EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT
July 1 through December 31, 1984

Supplemental Information

Facility TMI-1 License DPR-50

1. Regulatory Limits

   a. Fission and activation gases:
   b. Iodines:
   c. Particulates, half-lives > 8days:
   d. Liquid effluents:

   — TMI-1 - Unit 1 Technical Specifications Appendix A

2. Maximum Permissible Concentrations

   Provide the MPCs used in determining allowable release rates or concentrations.

   a. Fission and activation gases:
   b. Iodines:
   c. Particulates, half-lives > 8 days:
   d. Liquid effluents:

   — 10 CFR 20, Appendix B Table II.

3. Average Energy

   Provide the average energy ($\bar{E}$) of the radionuclide mixture in releases of fission and activation gases, if applicable.

   $E\gamma$=4.17E-1 $E\beta$=1.3E-1 $E\gamma+\beta$=5.47E-1

4. Measurements and Approximations of Total Radioactivity

   Provide the methods used to measure or approximate the total radioactivity in effluents and the methods used to determine radionuclide composition.

   a. Fission and activation gases: Gamma Spectroscopy, Liquid Scintillation.
   b. Iodines: Gamma Spectroscopy.
   c. Particulates: Gamma Spectroscopy, Beta Spectroscopy, Gas Flow Proportional.
   d. Liquid effluents: Gamma Spectroscopy, Liquid Scintillation.

5. Batch Releases

   Provide the following information relating to batch releases of radioactive materials in liquid and gaseous effluents.

	3rd Quarter	4th Quarter
a. Liquid		
1. Number of batch releases:	29	30
2. Total time period for batch releases: (min.)	37465	69478
3. Maximum time period for a batch release: (min.)	13260	12810
4. Average time period for batch releases: (min.)	1292	2316
5. Minimum time period for a batch release: (min.)	145	4
6. Average stream flow during periods of release of effluent into a flowing stream: (CFM)	1.23E6	1.31E6
b. Gaseous		
1. Number of batch releases:	34	31
2. Total time period for batch releases: (min.)	36887	52581
3. Maximum time period for a batch release: (min.)	16123	27000
4. Average time period for batch releases: (min.)	1085	1696
5. Minimum time period for a batch release: (min.)	525	545

6. Abnormal Releases

a. Liquid		
1. Number of releases	-0-	-0-
2. Total activity releases:	N/A	N/A
b. Gaseous		
1. Number of releases:	-0-	-0-
2. Total activity released:	N/A	N/A

TABLE 1A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1984)
GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES

	Unit	Quarter 3rd	Quarter 4th	Est.Total Error,%
A. Fission & activation gases				
1. Total release	Ci	<1.00E-4	<1.00E-4	N.A.
2. Average release rate for period	µCi/sec	N.A.	N.A.	
3. Percent of technical specification limit	%	-0-	-0-	
B. Iodines				
1. Total iodine - 131	Ci	<1.00E-8	<1.00E-8	N.A.
2. Average release rate for period	µCi/sec	N.A.	N.A.	
3. Percent of technical specification limit	%	-0-	-0-	
C. Particulates				
1. Particulates with half-lives > 8 days	Ci	<1.00E-4	1.27E-9	2.5E1
2. Average release rate for period	µCi/sec	N.A.	1.60E-10	
3. Percent of technical specification limit	%	*	*	
4. Gross alpha radioactivity	Ci	<1.00E-11	7.93E-10	
D. Tritium				
1. Total release	Ci	1.93E-5	1.79E-5	2.5E1
2. Average release rate for period	µCi/sec	2.43E-6	2.25E-6	
3. Percent of technical specification limit	%	*	*	

Note: All less than (<) values are in µCi/cc.

*% Tech Spec limits: Listed on Dose Summary Table

TABLE 1C

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1984)
GASEOUS EFFLUENTS - GROUND-LEVEL RELEASES

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter 3rd	Quarter 4th	Quarter 3rd	Quarter 4th
1. Fission gases					
krypton-85	Ci	<8.00E-6	<8.00E-6	<8.00E-6	<8.00E-6
krypton-85m	Ci	<5.00E-8	<5.00E-8	<5.00E-8	<5.00E-8
krypton-87	Ci	<8.00E-8	<8.00E-8	<8.00E-8	<8.00E-8
krypton-88	Ci	<1.00E-7	<1.00E-7	<1.00E-7	<1.00E-7
xenon-133	Ci	<8.00E-8	<8.00E-8	<8.00E-8	<8.00E-8
xenon-135	Ci	<5.00E-8	<5.00E-8	<5.00E-8	<5.00E-8
xenon-135m	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
xenon-138	Ci	<3.00E-7	<3.00E-7	<3.00E-7	<3.00E-7
Others (specify)	Ci				
	Ci				
	Ci				
unidentified	Ci				
Total for period	Ci	-0-	-0-	-0-	-0-
2. Iodines					
iodine-131	Ci	<1.00E-12	<1.00E-12	<1.00E-8	<1.00E-8
iodine-133	Ci	<1.00E-10	<1.00E-10	<1.00E-8	<1.00E-8
iodine-135	Ci	<1.00E-10	<1.00E-10	<1.00E-8	<1.00E-8
Total for period	Ci	-0-	-0-	-0-	-0-
3. Particulates					
strontium-89	Ci	<1.00E-11	<1.00E-11	--	--
strontium-90	Ci	<1.00E-11	1.27E-9	--	--
cesium-134	Ci	<1.00E-11	<1.00E-11	<1.00E-8	<1.00E-8
cesium-137	Ci	<1.00E-11	<1.00E-11	<1.00E-8	<1.00E-8
barium-lanthanum-140	Ci	<1.00E-11	<1.00E-11	<1.00E-8	<1.00E-8

Note: All less than values (<) are in μCi/cc.

TABLE 2A

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1984)
LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter 3rd	Quarter 4th	Est. Total Error, %
A. Fission and activation products				
1. Total release (not including tritium, gases, alpha)	Ci	1.28E-3	7.07E-3	2.5E1
2. Average diluted concentration during period	µCi/ml	1.33E-10	8.13E-10	
3. Percent of applicable limit	%	*	*	
B. Tritium				
1. Total release	Ci	2.16E-1	3.26E-1	2.5E1
2. Average diluted concentration during period	µCi/ml	2.25E-8	3.75E-8	
3. Percent of applicable limit	%	*	*	
C. Dissolved and entrained gases				
1. Total release	Ci	<1.00E-4	<1.00E-4	2.5E1
2. Average diluted concentration during period	µCi/ml	N.A.	N.A.	
3. Percent of applicable limit	%	-0-	-0-	
D. Gross alpha radioactivity				
1. Total Release	Ci	-0-	-0-	2.5E1
Volume of waste released (prior to dilution)	liters	5.52E6	6.78E6	1.0E1
Volume of dilution water used during period.	liters	9.60E9	8.70E9	1.0E1

Note: All less than values (<) are in µCi/ml.

*% Tech. Spec. Limits: Listed on Dose Summary Table.

TABLE 2B
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1984)
LIQUID EFFLUENTS

		Continuous Mode		Batch Mode	
Nuclides Released	Unit	Quarter 3rd	Quarter 4th	Quarter 3rd	Quarter 4th
strontium-89	Ci	<5.00E-8	<5.00E-8	<5.00E-8	<5.00E-8
strontium-90	Ci	<5.00E-8	<5.00E-8	7.12E-6	1.34E-3
cesium-134	Ci	<5.00E-7	<5.00E-7	4.87E-5	3.07E-4
cesium-137	Ci	<5.00E-7	<5.00E-7	1.14E-3	3.42E-3
iodine-131	Ci	<1.00E-6	<1.00E-6	<1.00E-6	<1.00E-6
cobalt-58	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
cobalt-60	Ci	<5.00E-7	<5.00E-7	9.19E-5	3.64E-4
iron-59	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
zinc-65	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
manganese-54	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
chromium-51	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
zirconium-niobium-95	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
molybdenum-99	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
technetium-99m	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
barium-lanthanum-140	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
cerium-141	Ci	<5.00E-7	<5.00E-7	<5.00E-7	<5.00E-7
Other (specify)	Ci				
Iron-55	Ci	<1.00E-6	<1.00E-6	<1.00E-6	1.60E-3
Antimony-125	Ci	<5.00E-7	<5.00E-7	<5.00E-7	4.05E-5
Phosphorus-32	Ci	<1.00E-6	<1.00E-6	<1.00E-6	<1.00E-6
Total for period (above)	Ci	-0-	-0-	1.28E-3	7.07E-3
xenon-133	Ci	<1.00E-4	<1.00E-4	<1.00E-4	<1.00E-4
xenon-135	Ci	<1.00E-4	<1.00E-4	<1.00E-4	<1.00E-4

TABLE 3A
EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT (1984)
SOLID WASTE AND IRRADIATED FUEL SHIPMENTS

A. Solid waste shipped off-site for burial or disposal (not irradiated fuel)

1. Type of waste *	UNIT I	6 MONTH PERIOD	EST. TOTAL ERROR, %
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3 Ci	144.42 354.34	5.00
b. Dry compressible waste, contaiminated equipment, etc.	m^3 Ci	66.24 4.182	5.00
c. Irradiated components, control rods, etc.	m^3 Ci	N.A.	N.A.
d. Other (describe)	m^3 Ci	N.A.	N.A.

2. Estimate of major nuclide composition (by type of waste)		
a. Cs-137	54.42%	
Ni-63	21.03%	
Cs-134	14.37%	
H-3	5.34%	
b. Cs-137	33.92%	
H-3	55.28%	
Co-60	2.38%	
Ni-63	4.42%	
Cs-134	3.04%	
c.		
d.		

3. Solid Waste Disposition Number of Shipments	Mode of Transportation	Destination
a. 10 Shipments	Tractor/Flatbed	Hanford, WA
a. 3 Shipments	Tractor/Flatbed	Barnwell, SC
a. 5 Shipments	Tractor/14/190M-Cask	Barnwell, SC
b. 3 Shipments	Tractor/Flatbed	Hanford, WA
b. 3 Shipments	Tractor/Closed Van	Hanford, WA
b. 1 Shipment	Tractor/CNSI 21/300 Cask	Barnwell, SC

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
N/A		
N/A		

* 1a. Evap. bottoms solidified in steel liners using cement resins dewatered in High Integrity Containers
1b. Shipped in LSA (Type A) steel drums, and LSA steel boxes.
1c. N.A.
1d. N.A.

PLANT NAME: THREE MILE ISLAND UNIT -1
YEAR: 1984

MAXIMUM OFF-SITE DOSES AND DOSE COMMITMENTS TO MEMBERS OF THE PUBLIC **

SOURCE	1ST QUARTER	2ND QUARTER	3RD QUARTER	4TH QUARTER	YEAR
LIQUID EFFLUENTS	1.22E-1 mrem Adult Whole Body	1.58E-1mrem Adult Whole Body	1.91E-2 mrem Adult Whole Body	7.54E-2 mrem Adult Whole Body	SEE ANNUAL REMP REPORT
AIRBORNE EFFLUENTS					
Iodines/Particulates	-0-	3.50E-9 mrem Total Body/Child	3.81E-9 mrem Total Body/Child	2.43E-7 mrem Child Bone	SEE ANNUAL REMP REPORT
Noble Gases	4.88E-5 mrem air dose (BETA) 2.58E-5 mrem skin	2.02E-6 mrem air dose (BETA) 1.24E-6 mrem skin	-0- mrad	-0- mrad	

**See TMI-1 Semi-Annual Reports for 1984

Based on meteorology data provided in the TMI Unit I 1984 Semi-Annual Reports, as required by Reg. Guide 1.21.

TABLE I

ATTACHMENT - Joint Frequency Tables for 3rd Quarter (1984)

ATTACHMENT - Joint Frequency Tables for 4th Quarter (1984)

ATTACHMENT - Summary of Maximum Individual Dose Accumulation for Third Quarter of 1984

ATTACHMENT - Summary of Maximum Individual Dose Accumulation for Fourth Quarter of 1984

UNIT 1
Quarter Dose Report

SUMMARY OF MAXIMUM INDIVIDUAL DOSES FOR UNIT 1 FROM
July 1, 1984 through September 30, 1984

Effluent	Applicable Organ	Estimated Dose (mrem)	Age Group	Location Dist (m)	Location Dir (toward)	% of Applicable Limit Quarterly	% of Applicable Limit Annual	10CFR50 App. I Limits (mrem) Quarterly	10CFR50 App. I Limits (mrem) Annual
Liquid	Total Body	1.91E-2	Adult	Receptor 1		1.3	6.4E-1	1.5	3.0
Liquid	Liver	2.99E-2	Teen	Receptor 1		6.0E-1	3.0E-1	5.0	10.0
Noble Gas	Air Dose (gamma-mrad)	0	-	-		-	-	5.0	10.0
Noble Gas	Air Dose (beta-mrad)	0	-	-		-	-	10.0	20.0
Noble Gas	Total Body	0	-	-		--	-	--	5.0
Noble Gas	Skin	0	-	-		--	-	--	15.0
Iodine & Particulates	Total Body	3.81E-9	Child	3000	NNE	5.1E-9	2.5E-8	7.5	15.0

SUMMARY OF MAXIMUM POPULATION DOSES FOR UNIT 1 FROM
July 1, 1984 through September 30, 1984

Effluent	Applicable Organ	Estimated Population Dose (person-rem)
Liquid	Total Body	5.5E-3
Liquid	Bone	8.8E-3
Gaseous	Total Body	1.6E-7
Gaseous	GI-Tract, Liver, Kidney, Lung, Thyroid	1.6E-7

UNIT 1
Quarter Dose Report

SUMMARY OF MAXIMUM INDIVIDUAL DOSES FOR UNIT 1 FROM
October 1, 1984 through December 31, 1984

Effluent	Applicable Organ	Estimated Dose (mrem)	Age Group	Location Dist (m)	Location Dir (toward)	% of Applicable Limit Quarterly	% of Applicable Limit Annual	10CFR50 App. I Limits (mrem) Quarterly	10CFR50 App. I Limits (mrem) Annual
Liquid	Total Body	7.54E-2	Adult	Receptor 1		5.0	2.5	1.5	3.0
Liquid	Bone	1.20E-1	Child	Receptor 1		2.4	1.2	5.0	10.0
Noble Gas	Air Dose (gamma-mrad)	0	-	-		-	-	5.0	10.0
Noble Gas	Air Dose (beta-mrad)	0	-	-		-	-	10.0	20.0
Noble Gas	Total Body	0	-	-		--	-	--	5.0
Noble Gas	Skin	0	-	-		--	-	--	15.0
Iodine & Particulates	Bone	2.43E-7	Child	2500	WNW	3.2E-6	1.6E-6	7.5	15.0

SUMMARY OF MAXIMUM POPULATION DOSES FOR UNIT 1 FROM
October 1, 1984 through December 31, 1984

Effluent	Applicable Organ	Estimated Population Dose (person-rem)
Liquid	Total Body	1.6E-1
Liquid	Bone	6.0E-1
Gaseous	Total Body	1.1E-6
Gaseous	Bone	3.5E-6

SITE THREE MILE ISLD. 02/08/85 08:48

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84070101-84093024
STABILITY CLASS: A DT/DZ
ELEVATION SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	8	8	6	1	0	0	17
NNE	1	7	1	0	0	0	9
NE	0	0	2	0	0	0	2
ENE	1	3	1	0	0	0	5
E	2	3	5	0	0	0	10
ESE	4	6	5	0	0	0	15
SE	1	8	3	0	0	0	12
SSE	6	13	2	0	6	0	21
S	4	23	3	0	0	0	30
SSW	0	33	10	0	0	0	61
SW	4	10	3	0	0	0	25
WSW	12	8	4	0	0	0	24
W	0	10	1	0	0	0	10
WNW	15	31	16	0	0	0	62
NW	15	55	33	4	1	0	108
NNW	17	30	27	4	0	0	78
TOTAL	102	256	130	9	1	0	498

PERIODS OF CALM(HOURS) 0
VARIABLE DIRECTION 33
HOURS OF MISSING DATA 20

SITE THREE MILE ISLD. 02/08/85 10:00

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84070101-84093024
STABILITY CLASS: B DT/DZ
ELEVATION SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	0	1	0	0	0	3
NNE	2	2	0	0	0	0	4
NE	0	1	2	0	0	0	3
ENE	1	3	0	0	0	0	4
E	3	4	0	0	0	0	7
ESE	2	4	1	0	0	0	7
SE	2	10	2	0	0	0	14
SSE	1	3	2	0	0	0	6
S	4	6	1	0	0	0	11
SSW	2	8	6	0	0	0	16
SW	2	4	2	0	0	0	8
WSW	5	2	2	0	0	0	9
W	1	3	1	0	0	0	5
WNW	1	5	1	0	0	0	7
NW	2	4	3	0	0	0	9
NNW	1	2	2	1	0	0	6
TOTAL	31	61	26	1	0	0	119

