4.106 Shipment of Radwaste (Reference 7.4).
- e. Procedure EHS 4.004 Radioactive Materials Shipment Notifications (Reference 7.6).
- f. Procedure EHS 4.704 Removal and Solidification of Plant Filters (Reference 7.11).
- g. Procedure EHS 4.007 Process Control Program (Reference 7.12).
- h. Procedure EHS 4.201 Radioactive Plant and Portable Filter Changeout and Dewatering Procedure (Reference 7.13).

### 2.1.2 For Shipments of Non-Radwaste:

- a. Procedure EHS 4.100 Preparation of Non-Radwaste for Shipment (Reference 7.3).
- b. Procedure EHS 4.104 Classification of Radioactive Materials per 49 CFR (Reference 7.9).
- c. Procedure EHS 4.107 Shipment of Non-Radwaste (Reference 7.5).

2.2 A shipment number shall be assigned to each shipment by the Radwaste Supervisors.

2.3 A file shall be maintained by the Radwaste Supervisor for each shipment from the time it is identified until all documentation for the shipment has been completed and the shipment has been received at its destination. This file should be kept in the Radwaste office, and filed by shipment number.

2.4 Perform the Prerequisite Section of the Documentation Checklist (ATTACHMENT 8.1).

## 3.0 PRECAUTIONS AND LIMITATIONS

3.1 This procedure shall be performed by a Radwaste Supervisor and a QA/QC inspector. Data entered on its Attachment should be based on document inspection and field verifications.

## 4.0 EQUIPMENT AND MATERIAL

None

## 5.0 INSTRUCTIONS

### 5.1 Definitions

5.1.1 Container - is a drum, box, liner, or other vessel designed to contain processed radwaste for on-site storage but is not usually the "packaging" designed for shipment purposes.

5.1.2 Package - means the packaging together with its radioactive contents as presented for transport.

5.1.3 Packaging - means the assembly of components necessary to ensure compliance with the specifications of 49 CFR, 10 CFR 71, and the certificate of compliance, as applicable. It may consist of receptacles, absorbent materials,

spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shock. The vehicle, tie-down system, and auxiliary equipment may also be designated as part of the packaging.

## 5.2 Shipment Compliance Verification Record

- 5.2.1 Shipment inspections, checklists and survey results should be documented pursuant to ATTACHMENT 8.1 SHIPMENT COMPLIANCE VERIFICATION RECORD.
- 5.2.2 Shipment final inspection should be performed by a Radwaste Supervisor and QA/QC Inspector.
- 5.2.3 Shipment final inspection shall verify each of the four (4) major phases of any shipment are in compliance:
  - a. Documentation
  - b. Surveys
  - c. Packaging and Loading
  - d. Transfer and Shipment

The Shipment Compliance Verification Record is established to provide a functional checklist for each phase.

- 5.2.4 Items which are not applicable to a particular shipment should be checked "NA". Each item shall be checked or commented and all discrepancies shall be resolved prior to shipment.
- 5.2.5 Discrepancy resolutions shall be explained in the Compliance Resolution Section of the "Verification Record".
- 5.2.6 The Shipment Compliance Verification Record should have copies of the results of all analyses, data sheets, surveys, classifications, and documents associated with a shipment appended to it for record purposes.

## 5.3 Completion of Verification Record Cover Sheet (Attachment 8.1)

- 5.3.1 Enter the shipment number and date in Item 1 of the cover sheet.
- 5.3.2 Enter the consignee name address and phone number of contact person in Item 2.

- 5.3.3 In Item 3, enter brief description of the shipment contents.
- 5.3.4 In Item 4, check the type of shipment corresponding to the subsection completed in Section 2.1 of this procedure (i.e., Radwaste, Non-Radwaste).
- 5.3.5 Item 5, check the mode of transport.
- 5.3.6 Item 6, enter the Carrier's name, address and phone number of contact person.
- 5.3.7 In Item 7, if the shipment is by exclusive (sole) use check "YES" otherwise check "NO".
- 5.3.8 In Item 8 enter total number of containers in shipment package type, and container type.
- 5.3.9 Item 9, enter the weight (total of the contents of all containers from the shipping papers prepared in accordance with Reference 7.2 and either Reference 7.4 or Reference 7.5 as applicable.
- a. Enter Tractor Trailer weight (empty).
  - b. Enter the total package weight (contents + containers + package).
  - c. Enter the total overall weight of the shipment (trailer + tractor + payload).

NOTE:

This weight is used in conjunction with the limits of Item 10 to determine overweight conditions.

- 5.3.10 Item 10 enter the State and the Local limit requiring an overweight permit for all states to be transmitted which are lower than the national limit shown.
- 5.3.11 Item 11A, Compare Shipment weight to state and national limits.
- b. Verify permit is attached if overweight.

5.4 Prerequisite Documentation

This section was completed per Section 2.0, Discussion, of this procedure. The Radwaste Supervisor and QA/QC Inspector shall sign this section when complete.

## 5.5 Shipment Documentation

- 5.5.1 The Shipment Documentation Section of the "Verification Record" shall be completed during and/or following performance of Reference 7.4 or Reference 7.5 as applicable.
- 5.5.2 Check each item applicable to a shipment type (radwaste, or non-radwaste). Check "NA" when an item does not apply.
- 5.5.3 When required documentation and processing activities have been verified in the office or field as completed in accordance with the applicable procedures, the Radwaste Supervisor and QA/QC inspector shall sign and date the final page of the Shipment Documentation Section of the Shipment Compliance Verification Record.

## 5.6 Container Inspection

- 5.6.1 Verify each container to be shipped for burial has been labeled with the Part 61 class and the form and stability is determined pursuant to Reference 7.7 Reference 7.1.
- a. Check Item 1 of the Container Inspection Section of Attachment 8.1.
- 5.6.2 Verify the proper shipping name of the material being shipped has been determined in accordance with Reference 7.4 or Reference 7.5.
- a. Check Item 2 of the Container Inspection Section of Attachment 8.1.
- 5.6.3 The hazard class of the media being shipped has been determined per Reference 7.4 or Reference 7.5.
- a. Check Item 3 of the Container Inspection section of Attachment 8.1.
- 5.6.4 The USDOT shipping classification (LSA Type A etc.) has been determined pursuant to Reference 7.9 or Reference 7.3.
- a. Check Item 4 of the Container Inspection section of Attachment 8.1.
- 5.6.5 All containers have been surveyed for radiation and loose surface contamination levels prior to being loaded on the transport vehicle. Separate survey data sheets Attachment 8.3 shall be used

for each container and attached to this Inspection Record. (For multi container shipments use page 3 of Attachment 8.3).

a. Check Item 5 of the Container Inventory section of Attachment 8.1.

