

QUAD CITIES STATION
RADIOACTIVE WASTE, ENVIRONMENTAL MONITORING AND
OCCUPATIONAL PERSONNEL RADIATION EXPOSURE

JANUARY THROUGH JUNE 1977

EXCERPTS

August 1977

1625 282

7912190 152

SUMMARY

Gaseous and liquid effluents for the period remained at a fraction of the Technical Specification limits. Calculations of environmental concentrations based on effluent, Mississippi River flow, and meteorological data for the period indicate that consumption by the public of radionuclides attributable to the plant will not exceed the quantity of those radionuclides that result from continuous exposure to the concentration values listed in Appendix B, Table II, of 10CFR20. Gamma radiation exposure from noble gases released to the atmosphere represented the critical pathway for the period with a maximum individual dose estimated to be 0.04 mrem for the six-month period, when a shielding and occupancy factor to two is assumed. Environmental monitoring results confirm that dose via other pathways was not significant.

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1.0 EFFLUENTS

1.1 GASEOUS EFFLUENTS TO THE ATMOSPHERE

Measured concentrations and isotopic composition of noble gases, radioiodine, and particulate radioactivity released to the atmosphere during the period January to June 1977, are listed in Table 1.1-1. A six-month total of $1.65 \text{ E}+04$ curies of noble gases was released during the period. Average release rates during either quarter of the period did not exceed 0.3% of the Technical Specification limit.

A total of 0.32 curies of I-131 and 1.18 curies of I-133 were released during the six-month period.

Six-month total of 0.28 curies of beta-gamma emitters and $1.1 \text{ E}-05$ curies of alpha emitters were released as airborne particulate matter.

1.2 LIQUIDS RELEASED TO MISSISSIPPI RIVER

A total of $7.2 \text{ E}+06$ liters of radioactive liquid wastes containing 1.03 curies (excluding tritium) were discharged from the station. These wastes were released at an average concentration of $3.23 \text{ E}-09$ Ci/ml which is 3.2% of the Technical Specification releases limit for unidentified radioactivity. During the same period, 14.7 curies of tritium and $5.3 \text{ E}-04$ curies of alpha radioactivity were released. Quarterly release estimates and principal radionuclides in liquid effluents are given in Table 1.2-1.

The maximum concentration of radioactivity, above background, in the Quad Cities Unit 1/2 discharge canal during the period was computed to be $4.09 \text{ E}-07$ $\mu\text{Ci/ml}$.

2.0 SOLID RADIOACTIVE WASTE

The total amount of solid waste packaged for disposal was cubic feet during the six-month period. The total amount of radioactivity involved was calculated to be $6.8 \text{ E}+03$ curies. Solid radioactive wastes were shipped to either Nuclear Engineering Company, Sheffield, Illinois, or Morehead, Kentucky, or Chemical Nuclear Services, Barnwell, So. Carolina. Date, volume and radioactivity of each shipment are shown in Table 2.0-1.

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TABLE 1.1-1

QUAD CITIES NUCLEAR POWER STATION

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter 1st	Quarter 2nd	Est. Total Error, %
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A. Fission & Activation Gases

1. Total release	Ci	1.31E+04	3.43E+03	
2. Average release rate for period	uCi/sec	1.68E+03	4.36E+02	
3. a. Percent of Tech. Spec. limit Chimney	%	1.57E-01	6.05E-02	
b. Percent of Tech. Spec. limit Stack	%	3.14E-01	<LDL	

B. Iodines

1. Total iodine-131	Ci	1.71E-01	1.53E-01	
2. Average release rate for period	uCi/sec	2.20E-02	1.94E-02	
3. a. Percent of Tech. Spec. limit station	%	1.24E+00	1.44E+00	

C. Particulates

1. Particulates with half-lives > 8 days	Ci	1.24E-01	1.65E-01	
2. Average release rate for period	uCi/sec	1.59E-02	2.12E-02	
3. Gross alpha radioactivity		1.47E-06	9.57E-06	

