ALABAMA POWER COMPANY

FARLEY NUCLEAR PLANT UNIT NO. ONE

LICENSE NO. NPF-2

AND

FARLEY NUCLEAR PLANT UNIT NO. TWO

LICENSE NO. NPF-8

SEMI-ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JAN.1, 1986 THROUGH JUNE 30, 1986

IE48
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A. INTRODUCTION

This semi-annual radioactive release report, for the period January 1 through June 30, 1986, is submitted in accordance with Appendix A of License Nos. NPF-2 and NPF-8. Appendix A will hereinafter be referred to as the Standard Technical Specifications or STS.

A single submittal is made for both units which combines those sections that are common. Separate tables of releases and release totals are included where separate processing systems exist.

This report includes a summary of hourly meteorological measurements taken during each quarter in the six month reporting period. This data appear as joint frequency distributions of wind direction and wind speed by atmospheric stability class. Hourly meteorological data for batch releases are presented for the periods of actual release. All assessments of radiation doses are performed in accordance with the OFFSITE DOSE CALCULATION MANUAL (ODCM).

B. SUPPLEMENTAL INFORMATION FOR EFFLUENT AND WASTE DISPOSAL

1. Regulatory Limits

a. Fission and Activation Gases

1. The dose rate from the site at any time due to noble gases shall be less than or equal to 500 mrem/yr to the total body and 3000 mrem/yr to the skin.

2. The air dose from each reactor unit from the site during any calendar quarter due to noble gases shall shall be less than or equal to 5 mrad for gamma radiation and 10 mrad for beta radiation.

3. The air dose from each reactor unit from the site during any calendar year due to noble gases shall be less than or equal to 10 mrad for gamma radiation and 20 mrad for beta radiation.

b. Iodines and Particulates

1. The dose rate from the site at any time due to iodines, particulates and radionuclides with half-lives greater than 8 days shall be less than or equal to 1500 mrem/yr to any organ.

2. The dose from each reactor unit from the site during any calendar quarter due to iodines, particulates and radionuclides with half-lives greater than 8 days shall be less than or equal to 7.5 mrem to any organ.

3. The dose from each reactor unit from the site during any calendar year due to iodines, particulates and radionuclides with half-lives greater than 8 days shall be less than or equal to 15 mrem to any organ.

c. Liquid Effluents

1. The concentration of radioactive materials released in liquid effluents to unrestricted areas from all reactors at the site shall not exceed at any time the values specified in 10 CFR Part 20, Appendix B, Table II, Column 2. The concentration of dissolved or entrained noble gases, released in liquid effluents to unrestricted areas from all reactors at the site, shall not exceed at any time 2E-4 uCi/ml in water.

2. The dose or dose commitment due to liquid effluents released from each reactor unit from the site during any calendar quarter shall be less than or equal to 1.5 mrem to the total body and 5 mrem to any organ.

3. The dose or dose commitment due to liquid effluents released from each reactor unit from the site during any calendar year shall be less than or equal to 3 mrem to the total body and 10 mrem to any organ.

2. Maximum Permissible Concentrations

a. Airborne - The maximum permissible concentration of radioactive materials in gaseous effluents is limited by the dose rate restrictions of 10CFR20. In this case, the maximum permissible concentrations are actually determined by the dose factors in the ODCM.

b. Liquid - 10 CFR Part 20, Appendix B, Table II, Column 2.*

*NOTE: The MPC chosen is the most conservative value of either the soluble or insoluble MPC for each isotope.

3. Average Energy

Not applicable for Farley's STS.

4. Measurements and Approximations of Total Activity

The following discussion details the methods used to measure and approximate total activity for the following:

a. Fission and Activation Gases
b. Iodines and Particulates
c. Liquid Effluents

Tables 5 and 6 give sampling frequencies and minimum detectable concentration requirements for the analysis of gaseous and liquid effluent streams, respectively.

Values in the attached tables given as zero do not mean that the nuclides were not present. A zero indicates that the nuclide was not present at levels greater than the sensitivity requirements shown in Tables 5 and 6. For some nuclides, lower detection limits than required may be readily achievable; when a nuclide is measured below its stated limit, it is reported.

a. Fission and Activation Gases

The following noble gases are considered in evaluating gaseous airborne discharge:

Kr-87	Xe-133
Kr-88	Xe-135
Xe-133m	Xe-138

Periodic grab samples from plant effluent streams are analyzed by a computerized pulse height analyzer system utilizing high resolution germanium detectors. (See Table 5 for sampling and analytical requirements). Isotopic values thus obtained are used for release rate calculations as specified in the ODCM. Only those nuclides that are detected are used in this computation. During the period between grab samples, the amount of radioactivity released is based on the effluent monitor readings. Monitors are assigned a calibration factor based upon the last isotopic analysis using the following relationship:

$CF_i = A_i / m$, where

CF_i = isotopic calibration factor for isotope i.

A_i = concentration of isotope in the grab sample, in uCi/ml.

m = net monitor reading associated with the effluent stream.

These calibration factors along with the hourly effluent monitor readings are inputs to the laboratory computer where the release rates for individual nuclides are calculated and stored.

To ensure isotopic distributions do not change significantly during major operational occurrences, the frequency of grab sampling is increased to satisfy the requirements of footnotes b & d of STS Table 4.11-2, "Radioactive Gaseous Waste Sampling and Analysis Program".

b. Iodines and Particulates

The radioiodines and radioactive materials in particulate forms to be considered are:

Mn-54	I-131
Fe-59	I-133
Co-58	Cs-134
Co-60	Cs-137
Zn-65	Ce-141
Sr-89	Ce-144
Sr-90	* H-3
Mo-99	

Other nuclides with half-lives greater than 8 days which are identified and measured are also considered. The MDC's will vary and are not required to meet the MDC limits of those isotopes listed specifically.

* Tritium is considered in the gaseous or water vapor form.

Continuous Releases: Continuous sampling is performed on the continuous release points (i.e. the Plant Vent Stack, Containment Purge and the Turbine Building Vent). Particulate material is collected by filtration. Periodically these filters are removed and analyzed on the pulse height analyzer to identify and quantify radioactive materials collected on the filters. Particulate filters are then analyzed for gross alpha and strontium as required. Gross alpha determinations are made using a 2 pi gas flow proportional counter. Sr-89 and 90 values are obtained by chemical separation and subsequent analysis using 2 pi gas flow proportional counters.

Batch Releases: The processing of batch type releases (from Containment or Waste Gas Decay Tanks) is analogous to continuous releases, except that the release is not commenced until samples have been obtained and analyzed.

c. Liquid Effluents

The radionuclides listed below are considered when evaluating liquid effluents:

Mn-54	I-131
Fe-59	Cs-134
Co-58	Cs-137
Co-60	Ce-141
Zn-65	Ce-144
Sr-89	Mo-99
Sr-90	Fe-55
	H-3

Batch Releases: Representative pre-release grab samples are obtained and analyzed per Table 6. Isotopic analyses are performed using the computerized pulse height analysis system previously described. Aliquots of each pre-release sample proportional to the waste volume released are composited in accordance with requirements in Table 6. Strontium and Iron determinations are made by performing chemical separations and counting the separated samples. Strontium samples are counted on a 2 pi gas flow proportional counter. Iron samples are counted on either a 2 pi gas flow proportional counter or a liquid scintillation counter. Gross beta and gross alpha determinations are made using 2 pi gas flow proportional counters. Tritium concentrations are determined by by using liquid scintillation techniques. Dissolved gases are determined employing grab sampling techniques and then counting on the pulse height analyzer.

Continuous Releases: Continuous releases (from the Steam Generator Blowdown) are analogous to that of the batch releases except that they are analyzed on a weekly composite basis per Table 6.

UNIT # 1

1986

5. Batch Release

a. Liquid

	Quarter 1	Quarter 2
1. Number of batch releases:	80	146
2. Total time period for releases:	6672 min.	11914 min.
3. Maximum time period for a release:	157 min.	117 min.
4. Average time period for a release:	83 min.	82 min.
5. Minimum time period for a release:	60 min.	31 min.
6. Average stream flow during periods of release of effluent into a flowing stream:	*8.54E3 cfs	*3.98E3 cfs

b. Gaseous

	Quarter 1	Quarter 2
1. Number of releases:	0	0
2. Total time period for releases:	0 min.	0 min.
3. Maximum time period for a release:	0 min.	0 min.
4. Average time period for a release:	0 min.	0 min.
5. Minimum time period for a release:	0 min.	0 min.

6. Abnormal Releases

a. Liquid

1. Number of releases: NONE
2. Total activity released: N/A

b. Gaseous

1. Number of releases: NONE
2. Total activity released: N/A

* Average River Flow Rate, taken at Walter F. George Lock and Dam, located 30.7 miles above Farley Nuclear Plant.

UNIT # 2

1986

5. Batch Release

a. Liquid

	Quarter 1	Quarter 2
1. Number of batch releases:	62	117
2. Total time period for releases:	5306 min.	10207 min.
3. Maximum time period for a release:	107 min.	150 min.
4. Average time period for a release:	86 min.	87 min.
5. Minimum time period for a release:	75 min.	65 min.
6. Average stream flow during periods of release of effluent into a flowing stream:	*8.54E3 cfs	*3.98E3 cfs

b. Gaseous

	Quarter 1	Quarter 2
1. Number of releases:	2	6
2. Total time period for releases:	1080 min.	3049 min.
3. Maximum time period for a release:	660 min.	784 min.
4. Average time period for a release:	540 min.	508 min.
5. Minimum time period for a release:	420 min.	405 min.

6. Abnormal Releases

a. Liquid

1. Number of releases:	None
2. Total activity released:	N/A

b. Gaseous

1. Number of releases:	None
2. Total activity released:	N/A

* Average River Flow Rate, taken at Walter F. George Lock and Dam, located 30.7 miles above Farley Nuclear Plant.

7. Estimate of Total Error

a. Liquid

1. The maximum error associated with volume and flow measurements, based upon plant calibration practice is estimated to be + or - 10%.

2. The average error associated with counting is estimated to be less than + or - 15%.

b. Gaseous

1. The maximum errors associated with monitor readings, sample flow, vent flow, sample collection, monitor calibration and laboratory procedure are collectively estimated to be:

Fission and Activation Gases	Iodines	Particulates	Tritium
75%	60%	50%	45%

2. The average error associated with counting is estimated to be:

Fission and Activation Gases	Iodines	Particulates	Tritium
6%	18%	19%	12%

c. Solid Radwaste

The error involved in determining the contents of solid radwaste shipments is estimated to be less than + or - 15%.

UNIT # 1

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8. Solid Waste

See Table 3

9. Radiological Impact On Man

a. Water Related Exposure Pathways

	1st Quarter	2nd Quarter
Total Body =	3.5E-03 mrem	1.2E-02 mrem
Bone =	1.9E-03 mrem	7.7E-03 mrem
Liver =	4.7E-03 mrem	1.9E-02 mrem
Thyroid =	1.4E-03 mrem	3.2E-03 mrem
Kidney =	2.3E-03 mrem	5.9E-03 mrem
Lungs =	2.3E-03 mrem	1.1E-02 mrem
GI Tract =	6.7E-03 mrem	1.6E-02 mrem

b. Gaseous Related Exposure Pathways

	1st Quarter	2nd Quarter
Total Body =	2.2E-02 mrem	1.7E-02 mrem
Skin =	3.5E-02 mrem	3.8E-02 mrem

c. Particulate and Iodine

	1st Quarter	2nd Quarter
Organ Dose =	1.6E-02 mrem	4.2E-03 mrem

UNIT # 2

1986

8. Solid Waste

See Table 3

9. Radiological Impact On Man

a. Water Related Exposure Pathways

	1st Quarter	2nd Quarter
Total Body	= 3.2E-03 mrem	3.8E-03 mrem
Bone	= 4.2E-02 mrem	4.0E-03 mrem
Liver	= 4.3E-03 mrem	7.9E-03 mrem
Thyroid	= 2.2E-03 mrem	2.9E-03 mrem
Kidney	= 2.6E-03 mrem	2.3E-03 mrem
Lungs	= 3.5E-03 mrem	8.2E-03 mrem
GI Tract	= 6.3E-03 mrem	5.3E-03 mrem

b. Gaseous Related Exposure Pathways

	1st Quarter	2nd Quarter
Total Body	= 9.4E-03 mrem	1.2E-02 mrem
Skin	= 1.7E-02 mrem	3.3E-02 mrem

c. Particulate and Iodine

	1st Quarter	2nd Quarter
Organ Dose	= 5.7E-03 mrem	4.9E-03 mrem

10. Meteorological Data

See Table 4A, "Cumulative Joint Frequency Distribution".

Continuous Release Mode:
1st Quarter, 1986 : 4A-CQ1
2nd Quarter, 1986 : 4A-CQ2

Batch Release Mode (Units 1&2):
1st Quarter, 1986 : 4A-1BQ1 & 4A-2BQ1
2nd Quarter, 1986 : 4A-1BQ2 & 4A-2BQ2

11. Minimum Detectable Concentration (MDC)

Detectable limits for activity analyses are based upon the technical feasibility and on the potential significance in the environment of the quantities released. However, in practice, when an isotope's a posteriori MDC could not be met due to other nuclides being present in much greater concentrations, the a priori MDC as defined in the STS Table 4.11-1 a. is relied upon.

TABLE 1A-1Q1

GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES

Farley Unit 1 - 1st Quarter, 1986

	UNITS	QTR 1	Est Error
A. Fission & activation gases:			
1. Total release	Ci	1.51E 02	1.24E 01
2. Average release rate	uCi/sec	1.95E 01	
3. % of Technical Specification	%	8.54E-04*	
	%	1.52E-03**	
B. Iodines			
1. Total iodine-131	Ci	2.02E-05	5.55E-06
2. Average release rate	uCi/sec	2.59E-06	
3. % of Technical Specification	%	1.50E-05***	
C. Particulates			
1. Particulates with T1/2>8 days	Ci	4.56E-06	1.79E-06
2. Average release rate	uCi/sec	5.87E-07	
3. % of Technical Specification	%	1.26E-06***	
4. Gross alpha radioactivity	Ci	0.00E 00	
D. Tritium			
1. Total release	Ci	5.09E 01	3.12E-01
2. Average release rate	uCi/sec	6.54E 00	
3. % of Technical Specification	%	1.15E-03***	

*: Whole body limit (<500 mrem/yr)
**: Extrem. limit (<3000 mrem/yr)
***: % of 1500 mrem/yr for all 19 isotopes

TABLE 1A-1Q2

GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES

Farley Unit 1 - 2nd Quarter, 1986

	UNITS	QTR 2	Est Error
A. Fission & activation gases:			
1. Total release	Ci	2.40E 02	2.32E 01
2. Average release rate	uCi/sec	3.05E 01	
3. % of Technical Specification	%	6.77E-04*	
	%	1.36E-03**	
B. Iodines			
1. Total iodine-131	Ci	2.29E-05	5.71E-06
2. Average release rate	uCi/sec	2.91E-06	
3. % of Technical Specification	%	1.69E-05***	
C. Particulates			
1. Particulates with T1/2>8 days	Ci	5.18E-06	1.94E-06
2. Average release rate	uCi/sec	6.59E-07	
3. % of Technical Specification	%	6.91E-09***	
4. Gross alpha radioactivity	Ci	0.00E 00	
D. Tritium			
1. Total release	Ci	1.55E 01	1.40E-01
2. Average release rate	uCi/sec	1.97E 00	
3. % of Technical Specification	%	3.47E-04***	

*: Whole body limit (<500 mrem/yr)
**: Extrem. limit (<3000 mrem/yr)
***: % of 1500 mrem/yr for all 19 isotopes

TABLE 1A-2Q1

GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES

Farley Unit 2 - 1st Quarter, 1986

	UNITS	QTR 1	Est Error
A. Fission & activation gases:			
1. Total release	Ci	2.04E 02	1.17E 01
2. Average release rate	uCi/sec	2.62E 01	
3. % of Technical Specification	%	9.13E-04*	
	%	1.62E-03**	
B. Iodines			
1. Total iodine-131	Ci	7.97E-06	6.94E-07
2. Average release rate	uCi/sec	1.02E-06	
3. % of Technical Specification	%	5.93E-06***	
C. Particulates			
1. Particulates with T1/2>8 days	Ci	6.23E-08	1.88E-08
2. Average release rate	uCi/sec	8.01E-09	
3. % of Technical Specification	%	4.64E-08***	
4. Gross alpha radioactivity	Ci	0.00E 00	
D. Tritium			
1. Total release	Ci	2.05E 01	1.98E-01
2. Average release rate	uCi/sec	2.64E 00	
3. % of Technical Specification	%	4.81E-04***	

*: Whole body limit (<500 mrem/yr)
**: Extrem. limit (<3000 mrem/yr)
***: % of 1500 mrem/yr for all 19 isotopes

TABLE 1A-2Q2

GASEOUS EFFLUENTS--SUMMATION OF ALL RELEASES

Farley Unit 2 - 2nd Quarter, 1986

	UNITS	QTR 2	Est Error
A. Fission & activation gases:			
1. Total release	Ci	1.13E 03	1.88E 01
2. Average release rate	uCi/sec	1.44E 02	
3. % of Technical Specification	%	1.85E-03*	
	%	4.32E-03**	
B. Iodines			
1. Total iodine-131	Ci	8.80E-04	2.19E-05
2. Average release rate	uCi/sec	1.12E-04	
3. % of Technical Specification	%	6.48E-04***	
C. Particulates			
1. Particulates with T1/2>8 days	Ci	4.12E-06	1.18E-06
2. Average release rate	uCi/sec	5.24E-07	
3. % of Technical Specification	%	2.56E-07***	
4. Gross alpha radioactivity	Ci	0.00E 00	
D. Tritium			
1. Total release	Ci	2.05E 01	6.31E-01
2. Average release rate	uCi/sec	2.61E 00	
3. % of Technical Specification	%	4.59E-04***	

*: Whole body limit (<500 mrem/yr)
**: Extrem. limit (<3000 mrem/yr)
***: % of 1500 mrem/yr for all 19 isotopes

TABLE 1B-1Q1

GASEOUS EFFLUENTS--ELEVATED RELEASE

Farley Unit 1 - 1st Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 1	BATCH Mode QTR# 1
1. Fission gases			
Ar-41	Ci	1.11E 01	0.00E 00
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	3.80E-01	0.00E 00
Kr-85M	Ci	8.68E-02	0.00E 00
Xe-135	Ci	1.60E 01	0.00E 00
Xe-133M	Ci	0.00E 00	0.00E 00
Kr-88	Ci	3.04E-01	0.00E 00
Xe-133	Ci	1.16E 02	0.00E 00
Total for period	Ci	1.44E 02	0.00E 00
2. Iodines			
I-133	Ci	1.53E-08	0.00E 00
I-131	Ci	1.80E-05	0.00E 00
Total for period	Ci	1.80E-05	0.00E 00
3. Particulates			
* Mo-99	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
Ba-140	Ci	9.92E-07	0.00E 00
* I-133	Ci	0.00E 00	0.00E 00
I-131	Ci	1.43E-06	0.00E 00
Ce-141	Ci	1.83E-06	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Total for period	Ci	4.25E-06	0.00E 00

* Isotope with half-life less than 8 days

TABLE 1B-1Q2

GASEOUS EFFLUENTS--ELEVATED RELEASE

Farley Unit 1 - 2nd Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 2	BATCH Mode QTR# 2
1. Fission gases			
Ar-41	Ci	5.57E 00	0.00E 00
Kr-85	Ci	3.62E-01	0.00E 00
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	0.00E 00
Xe-135	Ci	1.42E 01	0.00E 00
Xe-133M	Ci	0.00E 00	0.00E 00
Kr-88	Ci	7.67E-03	0.00E 00
Xe-133	Ci	2.13E 02	0.00E 00
Total for period	Ci	2.33E 02	0.00E 00
2. Iodines			
I-133	Ci	6.70E-07	0.00E 00
I-131	Ci	2.22E-05	0.00E 00
Total for period	Ci	2.29E-05	0.00E 00
3. Particulates			
* Mo-99	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Ce-144	Ci	5.05E-06	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
* I-133	Ci	0.00E 00	0.00E 00
I-131	Ci	0.00E 00	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Total for period	Ci	5.05E-06	0.00E 00

* Isotope with half-life less than 8 days

TABLE 1B-2Q1

GASEOUS EFFLUENTS--ELEVATED RELEASE

Farley Unit 2 - 1st Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 1	BATCH Mode QTR# 1
1. Fission gases			
Ar-41	Ci	1.35E 01	0.00E 00
Xe-137	Ci	0.00E 00	2.09E-02
Kr-85	Ci	0.00E 00	1.45E 00
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	0.00E 00
Kr-85M	Ci	0.00E 00	2.87E-02
Xe-135	Ci	5.69E 00	2.38E-01
Xe-133M	Ci	1.06E-01	1.99E-01
Kr-88	Ci	0.00E 00	1.06E-02
Xe-131M	Ci	4.94E-01	8.01E-01
Xe-133	Ci	1.47E 02	2.77E 01
Total for period	Ci	1.66E 02	3.05E 01
2. Iodines			
I-133	Ci	2.90E-07	0.00E 00
I-131	Ci	7.71E-06	0.00E 00
Total for period	Ci	8.00E-06	0.00E 00
3. Particulates			
* Mo-99	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
* I-133	Ci	0.00E 00	0.00E 00
I-131	Ci	6.11E-08	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Total for period	Ci	6.11E-08	0.00E 00

* Isotope with half-life less than 8 days

TABLE 1B-2Q2

GASEOUS EFFLUENTS--ELEVATED RELEASE

Farley Unit 2 - 2nd Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 2	BATCH Mode QTR# 2
1. Fission gases			
Ar-41	Ci	3.21E 00	0.00E 00
Kr-85	Ci	0.00E 00	5.46E 00
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	1.37E-03
Kr-85M	Ci	1.38E 00	0.00E 00
Xe-135	Ci	1.69E 01	1.44E-01
Xe-133M	Ci	1.40E 01	2.93E 00
Kr-88	Ci	0.00E 00	0.00E 00
Xe-131M	Ci	0.00E 00	3.14E 00
Xe-133	Ci	7.22E 02	3.41E 02
Total for period	Ci	7.57E 02	3.53E 02
2. Iodines			
I-133	Ci	1.37E-05	2.31E-08
I-131	Ci	8.60E-04	2.75E-08
Total for period	Ci	8.73E-04	5.06E-08
3. Particulates			
* Mo-99	Ci	6.86E-10	0.00E 00
Co-60	Ci	1.89E-07	6.75E-09
Zn-65	Ci	2.35E-10	0.00E 00
Fe-59	Ci	1.48E-10	0.00E 00
Mn-54	Ci	8.86E-11	0.00E 00
Ce-144	Ci	4.99E-10	0.00E 00
Co-58	Ci	3.68E-06	0.00E 00
Zr-95	Ci	1.48E-10	0.00E 00
Cs-137	Ci	1.60E-07	0.00E 00
Cs-134	Ci	9.19E-11	0.00E 00
Ba-140	Ci	1.75E-10	0.00E 00
* I-133	Ci	1.41E-10	2.31E-08
I-131	Ci	1.10E-10	2.75E-08
Cr-51	Ci	7.77E-10	0.00E 00
Ce-141	Ci	1.00E-10	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	6.71E-12	0.00E 00
Sr-90	Ci	4.92E-12	0.00E 00
Total for period	Ci	4.03E-06	5.73E-08

* Isotope with half-life less than 8 days

TABLE 1C-1Q1

GASEOUS EFFLUENTS--GROUND RELEASE

Farley Unit 1 - 1st Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 1	BATCH Mode QTR# 1
1. Fission gases			
Ar-41	Ci	5.55E-01	0.00E 00
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	2.15E-02	0.00E 00
Kr-85M	Ci	5.68E-03	0.00E 00
Xe-135	Ci	8.08E-01	0.00E 00
Xe-133M	Ci	0.00E 00	0.00E 00
Kr-88	Ci	1.34E-02	0.00E 00
Xe-133	Ci	6.00E 00	0.00E 00
Total for period	Ci	7.40E 00	0.00E 00
2. Iodines			
I-133	Ci	1.00E-09	0.00E 00
I-131	Ci	2.13E-06	0.00E 00
Total for period	Ci	2.13E-06	0.00E 00
3. Particulates			
* Mo-99	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
Ba-140	Ci	5.89E-08	0.00E 00
* I-133	Ci	0.00E 00	0.00E 00
I-131	Ci	5.97E-08	0.00E 00
Ce-141	Ci	1.96E-07	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Total for period	Ci	3.15E-07	0.00E 00

* Isotope with half-life less than 8 days

TABLE 1C-1Q2

GASEOUS EFFLUENTS--GROUND RELEASE

Farley Unit 1 - 2nd Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 2	BATCH Mode QTR# 2
1. Fission gases			
Ar-41	Ci	2.08E-01	0.00E 00
Kr-85	Ci	1.65E-02	0.00E 00
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	0.00E 00
Xe-135	Ci	4.44E-01	0.00E 00
Xe-133M	Ci	0.00E 00	0.00E 00
Kr-88	Ci	3.50E-04	0.00E 00
Xe-133	Ci	6.18E 00	0.00E 00
Total for period	Ci	6.85E 00	0.00E 00
2. Iodines			
I-133	Ci	4.87E-08	0.00E 00
I-131	Ci	6.49E-07	0.00E 00
Total for period	Ci	6.97E-07	0.00E 00
3. Particulates			
* Mo-99	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Ce-144	Ci	1.29E-07	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
* I-133	Ci	0.00E 00	0.00E 00
I-131	Ci	0.00E 00	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Total for period	Ci	1.29E-07	0.00E 00

* Isotope with half-life less than 8 days

TABLE 1C-2Q1

GASEOUS EFFLUENTS--GROUND RELEASE

Farley Unit 2 - 1st Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 1	BATCH Mode QTR# 1
1. Fission gases			
Ar-41	Ci	6.33E-01	0.00E 00
Xe-137	Ci	0.00E 00	8.29E-04
Kr-85	Ci	0.00E 00	5.53E-02
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	0.00E 00
Kr-85M	Ci	0.00E 00	1.14E-03
Xe-135	Ci	2.03E-01	9.47E-03
Xe-133M	Ci	5.47E-04	7.88E-03
Kr-88	Ci	0.00E 00	4.22E-04
Xe-131M	Ci	2.55E-03	3.14E-02
Xe-133	Ci	5.18E 00	1.09E 00
Total for period	Ci	6.02E 00	1.20E 00
2. Iodines			
I-133	Ci	1.21E-08	0.00E 00
I-131	Ci	2.55E-07	0.00E 00
Total for period	Ci	2.67E-07	0.00E 00
3. Particulates			
* Mo-99	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
* I-133	Ci	0.00E 00	0.00E 00
I-131	Ci	1.24E-09	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Total for period	Ci	1.24E-09	0.00E 00

* Isotope with half-life less than 8 days

TABLE 1C-2Q2

GASEOUS EFFLUENTS--GROUND RELEASE

Farley Unit 2 - 2nd Quarter, 1986

Nuclides Released	Unit	CONTINUOUS Mode QTR# 2	BATCH Mode QTR# 2
1. Fission gases			
Ar-41	Ci	4.53E-02	0.00E 00
Kr-85	Ci	0.00E 00	5.56E-02
Xe-138	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	5.50E-06
Kr-85M	Ci	7.34E-02	0.00E 00
Xe-135	Ci	5.36E-01	5.27E-04
Xe-133M	Ci	3.72E-01	1.64E-02
Kr-88	Ci	0.00E 00	0.00E 00
Xe-131M	Ci	0.00E 00	1.24E-02
Xe-133	Ci	1.93E 01	1.88E 00
Total for period	Ci	2.04E 01	1.96E 00
2. Iodines			
I-133	Ci	9.20E-08	1.26E-09
I-131	Ci	2.07E-05	1.35E-09
Total for period	Ci	2.08E-05	2.62E-09
3. Particulates			
* Mo-99	Ci	1.62E-11	0.00E 00
Co-60	Ci	3.75E-09	8.07E-11
Zn-65	Ci	5.54E-12	0.00E 00
Fe-59	Ci	3.50E-12	0.00E 00
Mn-54	Ci	2.09E-12	0.00E 00
Ce-144	Ci	1.18E-11	0.00E 00
Co-58	Ci	4.31E-08	0.00E 00
Zr-95	Ci	3.49E-12	0.00E 00
Cs-137	Ci	3.17E-09	0.00E 00
Cs-134	Ci	2.17E-12	0.00E 00
Ba-140	Ci	4.13E-12	0.00E 00
* I-133	Ci	3.34E-12	1.31E-09
I-131	Ci	2.60E-12	1.40E-09
Cr-51	Ci	1.84E-11	0.00E 00
Ce-141	Ci	2.36E-12	0.00E 00
Other	Ci	0.00E 00	0.00E 00
Sr-89	Ci	1.58E-13	0.00E 00
Sr-90	Ci	1.16E-13	0.00E 00
Total for period	Ci	5.01E-08	2.79E-09

* Isotope with half-life less than 8 days

TABLE 2A-1

LIQUID EFFLUENT--SUMMATION OF ALL RELEASES
Farley Unit 1 - 1st Half, 1986

		UNIT	Qtr 1	Qtr 2
A. Fission and Activation Products				
1. Total release	Note (1)	Ci	2.75E-02	2.56E-02
2. Average diluted concentration during period	Note (2)	uCi/ml	1.45E-09	1.35E-09
3. Percent of applicable limit during Period	Note (2)	%	7.19E-04	8.63E-03
B. Tritium				
1. Total release	Note (1)	Ci	2.62E 02	1.44E 02
2. Average diluted concentration during period	Note (2)	uCi/ml	1.38E-05	7.59E-06
3. Percent of applicable limit during period	Note (2)	%	4.60E-01	2.53E-01
C. Dissolved and Entrained Gases				
1. Total release	Note (1)	Ci	5.46E-01	5.14E-02
2. Average diluted concentration during period	Note (2)	uCi/ml	2.88E-08	2.71E-09
3. Percent of applicable limit during period	Note (2)	%	1.44E-02	1.35E-03
D. Gross Alpha Radioactivity Total release	Note (1)	Ci	4.72E-07	0.00E 00
E. Volume of Waste Water	Note (3)			
1. WMT		liters	1.16E 06	2.17E 06
2. SGBD and Turbine Bldg Sumps		liters	5.81E 07	6.51E 07
3. Liquid Radioactive Effluent TOTAL	Note (4)	liters	5.92E 07	6.73E 07
F. Volume of Dilution Water during Quarter		liters	1.47E 10	1.55E 10

NOTE:

(1) Steam Generator Blowdown and Turbine Building Sump release curie amounts and doses were measured and are included in these totals and in table 2B-1C in accordance with TABLE 4.11-1, Footnote E of Joseph M. Farley Nuclear Plant Unit Number 1 Technical Specifications (Appendix A of License No. NPF-2).
(2) During period of discharge
(3) Prior to dilution
(4) Steam Generator Blowdown and Turbine Building Sump releases are excluded from Total Liquid Radioactive Effluent in accordance with 10 CFR 20, Appendix B, Note 5.