5.6.6 Verify Survey Instruments used were properly calibrated and surveillance tested prior to use as per approved EHS Procedures.

a. Check Item 6 of the Container Inventory section of Attachment 8.1.

5.6.7 The Radwaste Supervisor and QA/QC Inspector shall review and sign with the date and time Item 7 of the container Inspection section of Attachment 8.1.

## 5.7 Vehicle Inspection

5.7.1 Perform incoming vehicle inspection as per Attachment 8.1 Vehicle Inspection Data Sheet Section B prior to the vehicle entering the protected area.

5.7.2 The Vehicle Inspection Data Sheet Section of Attachment 8.1 of this procedure shall be completed for all shipments involving radioactive material or radioactive waste.

5.7.3 Enter the shipment number and date of inspection at the top of each page of this section.

5.7.4 Complete the "Driver Data" Section A by recording the:

- a. Driver's Name
- b. Driver's License Number and State
- c. Check whether drivers physical condition and training appears satisfactory.

5.7.5 Complete the "Vehicle Safety" Section C of this vehicle inspection checking each item noted.

5.7.6 After loading is completed, perform the items indicated in Part D. "Final Vehicle Checks".

5.7.7 Resolve all applicable items of non-compliance recording such resolution in the Compliance Resolution Section of Attachment 8.1.

## 5.8 Records and File

- 5.8.1 Attach all survey data sheets, evaluation, calculation, analyses, etc., related to this shipment, to Attachment 8.1.
- 5.8.2 All photographs of containers and vehicles shall be attached to this record with the appropriate container and/or vehicle inspection data sheets.
- 5.8.3 Completed Attachment 8.5 by Radwaste Supervisor

#### 5.9 ALARA Compliance

- 5.9.1 Packages and Vehicles marked, labeled and/or placarded pursuant to 49 CFR, 10 CFR 71, 10 CFR 61, etc., DO NOT meet posting and labeling requirements of Reference 7.15 and Reference 7.16 while temporarily stored, parked, or otherwise present on site. The additional barrier rope, posting, labeling, and surveying as may be required shall be performed pursuant to applicable policies and procedures.

#### 5.10 Vehicle Departure

- 5.10.1 The vehicle used in shipment of radioactive materials shall not be released from Indian Point 2 until approved by the Radwaste Supervisor and a QA/QC representative completing this inspection.

#### 5.11 QA/QC Notification

The Radwaste Supervisors or designated alternate shall notify QA/QC to afford them the opportunity to perform surveillance of receipt inspection, dewatering, Wastetrak verifications and solidifications. Also a QA Engineer shall review Vendor Process Control Programs. Notification to QA/QC shall be documented an Attachment 8.1, QA/QC Notification Acknowledgement Record.

### 6.0 ACCEPTANCE CRITERIA

Acceptable performance of this procedure requires completion of all prerequisite procedures and Attachment 8.1 of this procedure.

- a. Prerequisites completed.
- b. Attachment 8.1 completed and all items of non-compliance have been satisfactorily resolved.
- c. All required documentation per Section 5.8 have been attached to the Shipment Compliance Verification Record.

### 7.0 REFERENCES

- 7.1 EHS 4.010, "Wastetrak Program Operation"

- 7.2 EHS 4.101, "Preparation of Radwaste for Shipment"
- 7.3 EHS 4.100, "Preparation of Non-Radwaste for Shipment"
- 7.4 EHS 4.106, "Shipment of Radwaste"
- 7.5 EHS 4.107, "Shipment of Non-Radwaste"
- 7.6 EHS 4.004, "Radioactive Materials Shipment Notifications"
- 7.7 EHS 4.103, "10 CFR Part 61 Radwaste Classification"
- 7.8 EHS 4.002, "Completion of Radwaste Shipping Manifests"
- 7.9 EHS 4.104, "Classification of Radioactive Materials"
- 7.10 EHS 4.105, "Receipt and Survey of Radioactive Materials"
- 7.11 EHS 4.704, "Removal and Solidification of Plant Filters"
- 7.12 EHS 4.007, "Process Control Program"
- 7.13 EHS 4.201, "Radioactive Plant and Portable Filter Changeout"
- 7.14 EHS 4.303, "Shipping Cask Handling Procedure"
- 7.15 EHS 3.001, "Radiological Posting Requirements"
- 7.16 10 CFR 20
- 7.17 10 CFR 71
- 7.18 10 CFR 61
- 7.19 49 CFR

8.0 ATTACHMENTS

- 8.1 Form EHS-4.000-1, Shipment Compliance Verification Record
- 8.2 Form EHS-4.000-2, Vehicle Survey Data Sheet
- 8.3 Form EHS-4.000-3, Container/Package Survey Data Sheet
- 8.4 Form EHS-4.000-4, Breakdown of Isotopes and Activity with less than 5 year T- $\frac{1}{2}$  and greater than 5 year T- $\frac{1}{2}$  life
- 8.5 Form EHS-Q-4.000-5, Radioactive Shipment Paper and Certification

9.0 ADDENDUM  
None

ATTACHMENT 8.1

Page 1 of 16

SHIPMENT COMPLIANCE VERIFICATION RECORD

COVER SHEET

1. Shipment Number \_\_\_\_\_ Date \_\_\_\_\_

2. Consignee \_\_\_\_\_

Phone: \_\_\_\_\_

3. Shipment Description \_\_\_\_\_

4. Type of Shipment

RADWASTE

NON-RADWASTE

5. Mode of Transport

HIGHWAY

RAIL

AIRCRAFT

6. Carrier Name and  
Address: \_\_\_\_\_

Phone: \_\_\_\_\_

7. Exclusive Use: YES  NO

8. Total Number Containers Shipped: \_\_\_\_\_ Package Type: \_\_\_\_\_  
Container Type: \_\_\_\_\_

9. Shipment A. Tractor & Trailer (Empty) \_\_\_\_\_ lbs.  
B. Package Weight \_\_\_\_\_ lbs.  
C. Total Weight \_\_\_\_\_ lbs.

10. This shipment (is, is not) overweight for ANY State to be transited.

STATE

LIMIT

(NATIONAL)

80,000 Lbs.

11A. Overweight permit required for any vehicle exceeding weight limit shown in item 10.