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TABLE 1.1-1 (Cont'd)

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

GASEOUS EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter 1st	Quarter 2nd	Est. Total Error, %
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D. Tritium

1. Total release	Ci	9.65E+00	1.56E+01	
2. Average release rate for period	uCi/sec	1.23E+00	2.01E+00	

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TABLE 1.1-1 (Cont'd)

QUAD CITIES NUCLEAR POWER STATION

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

GASEOUS EFFLUENTS- Elevated Release

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter 1st	Quarter 2nd	Quarter	Quarter

1. Fission gases

Kr-85	CI	< LDL	< LDL		
Kr-85m	CI	5.61E+02	2.18E+02		
Kr-87	CI	2.10E+01	1.97E+01		
Kr-88	CI	5.36E+02	2.64E+02		
Xe-133	CI	4.67E+03	1.31E+03		
Xe-135	CI	7.28E+03	1.61E+03		
Xe-135m	CI	< LDL	< LDL		
Xe-138	CI	< LDL	< LDL		
Kr83m	CI	< LDL	< LDL		
	CI				
Unidentified	CI	< LDL	< LDL		
Total for Period	CI	1.31E+04	3.43E+03		

2. Iodines

I-131	CI	1.43E-01	1.16E-01		
I-133	CI	5.07E-01	5.67E-01		
I-135	CI	1.25E-01	3.33E-01		
Total for Period	CI	7.75E-01	1.02E+00		

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TABLE 1.1-1 (Cont'd)

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

GASEOUS EFFLUENTS- Elevated Release

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter 1st	Quarter 2nd	Quarter	Quarter

3. Particulates

Sr-89	ci	1.09E-02			
Sr-90	ci	4.82E-05			
Cs-134	ci	2.01E-04	5.21E-04		
Cs-137	ci	5.58E-04	1.38E-03		
Ba-140	ci	9.99E-03	1.63E-02		
La-140	ci	1.34E-02	1.02E-02		
Mn54	ci	2.40E-06	< LDL		
Co60	ci	3.88E-04	1.20E-03		
I131	ci	8.47E-03	< LDL		
Ce141	ci	2.04E-04	2.43E-04		
	ci	< LDL	4.38E-05		
	ci				
	ci				
	ci				
	ci				
	ci				
	ci				
	ci				
Unidentified	ci	6.89E-02			

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TABLE 1.1-1 (Cont'd)

QUAD CITIES NUCLEAR POWER STATION

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

GASEOUS EFFLUENTS- Ground Level Release

Continuous Mode

Batch Mode

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter 1st	Quarter 2nd	Quarter	Quarter

1. Fission gases

Kr-85	ci	<LDL	<LDL		
Kr-85m	ci	3.47E-01	<LDL		
Kr-87	ci	4.00E-03	<LDL		
Kr-88	ci	3.67E-01	<LDL		
Xe-133	ci	3.41E+00	<LDL		
Xe-135	ci	2.84E+00	<LDL		
Xe-135m	ci	<LDL	<LDL		
Xe-138	ci	<LDL	<LDL		
	ci				
	ci				
Unidentified	ci	<LDL	<LDL		
Total for Period	ci	6.97E+00	<LDL		

2. Iodines

I-131	ci	2.80E-02	3.66E-02		
I-133	ci	5.87E-02	5.70E-02		
I-135	ci	2.26E-02	2.01E-02		
Total for Period	ci	1.09E-01	1.14E-01		

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TABLE 1.1-1 (Cont'd)

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

GASEOUS EFFLUENTS- Ground Level Release

Nuclides Released	Unit	Continuous Mode		Batch Mode	
		Quarter 1st	Quarter 2nd	Quarter	Quarter