TABLE 2A-2

LIQUID EFFLUENT--SUMMATION OF ALL RELEASES
Farley Unit 2 - 1st Half, 1986

		UNIT	Qtr 1	Qtr 2
A. Fission and Activation Products				
1. Total release	Note (1)	Ci	2.15E-02	2.15E-02
2. Average diluted concentration during period	Note (2)	uCi/ml	6.16E-09	1.45E-09
3. Percent of applicable limit during period	Note (2)	%	1.45E-03	1.16E-02
B. Tritium				
1. Total release	Note (1)	Ci	2.19E 02	1.66E 02
2. Average diluted concentration during Period	Note (2)	uCi/ml	6.27E-05	1.12E-05
3. Percent of applicable limit during period	Note (2)	%	2.09E 00	3.75E-01
C. Dissolved and Entrained Gases				
1. Total release	Note (1)	Ci	6.49E-01	1.05E-01
2. Average diluted concentration during period	Note (2)	uCi/ml	1.86E-07	7.08E-09
3. Percent of applicable limit during period	Note (2)	%	9.29E-02	3.54E-03
D. Gross Alpha Radioactivity				
Total release	Note (1)	Ci	0.00E 00	0.00E 00
E. Volume of Waste Water	Note (3)			
1. WMT		liters	9.20E 05	1.72E 06
2. SGBD and Turbine Bldg Sumps		liters	2.95E 07	7.65E 07
3. Liquid Radioactive Effluent TOTAL	Note (4)	liters	3.04E 07	7.83E 07
F. Volume of Dilution Water during Quarter		liters	1.32E 10	1.53E 10

NOTE:

(1) Steam Generator Blowdown and Turbine Building Sump release curie amounts and doses were measured and are included in these totals and in table 2B-2C in accordance with TABLE 4.11-1, Footnote E of Joseph M. Farley Nuclear Plant Unit Number 2 Technical Specifications (Appendix A of License No. NPF-8).
(2) During periods of discharge
(3) Prior to dilution
(4) Steam Generator Blowdown and Turbine Building Sump releases are excluded from Total Liquid Radioactive Effluent in accordance with 10 CFR 20, Appendix B, Note 5.

TABLE 2B-1B

LIQUID EFFLUENTS--BATCH
Farley Unit 1 - 1st Half, 1986

Nuclides Released	Unit	Qtr 1	Qtr 2
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Fe-55	Ci	2.32E-02	4.60E-03
Co-57	Ci	0.00E 00	0.00E 00
Ce-144	Ci	0.00E 00	0.00E 00
Tc-99M	Ci	0.00E 00	0.00E 00
Ce-141	Ci	0.00E 00	2.10E-06
Np-239	Ci	0.00E 00	0.00E 00
Cr-51	Ci	3.07E-05	1.65E-03
I-131	Ci	1.59E-05	4.22E-04
Ru-103	Ci	1.44E-06	6.80E-07
I-133	Ci	0.00E 00	2.76E-06
Ba-140	Ci	0.00E 00	5.78E-06
As-76	Ci	0.00E 00	0.00E 00
Cs-134	Ci	3.32E-05	2.29E-04
Ru-106	Ci	1.04E-04	5.61E-06
Cs-137	Ci	1.43E-04	4.45E-04
Mo-99	Ci	1.93E-05	1.50E-06
Zr-95	Ci	8.13E-06	1.06E-04
Nb-95	Ci	1.22E-04	2.57E-04
I-132	Ci	0.00E 00	2.68E-06
Co-58	Ci	7.00E-05	6.15E-03
Cs-136	Ci	3.75E-06	0.00E 00
Mn-54	Ci	4.78E-05	3.75E-04
Ag-110M	Ci	4.13E-04	1.49E-04
Sr-91	Ci	8.44E-06	0.00E 00
Zn-65	Ci	0.00E 00	0.00E 00
I-135	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	3.84E-04
Co-60	Ci	1.34E-03	2.54E-03
Na-24	Ci	1.49E-06	0.00E 00
La-140	Ci	4.65E-06	9.61E-05
Cu-64	Ci	0.00E 00	0.00E 00
Sb-124	Ci	4.11E-07	7.36E-06
Te-132	Ci	0.00E 00	3.37E-06
Sb-125	Ci	1.85E-03	4.76E-03
Zr-97	Ci	0.00E 00	0.00E 00
TOTALS	Ci	2.75E-02	2.22E-02
Xe-133	Ci	5.40E-01	5.13E-02
Xe-135	Ci	5.91E-03	1.53E-04
TOTALS	Ci	5.46E-01	5.15E-02
H-3	Ci	2.62E 02	1.44E 02

TABLE 2B-2B

LIQUID EFFLUENTS--BATCH
Farley Unit 2 - 1st Half, 1986

Nuclides Released	Unit	Qtr 1	Qtr 2
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Fe-55	Ci	1.78E-02	8.71E-03
Co-57	Ci	0.00E 00	0.00E 00
Ce-144	Ci	0.00E 00	0.00E 00
Tc-99M	Ci	0.00E 00	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Np-239	Ci	0.00E 00	0.00E 00
Cr-51	Ci	0.00E 00	3.65E-04
I-131	Ci	4.28E-06	4.89E-04
Ru-103	Ci	0.00E 00	4.08E-06
I-133	Ci	0.00E 00	0.00E 00
Ba-140	Ci	0.00E 00	0.00E 00
As-76	Ci	2.92E-06	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
Ru-106	Ci	6.78E-06	0.00E 00
Cs-137	Ci	0.00E 00	9.34E-06
Mo-99	Ci	2.21E-05	0.00E 00
Zr-95	Ci	0.00E 00	4.01E-07
Nb-95	Ci	7.87E-05	2.17E-05
I-132	Ci	0.00E 00	2.70E-05
Co-58	Ci	1.74E-05	3.11E-03
Cs-136	Ci	9.22E-06	0.00E 00
Mn-54	Ci	6.48E-06	9.46E-06
Ag-110M	Ci	3.52E-04	3.95E-05
Sr-91	Ci	0.00E 00	0.00E 00
Zn-65	Ci	3.05E-06	3.00E-07
I-135	Ci	0.00E 00	0.00E 00
Fe-59	Ci	1.46E-06	6.08E-04
Co-60	Ci	5.40E-04	4.95E-04
Cu-64	Ci	0.00E 00	2.78E-04
Na-24	Ci	0.00E 00	1.68E-06
La-140	Ci	0.00E 00	1.56E-05
Sb-124	Ci	4.82E-06	1.65E-04
Sb-125	Ci	2.64E-03	6.50E-03
Te-132	Ci	0.00E 00	8.55E-06
TOTALS	Ci	2.14E-02	2.09E-02
Xe-133	Ci	6.49E-01	1.04E-01
Xe-135	Ci	1.86E-04	2.42E-04
TOTALS	Ci	6.49E-01	1.04E-01
H-3	Ci	2.18E 02	1.64E 02

TABLE 2B-1C

LIQUID EFFLUENTS--CONTINUOUS
Farley Unit 1 - 1st Half, 1986

Nuclides Released	Unit	Qtr 1	Qtr 2
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Ce-144	Ci	0.00E 00	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Np-239	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
Cs-137	Ci	0.00E 00	0.00E 00
Mo-99	Ci	0.00E 00	0.00E 00
Co-58	Ci	0.00E 00	0.00E 00
Mn-54	Ci	0.00E 00	0.00E 00
Ag-110M	Ci	0.00E 00	0.00E 00
Fe-55	Ci	0.00E 00	3.44E-03
Zn-65	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	0.00E 00
Zr-95	Ci	0.00E 00	0.00E 00
TOTALS	Ci	0.00E 00	3.44E-03
Xe-133	Ci	0.00E 00	0.00E 00
Xe-135	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	0.00E 00
Kr-88	Ci	0.00E 00	0.00E 00
TOTALS	Ci	0.00E 00	0.00E 00
H-3	Ci	1.95E-02	0.00E 00

NOTE:

Although Steam Generator Blowdown and Turbine Building Sump releases were excluded from total liquid radioactive effluent volume in accordance with 10 CFR 20, Appendix B, Note 5, curie amounts and doses from these releases were measured and are reported here in accordance with Table 4.11-1, Footnote E of Joseph M. Farley Nuclear Plant Unit Number 1 Technical Specification (Appendix A of License No. NPF-2).

TABLE 2B-2C

LIQUID EFFLUENTS--CONTINUOUS
Farley Unit 2 - 1st Half, 1986

Nuclides Released	Unit	Qtr 1	Qtr 2
Sr-89	Ci	0.00E 00	0.00E 00
Sr-90	Ci	0.00E 00	0.00E 00
Ce-144	Ci	0.00E 00	0.00E 00
Ce-141	Ci	0.00E 00	0.00E 00
Cs-134	Ci	0.00E 00	0.00E 00
Cs-137	Ci	7.89E-05	3.34E-05
Mo-99	Ci	0.00E 00	0.00E 00
Zr-95	Ci	0.00E 00	0.00E 00
Nb-95	Ci	0.00E 00	0.00E 00
Co-58	Ci	0.00E 00	4.30E-04
Mn-54	Ci	0.00E 00	2.89E-05
Zn-65	Ci	0.00E 00	0.00E 00
I-135	Ci	0.00E 00	0.00E 00
Fe-59	Ci	0.00E 00	0.00E 00
Co-60	Ci	0.00E 00	1.11E-04
I-131	Ci	0.00E 00	0.00E 00
I-133	Ci	0.00E 00	0.00E 00
Co-57	Ci	0.00E 00	0.00E 00
Fe-55	Ci	0.00E 00	0.00E 00
Ag-110M	Ci	0.00E 00	0.00E 00
TOTALS	Ci	7.89E-05	6.03E-04
Xe-133	Ci	0.00E 00	0.00E 00
Xe-135	Ci	0.00E 00	0.00E 00
Kr-87	Ci	0.00E 00	0.00E 00
Kr-88	Ci	0.00E 00	0.00E 00
TOTALS	Ci	0.00E 00	0.00E 00
H-3	Ci	7.17E-01	2.25E 00

NOTE:

Although Steam Generator Blowdown and Turbine Building Sump releases were excluded from total liquid radioactive effluent volume in accordance with 10 CFR 20, Appendix B, Note 5, curie amounts and doses from these releases were measured and are reported here in accordance with Table 4.11-1, Footnote E of Joseph M. Farley Nuclear Plant Unit Number 2 Technical Specification (Appendix A of License No. NPF-8).

TABLE 3

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

1st Half, 1986

SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL
(Not irradiated fuel)

1. Type of Waste	UNITS	PERIOD Jan.1-June 30
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	1.609E 01
	Ci	3.063E 02
b. Dry compressible waste, contaminated equipment, etc.	m^3	6.008E 01
	Ci	2.010E-01
c. Irradiated components, control rods, etc.	m^3	None
	Ci	None
d. Other	m^3	None
	Ci	None

2. Estimate of major nuclide composition

	ISOTOPES	%	ISOTOPES	%
a.	H3	0.38	Fe-55	16.00
	Co-60	34.73	Co-57	0.18
	Co-58	3.73	Sb-125	0.17
	Mn-54	7.30	Cs-134	9.80
	Cs-137	12.74		
	Ni-63	14.81		
b.	H-3	1.56	Sr-90	1.59
	Co-60	51.93	Cs-134	5.59
	Co-58	9.49		
	Nb-95	1.26		
	Mn-54	11.30		
	Cs-137	10.75		
	Ni-63	3.51		
	Ce-144	2.84		
	Pu-241	0.17		

TABLE 3 (con't)

SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

1st Half, 1986

3. Solid Waste Disposition

a. Number of Shipments	7
b. Mode of Transportation	Chem-Nuclear Transport (2) Hittman Transport (5)
c. Destination	Chem-Nuclear Systems, Inc. Barnwell, South Carolina

4. Type of Containers

a. (1a)	Type "A" and "B" Packages, Steel Liners, High Integrity Containers
b. (1b)	"Strong and Tight" Wooden Boxes, Metal Boxes, and Steel Drums

5. Solidification Agents

a. (1a)	No solidifications during this period. All items (spent resin and charcoal) that are categorized for item 1a were shipped dewatered.
b. (1b)	N/A

B. IRRADIATED FUEL SHIPMENTS (Disposition)

1. Number of Shipments	None
2. Mode of Transportation	N/A
3. Destination	N/A

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: A
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	6	0	0	0	6
NNE	0	0	2	0	0	0	2
NE	0	0	1	0	0	0	1
ENE	0	2	2	0	0	0	4
E	0	1	1	0	0	0	2
ESE	0	0	0	0	0	0	0
SE	0	0	2	0	0	0	2
SSE	0	0	1	1	0	0	2
S	0	0	0	1	0	0	1
SSW	0	0	0	0	0	0	0
SW	1	0	0	1	0	0	2
WSW	0	4	2	1	0	0	7
W	0	0	2	5	0	0	7
WNW	0	0	0	2	0	0	2
NW	0	2	2	4	2	2	12
NNW	0	1	4	9	0	0	14
VARIABLE	0	0	0	0	0	0	0
Total	1	10	25	24	2	2	64

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: A
ELEVATION:10.0m

	Wind Speed (mph) at 10.0m level					
Wind Direction	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1	4	0	0	0	5
NNE	0	1	0	0	0	0	1
NE	0	1	0	0	0	0	1
ENE	0	3	1	0	0	0	4
E	0	1	0	0	0	0	1
ESE	0	0	2	0	0	0	2
SE	0	0	1	1	0	0	2
SSE	0	0	0	1	0	0	1
S	0	0	0	0	0	0	0
SSW	2	0	0	0	0	0	2
SW	1	0	2	1	0	0	4
WSW	1	2	5	0	0	0	8
W	0	1	2	0	0	0	3
WNW	0	0	1	0	0	0	1
NW	0	4	7	8	0	0	19
NNW	0	2	6	2	0	0	10
VARIABLE	0	0	0	0	0	0	0
Total	4	16	31	13	0	0	64

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: B
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	3	8	3	0	0	14
NNE	0	1	6	1	0	0	8
NE	0	2	5	1	0	0	8
ENE	0	5	3	4	0	0	12
E	0	3	4	0	0	0	7
ESE	0	3	4	0	0	0	7
SE	0	4	2	0	0	0	6
SSE	1	0	3	5	0	0	9
S	0	1	0	2	0	0	3
SSW	0	0	1	0	0	0	1
SW	0	0	0	0	0	0	0
WSW	0	3	7	1	1	0	12
W	0	0	1	6	0	0	7
WNW	0	0	3	4	0	0	7
NW	0	2	6	8	0	1	17
NNW	0	1	5	3	0	0	9
VARIABLE	0	0	0	0	0	0	0
Total	1	28	58	38	1	1	127

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: B
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	5	2	0	0	0	7
NNE	0	7	0	0	0	0	7
NE	0	6	5	1	0	0	12
ENE	0	5	1	1	0	0	7
E	1	6	3	0	0	0	10
ESE	0	5	1	0	0	0	6
SE	1	2	2	0	0	0	5
SSE	0	0	3	5	0	0	8
S	0	2	0	0	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	2	1	1	0	0	4
WSW	0	3	7	1	0	0	11
W	0	1	7	0	0	0	8
WNW	0	3	6	0	0	0	9
NW	0	1	13	2	0	0	16
NNW	0	4	10	1	0	0	15
VARIABLE	0	0	0	0	0	0	0
Total	2	52	61	12	0	0	127

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: C
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	14	3	0	0	0	17
NNE	0	9	16	0	0	0	25
NE	1	7	6	0	0	0	14
ENE	0	8	2	2	0	0	12
E	0	5	8	1	0	0	14
ESE	0	3	0	0	0	0	3
SE	0	4	3	0	0	0	7
SSE	0	2	3	2	0	0	7
S	0	1	1	4	0	0	6
SSW	0	2	1	0	0	0	3
SW	0	1	3	0	0	0	4
WSW	1	3	9	2	1	0	16
W	1	3	8	2	0	0	14
WNW	0	3	7	1	0	0	11
NW	0	5	4	2	2	0	13
NNW	0	1	4	4	0	0	9
VARIABLE	0	0	0	0	0	0	0
Total	3	71	78	20	3	0	175

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: C
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	31	1	0	0	0	32
NNE	0	11	0	0	0	0	11
NE	1	12	2	0	0	0	15
ENE	0	9	3	1	0	0	13
E	0	5	4	0	0	0	9
ESE	0	1	0	0	0	0	1
SE	1	5	3	1	0	0	10
SSE	0	3	3	3	0	0	9
S	0	2	0	0	0	0	2
SSW	1	1	1	0	0	0	3
SW	0	10	3	1	0	0	14
WSW	0	6	4	1	0	0	11
W	1	7	5	0	0	0	13
WNW	0	2	4	3	0	0	9
NW	0	6	6	1	0	0	13
NNW	0	7	3	0	0	0	10
VARIABLE	0	0	0	0	0	0	0
Total	4	118	42	11	0	0	175

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: D
ELEVATION:45.7m

	Wind Speed (mph) at 45.7m level						
Wind Direction	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	23	43	4	0	0	72
NNE	5	15	25	0	0	0	45
NE	2	11	23	5	0	0	41
ENE	3	13	18	10	0	0	44
E	2	15	4	0	0	0	21
ESE	3	10	2	0	0	0	15
SE	1	16	5	0	0	0	22
SSE	2	6	9	7	0	0	24
S	2	5	4	19	0	0	30
SSW	4	3	5	11	1	0	24
SW	2	3	17	6	13	1	42
WSW	5	12	24	9	6	2	58
W	4	13	15	7	0	0	39
WNW	2	12	6	8	0	0	28
NW	3	15	16	24	7	1	66
NNW	5	7	37	29	2	1	81
VARIABLE	0	0	0	0	0	0	0
Total	47	179	253	139	29	5	652

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: D
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	10	28	1	0	0	0	39
NNE	5	35	1	0	0	0	41
NE	5	25	12	0	0	0	42
ENE	6	14	14	0	0	0	34
E	7	19	0	0	0	0	26
ESE	2	9	1	0	0	0	12
SE	2	17	5	0	0	0	24
SSE	4	4	13	13	0	0	34
S	3	3	5	3	0	0	14
SSW	1	2	8	6	0	0	17
SW	12	19	27	19	2	0	79
WSW	7	25	10	2	0	0	44
W	6	11	8	0	0	0	25
WNW	5	11	9	4	0	0	29
NW	13	33	36	11	0	1	94
NNW	6	48	40	4	0	0	98
VARIABLE	0	0	0	0	0	0	0
Total	94	303	190	62	2	1	652

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86 > 3-31-86
STABILITY CLASS: E
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	23	28	2	0	0	55
NNE	2	8	18	0	0	0	28
NE	4	6	7	0	0	0	17
ENE	1	10	7	0	0	0	18
E	0	21	9	0	0	0	30
ESE	1	18	10	0	0	0	29
SE	1	7	15	0	0	0	23
SSE	0	6	22	6	0	0	34
S	2	2	18	16	0	0	38
SSW	4	3	13	8	0	0	28
SW	1	6	49	20	1	0	77
WSW	0	11	51	10	0	0	72
W	3	12	24	3	0	0	42
WNW	1	10	20	3	0	0	34
NW	0	5	28	9	0	0	42
NNW	1	4	40	10	0	0	55
VARIABLE	0	0	0	0	0	0	0
Total	23	152	359	87	1	0	622

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: E
ELEVATION: 10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	14	11	0	0	0	0	25
NNE	14	14	0	0	0	0	28
NE	20	8	0	0	0	0	28
ENE	14	7	0	0	0	0	21
E	16	10	1	0	0	0	27
ESE	8	12	2	0	0	0	22
SE	4	15	17	0	0	0	36
SSE	3	5	20	1	0	0	29
S	1	4	15	0	0	0	20
SSW	2	6	4	1	0	1	14
SW	8	70	40	2	0	0	120
WSW	11	33	5	0	0	0	49
W	17	9	4	0	0	0	30
WNW	17	24	4	0	0	0	45
NW	8	41	11	1	0	0	61
NNW	12	45	9	1	0	0	67
VARIABLE	0	0	0	0	0	0	0
Total	169	314	132	6	0	1	622

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1-1-86) 3-31-86
STABILITY CLASS: F
ELEVATION: 45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	9	5	0	0	0	15
NNE	0	6	7	0	0	0	13
NE	1	4	3	0	0	0	8
ENE	1	17	2	0	0	0	20
E	2	14	6	0	0	0	22
ESE	2	15	12	0	0	0	29
SE	1	3	5	0	0	0	9
SSE	2	3	6	0	0	0	11
S	0	1	3	3	0	0	7
SSW	2	0	2	1	0	0	5
SW	1	0	5	2	0	0	8
WSW	1	1	13	0	0	0	15
W	0	6	11	0	0	0	17
WNW	0	2	7	0	0	0	9
NW	1	3	9	4	0	0	17
NNW	0	5	11	1	0	0	17
VARIABLE	0	0	0	0	0	0	0
Total	15	89	107	11	0	0	222

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: F
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	33	4	0	0	0	0	37
NNE	17	3	0	0	0	0	20
NE	13	0	0	0	0	0	13
ENE	14	1	0	0	0	0	15
E	4	4	0	0	0	0	8
ESE	6	4	0	0	0	0	10
SE	2	4	4	0	0	0	10
SSE	2	1	0	0	0	0	3
S	0	1	0	0	0	0	1
SSW	0	1	2	0	0	0	3
SW	4	7	1	0	0	0	12
WSW	5	8	0	0	0	0	13
W	10	7	0	0	0	0	17
WNW	7	1	0	0	0	0	8
NW	12	15	0	0	0	0	27
NNW	21	4	0	0	0	0	25
VARIABLE	0	0	0	0	0	0	0
Total	150	65	7	0	0	0	222

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86 } 3-31-86
STABILITY CLASS: G
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	24	2	0	0	0	30
NNE	1	21	9	0	0	0	31
NE	2	12	15	0	0	0	29
ENE	4	11	9	0	0	0	24
E	2	13	13	0	0	0	28
ESE	4	4	12	0	0	0	20
SE	4	4	7	0	0	0	15
SSE	2	7	4	1	0	0	14
S	0	3	3	2	0	0	8
SSW	3	1	2	0	0	0	6
SW	2	2	0	2	0	0	6
WSW	3	9	3	0	0	0	15
W	6	10	4	0	0	0	20
WNW	2	14	4	0	0	0	20
NW	1	8	6	1	0	0	16
NNW	2	2	12	0	0	0	16
VARIABLE	0	0	0	0	0	0	0
Total	42	145	105	6	0	0	298

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 1 -1-86 } 3-31-86
STABILITY CLASS: G
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	89	3	0	0	0	0	92
NNE	41	1	0	0	0	0	42
NE	21	1	0	0	0	0	22
ENE	9	0	0	0	0	0	9
E	8	0	0	0	0	0	8
ESE	2	0	0	0	0	0	2
SE	6	3	0	0	0	0	9
SSE	1	1	0	0	0	0	2
S	0	1	0	0	0	0	1
SSW	3	1	1	0	0	0	5
SW	0	[illegible]	0	0	0	0	0
WSW	3	1	0	0	0	0	4
W	10	2	0	0	0	0	12
WNW	7	1	0	0	0	0	8
NW	11	1	0	0	0	0	12
NNW	64	6	0	0	0	0	70
VARIABLE	0	0	0	0	0	0	0
Total	275	22	1	0	0	0	298

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: A
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2	2	4	0	0	8
NNE	0	6	3	0	0	0	9
NE	0	2	5	2	0	0	9
ENE	0	3	7	0	0	0	10
E	1	5	6	0	0	0	12
ESE	0	8	9	0	0	0	17
SE	0	9	15	0	0	0	24
SSE	0	4	8	0	0	0	12
S	0	4	6	0	0	0	10
SSW	0	0	4	0	0	0	4
SW	0	10	17	0	0	0	27
WSW	0	4	9	3	0	0	16
W	0	0	9	1	0	0	10
WNW	0	0	8	0	0	0	8
NW	0	3	10	4	0	0	17
NNW	0	0	6	6	0	0	12
VARIABLE	0	0	0	0	0	0	0
Total	1	60	124	20	0	0	205

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: A
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3	4	1	0	0	0	8
NNE	1	4	0	0	0	0	5
NE	0	11	0	0	0	0	11
ENE	2	7	1	0	0	0	10
E	3	8	3	0	0	0	14
ESE	7	14	5	0	0	0	26
SE	10	6	1	0	0	0	17
SSE	1	9	1	0	0	0	11
S	5	1	0	0	0	0	6
SSW	5	7	0	0	0	0	12
SW	12	10	6	0	0	0	28
WSW	0	1	7	0	0	0	8
W	0	5	4	0	0	0	9
WNW	1	5	5	0	0	0	11
NW	1	9	6	1	0	0	17
NNW	1	3	5	3	0	0	12
VARIABLE	0	0	0	0	0	0	0
Total	52	104	45	4	0	0	205