( ) YES ( ) NO

B. Permit attached.

( ) YES ( ) NO

ATTACHMENT 8.1

Page 2 of 16

SHIPMENT COMPLIANCE VERIFICATION RECORD

PREREQUISITE DOCUMENTATION

1. Indian Point 2 possesses written verification that the consignee has a valid license to (eg. copy of licence) receive the type, quantity, and form of radionuclides being shipped, or  
NO ( ) YES ( ) NA ( )
  - a. Pending written receipt, Indian Point 2 has obtained telephone verification of a valid license as appropriate for this shipment, or  
NO ( ) YES ( ) NA ( )
  - b. This shipment contains only license exempt quantities of radionuclides being transferred under a general license. (verified by shipment documentation)  
NO ( ) YES ( ) NA ( )
2. Indian Point 2 possesses a current copy of the specification documentation (eg C of C) for any USDOT specification container used as packaging in this shipment.  
NO ( ) YES ( ) NA ( )
3. For shipments of Radwaste the to Barnwell Waste Management Facility, South Carolina:
  - a. Indian Point 2 possesses a valid South Carolina Waste Transport Permit  
NO ( ) YES ( ) NA ( )
  - b. Indian Point 2 possesses a current volume allocation number. (prior notification form)  
NO ( ) YES ( ) NA ( )
  - c. Prior notification has been provided to the State of South Carolina, and to CNSI, 72 hours prior to this shipments entry into South Carolina. (Prior notification form)  
NO ( ) YES ( ) NA ( )
  - d. Telephone verification of prior notification complete (This step to be performed by the Radwaste Supervisor only).  
NO ( ) YES ( ) NA ( )
  - e. Indian Point 2 possesses a current copy of the Barnwell Facility By products Materials Licenses; State License No. 097 and USNRC License 12-13536-01, as amended.  
NO ( ) YES ( ) NA ( )

ATTACHMENT 8.1

Page 3 of 16

SHIPMENT COMPLIANCE VERIFICATION RECORD  
PREREQUISITE DOCUMENTATION

- f. Indian Point 2 possess a current copy of the Barnwell Facility Burial Criteria, as revised. NO ( ) YES ( ) NA ( )
- g. Indian Point possesses a current copy of the Barnwell Facility Shipment Manifest Form. NO ( ) YES ( ) NA ( )
- h. Indian Point possesses a current copy of the Barnwell Radioactive Waste Certification Form and the Class "C" Waste Classification Record. NO ( ) YES ( ) NA ( )
4. For shipments of RADWASTE to Richland Facility, Washington:
- a. Indian Point 2 possesses a current Site Use Permit from the State of Washington. NO ( ) YES ( ) NA ( )
- b. IP #2 possesses a current copy of the Radioactive Materials License for the Richland facility. NO ( ) YES ( ) NA ( )
- c. Prior notification has been provided to the State of Washington and to Richland Facility. (Prior notification form) NO ( ) YES ( ) NA ( )
- d. Telephone verification of prior notification complete (by RW Supv.) NO ( ) YES ( ) NA ( )
- e. Indian Point possesses current copy of the U.S. Ecology Manifest form. NO ( ) YES ( ) NA ( )
5. For Shipments in USNRC Certified or Licensed Packaging (Casks):
- a. Indian Point 2 possesses a controlled, updated Certificate of Compliance (C of C) for this Cask, NO ( ) YES ( ) NA ( )
- C of C No. \_\_\_\_\_
6. Indian Point 2 has provided written 7 day advanced notice to the Governor's office of each state to be transited when the criteria of EHS 4.004 (Reference 7.6) is met. (Postal Receipt, letters to Governor) NO ( ) YES ( ) NA ( )

ATTACHMENT 8.1

Page 4 of 16

SHIPMENT COMPLIANCE VERIFICATION RECORD  
PREREQUISITE DOCUMENTATION

7. Transport vehicle has been surveyed for Radiation and Contamination limits in accordance with EHS 4.105 (Ref. 7.10) prior to entering the R.C.A. and limits meets the contamination and radiation limits in EHS 4.105.

NO ( ) YES ( ) NA ( )

All prerequisite documentation required above is complete and in compliance with regulations and/or criteria pursuant to Indian Point 2 Shipping Program Procedures and Policy. Items of non-compliance have been resolved and recorded on compliance resolution section of this procedure.

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RADWASTE SUPERVISOR

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QUALITY CONTROL

SHIPMENT COMPLIANCE VERIFICATION RECORD

SHIPMENT DOCUMENTATION

1. Completed Bill of Lading NO ( ) YES ( ) NA ( )
  - a. Number of packages.
  - b. Classification of radioactive material.
  - c. Description of material.
  - d. Hazardous material DOT identification number.
  - e. Chemical and physical form.
  - f. Predominant Isotopes.
  - g. A2 Value.
  - h. Transport Index.
  - i. Total Curies.
  - j. "Sole Use Vehicle Only."
  - k. Placarded "Radioactive."
  
2. Completed the Radioactive Waste Shipment Certification Form (DHEC-803) for Shipment to Barnwell Facility as per EHS 4.004 (Reference 7.6). NO ( ) YES ( ) NA ( )
  
3. Completed the Low-Level Radioactive Waste Shipment Certification Form (RHF-31A) for Shipment to Richland Facility as per EHS 4.004 (Reference 7.6). NO ( ) YES ( ) NA ( )
  
4. Cask Documentation and Inspection sheet for applicable cask completed as per EHS 4.303 (Reference 7.14). NO ( ) YES ( ) NA ( )
  
5. For shipments of Pressure Vessels, High Integrity Containers, or Dewatered Resins to the Barnwell Facility, verify the following as applicable.
  - a. A dewatering Completion Record has been completed which certifies free-standing water to be:
    - (1) Less than 0.5% for Carbon Steel Liners. NO ( ) YES ( ) NA ( )  
(As per C of C for applicable liner, Check List).
  
    - (2) Less than 1.0% for High Integrity Containers less than 195 ft<sup>3</sup> (As per CNSI FO-OP-023, Check List) NO ( ) YES ( ) NA ( )

ATTACHMENT 8.1

Page 6 of 16

SHIPMENT COMPLIANCE VERIFICATION RECORD

SHIPMENT DOCUMENTATION

- (3) Less than 0.5% for 24 inch pressure vessels containing activated carbon. (FO-OP-001, Check List) NO ( ) YES ( ) NA ( )
- (4) Less than 0.5% for 24 inch pressure vessels containing resins. (FO-OP-004, Check List) NO ( ) YES ( ) NA ( )
- b. Certification Statement for Disposal of High Integrity Container. NO ( ) YES ( ) NA ( )
- c. Certification Statement for Disposal of FRP High Integrity Container. NO ( ) YES ( ) NA ( )
- d. Certification Statement for DHEC-HIC-PL-001 (General). NO ( ) YES ( ) NA ( )
- e. Certification Statement for DHEC-HIC-FRP-003 (General). NO ( ) YES ( ) NA ( )
- f. Users check list for HIC completed (FO-AD-002). NO ( ) YES ( ) NA ( )
- g. Users check list for FRP HIC completed (FO-AD-002). NO ( ) YES ( ) NA ( )
- h. QA/QC had performed HIC container surveillance and has provided a copy for the shipment file. NO ( ) YES ( ) NA ( )
- i. QA/QC has performed surveillance of dewatering activities for container(s) in this shipment and has provided a copy for the shipment file. NO ( ) YES ( ) NA ( )
- j. For Resin, Charcoal, or Filter Cartridges, a copy of the Radiomuclide Analytical Data is attached to the Shipping papers. NO ( ) YES ( ) NA ( )

NOTE:

Items k and l below apply only to radiomuclides with half-lives greater than 5 years Attachment 8.4.