PERIODS OF CALM(HOURS) 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA 20

SITE THREE MILE ISLD. 02/08/85 10:02

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84070101-84093024
STABILITY CLASS: C DT/DZ
ELEVATION SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	1	0	0	0	0	1
NE	1	0	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	1	3	0	0	0	0	4
ESE	3	0	0	0	0	0	3
SE	2	2	0	0	0	0	4
SSE	3	5	1	0	0	0	9
S	1	0	0	0	0	0	1
SSW	0	1	4	2	0	0	7
SW	1	1	0	0	0	0	2
WSW	0	2	0	0	0	0	2
W	2	0	0	0	0	0	2
WNW	0	0	2	0	0	0	2
NW	0	0	2	1	0	0	3
NNW	3	1	1	0	0	0	5
TOTAL	18	24	10	3	0	0	55

PERIODS OF CALM(HOURS) 0
VARIABLE DIRECTION 0
HOURS OF MISSING DATA 20

SITE THREE MILE ISLD. 02/08/85 10:05

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84070101-84093024
STABILITY CLASS: D DT/DZ
ELEVATION SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5	11	3	0	0	0	19
NNE	5	4	0	0	0	0	9
NE	1	4	0	0	0	0	5
ENE	10	8	2	0	0	0	20
E	15	25	0	0	0	0	40
ESE	12	22	0	0	0	0	34
SE	7	25	0	0	0	0	32
SSE	10	22	2	0	0	0	34
S	0	17	11	0	0	0	37
SSW	5	22	12	1	0	0	40
SW	7	14	7	0	0	0	28
WSW	0	6	2	0	0	0	16
W	6	7	4	0	0	0	17
WNW	3	12	2	3	0	0	20
NW	6	27	13	4	0	0	50
NNW	3	10	3	3	0	0	19
TOTAL	112	236	61	11	0	0	420

PERIODS OF CALM(HOURS) 0
VARIABLE DIRECTION 33
HOURS OF MISSING DATA 20

SITE: THREE MILE ISLD. 02/08/85 10.05

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04070101-04083024
STABILITY CLASS: E DT/DZ
ELEVATION: SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	9	33	8	0	0	0	50
NNE	8	22	8	0	0	0	38
NE	6	19	0	0	0	0	25
ENE	8	4	1	0	0	0	13
E	32	8	0	0	0	0	40
ESE	20	11	0	0	0	0	31
SE	14	11	0	0	0	0	25
SSE	26	17	0	0	0	0	43
S	21	17	0	0	0	0	38
SSW	20	34	3	0	0	0	57
SW	20	21	3	0	0	0	44
WSW	26	19	1	1	0	0	47
W	34	23	1	0	0	0	58
WNW	14	23	11	1	0	0	49
NW	14	35	17	1	0	0	67
NNW	11	22	11	0	0	0	44
TOTAL	283	319	62	3	0	0	617

PERIODS OF CALM(HOURS): 9
VARIABLE DIRECTION: 63
HOURS OF MISSING DATA: 28

SITE: THREE MILE ISLD. 02/08/85 10.10

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04070101-04083024
STABILITY CLASS: F DT/DZ
ELEVATION: SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	13	4	1	0	0	0	18
NNE	8	2	0	0	0	0	10
NE	6	3	0	0	0	0	9
ENE	10	1	0	0	0	0	11
E	14	5	0	0	0	0	19
ESE	35	5	0	0	0	0	40
SE	25	9	0	0	0	0	34
SSE	22	2	0	0	0	0	24
S	27	2	0	0	0	0	29
SSW	24	5	0	0	0	0	29
SW	12	5	0	0	0	0	17
WSW	13	1	0	0	0	0	14
W	26	8	1	0	0	0	35
WNW	13	4	1	0	0	0	18
NW	6	8	5	0	0	0	19
NNW	7	14	2	0	0	0	23
TOTAL	261	78	10	0	0	0	349

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION: 61
HOURS OF MISSING DATA: 28

SITE: THREE MILE ISLD 02/08/85 10.12

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04070101-04083024
STABILITY CLASS: G DT/DZ
ELEVATION: SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	0	0	0	0	0	1
NNE	1	0	0	0	0	0	1
NE	2	0	0	0	0	0	2
ENE	0	1	0	0	0	0	1
E	3	1	0	0	0	0	4
ESE	0	0	0	0	0	0	0
SE	5	0	0	0	0	0	5
SSE	7	0	0	0	0	0	7
S	3	0	0	0	0	0	3
SSW	7	0	0	0	0	0	7
SW	4	0	0	0	0	0	4
WSW	0	0	0	0	0	0	0
W	7	3	0	0	0	0	10
WNW	5	0	0	0	0	0	5
NW	3	1	0	0	0	0	4
NNW	0	1	0	0	0	0	1
TOTAL	65	7	0	0	0	0	72

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION: 6
HOURS OF MISSING DATA: 28

SITE: THREE MILE ISLD. 02/08/85 10.13

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04070101-04083024
STABILITY CLASS: ALL DT/DZ
ELEVATION: SPEED.SP108A DIRECTION.DI108A LAPSE.DT150A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	33	56	18	1	0	0	108
NNE	25	38	7	0	0	0	70
NE	16	27	4	0	0	0	47
ENE	31	20	4	0	0	0	55
E	78	40	5	0	0	0	124
ESE	84	56	6	0	0	0	146
SE	56	65	5	0	0	0	126
SSE	75	62	7	0	0	0	144
S	69	65	15	0	0	0	149
SSW	67	103	44	3	0	0	217
SW	58	63	15	0	0	0	128
WSW	73	38	9	1	0	0	121
W	84	54	8	0	0	0	146
WNW	51	75	33	4	0	0	163
NW	46	130	73	10	1	0	260
NNW	42	88	46	0	0	0	176
TOTAL	872	981	299	27	1	0	2180

PERIODS OF CALM(HOURS): 0
VARIABLE DIRECTION: 213
HOURS OF MISSING DATA: 28

Third Quarter Joint Frequency Tables
(Specific Release Periods)

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/12/85 14.34

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 0407[illegible]-04[illegible]
STABILITY CLASS. A DT/DZ
ELEVATION. SPEED.SP10DA DIRECTION.DI10DA LAPSE.DT10DA

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2	1	0	0	0	3
NNE	1	1	0	0	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	1	1	0	0	0	2
ESE	1	5	1	0	0	0	7
SE	0	2	0	0	0	0	2
SSE	2	4	0	0	0	0	6
S	0	6	1	0	0	0	7
SSW	2	6	1	0	0	0	7
SW	0	2	0	0	0	0	2
WSW	1	1	1	0	0	0	3
W	2	1	0	0	0	0	5
WNW	2	3	6	0	0	0	11
NW	1	5	9	0	0	0	15
NNW	2	1	4	0	0	0	7
TOTAL	18	48	25	2	0	0	75

PERIODS OF CALM(HOURS) 3
VARIABLE DIRECTION 6
HOURS OF MISSING DATA 0

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/12/85 14.35

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 0407[illegible]-04[illegible]
STABILITY CLASS. B DT/DZ
ELEVATION. SPEED.SP10DA DIRECTION.DI10DA LAPSE.DT10DA

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	1	0	0	0	0	1
E	1	2	0	0	0	0	3
ESE	2	1	0	0	0	0	3
SE	1	2	0	0	0	0	3
SSE	0	2	0	0	0	0	2
S	2	1	0	0	0	0	3
SSW	0	1	0	0	0	0	1
SW	0	1	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	2	0	0	0	0	0	0
NW	1	0	1	0	0	0	2
NNW	0	0	0	0	0	0	0
TOTAL	8	11	1	0	0	0	20

PERIODS OF CALM(HOURS) 3
VARIABLE DIRECTION 3
HOURS OF MISSING DATA 0

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/12/85 14.36

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 0407[illegible]-04[illegible]
STABILITY CLASS. C DT/DZ
ELEVATION. SPEED.SP10DA DIRECTION.DI10DA LAPSE.DT10DA

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	1	0	0	0	0	1
NE	1	0	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	0	2	0	0	0	0	2
ESE	0	1	0	0	0	0	1
SE	1	0	0	0	0	0	1
SSE	0	2	0	0	0	0	2
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	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	0	0	0	0	0
NNW	0	0	0	0	0	0	0
TOTAL	3	7	0	0	0	0	10

PERIODS OF CALM(HOURS) 3
VARIABLE DIRECTION 1
HOURS OF MISSING DATA 0

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/12/85 14.38

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD = 0407[illegible]-04[illegible]
STABILITY CLASS. D DT/DZ
ELEVATION. SPEED.SP10DA DIRECTION.DI10DA LAPSE.DT10DA

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	2	2	0	0	0	4
NNE	2	0	0	0	0	0	2
NE	1	2	0	0	0	0	3
ENE	3	1	2	0	0	0	6
E	4	3	0	0	0	0	7
ESE	3	9	0	0	0	0	12
SE	1	13	0	0	0	0	14
SSE	3	5	2	0	0	0	10
S	0	1	0	0	0	0	1
SSW	0	2	0	0	0	0	2
SW	1	4	0	0	0	0	5
WSW	4	2	1	0	0	0	7
W	3	0	2	0	0	0	5
WNW	0	3	2	2	0	0	7
NW	0	3	2	4	0	0	9
NNW	0	2	1	0	0	0	3
TOTAL	25	52	14	6	0	0	97

PERIODS OF CALM(HOURS) 3
VARIABLE DIRECTION 0
HOURS OF MISSING DATA 0

Third Quarter Joint Frequency Tables
(Specific Release Periods)

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/12/85 14.38

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 0407[illegible]-0408[illegible]
STABILITY CLASS: E BT/BZ
ELEVATION: SPEED:SP108A DIRECTION:DI108A LAPSE:BT108A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	6	0	0	0	0	8
NNE	3	3	0	0	0	0	6
NE	1	3	0	0	0	0	4
ENE	1	2	0	0	0	0	3
E	4	2	0	0	0	0	6
ESE	3	4	0	0	0	0	7
SE	4	2	0	0	0	0	6
SSE	3	2	0	0	0	0	5
S	5	0	0	0	0	0	5
SSW	4	3	0	0	0	0	7
SW	4	0	0	0	0	0	4
WSW	2	1	0	1	0	0	4
W	8	8	0	0	0	0	16
WNW	3	6	5	0	0	0	14
NW	2	0	3	0	0	0	14
NNW	3	2	2	0	0	0	7
TOTAL	52	53	10	1	0	0	116

PERIODS OF CALM(HOURS): 3
VARIABLE DIRECTION: 13
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/12/85 14.37

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 0407[illegible]-0408[illegible]
STABILITY CLASS: F BT/BZ
ELEVATION: SPEED:SP108A DIRECTION:DI108A LAPSE:BT108A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	0	0	0	0	0	1
NNE	1	0	0	0	0	0	1
NE	1	1	0	0	0	0	2
ENE	4	1	0	0	0	0	5
E	2	1	0	0	0	0	3
ESE	6	0	0	0	0	0	6
SE	4	0	0	0	0	0	4
SSE	5	0	0	0	0	0	5
S	4	1	0	0	0	0	5
SSW	6	0	0	0	0	0	6
SW	0	0	0	0	0	0	0
WSW	5	0	0	0	0	0	5
W	4	3	0	0	0	0	7
WNW	1	1	0	0	0	0	2
NW	2	0	1	0	0	0	3
NNW	4	1	0	0	0	0	5
TOTAL	50	9	1	0	0	0	60

PERIODS OF CALM(HOURS): 3
VARIABLE DIRECTION: 17
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/12/85 14.37

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 0407[illegible]-0408[illegible]
STABILITY CLASS: G BT/BZ
ELEVATION: SPEED:SP108A DIRECTION:DI108A LAPSE:BT108A

WIND SPEED(MPH)

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	1	0	0	0	0	1
E	1	0	0	0	0	0	1
ESE	1	0	0	0	0	0	1
SE	2	0	0	0	0	0	2
SSE	1	0	0	0	0	0	1
S	1	0	0	0	0	0	1
SSW	3	0	0	0	0	0	3
SW	1	0	0	0	0	0	1
WSW	5	0	0	0	0	0	5
W	1	2	0	0	0	0	3
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
TOTAL	16	3	0	0	0	0	19

PERIODS OF CALM(HOURS): 3
VARIABLE DIRECTION: 3
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/12/85 14.38

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 0407[illegible]-0408[illegible]
STABILITY CLASS: ALL BT/BZ
ELEVATION: SPEED:SP108A DIRECTION:DI108A LAPSE:BT108A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	10	3	0	0	0	17
NNE	7	5	0	0	0	0	12
NE	4	6	0	0	0	0	10
ENE	9	6	2	0	0	0	17
E	12	11	1	0	0	0	24
ESE	16	20	1	0	0	0	37
SE	13	19	0	0	0	0	32
SSE	12	15	2	0	0	0	29
S	12	9	1	0	0	0	22
SSW	13	12	1	0	0	0	26
SW	6	7	0	0	0	0	13
WSW	17	5	2	1	0	0	25
W	18	14	2	0	0	0	34
WNW	6	13	13	2	0	0	34
NW	6	17	16	4	0	0	43
NNW	9	6	7	0	0	0	22
TOTAL	164	175	51	7	0	0	397

PERIODS OF CALM(HOURS): 3
VARIABLE DIRECTION: 52
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD 02/08/85 10:41

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04125124
STABILITY CLASS, A DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	2	1	0	0	0	4
NNE	2	1	0	0	0	0	3
NE	0	3	0	0	0	0	3
ENE	1	1	1	0	0	0	3
E	0	2	0	0	0	0	2
ESE	6	5	1	0	0	0	12
SE	3	6	1	0	0	0	10
SSE	1	2	0	0	0	0	3
S	4	5	3	0	0	0	12
SSW	3	7	5	3	0	0	18
SW	3	3	1	4	0	0	11
WSW	4	3	2	0	0	0	9
W	4	5	2	2	1	0	13
WNW	5	7	0	5	1	0	18
NW	11	14	0	11	2	0	46
NNW	4	10	10	13	0	0	37
TOTAL	52	76	34	38	4	0	284

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 11
HOURS OF MISSING DATA 53

SITE: THREE MILE ISLD 02/08/85 10:42

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04125124
STABILITY CLASS, B DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	1	1	0	0	0	3
NNE	0	0	0	0	0	0	0
NE	1	3	0	0	0	0	4
ENE	0	1	0	0	0	0	1
E	0	3	0	0	0	0	3
ESE	0	2	2	0	0	0	4
SE	0	4	0	0	0	0	4
SSE	3	2	0	0	0	0	5
S	2	3	2	0	0	0	7
SSW	3	1	0	0	0	0	4
SW	1	1	1	0	0	0	3
WSW	1	0	0	1	0	0	2
W	2	4	5	5	0	0	16
WNW	3	1	3	6	1	0	14
NW	0	0	3	9	4	0	16
NNW	4	5	1	3	0	0	13
TOTAL	21	31	18	24	5	0	99

PERIODS OF CALM(HOURS) 28
VARIABLE DIRECTION 7
HOURS OF MISSING DATA 53

SITE: THREE MILE ISLD 02/08/85 10:44

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04125124
STABILITY CLASS, C DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND SPEED(MPH)

WIND DIRECTION	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	1	0	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	0	1	0	0	0	0	1
ESE	4	1	1	0	0	0	5
SE	3	1	0	0	0	0	4
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	2	1	1	0	0	4
SW	1	2	0	0	0	0	3
WSW	2	0	0	0	0	0	2
W	1	1	3	4	0	0	9
WNW	0	2	2	4	0	0	8
NW	2	1	1	6	0	0	10
NNW	1	3	3	1	0	0	8
TOTAL	16	15	11	16	0	0	58

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 4
HOURS OF MISSING DATA 53

SITE: THREE MILE ISLD 02/08/85 10:46

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04125124
STABILITY CLASS, D DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND SPEED(MPH)

WIND DIRECTION	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	21	8	6	0	0	0	35
NNE	14	6	3	0	0	0	23
NE	12	3	0	0	0	0	15
ENE	11	0	0	0	0	0	20
E	18	21	3	0	0	0	42
ESE	16	40	7	0	0	0	63
SE	8	20	10	4	0	0	51
SSE	10	21	3	0	0	0	34
S	9	14	3	0	0	0	26
SSW	15	15	7	0	0	0	37
SW	5	0	5	1	0	0	10
WSW	6	0	0	1	0	0	24
W	16	21	20	16	2	0	75
WNW	9	23	43	48	0	0	123
NW	7	10	27	20	5	0	86
NNW	11	17	13	4	0	0	45
TOTAL	188	260	150	94	15	0	716

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 68
HOURS OF MISSING DATA 53

SITE. THREE MILE ISLD. 02/08/85 10.47

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04123124
STABILITY CLASS, E DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	22	25	8	0	0	0	55
NNE	21	10	0	0	0	0	31
NE	17	10	2	0	0	0	29
ENE	22	4	1	0	0	0	27
E	33	9	0	0	0	0	42
ESE	25	24	1	0	0	0	50
SE	10	27	2	0	0	0	47
SSE	10	11	0	0	0	0	20
S	17	12	0	0	0	0	22
SSW	27	13	5	0	0	0	45
SW	15	10	4	0	0	0	37
WSW	10	14	5	1	0	0	30
W	15	22	16	2	0	0	55
WNW	13	10	10	2	0	0	35
NW	12	10	11	5	0	0	30
NNW	24	30	13	5	0	0	60
TOTAL	302	257	70	15	0	0	652