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: B
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	7	4	0	0	0	11
NNE	0	10	3	0	0	0	13
NE	1	6	0	1	0	0	8
ENE	2	8	1	0	0	0	11
E	0	4	1	0	0	0	5
ESE	2	6	2	0	0	0	10
SE	0	12	1	0	0	0	13
SSE	0	7	7	0	0	0	14
S	0	4	5	0	0	0	9
SSW	0	1	3	0	0	0	4
SW	0	7	8	1	0	0	16
WSW	0	9	6	3	0	0	18
W	1	11	5	5	0	0	22
WNW	0	2	5	0	0	0	7
NW	0	10	10	1	0	0	21
NNW	1	3	8	3	0	0	15
VARIABLE	0	0	0	0	0	0	0
Total	7	107	69	14	0	0	197

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: B
ELEVATION: 10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	6	0	0	0	0	10
NNE	4	7	0	0	0	0	11
NE	2	6	0	0	0	0	8
ENE	3	6	0	0	0	0	9
E	1	7	0	0	0	0	8
ESE	6	5	0	0	0	0	11
SE	11	8	1	0	0	0	20
SSE	4	8	0	0	0	0	12
S	2	0	1	0	0	0	3
SSW	2	4	1	0	0	0	7
SW	7	13	4	1	0	0	25
WSW	3	10	4	0	0	0	17
W	2	6	6	0	0	0	14
WNW	1	12	2	0	0	0	15
NW	1	11	6	1	0	0	19
NNW	4	2	2	0	0	0	8
VARIABLE	0	0	0	0	0	0	0
Total	57	111	27	2	0	0	197

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: C
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	11	1	1	0	0	13
NNE	1	15	2	0	0	0	18
NE	1	10	2	0	0	0	13
ENE	5	8	0	0	0	0	13
E	2	4	1	0	0	0	7
ESE	1	7	2	0	0	0	10
SE	1	8	0	0	0	0	9
SSE	1	5	12	0	0	0	18
S	0	1	4	0	0	0	5
SSW	1	1	2	0	0	0	4
SW	0	5	8	2	0	0	15
WSW	2	6	6	1	0	0	15
W	0	12	9	2	0	0	23
WNW	1	7	4	0	0	0	12
NW	1	9	12	1	0	0	23
NNW	0	16	2	3	0	0	21
VARIABLE	0	0	0	0	0	0	0
Total	17	125	67	10	0	0	219

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: C
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	9	6	1	0	0	0	16
NNE	7	8	1	0	0	0	16
NE	4	5	1	0	0	0	10
ENE	4	5	1	0	0	0	10
E	7	8	0	0	0	0	15
ESE	1	2	0	0	0	0	3
SE	9	6	1	0	0	0	16
SSE	3	6	3	0	0	0	12
S	1	2	2	0	0	0	5
SSW	3	5	2	0	0	0	10
SW	5	2	5	0	0	0	12
WSW	7	6	4	0	0	0	17
W	2	11	8	0	0	1	22
WNW	3	9	2	0	0	0	14
NW	6	15	1	1	0	0	23
NNW	6	11	0	1	0	0	18
VARIABLE	0	0	0	0	0	0	0
Total	77	107	32	2	0	1	219

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: D
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5	21	3	3	0	0	32
NNE	5	19	5	0	0	0	29
NE	3	11	1	0	0	0	15
ENE	4	11	1	0	0	0	16
E	0	8	7	0	0	0	15
ESE	3	9	4	0	0	0	16
SE	2	14	10	1	0	0	27
SSE	3	6	11	0	0	0	20
S	1	7	5	0	0	0	13
SSW	1	4	11	9	1	0	26
SW	4	10	33	5	0	0	52
WSW	3	15	32	10	0	0	60
W	4	16	13	1	0	0	34
WNW	6	12	7	1	0	0	26
NW	6	20	7	0	0	0	33
NNW	5	13	14	6	0	0	38
VARIABLE	0	0	0	0	0	0	0
Total	55	196	164	36	1	0	452

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: D
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	22	5	1	0	0	0	28
NNE	15	[illegible]	0	0	0	0	23
NE	7	6	0	0	0	0	13
ENE	8	12	0	0	0	0	20
E	8	10	0	0	0	0	18
ESE	8	8	1	0	0	0	17
SE	20	12	1	0	0	0	33
SSE	4	4	1	0	0	0	9
S	5	7	3	2	0	0	17
SSW	10	10	5	4	0	0	29
SW	29	24	21	1	0	0	75
WSW	14	21	3	0	0	0	38
W	14	12	4	0	0	0	30
WNW	7	10	2	0	0	0	19
NW	20	17	5	0	0	0	42
NNW	18	16	7	0	0	0	41
VARIABLE	0	0	0	0	0	0	0
Total	209	182	54	7	0	0	452

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: E
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	19	6	0	0	0	26
NNE	4	17	3	0	0	0	24
NE	5	4	1	0	0	0	10
ENE	0	12	4	0	0	0	16
E	4	12	6	1	0	0	23
ESE	3	15	7	0	0	0	25
SE	5	18	16	0	0	0	39
SSE	2	13	18	1	0	0	34
S	3	11	9	1	0	0	24
SSW	2	10	2	1	0	0	15
SW	3	24	33	2	0	0	62
WSW	4	44	62	3	0	0	113
W	0	45	43	1	0	0	89
WNW	4	23	16	0	0	0	43
NW	1	18	13	1	0	0	33
NNW	1	10	15	4	0	0	30
VARIABLE	0	0	0	0	0	0	0
Total	42	295	254	15	0	0	606

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: E
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	17	4	0	C	0	0	21
NNE	16	1	0	0	0	0	17
NE	22	5	0	0	0	0	27
ENE	17	4	0	0	0	0	21
E	15	7	1	0	0	2	25
ESE	28	5	0	0	0	0	33
SE	15	13	3	0	0	0	31
SSE	10	8	2	0	0	0	20
S	13	2	1	0	0	0	16
SSW	16	3	1	0	0	0	20
SW	63	40	5	0	0	0	108
WSW	65	30	3	0	0	0	98
W	37	13	0	0	0	0	50
WNW	24	7	1	0	0	0	32
NW	32	11	1	0	0	0	44
NNW	30	8	5	0	0	0	43
VARIABLE	0	0	0	0	0	0	0
Total	420	161	23	0	0	2	606

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: F
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	15	11	0	0	0	28
NNE	2	4	16	0	0	0	22
NE	1	8	3	0	0	0	12
ENE	1	8	0	0	0	0	9
E	1	4	2	0	0	0	7
ESE	0	4	3	0	0	0	7
SE	1	7	13	0	0	0	21
SSE	0	4	13	0	0	0	17
S	2	2	6	2	0	0	12
SSW	2	2	0	1	0	0	5
SW	2	10	7	1	0	0	20
WSW	2	18	10	1	0	0	31
W	0	13	21	0	0	0	34
WNW	3	23	17	0	0	0	43
NW	2	9	16	0	0	0	27
NNW	4	13	18	0	0	0	35
VARIABLE	0	0	0	0	0	0	0
Total	25	144	156	5	0	0	330

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: F
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	23	0	0	0	0	0	23
NNE	14	1	0	0	0	0	15
NE	14	0	0	0	0	0	14
ENE	12	0	0	0	0	0	12
E	10	1	0	0	0	0	11
ESE	18	2	0	0	0	0	20
SE	7	10	0	0	0	0	17
SSE	7	2	0	0	0	0	9
S	2	1	0	0	0	0	3
SSW	2	2	0	0	0	0	4
SW	14	5	0	0	0	0	19
WSW	28	5	0	0	0	0	33
W	32	7	0	0	0	0	39
WNW	16	5	0	0	0	0	21
NW	35	5	0	0	0	0	40
NNW	47	3	0	0	0	0	50
VARIABLF	0	0	0	0	0	0	0
Total	281	49	0	0	0	0	330

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: G
ELEVATION: 45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	10	0	0	0	0	12
NNE	2	9	5	1	0	0	17
NE	2	1	7	0	0	0	10
ENE	1	3	2	0	0	0	6
E	2	5	4	0	0	0	11
ESE	1	4	4	0	0	0	9
SE	1	6	3	0	0	0	10
SSE	1	3	4	0	0	0	8
S	2	3	1	0	0	0	6
SSW	2	3	0	0	0	0	5
SW	1	7	2	0	0	0	10
WSW	1	6	3	0	0	0	10
W	1	7	1	0	0	0	9
WNW	0	8	2	0	0	0	10
NW	3	12	3	0	0	0	18
NNW	3	14	7	0	0	0	24
VARIABLE	0	0	0	0	0	0	0
Total	25	101	48	1	0	0	175

Periods of calm(hours): 0
Hours of missing data: 0

Table 4A-CQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Nuclear Plant - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: CONTINUOUS
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: G
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	47	0	0	0	0	0	47
NNE	22	0	0	0	0	0	22
NE	7	0	0	0	0	0	7
ENE	6	0	0	0	0	0	6
E	4	0	0	0	0	0	4
ESE	6	0	0	0	0	0	6
SE	3	0	0	0	0	0	3
SSE	1	0	0	0	0	0	1
S	1	0	0	0	0	0	1
SSW	4	0	0	0	0	0	4
SW	5	0	0	0	0	0	5
WSW	5	0	0	0	0	0	5
W	7	0	0	0	0	0	7
WNW	6	1	0	0	0	0	7
NW	18	1	0	0	0	0	19
NNW	31	0	0	0	0	0	31
VARIABLE	0	0	0	0	0	0	0
Total	173	2	0	0	0	0	175

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-1BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 1 - 1st Quarter, 1986

No batch releases were made during 1st Quarter 1986 therefore Cumulative Joint Frequency Distribution tables are not applicable.

TABLE 4A-1BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 1 - 2nd Quarter, 1986

No batch releases were made during 2nd Quarter 1986 therefore Cumulative Joint Frequency Distribution tables are not applicable.

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: A
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86 } 3-31-86
STABILITY CLASS: A
ELEVATION:10.0m

	Wind Speed (mph) at 10.0m level					
Wind Direction	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: B
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86 › 3-31-86
STABILITY CLASS: B
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): C
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: C
ELEVATION:45.7m

	Wind Speed (mph) at 45.7m level						
Wind Direction	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: C
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: D
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	4	0	0	0	4
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	1	0	0	0	0	1
SSW	0	0	1	0	0	0	1
SW	C	0	1	0	0	0	1
WSW	0	0	3	0	0	0	3
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	0	0	4	4	0	0	8
VARIABLE	0	0	0	0	0	0	0
Total	0	1	13	4	0	0	18

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: D
FLEVATION:10.0m

Wind Speed (mph) at 10.0m level

Wind Direction	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	2	0	0	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	2	1	0	0	0	3
WSW	0	1	0	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	1	0	0	0	1
NNW	0	6	5	0	0	0	11
VARIABLE	0	0	0	0	0	0	0
Total	0	11	7	0	0	0	18

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: E
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	2	0	0	0	2
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	2	0	0	0	2

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: E
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	2	0	0	0	0	2
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	2	0	0	0	0	2

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Qua. er, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86 } 3-31-86
STABILITY CLASS: F
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE. BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: F
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: G
ELEVATION: 45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ1

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 1st Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 1 -1-86) 3-31-86
STABILITY CLASS: G
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: A
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	C	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	2	0	0	0	2
S	0	0	2	0	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	1	0	0	0	1
WNW	0	0	3	0	0	0	3
NW	0	0	2	0	0	0	2
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	0	10	0	0	0	10

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: A
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	0	3	0	0	0	0	3
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	1	1	0	0	0	2
WNW	0	0	3	0	0	0	3
NW	0	1	0	0	0	0	1
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	1	5	4	0	0	0	10

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Fariey Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: B
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	1	0	0	0	0	1
WNW	0	0	0	0	0	0	0
NW	0	0	2	0	0	0	2
NNW	0	1	1	0	0	0	2
VARIABLE	0	0	0	0	0	0	0
Total	0	2	3	0	0	0	5

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DI''RIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: B
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	1	0	0	0	0	1
WNW	0	1	0	0	0	0	1
NW	0	2	1	0	0	0	3
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	0	4	1	0	0	0	5

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: C
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	1	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	1	1	0	0	0	2
WNW	0	0	0	0	0	0	0
NW	0	1	0	0	0	0	1
NNW	0	1	0	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
Total	0	3	2	0	0	0	5

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: C
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	1	0	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	1	0	0	0	0	1
W	0	1	0	0	0	0	1
WNW	0	1	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	1	0	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
Total	0	5	0	0	0	0	5

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: D
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	2	0	0	0	0	2
NE	0	1	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	1	1	0	0	0	0	2
SE	0	1	0	0	0	0	1
SSE	0	0	1	0	0	0	1
S	0	0	1	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	2	0	0	0	0	2
WNW	0	1	0	0	0	0	1
NW	0	2	0	0	0	0	2
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	2	10	2	0	0	0	14

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: D
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	1	0	0	0	0	2
NNE	2	0	0	0	0	0	2
NE	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	1	0	0	0	0	0	1
ESE	0	1	0	0	0	0	1
SE	1	0	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	0	1	0	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	1	0	0	0	0	0	1
W	0	1	0	0	0	0	1
WNW	0	1	0	0	0	0	1
NW	0	2	0	0	0	0	2
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	7	7	0	0	0	0	14

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: E
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	3	0	0	0	0	0	3
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	1	0	0	0	1
S	0	0	1	0	0	0	1
SSW	0	0	0	0	0	0	0
SW	0	3	0	0	0	0	3
WSW	0	1	0	0	0	0	1
W	0	2	1	0	0	0	3
WNW	0	2	2	0	0	0	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	3	9	5	0	0	0	17

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86 } 6-30-86
STABILITY CLASS: E
ELEVATION:10.0m

	Wind Speed (mph) at 10.0m level					
Wind Direction	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1	0	0	0	0	1
NNE	1	0	0	0	0	0	1
NE	1	0	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	0	1	0	0	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	3	0	0	0	0	0	3
WSW	1	0	0	0	0	0	1
W	2	2	0	0	0	0	4
WNW	2	1	0	0	0	0	3
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	12	5	0	0	0	0	17

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: F
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	1	0	0	0	1
S	0	1	0	0	0	0	1
SSW	0	0	0	0	0	0	0
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	1	0	0	0	0	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	1	2	1	0	0	0	4

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: F
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	1	0	0	0	0	0	1
SSW	0	0	0	0	0	0	0
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	1	0	0	0	0	0	1
VARIABLE	0	0	0	0	0	0	0
Total	4	0	0	0	0	0	4

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: G
ELEVATION:45.7m

Wind Direction	Wind Speed (mph) at 45.7m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	1	0	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	1	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	1	1	0	0	0	0	2

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4A-2BQ2

CUMULATIVE JOINT FREQUENCY DISTRIBUTION

Farley Unit 2 - 2nd Quarter, 1986

HOURS AT EACH WIND SPEED AND DIRECTION

RELEASE MODE: BATCH
PERIOD OF RECORD: 4 -1-86) 6-30-86
STABILITY CLASS: G
ELEVATION:10.0m

Wind Direction	Wind Speed (mph) at 10.0m level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	1	0	0	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
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	0	0	0	0	0	0	0
VARIABLE	0	0	0	0	0	0	0
Total	2	0	0	0	0	0	2

Periods of calm(hours): 0
Hours of missing data: 0

TABLE 4B

CLASSIFICATION OF ATMOSPHERIC STABILITY

Stability Classification	Pasquill Categories	σ_{Θ}[a] (degrees)	Temperature channel with height (°F/51m)
Extremely unstable	A	25.0	<-1.74
Moderately unstable	B	20.0	-1.74 to -1.56
Slightly unstable	C	15.0	-1.56 to -1.38
Neutral	D	10.0	-1.38 to -0.46
Slightly stable	E	5.0	-0.46 to 1.38
Moderately stable	F	2.5	1.38 to 3.6
Extremely stable	G	1.7	>3.6

a Standard deviations of horizontal wind direction fluctuation over a period of 15 minutes to 1 hour. The values shown are averages for each stability classification.

TABLE 5

RADIOACTIVE GASEOUS WASTE SAMPLING AND ANALYSIS PROGRAM
FARLEY NUCLEAR PLANT - UNITS 1 & 2

Gaseous Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Minimum Detectable Concentration (MDC)(uCi/ml)[a,h]
A. Waste Gas Storage Tank	Each Tank Grab Sample P[b]	Each Tank P	Principle Gamma Emitters[g,h]	1E-04
B. Containment Purge	Each Purge Grab Sample P[b]	Each Purge Grab Sample P[b]	Principle Gamma Emitters[g,j]	1E-04
			H-3	1E-06
C. Condenser Steam Jet Air Ejector Plant Vent Stack	M[b,c,e] Grab Sample	M[b]	Principle Gamma Emitters[g,j]	1E-04
			H-3	1E-06
D. Plant Vent Stack Containment Purge	Continuous[f] Charcoal	Charcoal Sample W[d]	I-131	1E-12
			I-133	1E-10
	Continuous[f]	Particulate Sample W[d]	Principle Gamma Emitters[g] (I-131, Others)	1E-11
	Continuous[f]	W[i] Composite Particulate Sample	Gross Alpha	1E-11
	Continuous[f]	Q[i] Composite Particulate Sample	Sr-89, Sr-90	1E-11
	Continuous[f]	Noble Gas Monitor	Noble Gases Gross Beta & Gamma	1E-06

TABLE 5 (Continued)

TABLE NOTATION

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

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

$$MDC = 4.66\, s_b \;/\; E * V * 2.22 \times 10^6 * Y * \exp(-\lambda \Delta t)$$

where:

MDC is the "a priori" lower limit of detection as defined above (as microcurie per unit mass or volume),

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

E is the counting efficiency (as counts per transformation),

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

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental samples).

The value of s_b used in the calculation of the MDC for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. Typical values of E, V, Y, and Δt shall be used in the calculation.

TABLE NOTATION

b. Analyses shall also be performed following shutdown from > or = 15% RATED THERMAL POWER, startup to > or = 15% RATED THERMAL POWER or a THERMAL POWER change exceeding 15% of the RATED THERMAL POWER within a one hour period.

c. Tritium grab samples shall be taken from the plant vent stack at least once per 24 hours when the refueling canal is flooded.

d. Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing (or after removal from sampler). Sampling shall also be performed at least once per 24 hours for at least 2 days following each shutdown from > or = 15% RATED THERMAL POWER, startup to > or = 15% RATED THERMAL POWER or THERMAL POWER change exceeding 15% of RATED THERMAL POWER in one hour and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding MDC may be increased by a factor of 10.

e. Tritium grab samples shall be taken at least once per 7 days from the ventilation exhaust from the spent fuel pool area, whenever spent fuel is in the spent fuel pool.

f. The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Specifications 3.11.2.1, 3.11.2.2 and 3.11.2.3.

g. The principle gamma emitters for which the MDC specification applies exclusively are the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141 and Ce-144 for particulate emissions. This list does not mean that only these nuclides are to be detected and reported. Other which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

h. Deviations from MDC requirements of Table 4.11-2 shall be reported per Specification 6.9.1.8 in lieu of any other report.

i. A composite particulate sample is one in which the quantity of air sampled is proportional to the quantity of air discharged. Either a specimen which is representative of the air discharged may be accumulated and analyzed or the individual samples may be analyzed and weighted in proportion to their respective volume discharged.

j. The principle gamma emitters for which the MDC specification applies exclusively are the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 for gaseous emissions. This does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable together with the above nuclides, shall also be identified and reported.

TABLE 6

RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM
FARLEY NUCLEAR PLANT - UNITS 1 & 2

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Minimum Detectable Concentration (MDC)(uCi/ml)[a,g]
A. Batch Waste Release Tanks[c]	P[P] Each Batch	P[P] Each Batch	Principle Gamma Emitters[e]	5E-07
			I-131	1E-06
	One Batch/M	M	Dissolved & Entrained Gases (Gamma Emitters)	1E-05
	P Each Batch	M[b] Composite	H-3	1E-05
			Gross Alpha	1E-07
	P Each Batch	Q[b] Composite	Sr-89, Sr-90	5E-08
			Fe-55	1E-06
B. Continuous Releases[d,f]	D Grab Sample	W[b] Composite	Principle Gamma Emitters[e]	5E-07
			I-131	1E-06
1. Steam Generator Blowdown	M Grab Sample	M	Dissolved & Entrained Gases (Gamma Emitters)	1E-05
	D Grab Sample	M[b] Composite	H-3	1E-05
			Gross Alpha	1E-07
	D Grab Sample	Q[b] Composite	Sr-89, Sr-90	5E-08
			Fe-55	1E-06
2. Turbine Building Sump	P Grab Sample	W[b] Composite	Principle Gamma Emitters[e]	5E-07
			H-3	1E-05

TABLE 6 (Continued)

TABLE NOTATION

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

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

$$MDC = 4.66 s_b / E * V * 2.22X10^6 * Y * \exp(-\lambda\Delta t)$$

where:

MDC is the "a priori" lower limit of detection as defined above (as microcurie per unit mass or volume),

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

E is the counting efficiency (as counts per transformation),

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

2.22×10^6 is the number of transformations per minute per microcurie,

Y is the fractional radiochemical yield (when applicable),

λ is the radioactive decay constant for the particular radionuclide, and

Δt is the elapsed time between midpoint of sample collection and time of counting (for plant effluents, not environmental samples).

The value of s_b used in the calculation of the MDC for a detection system shall be based on the actual observed variance of the background counting rate or of the counting rate of the blank samples (as appropriate) rather than on an unverified theoretically predicted variance. Typical values of E, V, Y, and Δt shall be used in the calculation.

TABLE 6 (Continued)

TABLE NOTATION

b. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.

c. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed, by a method described in the ODCM, to assure representative sampling.

d. A continuous release is the discharge of liquid wastes of a nondiscrete volume; e.g., from a volume of system that has an input flow during the effluent release.

e. The principle gamma emitters for which the MDC specification applies exclusively are the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported.

f. Sampling will be performed only if the effluent will be discharged to the environment.

g. Deviation from the MDC requirements of Table 4.11-1 shall be reported per Specification 6.9.1.8 in lieu of any other report.

TABLE 7

LIQUID DISCHARGES NOT MEETING SPECIFIED DETECTION LIMITS
Farley Units 1 & 2 - 1st half, 1986

Batch #	N/A*
Date	N/A
Count Time in Seconds	N/A
Volume Discharged in Gallons	N/A
Dilution Water in Gallons	N/A
Total Isotopic Activity (uCi/ml)	N/A
Isotope of Interest	N/A
MDC Measured	N/A
% of Total Isotopic Activity	N/A
% of Total Dose	N/A

* No liquid discharges made that did not meet specified detection limits.

12. Process Control Program

Changes to the Process Control Program (PCP) during the first semi-annual period of 1986 are submitted per STS section 6.13.2. Documentation that the changes were reviewed and found acceptable by the Plant Operations Review Committee is also submitted in the following section of this report.

CLOSURE OF HITTMAN RADLOK™ HIGH INTEGRITY CONTAINER FILL POINT CLOSURE ASSEMBLY

1.0 PURPOSE

The purpose of this procedure is to describe the proper method of sealing the fill port opening on Hittman RADLOK High Integrity Containers.

2.0 APPLICABLE DOCUMENTS

The following drawings and documents are listed as applicable to this procedure:

STD-D-03-009, Users Manual for Hittman RADLOK-200, RADLOK-500, and RADLOK-100 Containers
STD-D-03-008, Users Manual for Hittman RADLOK-55

3.0 PRE-SEALING INSTRUCTIONS

These steps are to be taken prior to filling the container.

3.1 Compression Plug

3.1.1 Examine the O-ring seal (Item 1, Figure 1) and small vertical seal (Item 2, Figure 1) for signs of significant gouges, splits, cracks or brittleness. Damaged seals should be replaced.

3.1.2 Clean the O-ring and vertical seal seats on the compression plug (Item 3, Figure 1) and remove all foreign matter.

3.1.3 Spray the O-ring and vertical seal seats with silicone rubber adhesive. Place the O-ring seal in the seat area. Place the vertical seal in its respective seat area. A liquid adhesive such as 3M Scotch-Weld CA-4 Cyanoacrylate Adhesive may also be used.

3.1.4 Apply a liberal coating of lubricant grease on the exposed seal surfaces.

NOTE: Caution must be exercised to ensure that the lubricant used does not contain any of the chemicals listed in Appendix A of the User's Manual. Acceptable lubricants include Vasoline and other petroleum jelly products.

3.1.5 Apply a liberal coating of lubricant grease to the threads on the fill port lid (Item 4, Figure 1).

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED	Document Number: STD-P-03-004	Rev: 7	Rev Date: 12/19/85
	Title: CLOSURE OF HITTMAN RADLOK™ HIGH INTEGRITY CONTAINER FILL PORT CLOSURE ASSEMBLY		

Rev.	Rev Date	Prepared by	Operations	Director Engineering	QA Manager		
0	4-7-82	JD Williams	[illegible]	[illegible]	[illegible]		
1	4-16-82	JD Williams	[illegible]	[illegible]	J. Pawlik for B. Rowe		ECN-82-091
2	4-28-82	[illegible]	[illegible]	[illegible]	[illegible]		ECN-82-096
3	9-10-82	[illegible]	[illegible]	[illegible]	[illegible]		ECN-82-182
4	3-1-83	[illegible]	[illegible]	[illegible] for CWM.	[illegible]		ECN-83-056
5	9-30-83	[illegible]	[illegible]	[illegible]	[illegible]		ECN-83-247
6	6/6/85	[illegible]	[illegible]	[illegible]	[illegible]		ECN-85-035
		Director Engr.	Product Manager	Q.A. Manager	X		
7	12/19/85	[illegible]	[illegible] for O.J. Dimmick 12/19	[illegible]			ECN-85-213

FORM-01(B)

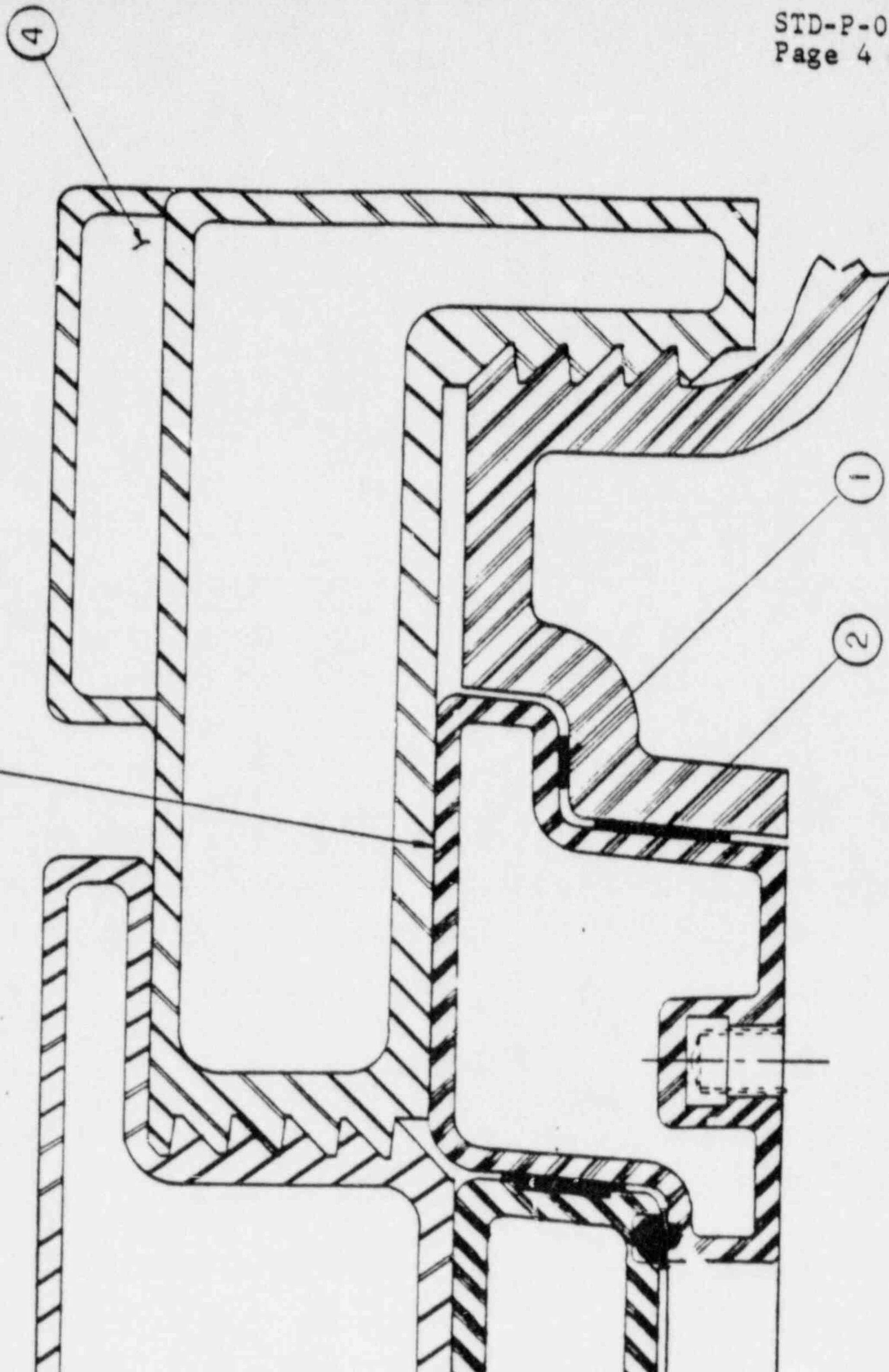

Figure 1

1. Procedure Number FNP-0-M-030 Revision Number 4
Procedure Title Process Control Program (PCP)

- XXX Safety Related ☐ Non-Safety Related
- ☐ New Procedure Request
- XXX Procedure Revision, New Revision Number 5
- ☐ Temporary Procedure Change, Effective until next permanent change, TCN ______
- ☐ Temporary Procedure Change, Req'd. by Plant Conditions, TCN __
- ☐ Temporary Procedure Change, One Time Use, TCN ____
- ☐ Delete procedure
- ☐ Delete TCN ______
- XX The procedure has been revised per Section 9 of FNP-0-AP-1.