- k. If the waste is unsolidified, the activity within a carbon steel vessel does not exceed 1 uCi/cc average over the volume of the media being shipped. NO ( ) YES ( ) NA ( )

ATTACHEMENT 8.1

SHIPMENT COMPLIANCE VERIFICATION RECORD  
SHIPMENT DOCUMENTATION

- 1. For shipments in High Integrity Containers, dewatered resin activity does not exceed 350 uCi/cc averaged over the volume of the resin being shipped. NO ( ) YES ( ) NA ( )
  
- m. For shipments of solidified waste in carbon steel liners. The final waste product is a uniform monolith with no free standing water and resists penetration with a 1" diameter wooden dowel. NO ( ) YES ( ) NA ( )
  
- n. The process control program checklist for solidified waste is completed and signed by a Supervisor and a QA/QC inspector per EHS-SQ-4.007 (Reference 7.12) NO ( ) YES ( ) NA ( )
  
- o. QA/QC has performed a surveillance of a process control program sample solidification and the solidification of the carbon steel liner. A copy of this surveillance shall be provided to Radwaste for the shipment file. NO ( ) YES ( ) NA ( )
  
- 6. For Radwaste shipments, Part 61 Classification Documentation has been completed in accordance with EHS 4.103.(Reference 7.7) or 4.010 (Reference 7.1) NO ( ) YES ( ) NA ( )
  
- 7. Radwaste has performed a check of WASTETRAK output (EHS 4.010, Reference 7.1) and a QA/QC Inspector has been provided with an opportunity to do a surveillance of WASTETRAK operations. NO ( ) YES ( ) NA ( )
  
- 8. For Radwaste shipments to Barnwell Facility, the Radioactive Shipment Manifest (RSM) has been completed in accordance with EHS 4.002.(Reference 7.8) NO ( ) YES ( ) NA ( )
  
- 9. For Radwaste shipments to Richland Facility, the Radioactive Waste Shipment and Disposal Manifest (RSDM) has been completed per EHS 4.002.(Reference 7.8) NO ( ) YES ( ) NA ( )
  
- 10. Radioactive shipment paper & certification completed as per Attachment 8.5. NO ( ) YES ( ) NA ( )
  
- 11. For Radioactive Materials Shipments other than radwaste, a Bill of Lading has been prepared pursuant to 4.107.(Reference 7.5) NO ( ) YES ( ) NA ( )

ATTACHMENT 8.1

Page 8 of 16

SHIPMENT COMPLIANCE VERIFICATION RECORD  
SHIPMENT DOCUMENTATION

12. For shipments of Radioactive Materials by Air, 2 copies of the IATA Shipper's Declaration for Dangerous goods has been prepared. NO ( ) YES ( ) NA ( )

13. For highway exclusive use shipments of radioactive materials, written instructions to the driver have been provided which include:

a. Special handling instructions. NO ( ) YES ( ) NA ( )

b. Instructions in case of accident. NO ( ) YES ( ) NA ( )

c. Tractor Trailer configuration precautions. NO ( ) YES ( ) NA ( )

d. Transfer and Storage instructions. NO ( ) YES ( ) NA ( )

14. For highway, exclusive use shipments, driver has been provided route instructions from site to destination, including precautions on route modifications. NO ( ) YES ( ) NA ( )

All shipment documentation required by 49 CFR; 10 CFR Parts 10, 30, 61, 71; Consignee's License; and Package User Requirements (Certificate of Compliance) have been performed pursuant to Indian Point 2 Shipping Program Procedures and policy. Items of non-compliance have been resolved and noted in the compliance resolution section of this procedure.

\_\_\_\_\_  
Radwaste Supervisor

\_\_\_\_\_  
QA Inspector

\_\_\_\_\_  
Time/Date

\_\_\_\_\_  
Time/Date

SHIPMENT COMPLIANCE VERIFICATION RECORD

CONTAINER INSPECTION

Shipment No.: \_\_\_\_\_

Container No.: \_\_\_\_\_

1. Each container of radwaste is properly labeled and the stability class recorded. NO ( ) YES ( ) NA ( )
2. The proper shipping name of the media being shipped has been determined and noted on the shipping document and container. NO ( ) YES ( ) NA ( )
3. The hazard class of the media being shipped has been determined and noted on the shipping document and container. NO ( ) YES ( ) NA ( )
4. The USDOT shipping classification (LSA, Type A, etc.) has been determined and noted on the shipping document and container. NO ( ) YES ( ) NA ( )
5. This container has been surveyed for radiation and loose surface contamination and has been recorded on Attachment 8.3. NO ( ) YES ( ) NA ( )
6. Survey instruments used were calibrated and surveillance tested prior to use. NO ( ) YES ( ) NA ( )

This container complies with the requirements of 49 CFR, 10 CFR 71, and Burial Facility Criteria as specified in references listed in Section 7.0. Discrepancies have been resolved and recorded on the Compliance Resolution section of this procedure.

\_\_\_\_\_  
Radwaste Supervisor

\_\_\_\_\_  
QA Inspector

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

SHIPMENT COMPLIANCE VERIFICATION RECORD

VEHICLE INSPECTION DATA SHEET

SHIPMENT NO: \_\_\_\_\_

DATE: \_\_\_\_\_

A. Driver Data

1. Name: \_\_\_\_\_

2. Lic. No.: \_\_\_\_\_ STATE: \_\_\_\_\_

3. Fitness/Training SAT ( ) UNSAT ( )

B. Receipt of Vehicle

1. Structural damage to package exterior SAT ( ) UNSAT ( ) NA

2. Structural damage to package tie downs SAT ( ) UNSAT ( ) NA

3. Missing or loose bolts in tie down assembly SAT ( ) UNSAT ( ) NA

4. All lid/cover hold down hardware in place SAT ( ) UNSAT ( ) NA

5. General Inspection of Cask & Trailer for damage  
Broken lights, flat tires, obvious frame  
cracks SAT ( ) UNSAT ( ) NA

C. Vehicle Safety

1. Tire Tread:

a. No Recaps on Front SAT ( ) UNSAT ( )

b. 4/32 on Front and Spare SAT ( ) UNSAT ( )

c. 2/32 on all others SAT ( ) UNSAT ( )

d. Tires Properly Inflated SAT ( ) UNSAT ( )

2. Brakes:

a. Service SAT ( ) UNSAT ( )

b. Connections to Trailer SAT ( ) UNSAT ( )

c. Parking SAT ( ) UNSAT ( )

d. Air Pressure SAT ( ) UNSAT ( )