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 99
HOURS OF MISSING DATA 53

SITE. THREE MILE ISLD. 02/08/85 10.49

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04123124
STABILITY CLASS, F DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	7	5	1	0	2	0	13
NNE	5	0	0	0	0	0	5
NE	5	1	0	0	0	0	6
ENE	9	2	0	0	0	0	11
E	17	0	0	0	0	0	25
ESE	20	4	0	0	0	0	32
SE	10	5	0	0	0	0	15
SSE	16	2	0	0	0	0	10
S	25	1	0	0	0	0	26
SSW	20	4	0	0	0	0	32
SW	12	5	3	0	0	0	20
WSW	9	3	2	0	0	0	14
W	12	4	1	0	0	0	17
WNW	7	4	0	0	0	0	11
NW	14	3	2	0	0	0	19
NNW	10	23	2	0	0	0	35
TOTAL	214	74	11	0	0	0	299

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 42
HOURS OF MISSING DATA 53

SITE. THREE MILE ISLD. 02/08/85 10.00

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04123124
STABILITY CLASS, C DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	6	1	1	0	0	0	8
NNE	0	0	0	0	0	0	0
NE	4	1	0	0	0	0	5
ENE	2	0	0	0	0	0	2
E	6	2	0	0	0	0	8
ESE	13	0	0	0	0	0	13
SE	9	0	0	0	0	0	9
SSE	10	1	0	0	0	0	11
S	12	2	0	0	0	0	14
SSW	13	4	0	0	0	0	17
SW	5	0	0	0	0	0	5
WSW	8	1	0	0	0	0	9
W	2	2	2	0	0	0	6
WNW	2	3	2	0	0	0	7
NW	5	2	0	1	0	0	8
NNW	2	3	0	0	0	0	5
TOTAL	99	22	5	1	0	0	127

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 11
HOURS OF MISSING DATA 53

SITE. THREE MILE ISLD. 02/08/85 10.52

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100101-04123124
STABILITY CLASS, ALL DT/DZ
ELEVATION, SPEED,SP100A DIRECTION,DI100A LAPSE,DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	58	41	10	0	0	0	117
NNE	42	17	3	0	0	0	62
NE	40	21	2	0	0	0	63
ENE	46	17	2	0	0	0	65
E	74	46	3	0	0	0	123
ESE	92	76	12	0	0	0	180
SE	51	72	13	4	0	0	140
SSE	50	39	3	0	0	0	100
S	62	37	0	0	0	0	107
SSW	00	46	10	4	0	0	157
SW	42	37	14	5	0	0	00
WSW	40	20	10	3	0	0	00
W	52	50	40	20	3	0	191
WNW	30	50	60	57	10	0	216
NW	51	40	52	60	11	0	223
NNW	56	00	42	26	0	0	223
TOTAL	002	735	316	100	24	0	2155

PERIODS OF CALM(HOURS) 20
VARIABLE DIRECTION 242
HOURS OF MISSING DATA 53

FOURTH QUARTER 1984 JOINT FREQUENCY TABLES
(Specific Release Periods)

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/21/85 10.13

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100125-04122407
STABILITY CLASS: A DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:DI100A LAPSE:DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	1	1	0	0	0	3
NNE	2	0	0	0	0	0	2
NE	0	3	0	0	0	0	3
ENE	1	1	1	0	0	0	3
E	0	2	0	0	0	0	2
ESE	2	4	1	0	0	0	7
SE	2	4	1	0	0	0	7
SSE	0	2	0	0	0	0	2
S	2	0	3	0	0	0	5
SSW	0	2	2	1	0	0	5
SW	1	3	1	0	0	0	5
WSW	2	1	0	0	0	0	3
W	2	3	0	0	0	0	5
WNW	4	4	0	0	0	0	8
NW	3	8	0	2	0	0	13
NNW	2	7	0	4	0	0	13
TOTAL	24	45	10	7	0	0	86

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION: 14
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/21/85 10.14

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100125-04122407
STABILITY CLASS: B DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:DI100A LAPSE:DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	1	0	0	0	0	2
NNE	0	0	0	0	0	0	0
NE	0	3	0	0	0	0	3
ENE	0	1	0	0	0	0	1
E	0	1	0	0	0	0	1
ESE	0	1	2	0	0	0	3
SE	0	2	0	0	0	0	2
SSE	1	2	0	0	0	0	3
S	1	2	1	0	0	0	4
SSW	1	1	0	0	0	0	2
SW	0	0	1	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	1	1	0	0	2
WNW	1	0	0	2	0	0	3
NW	0	0	2	1	0	0	3
NNW	0	3	0	1	0	0	4
TOTAL	5	17	7	5	0	0	34

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION: 2
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/21/85 10.14

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100125-04122407
STABILITY CLASS: C DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:DI100A LAPSE:DT100A

WIND DIRECTION	WIND SPEED(MPH) 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	1	1	1	0	0	0	3
SE	1	1	0	0	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	1	1	0	0	0	2
SW	0	1	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	1	0	0	0	0	0	1
WNW	0	1	0	1	0	0	2
NW	2	0	1	2	0	0	5
NNW	0	1	1	0	0	0	2
TOTAL	5	7	4	3	0	0	19

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION: 0
HOURS OF MISSING DATA: 0

SITE: THREE MILE ISLD. UNIT: UNIT 1 02/21/85 10.15

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 04100125-04122407
STABILITY CLASS: D DT/DZ
ELEVATION: SPEED:SP100A DIRECTION:DI100A LAPSE:DT100A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	0	2	0	0	0	4
NNE	0	4	3	0	0	0	13
NE	4	1	3	0	0	0	5
ENE	10	0	3	0	0	0	10
E	5	0	2	0	0	0	15
ESE	7	10	2	0	0	0	20
SE	3	16	1	0	0	0	20
SSE	5	10	1	0	0	0	16
S	5	10	0	0	0	0	15
SSW	8	7	4	0	0	0	17
SW	4	5	0	0	0	0	9
WSW	2	4	2	0	0	0	8
W	11	8	0	2	0	0	21
WNW	4	11	3	2	1	0	21
NW	3	14	7	2	2	0	28
NNW	3	6	5	2	0	0	16
TOTAL	83	123	29	8	3	0	246

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION: 58
HOURS OF MISSING DATA: 0

FOURTH QUARTER 1984 JOINT FREQUENCY TABLES
(Specific Release Periods)

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/21/85 16.16

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84100125-84122407
STABILITY CLASS. E DT/DZ
ELEVATION. SPEED.SPI88A DIRECTION.DI188A LAPSE.DT188A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	4	6	0	0	0	10
NNE	7	5	0	0	0	0	12
NE	6	4	0	0	0	3	18
ENE	11	1	0	0	0	0	12
E	12	2	0	0	0	0	14
ESE	14	10	0	0	0	0	24
SE	8	19	0	0	0	0	27
SSE	0	0	0	0	0	0	16
S	2	0	0	0	0	0	10
SSW	12	4	2	0	0	0	10
SW	7	5	0	0	0	0	12
WSW	3	1	0	0	0	0	4
W	0	0	4	0	0	0	21
WNW	5	2	0	0	0	0	10
NW	6	4	0	0	0	0	10
NNW	4	17	4	1	0	0	26
TOTAL	123	102	19	1	0	0	245

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION 00
HOURS OF MISSING DATA 0

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/21/85 16.18

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84100125-84122407
STABILITY CLASS. F DT/DZ
ELEVATION. SPEED.SPI88A DIRECTION.DI188A LAPSE.DT188A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3	1	0	0	0	0	4
NNE	2	0	0	0	0	0	2
NE	2	0	0	0	0	0	2
ENE	2	1	0	0	0	0	3
E	5	4	0	0	0	0	9
ESE	15	2	0	0	0	0	17
SE	6	2	0	0	0	0	8
SSE	6	0	0	0	0	0	6
S	7	0	0	0	0	0	7
SSW	11	2	0	0	0	0	13
SW	2	3	0	0	0	0	5
WSW	2	1	0	0	0	0	3
W	3	3	1	0	0	0	7
WNW	2	2	0	0	0	0	4
NW	4	1	0	0	0	0	5
NNW	3	13	1	0	0	0	17
TOTAL	75	35	2	0	0	0	112

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION 26
HOURS OF MISSING DATA 0

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/21/85 16.12

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84100125-84122407
STABILITY CLASS. G DT/DZ
ELEVATION. SPEED.SPI88A DIRECTION.DI188A LAPSE.DT188A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	0	0	0	0	0	4
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	2	1	0	0	0	0	3
ESE	4	0	0	0	0	0	4
SE	4	0	0	0	0	0	4
SSE	5	0	0	0	0	0	5
S	1	0	0	0	0	0	1
SSW	4	1	0	0	0	0	5
SW	2	0	0	0	0	0	2
WSW	2	0	0	0	0	0	2
W	2	0	0	0	0	0	2
WNW	1	0	0	0	0	0	1
NW	2	0	0	0	0	0	2
NNW	2	1	0	0	0	0	3
TOTAL	37	3	0	0	0	0	40

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION 6
HOURS OF MISSING DATA 0

SITE. THREE MILE ISLD. UNIT. UNIT 1 02/21/85 16.13

HOURS AT EACH WIND SPEED AND DIRECTION
PERIOD OF RECORD = 84100125-84122407
STABILITY CLASS. ALL DT/DZ
ELEVATION. SPEED.SPI88A DIRECTION.DI188A LAPSE.DT188A

WIND DIRECTION	WIND SPEED(MPH) 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	28	8	0	0	0	0	37
NNE	20	9	0	0	0	0	29
NE	13	11	0	0	0	0	24
ENE	25	4	1	0	0	0	30
E	24	18	2	0	0	0	44
ESE	43	37	5	0	0	0	85
SE	24	44	2	0	0	0	70
SSE	25	22	1	0	0	0	48
S	18	20	4	0	0	0	42
SSW	34	18	9	1	0	0	62
SW	16	17	2	0	0	0	35
WSW	11	7	2	0	0	0	20
W	20	22	6	3	0	0	50
WNW	17	20	6	5	1	0	49
NW	28	27	10	7	2	0	66
NNW	14	48	11	8	0	0	81
TOTAL	352	332	71	24	3	0	782

PERIODS OF CALM(HOURS): 6
VARIABLE DIRECTION 92
HOURS OF MISSING DATA 0

Revision 4 to the TMI-1 Off-Site Dose Calculation Manual (ODCM).

The TMI-1 ODCM, 9100-PLN-4200.01, Revision 4 was issued August 31, 1984, which was during the period of this Report (July 1 through December 31, 1984). The changes made in this Revision were administrative and will provide more explicit directions for implementation of the procedure. The REMP fish and aquatic sampling stations were changed from specific station locations to non-specific zones. The green leafy vegetables and fruits categories in Table A-1 were consolidated into one category "Food Products." This category consists of all NRC-required food stuff samples. The Table designators for the REMP sampling locations by media were amended to reflect the Table designators listed in the TMI-1 and TMI-2 Environmental Tech. Specs.

The following is a list of the page by page revisions. A copy of these pages are included for your reference.

Attachment ii - Table of Contents

1) Expanded Table A-1 to Tables 1 through 11
2) Renumbered Table A-2 as Table 12
3) Renumbered Map A-1, A-2 and A-3 to be Map 1, Map 2 and Map 3 respectively.

Page 3

1) Corrected Operations Procedure number from 1101.21 to 1101-2.1.

Page 4

1) Corrected to read ". . . past plant conditions. < LLD values. . ." instead of ". . . past plant conditions < LLD values. . ."

Page 9

1) Section 4.2.3, second sentence was changed to read "Default parameter values. . ." instead of "Default parameters values. . ."

Page 12

1) Radionuclide I-133 P_i dose parameter was qualified with **, showing these values may be further reduced by a factor as large as 2 for the growing season and a second factor of 2 to allow for iodine effluent (see Note).

Page 47

1) Changed Section 8 Tables A-1 and A-3 to Tables 1 through 12, and Map A-1, A-2 and A-3 to Map 1, 2, and 3 respectively.

Page 48

1) Changed Table A-1 to Table 1.

2) Eliminated the "Station Code" column so that only the NUREG Station-Codes are listed.

Page 49

1) Changed Table A-1 (continued) to Table 2.
2) Eliminated the "Station Code" column so that only the NUREG Station-Codes are listed.

Page 50

1) Changed Table A-1 (continued) to Table 2.
2) Eliminated the "Station Code" column so that only the NUREG Station-Codes are listed.

Page 51

1) Changed Table A-1 (continued) to Table 3 and Table 4.
2) Eliminated the "Station Code" column so that only the NUREG Station-Codes are listed.

Page 52

1) Changed Table A-1 (continued) to Table 5 and Table 6.
2) Eliminated the "Station Code" column so that only the NUREG Station-Codes are listed.

Page 53

1) Changed Table A-2 to Table 7 and Table 8.
2) Changed Table data and format to correlate to the new Tables.

Page 54

1) Changed Table A-2 to Table 9, Table 10 and Table 11.
2) Changed Table data and format to correlate to the new Tables.

Page 55

1) Changed Table A-2 to Table 12.
2) Eliminated the "NUREG Station Code" column.
3) Eliminated the (mi) note from "Distance" column and (^{o}) note from "Azimuth" column.

Pages 56 through 58

1) Added the pages to continue Table 12.

Page 59

1) Changed Map A-1 to Map 1.

Page 60

1) Changed Map A-2 to Map 2

Page 61

1) Changed Map A-3 to Map 3.

0181A

List of Tables

The setpoint concentration is converted to setpoint scale units using appropriate calibration factors.

This section of the ODCM is implemented by Operations Procedure 1101-2.1 Radiation Monitor System Setpoints and Radiological Controls Procedure 1622- "Releasing Radioactive Gaseous Waste".

2.2 Other Isotopes

Setpoints for monitors which detect isotopes other than noble gases are also established to assure that concentrations of these isotopes in gaseous effluents do not exceed the limits in 10 CFR 20.

Setpoints are established so as to satisfy the following equations:

$$c \leq \frac{1500}{(F) \times (P_i) \times (D_v)} \quad \text{(eq. 2.2)}$$

where:

c = setpoint concentration, in uCi/cc

F = effluent flow rate at the monitor, in cc/sec.

P_i = pathway dose parameter, in mrem/yr per uCi/m^3 for the inhalation pathway and $\frac{m^2\text{-mrem}}{yr}$ per uCi/sec for the food and ground pathway from Table 2-2.

1500 = annual dose limit to any organ from particulates and iodines and radionuclides (other than noble gases) with half lives greater than eight days.

D_v = the annual average atmospheric dispersion factor for the worst-case sector; maximum X/Q, in sec/m^3, for the inhalation pathway at the unrestricted area, and maximum D/Q, in m^{-2}, for the food and ground pathway at the nearest existing food and ground pathway locations. Dispersion factors may be read or interpolated from Table B-1 (Appendix B) for releases from the station vent and Table B-2 (Appendix B) for all other releases.

The setpoint concentration is further reduced such that concentration contributions from multiple release points would not combine to exceed 10 CFR 20 limits.

The setpoint concentration is converted to setpoint scale units using appropriate calibration factors.

This section of the ODCM is implemented by Operations Procedure 1101-2.1 Radiation Monitor Systems Setpoints and Radiological Controls Procedure - 1622- "Releasing Radioactive Gaseous Waste".

3.0 DOSE ASSESSMENT (LIQUID EFFLUENTS)

3.1 Liquid Effluents - 10 CFR 20 Limits

For purposes of demonstrating compliance with 10 CFR 20 the following equation must be satisfied:

$$\sum_i (C_i \div MPC_i) \leq 1 \quad \text{(eq 3.1)}$$

where:

C_i = the concentration of isotope, i, in the liquid effluent after dilution, in uCi/ml.

MPC_i = the maximum permissible concentration of isotope i in liquid effluent in an unrestricted area per 10 CFR 20, Appendix B, Table II, Col 2 (See Appendix A to this manual)

3.2 Liquid Effluents - 10 CFR 50 Appendix I

The dose from liquid effluents results from the consumption of fish and drinking water. Other pathways contribute negligibly at Three Mile Island. The dose contribution from all radionuclides in liquid effluents released to the unrestricted area is calculated using the following expression:

$$\text{Dose } j = \sum_i \sum_\ell (\Delta t_\ell) \times (C_{i\ell}) \times \left[(AW_{ij} \times \frac{FW_\ell}{FR_\ell}) + (AF_{ij} \times \frac{FW_\ell}{FP_\ell} \times 0.2)\right] \quad \text{(eq. 3.2)}$$

where:

Dose j = the cumulative dose commitment to the total body or any organ, j, from the liquid effluents for the total time period, in mrem.

Δt_ℓ = the length of the ℓth time period over which $C_{i\ell}$ and F_ℓ are averaged for all liquid releases, in hours.