2. Change Summary
2.1 Procedure Page Numbers Affected by Change See attached list of effective pages that show FNP revision 5

2.2 Description of Changes See attached list.

2.3 Reason for Change All changes are due to upgrade of PCP program by vendor.

3. Prepared By [signature], [illegible] 5-13-86
Signature Title Date

4. Reviewed By Joe M. Walden, Radwaste Supv. 5/16/86
Signature Title Date

5. Cross-Disciplinary/PORC Review

Group	Signature	Title	Date
PORC	[signature]	PORC ch'n	5/20/86

6. Temporary Change Approval (Signature/Date)

- ☐ Member Group Staff ______ / ______
- ☐ Shift Foreman ______ / ______
- ☐ Senior Reactor Operator ______ / ______
- ☐ General Manager-Nuclear Plant ______ / ______

7. Final Approval (Signature/Date, required within 60 days of temporary approval)

- ☐ Group Supervisor ______ / ______
- X Manager C. D. [signature] / 6-2-86
- ☐ MSAER ______ / ______
- ☐ Senior Vice President ______ / ______
- ☐ ______ ______ / ______
- ☐ General Manager - Nuclear Plant ______ / ______

FARLEY NUCLEAR PLANT
NUCLEAR SAFETY EVALUATION CHECK LIST

(1) UNIT SHARED

(2) CHECK LIST APPLICABLE TO: FNP-0-M-030 Revision 5 TCN n/a

(3) SAFETY EVALUATION - PART A: Does the procedure or procedure change to which this evaluation is applicable represent:

(3.1)	Yes ____	No X	A change to the plant as described in the FSAR?
(3.2)	Yes ____	No X	A change to procedures as described in the FSAR?
(3.3)	Yes ____	No X	A test or experiment not described in the FSAR?
(3.4)	Yes ____	No X	A change to the Technical Specifications or Operating License?
(3.5)	Yes ____	No X	A change to the Fire Protection System as described in the FPPR or a conflict with the requirements of 10CFR50, Appendix R?

If the answer to question 3.1, 3.2, or 3.3 or 3.4 is "Yes," complete Item (4) and attach a 10 CFR 50.59 evaluation. If the answer to question 3.4 is "Yes," also complete a 10 CFR 50.92 check list. If the answer to question 3.5 is "Yes", provide an evaluation of the impact of the procedure or procedure change on the Fire Protection System and 10CFR50, Appendix R requirements. If the answer to Items 3.1,3.2,3.3 and 3.4 is "No", omit Item (4) and Item (9).

(4) SAFETY EVALUATION - PART B

(4.1)	Yes ____	No ____	Will the probability of an accident previously evaluated in the FSAR be increased?
(4.2)	Yes ____	No ____	Will the consequences of an accident previously evaluated in the FSAR be increased?
(4.3)	Yes ____	No ____	May the possibility of an accident which is different than any already evaluated in the FSAR be created?
(4.4)	Yes ____	No ____	Will the probability of a malfunction of equipment important to safety previously evaluated on the FSAR be increased?
(4.5)	Yes ____	No ____	Will the consequences of a malfunction of equipment important to safety different than any already evaluated in the FSAR be increased?
(4.6)	Yes ____	No ____	May the possibility of a malfunction of equipment important to safety different than any already evaluated in the FSAR be created?
(4.7)	Yes ____	No ____	Will the margin of safety as defined in the basis to any Technical Specification be reduced?

If the answer to any of the above questions is "Yes," an unreviewed safety question may be involved.

(5) REMARKS: (Attach additional pages if necessary) These changes will not reduce the overall conformance of the Solidified Waste Program to existing criteria for solid wastes.

(6) PREPARED BY: Joe M. Walden DATE 5/2/86

(7) REVIEWED BY: Marvin W. [signature] DATE 5-6-86

(8) PORC REVIEW: [signature] DATE 5/20/86

(9) NORB REVIEW: ____ DATE ____

List of Effective Page

Section A Dewatering		WHNI Revision	Number of Pages	FNP Revision
STD-P-03-003	RADLOCK[RM] Manway Lid Closure and Sealing Procedure	8	4	5
STD-P-03-004	Closure of HITTMAN RADLOK[TM] High Integrity Container Fill Port Closure Assembly	7	4	5
STD-P-03-005	Dewatering Bead Ion Exchange Resin in HITTMAN RADLOK[TM] Containers with Flexable Underdrains to Less Than 1% Drainable Liquid	4	5	0
STD-P-03-006	Inspection of Completed HIDC Liners	1	9	1
STD-D-03-008	A Users Manual for the HITTMAN RADLOCK[TM]-55	7	15	5
STD-P-03-008	Transfer & Dewatering Powdered Resin in Hittman RADLOK[TM]-100, 200 or 500 Containers with a Flexible Underdrain Assembly to Less than 1% Drainable Liquid	5	7	5
STD-D-03-009	A Users Manual for the HITTMAN RADLOK[TM]-200, RADLOK 500, and RADLOK 100	9	18	5
STD-P-03-010	Transfer & Dewatering Bead Resin in Hittman RADLOK[TM]-100, 200 or 500 Containers with Single Layer Underdrain Assembly to Less Than 1% Drainable Liquid	6	12	5
STD-P-03-020	Radlok Inspection Procedure	5	5	5
STD-P-04-002	P.C.P. for Dewatering Ion Exchange Resin & Activated Charcoal Filter Media to .5% Drainable Liquid	6	11	5
Section B Solidification				
STD-P-05-002	P.C.P. for Incontainer Solidification of Oily Waste	4	18	5
STD-P-05-003	P.C.P. for Incontainer Solidification of 4 to 20 Weight Percent Boric Acid	4	32	3
STD-P-05-004	P.C.P. for Incontainer Solidification of Bead Resin	5	16	2

		WHNI Revision	Number of Pages	FNP Revision
STD-P-05-011	Process Control Program for Incontainer Solidification of Granular Activated Carbon (12-40 MESH)	2	12	2
STD-P-05-021	P.C.P. for Incontainer Solidification of Class A Unstable and Stable, Class B or C Decanted Diatomaceous Earth	1	24	4
STD-P-05-022	Calcium Hydroxide Addition Procedure	1	7	4
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STD-P-05-027	Full Scale Test Solidification Procedure for Class B or C Bead Resin	0	11	1
STD-P-05-034	PCP for Incontainer Solidification of Class A Stable, Class B and C Bead Resin at Maximum Packaging Efficiency	1	13	3
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STD-R-03-002	Report on Dewatering of Bead Ion Exchange Resin and Activated Carbon in HITTMAN RADLOK[RM] High Integrity Containers	1	17	1
STD-R-03-005	Summary Report of Powdered Resin Dewatering In a RADLOK[TM] Container	0	24	1
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		WHNI Revision	Number of Pages	FNP Revision
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HNDC-TS-13000	Field Assembly & Operating Procedure for Flexcon Cement Feed System	1	6	0
HNDC-TS-14000	Liner Loading Procedure	2	3	0
HNDC-TS-17000	Mixer Head Drive Mounting Procedure (Hydraulic / Electric)	1	2	0
HNDC-TS-19000	Field Assembly & Operating Procedure for Electric Mixer Drive Assembly	2	6	0
HNDC-TS-20000	Boric Acid Solidification Procedure	2	5	0
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Appendix A	Generic Information for Developing a Process Control Program	NA	1	3
Appendix B	Process Control Program For Absorption of Oil	NA	2	4

RADLOK™ MANWAY ASSEMBLY CLOSURE AND SEALING PROCEDURE

1.0 PURPOSE

The purpose of this procedure is to set forth the proper method of sealing the manway assembly on Hittman RADLOK-200, RADLOK-500, and RADLOK-100 high integrity containers.

2.0 APPLICABLE DOCUMENTS

The following document is applicable to this procedure:

STD-D-03-009, Users Manual for the Hittman RADLOK-200, RADLOK-500, and RADLOK-100 High Integrity Containers

3.0 MANWAY SEAL INSTALLATION

3.1 Examine both seals (Items 1 and 2, Figure 1) for signs of significant gouges, splits, cracks or brittleness. Damaged seals should be replaced.

3.2 Clean the flat seal seat area on the container body and the vertical seal seat area on the manway seal (Item 3, Figure 1) before installing seals or filling the container.

3.3 Spray the flat seal (Item 1, Figure 1) on one side with silicon rubber adhesive, and place the seal on the container body seat surface, adhesive side down. A liquid adhesive such as 3M Scotch-Weld CA-4 Cyanoacrylate Adhesive may also be used. Make sure the seal is seated at all points and in complete contact with the seat.

3.4 Using a small portion of a lubricant grease where necessary, slide the large vertical seal (Item 2, Figure 1) over the manway seal. NOTE: Caution must be exercised to ensure that the lubricant used does not contain any of the chemicals listed in Appendix A of the Users Manual. Acceptable lubricants include Vasoline and other petroleum jelly products.

3.5 Apply a liberal coating of lubricant grease to the outer edge of the manway seal and large vertical seal.

3.6 Check the seal seating surfaces in the container to again ensure that they are clean, then CAREFULLY place the manway seal inside the manway opening (small diameter face first) making sure not to disturb the flat seal.

4.0 MANWAY LID INSTALLATION

4.1 Apply a liberal coating of lubricant grease to the manway threads on the container or the threads of the manway lid.

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED	Document Number: STD-P-03-003	Rev: 8	Rev Date: 12/19/85
	Title: RADLOK™ Manway Assembly Closure and Sealing Procedure		

Rev.	Rev Date	Prepared by	Operations	Director Engineering	QA Manager		
0	4-7-82	J.D. Williams	[signature]	[signature]	[signature]		
1	4-16-82	J.D. Williams	[signature]	[signature]	J. Pawlik for B. ROWE		ECN-82-090
2	4-28-82	[signature]	[signature]	[signature]	[signature]		ECN-82-097
3	7-2-82	[signature]	[signature]	[signature]	J. Pawlik for B. ROWE		ECN-82-138
4	9-10-82	[signature]	[signature]	[signature]	[signature]		ECN-82-181
5	1-4-83	[signature]	[signature]	[signature]	J. Pawlik for B. ROWE		ECN-82-296
6	9-30-83	[signature]	[signature]	[signature]	[signature]		ECN-83-246
7	6/6/85	[signature]	[signature]	[signature]	[signature]		ECN-85-034
		Director Engr.	Product Manager	Q.A. Manager	X		
8	12/19/85	[signature] for RL	[signature]	[signature]			ECN-85-212

FORM·01(B)

4.2 Carefully place the manway lid (Item 4, Figure 1) over the opening, making sure that the manway seal is not disturbed in the process.

4.3 Screw down the manway lid by hand until a high degree of resistance is encountered.

4.4 Using an 8 ft length of 3/4" pipe or bar proceed to screw the lid down until less than 3/4" of space remains between the lid and container surface.

4.5 When the manway lid is properly screwed down, the manway lid may be secured with a security wire between the lid and the container lift lugs.

NOTE: Securing the lid need not be performed on containers to be shipped in Type A or Type B casks, or on containers to be shipped as strong tight packages.

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4.0 CONTAINER SEALING

These steps are to be taken after the container is filled.

4.1 Clean the seal contact areas in the fill neck of the container and remove all foreign material.

4.2 Place the fill port closure assembly (Item 5, Figure 1) into the fill port opening.

NOTE: On large RADLOKs with fill plates, orient the compression plug such that the vent filter does not interfere with any of the fill plate attachments.

4.3 Screw the lid into the container to a minimum of 150 foot-pounds of torque (this could be accomplished by a Hittman fill port torquing tool and a torque wrench).

4.4 Secure the fill port lid with a security wire between one ear of the fill port lid and the top perimeter lip of the container.

NOTE: Securing the fill port lid need not be performed on containers to be shipped in Type A or Type B casks, or on containers to be shipped as strong tight packages.

6H

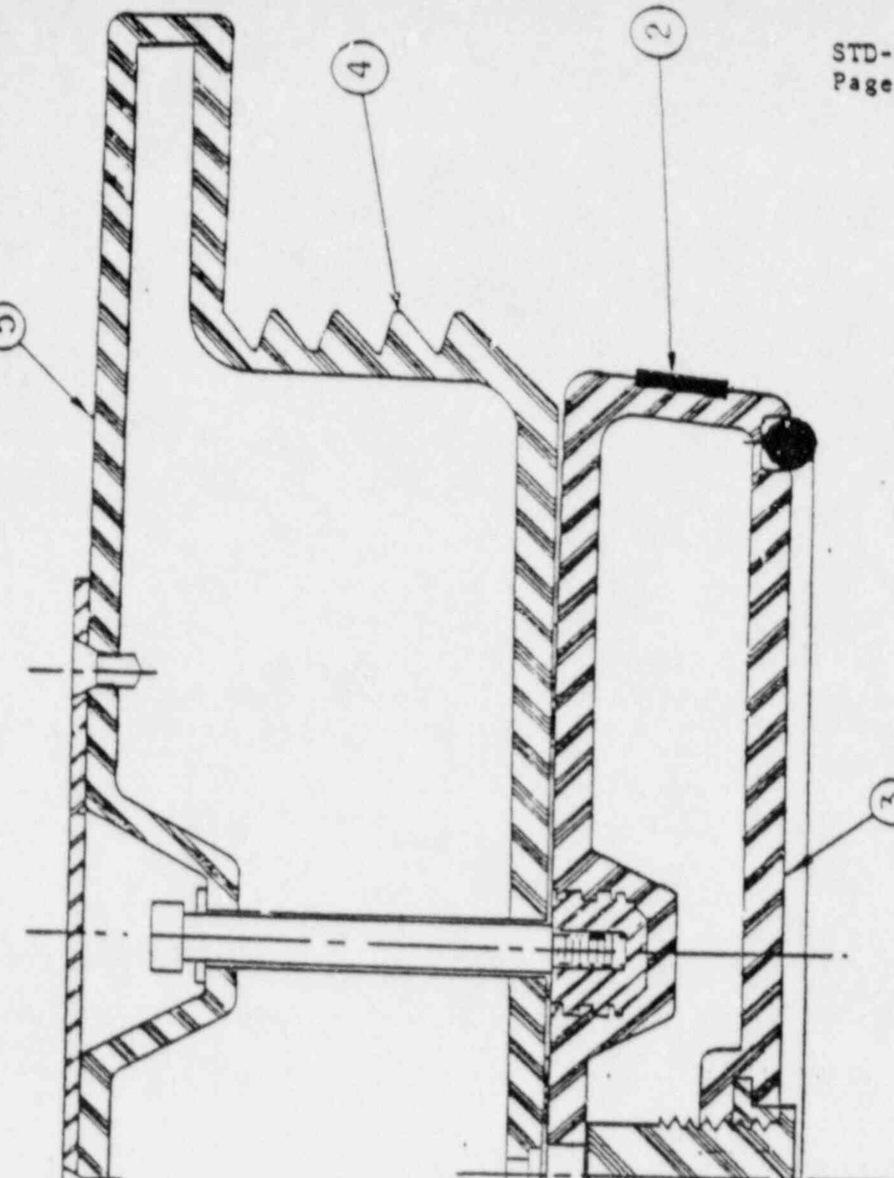

Figure 1

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED	Document Number: STD-D-03-008	Rev: 7	Rev Date: 1-31-86
	Title: A Users Manual for the HITTMAN RADLOK®-55		

Rev.	Rev Date	Responsible Engineer	Department Manager	Director Engineering	QA Manager	Project Manager	
0	4-16-82	J D Williams	[signature]	[signature]	J. Pawlik for B. ROWE	J D Williams	EWR-82-129
1	6-9-82	[signature]	[signature]	[signature]	[signature]	[signature]	ECN-82-121
2	10-25-82	[signature]	[signature]	[signature]	[signature]	[signature]	ECN-82-226
3	10-3-83	[signature]	[signature]	[signature]	[signature]	[signature]	ECN-83-157
4	2-9-84			[signature]	[signature]	[signature]	ECN-84-008
5	6-6-84			[signature]	[signature]	[signature]	ECN-84-090
6	12/20/85			[signature]	[signature]	[signature]	ECN-85-193 & 85-226
7	1-31-86			[signature]	[signature]	[signature]	ECN-85-230

A USERS MANUAL FOR THE HITTMAN RADLOK®-55

Purpose

The high integrity container is designed to provide waste isolation from the surrounding environment for a period of 300 years. Various unsolidified wastes may be disposed of at Barnwell; however, if the total specific activities of isotopes with half lives greater than five years is 1μCi/ml or greater, high integrity containers approved by the South Carolina Department of Health and Environmental Control must be used.

This document is intended to provide the user of the Hittman RADLOK drum with basic information required for the safe and proper use of the container. Included is a general description of the container, a listing of the approved contents, a listing of prohibited chemicals, and the handling/storage requirements of a RADLOK container. Inspection requirements prior to usage, lift requirements, and closure methods are also provided. The user must also refer to the requirements of the respective container certificate of compliance from the burial site.

Description of the RADLOK-55

The Hittman RADLOK-55 drum has been designed to closely approximate the size of present 55 gallon steel drums. The RADLOK drum has envelope dimensions of 35 inches high by 23 inches in diameter. The drum contains an 8 inch diameter fill port centered in the top. The container is fabricated from high density cross-linked polyethylene, molded to provide a one-piece body to the container. An approved vent is provided in the closure components of each container. An approved vent is required on containers buried after March 1, 1986.

Approved Contents

The Hittman RADLOK container has been designed to safely contain nuclear wastes including bead and powdered ion exchange resin, filter sludges, mechanical filters, stabilized incinerator ash, activated carbon, contaminated soil, and sandblasting grit. Procedures for loading metal filters, scrap metal and other non-compactible trash into the RADLOK container to ensure that protrusions and sharp edges do not damage the container must be submitted and approved by Hittman. The container may not contain free standing water greater than 1 percent of the waste volume.

Criteria for Packaging of Filter Elements and Scrap

The following criteria for the packaging of filter elements and scrap in Hittman RADLOK-55 containers shall be used in developing the required procedures.

Packaging Criteria
Waste Category

Parameter	Compactible Trash	Cartridge filters Elements	Rigid Metal Filter Elements with Exposed Ends, Noncompactible Trash with No Sharp Edges	Metal Scrap, Non-Compactible Trash with Sharp Edges
Maximum Length of of Individual Piece				
Placed Horizontal	none	20	20	20
Placed Vertical	none	24	24	18
Packing Material[1]	none	none	cement, vermiculite, sand, gravel, etc.	
Min. Depth of Packing[2] Material on Bottom	N/A	N/A	1"	2"
Padding[3]	none	none	none	pipe ends and sharp edges
Min. dist. waste to wall	none	none	none	2"
Packing between layers[4]	none	none	fill voids as loaded	2"
Maximum Depth of Waste	to underside of fill neck		2" below underside of fill neck	
Final Filling[4]	none	none	cover contents	cover contents plus 2"

[1]The packing material is used to protect the interior of the container and to prevent excessive settling of the waste during transit. Only required of waste that could potentially damage the container.

[2]To be placed in container prior to waste.

[3]To protect container walls if necessary. Among other items, rubber sheet or styrofoam blocks may be used. Only required on sharp edges or ends of rough cut pipe.

[4]Only necessary when packing material is used as defined in footnote number [1].

Prohibited Contents

Included in this guide, as Attachment A, is a copy of a MARLEX Resins Technical Service Memorandum from Phillips Chemical Company, No. TSM-293, Chemical Resistance of Marlex CL-100 and CL-50 Rotational Molding Cross linkable High Density Polyethylenes, dated December 1982. This document lists those chemicals that are incompatible with the material used in RADLOK high integrity containers. (Note: This document is oriented towards those applications where tanks manufactured using CL-100 (or CL-50) are used to store these chemicals in their pure form and not as contaminants in other materials.) When using a Hittman RADLOK, those chemicals listed in Table IV of the Appendix to Attachment A are considered prohibited and may not be disposed of in RADLOK high integrity containers. Chemicals listed elsewhere in the Appendix are not prohibited when disposed of as incidental contaminants to radioactive wastes.

Thermal Limitations

The Hittman RADLOK containers are licensed with a temperature limitation of 170°F for handling, lifting, and disposal operations. At no time is the container to be subjected to a temperature in excess of 200°F due to any process or its contents. These thermal limitations apply to the containment of all anticipated waste forms including, where present, incidental chemical contaminants (as contaminants, the chemicals listed in Table 1 of Attachment A are acceptable at the above temperature limits).

Storage Conditions

The Hittman RADLOK drum may be stored under proper conditions for periods up to two years before use. Storage of unused Hittman RADLOK containers for periods longer than two years will require specific Hittman approval following review of the conditions under which the containers are stored. As a photosensitive material, the containers shall be kept out of direct sunlight, and away from any other sources of ultraviolet radiation. Containers stored out of doors in direct sunlight must be used within one year of fabrication. Containers shall be stored in such a way that the bottom is flat and that no weight is located over the fill port area. This is to ensure that no potential deformation of the fill port area of the container or seal material occurs. Each container shall be stored with its designated closure assembly to prevent mismatching.

Following filling and closure of the container, it may be stored on-site prior to shipment for burial for up to five (5) years. The design of the facility must preclude the possibility of a wet or damp environment and any prolonged exposure of the container to any source of ultraviolet light. Short exposures to ultraviolet light, such as during placement or inspection are permitted. Storage of RADLOK containers for periods longer than five (5) years after filling will require specific Hittman approval following a review of the user's storage facility design.

Inspection Prior to Use

Prior to the use of a container to receive waste material the following items must be checked. The fill port closure assembly, consisting of the seals and the fill port lid bolted to the compression plug, is accounted for and in good condition. Seals are not hard or brittle and are free of defects. Thread areas and seal areas are free of foreign matter that could impair the seal or thread engagement. The exterior surfaces shall be inspected for damage that may have occured during transport or storage that could lessen container integrity. See the RADLOK Inspection Procedure, STD-P-03-020, for a detailed inspection procedure.

Lift Requirements

The RADLOK-55 comes equipped with a lift band, and may be lifted by either fork lift tines under the edges of the liftband or by the use of a standard drum grappler. Under maximum load conditions, the entire assembly would have a final weight of 950 pounds. The lift assembly is designed to accomodate this weight during a 3g abrupt lift. Note: Due to the nature of the container material, some bowing and deformation may be evident during the lift. This is an anticipated condition.

Fill Port Use and Closure

The standard fill port on the Hittman RADLOK-55 drum is an eight inch opening. The fill port is concentric with the top of the container and is sealed with the fill port closure assembly. Two seals are attached to the compression plug of the fill port closure assembly. The assembly is then lowered into the opening and screwed into position to a prescribed torque. For details of the closure procedure see Hittman procedure STD-P-03-004.

If the container is to be used as a Type A container, the lid shall be secured for transportation to prevent illicit opening. Details concerning methods of securing the lid are also provided in STD-P-03-004.

ATTACHMENT A TO STD-D-03-008

CHEMICAL RESISTANCE OF MARLEX CL-100 AND CL-50 ROTATIONAL MOLDING CROSSLINKABLE HIGH DENSITY POLYETHYLENES

TSM-293
DECEMBER, 1982

CHEMICAL RESISTANCE OF MARLEX CL-100 AND CL-50 ROTATIONAL MOLDING CROSSLINKABLE HIGH DENSITY POLYETHYLENES

INTRODUCTION

One of the most rapidly growing plastics applications is relatively large rotational molded storage tanks. This application and its growth has been keyed to the development and marketing of crosslinkable high density polyethylenes by Phillips Chemical Company. These polyethylenes are marketed under the designation of Marlex CL-100 and CL-50 rotational molding crosslinkable high density polyethylene.

Rotational molding is ideally suited for the manufacture of large tanks. In addition the unique toughness, chemical and stress crack resistance of the Marlex CL-100 and CL-50 resins are needed for the demanding requirements in industry and agriculture for chemical storage tanks and are the key to this expanding market. Today tanks are molded as large as 15,000 gallons (57,000 liters) and are used in such diverse storage applications as acids, insecticides, and chemical plant waste by-products.

The scope of this Technical Service Memorandum is to address the question of compatibility of chemicals with Marlex CL-100 and CL-50 resins in relation to storage tanks. Engineering principles used in determining the suitability of a given application are discussed. Lists of chemicals both suitable and not suitable are included in the appendix along with any limitations which may apply.

CHEMICAL RESISTANCE

"Chemical resistance" and "compatibility" are synonymous terms used in relation to the ability of a plastic to function in different environments. In regard to polyethylene chemical storage tanks, chemical resistance encompasses the total effect a product would have on a tank. The factors that make up the overall compatibility of a chemical to a rotomolded tank are chemical attack, solubility, absorption or permeation, and stress crack resistance. Each of these are discussed briefly.

Chemical Attack - By definition, chemical attack involves an actual chemical reaction with the plastic. This can be a breaking of molecular chains and/or addition of chemical groups to the molecule. For example, in the case of an oxidation reaction with polyethylene both occur with the addition of carbonyl groups. This causes an eventual loss of properties to the point that a tank would not be serviceable.

Polyethylene in general is one of the most inert plastics available. Very few chemicals react with polyethylene, and even with those that do the rate is relatively slow. The ultra high molecular weight characteristics of Marlex CL-100 and CL-50 resins after crosslinking makes these particular polyethylenes even more resistant than other grades. Therefore, chemical attack is not a factor in very many applications.

Permeation - This involves the physical absorption of the chemical into the polyethylene. If this is a volatile chemical, then an actual loss of the product can occur as the chemical vaporizes from the outer wall of the tank. The amount of absorption is generally limited to 3-7 percent by weight of the polyethylene. Also, the loss of volatile products is relatively small. For example, a 25-gallon tank with a 50-mil wall will only lose between 5 and 6 grams of gasoline a day due to permeation. The thicker the wall, the lower the rate of loss.

The absorption of a product into the wall of a tank will cause some property changes. The tensile strength is reduced approximately 10%, stiffness approximately 25%, and a linear and radial swell of from 1 to 5% will occur. Normally this does not affect the utility of the tank nor prohibit the application. It does, however, limit the temperature at which the tank can be used because the loss of these properties becomes a detemining factor as the temperature is increased. Also, if a chemical has too low a boiling point, the vapor pressure may be so high as to cause prohibitive distortion of the tank. This is why such chemicals as ether, pentane, etc., would not be suitable for storage in a sealed tank.

Solubility and Stress Resistance - Although these factors are to be considered with other plastics it is of no significance with Marlex CL-100 or CL-50. There are no known solvents at ambient conditions for these resins. Also, when properly molded and used, the phenomena of stress cracking just doesn't occur.

APPLICATION ENGINEERING

The appendix contains tables of chemicals indicating their compatibility with tanks molded using Marlex CL-100 and CL-50 resins. Table I lists chemicals that are suitable up to 150°F (66°C) without further qualification. Table II and III lists chemicals that permeate or are absorbed by the polyethylene. In these cases the use conditions

should be more thoroughly considered. For example, most of these chemicals are flammable. It should be determined if this would present a safety or code problem. Other considerations would be: 1) are the tanks vented, 2) are they in a confined or open space, and 3) personnel exposure.

In Table IV chemicals are listed that either attack polyethylene or have high vapor pressure and are not normally recommended for long service life of the tank. This does not automatically preclude tanks from being used with these chemicals. It may be economical to periodically replace the tank after a relatively short service life. Factors such as life of the currently used tanks, cost of tanks made using exotic materials, and the consequences if a failure occurs should all be considered.

SUMMARY

Marlex CL-100 and CL-50 rotational molding crosslinkable HDPE is one of the most chemical resistant plastics manufactured today. It is not without limits, however, and the attached tables should be used only as a guide in determining those applications which are suitable.

CHEM:126

APPENDIX

It has been well documented over the years the types of chemicals that are compatible with polyethylene, either through tests or experience. It would be impossible to list all the chemicals that may be involved in use with polyethylene storage tanks. Therefore, the included tables are only representative of typical chemicals.

Also, their rankings are specific to the application of chemical storage tanks and the superior properties of Marlex® CL-100 and CL-50. The following tables are to be used only as a guide for establishing those uses that would give satisfactory service. They are not a substitute for [illegible] engineering.

TABLE I

The following chemicals do not attack nor permeate Marlex® CL-100 or CL-50 resins up to 150°F (66°C). For temperatures over 150°F (65°C) each application should be considered individually. All concentrations apply except where noted.

- Acetic Acid
- Aluminum Salts
- Alum
- Ammonium Hydroxide
- Ammonium Salts
- Amyl Alcohol
- Antimony Salts
- Arsenic Acid
- Barium Hydroxide
- Barium Salts
- Benzene Sulfonic Acid
- Bismuth Salts
- Boric Acid
- Bromic Acid
- Butanediol
- Butyl Alcohol
- Calcium Hydroxide
- Calcium Salts
- Chromic Acid <50%
- Citric Acid
- Copper Salts
- Detergents
- Diazo Salts
- Diethyl Carbonate
- Diethanol Amine
- Diethylene Glycol
- Diglycolic Acid
- Dimethylamine
- Dimethyl Formamide
- Ethyl Alcohol
- Ethylene Glycol
- Ferric Salts
- Ferrous Salts
- Fluoboric Acid
- Flousilicic Acid
- Formic Acid
- Gallic Acid
- Gluconic Acid
- Glycol Ethers
- Glycolic Acid
- Hexanol
- Hydrazine <35%
- Hydrozine Hydrochloride
- Hydriodic Acid
- Hydrobromic Acid
- Hydrocyanic Acid
- Hydrochloric Acid
- Hydrofluoric Acid
- Hydrofluorsilicic Acid
- Hydrogen Peroxide <30%
- Hydrogen Phosphide
- Hydroquinone
- Hypochorous Acid
- Iodine Solutions
- Lactic Acid
- Latex
- Lead Acetate
- Magnesium Salts
- Mercuric Salts
- Mercurous Salts
- Mercury
- Methyl Alcohol
- Methylsulfuric Acid
- Nickle Salts
- Nicotinic Acid
- Nitric Acid <30%
- Oxalic Acid
- Perchloric Acid
- Phenol <10%
- Potassium Hydroxide
- Potassium Salts
- Phosphoric Acid
- Photographic Solutions
- Propyl Alcohol
- Propylene Glycol
- Sea Water
- Selenic Acid
- Sewage
- Silicic Acid
- Silver Salts
- Soap Solutions
- Sodium Acrylates
- Sodium Ferricyanide
- Sodium Ferrocyanide
- Sodium Hydroxide
- Sodium Hypochlorite <16%
- Sodium Salts
- Sodium Sulfonates
- Stanic Salts
- Stannous Salts
- Starch Solutions
- Stearic Acid
- Sulfuric Acid <98%*
- Sulfurous Acid
- Sugar Solutions
  - Glucose
  - Lactose
  - Sucrose, etc.
- Tannic Acid
- Tanning Extracts
- Tartaric Acid
- Titinium Salts
- Toluene Sulfonic Acid
- Triethanolamine
- Urea
- Vinegar
- Wetting Agents
- Zinc Salts

*Under some conditions acid will discolor.

TABLE II

The following oils and organic chemicals do not attack Marlex® CL-100 or CL-50 resins. They will be absorbed into the wall of the tank but there should be no loss of product. Because of this absorption, if tanks would be used for other service, contamination may result as the absorbed oil is leached out. Service at elevated temperatures up to 150°F (66°C) can be recommended provided the effects of the absorption on the properties of the tank are not prohibitive.

Fatty Acids

Butyric
Lauric
Linoleic
Oleic
Palmitic
Stearic

Mineral Oils

Lube
Transformer
Hydraulic

Vegetable Oils

Corn
Coconut
Cottenseed
Olive
Peanut

Animal Fats

Lard
Fish oil
Musk oil
Whale oil

TABLE III

The following organic chemicals do not attack Marlex® CL-100 or CL-50 resins. They will be absorbed into the wall of the tank and a permeation loss will occur. Because of this premeation and the effect it has on the physical properties of the tank it is generally not recommended they be used above 100°F (38°C). However, their use largely depends on such factors as size of the tank, its location, toxicity of the chemical, and applicable codes such as NFPA, OSHA, etc. This is not to discourage these chemical storage applications in which considerable experience with many has been documented on various polyethylene containers. For example, polyethylene gasoline tanks are used on lawn mowers, tractors, trucks, ATVs, snowmobiles, and as portable containers-even approved safety cans.

Aniline
Benzene
Carbon Tetrachloride
Chlorabenzene
Cychohexanol
Cyclohexanone
Dibutylphthalate
Diesel Fuel
Dimethylamine
Ethyl Butyrate
Ethylene Chlorohydrin
Fuel Oil
Furfural
Aliphatic hydrocarbons
  (hexane, octane, hexene, octene, etc.)
Jet fuel
Gasoline
Nitrobenzene
Octyl Cresol
Propylene dichloride
Toluene
Xylene

TABLE IV

The following chemicals are not recommended for general storage in tanks molded using Marlex® CL-100 or CL-50 resins. Their effect is not immediate nor catastrophic in nature. Therefore, under certain circumstances, tanks could be used either for the short term or in a limited life situation. Temperature is especially important!

Chemical Attack

Aqua Regia
Bromine
Chromic/Sulfuric acid
Fuming Sulfuric acid
Nitric Acid >50%
Organic peroxides
Phenol-concentrated

High Vapor Pressure

Acetone
Butane
Carbon Disulphide
Chloroform
Ethyl Ether
Ethylene Dichloride
Methylene Chloride
Methyl Ethyl Ketone
Propane
Pentane

TABLE V

APPLICATIONS OF CROSSLINKED HDPE CHEMICAL TANKS

AGRICULTURAL

Chemical Handled	Size of Tank (gallons)*	Type of Tank H*	Type of Tank V*	Type of Use S*	Type of Use P*	Years in Service
Cattle Supplements	5600		X	X		7
Insecticides	50 to 1500	X	X	X	X	10
Herbicides (Bicep, Dual, Sutan, Lasso)	50 to 1500	X	X	X	X	10
Liquid Fertilizer	100 to 5600	X	X	X	X	8
Nitrogen Solution	5600		X	X		8
Phosphoric Acid	1500 to 5600		X	X		8
Sulphur Solution	5600		X	X		8
Treflan	200	X			X	6

INDUSTRIAL

Chemical Handled	Size of Tank (gallons)*	Type of Tank H*	Type of Tank V*	Type of Use S*	Type of Use P*	Years in Service
Hydrochloric Acid (37% and lower)	5600		X	X		8
Hydrofluoric Acid	55 to 2500	X		X	X	6
Sulfuric Acid (98% and lower)	400 to 12,000		X	X		8
Propionic Acid	5600		X	X		8
Sodium Hypochlorite	4250 to 12,000		X	X		8
Sodium Hydroxide	1500 to 12,000		X	X		8
Hydrogen Peroxide (52%)	55 to 1600	X	X	X	X	5
Alum	5600		X	X		8
Cactus Juice	1500 to 6000		X	X		5
Detergents	100 to 6000	X	X	X	X	8
Floor Finishes & Cleaners	5600		X	X		8
Latex	6400		X	X		8
Oil Well Additives	200 to 1500	X	X	X	X	8
Plating Solutions	3000		X	X		4
Waste Water	12,000		X	X		8

H - Horizontal
V - Vertical
S - Stationary
P - Portable

*Constant to convert gallons to liters - gallons x 3.7854 = liters

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED	Document Number: STD-P-03-008	Rev: 5.	Rev Date: 6/13/85
	Title: Transfer & Dewatering Powdered Resin in Hittman RADLOK^{TM}-100,-200, or -500 Containers with a Flexible Underdrain Assembly to Less Than 1% Drainable Liquid.		

Rev.	Rev Date	Prepared by	Supervisor Laboratory Services	Director Engineering	Operations	QA Manager	
0	3-10-83	K. McDanel	E. Clolson	[signature]	[signature]	[signature]	EWR-82-481
1	12-8-83	X	X	[signature] for R. Leduc	[signature]	[signature]	ECN-83-267
2	3-19-84	X	X	[signature]	[signature]	[signature]	ECN-84-044
3	5-17-84	X	X	[signature]	[signature]	J. Pawlik for B. Rowe	ECN-84-084
4	6-6-84	X	X	[signature]	[signature]	[signature]	ECN-84-092
5	6/13/85	X	X	[signature]	[signature]	[signature]	ECN-85-038

TRANSFER AND DEWATERING POWDERED RESIN IN HITTMAN RADLOK™-100, -200, OR -500 CONTAINERS WITH A FLEXIBLE UNDERDRAIN ASSEMBLY TO LESS THAN 1% DRAINABLE LIQUID

1.0 SCOPE

This procedure is applicable to RADLOK-100, -200, and -500 High Integrity Containers with multi-layered flexible dewatering underdrains for dewatering unsolidified powdered ion exchange resins.

2.0 PURPOSE

To provide general instructions for the transfer and dewatering of powdered resin in RADLOK containers with flexible dewatering underdrains to meet burial site criteria of less than one percent drainable liquid upon receipt at the site. This procedure also assures that there is no drainable liquid at the time of shipment from the plant.

3.0 REFERENCES

3.1 Hittman RADLOK™ High Integrity Container Rad Services Manual, RSM-014.

3.2 Hittman drawing, STD-03-051, Sheet 4, RADLOK-100 and -500 Three Layer Underdrain Assembly.

3.3 Hittman drawing, STD-03-075, Equipment Arrangement for RADLOK-100 and -500 Containers with Three Layer Underdrain.

3.4 Hittman drawing, STD-03-084, Sheet 4, RADLOK-200 Two Layer Underdrain Assembly.

3.5 Hittman drawing, STD-03-091, Equipment Arrangement for RADLOK-200 Container with Two Layer Underdrain.

3.6 Hittman report, STD-R-03-005, Summary Report of Powdered Resin Dewatering in a RADLOK™ Container.

3.7 Hittman report, STD-R-03-006, Powdered Resin Dewatering in a Flat Bottom Container Using the Hittman Layered Underdrain System.

3.8 Hittman procedure, STD-P-03-003, RADLOK Manway Assembly Closure and Sealing Procedure.

3.9 Hittman procedure, STD-P-03-004, Closure of Hittman RADLOK High Integrity Container Fill Port Closure Assembly.

3.10 Hittman procedure, STD-P-03-020, RADLOK Inspection Procedure.

4.0 EQUIPMENT

4.1 Diaphragm pump 1-1/2" or equivalent with interconnecting hoses, quick disconnect fittings and clamps as required.

4.2 Hoses with fittings and clamps as required to connect from service air system to the diaphram pump. Minimum service air required is 40 SCFM at 100 psig.

4.3 Vacuum pump with minimum suction of 25 inches of mercury (29.9 inches Hg vacuum equals absolute vacuum) and 1/4 inch vacuum hoses.

4.4 Receiver tank with connecting hoses to the RADLOK container.

4.5 Overflow drum with connecting hoses to the RADLOK container (optional).

4.6 Liner level indicator panel.

4.7 Receiver tank level indicator panel.

4.8 Standpipes.

5.0 EQUIPMENT SET-UP

5.1 Prerequisites

5.1.1 The container has been satisfactorily inspected per STD-P-03-020.

5.2 Precautions

None.

5.3 Assembly

5.3.1 SET-UP equipment in accordance with Drawings STD-03-051, Sheet 4, and STD-03-075 for the RADLOK-100 or -500 or Drawings STD-03-084, Sheet 4 and STD-03-091 for the RADLOK-200.

6.0 TRANSFER AND DEWATERING

6.1 Prerequisites

6.1.1 The equipment is set up in accordance with Section 5.3.1 of this procedure.

6.1.2 An RWP is issued and Health Physics is notified prior to the waste transfer.

6.1.3 All valves on receiver tank except between tank and vacuum pump are closed.

6.2 Precautions

6.2.1 Be aware of changing radiological conditions as waste is transferred to the container and the container is dewatered.

6.2.2 If the RADLOK container is to be lifted after waste transfer has begun and before all processing is complete, a bottom support plate shall be utilized to prevent damage to the container internals. Consult Hittman home office for additional information.

6.3 Operating Steps

NOTE: Following establishment of initial vacuum in Step 6.3.1, the air inlet valve on the receiver tank shall be used to maintain vacuum between 15 and 20 inches of Hg during the entire dewatering process.

6.3.1 START the vacuum pump on the receiver tank and establish a vacuum of approximately 15 inches Hg.

NOTE: The diaphragm pump may be used to assist vacuum pump to establish desired vacuum.

6.3.2 START the transfer of waste in accordance with the appropriate system operating procedure.

6.3.3 TRANSFER until 50-100 gallons of waste are in the container and the bottom dewatering layer is covered.

6.3.4 OPEN the bottom dewatering layer isolation valve to the receiver tank while continuing the transfer.

NOTE: This valve will remain open throughout the entire operation.

6.3.5 START the diaphragm pump when the receiver tank level indicator panel indicates "OP/HI".

NOTE: Maintain diaphragm pump vacuum at least 5 inches of Hg greater than receiver tank vacuum.

6.3.6 Immediately STOP the waste transfer when the liner level indicator panel sounds an "OP/HI" alarm.

NOTE: The receiver tank vacuum shall be modulated to maintain water level in the receiver tank between the "OP/LOW" and "OP/HI" levels.

CAUTION: IF THE "HI/HI" LEVEL ON THE RECEIVER TANK ALARMS, TAKE IMMEDIATE ACTION TO REDUCE OR TERMINATE INFLUENT TO THE RECEIVER TANK UNTIL THE "OP/HI" LEVEL CLEARS. THIS CAN BE ACCOMPLISHED BY SHUTTING THE ISOLATION VALVES OR BY DECREASING THE VACUUM IN THE RECEIVER TANK.

6.3.7 CONTINUE dewatering from the bottom lateral while allowing the solids to settle in the container for 30 minutes.

6.3.8 OPEN the dewatering layer isolation valves to all remaining dewatering layers.

6.3.9 When vacuum is lost, CLOSE top dewatering layer isolation valve. For RADLOK-200 containers, proceed to Step 6.3.12 at this time.

6.3.10 CONTINUE dewatering until vacuum is lost again.

6.3.11 CLOSE middle dewatering layer isolation valve.

6.3.12 RESTART waste transfer to container until "OP/HI" alarms. Repeat Steps 6.3.6 through 6.3.10 until "OP/LOW" does not silence upon reaching loss of vacuum on the top laterals.

6.3.13 STOP the transfer operation.

NOTE: The waste transfer operation is now complete.

6.3.14 FLUSH the transfer line in accordance with the appropriate system operating procedure.

6.3.15 As the liquid level falls below the dewatering elements and vacuum in the receiver tank reduces by approximately ten (10) inches of mercury, CLOSE the dewatering element isolation valves sequentially starting at the top. Allow time between each isolation for the vacuum to recover and the container to dewater to the next lower layer.

6.3.16 CONTINUE the dewatering process through the lowest dewatering element for four hours after vacuum is lost. This completes the dewatering process.

NOTE: If a container is expected to remain on-site for more than six (6) days after completion

of final dewatering (Step 6.3.16), then Steps 6.3.17 through 6.3.21 should be followed. This will ensure compliance with Section 10.4.1 of ANSI/ANS-55.1-1979 which states that "processed solid waste, when ready for shipment, will not contain free liquid...".

6.3.17 CONNECT the suction hose from the diaphragm pump directly to the bottom layer dewatering pipe extension.

6.3.18 START the diaphragm pump.

6.3.19 REGULATE the pump suction vacuum at approximately 15 inches of vacuum.

6.3.20 APPLY vacuum for a minimum of four (4) hours.

6.3.21 DISCONNECT the diaphragm pump suction hose from the bottom layer dewatering pipe extension.

7.0 DISCONNECTION AND CLOSURE OF CONTAINER

7.1 Prerequisites

The waste transfer and dewatering operations are complete and subsequent transfers of waste to the container are not planned.

7.2 Precautions

As hoses are disconnected, be careful not to spill any residual water.

7.3 Operating Steps

7.3.1 DISCONNECT the waste transfer line from the fill pipe extension.

7.3.2 REMOVE the fill pipe extension from the container.

7.3.3 DISCONNECT the dewatering hoses from the dewatering pipe extensions on the container.

7.3.4 REMOVE the dewatering pipe extensions from the container.

7.3.5 DISCONNECT the vent/overflow hose from the vent/overflow pipe extension.

7.3.6 REMOVE the vent/overflow pipe extension from the container.

7.3.7 DISCONNECT the electrical cables from container. This can be accomplished by cutting the wire close to the fill plate or by unplugging.

NOTE: At this time the container may be secured.

7.3.8 DRAIN the receiver tank.

30H

HITTMAN NUCLEAR & DEVELOPMENT CORPORATION	Document Number: STD-D-03-009	Rev: 9	Rev Date: 1-31-86
	Title: A User's Manual for the Hittman RADLOK®-200, RADLOK®-500, and RADLOK®-100		

Rev.	Rev Date	Responsible Engineer	Department Manager	Director Engineering	QA Manager	Project Manager	
0 *	4-16-82	[signature]	[signature]	[signature]	J. Pawlik for B ROWE	[signature]	EWR-82-129
1*	6-9-82	[signature]	[signature]	[signature]	[signature]	[signature]	ECN-82-122
2 *	10-25-82	[signature]	[signature]	[signature]	[signature]	[signature]	ECN-82-227
3	1-4-83	[signature]	[signature]	[signature]	J. Pawlik for B ROWE	[signature]	ECN-82-297
4	10-3-83	[signature]	[signature]	[signature]	[signature]	[signature]	ECN-83-158
5	2-9-84	X	X	[signature]	[signature]	[signature]	ECN-84-009
6	6-6-84	X	X	[signature]	[signature]	[signature]	ECN-84-091
7	6/6/85	X	X	[signature]	[signature]	[signature]	ECN-85-032
8	12/20/85	X	X	[signature]	[signature]	[signature]	ECN-85-194
9	1-31-86	X	X	[signature]	[signature]	[signature]	ECN-85-231

A USERS MANUAL FOR THE HITTMAN RADLOK®-200, RADLOK®-500, and RADLOK®-100

Purpose

The high integrity container is designed to provide waste isolation from the surrounding environment for a period of 300 years. Various unsolidified wastes may be disposed of at Barnwell, however, if the total specific activities of isotopes with half lives greater than five years is 1μ Ci/ml or greater, high integrity containers approved by the South Carolina Department of Health and Environmental Control must be used.

This document is intended to provide the user of Hittman RADLOK containers with basic information required for the safe and proper use of the container. Included is a general description of the containers, a listing of the approved contents, a listing of prohibited chemicals, and the handling/storage requirements of a RADLOK container. Inspection requirements prior to usage, lift requirements, and closure methods are also provided. The user must also refer to the requirements of the respective container certificate of compliance from the burial site.

Description of the Hittman RADLOK-200, RADLOK-500, AND RADLOK-100

The Hittman RADLOK containers have the following approximate envelope dimensions (listed from smallest to largest container):

	Approx. Height	Approx. Diameter	Gross Weight (loaded)
RADLOK-200	61"	53"	5,500 lb.
RADLOK-500	66"	72"	9,500 lbs.
RADLOK-100	72"	72"	10,500 lbs.

All containers have a domed top that contains a concentric 16 inch diameter manway opening for possible underdrain installation and an 8 inch diameter fill port. Containers are fabricated from high density cross-linked polyethylene, molded to provide a one-piece body to the container. An underdrain system can be provided for either dewatering slurries transferred to the container or for disposable demineralizer applications. An approved vent is provided in the closure components of each container. An approved vent is required on containers buried after March 1, 1986.

Approved Contents

Hittman RADLOK containers have been designed to safely contain nuclear wastes including bead and powdered ion exchange resin, filter sludges, mechanical filters, stabilized incinerator ash, activated carbon, contaminated soil, and sandblasting grit. It should be noted that dewatering ion-exchange resin that has been in contact with nitrates or other strong oxidizing agents can be hazardous and should be avoided. Procedures for loading metal filters, scrap and other non-compactible trash into a RADLOK container to ensure that protrusions and sharp edges do not damage the container must be submitted and approved by Hittman. The container may not contain free standing water greater than 1 percent of the waste volume.

Packaging Criteria for RADLOK-200
Waste Category

Parameter	Compactible Trash	Cartridge filters Elements	Rigid Metal Filter Elements with Exposed Ends Noncompactible Trash with No Sharp Edges	Metal Scrap, Non-Compactible Trash with Sharp Edges
Maximum Length of Individual Piece				
Placed Horizontal	none	48"	40"	40"
Placed Vertical	none	40"	40"	30"
Packing Material[1]	none	none	cement, vermiculite, sand, gravel, etc.	
Min. Depth of Packing[2] Material on Bottom	N/A	N/A	1"	3"
Padding[3]	none	none	none	pipe end and sharp edges
Min. dist. waste to wall	none	none	none	3"
Packing between layers[4]	none	none	fill voids as loaded	2"
Maximum Depth of Waste	to underside of fill neck		3" below underside of fill neck	
Final Filling[4]	none	none	cover contents	cover contents plus 3"

[1]The packing material is used to protect the interior of the container and to prevent excessive settling of the waste during transit. Only required of waste that could potentially damage the container.

[2]To be placed in container prior to waste.

[3]To protect container walls if necessary. Among other items, rubber sheet or styrofoam blocks may be used. Only required on sharp edges or ends of rough cut pipe.

[4]Only necessary when packing material is used as defined in footnote number [1].

Packaging Criteria for RADLOK-500

Waste Category

Parameter	Compactible Trash	Cartridge filters Elements	Rigid Metal Filter Elements with Exposed Ends Noncompactible Trash with No Sharp Edges	Metal Scrap, Non-Compactible Trash with Sharp Edges
Maximum Length of Individual Piece				
Placed Horizontal	none	62"	54"	54"
Placed Vertical	none	48"	48"	36"
Packing Material[1]	none	All voids shall be filled with either cement, vermiculite, sand, gravel, etc.		
Min. Depth of Packing[2] Material on Bottom	N/A	N/A	1"	3"
Padding[3]	none	none	none	pipe end and sharp edges
Min. dist. waste to wall	none	none	none	3"
Packing between layers[4]	none	fill voids as loaded	fill voids as loaded	2"
Maximum Depth of Waste	to underside of fill neck		3" below underside of fill neck	
Final Filling[4]	none	fill voids	fill voids & cover contents	fill voids & cover contents plus 3"

[1]The packing material is used to protect the interior of the container and to prevent excessive settling of the waste during transit.

[2]To be placed in container prior to waste.

[3]To protect container walls if necessary. Among other items, rubber sheet or styrofoam blocks may be used. Only required on sharp edges or ends of rough cut pipe.

[4]Only necessary when packing material is used as defined in footnote number [1].

Packaging Criteria for RADLOK-100

Waste Category

Parameter	Compactible Trash	Cartridge filters Elements	Rigid Metal Filter Elements with Exposed Ends Noncompactibie Trash with No Sharp Edges	Metal Scrap, Non-Compactible Trash with Sharp Edges
Maximum Length of Individual Piece				
Placed Horizontal	none	68"	60"	60"
Placed Vertical	none	48"	48"	36"
Packing Material[1]	none	none	cement, vermiculite, sand, gravel, etc.	
Min. Depth of Packing[2] Material on Bottom	N/A	N/A	1"	3"
Padding[3]	none	none	none	pipe end and sharp edges
Min. dist. waste to wall	none	none	none	3"
Packing between layers[4]	none	none	fill voids as loaded	2"
Maximum Depth of Waste	to underside of fill neck		3" below underside of fill neck	
Final Filling[4]	none	none	cover contents	cover contents plus 3"

[1]The packing material is used to protect the interior of the container and to prevent excessive settling of the waste during transit. Only required of waste that could potentially damage the container.

[2]To be placed in container prior to waste.

[3]To protect container walls if necessary. Among other items, rubber sheet or styrofoam blocks may be used. Only required on sharp edges or ends of rough cut pipe.

[4]Only necessary when packing material is used as defined in footnote number [1].

Hittman standard dewatering procedures, provided in the Hittman Rad Services Manual for RADLOK Containers, may be used by reference to the appropriate document number.

Criteria for Packaging of Filter Elements and Scrap

The tables provide the criteria for the packaging of filter elements and scrap in Hittman RADLOK containers that shall be used in developing the required procedures.

Prohibited Contents

Included in this guide, as Attachment A, is a copy of a MARLEX Resins Technical Service Memorandum from Phillips Chemical Company, No. TSM-293, Chemical Resistance of Marlex CL-100 and CL-50 Rotational Molding Cross-linkable High Density Polyethylenes, dated December 1982. This document lists those chemicals that are incompatible with the material used in RADLOK high integrity containers. (Note: This document is oriented towards those applications where tanks manufactured using CL-100 (or CL-50) are used to store these chemicals in their pure form and not as contaminants in other materials.) When using a Hittman RADLOK, those chemicals listed in Table IV of the Appendix to Attachment A are considered prohibited and may not be disposed of in RADLOK high integrity containers. Chemicals listed elsewhere in the Appendix are not prohibited when disposed of as incidental contaminants to radioactive wastes.

Thermal Limitations

The Hittman RADLOK containers are licensed with a temperature limitation of 170°F for handling, lifting, and disposal operations. At no time is the container to be subjected to a temperature in excess of 200°F due to any process or its contents. When the containers include underdrain systems for processing waste, the maximum permitted temperature is reduced to 140°F because of the materials used in the underdrain assembly.