3. Parking Brake:

a. Parking Brake Operable SAT ( ) UNSAT ( )

b. Set during loading operations SAT ( ) UNSAT ( )

SHIPMENT COMPLIANCE VERIFICATION RECORD

VEHICLE INSPECTION DATA SHEET

SHIPMENT NO: \_\_\_\_\_

DATE: \_\_\_\_\_

- |  |         |                  |
|--|---------|------------------|
| 4. Steering Mechanism Demonstrated Operable  | SAT ( ) | UNSAT ( )        |
| 5. Turn Signals:   |         |                  |
| a. Front Tractor   | SAT ( ) | UNSAT ( )        |
| b. Rear Tractor  | SAT ( ) | UNSAT ( )        |
| c. Rear Trailer  | SAT ( ) | UNSAT ( )        |
| 6. Other Lights and Reflectors<br>(including Head and Tail Lights)   | SAT ( ) | UNSAT ( )        |
| 7. Horn  | SAT ( ) | UNSAT ( )        |
| 8. Fire Extinguisher<br>(Greater than or Equal to 10 BC)   | SAT ( ) | UNSAT ( )        |
| 9. Windshield Wipers   | SAT ( ) | UNSAT ( )        |
| 10. Rear View Mirrors  | SAT ( ) | UNSAT ( )        |
| 11. Trailer/Tractor Coupling<br>(Driver shall apply trailer<br>brakes and load test the fifth<br>wheel pin). | SAT ( ) | UNSAT ( )        |
| 12. Trailer Frame Crack Insp.  | SAT ( ) | UNSAT ( )        |
| 13. Cask and/or External Tie-Down System   | SAT ( ) | UNSAT ( )        |
| 14. All Non-Fixed Lifting Devices are Removed  | SAT ( ) | UNSAT ( )        |
| 15. Load has been properly placed and bracing<br>is installed  | SAT ( ) | UNSAT ( )        |
| 16. Driver provided written<br>Emergency Instructions  | YES ( ) | NO ( )    NA ( ) |
| 17. Evidence of driver daily log   | YES ( ) | NO ( )    NA ( ) |
| D. <u>Vehicle Final Checks</u>   |         |                  |
| 1. Placarding is placed on front, back, and  |         |                  |

SHIPMENT COMPLIANCE VERIFICATION RECORD

VEHICLE INSPECTION DATA SHEET

SHIPMENT NO: \_\_\_\_\_

DATE: \_\_\_\_\_

both sides of trailer and in front of the tractor. (verify that placarding complies with the bill of lading description) YES ( ) NO ( ) NA ( )

NOTE:

Placarding the front of the Trailer is optional.

2. Emergency Kit Provisions checked (Rad. Rope, ANTI-C's, Signs, etc.) SAT ( ) UNSAT ( )
3. Trailer load inspection completed and trailer doors secured with locking device (seal). YES ( ) NO ( ) NA ( )
4. Copies of all container and vehicle survey data sheets are attached to this inspection report. YES ( ) NO ( ) NA ( )
5. All vehicle external loose contamination surveys have been completed and limits are within those specified in Attachment 8.2 of this procedure. All vehicle external radiation surveys have been completed and limits are within those specified in Attachment 8.2.

Contamination

- a. Alpha - less than 20 dpm 100/cm<sup>2</sup> YES ( ) NO ( ) NA ( )
- b. Beta-gamma - less than 1000dpm 100/cm<sup>2</sup> YES ( ) NO ( ) NA ( )

Radiation Level Limits

- a. At 2 Meters from vehicle YES ( ) NO ( ) NA ( )
- b. Contact with vehicle including under carriage YES ( ) NO ( ) NA ( )
- c. Cab limit YES ( ) NO ( ) NA ( )
- d. Package limits YES ( ) NO ( ) NA ( )
6. Photographs made of all sides of vehicle and labeled with shipment number, date and time. YES ( ) NO ( ) NA ( )
7. Driver provided with written exclusive use vehicle maintenance instructions. YES ( ) NO ( ) NA ( )

SHIPMENT COMPLIANCE VERIFICATION RECORD  
VEHICLE INSPECTION

SHIPMENT NO: \_\_\_\_\_ DATE: \_\_\_\_\_

8. Driver provided copies of shipping papers,  
waste manifest, bill of lading, and other  
applicable shipping documents.

YES ( ) NO ( ) NA ( )

This vehicle is certified to be in compliance with applicable USDOT/USNRC requirements for shipping radioactive materials. Compliance has been verified through document inspection and field checks. Items of ~~Non~~-Compliance were resolved as indicated on the Compliance Resolution Sheet of this Procedure.

_____ DRIVER	_____ RADWASTE SUPERVISOR	_____ Q.C. INSPECTOR
_____ TIME/DATE	_____ TIME/DATE	_____ TIME/DATE

SHIPMENT COMPLIANCE VERIFICATION RECORD

COMPLIANCE RESOLUTION AND COMMENTS

SHIPMENT NO: \_\_\_\_\_

DATE: \_\_\_\_\_

A. Items of Non-Compliance - Resolution: (If none mark, none and sign.)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

B. Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

QA \_\_\_\_\_ / DATE

RW \_\_\_\_\_ / DATE

ATTACHMENT 8.1  
Page 15 of 16  
INDIAN POINT UNIT 2  
QA/QC NOTIFICATION ACKNOWLEDGEMENT RECORD

1. EHS-SQ-4.200 Operation and Dewatering of CNSI Mobile  
Demineralization System.

1.1 The Radwaste Supervisor has notified QA/QC of the arrival on site of HIC/FRP to be used for waste processing.

\_\_\_\_\_/\_\_\_\_\_  
QA/QC Inspector Date

1.2 The Radwaste Supervisor/CNSI operator has notified QA/QC of the intent to begin dewatering operations.

\_\_\_\_\_/\_\_\_\_\_  
QA/QC Inspector Date

2. EHS-SQ-4.010 Rev. 0 Wastetrak Program Operation

2.1 The Radwaste Supervisor has notified QA/QC of the intention to perform hand/computer based calculations to verify the WASTETRAK Program.

\_\_\_\_\_/\_\_\_\_\_  
QA/QC Inspector Date

3. EHS-SQ-4.007 Rev. 1 Process Control Program

3.1 The Radwaste Supervisor and a QA Engineer have reviewed the vendors Process Control Program and have completed Attachment 8.1 Checklist for Vendor Process Control Program.