3. Particulates

Sr-89	ci	8.40E-04			
Sr-90	ci	2.31E-05			
Cs-134	ci	3.56E-04	5.25E-04		
Cs-137	ci	5.03E-04	8.04E-04		
Ba-140	ci	1.35E-03	1.19E-03		
La-140	ci	1.54E-03	2.85E-03		
Cr51	ci	5.66E-04	2.34E-03		
Mn54	ci	2.40E-05	6.32E-05		
Co58	ci	4.25E-06	5.26E-05		
Co60	ci	4.53E-04	1.10E-03		
I131	ci	3.71E-03	2.54E-03		
Ag110m	ci	1.75E-05	< LDL		
Zn65	ci	< LDL	5.16E-05		
Cs136	ci	< LDL	6.80E-05		
Zr95	ci	< LDL	3.12E-05		
Nb95	ci	< LDL	8.42E-05		
	ci				
Unidentified	ci	1.81E-03			

TABLE 1.2-1

QUAD CITIES NUCLEAR POWER STATION

EFFLUENT AND WASTE DISPOSAL SEMI-ANNUAL REPORT 1977

LIQUID EFFLUENTS-SUMMATION OF ALL RELEASES

	Unit	Quarter 1st	Quarter 2nd	Est. Total Error, %
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A. Fission and Activation Products

1. Total release (not including tritium, gases, alpha)	CI	6.19E-01	4.20E-01	
2. Average diluted concentration during period	uCi/ml	4.04E-09	2.43E-09	
3. Percent of applicable limit	%	4.04E+00	2.43E+00	
4. Maximum diluted concentration during period	uCi/ml	4.09E-07	7.17E-08	

B. Tritium

1. Total release	CI	9.24E+00	5.5E+00	
2. Average diluted concentration during period	uCi/ml	6.04E-08	3.2E-08	
3. Percent of applicable limit	%	2.01E-03	1.07E-03	

C. Dissolved and Entrained Gases

1. Total release	CI	< LDL	< LDL	
2. Average diluted concentration during period	uCi/ml	< LDL	< LDL	
3. Percent of applicable limit	%	N/A	N/A	

D. Gross Alpha Radioactivity

1. Total release	CI	1.45E-04	3.86E-04	
2. Average concentration released	uCi/ml	9.50E-13	2.25E-12	

E. Volume of waste released (prior to dilution)	Liters	4.26E+06	2.97E+06	
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F. Volume of dilution water used during period	Liters	1.53E+11	1.72E+11	
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QUAD CITIES NUCLEAR POWER STATION

EFFLUENT AND WASTE DISPOSAL SEMIANNUAL REPORT 1977

LIQUID EFFLUENTS

	Unit	Continuous Mode		Batch Mode	
		Quarter	Quarter	Quarter 1st	Quarter 2nd
Sr-89	Ci			2.98E-03	
Sr-90	Ci			3.15E-04	
Sr-134	Ci			5.35E-02	5.40E-02
Cs-137	Ci			1.74E-01	8.68E-02
I-131	Ci			7.85E-02	9.83E-04
Co-58	Ci			1.06E-03	1.49E-03
Co-60	Ci			6.96E-02	6.93E-02
Fe-59	Ci			< LDL	< LDL
Zn-65	Ci			3.35E-05	< LDL
Mn-54	Ci			1.44E-03	2.50E-03
Cr-51	Ci			2.57E-03	2.85E-04
Zr-95	Ci			< LDL	7.45E-05
Nb-95	Ci			< LDL	7.45E-05
Mo-99	Ci			< LDL	< LDL
Aq110m	Ci			7.63E-05	< LDL
Ba-140	Ci			< LDL	< LDL
Cs136	Ci			2.78E-05	< LDL
La-140	Ci			1.69E-02	< LDL
Mn 56	Ci			< LDL	3.33E-04
Unidentified	Ci			1.91E-01	
Total for Period (above)	Ci			4.27E-01	
Xe-133	Ci			< LDL	< LDL
Xe-135	Ci			< LDL	< LDL