C_i = the average concentration of radionuclide, i, in undiluted liquid effluent during time period Δt_ℓ from any liquid release, in uCi/ml.

NOTE: For Sr-89, Sr-90, conservative concentration values will be used in the dose calculation based on similar past plant conditions. <LLD values are not used in dose calculations.

FW_ℓ = undiluted liquid waste flow, in gpm.

R_i = the dose factor for each identified radionuclide, i, in, mrem/yr per uCi/m^3 for the inhalation pathway and m^2· mrem/yr per uCi/sec for other pathways, from Table 4-2.2a.

D_V = the annual average atmospheric dispersion parameter, for the worst-case sector, for estimating the dose to an individual at the critical location; X/Q, in sec/m^3, for the inhalation pathway, and D/Q, in m^{-2}, for other pathways. In the case of H-3 only X/Q's are used for all pathways. Dispersion factors may be read or interpolated from Table B-1 (Appendix B) for station vent releases and Table B-2 (Appendix B) for all other releases.

$\tilde{Q}_i$ = release of radioiodines, and radioactive materials in particulate form in gaseous effluents, i, with half-lives greater than 8 days, in uCi, cumulative over the specified time period.

3.17E-8 = inverse of the number of seconds in a year.

4.2.3 Alternative Calculational Methodologies

As an alternative to the methods described above, the models in/or based upon, those presented in Regulatory Guide 1.109 (Rev. 1) may be used to make a comprehensive dose assessment. Default parameter values from Reg. Guide 1.109 (Rev. 1) and/or actual site specific data can be used where applicable. Dispersion parameter values for such analyses may be drawn from Table B-1 and B-2 or may be computed from site meteorological data for the specified time period using acceptable models such as those presented in Regulatory Guide 1.111.

Table 2-2

DOSE PARAMETERS FOR RADIOIODINES AND RADIOACTIVE PARTICULATE, GASEOUS, EFFLUENTS*

Radionuclide	P_i Inhalation Pathway (mRem/yr per *Ci/m^3)	P_i Food & Ground Pathways (m^2·mRem/yr per *Ci/sec)	Radionuclide	P_i Inhalation Pathway (mRem/yr per *Ci/m^3)	P_i Food & Ground Pathways (m^2·mRem/yr per *Ci/sec)
H-3	6.5E+02	2.4E+03	Cd-115m	7.0E+04	4.8E+07
Cr-51	3.6E+02	1.1E+07	Sn-126	1.2E+06	1.1E+09
Mn-54	2.5E+04	1.1E+09	Sb-125	1.5E+04	1.1E+09
Fe-59	2.4E+04	7.0E+08	Te-127m	3.8E+04	7.4E+10
Co-58	1.1E+04	5.7E+08	Te-129m	3.2E+04	1.3E+09
Co 60	3.2E+04	4.6E+09	Te-132	1.0E+03	7.2E+07
ZN 65	6.3E+04	1.7E+10	Cs-134	7.0E+05	5.3E+10
Rb 86	1.9E+05	1.6E+10	Cs-136	1.3E+05	5.4E+09
Sr 89	4.0E+05	1.0E+10	Cs-137	6.1E+05	4.7E+10
Sr 90	4.1E+07	9.5E+10	Ba-140	5.6E+04	2.4E+08
Y-91	7.0E+04	1.9E+09	Ce-141	2.2E+04	8.7E+07
Zr 95	2.2E+04	3.5E+08	Ce-144	1.5E+05	6.5E+08
Nb 95	1.3E+04	3.6E+08	Np-239	2.5E+04	2.5E+06
MO 99	2.6E+02	3.3E+08	I-131	1.5E+07	1.1E+12**
Ru 103	1.6E+04	3.4E+10	I-133	3.6E+06	9.6E+09**
Ru 106	1.6E+05	4.4E+11	Unident.	4.1E+07	9.5E+10
Ag 110m	3.3E+04	1.5E+10			

*The listed dose parameters are for radionuclides that may be detected in gaseous effluents. Additional dose parameters or isotopes not included in Table 2-2 may be calculated using the methodology described in NUREG-0133.

**These values may be further reduced by a factor as large as 2.0 to allow for the half-year growing season and a second factor as large as 2.0, to allow for 50% of the iodine effluent in organic form. These reductions conform to Reg. Guide 1.109 (Rev. 1).

5.0 LIQUID WASTE TREATMENT SYSTEM

5.1 Operability

The Liquid Waste Treatment System as described in Section 11 of the Final Safety Analysis Report is considered to be operable when one of each of the following pieces of equipment is available to perform its intended function:

a) Miscellaneous Waste Evaporator (WDL-Z1B) or Reactor Coolant Evaporator (WDL-Z1A)

b) Waste Evaporator Condensate Demineralizer (WDL-K3 A or B)

c) Waste Evaporator Condensate Storage Tank (WDL-T 11 A or B)

d) Evaporator Condensate Pumps (WDL-P 14 A or B)

5.2 Representative Sampling Prior to Discharge

All liquid releases from the Liquid Waste Treatment System are made through the Waste Evaporator Condensate Storage Tanks. To provide thorough mixing and a representative sample, the contents of the tank are recirculated using one of the Waste Evaporator Condensate Transfer Pumps.

6.0 GASEOUS WASTE TREATMENT SYSTEM

6.1 Operability

Operability of the Gaseous Waste Treatment System is defined as the ability to remove gas from the vent header/tank gas spaces and store it under a higher pressure in the Waste Gas Decay Tanks for subsequent release.

7.0 SOLID WASTE MANAGEMENT SYSTEM - PROCESS CONTROL PROGRAM

(The Process Control Program is available as a separate document, see LIL 133, dated June 24, 1981.)

8.0 ENVIRONMENTAL MONITORING INFORMATION

The Radiological Environmental Monitoring Program shall be conducted as outlined in Section 3.23, Table 3.23.1 of Amendment 72 to the TMINS Unit 1 Technical Specifications. Sampling locations will be as indicated in Tables 1 through 12 and Map 1, 2, and 3.

Table 1

TMINS REMP STATION LOCATIONS-AIR PARTICULATE AND AIR IODINE

NUREG Station Code	Distance	Azimuth
A1-1	0.4 mi.	0°
E1-2	0.4	90
M2-1	1.3	253
A3-1	2.6	358
H3-1	2.3	159
G10-1	9.8	127
J15-1	12.6	180
Q15-1	13.5	305

Table 2

TMINS REMP STATION LOCATIONS-DIRECT RADIATION (TLD)

NUREG Station Code	Distance	Azimuth
A1-1	0.4 mi.	0°
B1-1	0.7	25
D1-1	0.3	71
E1-1	0.2	95
H1-1	0.4	167
J1-1	0.8	184
K1-2	0.4	195
L1-1	0.1	221
N1-1	0.4	270
P1-1	0.4	293
Q1-1	0.5	317
R1-1	0.2	340
C1-1	0.6	35
D1-2	0.5	65
E1-2	0.4	90
F1-1	0.5	117
G1-2	0.6	143
L1-2	0.5	221
R1-2	0.7	332

Table 2

TMINS REMP STATION LOCATIONS-DIRECT RADIATION (TLD) (CONT'D)

NUREG Station Code	Distance	Azimuth
K2-1	1.1 mi.	200°
L2-1	1.9	227
M2-1	1.3	253
N2-1	1.2	262
P2-1	1.6	297
Q2-1	1.8	310
A3-1	2.6	358
H3-1	2.3	159
A5-1	4.3	3
B5-1	4.8	18
C5-1	4.5	42
D6-1	5.2	65
E5-1	4.6	81
F5-1	4.7	107
G5-1	4.8	131
H5-1	4.1	157
J5-1	4.9	182
K5-1	5.0	200
L5-1	4.1	228
M5-1	4.3	249
N5-1	4.9	268
P5-1	4.9	281
Q5-1	5.0	318
R5-1	4.9	339
B10-1	9.4	21
C8-1	7.2	48
D9-1	8.5	72
E7-1	6.8	86
F10-1	9.4	112
G10-1	9.8	127
H8-1	7.4	163
J7-1	6.5	177
K8-1	7.4	196
L8-1	8.0	225

Table 2

TMINS REMP STATION LOCATIONS-DIRECT RADIATION (TLD) (CONT'D)

NUREG Station Code	Distance	Azimuth
M9-1	8.6 mi.	242°
N8-1	7.8	260
P8-1	8.0	292
Q9-1	8.5	308
R9-1	8.1	340
C20-1	19.6	47
D15-1	10.9	63
F25-1	21.1	113
G15-1	14.4	124
H15-1	13.2	157
J15-1	12.6	180
K15-1	12.7	204
L15-1	11.7	225
M15-1	11.9	237
N15-2	10.4	274
N15-1	13.2	276
P15-1	12.2	300
Q15-1	13.5	305
Q15-2	11.5	310
R15-1	11.2	330
A1-4	0.4	2
B1-2	0.4	26
B1-3	0.5	15
C1-2	0.3	45
E1-4	0.2	90
G1-3	0.3	124
H1-9	0.3	148
J1-3	0.3	185
K1-5	0.2	202
K1-4	0.2	208
N1-3	0.1	270
Q1-2	0.2	325
F1-2	0.2	102

Table 3

TMINS REMP STATION LOCATIONS-SURFACE WATER (CONT'D)

NUREG Station Code	Distance	Azimuth
N1-2A (R)	0.1	270°
J1-2 (R)	0.5	188
J2-1 (R)	1.5	182
A3-2 (R)	2.5	355
H3-2 (R)	2.3	165
H5-2 (R,F)	4.1	160
C9-1 (R,F)	8.5	308
G15-1 (F)	14.4	124
G15-2 (F)	13.6	128
G15-3 (F)	14.8	124
J15-2 (F)	14.7	178
F15-1 (R)	12.6	122

(R) = Raw Water
(F) = Finished Water

Table 4

TMINS REMP STATION LOCATIONS-AQUATIC SEDIMENT

NUREG Station Code	Distance	Azimuth
A1-3	0.7 mi.	0°
G1-1	0.3	137
K1-3	0.8	202
J2-1	1.5	182
K2-2	1.1	197
L1-3	0.5	225

Table 5

TMINS REMP STATION LOCATIONS-MILK

NUREG Station Code	Distance	Azimuth
A2-1 (MG)	1.2 mi.	5°
D15-2 (MG)	10.0	68
D2-1 (M)	1.1	65
G2-1 (M)	1.6	130
P7-1 (M)	6.7	293
A15-1 (M)	10.5	10
P4-1 (M)	3.6	295
E2-2 (M)	1.1	93

MG = Goat Milk
M = Cow Milk

Table 6

TMINS REMP STATION LOCATIONS-FISH AND AQUATIC PLANTS

Station Code	Station Designation
TM-AQF-IND	Downstream of Station Discharge
TM-AQF-BKG	Upstream of Station Discharge
TM-AQP-IND	Downstream of Station Discharge
TM-AQP-BKG	Upstream of Station Discharge

AQF = Fish
AQP = Aquatic Plants

Table 7

TMINS REMP STATION LOCATIONS-FOOD PRODUCTS

	NUREG Station Code	Distance	Azimuth
	D2-1 (FPL)	1.1 mi.	65°
	G2-1 (FPL)	1.6	130
	A9-2 (FPL)	9.3	357
	P3-1 (FPL)	2.6	293
	A15-1 (FPL)	10.5	10
	E1-3 (FPL)	0.7	90
	E2-1 (FPL)	1.1	80
	H1-2 (FPL)	0.9	150
TM-FPF-5F2	E6-1	5.9	100
12G2	M15-2	13.6	253
8A1	H1-2	0.9	150
	D1-3	0.5	65

FPL = Broad Leaf Vegetation or Vegetables
FPF = Fruits

Table 8

TMINS REMP STATION LOCATIONS-SOIL

Station Code	NUREG Station Code	Distance	Azimuth
TM-S-1C1	A3-3	2.5 mi.	354°
1F1	A9-1	9.2	0
1F2	A9-2	9.3	357
4B1	D2-1	1.1	65
5A1	E1-2	0.4	90
5B1	E2-1	1.1	80
7B2	G2-2	1.3	133
7B3	G2-3	1.6	132
7C1	G3-1	2.8	131
7F1	G10-1	9.8	127
15G1	O15-1	13.5	305

Table 9

TMINS REMP STATION LOCATIONS-EFFLUENT WATER

NUREG Station Code	Distance	Azimuth
K1-1	0.2 mi.	200°

Table 10

TMINS REMP STATION LOCATIONS-PRECIPITATION

NUREG Station Code	Distance	Azimuth
E1-2	0.4 mi.	90°
H3-1	2.3	159
G10-1	9.8	127
Q15-1	13.5	305
A3-1	2.6	358

Table 11

TMINS REMP STATION LOCATIONS-CRYOGENIC AIR SAMPLE

NUREG Station Code	Distance	Azimuth
A3-1	2.6 mi.	358°
E1-2	0.4	90
H3-1	2.3	159
M2-1	1.3	253

Table 12

Revision 4

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE LOCATION

Sample Medium	Station Code	Map Number	Distance	Azimuth	Description
AP,AI,ID	AI-1	1	0.4 mi	0°	N of site, North Weather Station TMI
ID	AI-4	-	0.4	2	N of Reactor Building on W. Fence adjacent to N Weather Station TMI
ID	BI-1	2	0.7	25	NNE of site on light pole in middle of North Bridge TMI
ID	BI-2	-	0.4	26	NNE of Reactor Building at Top of Dike TMI
ID	BI-3	-	0.5	15	NNE of Reactor Building on W fence adjacent to S end of N Bridge TMI
ID	CI-2	-	0.3	45	NE of Reactor Building at Top of Dike TMI
ID	DI-1	3	0.3	71	ENE of site on top of dike, east fence TMI
ID	EI-1	4	0.2	95	E of site on top of dike, east fence TMI
ID	EI-4	-	0.2	90	E of Reactor Building at Top of Dike TMI
ID	FI-2	-	0.2	102	ESE of Reactor Building at top of Dike midway within Interim Solid Waste Staging Facility TMI
ID	GI-3	-	0.3	124	SE of Reactor Building at Top of Dike TMI
ID	HI-1	5	0.4	167	SSE TMI
ID	HI-9	-	0.3	148	SSE of Reactor Building at Top of Dike TMI
ID	JI-1	6	0.8	184	S TMI
ID	JI-3	-	0.3	185	S of Reactor Building on wooden post by old S. Gate Guard Building TMI
EW	KI-1	7	0.2	200	On site, RML-7 station discharge
ID	KI-2	8	0.4	195	SSW TMI
ID	KI-5	-	0.2	202	SSW of Reactor Building on fence behind Warehouse #3 TMI
ID	KI-[illegible]	-	0.2	208	SSW of Reactor Building on fence behind Warehouse #2 TMI
ID	[illegible]	9	0.1	221	SW of site, west of mechanical draft towers on dike TMI
ID	NI-[illegible]	10	0.4	270	W of site on Shelley Island
	NI-[illegible]	-	0.1	270	W of Reactor Building on fence adjacent to screenhouse entrance gate TMI
SW	NI-[illegible]	11	0.1	270	On site, station intakes (Units 1 & 2)
ID	PI-[illegible]	12	0.4	293	WNW of site on Shelley Island
ID	QI-1	13	0.5	317	NW of site on Shelley Island
ID	QI-2	-	0.2	325	NW of Reactor Building on fence behind Warehouse #1 TMI
ID	RI-1	14	0.2	340	NNW of site at gate in fence on W side of TMI, north boat dock
AQS	AI-2	15	0.7	1	N of site at North tip of TMI
AQS	AI-3	16	0.7	0	N of site at north tip of TMI
ID	CI-1	17	0.6	35	NE of site on Route 441 N.
ID	DI-2	18	0.5	65	ENE of site on Laurel Road
AP,AI,RW,ID,CR,S	EI-2	19	0.4	90	E of site on N side of Observation Center
ID	FI-1	20	0.5	117	ESE of site on light pole on Route 441 N.
AQS	GI-1	21	0.3	137	SE of site
ID	GI-2	22	0.6	143	SE of site on Route 441 S.
SW	JI-2	23	0.5	188	S of site below discharge pipe
AQS	KI-3	24	0.8	202	SSW of site

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE LOCATION (Cont'd)