\_\_\_\_\_/\_\_\_\_\_  
QA/QC Inspector Date

4. EHS-SQ-4.704 Removal and Solidification of Plant Filters

4.1 The Radwaste Supervisor has notified QA/QC to allow them an opportunity to perform solidification surveillance.

\_\_\_\_\_/\_\_\_\_\_  
QA/QC Inspector Date

ATTACHMENT 8.1

Page 16 of 16

INDIAN POINT UNIT 2

QA/QC NOTIFICATION ACKNOWLEDGEMENT RECORD

5. EHS-SQ-4.201 Radioactive Plant and Portable Filter Changeout  
and Dewatering

5.1 The Radwaste Supervisor has notified QA/QC to afford them the opportunity to perform a receipt inspection on any HIC to be dewatered.

\_\_\_\_\_  
QA/QC Inspector

\_\_\_\_\_  
Date

5.2 The Radwaste Supervisor has notified QA/QC to afford them the opportunity to perform a dewatering surveillance.

\_\_\_\_\_  
QA/QC Inspector

\_\_\_\_\_  
Date

ATTACHMENT 8.2  
Page 1 of 3  
INDIAN POINT UNIT 2  
VEHICLE SURVEY DATA SHEET

SHIPMENT NO: \_\_\_\_\_ DATE: \_\_\_\_\_

A. Carrier Data

1. Name _____	2. Vehicle No. _____
3. Trailer No. _____	4. License No. _____
5. Cask No. _____	6. State _____

B. Vehicle Survey

1. Purpose of Survey:

Vehicle Arrival ( )	Vehicle Release ( )
Detailed ( )	
2 Meters ( )	Contact ( ) Cab ( )
Undercarriage ( )	Internals Empty ( )
Cask Exterior ( )	

C. Survey Results

(MREM/HR)

2 Meter: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Cab: \_\_\_\_\_

(Vehicle Sketch)

NO.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

0 = Swipe Locations

ATTACHMENT 8.2  
Page 2 of 3  
INDIAN POINT UNIT 2  
VEHICLE SURVEY DATA SHEET

SHIPMENT NO: \_\_\_\_\_ DATE: \_\_\_\_\_

---

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D. Instrumentation data

<u>Model Number</u>	<u>Serial Number</u>	<u>Calib. Date</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

E. Survey Evaluation

(Radiation, Contamination both) results are in compliance with (Site, USDOT, both) limits. This vehicle is recommended for (Receipt/Release/Decon).

Performed By: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Reviewed By: \_\_\_\_\_ Date/Time: \_\_\_\_\_

F. Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ATTACHMENT 8.2

Page 3 of 3

RADIOACTIVE MATERIALS PACKAGES  
MAXIMUM RADIATION AND CONTAMINATION LEVEL LIMITATIONS  
(SEE SECTIONS 173.441 (a) AND (b) SEE CASK CNS 8-120  
CERTIFICATE OF COMPLIANCE FOR LIMIT "E" BELOW

I. Radiation Levels

Radiation Level Dose Rate at any point on the external surface of any package of R.A.M. may not exceed:

- A. 200 Millirem per hour.
- B. 10 millirem per hour at one meter\* Transport Index may not exceed 10).

Unless the packages are transported in an "Exclusive Use" closed transport vehicle (aircraft prohibited) - then the maximum radiation levels may be:

- A. 1000 millirem per hour on the accessible external package surface.
- B. 200 millirem per hour at any point on the outer surface of the vehicle.\*\*\*
- C. 10 millirem per hour at two meters\*\* from external surface of the vehicle.\*\*\*\*
- D. 2 millirem per hour in any position of the vehicle which is occupied by a person.\*\*\*\*\*
- E. 125 millirem at 3 feet from the surface of a CNS 8-120 cask.

II. Contamination Levels

- A. When shipped in a shielded cask, all external surfaces of any container shall be less than 40,000 dpm/100cm<sup>2</sup> beta gamma or 220 dpm/100cm<sup>2</sup> alpha.
- B. When shipped by other than a shielded cask, all external surfaces of any container shall be less than 1,000 dpm/100cm<sup>2</sup> beta gamma and 20 dpm/100cm<sup>2</sup> alpha.

\* 3.3 feet

\*\* 6.6 feet

\*\*\* The external surface includes the top and underside of the vehicle. For a flatbed, external surface means at any point on the vertical planes projected from other edge of the truck and on the upper surface of the load or enclosure (if used).

\*\*\*\* Excluding the top and underside of the vehicle.

\*\*\*\*\* Doesn't apply to private carriers w/dosimetry who operate under State or Federal regulated radiation protected program.



ATTACHMENT 8.3  
Page 2 of 3  
INDIAN POINT UNIT 2

CONTAINER/PACKAGE SURVEY DATA SHEET

SHIPMENT NO: \_\_\_\_\_

DATE: \_\_\_\_\_

A.	B.	C.
<u>Survey Results</u> (MREM/HR)	<u>Survey Results</u> (DMP/100cm <sup>2</sup> )	Instrument DATA
1 Meter: _____	Alpha _____	Type _____
Contact: _____	Beta _____	Ser # _____
Contents: _____	Gamma _____	Calibration Date _____

D. Evaluation

(Radiation, Contamination both) results are in compliance with (Site, USDOT, both) limits. This (Container, Package) is recommended for (Receipt/Shipment, Decon.).

Performed By: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Reviewed By: \_\_\_\_\_ Date/Time: \_\_\_\_\_

E. Comments:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



BREAKDOWN OF ISOTOPES AND ACTIVITY 5 YEAR T-1/2 AND 5 YEAR T-1/2

SHIPMENT NO. \_\_\_\_\_ ACTIVITY DETERMINED \_\_\_\_\_  
DECAY CORRECTED \_\_\_\_\_

\* NP-Not Present

ISOTOPES 5 YEAR HALF-LIFE

131 I	uCi/cc	140 La	uCi/cc
54 Mn	uCi/cc	125 Sb	uCi/cc
134 Cs	uCi/cc	124 Sb	uCi/cc
58 Co	uCi/cc	51 Cr	uCi/cc
242 Cm	uCi/cc		uCi/cc
187 W	uCi/cc		uCi/cc
65 Ni	uCi/cc		uCi/cc
55 Ni	uCi/cc		uCi/cc
59 Fe	uCi/cc		uCi/cc
144 Ce	uCi/cc		uCi/cc

Total of Isotopes \_\_\_\_\_ uCi/cc

ISOTOPES 5 YEAR HALF-LIFE

137 Cs	uCi/cc	90 Sr	uCi/cc
60 Co	uCi/cc	241 Pu	uCi/cc
3 H	uCi/cc	243 Cm	uCi/cc
14 O	uCi/cc	99 Tc	uCi/cc
63 Ni	uCi/cc	129 I	uCi/cc
238 Pu	uCi/cc	244 Cm	uCi/cc
239 Pu	uCi/cc	241 Am	uCi/cc
240 Pu	uCi/cc	242 Pu	uCi/cc

Total of Isotopes \_\_\_\_\_ uCi/cc

Radwaste Supervisor \_\_\_\_\_

RADIOACTIVE SHIPMENT PAPER AND CERTIFICATION

Date: \_\_\_\_\_

FROM: _____	SHIPMENT NO: _____
TO: _____	DEPT. SHIPPING: _____
ATTENTION OF: _____	TYPE OF CARRIER: _____
	RECIPIENT'S LICENSE NO: * _____
	EXPIRATION DATE: _____

SPECIAL PHONE #s @ (212) 460-3267 @ (914) 526-5294 @ (914) 526-5039

Description of Article and Weight: Radioactive Materials, \_\_\_\_\_

Weight \_\_\_\_\_ lbs.