These thermal limitations apply to the containment of all anticipated waste forms including, where present, incidental chemical contaminants (as contaminants, the chemicals listed in Table 1 of Attachment A are acceptable at the above temperature limits).

Storage Conditions

Hittman RADLOK containers may be stored under proper conditions for periods up to two years before use. Storage of unused Hittman RADLOK containers for periods longer than two years will require specific Hittman approval following review of the conditions under which the containers are stored. As a photosensitive material, the containers shall be kept out of direct sunlight, and away from any other sources of ultraviolet radiation. Containers stored out of doors in direct sunlight must be used within one year of fabrication. To minimize any chance of damage to a container with an underdrain system, the container should be kept out of sub-freezing weather conditions. Containers shall be stored in such a way that the bottom is flat and that no weight is located over the manway/fill port area. This is to ensure that no potential deformation of the manway/fill port area of the container or seal material occurs. Each container shall

be stored with its designated closure assemblies to prevent mismatching. The RADLOK containers are shipped palletized for protection and handling convenience. The container should remain palletized until just before use to extend this protection.

Following filling and closure of the container, it may be stored on-site prior to shipment for burial for up to five (5) years. The design of the facility must preclude the possibility of a wet or damp environment and any prolonged exposure of the container to any source of ultraviolet light. Short exposures to ultraviolet light such as during placement or inspection are permitted. Storage of RADLOK containers for periods longer than five (5) years after filling will require specific Hittman approval following a review of the user's storage facility design.

Inspection Prior to Use

Prior to the use of a container to either receive waste material or to be put in service as a portable demineralizer, the following items must be checked. The fill port closure assembly, consisting of the seals and the fill port lid bolted to the compression plug, is accounted for and in good condition. The manway assembly parts are installed on the container (usually shipped this way) and in good condition. Seals are not hard or brittle and are free of defects. Thread areas and seal areas are free of foreign matter that could impair the seal or thread engagement. The exterior surfaces shall be inspected for damage that may have occured during transport or storage that could lessen container integrity. See the RADLOK Inspection Procedure, STD-P-03-020, for a detailed inspection procedure.

The manway lid shall be inspected for sufficient closure. There should be less than a 3/4-inch space between the bottom of the manway lid and the container body when properly closed. If this is not the case, refer to Hittman procedure STD-P-03-003 in the Rad Services Manual for proper closure methods.

Handling and Lift Requirements

The Hittman RADLOK-200, RADLOK-500, and RADLOK-100 containers come equipped with a lift band, lift lugs, and two slings for lifting. Under maximum load conditions, the entire assembly would have a gross weight as listed earlier. The lift assembly for each container is designed to accomodate the respective weight when both slings are used and a 3g abrupt lift is applied. It is recommended that both slings be used when lifting the container in an empty condition. The container shall not be lifted by one sling if it is partially or totally full. If an underdrained RADLOK container is to be lifted after waste transfer has begun and before all processing is complete, a bottom support plate shall be utilized to prevent damage to the container internals. Consult the Hittman home office for additional information. Note: Due to the nature of the container material, some bowing and deformation may be evident during lifting. This is an anticipated condition.

Underdrained RADLOKs must be handled with reasonable care to prevent damage to the underdrain. A thorough inspection of the underdrain should

be accomplished following rough handling (e.g., container dropped or banged against another object).

The polyethylene container has extraordinary resilience but can be damaged (scraped or gouged) by sharp objects with sufficient application force (e.g., fork lift tines, setting the container down on sharp objects or abrasive surfaces). Reasonable care during handling (and using the pallet provided) will prevent this type of damage.

Remote grapples are available for remote handling of RADLOK containers. Use of these grapples allows for remote pickup and set down in non-accessible areas such as interim and long-term storage facilities. Reusable grapples (removed when the containers are loaded for shipment) and disposable grapples are available for the RADLOK containers.

Manway Use and Closure

The Hittman RADLOK containers are equipped with two concentric openings, a 16 inch diameter manway and an 8 inch diameter fill port. The manway opening is used in the installation of any internals and will be sealed prior to arrival at the user's site. If, for various reasons, it is desirable to use the manway as a large diameter "fill" port, advise Hittman and the appropriate measures will be taken.

Fill Port Use and Closure

The standard fill port on the Hittman RADLOK container is an eight inch opening. The fill port is concentric with the manway opening, and is sealed with the fill port closure assembly. Two seals are attached to the compression plug of the fill port closure assembly. The assembly is then lowered into the opening and screwed into position to a prescribed torque. For details of the closure procedure see Hittman procedure STD-P-03-004.

If the container is to be used as a Type A container the lid shall be secured for transportation to prevent illicit opening. Details concerning methods of securing the lid are also provided in procedure STD-P-03-004.

ATTACHMENT A TO STD-D-03-009

CHEMICAL RESISTANCE OF MARLEX CL-100 AND CL-50 ROTATIONAL MOLDING CROSSLINKABLE HIGH DENSITY POLYETHYLENES

TSM-293
DECEMBER, 1982

CHEMICAL RESISTANCE OF MARLEX CL-100 AND CL-50 ROTATIONAL MOLDING CROSSLINKABLE HIGH DENSITY POLYETHYLENES

INTRODUCTION

One of the most rapidly growing plastics applications is relatively large rotational molded storage tanks. This application and its growth has been keyed to the development and marketing of crosslinkable high density polyethylenes by Phillips Chemical Company. These polyethylenes are marketed under the designation of Marlex CL-100 and CL-50 rotational molding crosslinkable high density polyethylene.

Rotational molding is ideally suited for the manufacture of large tanks. In addition the unique toughness, chemical and stress crack resistance of the Marlex CL-100 and CL-50 resins are needed for the demanding requirements in industry and agriculture for chemical storage tanks and are the key to this expanding market. Today tanks are molded as large as 15,000 gallons (57,000 liters) and are used in such diverse storage applications as acids, insecticides, and chemical plant waste by-products.

The scope of this Technical Service Memorandum is to address the question of compatibility of chemicals with Marlex CL-100 and CL-50 resins in relation to storage tanks. Engineering principles used in determining the suitability of a given application are discussed. Lists of chemicals both suitable and not suitable are included in the appendix along with any limitations which may apply.

CHEMICAL RESISTANCE

"Chemical resistance" and "compatibility" are synonymous terms used in relation to the ability of a plastic to function in different environments. In regard to polyethylene chemical storage tanks, chemical resistance encompasses the total effect a product would have on a tank. The factors that make up the overall compatibility of a chemical to a rotomolded tank are chemical attack, solubility, absorption or permeation, and stress crack resistance. Each of these are discussed briefly.

Chemical Attack - By definition, chemical attack involves an actual chemical reaction with the plastic. This can be a breaking of molecular chains and/or addition of chemical groups to the molecule. For example, in the case of an oxidation reaction with polyethylene both occur with the addition of carbonyl groups. This causes an eventual loss of properties to the point that a tank would not be serviceable.

Polyethylene in general is one of the most inert plastics available. Very few chemicals react with polyethylene, and even with those that do the rate is relatively slow. The ultra high molecular weight characteristics of Marlex CL-100 and CL-50 resins after crosslinking makes these particular polyethylenes even more resistant than other grades. Therefore, chemical attack is not a factor in very many applications.

Permeation - This involves the physical absorption of the chemical into the polyethylene. If this is a volatile chemical, then an actual loss of the product can occur as the chemical vaporizes from the outer wall of the tank. The amount of absorption is generally limited to 3-7 percent by weight of the polyethylene. Also, the loss of volatile products is relatively small. For example, a 25-gallon tank with a 50-mil wall will only lose between 5 and 6 grams of gasoline a day due to permeation. The thicker the wall, the lower the rate of loss.

The absorption of a product into the wall of a tank will cause some property changes. The tensile strength is reduced approximately 10%, stiffness approximately 25%, and a linear and radial swell of from 1 to 5% will occur. Normally this does not affect the utility of the tank nor prohibit the application. It does, however, limit the temperature at which the tank can be used because the loss of these properties becomes a detemining factor as the temperature is increased. Also, if a chemical has too low a boiling point, the vapor pressure may be so high as to cause prohibitive distortion of the tank. This is why such chemicals as ether, pentane, etc., would not be suitable for storage in a sealed tank.

Solubility and Stress Resistance - Although these factors are to be considered with other plastics it is of no significance with Marlex CL-100 or CL-50. There are no known solvents at ambient conditions for these resins. Also, when properly molded and used, the phenomena of stress cracking just doesn't occur.

APPLICATION ENGINEERING

The appendix contains tables of chemicals indicating their compatibility with tanks molded using Marlex CL-100 and CL-50 resins. Table I lists chemicals that are suitable up to 150°F (66°C) without further qualification. Table II and III lists chemicals that permeate or are absorbed by the polyethylene. In these cases the use conditions

should be more thoroughly considered. For example, most of these chemicals are flammable. It should be determined if this would pr[illegible]nt a safety or code problem. Other considerations would be: 1) are the tanks ven[illegible], 2) are they in a confined or open space, and 3) personnel exposure.

In Table IV chemicals are listed that either attack polyethylene or have high vapor pressure and are not normally recommended for long service life of the tank. This does not automatically preclude tanks from being used with these chemicals. It may be economical to periodically replace the tank after a relatively short service life. Factors such as life of the currently used tanks, cost of tanks made using exotic materials, and the consequences if a failure occurs should all be considered.

SUMMARY

Marlex CL-100 and CL-50 rotational molding crosslinkable HDPE is one of the most chemical resistant plastics manufactured today. It is not without limits, however, and the attached tables should be used only as a guide in determining those applications which are suitable.

CHEM:126

APPENDIX

It has been well documented over the years the types of chemicals that are compatible with polyethylene, either through tests or experience. It would be impossible to list all the chemicals that may be involved in use with polyethylene storage tanks. Therefore, the included tables are only representative of typical chemicals.

Also, their rankings are specific to the application of chemical storage tanks and the superior properties of Marlex® CL-100 and CL-50. The following tables are to be used only as a guide for establishing those uses that would give satisfactory service. They are not a substitute for sound engineering.

TABLE I

The following chemicals do not attack nor permeate Marlex® CL-100 or CL-50 resins up to 150°F (66°C). For temperatures over 150°F (65°C) each application should be considered individually. All concentrations apply except where noted.

Acetic Acid
Aluminum Salts
Alum
Ammonium Hydroxide
Ammonium Salts
Amyl Alcohol
Antimony Salts
Arsenic Acid
Barium Hydroxide
Barium Salts
Benzene Sulfonic Acid
Bismuth Salts
Boric Acid
Bromic Acid
Butanediol
Butyl Alcohol
Calcium Hydroxide
Calcium Salts
Chromic Acid <50%
Citric Acid
Copper Salts
Detergents
Diazo Salts
Diethyl Carbonate
Diethanol Amine
Diethylene Glycol
Diglycolic Acid
Dimethylamine
Dimethyl Formamide
Ethyl Alcohol
Ethylene Glycol
Ferric Salts
Ferrous Salts
Fluoboric Acid
Flousilicic Acid
Formic Acid

Gallic Acid
Gluconic Acid
Glycol Ethers
Glycolic Acid
Hexanol
Hydrazine <35%
Hydrozine Hydrochloride
Hydriodic Acid
Hydrobromic Acid
Hydrocyanic Acid
Hydrochloric Acid
Hydrofluoric Acid
Hydrofluorsilicic Acid
Hydrogen Peroxide <30%
Hydrogen Phosphide
Hydroquinone
Hypochorous Acid
Iodine Solutions
Lactic Acid
Latex
Lead Acetate
Magnesium Salts
Mercuric Salts
Mercurous Salts
Mercury
Methyl Alcohol
Methylsulfuric Acid
Nickle Salts
Nicotinic Acid
Nitric Acid <30%
Oxalic Acid
Perchloric Acid
Phenol <10%
Potassium Hydroxide
Potassium Salts
Phosphoric Acid

Photographic Solutions
Propyl Alcohol
Propylene Glycol
Sea Water
Selenic Acid
Sewage
Silicic Acid
Silver Salts
Soap Solutions
Sodium Acrylates
Sodium Ferricyanide
Sodium Ferrocyanide
Sodium Hydroxide
Sodium Hypochlorite <16%
Sodium Salts
Sodium Sulfonates
Stanic Salts
Stannous Salts
Starch Solutions
Stearic Acid
Sulfuric Acid <98%*
Sulfurous Acid
Sugar Solutions
  Glucose
  Lactose
  Sucrose, etc.
Tannic Acid
Tanning Extracts
Tartaric Acid
Titinium Salts
Toluene Sulfonic Acid
Triethanolamine
Urea
Vinegar
Wetting Agents
Zinc Salts

*Under some conditions acid will discolor.

TABLE II

The following oils and organic chemicals do not attack Marlex® CL-100 or CL-50 resins. They will be absorbed into the wall of the tank but there should be no loss of product. Because of this absorption, if tanks would be used for other service, contamination may result as the absorbed oil is leached out. Service at elevated temperatures up to 150°F (66°C) can be recommended provided the effects of the absorption on the properties of the tank are not prohibitive.

Fatty Acids

Butyric
Lauric
Linoleic
Oleic
Palmitic
Stearic

Mineral Oils

Lube
Transformer
Hydraulic

Vegetable Oils

Corn
Coconut
Cottenseed
Olive
Peanut

Animal Fats

Lard
Fish oil
Musk oil
Whale oil

TABLE III

The following organic chemicals do not attack Marlex® CL-100 or CL-50 resins. They will be absorbed into the wall of the tank and a permeation loss will occur. Because of this premeation and the effect it has on the physical properties of the tank it is generally not recommended they be used above 100°F (38°C). However, their use largely depends on such factors as size of the tank, its location, toxicity of the chemical, and applicable codes such as NFPA, OSHA, etc. This is not to discourage these chemical storage applications in which considerable experience with many has been documented on various polyethylene containers. For example, polyethylene gasoline tanks are used on lawn mowers, tractors, trucks, ATVs, snowmobiles, and as portable containers-even approved safety cans.

Aniline
Benzene
Carbon Tetrachloride
Chlorabenzene
Cychohexanol
Cyclohexanone
Dibutylphthalate
Diesel Fuel
Dimethylamine
Ethyl Butyrate
Ethylene Chlorohydrin
Fuel Oil
Furfural
Aliphatic hydrocarbons
(hexane, octane, hexene, octene, etc.)
Jet fuel
Gasoline
Nitrobenzene
Octyl Cresol
Propylene dichloride
Toluene
Xylene

TABLE IV

The following chemicals are not recommended for general storage in tanks molded using Marlex® CL-100 or CL-50 resins. Their effect is not immediate nor catastrophic in nature. Therefore, under certain circumstances, tanks could be used either for the short term or in a limited life situation. Temperature is especially important!

Chemical Attack

Aqua Regia
Bromine
Chromic/Sulfuric acid
Fuming Sulfuric acid
Nitric Acid >50%
Organic peroxides
Phenol-concentrated

High Vapor Pressure

Acetone
Butane
Carbon Disulphide
Chloroform
Ethyl Ether
Ethylene Dichloride
Methylene Chloride
Methyl Ethyl Ketone
Propane
Pentane

TABLE V

APPLICATIONS OF CROSSLINKED HDPE CHEMICAL TANKS

AGRICULTURAL

Chemical Handled	Size of Tank (gallons)*	Type of Tank		Type of Use		Years in Service
		H*	V*	S*	P*	
Cattle Supplements	5600		X	X		7
Insecticides	50 to 1500	X	X	X	X	10
Herbicides (Bicep, Dual, Sutan, Lasso)	50 to 1500	X	X	X	X	10
Liquid Fertilizer	100 to 5600	X	X	X	X	8
Nitrogen Solution	5600		X	X		8
Phosphoric Acid	1500 to 5600		X	X		8
Sulphur Solution	5600		X	X		8
Treflan	200	X			X	6

INDUSTRIAL

Chemical Handled	Size of Tank (gallons)*	H*	V*	S*	P*	Years in Service
Hydrochloric Acid (37% and lower)	5600		X	X		8
Hydrofluoric Acid	55 to 2500	X		X	X	6
Sulfuric Acid (98% and lower)	400 to 12,000		X	X		8
Propionic Acid	5600		X	X		8
Sodium Hypochlorite	4250 to 12,000		X	X		8
Sodium Hydroxide	1500 to 12,000		X	X		8
Hydrogen Peroxide (52%)	55 to 1600	X	X	X	X	5
Alum	5600		X	X		8
Cactus Juice	1500 to 6000		X	X		5
Detergents	100 to 6000	X	X	X	X	8
Floor Finishes & Cleaners	5600		X	X		8
Latex	6400		X	X		8
Oil Well Additives	200 to 1500	X	X	X	X	8
Plating Solutions	3000		X	X		4
Waste Water	12,000		X	X		8

H - Horizontal
V - Vertical
S - Stationary
P - Portable

*Constant to convert gallons to liters - gallons x 3.7854 = liters

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED	Document Number: STD-P-03-010	Rev: 6	Rev Date: 12/20/85
	Title: Transfer & Dewatering Bead Resin in Hittman RADLOK™ -100, -200, or -500 Containers with a Single Layer Underdrain Assembly to Less than 1% Drainable Liquid		

Rev.	Rev Date	Prepared by	Director Engineering	Manager Field Services	QA Manager		
0	11-10-82	K. McDaniel	[signature]	[signature]	[signature]		EWR-82-624
1	11-30-82	E. Closan	[signature]	[signature]	[signature]		ECN-82-265
2	9-30-83	[signature]	[signature]	[signature]	[signature]		ECN-83-248
3	3-19-84	X	[signature]	[signature]	[signature]		ECN-84-045 Rewritten
4	5-10-84	X	[signature]	[signature]	[signature]		ECN-84-082
5	6-6-84	X	[signature]	[signature]	[signature]		ECN-84-093
6	12/20/85	X	[signature]	[signature]	[signature]		ECN-85-215

TRANSFER AND DEWATERING BEAD RESIN IN HITTMAN RADLOK™-100, 200, or -500 CONTAINERS WITH A SINGLE LAYER UNDERDRAIN ASSEMBLY TO LESS THAN 1% DRAINABLE LIQUID

1.0 SCOPE

This procedure is applicable to RADLOK-100, -200, and -500 High Integrity Containers with single layer underdrains for dewatering bead ion exchange resins and other granular media.

2.0 PURPOSE

To provide general instructions for the transfer and dewatering of bead ion exchange resins (or other granular media) to meet the burial site criteria of less than one (1) percent drainable liquid upon receipt at the site. This procedure also assures that there is no drainable liquid at the time of shipment from the plant.

3.0 REFERENCES

3.1 Hittman RADLOK™ High Integrity Container Rad Services Manual, RSM-014.

3.2 ANSI/ANS-55.1-1979, Solid Radioactive Waste Processing System for Light Water Cooled Reactor Plants.

3.3 Hittman report, STD-R-03-002, Report on Dewatering of Bead Ion Exchange Resin and Activated Carbon in Hittman RADLOK High Integrity Containers.

3.4 Hittman procedure, STD-P-03-003, RADLOK Manway Assembly Closure and Sealing Procedure.

3.5 Hittman procedure, STD-P-03-004, Closure of Hittman RADLOK High Integrity Container Fill Port Closure Assembly.

3.6 Hittman procedure, STD-P-03-020, RADLOK Inspection Procedure.

3.7 Hittman drawing, STD-03-010, Sheet 4, RADLOK™-100 and -500 Single Layer Underdrain Assembly.

3.8 Hittman drawing, STD-03-083, Sheet, 4, RADLOK-200 Single Layer Underdrain Assembly.

4.0 EQUIPMENT

4.1 Diaphragm pump, 1½" or equivalent, with interconnecting hoses, quick disconnect fittings and clamps as required.

4.2 Hoses with fittings and clamps as required to connect from the service air system to the diaphragm pump. Minimum service air required is 40 SCFM at 100 psig.

4.3 Overflow drum with connecting hose to the container (optional).

4.4 Standpipes, as required (pipe extensions for fill plate connections).

4.5 Liner level indicator panel.

4.6 Vacuum pump with minimum suction of 25 inches of mercury (29.9 inches Hg vacuum equals absolute vacuum) and ¼-inch vacuum hoses and clamp.

4.7 Glass collection bottle per Figure 1, minimum size of two (2) gallons, rated for full vacuum.

5.0 EQUIPMENT SETUP

5.1 Prerequisites

5.1.1 The container has been satisfactorily inspected in accordance with STD-P-03-020.

5.2 Precautions

None.

5.3 Assembly for Transfer and Dewatering

5.3.1 CONNECT the standpipes to the threaded connections on the fill plate. See STD-03-010 or STD-03-083.

5.3.2 CONNECT the electrode plug to the level indicator panel.

5.3.3 CONNECT the dewatering pump suction hose to the standpipe on the fill plate suction connection.

5.3.4 CONNECT the dewatering pump to the service air system using service air hoses.

5.3.5 CONNECT the dewatering pump discharge hose to the appropriate plant connection.

5.3.6 CONNECT the final dewatering connection hose from the container to the respective tube in the collection bottle. See Figure 1.

5.3.7 CLAMP off the final dewatering connection hose near the collection bottle.

5.3.8 CONNECT a hose from the standpipe on the fill plate vent connection, if provided, to an overflow drum, plant return line or plant drain as appropriate.

5.3.9 CONNECT the standpipe on the fill plate fill connection to the plant's waste supply line.

5.4 Assembly for Dewatering Only

5.4.1 CONNECT one of the standpipes to the suction connection on the fill plate. See STD-03-010 or STD-03-083.

5.4.2 CONNECT the dewatering pump suction hose to the standpipe on the fill plate suction connection.

5.4.3 CONNECT the dewatering pump to the service air system using service air hoses.

5.4.4 CONNECT the final dewatering connection hose from the container to the respective tube in the collection bottle. See Figure 1.

5.4.5 CLAMP off the final dewatering connection hose near the collection bottle.

5.4.6 CONNECT the dewatering pump discharge hose to the appropriate plant connection.

6.0 TRANSFER AND DEWATERING

6.1 Prerequisites

6.1.1 The equipment is set up in accordance with Section 5.3 or 5.4 of this procedure, as applicable.

6.1.2 An RWP is issued and Health Physics is notified prior to waste transfer.

6.2 Precautions

Be aware of changing radiological conditions as waste is transferred to the container and the container is dewatered.

6.3 Operating Steps, Transfer and Dewatering

6.3.1 BEGIN the waste transfer.

6.3.2 CONTINUE the waste transfer until the "OP/LOW" indicator alarm sounds. Once this alarm sounds terminate the waste transfer and allow the waste to settle for fifteen (15) minutes.

NOTE: If the "OP/HI" indicator alarm sounds, the waste is about to overflow the RADLOK container. If this alarm sounds, the operator should take action to isolate flow to the container. If the waste flow is not stopped it will overflow the container. Before restarting the

transfer operation, any overflow waste must be pumped out of the overflow drum and the "OP/HI" and "OP/LOW" indicator signals must be cleared.

6.3.3 START the diaphragm pump and begin the dewatering operation. The waste level in the container will recede and the "OP/LOW" light will go out.

6.3.4 MAINTAIN a no-fill mode for three (3) minutes or until the dewatering pump loses suction. Loss of suction may be defined as less than ten (10) inches mercury vacuum.

6.3.5 RESUME waste transfer.

6.3.6 REPEAT steps 6.3.2 through 6.3.5 until the "OP/LOW" indicator light fails to go out. At this point the container is full and the transfer is completed. Any flushing of transfer lines should be done at this time.

NOTE: If during the flush operation, the "OP/HI" alarm sounds, immediately stop flush and do not resume it until the dewatering pump loses suction.

6.3.7 Continue to OPERATE the dewatering pump for four hours after loss of suction.

6.3.8 Twenty (20) hours after completion of Step 6.3.7, DEWATER with the dewatering pump for one (1) hour.

6.3.9 CONNECT the vacuum pump to the collection bottle.

6.3.10 CHECK all connections for fit and secure with hose clamps where necessary.

6.3.11 ESTABLISH 15"-18" mercury vacuum in the collection bottle. REMOVE the pinch clamp. MONITOR the water level in the collection bottle.

NOTE: Should the liquid level in the bottle get close enough to the top to risk water being sucked into the vacuum pump, stop the pump and empty the collection bottle, using proper radiological procedures.

6.3.12 DEWATER via this method for one (1) hour after continuous flow is lost. Continuous flow is considered lost when air bubbles begin coming through the hose from the container.

6.3.13 Upon termination of the dewatering process as defined in Step 6.3.12, STOP the vacuum pump.

6.3.14 If the container is expected to remain on-site for more than four (4) days after completion of Step 6.3.13, REPEAT steps

6.3.11 through 6.3.13 within the twenty-four (24) hour period prior to shipment.

NOTE: The purpose of this final step is to ensure compliance with ANSI/ANS standard 55.1-1979 that there be no drainable liquid in the container at the time of shipment and need only be performed if it is plant policy to conform to this standard.

6.4 Operating Steps, Dewatering Only

6.4.1 START the dewatering pump and begin the dewatering operation.

NOTE: Depending on the quantity of water in the container, continuous pump flow may not be attained. If this is the case, begin timing the next step whenever convenient.

6.4.2 Continue to OPERATE the dewatering pump for four (4) hours after loss of suction. Loss of suction may be defined as less than ten (10) inches of mercury vacuum.

6.4.3 Twenty (20) hours after completion of step 6.4.2, DEWATER with the dewatering pump for one (1) hour.

6.4.4 CONNECT the vacuum pump to the collection bottle.

6.4.5 CHECK all connections for fit and secure with hose clamps where necessary.

6.4.6 ESTABLISH 15"-18" mercury vacuum in the collection bottle. REMOVE the pinch clamp. MONITOR the water level in the collection bottle.

NOTE: Should the liquid level in the bottle get close enough to the top to risk water being sucked into the vacuum pump, stop the pump and empty the collection bottle, using proper radiological precautions.

6.4.7 DEWATER via this method for one (1) hour after continuous flow is lost. Continuous flow is considered lost when air bubbles begin coming through the hose from the container.

6.4.8 Upon termination of the dewatering process as defined in step 6.4.7, STOP the vacuum pump.

6.4.9 If the container is expected to remain on-site for more than four (4) days after completion of step 6.4.8, REPEAT steps 6.4.6 through 6.4.8 within the twenty-four (24) hour period prior to shipment.

NOTE: The purpose of this final step is to ensure compliance with ANSI/ANS Standard 55.1-1979 that there be no drainable liquid in the container at the time of shipment and need only be performed if it is plant policy to conform to this standard.

7.0 DISCONNECTION AND CLOSURE OF CONTAINER

7.1 Prerequisites

No additional transfers of waste into the container are planned and dewatering is complete.

7.2 Precautions

As hoses are disconnected, be careful not to spill any residual water.

7.3 Operating Steps

7.3.1 DISCONNECT the final dewatering connection hose from the collection bottle.

7.3.2 EMPTY the collection bottle.

7.3.3 DISCONNECT the waste transfer hose from the standpipe on the fill plate fill connection.

7.3.4 DISCONNECT the hose from the standpipe on the fill plate vent connection, if provided.

7.3.5 DISCONNECT the hose from the standpipe on the fill plate suction connection.

7.3.6 CUT the final dewatering connection hose close to the packing gland on the fill plate.

7.3.7 UNSCREW the standpipes from the fill plate.

NOTE: The container is now ready to be closed and sealed for shipment to the burial site.

7.3.8 CLOSE the container in accordance with Hittman procedure STD-P-03-004.

INSPECTION AND OPERATION CHECKLIST FOR RADLOK-100, -200, or -500 EQUIPPED WITH A SINGLE LAYER UNDERDRAIN SYSTEM FOR BEAD RESINS

TRANSFER AND DEWATERING

Date: ______________________

Shipment No.: ______________________

Container Serial Number: ______________

	TIME	DATE	INITIALS
Container Inspected (In accordance with STD-P-03-020)	____	____	______
Manway Assembly Installed (In accordance with STD-P-03-003)	____	____	______

Transfer and Dewater

The following steps should be performed:
(In accordance with STD-P-03-010)

	TIME	DATE	INITIALS
1. Completed System Assembly (In accordance with 5.3)	____	____	______
2. Completed Resin Transfer (In accordance with 6.3.1 through 6.3.6)	____	____	______
3. Started Initial Dewatering (In accordance with 6.3.7)	____	____	______
4. Completed Initial Dewatering (In accordance with 6.3.7)	____	____	______
5. Started Final Dewatering (In accordance with 6.3.8 through 6.3.12)	____	____	______
6. Completed Final Dewatering (In accordance with 6.3.13)	____	____	______
7. Disconnected Container from all Connections (In accordance with 6.3.14 and 7.0)	____	____	______
Install and Torque Fill Port Closure Assembly (In accordance with STD-P-03-004)	____	____	______

	TIME	DATE	INITIALS
Label the Container (In accordance with burial site criteria)	_____	_____	_______

Signature: ______________________________

Title: ______________________________

Date: ______________________________

INSPECTION AND OPERATION CHECKLIST FOR RADLOK-100, -200, -500 EQUIPPED WITH A SINGLE LAYER UNDERDRAIN SYSTEM FOR BEAD RESINS

DEWATERING ONLY

Date: ______________________

Shipment No.: ________________

Container Serial Number: __________

	TIME	DATE	INITIALS
Container Inspected (In accordance with STD-P-03-020)	____	____	______
Manway Assembly Installed (In accordance with STD-P-03-003)	____	____	______

Dewatering Only

The following steps should be performed: (In accordance with STD-P-03-010)

	TIME	DATE	INITIALS
1. Completed System Assembly (In accordance with 5.4)	____	____	______
2. Started Initial Dewatering (In accordance with 6.4.1)	____	____	______
3. Completed Initial Dewatering (In accordance with 6.4.2)	____	____	______
5. Started Final Dewatering (In accordance with 6.4.3 through 6.4.7)	____	____	______
6. Completed Final Dewatering (In accordance with 6.4.8)	____	____	______
7. Disconnected Container from all Connections (In accordance with 6.4.9 and 7.0)	____	____	______
Install and Torque Fill Port Closure Assembly (In accordance with STD-P-03-004)	____	____	______

INSPECTION AND OPERATION CHECKLIST FOR RADLOK-100, -200, -500 EQUIPPED WITH A SINGLE LAYER UNDERDRAIN SYSTEM FOR BEAD RESINS
(Continued)

DEWATERING ONLY

	TIME	DATE	INITIALS
Label the Container (In accordance with burial site criteria)	_____	_____	_________

Signature: ______________________________

Title: ______________________________

Date: ______________________________

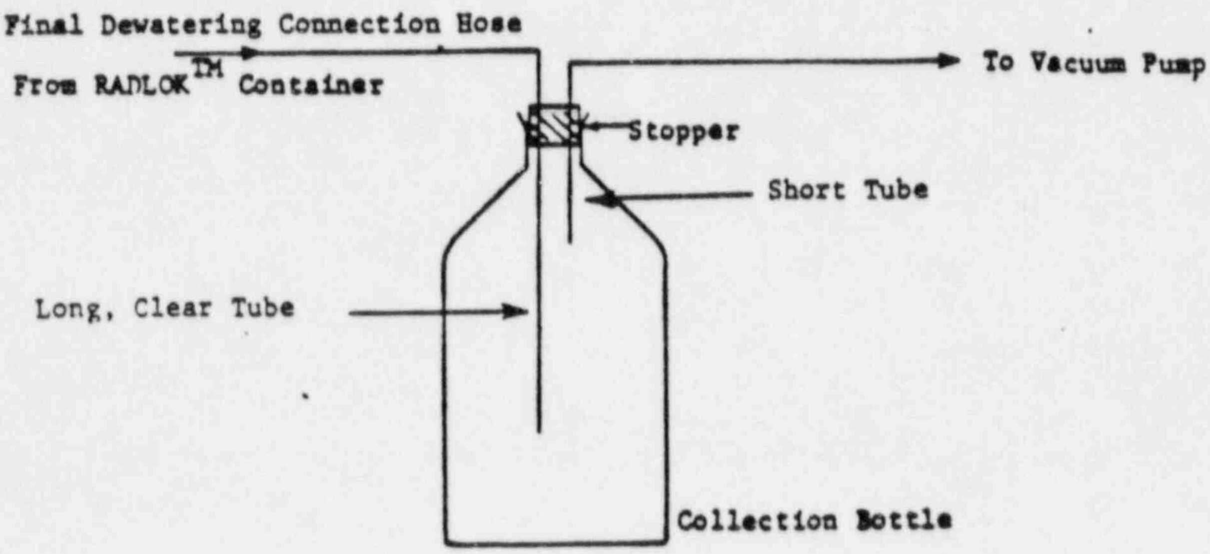
Final Dewatering Connection Hose
From RADLOK™ Container
To Vacuum Pump
Stopper
Short Tube
Long, Clear Tube
Collection Bottle

Figure 1

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED	Document Number: STD-P-03-020	Rev: 5	Rev Date: 1-30-86
	Title: RADLOK® Inspection Procedure		

Rev.	Rev Date	Director Engin.	Project Manager	QA Manager			
0	10-3-83						EWR-83-562
1	3-29-84						ECN-84-049
2	5-17-84			J. Pawlak for B ROWE			ECN-84-083
3	6/6/85						ECN-85-037
4	12/19/85						ECN-85-214
5	1-30-86						ECN-86-007

FORM-01(B)

RADLOK® Inspection Procedure

1.0 PURPOSE

To provide instructions for inspection of RADLOK High Integrity Containers.

2.0 SCOPE

This procedure is applicable to all RADLOK containers. Sections pertaining to the manway assembly are not applicable to the RADLOK-55 or to large containers where the manway assembly is presealed.

In these cases, the respective sections on the checklist should be marked N/A.

3.0 REFERENCES

3.1 STD-D-03-008, A Users Manual for the Hittman RADLOK-55.

3.2 STD-D-03-009, A Users Manual for the Hittman RADLOK-200, RADLOK-500, and RADLOK-100.

3.3 Drawing STD-03-006, RADLOK-55 User Drawing.

3.4 Drawing STD-03-104, RADLOK-200 User Drawing.

3.5 Drawing STD-03-110, RADLOK-500 User Drawing.

3.6 Drawing STD-03-007, RADLOK-100 User Drawing.

3.7 STD-P-03-003, RADLOK Manway Assembly Closure and Sealing Procedure.

4.0 INSPECTION

4.1 Prerequisites

None.

4.2 Precautions

Each container is matched with specific closure components and seals at time of manufacture. All components are identified using a common serial number. Should components become mismatched, contact your Hittman Regional Operations Manager prior to RADLOK use.

4.3 Pre-Use Inspection for All RADLOK Containers.

NOTE: Complete applicable portions of Attachment A as inspection steps are completed.

4.3.1 ENSURE that all of the sealing components including the fill port closure assembly, the manway seal (if applicable), and the manway lid (if applicable) are accounted for and are in good condition.

4.3.2 ENSURE that all of the seals are accounted for. The seals shall be free of defects, not hard or brittle, and the glued joints shall be intact.

4.3.3 CHECK the seal sizes to ensure proper fit.

4.3.4 ENSURE that the thread and seal seat areas are free of foreign material.

4.3.5 ENSURE that a vent filter is installed in the fill port closure assembly.

4.3.6 ENSURE a proper fit of the manway lid (if applicable) and the fill port closure assembly.

4.3.7 ENSURE that the exterior surfaces are free of damage.

<u>NOTE</u>: The following surface acceptance criteria has been compiled in keeping with the State of South Carolina's RADLOK Certificates of Compliance and provides guidance for inspection.

- Container "pock" marks are acceptable.
- Voids in the bottom (starting) thread of the container closures are acceptable.
- Surface abrasions and scrapes are acceptable when depth of removed material is less than 1/32" on the RADLOK-55, 1/16" on the RADLOK-200, -500, and -100.
- Surface cuts (sharp, clearly defined separation of the container skin) and punctures shall be evaluated on a case-by-case basis. Report the size and location of same to the Hittman office so that an evaluation may be made.

4.3.8 INSPECT the manway lid for proper closure (does not apply to RADLOK-55). (criterion $\leq$ 3/4 inch space between lid and container body).

4.3.9 ENSURE that the RADLOK certificate number and serial number are imprinted on the container.

4.3.10 NOTIFY Hittman if any components are missing or damaged for repair or replacement as necessary.

4.4 <u>Additional Pre-Use Inspection for RADLOK Containers With Dewatering Systems</u>.

<u>NOTE</u>: Complete applicable portions of Attachment A marked by (*) as inspection steps are completed.

4.4.1 REMOVE the fill port closure assembly.

4.4.2 REMOVE the manway lid. (See STD-P-03-003).

NOTE: For single layer dewatering systems inspect the dewatering system per Sections 4.4.3 through 4.4.6, 4.4.9 through 4.4.11. For multi-layered dewatering systems inspect per Sections 4.4.7 through 4.4.11.

4.4.3 Carefully LIFT the manway seal to allow visual inspection of the internals.

4.4.4 VERIFY that the dewatering hose and the vacuum tube are secured to the proper fittings.

4.4.5 INSPECT the dewatering tubes for breakage.

4.4.6 INSPECT the hoses for kinks, crushing or tears.

4.4.7 Carefully LIFT the manway seal to allow visual inspection of internals while heeding the following cautions.

CAUTION: TO LIFT THE MANWAY SEAL AND UNDERDRAIN, SCREW A PIPE EXTENSION INTO THE CENTER DEWATERING CONNECTION AND USE A STEADY, VERTICAL FORCE TO LIFT THE SEAL. AT NO TIME SHOULD THE MANWAY SEAL BE PRIED OR TURNED, OR THE PIPE EXTENSION LEVERED DURING THE REMOVAL PROCESS (IF TIGHT, KNOCKING ON THE CONTAINER NECK-TO-MANWAY SEAL JOINT AREA SHOULD FREE THE SEAL). DO NOT LIFT THE MANWAY SEAL ENOUGH TO PERMIT THE TOP LAYER OF DEWATERING TUBES TO IMPINGE ON THE UPPER SECTION OF RADLOK BODY.

4.4.8 VERIFY that the dewatering tubes and pipe risers are intact by visual inspection.

4.4.9 REPLACE the manway seal and manway lid per STD-P-03-003.

4.4.10 VERIFY that all strain relief connector bushings securely seal the electrical cords and tubing that penetrate the fill plate.

NOTE: Connectors shall only be hand-tightened around tubing so that it is not constricted.

4.4.11 NOTIFY Hittman if any components are missing or damaged for repairs or replacements.

ATTACHMENT A

Pre-Use Inspection Checklist for RADLOK Container

On-Site Inspector: ______________________________

Location: ______________ Date: ______________

Container Type/Options: ______________________________

Container Serial No.: ______________________________

(* - Applicable to RADLOK Containers with Dewatering Systems Only.)

Inspection Item	Initials/Date
Serial number matches on all components (4.2)	________
All sealing components accounted for (4.3.1)	________
All seals accounted for and in good condition (4.3.2)	________
All seals fit properly (4.3.3)	________
Thread and seal seat areas free of foreign material (4.3.4)	________
Sealing components fit properly (4.3.6)	
Manway Assembly (if applicable)	________
Fill Port Closure Assembly	________
Exterior surface free of damage (4.3.7)	________
Manway lid properly sealed (if pre-sealed) (4.3.8)	________
Certificate number imprinted on container (4.3.9)	________
Containers with Single Layer Dewatering Systems.	
* Dewatering hose and vacuum tube secure (4.4.4)	________
* Dewatering tubes intact (4.4.5)	________
* Hoses not kinked, crushed or torn (4.4.6)	________
Containers with Multi-Layered Dewatering Systems.	
* Dewatering tubes and pipe risers intact (4.4.8)	________
* Strain relief connectors intact and tightened (4.4.10)	________

WESTINGHOUSE HITTMAN NUCLEAR INCORPORATED

Document Number: STD-P-04-002

Rev: 6

Rev Date: 3-24-86

Title: Process Control Program for Dewatering Ion-Exchange Resin & Activated Charcoal Filter Media to ½% Drainable Liquid

Rev.	Rev Date	Prepared by	Reviewed by	Responsible Manager	Director Engineering	Quality Assurance	
0	12-3-81	[signature]	[signature]	[signature]	[signature]	[signature]	
1	5-19-83	K. McDaniel	E. Closson	[signature]	[signature]	[signature]	ECN-83-133
2	9-28-83	K. McDaniel	E. Closson	[signature]	[signature]	[signature]	ECN-83-241
3	4-23-84	X	X	[signature]	[signature]	[signature]	ECN-84-081
4	10-8-85	X	X	M. McCauley	[signature]	[signature]	ECN-85-156
5	2-07-86	X	X	M. McCauley	[signature]	[signature]	ECN-86-030
6	3-24-86	X	X	M. McCauley	[signature]	[signature]	ECN 86-071

J WALDEN FARLEY

DOCUMENT CONTROL
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No 006

PROCESS CONTROL PROGRAM FOR DEWATERING ION EXCHANGE RESIN AND ACTIVATED CHARCOAL FILTER MEDIA TO 1/2% DRAINABLE LIQUID

1.0 SCOPE

This procedure is applicable to Hittman steel liners having rigid underdrains for dewatering bead ion exchange resins or activated carbon.

2.0 PURPOSE

2.1 The purpose of the Process Control Program (PCP) for dewatered resin and activated carbon is to provide a program which will assure that at the time of arrival at the burial site the disposable liner contains less than one-half of one percent free liquid.

2.2 This document is complete in and of itself and can be used for demineralizer and carbon filter liners into which exhausted resins are transferred. Other Hittman procedures may also include procedures for connecting dewatering equipment to the liner prior to other operations. Should this be the case those procedures obviously need not be required.

3.0 REFERENCES

3.1 Report on Dewatering of Bead Ion Exchange Resin and Activated Carbon, Hittman Report STD-R-03-001.

4.0 EQUIPMENT

4.1 Diaphragm pump, 1½" or equivalent, with interconnecting hoses, quick disconnect fittings and clamps as required.

4.2 Hoses with fittings and clamps as required to connect from the service air system to the diaphragm pump. Minimum service air required is 40 SCFM at 100 psig.

4.3 Vacuum pump with minimum suction of 25 inches of mercury and 1/4-inch vacuum hoses and clamp.

4.4 Tool for connection to side bottom dewatering connection similar to device shown in Figure 1 (Optional).

4.5 Glass collection bottle per Figure 2, minimum size of two (2) gallons.

5.0 GENERAL REQUIREMENTS

5.1 As required by the South Carolina Department of Health and Environmental Controls License No. 097, Amendment No. 30 for

the Barnwell Waste Management Facility, the PCP shall be used to verify adequate dewatering of unsolidified wet radioactive wastes.

5.2 The PCP applies to shipments of resins transferred to Hittman liners and for Hittman liners used as portable demineralizers or carbon filters. These shipments shall be dewatered to meet burial site free liquid criteria according to Hittman's Liner Dewatering Test Report, STD-R-03-001, which has been filed, on behalf of Hittman clients, with the operator of the Barnwell, South Carolina burial facility.

5.3 For liners that are to be shipped unshielded, or when adequate shielding can be supplied at the plant, this dewatering procedure can be accomplished prior to loading the liner onto the truck. When adequate shielding is not available, or for resins transferred to a liner already in the shipping cask, this dewatering procedure must be accomplished after the liner is loaded into the shipping cask.

5.4 In all cases, the liner must be tipped approximately 7° to 9° with the final dewatering element at the low point. The location of the final dewatering element is marked on the outside of the liner.

5.5 For liners to be dewatered in the shipping cask, the method of tipping the cask either on or off the trailer must be cleared with the responsible Hittman transportation office prior to commencement of work.

6.0 <u>DEWATERING PROCEDURE</u>

6.1 <u>Disposable Demineralizers and Carbon Filters</u>

6.1.1 Upon completion of the waste processing, CONTINUE DEWATERING the liner until pump suction is lost. RECORD on the Dewatering Verification Data Sheet, Form STD-P-04-002, Item (1) that Step 6.1.1 is complete.

6.1.2 MOVE the liner to the location for final dewatering and set in the tipped configuration. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (2) that Step 6.1.2 is complete.

6.1.3 CONNECT the dewatering hose used during normal waste processing to a Warren-Rupp double diaphragm air operated pump or equivalent.

6.1.4 CONNECT the pump discharge hose to the appropriate plant drain or to a large collection vessel.

6.1.5 REMOVE the pipe plug from the final dewatering connection.

NOTE: For liners with a top dewatering connection this is a 1/4" pipe plug. For liners with the side bottom dewatering connection this is a 1½" pipe plug.

6.1.6 For liners with the top dewatering connection REPLACE the pipe plug with a ¼" threaded pipe.

6.1.7 For liners with the side bottom dewatering connection CONNECT the dewatering tool shown in Figure 1, or a similar device, to the quick disconnect fitting found under the 1½" pipe plug.

6.1.8 CONNECT the vacuum hose from the vacuum bottle to the final dewatering connection installed in Step 6.1.6 or Step 6.1.7. See Figure 2.

6.1.9 CONNECT a second vacuum hose from the vacuum bottle to the vacuum pump.

6.1.10 CLAMP off hose connected in Step 6.1.8 near vacuum bottle.

6.1.11 DEWATER the liner using the air operated pump for a minimum of four (4) hours at which time the pump is to be shut off, but not disconnected. If the discharge hose is routed to a larger collection vessel, RECORD on the Dewatering Verification Data Sheet, Form STD-P-04-002-01, Item (3) the volume of liquid collected. RECORD that Steps 6.1.3 through 6.1.11 are complete.

6.1.12 Allow the liner to SIT in this position for twenty (20) hours. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (4) Step 6.1.12 is complete.

6.1.13 DEWATER using the air operated pump for one (1) hour. If the discharge hose is routed to a collection vessel, RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (5) the volume of liquid collected. RECORD that Step 6.1.13 is complete.

6.1.14 START the vacuum pump and establish a vacuum (15" - 18" mercury) in collection bottle. REMOVE pinch clamp. MONITOR water level in the collection bottle.

NOTE: Should the liquid level in the bottle get close enough to the top to risk water being sucked into the vacuum pump,

stop the pump and empty the collection bottle, using proper radiological procedures.

6.1.15 DEWATER via this method for one (1) hour after continuous flow is lost. Continuous flow is considered lost when air bubbles begin coming through the vacuum hose from the container. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (6) the quantity of water collected and that Steps 6.1.14 and 6.1.15 are complete.

6.1.16 REPEAT Steps 6.1.14 and 6.1.15 at 24-hour intervals for three days. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Items (7) through (9) the quantity of water collected and that Steps 6.1.14 and 6.1.15 are complete.

6.1.17 Upon completion of the fourth vacuum draining, the liner is dewatered and ready for shipment.

<u>NOTE</u>: Do not complete Item (10) on the Dewatering Verification Sheet, Form STD-P-04-002-01 unless the resin volume in the liner exceeds 140 cubic feet. In that case, REFER to Step 6.2.5.

6.2 <u>Resin Transfer Liners</u>

6.2.1 Upon completion of the resin transfer operation, CONTINUE operating the dewatering pump until pump suction is lost. RECORD on the Dewatering Verification Data Sheet, Form STD-P-04-002-01, Item (1), Step 6.2.1 is complete.

6.2.2 DISCONNECT the dewatering pump from the liner.

6.2.3 PLACE the liner in the tipped configuration. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (2), Step 6.2.3 is complete.

6.2.4 COMPLETE steps 6.1.3 through 6.1.16. COMPLETE Items (3) through (9) on the Verification Sheet, Form STD-P-04-002-01 as Steps 6.1.3 through 6.1.16 are completed.

6.2.5 For liners containing greater than 140 cubic feet of resin, ADD one additional day of dewatering prior to shipment and COMPLETE Item (10) on the Dewatering Verification Sheet, Form STD-P-04-002-01.

7.0 DISCONNECTING DEWATERING EQUIPMENT

7.1 DISCONNECT dewatering hose from the dewatering pump. The portion of this hose exiting the liner through the liner neck is to be pushed back into the liner prior to capping. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (11) that Step 7.1 is complete.

7.2 DISCONNECT the final dewatering line from the liner top and replace the 1/4 inch plug, or remove the dewatering tool, or similar device, and replace the 1-1/2 inch plug. RECORD on the Dewatering Verification Sheet, Form STD-P-04-002-01, Item (12) that Step 7.2 is complete. COMPLETE Items (13) through (18) on Form STD-P-04-002-01.

NOTE: For liners with the side bottom connection it is recommended that the pipe plug be tack welded in place to eliminate the possibility of it vibrating loose during transportation.

Date: ____________________

Liner: ____________________

DEWATERING VERIFICATION SHEET

SECTION I - DEWATERING

	Initials	
	Hittman	Plant Radwaste
Item (1) Step 6.1.1 or 6.2.1, Waste Processing or Resin Transfer is complete and resin dewatered until loss of suction.	______	____________
Item (2) Step 6.1.2 or 6.2.2 and 6.2.3, Liner is Set in Tipped Configuration (7 to 9 degrees)	______	____________
Item (3) Steps 6.1.3 through 6.1.11, set-up for dewatering are complete and liner has been dewatered for four (4) hours using the air operated pump Time Start: __________ Time Completed: _______ Volume Collected: ________	______	____________
Item (4) Step 6.1.12, Liner allowed to sit for 20 hours Time Start: ______ Date: ________ Time Completed: _______ Date: ________	______	____________
Item (5) Step 6.1.13, Dewatered one (1) hour using air operated pump Time Start: ______________ Time Completed: _________ Volume Collected: ________	______	____________
Item (6) Steps 6.1.14 and 6.1.15, Vacuum (15" - 18" mercury) established in collection bottle and liner has been dewatered one (1) hour after continuous flow is lost. Date: ______________ Vacuum: ____________ Time Start (After Continuous flow is lost: ___________ Time Completed: ___________ Volume Collected: __________	______	____________

SECTION I - DEWATERING
(Continued)

Initials
Hittman Plant Radwaste

Item (7) Steps 6.1.16, Steps 6.1.14 and 6.1.15 repeated after first 24 hour period, Vacuum (15 - 18" mercury) established in collection bottle and liner has been dewatered one (1) hour after continuous flow is lost.

Date: ____________________
Vacuum: ____________________

Time Start (after continuous flow is lost: ____________

Time Completed: ____________

Volume Collected: ____________ ______ ____________

Item (8) Step 6.1.16, Steps 6.1.14 and 6.1.15 repeated after second 24 hour period, Vacuum (15"-18" mercury) established in collection bottle and liner has been dewatered one (1) hour after continuous flow is lost.

Date: ____________________

Vacuum: ____________________

Time Start (after continuous flow is lost) ____________

Time Completed: ____________

Volume Collected: ____________ ______ ____________

Item (9) Step 6.1.16, Steps 6.1.14 and 6.1.15 repeated after third 24 hour period, Vacuum (15"-18" mercury) established in collection bottle and liner has been dewatered one (1) hour after continuous flow is lost.

Date: ____________________
Vacuum: ____________________

Time Start (after continuous flow is lost) ____________

Time Completed: ____________

Volume Collected: ____________ ______ ____________

SECTION II - DISCONNECTION OF DEWATERING EQUIPMENT

Item (10) Step 6.2.5 completed if liner contains greater than 140 cubic feet of resin.

Date: ______________

Vacuum: ______________

Time Start (after continuous flow is lost) ________

Time Completed: ________

Volume Collected: ________ ______ ____________

Item (11) Step 7.1, Disconnect and Storing of Dewatering Hose is complete. ______ ____________

Item (12) Step 7.2., Disconnect of Final Dewatering Line is complete. ______ ____________

SECTION III - LINER INFORMATION

Item (13) Liner Number: ____________

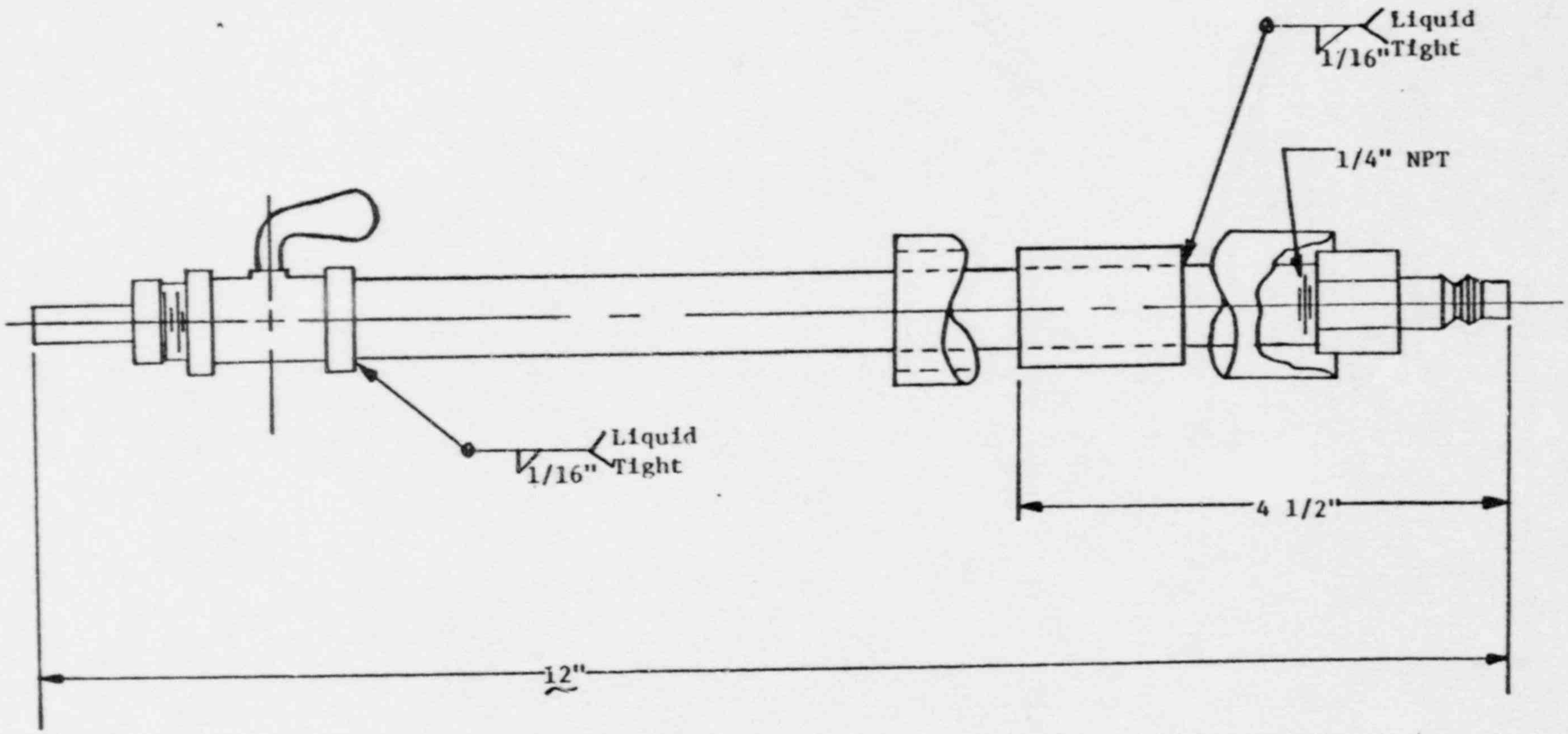
Item (14) Liner Type: ______________

Item (15) Dose Rate: ______________

Item (16) Shipping Date: ____________

Item (17) Site Technician: ____________________ ____________
Date

Item (18) Plant Radwaste Personnel: ____________________ ____________
Date



Steel Liner Dewatering Tool

Figure 1

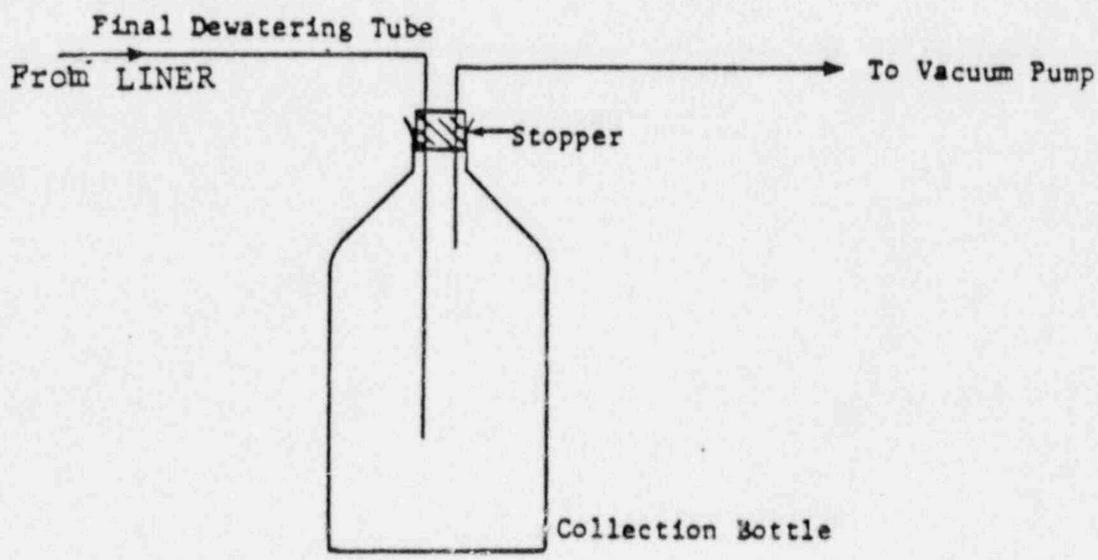

Final Dewatering Tube
From LINER
To Vacuum Pump
Stopper
Collection Bottle

Figure 2

HITTMAN NUCLEAR & DEVELOPMENT CORPORATION	Document Number: STD-P-05-002	Rev: 4	Rev Date: 4-9-86
	Title: Process Control Program for Incontainer Solidification of Oily Waste		

Rev.	Rev Date	Prepared by	Supervisor Laboratory Services	Director Engineering	Manager Field Services	QA	
0	11-17-81	[signature]	E. Cholran	[signature]	[signature]	[signature]	
1	6-9-82	[signature]	E. Cholran	[signature]	[signature]	J. Pawlik for B. LOWE	ECN-82-124
2	7-2-82	E. Cholran	E. Cholran	[signature]	[signature]	[signature]	ECN-82-137
3	4-27-84	X	X	[signature]	[signature]	[signature]	ECN-84-065 Rewritten
4	4-9-86	X	X	[signature]	[signature] for MM	[signature]	ECN 86-074 Rewritten

J. WALDEN FARLEY

DOCUMENT CONTROL
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No. 009

PROCESS CONTROL PROGRAM FOR INCONTAINER SOLIDIFICATION OF OIL

1.0 SCOPE

This procedure is applicable to the solidification of oils classified as either Class A Unstable or Stable, Class B or Class C waste under the requirements of 10CFR61.55, Waste Classification. Class A Unstable waste meets the requirements under the NRC criteria of 10CFR61.55, Waste Classification. Class A Stable waste must meet the same stability requirements of Class B and Class C wastes under the criteria of 10CFR61.56, Waste Characteristics as required by the state of South Carolina.

2.0 PURPOSE

2.1 The purpose of the Process Control Program (PCP) for the incontainer solidification of oil is to provide a program which will assure a solidified product which meets the requirements of 10CFR61.56, Waste Characteristics.

The program consists of the following major steps:

(a) Procedures for collecting and analyzing samples;

(b) Procedures for solidifying samples;

(c) Criteria for process parameters for acceptance or rejection as solidified waste.

(d) Calculational methodology for determining quantities of solidification agents and additives for full scale operations.

2.2 This document shall be considered complete only when used in concert with the Westinghouse Hittman Nuclear Incorporated procedures for field solidification. This document describes the methodology for determining the acceptable ratios of waste, additional water, cement and additive that will result in an acceptable product for transportation and burial.

3.0 COLLECTION AND ANALYSIS OF SAMPLES

3.1 General Requirements

3.1.1 As required by the Radiological Effluent Technical Specifications for PWRs and BWRs, the PCP shall be used to verify the solidification of at least one representative test specimen from every tenth batch of each type of radioactive waste.

3.1.2 For the purposes of the PCP a batch is defined as the quantity of waste required to fill a disposable liner with the appropriate quantity of waste prior to solidification.

3.1.3 If any test specimen fails to solidify, the batch under test shall be suspended until such time as additional test specimens can be obtained, alternative solidification parameters can be determined in accordance with the Process Control Program, and a subsequent test verifies solidification. Solidification of the batch may then be resumed using the alternate solidification parameters determined.

3.1.4 If the initial test specimen from a batch of waste fails to verify solidification, then representative test specimens shall be collected from each consecutive batch of the same type of waste until three (3) consecutive initial test specimens demonstrate solidification. The Process Control Program shall be modified as required to assure solidification of subsequent batches of waste.

3.1.5 For high activity wastes, where handling of samples could result in personnel radiation exposures which are inconsistent with the ALARA principle, representative non-radioactive samples will be tested. These samples should be as close to the actual wastes' chemical properties as possible.

3.1.6 Since it is unlikely that more than one batch of oil will have the same properties, it is recommended that a test solidification be performed for each liner unless large quantities of relatively pure oil are to be solidified.

3.2 Collection of Samples

3.2.1 Radiological Protection

NOTE: These procedures should be followed during sampling to minimize personnel exposure and to prevent the spread of contamination.

3.2.1.1 Comply with applicable Radiation Work Permits.

3.2.1.2 Test samples which use actual waste may be disposed of by placing in the solidified liner.

3.2.1.3 A Test Solidification Data Sheet will be maintained for each test sample solidified. Each data sheet will contain pertinent information on the test sample and the batch numbers of waste solidified based on each test sample.

3.2.2 Test Solidification Data Sheet

The Test Solidification Data Sheet will contain pertinent information on the characteristics of the test sample solidified so as to verify solidification of subsequent batches of similar waste without retesting.

3.2.2.1 The test sample data for oil will include, but not necessarily be limited to, the type of waste solidified, pH, volume of sample, sample number, amount of oil in sample, the volume ratio of oil to water, and the quantity of any additive used to precondition the waste.

3.2.2.2 The Test Solidification Data Sheet will include the Solidification Number, Liner Number, Waste Volume, and Date Solidified, for each batch solidified.

3.2.3 Collection of Samples

3.2.3.1 Two samples shall be taken for analysis. If the radioactivity levels are too high to permit full size samples to be taken then smaller samples shall be taken with the results corrected accordingly. Sample sizes shall be determined by the plant Health Physics Staff.

3.2.3.2 If possible, samples should be drawn at least two days prior to the planned waste solidification procedure to allow adequate time to complete the required testing and verification of solidification, and to allow for retesting if necessary. Approximately 28 hours are required for verification.

3.2.3.3 If the contents of more than one tank are to be solidified in the same liner then representative samples of each tank should be drawn. The samples should be of such size that when mixed together they form samples of standard size as prescribed in Section 3.2.3.1. If the contents of a particular tank represent x% of the total waste quantity to be solidified then the sample of that tank should be of such size to represent x% of the composite samples.

3.3 Analysis of Samples

This document only defines the parameters to be analyzed and not the methodology. This is left to the plant staff.

Parameter	Acceptable
pH	>5
Detergents	No Appreciable Foaming
Oil (percent by volume)	40%

4.0 DETERMINATION OF THE QUANTITY OF WASTE IN THE LINER TO BE SOLIDIFIED

NOTE: For the solidification of oil, water must be added to the oil. The total waste volume listed in the Solidification Data Tables,

Form STD-P-05-002-04, includes the water necessary for solidification. The quantity of oil that may be transferred to the liner is 40% of the listed volumes.

4.1 DETERMINE the volume of total waste that is to be added to the liner.

4.2 RECORD the volume of total waste on the Test Solidification Data Sheet (Item 1 on Form STD-P-05-002-01).

4.3 CALCULATE and RECORD the quantity of oil that is to be transferred to the liner per the instructions on the Test Solidification Data Sheet (Item 2 on Form STD-P-05-002-01).

4.4 CALCULATE and RECORD the quantity of water to be added to the oil in the liner per instructions on the Test Solidification Data Sheet (Item 3 on Form STD-P-05-002-01).

4.5 CALCULATE and RECORD the quantity of Maysol 776 to be added to the liner per the instructions on the Test Solidification Data Sheet (Item 4 on Form STD-P-05-002-01).

4.6 Items 1, 2, 3, and 4 should also be entered as Items 1, 2, 3, and 4 on the Solidification Calculation Sheet (Form STD-P-05-002-02).

NOTE: ENSURE that Section 4.0, Determination of the Quantity of Waste in the Liner to be Solidified is completed according to Steps 4.1 through 4.6 and verify this on Form STD-P-05-002-03.

5.0 TEST SOLIDIFICATION AND ACCEPTANCE CRITERIA

5.1 General

NOTE: The sample for solidification may be fabricated using the same waste type that was added to the liner or the solidification sample may be taken directly from the liner after the water and emulsifier have been added and are thoroughly mixed to emulsify the waste.

5.1.1 If large foam causing quantities of detergents are present, the sample should be treated with an anti-foam agent. The quantity of anti-foam agent required shall not exceed one half of one percent by volume of the oil plus water.

5.1.2 If the pH of the sample is less than 5, it shall be adjusted to at least 5 by the addition of 50% sodium hydroxide.

NOTE: pH paper may be used to measure the pH level.

5.1.3 The test sample may be either fabricated or taken directly from the liner after emulsification is complete.

NOTE: If the test sample is to be taken directly from the liner after emulsification, OMIT sections 5.2 and 5.3.1. CONTINUE on to Section 5.3.2.

5.2 Fabrication of Test Sample

5.2.1 MEASURE into a one liter calibrated disposable beaker 140 ml of the oil to be solidified.

5.2.2 RECORD the volume of oil on the Test Solidification Data Sheet (Item 5 on Form STD-P-05-002-01).

5.2.3 ADD 210 ml of water to the oil to be solidified.

5.2.4 RECORD the quantity of water added on the Test Solidification Data Sheet (Item 6 on Form STD-P-05-002-01).

5.2.5 MEASURE the volume of oil plus water.

5.2.6 RECORD the volume on the Test Solidification Data Sheet (Item 7 on Form STD-P-05-002-01).

5.2.7 CALCULATE and RECORD the quantity of emulsifier to add to the Test Sample per instructions on the Test Solidification Data Sheet (Item 8 on Form STD-P-05-002-01).

5.2.8 MEASURE out the required quantity of emulsifier and ADD it to the Test Sample.

NOTE: Maysol 776 is used as the emulsification agent at a ratio of 20% by volume of the oil. The density of the emulsifier is 1 gm/ml, i.e., 1 gram = 1 ml. The quantity of emulsifer may be weighed directly into the test sample.

5.2.9 MIX the sample at least five (5) minutes so that a homogeneous mixture is obtained.

NOTE: Mixing should be accomplished by stirring with an electric mixer with blade. Any signs of pure oil may be an indication that the emulsion is breaking down. Should this occur do not proceed. Contact HITTMAN for further instructions.

5.2.10 If large foam causing quantities of detergents are present, TREAT the sample with an anti-foam agent. The quantity of anti-foam agent required shall be recorded on the Test Solidification Data Sheet.

5.2.11 If the pH of the sample is less than 5, ADD 50% sodium hydroxide solution until the pH is at least 5. The quantity of 50% sodium hydroxide used for this purpose shall be recorded on the Test Solidification Data Sheet.

5.2.12 RECORD the initial pH and the quantities of anti-foam agent and 50% sodium hydroxide used on the Test Solidification Data Sheet (Items 9, 10, and 11 on Form STD-P-05-002-01).

5.3 Test Solidification of Class A Unstable and Stable, Class B or C Waste

5.3.1 Test Solidification of Fabricated Sample

5.3.1.1 WEIGH out 447.3 gms of Portland Type I cement and 51.8 gms of anhydrous sodium metasilicate (ASMS) into separate vessels.

5.3.1.2 RECORD the quantities of cement and ASMS on the Test Solidification Data Sheet (Items 12 and 13 on Form STD-P-05-002-01).

5.3.1.3 Slowly ADD the cement to the Test Sample while it is being mixed.

NOTE: Mixing should be accomplished by stirring with an electric mixer with blade until a homogeneous mixture is obtained but in no case less than two (2) minutes.

5.3.1.4 After all the cement is added, slowly ADD the ASMS to the test sample while it is being mixed.

5.3.1.5 MIX for two (2) minutes after all the ASMS is added and a homogeneous mixture is obtained.

5.3.1.6 SEAL the sample and CURE at 120 ±5°F for 24 hours.

NOTE: If at any time during the 24 hour cure time, the sample meets the acceptance criteria, the liner solidification may proceed. However, no test solidification shall be disqualified without at least 24 hours of cure. It is not mandatory to cure Class A Unstable wastes at 120 ±5°F for 24 hours. Class A Unstable wastes may be cured at room temperature for 24 hours.

NOTE: Ensure that Section 5.3.1, Test Solidification of Fabricated Sample is completed according to Step 5.3.1.1 through 5.3.1.6 and verify this on Form STD-P-05-002-03.

5.3.2 Test Solidification of Pre-Emulsified Sample from Liner

5.3.2.1 For the solidification of pre-emulsified samples, MEASURE into the mixing vessel, 400 ml of emulsified waste taken from the liner.

5.3.2.2 RECORD the volume of waste on the Test Solidification Data Sheet (Item 14 on Form STD-P-05-002-01).

5.3.2.3 CALCULATE and RECORD the volume of oil plus water in the sample per the instructions on the Test Solidification Data Sheet (Item 15 on Form STD-P-05-002-01).

5.3.2.4 If large foam causing quantities of detergents are present, TREAT the sample with an anti-foam agent. The quantity of anti-foam agent required shall be recorded on the Test Solidification Data Sheet.

5.3.2.5 If the pH of the sample is less than 5, ADD 50% sodium hydroxide solution until the pH is at least 5. The quantity of 50% sodium hydroxide used for this purpose shall be recorded on the Test Solidification Data Sheet.

5.3.2.6 RECORD the initial pH and the quantities of anti-foam agent and 50% sodium hydroxide used on the Test Solidification Data Sheet (Items 16, 17 and 18 on Form STD-P-0 5-002-01).

5.3.2.7 WEIGH out 473.3 gms of Portland Type I cement and 54.8 gms of anhydrous sodium metasilicate (ASMS) into separate vessels.

5.3.2.8 RECORD the quantities of cement and ASMS on the Test Solidification Data Sheet (Items 19 and 20 on Form STD-P-05-002-01).

5.3.2.9 REPEAT Steps 5.3.1.3 through 5.3.1.6.

<u>NOTE</u>: ENSURE that Section 5.3.2, Test Solidification of Pre-Emulsified Samples is completed according to Steps 5.3.2.1 through 5.3.2.9 and VERIFY this on Form STD-P-05-002-03.

5.4 <u>Solidification Acceptability</u>

The following criteria define an acceptable solidification process and process parameters.

5.4.1 The sample solidifications are considered acceptable if there is no free standing water or oil, and

5.4.2 If upon visual inspection the waste appears that it would hold its shape if removed from the mixing vessel, and

5.4.3 It resists penetration.

<u>NOTE</u>: Even though the sample surface appears hard and dry, this may be just a thin surface crust. In

order to avoid this situation, the solidification shall be considered acceptable if a flat surfaced metal probe approximately 1/8 inch in diameter cannot break the surface and penetrate to the sample core. Nominal denting of the surface is acceptable.

5.4.4 VERIFY the acceptance criteria by signing and dating each item in Section IV of the Test Solidification Data Sheet.

NOTE: ENSURE that Section 5.4, Solidification Acceptability is completed according to Steps 5.4.1 through 5.4.4 and VERIFY this on Form STD-P-05-002-03.

5.5 Solidification Unacceptability

5.5.1 If the waste fails any of the criteria set forth in Section 5.4, the solidification will be termed unacceptable and a revised test procedure with revised solidification parameters will need to be established under the procedures in Section 5.6.

5.5.2 If the test solidification is unacceptable then the revised test procedures must be followed on each subsequent batch of the same type of waste until three (3) consecutive test samples are solidified.

5.6 Alternate Solidification Parameters

5.6.1 If a test sample fails to provide acceptable solidification of the waste, the following procedures should be followed.

5.6.1.1 Class A Unstable Wastes

(a) MIX 454.5 gms of cement and 45.5 gms of ASMS with 400 ml of water to ensure that the problem is not a bad batch of cement.

(b) If the waste is only partially solidified, use modified waste to cement and anhydrous sodium metasilicate ratios. Using the recommended quantities of cement and anhydrous sodium metasilicate, reduce the waste sample volume by 25 ml. Continue reducing the waste volume by this increment until the acceptability criteria of Section 5.4 are met.

(c) If an acceptable product is still not achieved, or if additional information is needed, CONTACT Hittman.

5.6.1.2 Class A Stable, Class B or C Wastes

(a) CONTACT Hittman.

6.0 PARAMETERS FOR FULL SCALE SOLIDIFICATION

6.1 After successful completion of the test solidifications, CALCULATE the amounts of additives and solidification agents necessary, per cubic foot of waste per instructions in Section V of the Test Solidification Data Sheet (Items 21 through 29, Form STD-P-05-002-01).

6.2 DETERMINE the amounts of additives and solidification agents to be added to the liner per instructions on the Solidification Calculation Sheet, (Items 5 through 13, Form STD-P-05-002-02).

NOTE: ENSURE that Section 6.0 is completed according to Steps 6.1 and 6.2 and verify this on Form STD-P-05-002-03.

CLASS A UNSTABLE AND STABLE, CLASS B OR C
TEST SOLIDIFICATION DATA SHEET FOR OILY WASTE

I. DETERMINATION OF QUANTITY OF WASTE TRANSFERRED TO THE LINER

Volume of Oil plus Water to Add to Liner[1], ft^3: ____________________ (1)

Volume of Oil to Add to Liner, ft^3:

Item (1) ______________ x 0.40 = ____________________ (2)

Volume of Water to Add to Liner, ft^3:

Item (1) ______________ - Item (2) __________ = __________ (3)

Volume of Maysol 776 to Add to Liner, gallons[2]:

Item (2) ______________ x 0.2 x 7.48 = ____________________ (4)

II. FABRICATED TEST SAMPLE PREPARATION

Volume of Oil to be Solidified, ml: ____________________ (5)

Volume of Water Added to the Oil, ml: ____________________ (6)

Volume of Oil plus Water, ml: ____________________ (7)

Quantity of Emulsifier to Add to Sample, ml or gms:

Item (5) ______________ x 0.20 = ____________________ (8)

Initial pH: ____________________ (9)

Quantity of Anti-Foam Agent Added to Sample, gms: ______________ (10)

Quantity of 50% NaOH Added to Sample, gms: ______________ (11)

Quantity of Portland Type I Cement Added to Sample, gms: ______________ (12)

Quantity of ASMS Added to Sample, gms: ______________ (13)

III. PRE-EMULSIFIED TEST SAMPLE PREPARATION

Volume of Emulsified Waste that is to be Solidified, ml: __________ (14)

Volume of Emulsified Waste that is Oil plus Water, ml:

______________ Item (14) x .926 = ____________________ (15)

Initial pH: ____________________ (16)

Quantity of Anti-Foam Agent Added to Sample, gms: ______________ (17)

Quantity of 50% NaOH Added to Sample, gms: ______________ (18)

Quantity of Portland Type I Cement Added to Sample, gms: __________ (19)

Quantity of ASMS Added to Sample, gms: ______________ (20)

IV. SAMPLE INSPECTION

Sample Cured for 24 Hours[3]: ☐ Yes ☐ No

____________________ ______________
Verified by Date

Sample contains "No Free Liquid": ☐ Yes ☐ No

____________________ ______________
Verified by Date

Sample is a "Free Standing Monolith": ☐ Yes ☐ No

____________________ ______________
Verified by Date

Sample resists Penetration: ☐ Yes ☐ No

____________________ ______________
Verified by Date

Additional batches solidified based on this sample solidification:

Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date

V. PARAMETERS FOR FULL-SCALE SOLIDIFICATION

A. From Fabricated Sample Data:

Quantity of Maysol 776:

________ (8) x 7.48 ÷ ________ (5) = ______ gallons of emulsifier per ft^3 oil (21)

Quantity of Anti-Foam Agent:

________ (10) x 7.48 ÷ ________ (7) = ______ gallons of anti-foam per ft^3 of oil plus water (22)

Quantity of 50% NaOH:

________ (11) x 4.86 ÷ ________ (7) = ______ gallons of 50% NaOH per ft^3 of oil plus water (23)

Quantity of Portland Type I Cement:

________ (12) x 62.43 ÷ ________ (7) = ______ pounds of cement per ft^3 of oil plus water (24)

Quantity of ASMS:

________ (13) x 62.43 ÷ ________ (7) = ______ pounds of ASMS per ft^3 of oil plus water (25)

B. From Pre-Emulsified Sample Data:

Quantity of Anti-Foam Agent:

________ (17) x 7.48 ÷ ________ (15) = ______ gallons of anti-foam per ft^3 of oil plus water (26)

Quantity of 50% NaOH:

________ (18) x 4.86 ÷ ________ (15) = ______ gallons of 50% NaOH per ft^3 of oil plus water (27)

Quantity of Portland Type I Cement:

________ (19) x 62.43 ÷ ________ (15) = ______ pounds of cement per ft^3 of oil plus water (28)

Quantity of ASMS:

________ (20) x 62.43 ÷ ________ (15) = ______ pounds of ASMS per ft^3 of oil plus water (29)

FOOTNOTES

[1] The volume of oil plus water cannot exceed the maximum volumes listed on the Solidification Data Tables for Class A Unstable and Stable, Class B or C Wastes, Form STD-P-05-002-04.

[2] Quantity of emulsifier is 20% by volume of the oil.

[3] If the sample is qualified in less than 24 hours, note the total hours cured.

CLASS A UNSTABLE AND STABLE, CLASS B OR C SOLIDIFICATION CALCULATION SHEET

Volume of Oil plus Water Added to Liner[1], ft^3: ____________________ (1)

Volume of Oil Added to Liner, ft^3: ____________________ (2)

Volume of Water Added to Liner, ft^3: ____________________ (3)

Volume of Maysol 776 Added to Liner, gallons: ____________________ (4)

Quantity of Maysol 776 to Add to Liner if Maysol 776 has not been Added:

A. From Fabricated Sample Data:

_____ (2) x ____________________ = ____________ gallons (5)
Item (21) Form STD-P-05-002-01

Quantity of Anti-Foam Agent to Add to Liner[2]:

A. From Fabricated Sample Data:

_____ (1) x ____________________ = ____________ gallons (6)
Item (22) Form STD-P-05-002-01

B. From Pre-Emulsified Sample Data:

_____ (1) x ____________________ = ____________ gallons (7)
Item (26) Form STD-P-05-002-01

Quantity of 50% NaOH to Add to Liner[2]:

A. From Fabricated Sample Data:

_____ (1) x ____________________ = ____________ gallons (8)
Item (23) Form STD-P-05-002-01

B. From Pre-Emulsified Sample Data:

_____ (1) x ____________________ = ____________ gallons (9)
Item (27) Form STD-P-05-002-01

Quantity of Portland Type I Cement to Add to Liner:

A. From Fabricated Sample Data:

_____ (1) x ____________________ = ____________ pounds (10)
Item (24) Form STD-P-05-002-01

B. From Pre-Emulsified Sample Data:

_____ (1) x ____________________ = ____________ pounds (11)
Item (28) Form STD-P-05-002-01

Quantity of ASMS to Add to Liner:

A. From Fabricated Sample Data:

_____ (1) x ____________________________ = ____________ pounds (12)
Item (25) Form STD-P-05-002-01

B. From Pre-Emulsified Data:

_____ (1) x ____________________________ = ____________ pounds (13)
Item (29) Form STD-P-05-002-01

FOOTNOTES

[1] The volume of oil plus water cannot exceed the maximum volumes listed on the Solidification Data Tables for Class A Unstable and Stable, Class B or C Waste, Form STD-P-05-002-04.

[2] Reduce the quantity of total waste (oil + water) in the liner by 1 ft^3 for every 10 gallons of anti-foam plus 50% NaOH added to the liner. No adjustment is necessary for the first 10 gallons.

Date: ____________________

Liner No.: ________________

PROCEDURE VERIFICATION SHEET

Verified By:

Section 4.0, Determination of Quantity of Waste in the Liner to be Solidified, Steps 4.1 through 4.6 completed. ____________

Section 5.3.1, For Fabricated Sample or Section 5.3.2 for Non-Fabricated Samples, Test Solidification Steps 5.3.1.1 through 5.3.1.6 or Steps 5.3.2.1 through 5.3.2.9 completed. ____________

Section 5.4., Solidification Acceptability, Steps 5.4.1 through 5.4.4 completed. ____________

Section 6.0, Parameters for Full-Scale Solidification, Steps 6.1 and 6.2 completed. ____________

SOLIDIFICATION DATA TABLES FOR CLASS A UNSTABLE AND STABLE, CLASS B OR C OILY WASTE

	HN-100 M Series 1[1]	Series 2[1]	Series 3	S	HN-100 LVM Series 3[2]
Usable Liner Vol., cu.ft.	141.1	141.1	141.1	141.1	157.5
Max. Waste Vol., (oil plus water), cu.ft.	85.3	82.0	93.7	93.7	104.6
Max. Solidification Vol., cu.ft.	128.5	123.5	141.1	141.1	157.5
Max. Rad Level R/hr Contact	12	12	12	3	12

For unshielded shipments, USE the Series 3 Cask data for the HN-100 or HN-100 LVM liners.

FOOTNOTES:

[1] For less than A_2 quantities of LSA waste, use data for Series 3 Cask.

[2] For less than A_2 quantities of LSA waste. If the waste contains greater than A_2 quantities, the waste volume must be reduced to 103.4 cu.ft. due to weight limitations.

Mailing Address
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600 North 18th Street
Post Office Box 2641
Birmingham, Alabama 35291
Telephone 205 783-6090

R. P. McDonald
Senior Vice President
Flintridge Building

NT-86-0403

D. Collins
P. Stoddard
Docket
[illegible] 9/8

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AlabamaPower
the southern electric system

August 26, 1986

Docket Nos. 50-348
50-364

Dr. J. Nelson Grace
Regional Administrator
U. S. Nuclear Regulatory Commission
Suite 2900
101 Marietta Street, N. W.
Atlanta, Georgia 30323

RE: Joseph M. Farley Nuclear Plant
Radioactive Effluent Release Report

Dear Dr. Grace:

The Joseph M. Farley Nuclear Plant Semi-Annual Radioactive Effluent Release Report for the period of January 1, 1986 through July 31, 1986 is herewith submitted in accordance with the Unit 1 and Unit 2 Technical Specifications, Section 6.9.1.8. Included with this submittal as required by Technical Specification 6.13.2 is documentation of changes made to the Farley Nuclear Plant Process Control Program.

If you have any questions, please advise.

Yours very truly,

W. S. [signature] for
R. P. McDonald

RPM/MAT:emb

Enclosures (2)

xc: Director
Office of Nuclear Reactor Regulation
Director
Office of Inspection and Enforcement
Mr. L. B. Long
Mr. G. F. Trowbridge
Mr. W. H. Bradford
Mr. E. A. Reeves

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