Sample Medium	Station Code	Map Number	Distance	Azimuth	Description
AQS	L1-3	25	0.5	225	SW of site
ID	L1-2	26	0.5	221	SW of site on Beech Island
ID	R1-2	27	0.7	332	NNW of site on Henry Island
MG,FPL	A2-1	28	1.2	5	N of site, farm along Route 441
M,FPL,S	D2-1	29	1.1	65	ENE of site, farm on Gingrich Road
M,FPL	G2-1	30	1.6	130	SE of site, farm on the E side of Conewago Creek
SW,AQS	J2-1	31	1.5	182	S of site above York Haven Dam
ID	K2-1	32	1.1	200	SSW of site on S Shelley Island
ID	L2-1	33	1.9	227	SW of site on Route 262
AP,AI,ID,CR	M2-1	34	1.3	253	WSW of site adjacent to Fishing Creek, Goldsboro Air Station
ID	N2-1	35	1.2	262	W of site at Goldsboro Marina
ID	P2-1	36	1.6	297	WNW of site off of Old Goldsboro Pike
ID	Q2-1	37	1.8	310	NW of site on access road along river
AP,AI,ID,RW,CR	A3-1	39	2.6	358	N of site at Middletown Substation
SW	A3-2	40	2.5	355	N of site of Swatara Creek
AP,AI,RW,ID,CR	H3-1	41	2.3	159	SSE of site at Falmouth-Collins Substation
SW	H3-2	42	2.3	165	SSE of site, York Haven Hydro
M,FPL	P4-1	43	3.6	295	WNW of site at Fisher's farm on Valley Road
ID	A5-1	44	4.3	3	N of site on Vine Street exit from Route 283
ID	B5-1	45	4.8	18	NNE of site, School House Lane and Miller Road
ID	C5-1	46	4.5	42	NE of site on Kennedy Lane
ID	D5-1	47	5.2	65	ENE of site off of Beagle Road
ID	E5-1	48	4.6	81	E of site, North Market Street and Zeager Road
ID	F5-1	49	4.7	107	ESE of site on Amosite Road
ID	G5-1	50	4.8	131	SE of site, Bainbridge and Risser Roads
SW	H5-2	51	4.1	160	SSE of site on Brunner Island
ID	H5-1	52	4.1	157	SSE of site Guard Shack on Brunner Island
ID	J5-1	53	4.9	182	S of site on Canal Road, Conewago Heights
ID	K5-1	54	5.0	200	SSW of site on Conewago Creek Road, Strinestown
ID	L5-1	55	4.1	228	SW of site, Stevens and Wilson Roads
ID	M5-1	56	4.3	249	WSW of site, Lewisberry and Roxberry Roads, Newberrytown
ID	N5-1	57	4.9	268	W of site, off of Old York Road on Robin Hood Drive
ID	P5-1	58	4.9	281	WNW of site, Route 262 and Belnhower Road
ID	Q5-1	59	5.0	318	NW of site on Lumber Street, Highspire
ID	R5-1	60	4.9	339	NNW of site, Spring Garden Drive and Route 441
ID	B10-1	61	9.4	21	NNW of site, West Areba Avenue and Mill Street, Hershey
ID	C8-1	62	7.2	48	NE of site, Schenk's Church on School House Road
ID	D9-1	63	8.5	72	ENE of site on Mt. Gretna Road, Bellaire
ID	E7-1	64	6.8	86	E of site on Hummelstown Street, Elizabethtown
FPF	E6-1	65	5.9	100	E of site, orchard at Masonic Homes
ID	F10-1	66	9.4	112	ESE of site, Donegal Springs Road, Donegal Springs
AP,AI,RW,ID,S	G10-1	67	9.8	127	SE of site at farm off Engle's Tollgate Road

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE LOCATION (Cont'd)

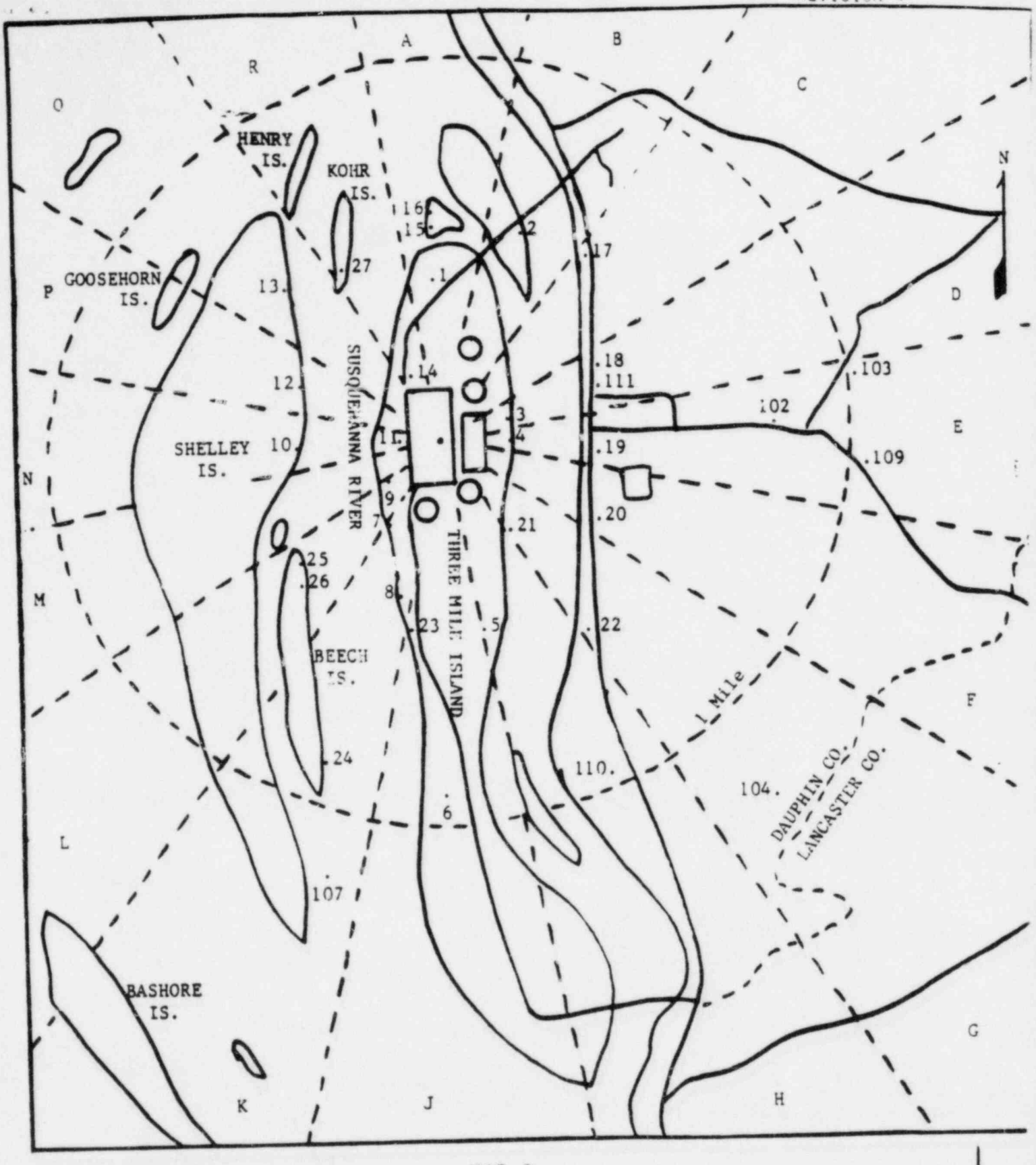
Sample Medium	Station Code	Map Number	Distance	Azimuth	Description
ID	H8-1	68	7.4 mi	163°	SSE of site on Saginaw Road, Starview
ID	J7-1	69	6.5	177	S of site on Maple Street, Manchester
ID	K8-1	70	7.4	196	SSW of site, Coppenhaffer Road and Route 295, Zion's View
ID	L8-1	71	8.0	225	SW of site on Rohler's Church Rd., Andersontown
ID	M9-1	72	8.6	242	WSW of site on Alpine Road, Maytown
ID	N8-1	73	7.8	260	W of site on Route 382, 1/2 mile north of Lewisberry
ID	P8-1	74	8.0	292	WNW of site on Evergreen Road, Reeser's Summit
M	P7-1	75	6.7	293	WNW of site on Old York Road, New Cumberland
SW, ID	Q9-1	76	8.5	308	NW of site across from parking lot of Steelton Water Company
ID	R9-1	77	8.1	340	NNW of site on Derry Street, Rutherford Heights
M, FPL	A15-1	78	10.5	10	NNE of site, farm on Route 39 Hummelstown
ID	C20-1	79	19.6	47	NE of site on Cumberland Street, Lebanon
ID	D15-1	80	10.9	63	ENE of site, Route 241, Lawn, PA
MG, FPL	D15-2	81	10.0	68	ENE of site, Route 241, 200 meters South of PA Turnpike, Davidhizer Farm
ID	F25-1	82	21.1	113	ESE of site, Steel Way and Loop Roads, Lancaster
SW	F15-1	83	12.6	122	ESE of site, Chickies Creek
SW, ID	G15-1	84	14.4	124	SE of site at Columbia Water Treatment Plant
SW	G15-2	85	13.6	128	SE of site, Wrightsville Water Treatment Plant
SW	G15-3	86	14.8	124	SE of site, Lancaster Water Treatment Plant
ID	H15-1	87	13.2	157	SSE of site, Orchard and Stonewood Roads, Wilshire Hills
AP, AI, ID	J15-1	88	12.6	180	S of site in Met-Ed York Load Dispatch Station
SW	J15-2	89	14.7	178	S of site at York Water Company
ID	K15-1	90	12.7	204	SSW of site, Alta Vista Road, Wrightstown at Dover Township Fire Dept. Bldg.
ID	L15-1	91	11.7	225	SW of site on West side of Route 74, Mt. Royal
ID	M15-1	92	11.9	237	WSW of site, West side of Route 74, In front of Earth Crafts, Rossville
FPF	M15-2	93	13.6	253	WSW of site on W side of Route 74, Lerew's orchard
ID	N15-1	94	13.2	276	W of site, Orchard Lane and Hertzler Road, Mt. Allen
ID	N15-2	95	10.4	274	W of site, Lisburn Road and Main Street, Lisburn
ID	P15-1	96	12.2	300	WNW of site on Erford Road in front of Penn Harris Motel, Camp Hill
AP, AI, RW, ID, S	Q15-1	97	13.5	305	NW of site at West Fairview Substation
ID	Q15-2	98	11.5	310	NW of site, Penn and Forster Streets, Harrisburg
ID	R15-1	99	11.2	330	NNW of site, Route 22 and Colonial Road, Colonial Park
S	A9-1	100	9.2	0	N of site off of Union Deposit Road
FPL, S	A9-2	101	9.3	357	N of site on Union Deposit Road, W of Hoernerstown
FPL	E1-3	102	0.7	90	E of site, 100 m W of Peck Road and Zion Road Intersection
FPL, S	E2-1	103	1.1	80	E of site on Zion Road
S	G2-2	104	1.3	133	SE of site on Engle Road

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SAMPLE LOCATION (Cont'd)

Sample Medium	Station Code	Map Number	Distance	Azimuth	Description
S	G3-1	105	2.8 mi	131°	SE of site on Governor's Stable Road intersection with Keener Road
FPL	P3-1	106	2.6	293	WNW of site on Route 392 (Yocumtown Road)
AQF, AQP	Indicator	-	-	-	All locations where fish and plants are collected below the discharge are grouped together and referred to as "Indicator" (i.e., sectors 11 and geographically below)
AQF, AQP	Control	-	-	-	All locations where fish and plants are collected above the discharge are grouped together and referred to as "control" (i.e., sectors 12 and geographically above)
AQS	K2-2	107	1.1	197	SSW of site E of Shelley Island
S	A3-3	108	2.5	354	N of site at junction of Swatara Creek and Route 441
M	E2-2	109	1.1	93	E of site on Peck Road
FPL, FPF	H1-2	110	0.9	150	SSE of site stand off of Rt. 441 S.
FPF	D1-3	111	0.5	65	ENE of site House next to Yinger's Greenhouse
S	G2-3	112	1.6	132	SE of site near Conewago Cr.

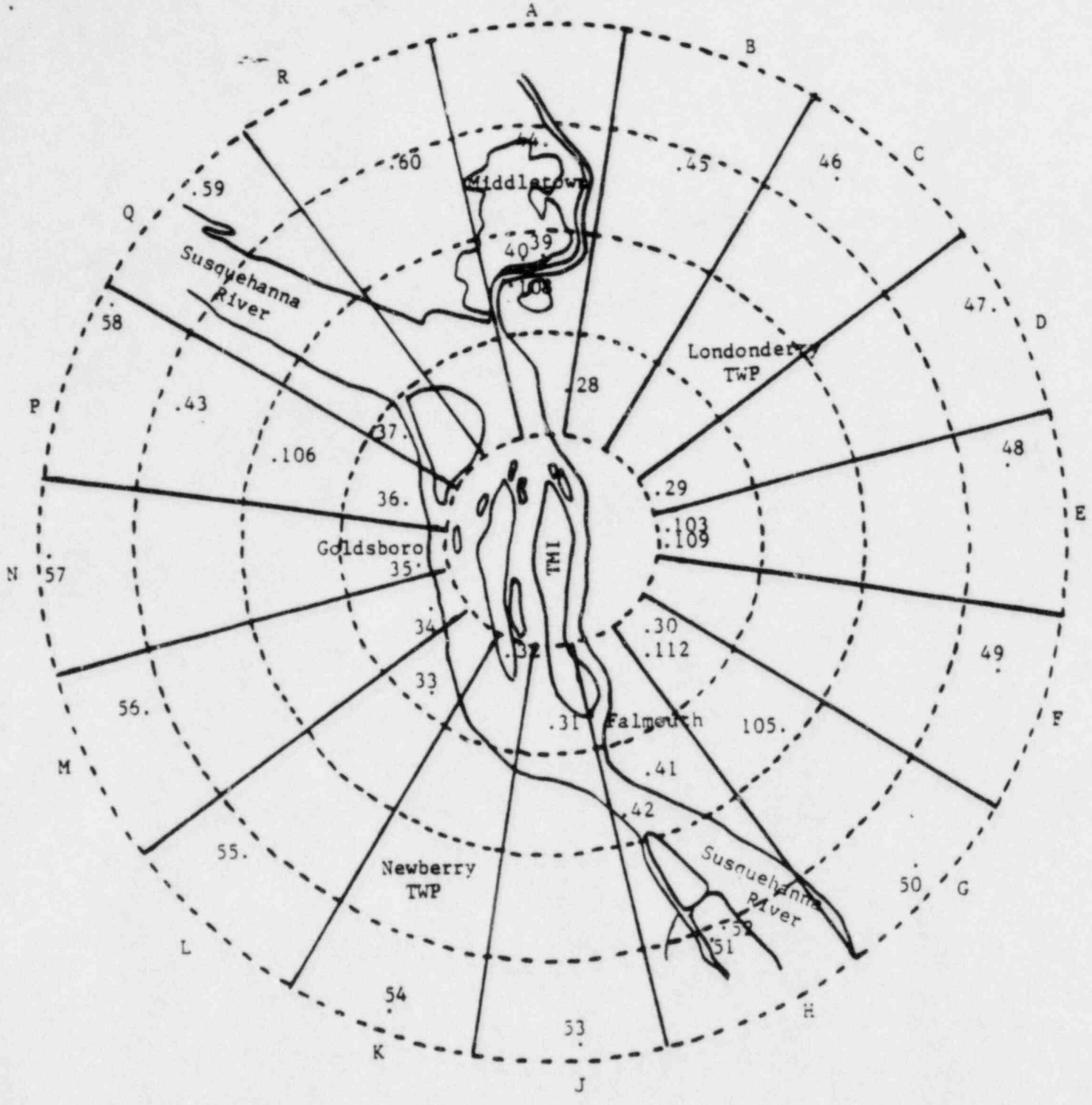
IDENTIFICATION KEY

ID = Immersion Dose (TLD)	CR = Cryogenic Air Sample	AQF = Fish
SW = Surface Water	RW = Rain Water	AQP = Aquatic Plants
AI = Air Iodine	M = Milk (cow)	AQS = Aquatic Sediment
AP = Air Particulate	MG = Milk (goat)	FPL = Green Leafy Vegetation or Vegetables
S = Soil	EW = Effluent Water	FPF = Fruit