Isotopic Identification: _____	Fields on Contact: Pkg. _____
Curie Amount: _____	Fields 1 meter From Pkg. _____
Physical Form: _____	Fields @ side of Veh. _____
Vehicle Placard: _____	Fields @ 2 meters from sides of _____
Normal or Special Form: _____	vehicle: _____
Quantity Category: _____	Fields at Back of Cab: _____
Packaging Category: * _____	Pkg. Surface Contam.: _____
Labeling Attached: _____	Vehicle Surface Contam: _____

Surveyor: \_\_\_\_\_

Description Type of Transportation: \_\_\_\_\_ APPROVED FOR SHIPMENT

* If cask is used: Type _____	Radwaste Supervisor: _____
License # _____ Company _____	
Lic. Exp. Date _____	
Model No. _____ Lic. on File _____	

Certification: This is to certify that the above named article(s) is properly classified, described, packaged, marked and labeled and is in proper condition for transportation, according to the applicable regulations of the Department of Transportation.

\_\_\_\_\_  
Radwaste Supervisor

PROCESS CONTROL PROGRAM

Prepared by: Christopher English Technical Reviewer: Not required per EHS-4  
Reviewer: Robert H. Stronum 7/25/86 Reviewer: Thomas Glumac  
Reviewer: \_\_\_\_\_ Reviewer: \_\_\_\_\_  
Reviewer: \_\_\_\_\_ Reviewer: \_\_\_\_\_  
SNSC Review Not required per EHS-7.002  
Meeting No. \_\_\_\_\_ /Date \_\_\_\_\_  
EH&S General Manager Approval Michael L. Miele 8/5/86  
Effective/Date

Temporary Procedure Changes:

Change No.	Date	Change No.	Date	Change No.	Date
------------	------	------------	------	------------	------

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UP TO DATE

VERIFIED COPY

ON No.	<u>192 Aug 86</u>
DATE	
BY	<u>[Signature]</u>
SIGNATURE	

CONTROLLED COPY

QUALITY ASSURANCE PROGRAM DOCUMENT

When Stamped in Red

## PROCESS CONTROL PROGRAM

### 1.0 PURPOSE

- 1.1 The purpose of the Process Control Program (PCP) is to provide reasonable assurance of the complete solidification of processed radioactive wastes and of the absence of free standing water in the processed wastes prior to shipment offsite and subsequent burial.

### 2.0 DISCUSSION

The Indian Point II Station currently uses contractor solidification services for process waste such as filters, sludges, plant resin and water clean-up resins. In order to assure that such wastes are completely solidified and absent of free standing water, the vendors' Process Control Program shall be implemented subject to the stations approval and the following guidelines. This PCP establishes these guidelines and is used in conjunction with specific procedures for solidification and dewatering developed by the staff. These in-house procedures incorporate vendor procedures, equipment, and processing methodologies. The utility procedures also include controls covering the following area:

- o Personnel and equipment involved in the program
- o Radiological Protection
- o Accountability of Material and Personnel
- o Waste/Binder Compatibility

### 3.0 PRECAUTIONS AND LIMITATIONS

- 3.1 Precautions shall be detailed in the vendor Process Control Program and/or the utility procedure for each type of waste to be processed.
- 3.2 Changes in solidification agents, processes for solidification and dewatering, and changes in vendors as they occur must be examined in full and changes to this and other related procedures incorporated prior to implementation. Quality Assurance must also review and approve all changes prior to implementation.

### 4.0 EQUIPMENT AND MATERIAL

- 4.1 Equipment and instrumentation shall be designated in the vendor's Process Control Program and/or the utility procedure for each type of waste to be processed.
- 4.2 The vendor must furnish the utility a copy of its NRC approved 10 CFR 61 Waste Form Topical Report.

## 5.0 INSTRUCTIONS

### 5.1 Management Verification of Vendor Acceptability

- 5.1.1 The Radwaste Manager, Environmental Health and Safety shall:
- a. Verify that contracted services meet Con Edison's standards and specifications.
  - b. Review the vendor's Process Control Program, operating procedures and proposed contractual agreements, and advise the appropriate management as to their adequacy.
  - c. Retain vendor supplied documentation for NRC inspection and review.
  - d. Monitor vendor operations to assure compliance with Con Edison practices and procedures as well as contractual agreement.
  - e. Document verification of vendor acceptability on Attachment 8.1. This form will be signed by a Radwaste Supervisor and a QA/Engineer.

### 5.2 Vendor Responsibilities

- 5.2.1 The qualified solidification and dewatering vendor will:
- a. Provide a Process Control Program approved by:
    - (1) NRC
    - (2) Disposal site licensee
  - b. Demonstrate the ability to meet:
    - (1) NRC 10 CFR 61.56 Waste Form Standards including the standards related to High Integrity containers (HIC's).
    - (2) Disposal site specifications for solidified liquid
    - (3) DOT shipping regulations
    - (4) Con Edison Radiation Protection procedures and practices.
    - (5) Con Edison Corporate Instruction 240, Supplement 1-Quality Assurance Program

c. Provide the following for review and evaluation:

- (1) A general description of the laboratory mixing of a sample of the waste to arrive at process parameters prior to commencing the solidification process.
- (2) A general description of the solidification process including type of solidification agent, process control parameters, parameter boundary conditions, proper waste form properties, and assurances that the solidifications systems are operated within the established process parameters.
- (3) A general description of sampling of at least one representative sample from each tenth batch to ensure solidification and the action to be taken if the sample fails to verify solidification. A chemically similar but nonradioactive sample may undergo test solidification if worker ALARA conditions warrant it.
- (4) The provisions to verify the absence of free liquid in solidified waste.
- (5) The provisions to reprocess containers containing solidified waste in which free liquids are detected.
- (6) If the solidification process is exothermic, the process control parameters that must be met prior to capping the container. This includes the use of an in-situ temperature probe.
- (7) A general description for the treatment of oily wastes that are to be transported offsite for burial.
- (8) As appropriate, a sketch of the process systems.
- (9) A statement that ALARA considerations were addressed in all phases of the solidification process.
- (10) A description of the dewatering technique and control procedures. If a HIC is used this should include a PCP to ensure that free standing liquid requirements are met (0.5% or 1.0% free standing liquid).
- (11) A description of provisions to reprocess wastes through the dewatering system if excess free water is observed.

### 5.3 Operation

- 5.3.1 The vendor shall solidify, dewater, and package the supplied liquid wastes and slurries according to approved procedures.
- 5.3.2 The vendor shall perform the tests described in the approved Process Control Program/procedures.
- 5.3.3 The vendor shall supply the Radwaste Manager, Environmental Health and Safety with all documentation required to demonstrate compliance with solidification, dewatering and packaging requirements.
- 5.3.4 The vendor shall be able to demonstrate that the final waste form provided falls within the range of waste characteristics presented in the vendors 10 CFR 61 Waste Form Topical Report.

### 5.4 Sample Collection

- 5.4.1. All samples collected shall be handled and stored, as directed by Radiation Protection Personnel, in a safe and proper radiological manner. In addition, all precautions shall be implemented to reduce worker exposure and prevent the spread of contamination.
- 5.4.2 Appropriate protective clothing, face shields, aprons and gloves shall be worn when collecting and handling samples.
- 5.4.3 When radiological conditions do not warrant the collection of an actual sample, a "simulated" test specimen may be substituted if agreed to by both the contractor performing the solidification and the burial site licensee.

### 5.5 Sample Analysis and Solidification

- 5.5.1 Notify a QA/QC inspector prior to sample solidification in order to provide them an opportunity to perform surveillance of the Process Control Program Test Solidification. Notification shall be documented by QA on Attachment 8.1 of Reference 7.7.
- 5.5.2 When appropriate, the test specimen shall be analyzed for relevant characteristics such as boron, pH, oil content, etc. The results shall be recorded on vendor provided data sheets.

- 5.5.3 When the ratios of chemical additives (e.g. lime) and binding agent (e.g. cement) to sample specimen are determined, a test solidification shall be performed. The quantity of chemical additives, solidification agent and sample volume shall be recorded on vendor provided data sheets.
- 5.5.4 Cure time for the test solidifications shall be recorded on vendor provided data sheets.
- 5.5.5 Unless proprietary in nature, the following documentation, at a minimum, shall be provided by the vendor to the station:
- a. Quantity of chemical additives.
  - b. Quantity of solidification agent(s).
  - c. Sample volume.
  - d. Cure time for test solidification.

## 6.0 ACCEPTANCE CRITERIA

- 6.1 Attachment 8.1 has been completed and signed by a Radwaste Supervisor and a QA Engineer prior to implementation.
- 6.2 The sample solidification will be considered acceptable if:
- a. The end product indicates a uniform, dry, free-standing monolith.
  - b. The end product resists penetration when probed with a firm object.

## 7.0 REFERENCES

- 7.1 10 CFR 20, Standards for Protection Against Radiation.
- 7.2 10 CFR 61, Licensing Requirements for Land Disposal of Radioactive Waste.
- 7.3 10 CFR 71, Packaging of Radioactive Material for Transportation.
- 7.4 49 CFR 173, Shipping Requirements for Radioactive Material.
- 7.5 Consolidated Edison Corporate Instruction CI-240 Supplement 1 Quality Assurance Program for Radioactive Material Packages and Quality Control Requirements for Radioactive Waste Classification and Characterization (Form).

- 7.6 Chem Nuclear Systems Inc. Procedure SD-OP-003 Process Control Program for CNSI Cement Solidification Units.
- 7.7 EHS-SQ-4.000, "Shipment Final QA Inspection"
- 7.8 SD-OP-048 CNSI Operating Procedure for In-Situ Solidification of Suspended Objects.
- 7.9 SD-OP-050 CNSI Operating Procedure for Mobile Cement Solidification.
- 7.10 SD-OP-026 CNSI Process Control Program for Cement/Oil Solidification.
- 7.11 DM-OP-022 Process Control Program for the CNSI Demineralization System.
- 7.12 FO-OP-022 Dewatering Procedure for CNSI 14-195 or Smaller Liners.
- 7.13 FO-OP-023 Bead Dewatering Procedure for CNSI 14-195 or Smaller Liners.
- 7.14 NUREG-0800, Standard Review Plan for Solid Waste Management Systems.
- 7.15 U.S.N.R.C, Final Waste Classification and Waste Form Technical Position Papers dated May 1983.

8.0 ATTACHMENTS

- 8.1 Form EHS 4.007-1, Checklist for Vendor Process Control Program (PCP)

9.0 ADDENDUM

NONE

ATTACHMENT 8.1  
Page 1 of 2

CHECKLIST FOR VENDOR PROCESS CONTROL PROGRAM (PCP)

- 1. PCP Approved by NRC and Disposal Site YES NO
- 2. PCP MEETS:
  - a. NRC Solidification Standards YES NO
  - b. Disposal Site Specifications for Solidified Liquids YES NO
  - c. DOT Shipping Regulations YES NO
  - d. Con Ed Radiation Protection Procedures and Practices YES NO
- 3. PCP Contains the Following:
  - a. A general description of the Laboratory mixing of a sample of the waste to arrive at process parameters prior to commencing the solidification process. YES NO
  - b. A general description of the solidification process including type of solidification agent, process control parameters, parameter boundary conditions, proper waste form properties, and operated within the established process parameters. YES NO
  - c. A general description of sampling of at least one representative sample from every tenth batch to ensure solidification and the action to be taken if the sample fails to verify solidification. A chemically similar but non-radioactive sample may undergo test solidification if worker ALARA conditions warrant it. YES NO
  - d. The provisions to verify the absence of free liquid in solidified waste. YES NO
  - e. The provisions to reprocess containers containing solidified waste where free liquids are detected. YES NO
  - f. If the solidification process is exothermic, the process control parameters that must be met prior to capping the container. This includes the use of an in-site temperature probe. YES NO

ATTACHMENT 8.1  
Page 2 of 2  
CHECKLIST FOR VENDOR PROCESS CONTROL PROGRAM

- |    |   |     |    |
|----|---|-----|----|
| g. | A general description for the treatment of oily wastes that are to be transported offsite for burial.             | YES | NO |
| h. | As appropriate, a sketch of the process systems.  | YES | NO |
| i. | A statement that ALARA considerations were addressed in all phases of the solidification process.                 | YES | NO |
| j. | A description of the dewatering technique and control procedures (applicable to solidification liners and HIC's). | YES | NO |
| k. | A description of provisions to reprocess wastes through the dewatering system if excess free water is observed.   | YES | NO |
| l. | Sample solidification worksheet.  | YES | NO |

4. Verification of Checklist Entries

This checklist is applicable to any shipment which utilize the attached procedures and documents and their specified revisions.

\_\_\_\_\_  
Name                      Date  
Radwaste Supervisor

\_\_\_\_\_  
Name                      Date  
QA Engineer