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TABLE 2.0-1

SOLID RADIOACTIVE WASTE SUMMARY
 UNITS 1/2
 QUAD-CITIES STATION

Date	Disposition of Material		Volume (ft ³)	Curies	Date	Disposition of Material		Volume (ft ³)	Curies
	Co. Trans.	Burial Site	Per Shipment	Per Shipment		Co. Trans.	Burial Site	Per Shipment	Per Shipment
1/03	CN	Sheffield, IL	44.1	10.10	2/02	CN	Sheffield, IL	44.1	4.68
1/03	HN	"	102.9	7.00	2/02	HN	"	384.0	0.01
1/04	CN	"	44.1	10.44	2/02	HN	"	514.5	0.31
1/04	CN	"	44.1	8.35	2/02	HN	"	147.0	0.02
1/04	HN	"	102.9	3.73	2/03	HN	"	132.3	2.26
1/05	HN	"	102.9	4.58	2/07	HN	"	51.45	6.82
1/06	CN	"	44.1	5.35	2/07	HN	"	106.65	12.14
1/10	HN	"	102.9	2.66	2/09	HN	"	102.9	3.20
1/10	CN	"	44.1	10.35	2/10	CN	"	44.1	3.61
1/11	HN	"	688.35	0.14	2/10	HN	"	73.5	7.72
1/12	HN	"	102.9	7.53	2/11	HN	"	102.9	4.65
1/13	CN	"	44.1	8.77	2/14	HN	"	51.45	2.61
1/13	CN	"	44.1	10.10	2/14	CN	"	44.1	22.04
1/14	CN	"	44.1	9.85	2/16	HN	"	102.9	10.10
1/17	HN	"	102.9	3.24	2/16	CN	"	44.1	4.68
1/18	CN	"	44.1	5.08	2/17	CN	"	44.1	15.20
1/19	CN	"	44.1	8.68	2/18	HN	"	433.65	0.50
1/20	CN	"	44.1	10.02	2/18	HN	"	102.9	5.18
1/20	HN	"	95.5	4.26	2/21	HN	"	102.9	5.08
1/21	CN	"	44.1	6.35	2/22	HN	"	102.9	3.79
1/21	CN	"	44.1	9.52	2/23	HN	"	88.2	3.36
1/24	HN	"	132.3	3.57	2/23	HN	"	102.9	4.93
1/26	HN	"	132.3	3.89	2/24	HN	"	51.45	4.68
1/26	CN	"	44.1	4.76	2/24	HN	"	102.9	10.37
1/28	HN	"	132.3	3.78	2/24	CN	"	44.1	5.34
1/31	HN	"	102.9	4.76	2/25	CN	"	44.1	8.77
					2/28	CN	"	44.1	1.82
					2/28	CN	"	44.1	7.01
					2/28	HN	"	102.9	7.56
			2,498.45ft ³	165.93ft ³				3,357.15ft ³	168.4ft ³
			per month	per month				per month	per month

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Hittman Nuclear and Development
 Co. for burial at Nuclear Engr'g
 Co., Inc.

CN-Chemical Nuclear Co. for
 Burial at Nuclear Engr'g
 Co., Inc.

TABLE 2.0-1 (Cont'd)

SOLID RADIOACTIVE WASTE SUMMARY

UNITS 1/2

QUAD-CITIES STATION

Date	Disposition of Material		Volume (ft ³) Per Shipment	Curies Per Shipment	Date	Disposition of Material		Volume (ft ³) Per Shipment	Curies Per Shipment
	Co. Trans.	Burial Site				Co. Trans.	Burial Site		
3/01	CN	Sheffield, IL	44.1	3.4	3/15	CN	Sheffield, IL	44.1	7.68
3/01	CN	"	44.1	5.00	3/16	HN	"	105.0	8.50
3/02	HN	"	102.9	5.63	3/17	CN	"	44.1	2.42
3/02	CN	"	44.1	2.74	3/17	HN	"	105.0	13.36
3/02	CN	"	44.1	12.54	3/18	HN	"	102.9	6.85
3/03	HN	"	102.9	3.41	3/18	CN	"	44.1	3.01
3/03	HN	"	102.9	4.33	3/21	HN	Maxey Flats, KY	102.9	7.33
3/04	CN	"	44.1	6.86	3/22	HN	Sheffield, IL	105.0	5.56
3/05	HN	"	102.9	5.01	3/22	CN	"	195.0	0.01
3/06	HN	"	102.9	13.78	3/23	HN	"	617.4	0.08
3/07	HN	"	102.9	7.87	3/24	HN	"	105.0	4.36
3/07	HN	"	102.9	21.47	3/24	HN	"	105.0	8.85
3/08	CN	"	44.1	14.38	3/28	HN	"	105.0	5.50
3/08	CN	"	44.1	11.52	3/29	CN	"	150.0	48.80
3/08	HN	"	102.9	10.69	3/29	CN	"	44.1	2.19
3/09	CN	"	44.1	2.02	3/29	CN	"	195.0	15.85
3/09	HN	"	102.9	3.45	3/30	CN	"	150.0	14.00
3/10	CN	"	44.1	5.02	3/30	HN	"	105.0	3.39
3/10	HN	"	102.9	10.07	3/31	HN	"	100.8	6.18
3/10	HN	"	102.9	9.02	3/31	CN	Barnwell, SC	195.0	67.00
3/11	HN	"	617.4	4.36					
3/11	HN	"	617.4	0.17					
3/12	HN	"	102.9	5.58				5,532.3ft ³	432.60ft ³
3/14	HN	"	102.9	7.40				per month	per month
3/14	HN	"	102.9	6.74					
3/14	CN	"	44.1	3.84					
3/15	HN	"	105.0	8.75					
3/15	HN	"	105.0	6.56					

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HN-Hittman Nuclear and Development Co. for burial at Nuclear Engr'g Co., Inc.
 CN-Chemical Nuclear Co. for Burial at Nuclear Engr'g Co., Inc.

TABLE 2.0-1 (Cont'd)
 SOLID RADIOACTIVE WASTE SUMMARY
 UNITS 1/2
 QUAD-CITIES STATION

Date	Disposition of Material		Volume (ft ³) Per Shipment	Curies Per Shipment	Date	Disposition of Material		Volume (ft ³) Per Shipment	Curies Per Shipment
	Co. Trans.	Burial Site				Co. Trans.	Burial Site		
4/01	CN	Sheffield, IL	150.0	15.00	5/02	CN	Barnwell, SC	195.0	289.95
4/01	CN	"	150.0	10.70	5/03	HN	Sheffield, IL	52.5	8.06
4/01	CN	Barnwell, SC	85.0	6.00	5/03	HN	"	105.0	9.49
4/04	HN	Sheffield, IL	105.0	3.70	5/04	HN	"	105.0	5.85
4/05	CN	"	195.0	73.51	5/05	HN	"	82.5	19.54
4/05	HN	"	90.0	3.59	5/06	CN	"	195.0	90.54
4/06	HN	"	90.0	4.04	5/06	CN	Barnwell, SC	85.0	332.50
4/07	HN	"	105.0	6.35	5/09	HN	Sheffield, IL	105.0	13.61
4/08	HN	"	630.0	0.30	5/10	HN	"	105.0	13.89
4/11	HN	"	105.0	7.75	5/10	CN	Barnwell SC	195.0	220.53
4/11	CN	"	150.0	47.48	5/11	CN	"	195.0	169.77
4/12	CN	"	45.0	3.34	5/11	HN	Sheffield, IL	105.0	9.94
4/12	HN	"	88.2	4.89	5/11	HN	"	585.0	0.10
4/13	HN	"	105.0	8.18	5/12	HN	"	105.0	19.12
4/12	CN	Barnwell, SC	142.0	12.00	5/13	CN	"	85.0	18.34
4/14	HN	Sheffield, IL	105.0	7.50	5/15	HN	"	52.5	20.27
4/14	CN	"	150.0	23.74	5/16	HN	"	52.5	14.53
4/14	CN	Barnwell, SC	195.0	147.02	5/16	HN	"	63.0	6.71
4/15	HN	Sheffield, IL	103.5	4.42	5/18	HN	"	1,155.0	0.13
4/18	CN	"	195.0	141.48	5/20	HN	"	360.0	0.14
4/18	HN	"	105.0	1.61				3,983.0ft ³	1262.00ft ³
4/19	HN	"	105.0	3.92				per month	per month
4/20	CN	"	150.0	4.58					
4/21	HN	"	105.0	7.21					
4/21	CN	Barnwell, SC	85.0	2390.00					
4/22	HN	Sheffield, IL	532.5	0.10					
4/22	HN	"	90.0	8.18					
4/25	HN	"	97.2	4.09					
4/25	HN	"	97.5	2.25					
4/27	HN	"	90.0	2.26					
4/27	HN	"	60.0	12.70					
4/27	CN	"	150.0	76.40					
4/28	CN	"	150.0	114.60					
4/28	HN	"	308.0	0.06					
4/28	CN	Barnwell, SC	85.0	380.00					
4/29	CN	Sheffield, IL	82.5	19.88					
4/30	CN	Barnwell, SC	150.0	59.35					
			5,426.4ft ³	4,306ft ³					
			per month	per month					

HN- Hittman Nuclear and Development
 Co. for burial at Nuclear Engr'g Co., Inc.

CN- Chemical Nuclear Co. for
 burial at Nuclear Engr'g Co., Inc.

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TABLE 2.0-1 (Cont'd)
 SOLID RADIOACTIVE WASTE SUMMARY
 UNITS 1/2
 QUAD-CITIES STATION

Date	Disposition of Material		Volume (ft ³) Per Shipment	Curies Per Shipment	Date	Disposition of Material		Volume (ft ³) Per Shipment	Curies Per Shipment
	Co. Trans.	Burial Site				Co. Trans.	Burial Site		
6/01	CN	Sheffield, IL	45.0	2.83	6/20	HN	Sheffield, IL	105.0	7.86
6/01	HN	"	52.5	10.35	6/21	CN	"	45.0	4.31
6/02	CN	"	195.0	84.89	6/22	HN	"	495.0	0.13
6/02	CN	"	195.0	90.54	6/23	CN	"	45.0	3.42
6/02	HN	"	105.0	6.19	6/23	HN	"	105.0	13.03
6/05	CN	"	195.0	79.23	6/24	CN	"	45.0	6.51
6/06	HN	"	1080.0	0.003	6/24	HN	"	102.9	6.38
6/06	CN	"	195.0	45.27	6/27	CN	"	45.0	8.02
6/07	HN	"	120.0	5.01	6/27	HN	"	105.0	6.44
6/08	HN	"	120.0	5.45	6/27	CN	"	45.0	9.02
6/10	HN	"	82.5	17.74	6/28	HN	"	645.0	0.20
6/13	HN	"	120.0	2.62	6/29	HN	"	102.9	16.63
6/14	CN	"	45.0	3.01	6/30	CN	"	45.0	5.59
6/15	CN	"	45.0	2.35	6/30	HN	"	102.9	13.45
6/15	CN	"	45.0	2.19				5,079.0ft ³	478.00ft ³
6/15	HN	"	105.0	2.86				per month	per month
6/16	HN	"	105.0	7.47					
6/16	CN	"	45.0	2.59					
6/17	HN	"	105.0	3.94					
6/17	CN	"	45.0	3.27					

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HN - Hitman Nuclear and Development Co.
 for burial at
 Nuclear Engr'g Co., Inc.

CN - Chemical Nuclear Co.
 for burial at
 Nuclear Engr'g Co., Inc.