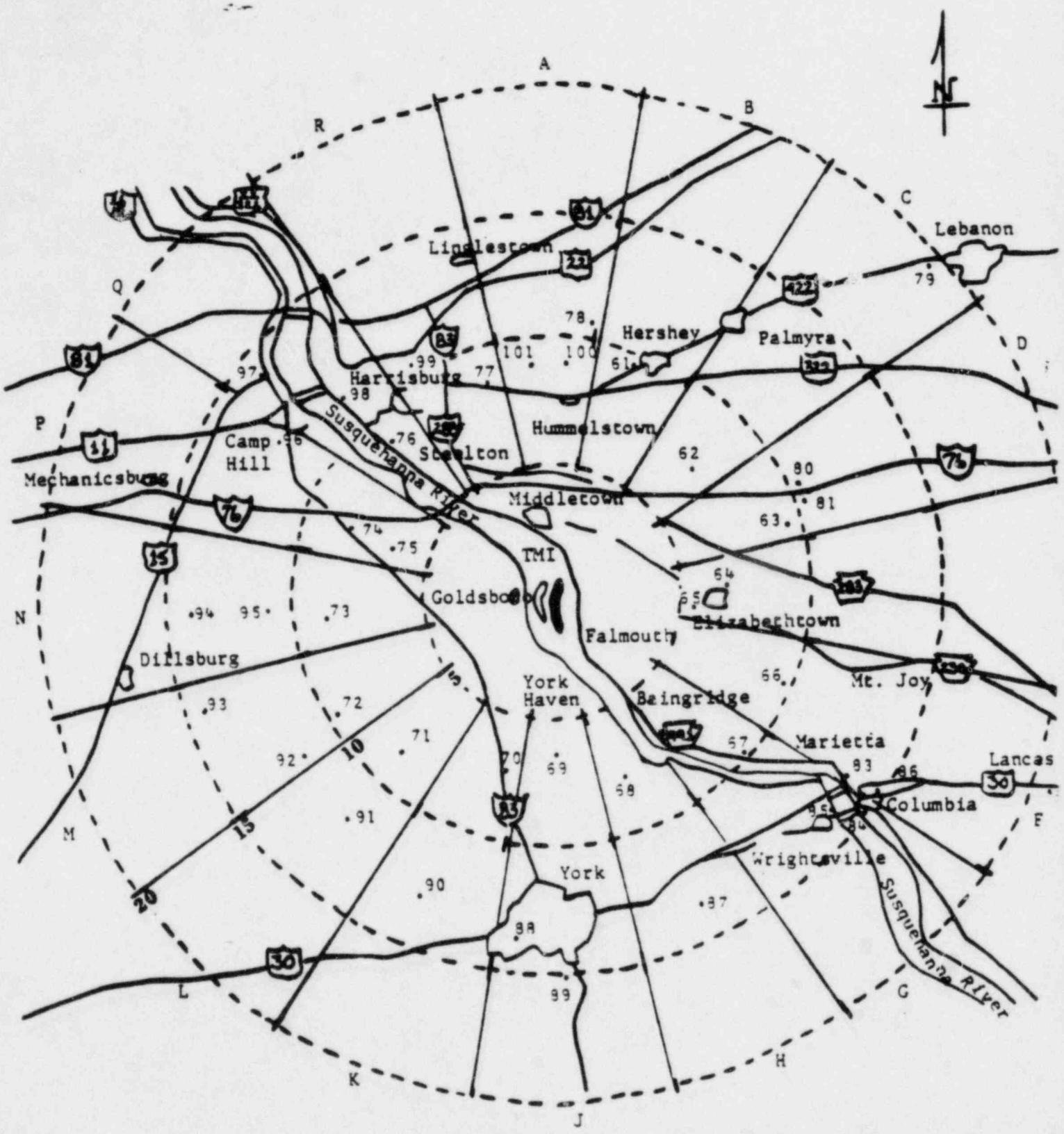
MAP 1

THREE MILE ISLAND NUCLEAR STATION
LOCATIONS OF RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM (REMP)
STATIONS APPROXIMATELY 1 MILE FROM THE SITE



MAP 2

THREE MILE ISLAND NUCLEAR STATION
LOCATIONS OF RADIOLOGICAL ENVIRONMENTAL MONITORING STATIONS
WITHIN 5 MILES OF THE SITE



MAP 3

THREE MILE ISLAND NUCLEAR STATION
LOCATIONS OF RADIOLOGICAL ENVIRONMENTAL MONITORING
PROGRAM (REMP) STATIONS GREATER THAN 5 MILES
FROM SITE

ATTACHMENT II

Revision 3 to the TMI-1 Process Control Program (PCP).

The TMI-1 PCP, OP1104-28I, Revision 3 was issued July 31, 1984, which was during the period of this Report (July 1 through December 31, 1984).

Operations memo 3210-84-0337 (attached) provides background as to the basis of the TMI-1 Process Control Program (PCP) and the input from Westinghouse Hittman who is under contract to GPU Nuclear to provide waste solidification services at TMI-1.

The following is a list of the revisions by Section. A copy of the Program is included for your reference.

GENERAL

All Procedure changes, other than those specified below, identified by "Change Bars" in the right margin were numbering or wording changes, and do not change the intent of the procedure.

1.0 SECTION 1.0 - PURPOSE

a. Identifies that the Individual Waste Stream PCP's are a result from testing performed by Westinghouse-Hittman, included in Topical Report STD-R-05-007 and meets the requirements of 10CFR61.56, Waste Characteristics.

2.0 SECTION 2.0 - COLLECTION AND ANALYSIS OF SAMPLES

a. Item 2.1.6 includes a new requirement that all chemicals used in the verification testing of a waste stream are identical to those used in full scale solidification.

b. Item 2.2.2.2 has been changed to identify the information required on the Test Solidification Data Sheet.

c. Item 2.2.3.3 provides suggested time requirements to perform verification testing prior to performing full scale solidification.

3.0 SECTION 3.0 - TEST SOLIDIFICATION AND ACCEPTANCE CRITERIA

a. The note prior to 3.1 identifies the need to use sequential numbers when performing verification testing.

b. The note prior to 3.2 has been added to notify Quality Controls of upcoming verification testing for monitoring purposes.

c. Table 1 Solidification Ratios has been updated to identify the waste/binder ratios for the waste streams processed at TMI-1 for both unstable and stable waste forms.

d. Items 3.2.7 and 3.2.9 incorporate the new steps for conducting verification testing for both unstable and stable waste forms.

e. Items 3.5.1 and 3.5.2 provide upgraded parameters to be followed in the event verification testing results in an unacceptable product.

4.0 DATA SHEETS

The Test Solidification Data Sheets and Calculation Sheets have been updated for the four (4) waste streams processed at TMI-1. Data sheets are provided for both unstable and stable waste forms, except for concentrated waste which at this time is processed only as an unstable waste.

GPU Nuclear

Memorandum

Subject: CHANGES TO THE PROCESS CONTROL PROGRAM FOR RADIOACTIVE WASTE SOLIDIFICATION

Date: August 7, 1984

From: J. W. BOYER, RADWASTE OPERATIONS ENGINEER III

Location: Three Mile Island
3210-84-0337
File: NRC-LI
84-9200

To: J. BURGESS, LICENSING ENGINEER

Westinghouse-Hittman Nuclear Inc. is currently under contract with TMI-I to provide waste solidification services using cement. Part of these services include Process Control Program (PCP) development to ensure consistency with regulatory changes.

With implementation of 10CFR61, Hittman has pursued the required testing of a variety of simulated radioactive waste streams in order to demonstrate compliance with the stability requirements of 10CFR61.56, "Waste Qualification" and the Branch Technical Position on Waste Forms.

Hittman has tested seventeen (17) waste streams commonly found at LWR. The formulations were developed using Portland Type I Cement. To date, the test results of this qualification program are included in "Topical Report Cement Solidification Requirements of 10CFR61" (STD-R-05-007, Rev. 0 dated May 23, 1984).

The waste streams generated at TMI-I are bounded by those tested by Hittman. As a result, the formulations converted into PCP's by Hittman for these waste streams have been included into the governing Process Control Program at TMI-I, OP 1104-28I.

OP 1104-28I Rev. 3, is currently applicable to the solidification of borated waste, oily waste, bead or powdered resin either as Class A unstable for borated wastes or Class A unstable, Class A stable, B and C for the other identified waste streams.

This program describes the methodology for determining the acceptable ratios of waste, binder and additives to ensure an acceptable waste product which meets the requirements of 10CFR61.56 and which is acceptable for burial.

Attached is a copy of the current approved revision of OP 1104-28I. The vertical lines in the right hand margin identify the most recent changes to the body of the procedure.

These changes are a result of 10CFR61 implementation and based on the information supplied by Hittman resulting from their internal PCP adaptation of the Topical Report. These changes do not reduce the overall conformance of the solidified waste product to the existing criteria for solid waste.

J. W. Boyer
Ext. 8769

JWB/dds

cc: W. T. Conaway, Radwaste Support Manager
L. L. Ritter, Administrator II, Plant Operations
CARIRS-TMI

IMPORTANT TO SAFETY
ENVIRONMENTAL IMPACT RELATED

CONTROLLED COPY FOR
USE IN UNIT I ONLY

THREE MILE ISLAND NUCLEAR STATION
UNIT NO. 1 OPERATING PROCEDURE 1104-28I
HITTMAN NUCLEAR AND DEVELOPMENTAL CORPORATION PROCESS CONTROL PROGRAM

Incontainer Solidification

Table of Effective Pages

CONTROL ROOM
WORKING COPY

Page	Revision	Page	Revision	Page	Revision	Page	Revision
1.0	3	26.0	3				
2.0	3	27.0	3				
3.0	3	28.0	3				
4.0	3	29.0	3				
5.0	3	30.0	3				
6.0	3	31.0	3				
7.0	3	32.0	3				
8.0	3	33.0	3				
9.0	3	34.0	3				
10.0	3	35.0	3				
11.0	3	36.0	3				
12.0	3	37.0	3				
13.0	3	38.0	3				
14.0	3	39.0	3				
15.0	3						
16.0	3						
17.0	3						
18.0	3						
19.0	3						
20.0	3						
21.0	3						
22.0	3						
23.0	3						
24.0	3						
25.0	3						

INFO ONLY
JWB
8-8-84

M. A. Nelson
Signature

7/31/84
Date

R. J. Toole
Signature

7-31-84
Date

Document ID: 0212T

THREE MILE ISLAND NUCLEAR STATION
UNIT NO. 1 OPERATING PROCEDURE 1104-28I
HITTMAN NUCLEAR AND DEVELOPMENT CORPORATION PROCESS CONTROL PROGRAM

Incontainer Solidification

1.0 PURPOSE

The purpose of the Process Control Program (PCP) for incontainer solidification is to provide a program which will assure a solidified product with no free liquid prior to transportation for disposal and which meets the requirements of 10 CFR 61.56, Waste Characteristics.

The program consists of three major steps, which are:

a. Procedures for collecting and analyzing samples;

b. Procedures for solidifying samples;

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

The PCP's for each waste steam included in this procedure are based on laboratory testing, the results of which are included in "Topical Report Cement Solidified Waste to meet the stability requirements of 10 CFR 61" (STD-R-05-007, Rev. 0) prepared by Hittman. These PCP's are valid for all liner types using electric or hydraulic mixing heads provided by Hittman.

2.0 COLLECTION AND ANALYSIS OF SAMPLES

2.1 General Requirements

2.1.1 As required by the Radiological Effluent Technical Specifications for PWR's and BWR's the PCP shall be used to verify the solidification of at least one representative test specimen from at least every tenth batch of

each type of wet radioactive waste (e.g., evaporator bottoms, boric acid solution, sodium sulfate solutions, resin and precoat sludge).

2.1.2 For the purpose of the PCP a batch is defined as that quantity of waste required to fill a disposable liner to the waste level indicator.

2.1.3 If any test specimen fails to solidify, solidification of 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.

2.1.4 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 the three (3) consecutive initial test specimens demonstrate solidifications. The Process Control Program shall be modified as requires to assure solidification of subsequent batches of waste.

2.1.5 For high activity wastes, such as spent resin or used precoat, 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 waste and chemical properties as possible. Typical unexpended mixed bed resin shall be used to simulate the spent bead resin and the appropriate mix of anion to cation powdered resin shall be used to simulate used precoat.

2.1.6 All Chemicals used to condition or solidify waste or simulated waste in solidification tests shall be the actual chemicals used in full scale solidification.

2.2 Collection of Samples

2.2.1 Radiological Protection

2.2.1.1 Comply with applicable Radiation Work Permits.

2.2.1.2 Test samples which use actual waste shall be disposed of by placing in the disposal liner.

2.2.1.3 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 liner numbers of wastes solidified based on each test sample.

2.2.2 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 wastes without retesting.

2.2.2.1 a. The test sample data for concentrated waste will include, but not necessarily be limited to, the type of waste solidified, major constituents, percent

solids, pH, volume of sample, amount of oil in sample and the ratio of the sample volume to the final volume of the solidification product.

b. The test sample data for spent resin and used precoat will include, but not necessarily be limited to, the type of waste solidified, volume of sample and ratio of sample volume to the final volume of the solidified product.

c. The test sample data for other waste streams will include, but not necessarily be limited to, the type of waste solidified, volume of sample, amount of oil in sample, pH and the ratio of sample volume to the final volume of the solidified product.

2.2.2.2 The Test Solidification Data Sheet will include the Liner Number, Batch Volume, and Date Solidified, for each batch solidified based on sample described.

2.2.3 Collection of Samples

2.2.3.1 Concentrated waste shall be kept heated or reheated to 130°F prior to testing.

NOTE:	If the concentrated waste had previously been neutralized prior to solidification to prevent boric acid precipitation the sample may be tested at ambient temperatures.

2.2.3.2 Two samples shall be taken for analysis. One sample shall be compatible with the standard size sample used for the radioactivity analysis and the second for the chemical 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.

2.2.3.3 Samples should be drawn at least six hours prior to the planned waste solidification procedure to allow adequate time to complete the required testing and verification of solidification for Class A unstable waste. 28 hours should be allowed, if practical, for Class A stable, Class B and C wastes.

2.2.3.4 The tank containing the waste to be solidified should be mixed by recirculating the tank contents for at least one volume change prior to sampling to assure a representative sample.

2.2.3.5 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. These samples should be of such size that when mixed together they form samples of standard size as prescribed in Section 2.2.3.2. If the contents of a particular tank represents X percent of the total waste quantity to be solidified then the sample of that tank should be of such size to represent X percent of the composite samples.

3.0 TEST SOLIDIFICATION AND ACCEPTANCE CRITERIA

NOTE:	For the PCP test to be performed, use the Test Solidification Data Sheet for the waste stream and use the next sequential Sample No. to identify the test.

3.1 Waste Conditioning

3.1.1 For concentrated waste (up to 14 weight percent) prior to solidification, the pH of the sample should be adjusted to a range of 7.4 to 9.2 or greater than 11.5 with 50 wt.% sodium hydroxide (NaOH). The quantity of NaOH added shall be recorded.

NOTE:	If foaming is apparent during the solidification testing the sample should be treated with an anti-foaming agent. The quantity of anti-foaming agent required shall be recorded. If a floating oil film is present in quantities greater than 1 percent by volume, the oil should be broken up with Maysol or other emulsification agent. The quantity of emulsification agent added shall be recorded.

3.1.2 For bead or powdered resin, prior to solidification the pH of the sample should be adjusted to a range of 5 to 8 if Metso Beads are used or to a range of 8 to 10 if they are not used. The quantity of NaOH used shall be recorded. This is required for Class A unstable waste only.

3.1.3 If waste oil is to be solidified, an emulsifier shall be added to pretreat the waste sample as follows:

a. Allow one sample to stand undisturbed until the water/oil interface is clearly discernible and

determine the percent by volume of the oil. If this volume is greater than 40 percent add a sufficient quantity of concentrated waste to reduce the percent of oil by volume to less than 40 percent. Use the Test Solidification Data Sheet to determine the quantity of liquid to add. When the correct oil to water ratio is reached, measure and record the pH (pH paper may be used if a measurement cannot be made with a meter because of oil fouling).

b. Prior to the test sample solidification, the waste oil is treated with a predetermined quantity of emulsifier. For this application, Maysol 776 is used at a ratio of 1 part emulsifier to 5.1 parts oil by volume. The emulsifier has a density of one.

c. After the emulsifier is thoroughly mixed into the sample, a quantity of Metso Beads the weight of which is twice the weight of the emulsifier used, is mixed in thoroughly until the Metso Beads have completely dissolved.

3.2 Test Solidification

NOTE:	Contact the Quality Controls Group to inform them of the Test Solidification and if they care to witness the test.

3.2.1 Any sample to be solidified shall be pretreated as specified in Section 3.1.

3.2.2 Test solidification should be conducted using a 1000 ml. disposal beaker or similar size container. Mixing should be accomplished by stirring with a rigid stirrer until a homogenous mixture is obtained, but in no case for less than two (2) minutes.

3.2.3 For the test solidification of resin, measure into a mixing vessel the appropriate ratios of waste and water based on the waste classification chosen. Measure out the required quantities of cement and Metso beads as shown in Table 1.

3.2.4 For the test solidification of used precoat, measure into a mixing vessel the appropriate ratios of waste and water based on the waste classification. Measure out the required quantities of cement and Metso beads as shown in Table 1.

3.2.5 For the test solidification of Concentrated Waste, measure into two mixing vessels 400 ml. of pH adjusted waste each. Measure out the required quantities of cement and Metso beads as shown in Table 1.

3.2.6 For the test solidification of Waste Oil and Concentrated Waste measure the appropriate of ratios of waste and Maysol No. 776 into a mixing vessel as shown in Table 1. Stir mixture for no less than 5 minutes. Measure out the required quantities of cement and Metso Beads.

SOLIDIFICATION RATIOS

Table 1

CLASS A UNSTABLE	Waste	Water	Cement	Metso	Maysol	$Ca(OH_2)$
Bead Resin	240 gm	90 ml	189 gm	19 gm	----	----
Used Precoat	300 gm	90 ml	223 gm	22 gm	----	----
Waste Oil and Conc. Waste	350 ml*	----	447.3 gm	51.8 gm	27.5 gm	----
Conc. Waste						
Sample A	400 gm	----	440 gm	63 gm	----	----
Sample B	400 gm	----	505 gm	84.2 gm	----	----
CLASS A STABLE, B AND C						
Bead Resin	320 gm	235.3 ml	653.6 gm	----	----	18 gm
Used Precoat	382 gm	151 ml	444 gm	----	----	10 gm
Waste Oil and Conc. Waste	350 ml*	----	447.4 gm	51.8 gm	27.5 gm	----

*The 350 ml is divided as follows: 210 ml C.W., 140 ml Oil

NOTE:	Omit the following step if Metso Beads were previously added.

3.2.7 For Class A unstable wastes mix the cement and additives together and slowly add this mixture to the test sample while it is being stirred.

3.2.8 After two (2) minutes of mixing and a homogeneous mixture is obtained allow the waste to stand for a minimum of 4 hours.

3.2.9 For Class A stable, Class B and C waste, mix the cement and additives together and slowly add this mixture to the test sample while it is being stirred. If calcium hydroxide is being used, slowly add to the waste two (2) grams at a time. Mix for three (3) minutes between additions until all the additive is used. Then add the cement and mix for one (1) additional minute.

3.2.10 Allow the sample to cure for 24 hours at 120° ±5°F.

NOTE:	If at any time during the 24 hour cure time the sample meets the acceptance criteria, the liner solidification may proceed.

3.3 Solidification Acceptability

The following criteria define an acceptable solidification process and process parameters.

3.3.1 The sample solidification is considered acceptable if there is not visual or drainable free water.

3.3.2 The sample solidification is considered acceptable if upon visual inspection the waste appears that it would hold its shape if removed from the beaker and it resists penetration by a rigid stick.

3.4 Solidification Unacceptability

3.4.1 If the waste fails any of the criteria set forth in Section 3.3 the solidification will be termed unacceptable and a new set of solidification parameters will need to be established under the procedures in Section 3.5.

3.4.2 If the test solidification is unacceptable then the same test procedure must be followed on each subsequent batch of the same type of waste until three consecutive test samples are solidified.

3.5 Alternate Solidification Parameters

3.5.1 If a test sample for Class A unstable waste fail to provide acceptable solidification of waste the following procedures should be followed.

1. Mix equal volumes of dry cement and water to ensure that the problem if not a bad batch of cement.
2. Add additional 50 wt.% NaOH to raise the pH above 8 but less than 9.2 for borated wastes.
3. If the waste (other than waste oil) is only partially solidified, use lower waste to cement and Metso ratios. Using the recommended quantities of cement and Metso Beads, reduce the waste sample to

325 ml and continue reducing the sample volume by 25 ml. until the acceptability criteria of Section 3.3 are met.

4. If the waste oil mixture is only partially solidified try using lower waste to cement ratios. Reduce the quantity of waste by 25 ml. and the emulsifier by 1 ml., (This will result in a slightly higher concentration of emulsifier in the waste) and proceed with the test solidification. Continue with similar reductions until a satisfactory product is achieved.

3.5.2 If the test sample fails to provide acceptable solidification of waste following the actions of Section 3.5.1 the following sample analysis should be performed. The waste should fall within the acceptable range.

SAMPLE ANALYSIS

For Concentrated Waste < 14 Weight Percent (24000 ppm as B)

pH	7.4 to 9.2 or > 11.5
Percent Boric Acid	≤ 14
ppm as Boron	≤ 24000
Detergents	No appreciable foaming during agitation
Oil (floating)	< 1 percent by volume

For Bead and Used Precoat Resin

pH	> 5
Detergents	No appreciable foaming during agitation
Oil (floating)	< 1 percent by volume

Waste Oil Mixed with Concentrated Waste

pH	> 5
Percent Boric Acid	≤ 14 (prior to mixing)
ppm as Boron	≤ 24000 (prior to mixing)
Oil	≤ 40 percent by volume
Detergents	No appreciable foaming during agitation

3.5.3 For Class A stable, Class B and C waste test samples that fail to solidify, Contact Radwaste Operations Engineering for resolution.

TEST SOLIDIFICATION DATA SHEET
Class A Unstable Concentrated Waste

Liner No.: _____

Sample No.: _____

Date: _____

I. SAMPLE PREPARATION

Sample Volume, ml.: Sample A _____ Sample B _____ (3.2.5)

pH: _____ Volume NaOH solution used to adjust pH, ml ____

Quantity of Oil percent: _____

Quantity of Emmulsifier, ml: _____

Quantity of Anti-Foam, ml: _____

Quantity of Cement Added: Cement Ratio[1] _____: (#/ft³ Waste)

Sample A _____ gms Sample A _____

Sample B _____ gms Sample B _____

Quantity of Additive Added: Additive Ratio[2] _____: (#/ft³ Waste)

Sample A _____gms Sample A _____

Sample B _____gms Sample B _____

Packaging Efficiency: Waste Volume/Solidified Waste Volume

Sample A _____ Sample B _____

Product Acceptable: Sample A___Yes ___No (If no, refer to Section 3.5 and proceed as directed)

Sample B___Yes ___No

Additional batches solidified based on this sample solidification:

Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date

II. SAMPLE INSPECTION

Test Solidifications Performed by: _____ _____
Date

Sample Contains "No Free Liquid": _____ _____
Verified By Date

FOOTNOTES:

1 The cement ratio is defined as the pounds of cement required to solidify one cubic foot of waste. Ratios is this PCP yield cement ratios of 68.6 lbs/ft^3 and 78.8 lbs/ft^3 for samples A and B respectively.

2 The additive ratio is defined as the pounds of additive required to solidify one cubic foot of waste. Ratios in this PCP yield additive ratios of 9.8 $lbs.ft^3$ and 13.1 lbs/ft^3 for Samples A and B respectively.

SOLIDIFICATION CALCULATION SHEET

Waste Volume[1], ft^3: _____ (1)

Cement Ratio, #/ft^3: Sample A _____ (2A)

Sample B _____ (2B)

Additive: _____

Additive Ratio, #/ft^3: Sample A: _____ (3A)

Sample B: _____ (3B)

Cement Quantity[2]

_____(1)[1] x _____(2A) = _____lbs. (4A)

_____(1)[1] x _____(2B) = _____lbs. (4B)

Additive Quantity[2]

_____(1) x _____(3A) = _____lbs. (5A)

_____(1) x _____(3B) = _____lbs. (5B)

FOOTNOTES:

1 The quantity of waste to be solidified in a single liner cannot exceed the maximum waste volume listed on the attached Solidification Data Tables.

2 4A and 5A define the minimum quantity of cement and additive respectively that must be mixed with the waste to assure solidification. The recommended quantities to use are represented by 4B and 5B.

SOLIDIFICATION DATA TABLES

For Concentrated Waste

NOTE: Recommended Amount of Cement and Additives.

	HN-100 Series 1	HN-100 Series 2	HN-100 Series 3	HN-100S	HN-100 LVM Series 3
Usable Liner Volume, (cu. ft.)	143	143	143	143	160.0
Max. Waste Vol. (cu. ft.)	77.6	75.7	97.1	93.3	108.6
Max. Solidified Waste Vol. (cu. ft.)	114.3	111.5	143	137.4	160.0
Cement Added at ax. Waste Vol.					
Weight (lbs.)	6112.9	5964.5	7651.2	7350.4	8560.8
Volume (bags)	65	63.5	81.4	78.2	91.1
Anhydrous Sodium Metasilicate Added at Max. Waste Vol.					
Weight (lbs.)	1016.2	991.6	1272	1222	1423.2
Volume (bags)	10.2	9.9	12.7	12.2	14.2
Max. Radiation Level R/hr Contact	12	12	12	3	12

SOLIDIFICATION DATA TABLES

For Concentrated Waste

NOTE: For the Minimum Amount of Cement and Additive.

	HN-100 Series 1	HN-100 Series 2	HN-100 Series 3	HN-100S	HN-100 LVM Series 3
Usable Liner Volume, (cu. ft.)	143	143	143	143	160
Max. Waste Vol. (cu. ft.)	84.8	82.7	104.5	101.9	117
Max. Solidified Waste Vol. (cu. ft.)	116	113.1	143	139.4	160
Cement Added at Max. Waste Vol.					
Weight (lbs.)	5814.8	5673.5	7171.0	6991.8	8023.5
Volume (bags)	61.9	60.4	76.3	74.4	85.4
Anhydrous Sodium Metasilicate Added at Max. Waste Vol.					
Weight (lbs.)	830.7	810.5	1024.4	998.8	1146.2
Volume (bags)	8.3	8.1	10.2	10.0	14.2
Max. Radiation Level R/hr Contact	12	12	12	3	12

CLASS A UNSTABLE AND STABLE, CLASS B OR C TEST SOLIDIFICATION DATA SHEET

FOR WASTE OIL

Liner No.: _____

Sample No.: _____

Date: _____

I. SAMPLE PREPARATION (3.2.6)

Sample Volume, ml.: _____ (1)

Oil Volume, ml: _____ (2)

Percent Oil by Volume: _____ (3)

Quantity of Water Removed or Added to Obtain 40% Oil by Volume: _____ (4)

pH: _____ (5)

Quantity of Emulsifier Added, ml: _____ (6)

Grams of Portland Type I Cement: _____ (7)

Grams of Anhydrous Sodium Metasilicate (ASMS): _____ (8)

Additional batches solidified based on this sample solidification:

Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date

II. SAMPLE INSPECTION

Test Solidifications Performed by: _____ _____
Date

Sample cured for 24 hours' at 120° ±5°F: _____ _____
Verified By Date

Sample Contains "No Free Liquid": _____ _____
Verified By Date

III. PARAMETERS FOR FULL SCALE SOLIDIFICATION

Quantity of Maysol 776: _____ (6) ml Maysol 776 (9)
from above x 0.0214 = gallons Emulsifier per ft³ waste (including water).

Quantity of Portland Type 1 Cement: _____ (7) (10)
gms cement from above x 0.1784 = lbs cement per ft³ waste (including water).

Quantity of Anhydrous Sodium Metasilicate: _____ (8) (11)
gms ASMS from above x 0.1784 = _____ lbs. ASMS per ft³ waste (including water).

FOOTNOTES:

1 If the sample is qualified in less than 24 hours cure time, note the total hours cured. Class A unstable wastes may be cured at room temperature for 4 hours.

CLASS A STABLE AND UNSTABLE, CLASS B OR C WASTE

SOLIDIFICATION CALCULATIONS SHEET

Volume of waste[1] (including water) to be solidified[2], ft^3: _____ (1)

Emulsifier Ratio, gallons/ft^3: _____ (Item 9, Part III) (2)

Cement Ratio, lbs/ft^3: _____ (Item 10, Part III) (3)

ASMS Ratio, lbs/ft^3: _____ (Item 11, Part III) (4)

Quantity of Emulsifier to be added:

$$\frac{\text{Waste Volume } (ft^3)}{(1)} \times \frac{\text{gallons}/ft^3}{(2)} = \text{\_\_\_\_\_ gallons} \quad (5)$$

Quantity of Portland Type I Cement to be added:

$$\frac{\text{Waste Volume } (ft^3)}{(1)} \times \frac{\text{lbs}/ft^3}{(3)} = \text{\_\_\_\_\_ lbs} \quad (6)$$

Quantity of ASMS to be added:

$$\frac{\text{Waste Volume } (ft^3)}{(1)} \times \frac{\text{lbs}/ft^3}{(4)} = \text{\_\_\_\_\_ lbs} \quad (7)$$

FOOTNOTES:

1 For the purpose of this PCP, the volume of waste is considered as the volume of oil plus the volume of water necessary for solidification.

2 The volume of waste to be solidified cannot exceed the maximum volumes listed on the Class A Stable and Unstable, Class B and C Solidification Data Sheets.

SOLIDIFICATION DATA TABLES FOR WASTE OIL CLASS A UNSTABLE AND STABLE, CLASS B AND C

	HN-100 Series 1	HN-100 Series 2	HN-100 Series 3	LVM	100S
Usable Liner Volume, (ft^3)	143	143	143	160	143
Max. Waste Volume (oil and water), ft^3	86.4	84.3	101.0	113.0	101.0
Max. Solidified Volume, ft^3	122.3	119.4	143.0	160.0	143.0
Maysol 776 Added at Maximum Waste Volume (gallons)	50.8	49.6	59.4	66.5	59.4
Portland Type I Cement Added at Maximum Waste Volume					
lbs	6891.8	6724.4	8056.5	9014.2	8056.5
94 lb bags	73.3	71.5	85.7	95.9	85.7
ASMS Added at Maximum Waste Volume					
lbs	794.6	775.2	928.8	1039.2	928.8
100 lb bags	8.0	7.8	9.3	10.4	9.3
Maximum Rad Level R/hr Contact	12	12	12	12	3

(1)
S = HN-600 Stackable
G = HN-600 Grappable
S&G = HN-600 Stackable-Grappable
R = HN-600 Regular

CLASS A TEST SOLIDIFICATION SHEET
for Used Precoat

Batch No.: _____

Sample No.: _____

Date: _____

I. SAMPLE PREPARATION (3.2.4)

Sample Volume, ml.: _____ (1)

pH[1]: _____ Volume NaOH solution used to adjust pH, ml _____ (2)

Quantity of Oil %: _____ (3)

Quantity of Emmulsifier, (20% by volume of oil) ml[1]: _____ (4)

Quantity of Anti-Foaming agent, ml: _____ (5)

Quantity of Cement Added: Cement Ratio[2] (#/ft³ Waste)

Sample _____ gms Sample _____ (6)

Quantity of Additive Added: Additive Ratio[3] (#/ft³ Waste)

Sample _____ gms Sample _____ (7)

Product Acceptable: Sample _____Yes _____No (If no, refer to Section 3.5 and proceed as directed)

Additional batches solidified based on this sample solidification:

Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date

II. SAMPLE INSPECTION

Test Solidification Performed by: _____ _____
Date

Sample Contains "No Free Liquid": _____ _____
Verified By Date

FOOTNOTES

1 If pH adjust is required, note chemical used, quantity used and pH after adjustment.

2 The cement-to-waste ratio is 48.7 pounds of cement per cubic foot of settled powdered resin. If a quantity of cement is used for the test solidification that is different from the quantity listed, multiply the gms by 0.218 to obtain the correct pounds of cement per cubic foot of settled powdered resin.

3 The additive-to-waste ratio if 4.9 pounds additive per cubic foot of settled powdered resin. If alternate additive ratios are used see the multiplier in Note 2 to obtain the correct pounds of additive per cubic foot of powdered resin.

4 The following table shows the minimum mix ratio for a 390 gms sample size of 5 to 27 dry weight percent powdered resin:

Slurry Concentration, Dry Weight Percent	Minimum Cement (gms)	Minimum Additive (gms)	Minimum Cement (lb/ft^3)	Minimum Additive (lb/ft^3)
5 - 12	429	42.4	93.5	9.4
13 - 21	351	35.1	76.6	7.7
22 - 27	234	23.4	51.0	5.1

CLASS A WASTE SOLIDIFICATION CALCULATION SHEET
for Used Precoat

Waste Volume to be Solidified[1]: _____ (1)

Cement Ratio, #/ft³: Sample _____ (2)
Item 6 - Data Sheet

Additive Ratio, #/ft³: Sample _____ (3)
Item 7 - Data Sheet

Cement Quantity[2]

_____(1) x _____(2) = _____lbs. (6)
Waste Volume lb/ft³

Additive Quantity[2]

_____(1) x _____(3) = _____lbs. (7)
Waste Volume lb/ft³

Quantity of Water to be added:

_____(1) x _____³ = _____gallons (8)
Waste Volume gal/ft³

Divide the Quantity of Water to be added (8) by the supply flowrate to determine how long water should be pumped to the disposal liner or use a premeasured quantity of water. (9)

_____(8) ÷ _____gal/min (9) = _____minutes (10)

Quantities of additional additives that must be added to the liner are found by multiplying the volume of the additive used in the test solidification, in ml, by 0.0249 and then by the volume of waste to be solidified. Volumes of additional additives are taken from items 2, 4, and 5 on Data Sheet.

_____ ml x 0.0249 Xx_____(1) = _____ gallons (11)
Item 2, 4, or 5

FOOTNOTES:

1 The quantity of waste to be solidified in a single liner can not exceed the maximum waste volume listed on the Class A Waste Solidification Data Table.

2 6 and 7 define the recommended quantity of cement and additive respectively that must be mixed with the waste to assure solidification.

3 For decanted powdered resin, add 2.02 gallons of water per cubic foot of settled waste and 2.36 gallons of water per cubic foot of dewatered powdered resin.

4 Reduce the quantity of waste in the liner by 1 ft^3 for every 10 gallons of additional additive.

CLASS A WASTE SOLIDIFICATION DATA TABLE
for Used Precoat

	HN-600[1]	HN-200
Usable Liner Volume, ft^3	65	60
Max. Solidified Waste Vol. ft^3	65	60
Max. Dewatered or Decanted Waste Vol., ft^3	42.4[2]	39.2[3]
Cement added at Max. Waste Vol.: pounds	2063	1910
: 1 ft^3 bags	22	20 1/4
Water Added at Max Waste Volume: gallons		
Dewatered	100[4]	93
Decanted	86	79
Anhydrous Sodium Metasilicate Added at Max. Waste Vol.: Pounds	206	191
100 bags	2	2
Max. Radiation Level R/hr Contact of Liner	100	800

FOOTNOTES:

1 Values shown for regular and grappable. Multiply all values by 0.922 for stackable or 0.893 for the grappable/stackable liners. See Footnote 4.

2 Based on 18" maximum depth of filter sludge in the liner, 16-3/4 inches in the stackable or grappable/stackable.

3 Based on 31 1/2" maximum depth of filter sludge in the liner.

4 For dewatered powdered resin, use 100 gallons of additional water for all sizes of HN-600 liners.

CLASS B AND C TEST SOLIDIFICATION DATA SHEET
for Used Precoat

Liner No.: _____

Sample No.: _____

Date: _____ _____

I. SAMPLE PREPARATION

Sample Volume, ml: _____ (1)

Initial pH: _____ Quantity of Oil[1], % _____

Grams $Ca(OH)_2$ to raise pH to $\geq$ 11.0[2], gm: _____ (2)

Grams Portland Type I Cement added, gm _____ (3)

II. SAMPLE INSPECTION

Test Solidification Performed by: _____ _____
Date

Sample cured for 24 hours[3] at 120° ±5°F: _____ _____
Verified By Date

Sample Contains "No Free Liquid": _____ _____
Verified By Date

Sample is "Free Standing Monolith": _____ _____
Verified By Date

III. PARAMETERS FOR FULL SCALE SOLIDIFICATION:

Quantity of $(Ca\ OH)_2$: _____(2) gm $Ca(OH)_2$ from above (4)
x 0.172 = _____ lb $Ca(OH)_2$ per ft^3 decanted/dewatered powdered resin.

Quantity of Cement: _____(3) gm Cement from above (5)
x 0.172 = _____ lb Portland Type I Cement per ft^3 decanted/dewatered powdered resin.

FOOTNOTES

1 Must be $\leq$1% of waste volume.

2 If the sample is qualified in less than 24 hours cure time note the total hours cured.

CLASS B AND C WASTE SOLIDIFICATION CALCULATION SHEET
for Used Precoat

Waste Volume to be Solidified[1]: _____ _____ (1)

$Ca(OH)_2$ Ratio; #/ft³: _____ (Item. 4 Data Sheet) (2)

Cement Ratio; #/ft³: _____ (Item 5, Data Sheet) (3)

Quantity of Water to be Added:

_____(1) x _____[2] gal/ft³ = _____gallons (4)

Quantity of Calcium Hydroxide ($Ca(OH)_2$) to be added:

$$\frac{\text{\_\_\_\_\_}}{\text{Waste Volume}}(1) \times \frac{\text{\_\_\_\_\_}}{\text{lb/ft}^3}(2) = \text{\_\_\_\_\_ lbs} \quad (5)$$

Quantity of Cement (Portland Type I) to be added:

$$\frac{\text{\_\_\_\_\_}}{\text{Waste Volume}}(1) \times \frac{\text{\_\_\_\_\_}}{\text{lb/ft}^3}(3) = \text{\_\_\_\_\_ lbs} \quad (6)$$

1 The volume of waste, either dewatered or decanted settled solids, to be solidified in a liner cannot exceed the maximum settled waste volume listed on the Class B Waste Solidification Data Table.

2 For decanted powdered resin, add 2.75 gallons of water per cubic foot of settled waste, and 3.12 gallons of water per cubic foot of dewatered waste.

CLASS B AND C WASTE SOLIDIFICATION DATA TABLE
for Used Precoat

	HN-600[1]	HN-200
Usable Liner Volume, ft^3	65	60
Max. Solidified Waste Vol. ft^3	65	60
Max. Settled Waste Vol., ft^3	36.5[2]	33.7[3]
Water Added at Max. Waste Volume: gallons		
Dewatered	114[4]	105
Decanted	100	93
$Ca(OH)_2$ Added	5	5
Cement Added at Max. Waste Vol.: Pounds	2787	2574
1 ft^3 bags	29.7	27.4
Max. Radiation Level R/hr Contact of Liner	100	800

FOOTNOTES:

1 Values shown for plain and grappable liner. Multiply all values by 0.922 for stackable or 0.893 for the stackable/grappable liners. See Footnote 4.

2 Based on 15 inches of settled powdered resin in the liner, 14 inches for stackable and stackable/grappable.

3 Based on 28 1/2 inches of settled powdered resin in the liner.

4 For dewatered powdered resin use 114 gallons of additional water for all sizes of HN-600 liners.

5 To be calculated for each solidification.

CLASS A UNSTABLE TEST SOLIDIFICATION DATA SHEET
for Bead Resin

Liner No.: _____

Sample No.: _____

Date: _____

I. SAMPLE PREPARATION (3.2.3)

Sample Volume, ml: _____ (1)

Sample pH: _____ Volume NaOH solution used to adjust pH, ml: _____ (2)

Quantity of Oil %: _____ (3)

Quantity of emulsifier (20% by volume of oil), ml: _____ (4)

Quantity of anti-foaming agent, ml: _____ (5)

Temperature at Solidification, °F: _____

Quantity of Cement Added: Cement Radio[1] (lbs/ft³ Waste)

Sample _____ gms Sample _____ (6)

Quantity of Additive Added: Additive Ratio[2] (lbs/ft³ Waste)

Sample _____ gms Sample _____ (7)

Product Acceptable: Sample A _____ Yes _____ No

Additional batches solidified based on this sample solidification:

Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date

II. SAMPLE INSPECTION

Test Solidifications Performed by: _____ _____
Date

Sample Contains "No Free Liquid": _____ _____
Verified By Date

FOOTNOTES:

1 The cement ratio is defined as the pounds of cement required to solidify one cubic foot of dewatered waste. The ratio in this PCP is 39.3 lbs/ft^3.

2 The additive ratio is defined as the pounds of additive required to solidify one cubic foot of dewatered waste. The ratio in this PCP is 3.93 lbs/ft^3.

CLASS A UNSTABLE SOLIDIFICATION CALCULATION SHEET
for Bead Resin

Waste Volume[1], ft^3: _____ (1)

Cement Ratio; lbs/ft^3: Sample _____ (2)
Item 6 Data Sheet

Additive: _____

Additive Ratio, lbs/ft^3: Sample _____ (3)
Item 7 Data Sheet

Cement Quantity[2]

_____ (1) x _____ (2) = _____ lbs. (4)
Waste Volume

Additive Quantity[2]

_____ (1) x _____ (3) = _____ lbs. (5)
Waste Volume

Quantity of Water to be Added in Gallons:

_____ (1) x 2.25 = _____ gallons (6)
Waste Volume

Quantities of additional additives that must be added to the liner are found by multiplying the volume of the additive used in the test solidification, in ml, by 0.0249 and then by the volume of waste to be solidified. Volumes of additional additives are taken from items 2, 4, and 5 on the Data Sheet.

_____ ml x 0.0249 x _____ (1) = _____ gallons[3]
Item 2, 4, or 5 Data Sheet

FOOTNOTES:

1 The quantity of dewatered waste to solidified in a single liner cannot exceed the maximum waste volume listed on the attached Solidification Data Tables.

2 (4) and (5) define the recommended quantity of cement and additive respectively that must be mixed with the waste to assure solidification.

3 Reduce the quantity of water in the liner by 1 ft^3 for every 10 gallons of additional additives.

SOLIDIFICATION DATA TABLES

BEAD RESIN

NOTE: For the Recommended Amount of Cement and Additive.

	HN-100 Series 1	HN-100 Series 2	Series 3	100S	HN-200	HN-600* S	HN-600* G	HN-600* S+G	HN-600* R
Usable Liner Volume (cu. ft.)	143.0	143.0	143.0	143.0	59.5	59.6	64.6	57.7	64.6
Max. Dewatered Waste Vol. (cu. ft.)	105.0	102.3	110.0	110.0	48.3	48.3	52.4	46.8	52.4
Max. Solidified Waste Vol. (cu. ft.)	129.5	126.2	143.0	143.0	59.5	59.6	64.6	57.7	64.6
Cement Added at Max. Waste Vol.									
Weight (lbs.)	4126.1	4020.8	4320.7	4320.7	1896.6	1899.6	2059.0	1839.0	2059.0
Volume (bags)	43.8	42.8	46.0	46.0	20.2	20.2	21.9	19.6	21.9
Anhydrous Sodium Metasilicate Added at Max. Waste Vol.									
Weight (lbs.)	412.6	402.1	432.1	432.1	189.6	190.0	205.9	183.9	205.9
Volume (bags)	4.1	4.0	4.3	4.3	1.9	1.9	2.1	1.8	2.1
Water Added to Max. Waste Vol. (Gallons)	236.2	230.2	247.3	247.3	108.6	108.8	117.9	105.3	117.9
Max. Radiation Level R/hr Contact	12	12	12	3	800	100	100	100	100

* S = HN-600 Stackable
G = HN-600 Grappable
S+G = HN-600 Stackable/Grappable
R = HN-600 Regular

CLASS A STABLE, CLASS B AND C TEST SOLIDIFICATION DATA SHEET
for Bead Resin

Liner No.: _____

Sample No.: _____

Date: _____

I. SAMPLE PREPARATION

Sample Volume, ml: _____ (1)

Initial pH: _____ Quantity of Oil[1] %: _____

Grams $Ca(OH)_2$ to raise pH to $\geq$11.5, gm: _____ (2)

Grams Portland Type I Cement added, gm: _____ (3)

Additional batches solidified based on this sample solidification:

Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date	Liner No.	Waste Vol.	Date

II. SAMPLE INSPECTION

Test Solidification Performed by: _____ _____
Verified By Date

Sample cured for 24 hours[2] at 120° ±5°F: _____ _____
Verified By Date

Sample Contains "No Free Liquid": _____ _____
Verified By Date

III. PARAMETERS FOR FULL SCALE SOLIDIFICATION

Quantity of $Ca(OH)_2$: _____(2) gm $Ca(OH)_2$ from above x 0.156 = _____lb $Ca(OH)_2$ per ft^3 dewatered resin. (4)

Quantity of Cement: _____(3) gm cement from above x 0.156 = _____lb Cement per ft^3 dewatered resin. (5)

FOOTNOTES:

1 Must be ≤1% of waste volume.

2 If the sample is qualified in less than 24 hours cure time, note the total hours cured.

CLASS A STABLE, CLASS B AND C WASTE SOLIDIFICATION CALCULATION SHEET
for Bead Resin

Volume dewatered resin to be solidified[1], ft^3: _____ (1)

$Ca(OH)_2$ Ratio, lbs/ft^3 _____ Item 4 Data Sheet (2)

Cement Ratio lbs/ft^3 _____ Item 5 Data Sheet (3)

Quantity of Water to be Added:

$$\frac{\text{(1)}}{\text{Waste Volume } (ft^3)} \times 4.4 \text{ gallons}/ft^3 = \text{\_\_\_\_\_ gallons} \quad (4)$$

Quantity of Calcium Hydroxide ($Ca(OH)_2$) to be added:

$$\frac{\text{(1)}}{\text{Waste Volume } (ft^3)} \times \frac{\text{\_\_\_\_\_ (2)}}{lb/ft^3} = \text{\_\_\_\_\_ lbs.} \quad (5)$$

Quantity of Cement (Portland Type I) to be added:

$$\frac{\text{(1)}}{\text{Waste Volume } (ft^3)} \times \frac{\text{\_\_\_\_\_ (3)}}{lb/ft^3} = \text{\_\_\_\_\_ lbs.} \quad (6)$$

1 The volume of dewatered bead resin to be solidified cannot exceed the maximum waste volume listed on the Class A Stable, Class B and C Test Solidification Data Sheet for Bead Resin.

CLASS A STABLE, CLASS B AND C WASTE

SOLIDIFICATION DATA TABLES
for Bead Resin

	HN-100 Series 1	HN-100 Series 2	HN-100 Series 3	HN-100S	HN-200	HN-600[1] S	HN-600[1] G	HN-600[1] S+G	HN-600[1] R
Usable Liner Volume (cu. ft.)	143.0	143.0	143.0	143.0	59.5	59.6	64.6	57.7	64.6
Max. Dewatered Waste Volume (cu. ft.)	61.5	59.9	77.9	77.9	32.4	32.5	35.2	31.4	35.2
Max. Solidified Waste Volume (cu. ft.)	112.8	109.9	143	143	59.5	59.6	64.6	57.7	64.6
$Ca(OH)_2$ added at Max. Waste Volume[2]									
Weight (lbs.)	172	168	218	218	91	91	99	88	99
Volume (bags)	3.4	3.4	4.4	4.4	1.8	1.8	2.8	1.8	2.0
Portland Type I Cement Added at Max. Waste Vol.[2]									
Weight (lbs.)	6273	6110	7945.8	7945.8	3304.8	3315	3590.4	3202.8	3590.4
Volume (bags)	66.7	65.0	84.5	84.5	35.2	35.3	38.2	34.1	38.2
Water Added to Max. Waste Vol. (Gallons)	271	264	343	343	143	143	155	138	155
Max. Rad. Level R/hr Contact	12	12	12	3	800	100	100	100	100

(1) S = HN-600 Stackable
G = HN-600 Grappable
S+G = HN-600 Stackable - Grappable
R = HN-600 Regular

Rec 5/7/84

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

April 30, 1984
5211-84-3155

TMI-1
Distribution
AI# 849261
Subject: LETTER
5211-84-3155

Assigned to: BAM, Mehler
Due Date: 7-15-84

Dist.	C	A
Long-Parsip.		
Hukill-Trl.122	✓	
R. Wilson-Parsip.		
Barton-Admin.		
Ballard-Trl.24	X	
Colitz-Trl.144		
Finfrock-Parsip.		
Giangi-Trl.67		
Heward-Parsip.	✓	
Kuehn-Srv.Bldg.	✓	
Kazanas-Parsip.	X	
Newton-Training		
Lacey-Parsip.		
Byrne-Admin.		
Troffer-Trl.196		
Nelson-Trl.145	✓	
Hurd-Trl.88	✓	
Baker-EOF Bldg.		
Ross-Srv.Bldg.	✓	
Croneberger-Unrsh		
Slear-Parsip.	X	
Thorpe-Parsip.		
Toole-Srv.Bldg.		
Fetmore-Parsip.	X	X
Walsh-Parsip.		
Hawkins-Trl.127		
Tedell-Admin.		
CARIRS	X	X
EDCC-Cherry Hill	X	X
CPUN Board Dir. Ray Hukn	✓	

REVIEWS:
LIC. J.G. Burgess
T.F.
OPS.
DIST. DATE: 5-18-84

TO ALL OPERATING REACTORS AND APPLICANTS FOR OPERATING LICENSES

Gentlemen:

SUBJECT: COMPLIANCE WITH 10 CFR PART 61 AND IMPLEMENTATION OF THE RADIOLOGICAL EFFLUENT TECHNICAL SPECIFICATIONS (RETS) AND ATTENDANT PROCESS CONTROL PROGRAM (PCP) (GENERIC LETTER 84-12)

This letter is to inform you that the waste manifest provisions of 10 CFR 20.311 became effective on December 27, 1983. The manifest system is closely related to certain requirements of 10 CFR Part 61 that place new requirements on classification and acceptable forms for low-level radioactive wastes being shipped from commercial nuclear power plants to commercial disposal facilities. The NRC staff has been made aware of the fact that neither the states nor the disposal facility operators currently have sufficient resources to assure that all incoming low-level radioactive waste is in compliance with these new regulations. [redacted] reasonable [redacted] provisions of [redacted].

During the development of Part 61, the NRC staff determined that compliance with the radioactive waste form requirements of Part 61 and the certification requirements of 10 CFR 20.311 could be achieved by the development and use of a Process Control Program (PCP) as an attendant part of the licensee's Radiological Effluent Technical Specifications (RETS). This approach was determined to be acceptable by the responsible state regulatory agencies that license the disposal sites. [redacted], however, that [redacted] has a PCP [redacted].

As an interim measure, the responsible state regulatory agencies and the disposal site operators have agreed to continue to accept nuclear power plant low-level radioactive wastes based upon the NRC staff's assurance [redacted] compliance [redacted] Part 61 and Part 20 [redacted] has been readily [redacted] NRC [redacted] RETS and the attendant PCPs. The NRC staff will assume a good-faith effort on the part of these licensees to modify in a timely fashion the PCPs to accommodate all new and applicable Part 61 and Part 20 requirements. [redacted] licensees which presently have approved PCPs to assure that they are upgraded [redacted]; however, the NRC staff cannot offer the same type of assurances for those operating plants which do not possess currently approved RETS and PCPs. Prompt action may be necessary if radioactive waste shipments from these plants are to continue without interruption.

The NRC staff will make every effort to avoid any interruption of low-level radioactive waste shipments by its licensees. We are prepared to expedite the implementation of NRC approved RETS and PCPs for all licensees who request assistance.

If you have any questions concerning this subject, please contact either W. Gammill or F. Congel via your Project Manager.

Darrell G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation