CCN NO. 038386

COM. TYPE 1 / D / B

ADVANCED TECHNOLOGY DIVISION
COMMUNICATION DISTRIBUTION
FUSRAP PROJECT

COM. REF. NO. ______

COM. DATE 3-28 PROCESS DATE 7-15-86

FROM D. McCracken TO J. Feldman

SUBJECT Hazardous Waste Site Rating Sheets for sites in NY and NJ

FILE NO. 040 WBS 115-39-103-123-129-118-K AFF. DOC. NO. ______

DISTRIBUTION

		W/A	W/O			W/A	W/O
PROJECT DIRECTOR	PD		\	PROJECT MANAGER: T. Beer	PM	\	
DEPUTY PROJECT DIRECTOR	DP			LEAD ENGINEER: J. Grindstaff			
				Health Physics: C. Hickey			
PROJECT ENGINEER	PE			Cost/Sch. Eng.: D. Sherwood			
ENVIRON. HEALTH & SAFETY	EH	\					
Environment/Permits	EH			115/202 Niagara Falls Sites			
Health Physics	EH			201/401 Weldon Spring Site			
Industrial Safety	EH			134 SLAPSS Site			
Industrial Hygiene	EH			140 Hazelwood Site			
Operations	EH			133 SLAPSS Disp. Site			
Eberline Analytical Corp.	EH						
				PROJECT MANAGER: C. Crotwell	PM	\	
PROCUREMENT	PO			LEAD ENGINEER: J. McConnell			
Cohose Petelos				Health Physics: C. Leichtweis			
FIELD CONSTRUCTION	FC			Cost/Sch. Eng.: E. Rudolph			
PROJECT CONTROLS	PC			Kennard		\	
PROJECT QUALITY ASSUR.	QA			117/118 Middlesex Sites			
PROJECT ADMINISTRATION	PA			137 Wayne Site			
PUBLIC RELATIONS	PR			138 Maywood Site			
TECHNICAL REPORTS	TR			139 Colonie Site			
LIBRARY	L			136 N. J. Disp. Site			
ACCOUNTING	A						
PDCC	DC	orig					

PLEASE RETURN TO PDCC FOR CORRECTIONS

200-1e

NFSS_01.06_0432_a

038886

MAY 28 198█

CONCURRENCES
RTG SYMBOL CE-53
INITIALS/SIG. McCracker
DATE 5/28
RTG SYMBOL
INITIALS/SIG.
DATE
RTG SYMBOL
INITIALS/SIG.
DATE
RTG SYMBOL
INITIALS/SIG.
DATE
RTG SYMBOL
INITIALS/SIG.
DATE
RTG SYMBOL
INITIALS/SIG.
DATE
RTG SYMBOL
INITIALS/SIG.
DATE
RTG SYMBOL
INITIALS/SIG.
DATE

Ms. Joyce Feldman
U.S. Environmental Protection Agency
26 Federal Plaza Room 737
New York, New York 10278

Dear Ms. Feldman:

HAZARDOUS WASTE SITE RATING SHEETS FOR SITES IN NEW YORK AND NEW JERSEY

Enclosed you will find the DOE prepared Hazard Ranking System rating sheets for the Niagara Falls Storage Site, Lewiston, New York, and the former NL Industries plant in Colonie, New York. I have requested from DOE-HQ the rating sheets for sites in Tonowanda, New York (Seaway Industrial Park, Ashland Oil I and II, and Linde Air Products Division) and for the Middlesex Sampling Plant in New Jersey. These will be sent to you as soon as they are available.

As soon as you would like to meet and discuss this information please give me a call.

Sincerely,
ORIGINAL SIGNED BY
STEPHEN H. McCRACKEN

Stephen H. McCracken
Site Manager
Technical Services Division

CE-53:McCracken

Enclosure:
As stated

cc: G. Turi, NE-23, GTN

CE-53:SHMcCracken:db:6-4403:5/27/86
Memorywriter 092/feldman

DOE F 1325.10
(7-79)

OFFICIAL FILE COPY

~~L Comptitt~~ LFC
W I ~~n~~ 038386
~~Gwan~~

Department of Energy
Washington, D.C. 20545

MAR 18 1985

Mr. William J. Librizzi, Director
Emergency and Remedial Response Division
U.S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, New York 10278

Dear Mr. Librizzi:

This is to follow up on my February 11, 1985, letter providing information that you requested on the Department of Energy (DOE) sites that are part of the FUSRAP and SFMP. Enclosure 1 is our Hazard Ranking System rating sheets for the Niagara Falls Storage Site, Lewiston, New York. The site has been rated for two conditions: (1) current site conditions, and (2) site conditions that will exist following completion of the interim remedial actions (1985). In addition, the site has also been rated (Enclosure 2) for these two conditions using the Modified Hazard Ranking System, which explicitly accounts for radioactive material as well as nonradioactive hazardous wastes. A description of the Modified Hazard Ranking System was included with my previous correspondence.

We have also compiled a list of reports that provide the information which would be included in a Remedial Investigations Report. Enclosure 3 shows the Remedial Investigations Report table of content by section and reports on the Niagara Falls Storage Site that contain applicable information. The reports that can be obtained from the Remedial Action Program Information Center, Oak Ridge National Laboratory, Building 2001, P.O. Box X, Oak Ridge, Tennessee 37830, are marked with an asterisk. We will provide the other referenced documents upon request.

We are meeting with the Environmental Impacts Branch to discuss comments on the draft Environmental Impact Statement for Long-Term Management of the Wastes and Residues at the Niagara Falls Storage Site on March 25 and would be available to answer any questions that you might have on the enclosed information. I hope that this information is useful to you, and if you have any questions please call Mr. Edward DeLaney (FTS 233-4716 or 301-353-4717).

NE-24
DeLaney
3/15/85
NE-24
Baublitz
3/17/85

Sincerely,

/s/

John E. Baublitz, Director
Division of Remedial Action Projects
Office of Terminal Waste Disposal
and Remedial Action
Office of Nuclear Energy

3 Enclosures

cc:
S. Williams, EPQ/HQ

bcc: W. Voigt, NE-20
T. Frangos, PE-243
L. Campbell, OR
C. Miller, RL
P. Merry-Libby, ANL
Aerospace
J. Baublitz
NE-73 (4)
NE-24
Turi

NE-24:GTuri:ph:353-2765:3/15/85:IBM:73/6:2.32.1.4
IBM:73/24 (Encl. 3)

Enclosure 1

038386

EPA HAZARDOUS WASTE SITE RANKING SYSTEM CALCULATIONS FOR THE NIAGARA FALLS STORAGE SITE (NFSS)

Location: Lewiston, New York
EPA Region II
Reviewer: B. Fritz
Date: 3-4-85
Facility Description: Facility is part of a former Manhattan Engineer District (MED) site, which in turn was part of the former Lake Ontario Ordnance Works. Beginning in 1944, MED used the site for the storage of radioactive residues resulting from processing of uranium ore (primarily at Linde Air Products, Town of Tonawanda, New York, and Mallinckrodt Chemical Co., St. Louis, Missouri), contaminated scrap and rubble from decommissioning activities, biological and miscellaneous wastes from the University of Rochester, and low-level fission product waste from Knolls Atomic Power Laboratory. The primary waste constituents of concern are radium and uranium. Site is being cleaned up under the Department of Energy's Surplus Facilities Management Program. Interim remedial actions consist of consolidation of all wastes (residues plus contaminated soil from vicinity properties being decontaminated under the Formerly Utilized Sites Remedial Action Program) into a single pile on the southwest portion of the site. The pile is surrounded by a dike and underlain by a clay liner. Upon completion of the remedial actions, expected to be late 1985, the pile will be covered with layers of clay, sand, and soil. Final disposition of the material awaits completion of the NEPA process. Primary exposure pathway is groundwater route.

Scores:

Current site conditions:

S_M=8.17 (S_{gw}=13.97 S_{sw}=2.18 S_a=0)

S_{FE}= N/A

S_{DC}= N/A

Site conditions following completion of interim remedial actions:

S_M=4.04 (S_{gw}=6.98 S_{sw}=0 S_a=0)

S_{FE}= N/A

S_{DC}= N/A

038386

Ground Water Route Work Sheet - Current Site Conditions

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 (3)	2	6	6	
Net Precipitation	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 (2) 3	1	2	3	
Physical State	0 (1) 2 3	1	1	3	
	Total Route Characteristics Score		11	15	
3 Containment	0 1 (2) 3	1	2	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
	Total Waste Characteristics Score		26	26	
5 Targets					3.5
Ground Water Use	0 1 (2) 3	3	6	9	
Distance to Nearest Well/Population Served	0 4 6 (8) 10 / 12 16 18 20 / 24 30 32 35 40	1	8	40	
	Total Targets Score		14	49	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			8,008	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} = 13.97		

GROUND WATER ROUTE WORK SHEET

038386

Ground Water Route Work Sheet – Site Conditions After Interim Remedial Actions					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	0 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 (3)	2	6	6	
Net Precipitation	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 (2) 3	1	2	3	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			11	15	
3 Containment	0 (1) 2 3	1	1	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					3.5
Ground Water Use	0 1 (2) 3	3	6	9	
Distance to Nearest Well/Population Served	0 4 6 (8) 10 / 12 16 18 20 / 24 30 32 35 40	1	8	40	
Total Targets Score			14	49	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			4,004	57,330	
7 Divide line 6 by 57,330 and multiply by 100		S_{gw} = 6.98			

GROUND WATER ROUTE WORK SHEET

Groundwater Route Work Sheet

1. No observed release (all average concentrations are within permitted levels (ref. 1, p. 10).

2. a. Knowledge regarding the fluctuation of groundwater levels throughout the year is limited. Saturated conditions prevail during Spring snowmelt. The site is poorly drained and experiences ponding during snowmelt and periods of heavy precipitation. This suggests that zero depth to groundwater should be assumed during some periods of the year. Furthermore, there is a significant water-bearing zone at a depth of 10-12 feet and wells drilled into it have sufficient yields for limited uses (ref. 2, pp. 3-5,6, 4-60).

b. Annual rainfall is approximately 33 in. Evaporation is approximately 27 in/yr (ref. 3). Therefore, the net precipitation is about 6 in/yr.

c. Upper soil column consists of layers of silt mixed with sand and gravel, and layers of clay mixed with silt, sand, and gravel (ref. 2). The assigned value of 2 is assumed to be conservative.

d. The contamination of concern is unconsolidated solid material, i.e., soil.

3. The current situation, scored on the first of the two worksheets, is an uncovered pile of unstabilized waste with a moderately permeable liner (the thickness of the clay layer is variable and it is not known whether it is continuous underneath the entire pile) and no leachate collection system. The pile is surrounded by a clay dike. By the end of 1985, the pile will be covered with an interim cap consisting of clay (3 ft), sand (0.5 ft), and soil (1.5 ft). If a decision is made to used the site for permanent disposal of the waste, a more elaborate cap will be constructed. This situation is not identical to any of those listed in Table 3 of the EPA User's Manual (ref. 3). The closest scenario in Table 3 is the second entry under part C: pile uncovered, waste unstabilized, moderately permeable liner, and leachate collection system. The cover on the NFSS pile is assumed to compensate for the lack of a leachate collection system, and the value corresponding to this case is scored on the second worksheet.

4. a. Radium and uranium receive rankings of 3 for toxicity because of their carcinogenic potential and 3 for persistence because of their long half-lives.

b. The total waste volume is estimated at 250,000 yd^3, including about 15,000 yd^3 of residues and about 180,000 yd^3 of contaminated soil and rubble (ref. 2).

5. a. The Lockport Dolomite, the only aquifer in the area used for drinking water supply to a significant degree, is absent north of the Niagara escarpment and, hence, absent at NFSS. Wells in both the upper soil aquifer and the bedrock aquifer at and near the site have relatively low yields that are nonetheless sufficient for limited uses. However, the groundwater is of low quality (ref. 2, pp. 3-5 through 3-7). No well surveys of the region are available. It is possible that a small number of residential wells exist and are used to supply drinking water. Therefore, in order to be conservative, this analysis uses a score of 2 for this factor. Alternate unthreatened sources of drinking water are available.

b. Most of the property in the area of NFSS is used for industrial purposes. The nearest residence is 0.7 miles southwest of the site. It is assumed that this house is served by a well and that the total number of people drinking groundwater at all locations within four miles of the site does not exceed 100.

038386

Surface Water Route Work Sheet – Current Site Conditions					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment	0 (1) 2 3	1	1	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	(0) 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			1,404	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{sw} = 2.18		

SURFACE WATER ROUTE WORK SHEET

Surface Water Route Work Sheet - Site Conditions After Interim Remedial Actions

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment	(0) 1 2 3	1	0	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	(0) 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			0	64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} = 0				

SURFACE WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

1. No observed release (all average concentrations are within permitted levels (ref. 1, p. 10).

2. a. The facility is a closed basin, i.e., the waste pile is surrounded by a dike.

b. The 1-yr, 24-hr rainfall is approximately 2.1 inches (ref. 3, p. 33).

c. Drainage from the site enters Fourmile Creek 2.75 miles from the site boundary via the central drainage ditch which runs through the site and within 1000 ft of the waste pile.

d. The contamination of concern is unconsolidated solid material, i.e., soil.

3. The current mode of waste storage is not identical to any of the scenarios listed in Table 9 of the EPA User's Manual (ref. 3). The pile is uncovered, but surrounded by a sound containment dike. This seems closest to the second situation under part C of the table: piles covered, wastes unconsolidated, diversion or containment system not adequate. It is assumed that the adequate diking compensates for the pile not being covered. The score corresponding to this case is reflected on the first worksheet.

After the interim remedial actions are completed, the first case under part C of the table will apply: pile covered and surrounded by sound diversion or containment system. The score corresponding to this case is reflected on the second worksheet.

4. a. Radium and uranium receive rankings of 3 for toxicity because of their carcinogenic potential and 3 for persistence because of their long half-lives.

b. The total waste volume is estimated at 250,000 yd^3, including about 15,000 yd^3 of residues and about 180,000 yd^3 of contaminated soil and rubble (ref. 2).

5. a. Fourmile Creek is used for boating and fishing (ref. 2).

b. No wetlands or endangered species habitat is affected by runoff from the site.

c. There are no intakes for drinking water supply within 3 stream-miles of the site boundary.

Air Route Work Sheet						
Rating Factor	**Assigned Value (Circle One)**		**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
1 Observed Release	(0)	45	1	0	45	5.1

Date and Location: *Monthly during 1983 at 34 locations on-site and at site boundary*

Sampling Protocol: *Terradex Type-F Track-Etch detectors*

If line 1 is 0, the S_a = 0. Enter on line 5.
If line 1 is 45, then proceed to line 2.

Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
2 Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
3 Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
Total Targets Score				39	
4 Multiply 1 x 2 x 3			0	35,100	
5 Divide line 4 by 35,100 and multiply by 100			S_a = 0		

AIR ROUTE WORK SHEET

Air Route Sheet

1. No observed release (all average ^{222}Rn concentrations are within permitted levels (ref. 1, p. 10).

	S	S^2
Groundwater Route Score (S_{gw})	13.97	195.11
Surface Water Route Score (S_{sw})	2.18	4.76
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		199.87
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		14.14
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}\,/1.73 = S_M =$		8.17

WORKSHEET FOR COMPUTING S_M

Current Site Conditions

038386

	S	S^2
Groundwater Route Score (S_{gw})	6.98	48.78
Surface Water Route Score (S_{sw})	0	0
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		48.78
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		6.98
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		4.04

WORKSHEET FOR COMPUTING S_M

Site Conditions Following Completion
of Interim Remedial Actions

References

038336

1. Bechtel National, Inc. 1984. Niagara Falls Storage Site Environmental Monitoring Report, Calendar Year 1983. DOE/OR/20722-18, July 1984.

2. U.S. Department of Energy. 1984. Draft Environmental Impact Statement, Long-Term Management of the Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site. DOE/EIS-0109D, August 1984.

3. U.S. Environmental Protection Agency. 1984. Uncontrolled Hazardous Waste Site Ranking System, A Users Manual.

ENCLOSURE 2

038336

PNL MODIFIED HAZARDOUS WASTE SITE RANKING SYSTEM CALCULATIONS FOR THE NIAGARA FALLS STORAGE SITE (NFSS)

Location: Lewiston, New York
EPA Region II
Reviewer: B. Fritz
Date: 3-4-85
Facility Description: Facility is part of a former Manhattan Engineer District (MED) site, which in turn was part of the former Lake Ontario Ordnance Works. Beginning in 1944, MED used the site for the storage of radioactive residues resulting from processing of uranium ore (primarily at Linde Air Products, Town of Tonawanda, New York, and Mallinckrodt Chemical Co., St. Louis, Missouri), contaminated scrap and rubble from decommissioning activities, biological and miscellaneous wastes from the University of Rochester, and low-level fission product waste from Knolls Atomic Power Laboratory. The primary waste constituents of concern are radium and uranium. Site is being cleaned up under the Department of Energy's Surplus Facilities Management Program. Interim remedial actions consist of consolidation of all wastes (residues plus contaminated soil from vicinity properties being decontaminated under the Formerly Utilized Sites Remedial Action Program) into a single pile on the southwest portion of the site. The pile is surrounded by a dike and underlain by a clay liner. Upon completion of the remedial actions, expected to be late 1985, the pile will be covered with layers of clay, sand, and soil. Final disposition of the material awaits completion of the NEPA process. Primary exposure pathway is groundwater route.

Scores:

Current site conditions:

S_M=4.69 (S_{gw}=8.06 S_{sw}=0.92 S_a=0)

S_{FE}= N/A

S_{DC}= N/A

Site conditions following completion of interim remedial actions:

S_M=2.33 (S_{gw}=4.03 S_{sw}=0 S_a=0)

S_{FE}= N/A

S_{DC}= N/A

038336

Ground Water Route Work Sheet - Current Site Conditions					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 (3)	2	6	6	
Net Precipitation	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 (2) 3	1	2	3	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			11	15	
3 Containment	0 1 (2) 3	1	2	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score			15	26	
5 Targets					3.5
Ground Water Use	0 1 (2) 3	3	6	9	
Distance to Nearest Well/Population Served	0 4 6 (8) 10 / 12 16 18 20 / 24 30 32 35 40	1	8	40	
Total Targets Score			14	49	
6 If line 1 is 45, multiply 1 x 4 x 5 / If line 1 is 0, multiply 2 x 3 x 4 x 5			4,620	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} = 8.06		

GROUND WATER ROUTE WORK SHEET

038386

Ground Water Route Work Sheet – Site Conditions After Interim Remedial Actions

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 (3)	2	6	6	
Net Precipitation	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 (2) 3	1	2	3	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			11	15	
3 Containment	0 (1) 2 3	1	1	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score			15	26	
5 Targets					3.5
Ground Water Use	0 1 (2) 3	3	6	9	
Distance to Nearest Well/Population Served	0 4 6 (8) 10 / 12 16 18 20 / 24 30 32 35 40	1	8	40	
Total Targets Score			14	49	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			2,310	57,330	
7 Divide line 6 by 57,330 and multiply by 100	S_{gw} = 4.03				

GROUND WATER ROUTE WORK SHEET

Groundwater Route Work Sheet

1. No observed release (all average concentrations are within permitted levels (ref. 1, p. 10).

2. a. Knowledge regarding the fluctuation of groundwater levels throughout the year is limited. Saturated conditions prevail during Spring snowmelt. The site is poorly drained and experiences ponding during snowmelt and periods of heavy precipitation. This suggests that zero depth to groundwater should be assumed during some periods of the year. Furthermore, there is a significant water-bearing zone at a depth of 10-12 feet and wells drilled into it have sufficient yields for limited uses (ref. 2, pp. 3-5,6, 4-60).

b. Annual rainfall is approximately 33 in. Evaporation is approximately 27 in/yr (ref. 3). Therefore, the net precipitation is about 6 in/yr.

c. Upper soil column consists of layers of silt mixed with sand and gravel, and layers of clay mixed with silt, sand, and gravel (ref. 2). The assigned value of 2 is assumed to be conservative.

d. The contamination of concern is unconsolidated solid material, i.e., soil.

3. The current situation, scored on the first of the two worksheets, is an uncovered pile of unstabilized waste with a moderately permeable liner (the thickness of the clay layer is variable and it is not known whether it is continuous underneath the entire pile) and no leachate collection system. The pile is surrounded by a clay dike. By the end of 1985, the pile will be covered with an interim cap consisting of clay (3 ft), sand (0.5 ft), and soil (1.5 ft). If a decision is made to used the site for permanent disposal of the waste, a more elaborate cap will be constructed. This situation is not identical to any of those listed in Table 3 of the EPA User's Manual (ref. 3). The closest scenario in Table 3 is the second entry under part C: pile uncovered, waste unstabilized, moderately permeable liner, and leachate collection system. The cover on the NFSS pile is assumed to compensate for the lack of a leachate collection system, and the value corresponding to this case is scored on the second worksheet.

4. ^{226}Ra is the dominant hazard. The highest observed groundwater concentration was 7.0 pCi/l (ref. 1, p. 27, sample BH-68). This receives a score of 15 (ref. 4).

5. a. The Lockport Dolomite, the only aquifer in the area used for drinking water supply to a significant degree, is absent north of the Niagara escarpment and, hence, absent at NFSS. Wells in both the upper soil aquifer and the bedrock aquifer at and near the site have relatively low yields that are nonetheless sufficient for limited uses. However, the groundwater is of low quality (ref. 2, pp. 3-5 through 3-7). No well surveys of the region are available. It is possible that a small number of residential wells exist and are used to supply drinking water. Therefore, in order to be conservative, this analysis uses a score of 2 for this factor. Alternate unthreatened sources of drinking water are available.

b. Most of the property in the area of NFSS is used for industrial purposes. The nearest residence is 0.7 miles southwest of the site. It is assumed that this house is served by a well and that the total number of people drinking groundwater at all locations within four miles of the site does not exceed 100.

038386

Surface Water Route Work Sheet - Current Site Conditions

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment	0 (1) 2 3	1	1	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score			11	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	(0) 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			594	64,350	
7 Divide line 6 by 64,350 and multiply by 100			S_{sw} = 0.92		

SURFACE WATER ROUTE WORK SHEET

038386

Surface Water Route Work Sheet – Site Conditions After Interim Remedial Actions

Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment	(0) 1 2 3	1	0	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 18	1		18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score			11	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	(0) 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} = 0				

SURFACE WATER ROUTE WORK SHEET

Surface Water Route Work Sheet

1. No observed release (all average concentrations are within permitted levels (ref. 1, p. 10).

2. a. The facility is a closed basin, i.e., the waste pile is surrounded by a dike.
   b. The 1-yr, 24-hr rainfall is approximately 2.1 inches (ref. 3, p. 33).
   c. Drainage from the site enters Fourmile Creek 2.75 miles from the site boundary via the central drainage ditch which runs through the site and within 1000 ft of the waste pile.
   d. The contamination of concern is unconsolidated solid material, i.e., soil.

3. The current mode of waste storage is not identical to any of the scenarios listed in Table 9 of the EPA User's Manual (ref. 3). The pile is uncovered, but surrounded by a sound containment dike. This seems closest to the second situation under part C of the table: piles covered, wastes unconsolidated, diversion or containment system not adequate. It is assumed that the adequate diking compensates for the pile not being covered. The score corresponding to this case is reflected on the first worksheet.

   After the interim remedial actions are completed, the first case under part C of the table will apply: pile covered and surrounded by sound diversion or containment system. The score corresponding to this case is reflected on the second worksheet.

4. The highest observed surface water concentration of ^{226}Ra was 4.0 pCi/l (ref. 1, p. 27, sample 11). This receives a score of 11 (ref. 4). The highest uranium concentration in surface water was 3.9 mg/l (2,600 pCi/l ^{238}U + ^{234}U, assuming normal isotopic ratios). This also receives a score of 11 (ref. 4).

5. a. Fourmile Creek is used for boating and fishing (ref. 2).
   b. No wetlands or endangered species habitat is affected by runoff from the site.
   c. There are no intakes for drinking water supply within 3 stream-miles of the site boundary.

Air Route Work Sheet					
Rating Factor	**Assigned Value (Circle One)**	**Multi-plier**	**Score**	**Max. Score**	**Ref. (Section)**
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location: Monthly during 1983 at 34 locations on-site and at site boundary					
Sampling Protocol: Terradex Type-F Track-Etch detectors					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
	Total Waste Characteristics Score			20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
	Total Targets Score			39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100			S_a = 0		

AIR ROUTE WORK SHEET

038386

Air Route Sheet

1. No observed release (all average ^{222}Rn concentrations are within permitted levels (ref. 1, p. 10).

038386

	S	S^2
Groundwater Route Score (S_{gw})	8.06	64.94
Surface Water Route Score (S_{sw})	0.92	0.85
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		65.79
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		8.11
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		4.69

WORKSHEET FOR COMPUTING S_M

Current Site Conditions

038386

	s	s^2
Groundwater Route Score (S_{gw})	4.03	16.24
Surface Water Route Score (S_{sw})	0	0
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		16.24
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		4.03
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		2.33

WORKSHEET FOR COMPUTING S_M

Site Conditions Following Completion of Interim Remedial Actions

References

038386

1. Bechtel National, Inc. 1984. Niagara Falls Storage Site Environmental Monitoring Report, Calendar Year 1983. DOE/OR/20722-18, July 1984.

2. U.S. Department of Energy. 1984. Draft Environmental Impact Statement, Long-Term Management of the Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site. DOE/EIS-0109D, August 1984.

3. U.S. Environmental Protection Agency. 1984. Uncontrolled Hazardous Waste Site Ranking System, A Users Manual.

4. Pacific Northwest Laboratory. 1984. A Users Guide for the Modified Hazard Ranking System (MHRS). October 1984 draft.

038386

Enclosure 3

EPA Remedial Investigation Report	DOE Document Containing Info
1.0 Introduction	
1.1 Site Background Information	(NFSS Project Management Plan
1.2 Nature & Extent of Problem	(NFSS, DEIS Section 1.1
1.3 Remedial Investigation Summary	(NFSS, DEIS Section 1.2
1.4 Overview of Report	(
2.0 Site Features Investigation	
2.1 Demography	NFSS, DEIS Section 3.1.6
2.2 Land Use	NFSS, DEIS Section 3.1.5
2.3 Natural Resources	NFSS, DEIS Section 3.1.1
2.4 Climatology	NFSS, DEIS Section 3.1.3
3.0 Hazardous Substances Investigation	
3.1 Waste Types	(Anderson et al
3.2 Waste Component Characteristics and Behavior	(Haywood
	(Hazen
	(Urbanczyk
4.0 Hydrogeologic Investigation	
4.1 Soils	(NFSS Geologic Report
4.2 Geology	(Acres American
4.3 Groundwater	(NFSS DEIS Sections 3.1.1, 3.1.2
	(NFSS Geotechnical
	(NFSS Environmental Monitoring Reports
5.0 Surface-Water Investigation	
5.1 Surface Water	(NFSS Geologic Report
5.2 Sediments	(Acres American
5.3 Flood Potential	(NFSS Flood
5.4 Drainage	(
6.0 Air Investigation	NFSS Environmental Monitoring Reports
7.0 Biota Investigation	
7.1 Flora	NFSS DEIS Section 3.1.4
7.2 Fauna	

038386

8.0 Bench and Pilot Tests	Same as Section 3 Studies will also be conducted during design and construction activities Kelmers and Seeley NFSS Geotechnical NFSS Earthwork
9.0 Public Health and Environmental Concerns	(NFSS DEIS (NFSS Environmental Monitoring Reports (NFSS Project Management Plan

038386

LIST OF NIAGARA FALLS STORAGE SITE REPORT

Acres American	Acres American Incorporated. 1981. Hydrologic and Geologic Characterization of the DOE-Niagara Falls Storage Site. Prepared for NLO, Incorporated, Fernald, OH, by Acres American Incorporated, Buffalo, NY. September 30, 1981.
Anderson et al	Anderson, T.L., J.F. Dettorre, D.R. Jackson, and B.S. Ausmus. 1981. A Comprehensive Characterization and Hazard Assessment of the DOE-Niagara Falls Storage Site. BMI-2064 (Revised). Prepared for the U.S. Department of Energy, Remedial Action Program, by Battelle Columbus Laboratories, Columbus, OH. June 1981. 3 v.
NFSS Geologic Report	Bechtel National, Inc. 1984b. Geologic Report, Niagara Falls Storage Site, Lewiston, New York. DOE/OR/20722-8. Prepared for U.S. Department of Energy. June 1984. *
NFSS Geotechnical	Bechtel National. Inc. 1984. Geotechnical Post Construction Report - Niagara Falls Storage Site. January 1984.
NFSS Earthwork	Bechtel National, Inc. 1984. Technical Specifications for Earthwork, Lewiston, NY, Niagara Falls Storage Site (14501 - Specifications - 115-37-C-01). December 1984.
NFSS Flood	Bechtel Civil and Minerals, Inc. 1984. Determination of Probable Maximum Flood at Niagara Falls Storage Site. FUSRAP Project Job Number 1405-115. July 1984.
Haywood	Haywood, F. 1983. Results of Analysis of Three (3) NFSS Central Ditch Samples for EPA Priority Pollutants. Memorandum from F. Haywood (Eberline Instrument Corporation) to E. Walker (Bechtel National, Inc.). March 3, 1983.
Hazen	Hazen Research, Incorporated. 1974. Treatment of Pitchbende Residues for Recovery of Metal Values. Prepared for Cotter Corporation of Canon City, Colorado. HRI Project No. 1373. Golden, Colorado. May 1974.
Kelmers and Seeley	Kelmers, A.D., and F.G. Seeley. 1983. Geotechnical Studies for the Formerly Utilized Sites Remedial Action Program (FUSRAP) Site Management: Chemical Support. Progress Reports for the Period February 16 - March 15, 1983 and March 16 - April 15, 1983. Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, TN.

NFSS Project Management Plan — USDOE. 1984. "Niagara Falls Storage Site Project Management Plan. ORO-845. July 1984.

NFSS DEIS — USDOE. 1984. "Draft Environmental Impact Statement, Long-term Management of Existing Radioactive Wastes and Residues at the Niagara Falls Storage Site," August 1984. *

Urbanczyk — Urbanczyk, D. 1983. Letters to Bert Zimtrich (Bechtel National, Inc., Oak Ridge, TN), dated September 13 and 22, 1983.

NFSS Environmental Monitoring Rpt. — U.S. Department of Energy. 1983c. Niagara Falls Storage Site (NFSS). Environmental Monitoring Report. Calendar Year 1981. 10-05-202-002. Oak Ridge Operations, Oak Ridge, TN. May 1983.

U.S. Department of Energy. 1983d. Niagara Falls Storage Site (NFSS). Environmental Monitoring Report. Calendar Year 1982. 10-05-202-002. Oak Ridge Operations, Oak Ridge, TN. May 1983.

U.S. Department of Energy. 1984. Niagara Falls Storage Site (NFSS). Environmental Monitoring Report. Calendar Year 1983. DOE/OR/20277-18. Oak Ridge Operations, Oak Ridge, TN. July 1984. *

U.S. Department of Energy. 1981. Environmental Monitoring Report for Niagara Falls Storage Site for 1979-1980. NLCO-007 EV (Rev.) Oct. 1981.

HAZARDOUS WASTE SITE RANKING SYSTEM CALCULATIONS FOR COLONIE INTERIM STORAGE SITE, COLONIE, NEW YORK ENVIRONMENTAL PROTECTION AGENCY SYSTEM

Location: Colonie, New York
EPA Region II
Reviewer: B. Fritz
Date: 10-15-85, revised 12-9-85
Facility Description: 10-acre site located adjacent to the border between the town of Colonie and the city of Albany was formerly occupied by NL Industries, Inc. Site was used primarily for the fabrication of shielding components from depleted uranium for the Department of Defense, but also for fabrication of 3.5 percent enriched fuel elements and the chemical processing of unirradiated enriched uranium scrap for Department of Energy (DOE) predecessors. The roof of the plant, site grounds and private residences in the vicinity became contaminated as a result of airborne emissions of particulate uranium. Subsurface uranium contamination also exists on the site, indicating that some material may have been buried. Surface contamination is greatest in the direction of the prevailing winds. 36 private properties have been identified as having soil contaminated in excess of remedial action guidelines. Most of the contamination is in the top few inches of soil and is concentrated along roof drip lines and downspouts. DOE is cleaning up the site and vicinity properties pursuant to the fiscal year 1984 Energy and Water Development Appropriations Act (P.L. 98-360). To date, 11 vicinity properties have been decontaminated, with the remainder to be cleaned up by 1987. Contaminated material from the vicinity properties is being placed inside the NL Industries plant, acquired by DOE on February 29, 1984. After the vicinity properties have been decontaminated and a permanent disposal facility identified, remedial action will be performed on the former NL Industries site itself and the adjacent vicinity property formerly owned by Niagara Mohawk Power Company (now owned by DOE). This analysis considers only the DOE property, because it contains the bulk of the radioactive material. Primary pathway of concern is groundwater.

Scores: $S_M = 9.44$ ($S_{gw} = 14.97$ $S_{sw} = 6.55$ $S_a = 0$)

$S_{FE} =$ N/A

$S_{DC} = 0$

Ground Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	3.1
If observed release is given a score of 45, proceed to line 4. If observed release is given a score of 0, proceed to line 2.					
2 Route Characteristics					3.2
Depth to Aquifer of Concern	0 1 2 (3)	2	6	6	
Net Precipitation	0 1 (2) 3	1	2	3	
Permeability of the Unsaturated Zone	0 1 (2) 3	1	2	3	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			11	15	
3 Containment	0 1 2 (3)	1	3	3	3.3
4 Waste Characteristics					3.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					3.5
Ground Water Use	0 1 (2) 3	3	6	9	
Distance to Nearest Well/Population Served	0 (4) 6 8 10 / 12 16 18 20 / 24 30 32 35 40	1	4	40	
Total Targets Score			10	49	
6 If line 1 is 45, multiply 1 x 4 x 5; If line 1 is 0, multiply 2 x 3 x 4 x 5			8,580	57,330	
7 Divide line 6 by 57,330 and multiply by 100			S_{gw} = 14.97		

GROUND WATER ROUTE WORK SHEET

Groundwater Route Work Sheet

038386

1. Groundwater data is limited. Samples were taken in 1982 and 1984 from four wells in the surficial aquifer around the plant site. Gross alpha activity was less than 3 pCi/l. Gross beta activity ranged to 5.1 pCi/l (ref. 1, p. 3-3), radium concentrations ranged to 0.8 pCi/l, and total uranium concentrations ranged to 21.5 pCi/l (ref. 5, p. 16). All of these concentrations are well within the DOE 5480.1 limits for uncontrolled areas.

2. a. The main aquifer of concern from the standpoint of both quality and quantity is the surficial glacial till. The water table depth at the plant ranges from 2 to 16 feet (ref. 1, p. 3-3).

b. Mean annual precipitation is 37 inches (ref. 1, p. 3-3). Mean annual lake evaporation is 27 inches (ref. 2, p. 13), leaving a net annual precipitation of +10 inches.

c. Surficial soil consists of fine brown sand and layers of grey sand, silt, and clay. This most closely matches the third type of material in Table 2 of ref. 2 (p. 15).

d. Physical state is unconsolidated/unstabilized solid, i.e., contaminated soil.

3. There are currently no engineered barriers to waste migration.

4. a. Uranium receives a ranking of 3 for toxicity because of its carcinogenic potential and 3 for persistence because of its long half-life.

b. The total waste volume (site plus vicinity properties) is estimated to be 30,000 yd^3 (ref. 3, p.I-6).

5. a. The surficial aquifer yields water that is potentially useable, both in terms of quality and quantity (ref. 1, p. 3-2,3). However, most potable water in the vicinity of the plant is supplied by municipal community water systems. Colonie is served by the Latham Water District system which draws its water primarily from the Mohawk River. The system is fed by some wells, too, but they are located about 6 miles north of the plant (refs. 6 and 9). The NL Industries site itself is served by the Albany City system which is supplied by Alcove Reservoir (refs. 1 and 9). The nearest wells that supply a public water system are part of a non-municipal community system serving Whitestone Mobile Home Park, located about 2.5 miles northwest of the NL Industries site. The wells serve approximately 76 people (ref. 9). No records on private wells are available. However, given the availability of public water and the urbanized nature of the area around the plant, it is unlikely that there is currently any significant private use of the groundwater (ref. 7).

b. The only use of groundwater identified within 3 miles of the plant is the mobile home park described in 5.a above.

038386

Surface Water Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
1 Observed Release	(0) 45	1	0	45	4.1
If observed release is given a value of 45, proceed to line 4. If observed release is given a value of 0, proceed to line 2.					
2 Route Characteristics					4.2
Facility Slope and Intervening Terrain	(0) 1 2 3	1	0	3	
1-yr. 24-hr. Rainfall	0 1 (2) 3	1	2	3	
Distance to Nearest Surface Water	0 1 2 (3)	2	6	6	
Physical State	0 (1) 2 3	1	1	3	
Total Route Characteristics Score			9	15	
3 Containment	0 1 2 (3)	1	3	3	4.3
4 Waste Characteristics					4.4
Toxicity/Persistence	0 3 6 9 12 15 (18)	1	18	18	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 (8)	1	8	8	
Total Waste Characteristics Score			26	26	
5 Targets					4.5
Surface Water Use	0 1 (2) 3	3	6	9	
Distance to a Sensitive Environment	(0) 1 2 3	2	0	6	
Population Served/Distance to Water Intake Downstream	(0) 4 6 8 10 12 16 18 20 24 30 32 35 40	1	0	40	
Total Targets Score			6	55	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			4,212	64,350	
7 Divide line 6 by 64,350 and multiply by 100	S_{sw} = 6.55				

SURFACE WATER ROUTE WORK SHEET

038386

Surface Water Route Work Sheet

1. Surface water was sampled in 1984 in a small, unnamed stream that enters the site from the northwest through a culvert, flows through an old lake bed, and exists through another culvert on the south side of the site. Samples were taken near the entrance and exit to the second culvert. Samples were also taken from Patroon Creek, both upstream and downstream of its confluence with the unnamed stream from the site. The highest ^{226}Ra concentration observed was 0.8 pCi/l, well below standards. With one exception, all uranium concentrations were also within standards (740 pCi/l). The maximum concentration, 2,632 pCi/l, was obtained upstream of the site (i.e., at the entrance to the culvert). It is speculated that the sample may have been contaminated with sediments. The next highest concentration measured at the same location was 129 pCi/l (ref. 5, pp. 12 and 14). The reported concentrations are not considered to constitute an observed release for the purposes of this analysis, because the standard was exceeded solely because of one questionable sample.

2. a. The site itself is flat. Terrain between the site and Patroon Creek has a slope of less than 1 percent (ref. 4).
   b. The 1-yr. 24-hr. rainfall for Albany is approximately 2.5 inches (ref. 2, p. 33).
   c. Patroon Creek passes approximately 1,700 feet from the southeast corner of the site. However, an unnamed tributary flows through the site in a concrete conduit.
   d. Physical state is unconsolidated/unstabilized solid, i.e., contaminated soil.

3. There are currently no engineered barriers to waste migration.

4. a. Uranium receives a ranking of 3 for toxicity because of its carcinogenic potential and 3 for persistence because of its long half-life.
   b. The total waste volume (site plus vicinity properties) is estimated to be 30,000 yd^3 (ref. 3, p.I-6).

5. a. Patroon Creek is used for fishing downstream of the plant (ref. 7).
   b. No wetlands and no critical habitat present (ref. 1, p. 3-4).
   c. No use of Patroon Creek for irrigation or drinking water (ref. 1, p. 3-2).

038386

Air Route Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multiplier	Score	Max. Score	Ref. (Section)
[1] Observed Release	(0) 45	1	0	45	5.1
Date and Location: None					
Sampling Protocol:					
If line [1] is 0, the S_a = 0. Enter on line [5]. If line [1] is 45, then proceed to line [2].					
[2] Waste Characteristics					5.2
Reactivity and Incompatibility	0 1 2 3	1		3	
Toxicity	0 1 2 3	3		9	
Hazardous Waste Quantity	0 1 2 3 4 5 6 7 8	1		8	
Total Waste Characteristics Score				20	
[3] Targets					5.3
Population Within 4-Mile Radius	0 9 12 15 18 21 24 27 30	1		30	
Distance to Sensitive Environment	0 1 2 3	2		6	
Land Use	0 1 2 3	1		3	
Total Targets Score				39	
[4] Multiply [1] x [2] x [3]			0	35,100	
[5] Divide line [4] by 35,100 and multiply by 100		S_a = 0			

AIR ROUTE WORK SHEET

Air Route Work Sheet

038386

1. No air sampling has been performed since the plant was shut down. Because the material used at the site was depleted uranium, radium concentrations are low. Therefore, radon would not be expected to be a significant hazard. Concentrations of airborne radioactive particulates would also be low in the absence of stack emissions.

	s	s^2
Groundwater Route Score (S_{gw})	14.97	223.98
Surface Water Route Score (S_{sw})	6.55	42.84
Air Route Score (S_a)	0	0
$S_{gw}^2 + S_{sw}^2 + S_a^2$		266.82
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$		16.33
$\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$		9.44

WORKSHEET FOR COMPUTING S_M

Fire and Explosion Work Sheet

038386

N/A

Direct Contact Work Sheet					
Rating Factor	Assigned Value (Circle One)	Multi-plier	Score	Max. Score	Ref. (Section)
1 Observed Incident	(0) 45	1	0	45	8.1
If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2					
2 Accessibility	(0) 1 2 3	1	0	3	8.2
3 Containment	0 15	1		15	8.3
4 Waste Characteristics Toxicity	0 1 2 3	5		15	8.4
5 Targets					8.5
Population Within a 1-Mile Radius	0 1 2 3 4 5	4		20	
Distance to a Critical Habitat	0 1 2 3	4		12	
Total Targets Score				32	
6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5			0	21,600	
7 Divide line 6 by 21,600 and multiply by 100			S_{DC} = 0		

DIRECT CONTACT WORK SHEET

Direct Contact Work Sheet

038386

1. No observed incidents.

2. The site is surrounded by a fence with locked entrances.

3. N/A (see 2 above)

4. N/A (see 2 above)

5. N/A (see 2 above)

References

038386

1. Argonne National Laboratory. June 5, 1984. Action Description Memorandum, Proposed FY 1984 Remedial Actions for Vicinity Properties at the Colonie, New York, FUSRAP Site.

2. U.S. Environmental Protection Agency. 1984. Uncontrolled Hazardous Waste Site Ranking System, A Users Manual.

3. Oak Ridge Operations Office. April 1985. Energy Systems Acquisition Project Plan (ESAPP), Formerly Utilized Sites Remedial Action Program (FUSRAP). Revision 1.

4. U.S. Geological Survey. 1980. 7.5 Minute Series Topographic Map, Albany Quadrangle.

5. Bechtel National, Inc. July 1985. Colonie Interim Storage Site, Environmental Monitoring Report, Colonie, New York, Calendar Year 1984. DOE/OR/20722-53.

6. Schmelz, Bernard, Senior Planner, Town of Colonie Engineering Department. Personal communication, October 1, 1985.

7. Lukowski, Steve, Albany County Health Department. Personal Communication, October 1, 1985.

8. Rand McNally. 1985. Road Atlas.

9. Albany County Health Department, community water system data for Albany and Rensselaer counties.

C. Kilcrease

038386

Department of Energy
Washington, D.C. 20545

FEB 11 1985

Mr. William J. Librizzi, Director
Emergency and Remedial Response Division
U.S. Environmental Protection Agency
Region II
26 Federal Plaza
New York, New York 10278

Dear Mr. Librizzi:

In your letter dated October 26, 1984, to Mr. Carl Welty, you requested information on the most recent status of environmental assessments and copies of all reports on our control programs for a list of facilities. Mr. Thomas Frangos' letter to you dated November 26, 1984, stated that I would provide, as the responsible Department of Energy (DOE) program official, information on all the sites listed except for the Brookhaven National Laboratory. I am providing the available information on these sites as enclosures to this letter, except for the former New Brunswick Laboratory, New Brunswick, New Jersey, and the Center for Energy and Environmental Research, Puerto Rico. Information on these two sites and additional information on the other sites will be provided to you in subsequent transmittals as it becomes available.

We have also scored some of these sites in accordance with the Hazards Ranking System (HRS) used by the Environmental Protection Agency for Superfund sites. In addition, we have scored these same sites by a Modified Hazards Ranking System, which explicitly accounts for radioactive material as well as nonradioactive hazardous wastes. A description of this modified HRS is provided as Enclosure 1. Copies of our scoring are provided in the enclosures for each site. Although the scores obtained by these two methods are not significantly different for the sites which we evaluated, we believe the modified HRS is more appropriate for sites with mixed radioactive and nonradioactive hazardous wastes. The modified HRS has been proposed to the EPA Headquarters Superfund office.

We wish to work with you to provide the information you need as it becomes available, and to proceed as expeditiously as possible with our projects for remedial actions at these sites. The contact in my office for these sites, which are part of the Department's Formerly Utilized Sites Remedial

001010

038386

.ion Program and Surplus Facilities Management Program is Edward DeLaney (FTS 233-4716; Commercial 301-353-4716).

NE-24
DeLaney
2/8/85

Sincerely,

/s/

NE-24
Baublit
2/8/85

John E. Baublitz, Director
Division of Remedial Action Projects
Office of Terminal Waste Disposal
and Remedial Action
Office of Nuclear Energy

Enclosures
1. A Ranking System for Mixed Radioactive and Hazardous Waste Sites
2. Lake Ontario Ordnance Works
3. Niagara Falls Storage Site
4. Ashland Oil I and II and Seaway Industrial Park
5. Linde Air Products Division
6. Middlesex Sampling Plant

cc:
S. Williams, EPA/HQ

bcc:
E. Keller, OR
C. Miller, RL
T. Frangos, PE-243
Aerospace
W. Voigt, NE-20
NE-73 (4)
NE-24 RF
DeLaney RF

NE-24:EDeLaney:ph:353-4716:2/7/85:IBM:38/24:3.0.8.5

038386

Department of Energy
Washington, D.C. 20545

NOV 26 1984

Mr. William J. Librizzi, Director
Emergency and Remedial Response Division
United States Environmental Protection Agency
Region 11
26 Federal Plaza
New York, New York 10278

Mr. Librizzi:

This is in response to your letter of October 26, 1984, in which you requested the most recent status of environmental assessment and control programs for Department of Energy (DOE) facilities located in EPA Region II for the purpose of possible listing of these sites on the National Priorities List (NPL) of hazardous waste sites under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

The facilities in which you have expressed interest fall under different program responsibilities within DOE. Information that you requested for Brookhaven National Laboratory, Upton, New York, will be sent to you directly by Mr. Roger Mayes, Assistant Director, Environmental Protection . Chicago Operations Office, 9800 South Cass Avenue, Argonne, Illinois TS 972-2256. Information on the balance of these facilities will be you by Mr. John E. Baublitz, Director, Office of Remedial Action jects, NE-24, Washington, D.C. 20545, FTS 233-5272. As you proceed with r analysis and ranking, you should plan to work directly with these two offices.

I would also bring to your attention that our office has had discussions with staff of the EPA Office of Federal Activities and the Superfund office on two items of concern to DOE. The first is our concern with the application of the Hazard Ranking System model to radiologic activities of DOE. And second, DOE is interested in developing a memorandum of understanding with EPA on overall management of CERCLA program at DOE facilities across country. We trust you will be cognizant of this activity as you proceed with your analysis for ranking. If you have any questions on this aspect of the DOE CERCLA program, please feel free to contact Dr. Vincent J. DeCarlo, FTS 233-5684, of this office.

We will make every effort to supply the information that you have requested in as timely a manner as possible.

Sincerely,

Thomas G. Frangos
Acting Director
Environmental Protection Division

cc: P. Beam, EPA
S. Williams, EPA
R. Tiller, PE-20
R. Mayes, CH
J. Baublitz, NE-24

Enclosure 1

038386

A RANKING SYSTEM FOR MIXED RADIOACTIVE AND HAZARDOUS WASTE SITES[1]

B. A. Napier and K. A. Hawley
Pacific Northwest Laboratory
Richland, Washington

ABSTRACT

The Environmental Protection Agency's Hazards Ranking System (HRS) is a simplified management decision tool, that provides a common basis for evaluating a multitude of hazardous waste sites. A deficiency in the HRS for application to Department of Energy mixed radioactive and hazardous waste sites is its inability to explicitly handle radioactive material. A modification to the basic HRS to add the capability to consider radioactivity is described in this paper.

The HRS considers the exposure routes of direct contact, fire and explosion, atmospheric release, surface-water release, and ground-water release. Each exposure route is further divided into release, route, containment, waste, and target characteristics. To best use the HRS structure, the modification is applied to the waste characteristics subsection of each exposure route.

A system of ranking factors is developed, using radiation dose pathway analysis to group radionuclides by dose factor. For mixed waste sites, the ranking factor for radionuclides is compared with the ranking factor for hazardous chemicals, and the most restrictive is used in the overall ranking. The modification to the HRS has the advantages of a scientific basis, compatibility with the original HRS, reasonable information requirements, and defensible conclusions.

1.0 INTRODUCTION

The Environmental Protection Agency uses the Hazards Ranking System (HRS) to evaluate hazardous waste sites which fall under the jurisdiction of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or "Superfund"). It has been proposed that this system be used to evaluate waste sites located at DOE facilities. The method, however, was not designed to assess sites containing radioactive waste.

---

[1] Work supported by the U.S. Department of Energy, Office of Operational Safety, under Contract DE-AC06-76RLO ....

038386

Staff at the Pacific Northwest Laboratory (PNL) have been asked by the Department of Energy's Office of Operational Safety to modify the HRS method to include radioactive and mixed waste sites. The following is a discussion of PNL's proposed modifications.

2.0 HAZARDS RANKING SYSTEM

The Hazards Ranking System consists of several work sheets that are used to collect specific information on the waste site. Through a series of questions, which examine five potential routes of exposure a score is developed for the site. The routes that are examined include migration of the hazardous material through air, surface water, and ground water, exposure by fire or explosion, or by direct contact with the site. The questions evaluate the characteristics of the route of exposure (including such things as amount of rainfall and soil permeability), the characteristics of the waste (the degree of hazard presented by the waste), and the "targets" (people or sensitive environments) located in the vicinity of the site. A score is given for each of the five routes of exposure and an overall site ranking is generated by weighting each of the individual route scores.[2]

The stature of the HRS method for evaluating one route of exposure is shown in Figure 1.[3]

The user of the HRS method collects information (as necessary) on each route (e.g., surface water, ground water, air) through which a release could occur. The user examines the characteristics of the waste, and assesses the potential targets in the vicinity. The HRS is one of the few available tools for comparing a diverse number of waste sites to arrive at a common ranking for all. However, the HRS system as it was originally designed was not meant to evaluate radioactive or mixed radioactive and hazardous waste sites.

3.0 THE MODIFIED HAZARDS RANKING SYSTEM

3.1 Basic Approach

A modified HRS (m HRS) was developed by PNL to work within the existing framework of the HRS method. This approach allows the overall scoring system of HRS to remain unchanged. The modifications are restricted to the "Waste Characteristics" section of each of the five routes and leaves the other sections intact. We feel this approach is justified since all information on route characteristics and targets is pertinent to both the radioactive and nonradioactive (i.e., chemical) constituents of the site.

---

[2]For additional information on the HRS system, the reader is referred to Subpart H, Appendix A of the National Oil and Hazardous Substance Contingency Plan, Uncontrolled Hazardous Waste Site Ranking System; a Users Manual, 47 *Fed. Reg.* 31219-43(July 16,1982)

[3]The specific approach of the HRS varies according to the route being examined. Figure 1 best represents the method used to evaluate the surface and ground-water routes.

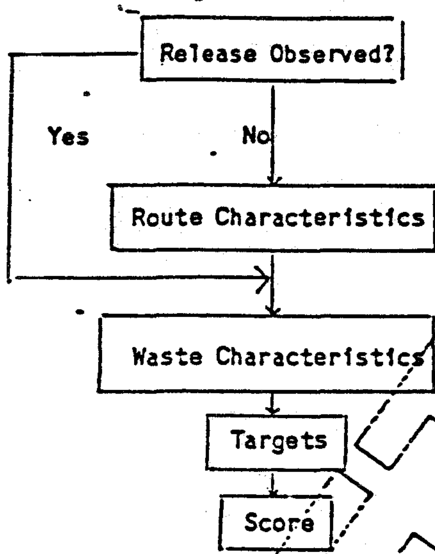

FIGURE 1. HRS Logic Diagram

The m HRS splits the Waste Characteristics section into two subsections: 1) radioactive wastes and 2) chemical wastes. A "separate but equal" approach is taken where the relative hazards of the radioactive and nonradioactive constituents are evaluated separately and the scores are assigned over the same range of values. Figure 2 depicts the structure of the modified HRS method for ranking waste sites.

3.2 Radioactive Waste Characteristics Score

The scoring system designed for the radioactive waste characteristics portion of the modified HRS is based on an estimate of the relative potential dose to man. The degree of hazard presented by a waste site is presumed to be a function of the amount and type of radioactive material contained at (or released from) the site. A series of pathway analyses was conducted using the computer code ONSITE/MAXI1 (Napier, Peloquin, Kennedy 1984) to develop dose factors for radionuclides for each of the five exposure routes considered by HRS. One representative, conservatively high, exposure scenario was used for each of the five exposure routes. The dose factors are comparable to Maximum Permissible Concentrations (MPCs) (10 CFR 20) or Concentration Guides (DOE 5480.1 1977) in that they provide an estimate of the dose resulting from activity ingested or inhaled for each radionuclide (rem/Ci). They differ somewhat, however, because they take into account the behavior and availability of the radionuclides in various environmental media. The radionuclides used in the pathway analysis were selected from those reported by DOE sites as being released in their effluents to air and water or known to be handled in waste management activities. Only radionuclides with half-lives greater than one year were used in the calculations.

038386

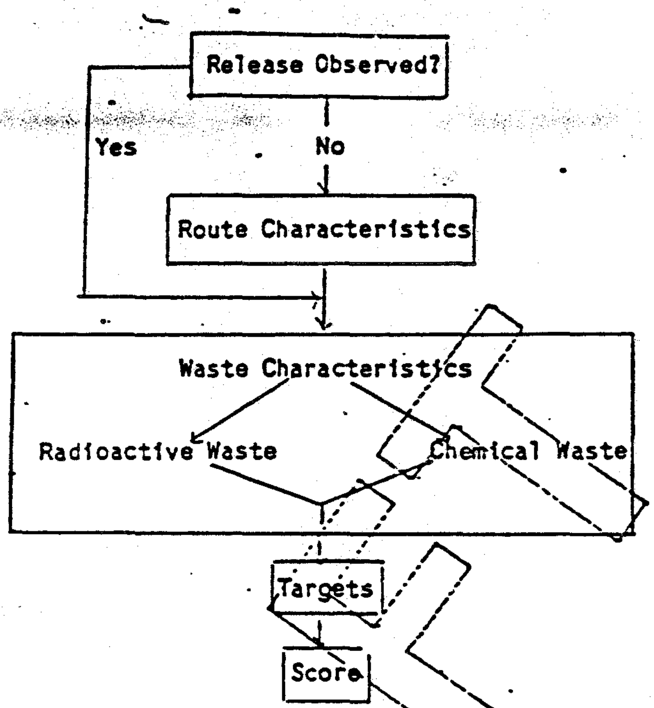

FIGURE 2. Modified HRS Logic Diagram

pathway analysis provides generic maximum annual radiation doses based on [illegible] concentrations of the radionuclides in air, water, and soil. Maximum annual doses were calculated considering the following types of exposures:

Air Route	chronic
Surface Water Route	chronic
Ground Water Route	chronic
Fire/Explosion Route	acute
Direct Contact Route	acute

The dose factors derived for the radionuclides used in the pathway analysis fall into distinct groups with values for each group approximately an order of magnitude apart in "relative dose impact". The groups, which are a function of the pathway of exposure, were developed for each of the five exposure routes. Table 1 lists the groups developed for the Air Route.

The relationship between dose factors and concentration can be expressed as a matrix that relates the ranking to the potential relative dose based on the selected exposure scenario. The sample matrix is shown in Table 2.

TABLE 1. Air Route Groups for Radionuclides

Group	Nuclides
A	Am-241, Am-243, Cm-243, Cm-244, Np-237+D, Pb-210+D, Pu-238, Pu-239, Pu-240, Pu-242, Pu-244, Ra-226+D, Th-228+D, Th-229+D, Th-230+D, U-233+D, U-234, U-235+D, U-238+D, unidentified alpha emitters
B	Ac-225, Co-60, Nb-94, Ra-225, unidentified beta and gamma emitters
C	Cs-134, Cs-137+D, Eu-152, I-129, Na-22, Pu-241+D, Sb-125+D, Sr-90+D, Th-232+D
D	Cd-109, Eu-154, Mo-93, Np-239, Tc-99
E	C-14, Cs-135, Fe-55, H-3, Ni-63, Ni-59, Sm-151, U-240

The variable r_1 is the ranking value assigned to the dose derived from the selected exposure scenario for a particular concentration of a radionuclide group. The scale assigns a value of zero to those concentrations of radionuclides for which the pathway analysis of the selected exposure scenario projects an annual dose of less than one millirem. The maximum value on the scale is assigned to projected annual doses greater than 1000 rem for the exposure scenario. The projected doses are not meant to imply that individuals will receive doses of that magnitude from the wastes, since it is unlikely that anyone would behave exactly as described in the conservative exposure sceanrios, but rather they are used as a convenient scale for the potential hazard of the contaminated materials. (It is also important to remember that a dose of 1000 rem does not necessarily mean the death of the exposed individual. The body's tolerance for radiation exposure is to a large extent a function of the time over which the exposure is received.)

The value of r_1 is determined by the range of the Waste Characteristics score for a particular route in the existing HRS. For example, a maximum value of 26 is allowed for the surface water route for the Waste Characteristics score. The values of r_1 can be integers between 0 and 26. The assignment of r_1 is based on the degree of hazard reflected by potential dose. In the concentration/dose-factor relationship, increasing the concentration by an order of magnitude results in a similar increase in dose. So over the range of doses being considered for ranking (1 mrem to 1000 rem) there are 6 orders of magnitude difference in the potential dose. However, the variable r_1 must be constrained to integer values over the range of 0 to 26 for the surface-water route, and have 8 values to correspond to the doses ≤ 1 mrem, 10 mrem, 100 mrem, 1 rem, 10 rem, 100 rem, 1000 rem, >1000 rem. In the existing HRS, the ranking score for waste quantity increases one increment for each doubling of waste volume. Thus, the rankings are not linear with potential hazard, but are instead a power function. A radiological hazard ranking based on dose/health effect relationships could use the "linear hypothesis;" however, for compatibility with the existing system, we have also chosen to use a power function to obtain the ranking scores. The net effect of not using a strictly linear set of

TABLE 2. Matrix Table for Deriving Radioactive Waste Characteristics Score

Concentration, pCi/L

Unit Dose Factors (rem/pCi/L)	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^7
10^4	r_1	r_2	r_3	r_4				
10^3		r_1	r_2	r_3	r_4			
10^2			r_1	r_2	r_3	r_4		
10^1				r_1	r_2	r_3	r_4	
10^0					r_1	r_2	r_3	r_4

isodose lines

factors is to over predict the hazard from small quantities of material. The same shape of hazard/waste characteristics score response function is used for all exposure route calculations. Values for the radioactive Waste Characteristics score were all derived based on this function.

3.3 Ranking Observed Versus Potential Radionuclide Concentrations

For cases where the concentration of the radionuclides in air, water, or soil are known, the matrix table provides a simple method to arrive at a ranking for the radioactive waste. But for circumstances where a concentration of the radionuclides in the media of interest has not been detected, a potential hazard can still be predicted.

3.3.1 Estimating Maximum Potential Surface Water Concentrations

For the surface water route, two equations are used to determine the "maximum potential" concentration of radionuclides in surface water. Both use the overland flow model[3] contained in NUREG/CR-0570 (Murphy and Napier 1980) to estimate a yearly fractional release of 10^{-4} from the waste site.

For sites with surface streams within the vicinity of the waste site, an estimation of the maximum potential concentration is obtained using the following calculation:

$$\text{Potential Concentration (pCi/L)} = \frac{X\,(10^{-4})}{Q}$$

where X = is the total activity of a specific radionuclide group that has been disposed at the site (pCi)

10^{-4} = the fractional release rate from the site (years^{-1})

Q = the average annual flow of the nearest surface stream (L/yr)

In cases where the nearby streams are intermittent and the average flow can not easily be estimated, a value can be calculated using the Rational Method (Gray 1970). The flow is estimated using the following equation:

$$Q = ciAk$$

where Q = Flow, in L/yr
c = $(1 - c_1 - c_2 - c_3)$, or $(1 - c_{tot})$ with the values for c_1, c_2, c_3, c_{tot} derived from Table 3.
A = Area of the watershed (acres)
k = Unit conversion factor = 10^5
i = Annual rainfall, inches/yr

Once the radionuclide groups have been identified and the maximum potential surface water concentration determined for each group of nuclides, the matrix table is used to determine the waste characteristics score. In cases where a value was derived for an actual observed concentration, the two are compared and the larger value selected as the radioactive waste score for that particular route.

3.3.2 Estimating Maximum Potential Ground Water Concentrations

Migration of radionuclides from waste sites through the ground water is directly related to many site specific parameters such as rainfall, hydraulic conductivity, porosity, soil density, and overall geology of the site. Thus, any generic attempt to relate potential ground-water contamination to known or estimated inventories of radionuclides is at best a first-order estimate. However, the potential for any one type of waste to migrate can be considered to be a property of the waste independent of the disposal site. This allows the potential for migration to be considered as a Waste Characteristic in the HRS, which then may be modified on a site specific basis by the HRS Site Characteristics section. This approach is philosophically similar to that developed by Oztunali (1981) and used in the Draft Environmental Impact Statement (DEIS) for 10 CFR 61 by the Nuclear Regulatory Commission (1981).

---

[3] "Overland flow is modeled assuming the burial ground is inudated by a water table that intersects the soil surface at the burial ground. It is assumed that all water flowing through the burial ground arrives at the surface and flows overland in a small stream to the river 1 km distant. Sorption is assumed to be insignificant during overland flow. Since no significant sorption is assumed to occur ... leach times are probably on the order of 10,000 years." (Murphy and Holter 1980)

038386

TABLE 3. Contributions to the Runoff Coefficient

c_i	Type of Area	Value
	Agricultural	
c_1	Flat land, with average slopes of 1 ft to 3 ft per mi	0.3
	Rolling land, with average slopes of 15 ft to 20 ft per mi	0.2
	Hilly land, with average slopes of 150 ft to 250 ft per mi	0.1
c_2	Tight impervious clay	0.1
	Medium combinations of clay and loam	0.2
	Open sandy loam	0.4
c_3	Cultivated lands	0.1
	Woodlands	0.2
	Urban	
c_{tot}	Flat, residential, with about 30% of area impervious	0.4
	Moderately steep, residential, with about 50% of area impervious	0.65
	Moderately steep, built up, with about 70% impervious	0.8

To identify a single parameter best suited to quantify the potential for ground-water contamination, a selection of reports describing generic ground water calculations were reviewed. Correlations were developed between assumed radionuclide inventories in idealized burial grounds and resulting calculated ground-water contamination maxima for a number of radionuclides. Representative results of this correlation development are show in Table 4; a fairly consistent pattern can be observed. Radionuclides that are not sorbed to soil appear to have a ratio of around 100 pCi/L calculated for ground-water contamination for each curie disposed. Nuclides that are sorbed have lower ratios that depend on the sorption coefficient, K_d. The results generated from the data given in Staley, Turi, and Schreiber (1979) are particularly instructive - the data shown in Table 4 are for a "worst-case" media, sand, both with and without sorption. These represent a good example of the actual waste characteristics, unmodified by any site conditions. The results derived from Murphy and Holter (1980) show good agreement with Staley, those derived from the equations given by Oztunali, et al (1981) show agreement and also the effects of considering additional site/packaging characteristics, since the area over which the waste is disposed (directly related to the volume of the waste site) would also influence the result. The results of Staley, Turi, and Schreiber, are used to prepare the transport coeffificients for the modified HRS ranking, extended to other nuclides by analogy based on reported values of K_d (with the assistance of W. Hansen (1984)).

The transport coefficients given for ground-water contamination in the modified HRS have been compared against other generic studies (Adam and Rogers 1978, Macbeth et al. 1979) the NRC's DEIS for Low-Level Waste (NRC 1981), and site specific studies of DOE sites at Idaho National Engineering

TABLE 4. Ratio of Calculated Peak Ground-Water Contamination to Disposed Activity Derived from Literature Sources (pCi/L per Ci disposed)

Radionuclide	Staley, Turi, and Schreiber: Without Sorption	Staley, Turi, and Schreiber: With Sorption	Murphy and Holter	Oztunali, et al.[(a)]
^{3}H	1E+2	1E+2	1E+2	2E+3/Volume
^{14}C	1E+2	-	2E+2	4E+2/Volume
^{90}Sr	1E+2	1E+2	8E+2	2E-4/Volume
^{99}Tc	1E+2	1E+1	2E+2	8E+3/Volume
^{137}Cs	1E+2	3E+1	2E-1	---
^{239}Pu	1E+2	2E+1	3E-1	6E+0/Volume
^{241}Am	1E+2	4E+1	2E-1	---

(a) The equations given by Oztunali, et al. give a result dependent on the volume in which the waste is disposed. However, the spread of the results closely follows that seen in the other examples.

Laboratory (INEL) (DOE 1982), Hanford (Wallace 1980), and data for Hanford (Napier 1984). In all cases the transport coefficients have shown either remarkable agreement or been conservatively high (but not unreasonably so).

The maximum potential release to ground water is estimated using transport coefficients as multipliers of the radionuclide inventory:

$$pCi/L = (Ci) \times (\text{Transport Coefficient})$$

where Ci = activity (in Ci) of each radionuclide disposed at the site
Transport Coefficient = variable derived for each element, values are listed in Table 5.

Once the maximum potential concentration is calculated for each radio-radionuclide, the total potential ground water concentration associated with each nuclide group is obtained by summing the potential concentrations of nuclides within the group. The matrix table is then used to determine the waste characteristics score. In cases where a value was derived for an actual observed concentration, the two are compared and the larger value selected as the radioactive waste score for that particular route.

3.3.3 Estimating Waste Concentrations for the Fire and Explosion Contact Route

unmodified HRS computes a score for the fire and explosion hazard route only when it has been documented that the facility presents a

TABLE 5. Transport Coefficients for the Ground Water Route

Element	Transport Coefficient	Element	Transport Coefficient
Am	3	Pb	20
C	100	Pu	1
Cm	3	Ra	20
Co	10	Sb	20
Cs	20	Sm	1
Eu	3	Sr	10
Fe	10	Tc	100
H	100	Th	1
I	100	U	20
Na	100		
Nb	10	alpha	20
Ni	10	beta	100
Np	20	gamma	100

significant fire or explosion hazard. As with the other routes of exposure, an estimate of the radiological hazard is based on a measured or calculated concentration of the radionuclides in the pathway of concern.

For purposes of dose estimation, the radionuclides are assumed to be distributed over an infinite plane at the maximum known concentration in the waste site. Exposure calculations to develop the radionuclide groupings were done assuming acute exposure to an atmosphere containing a large quantity of resuspended material. The concentration used in the matrix table (and hence dose) is revised downward based on the site size (correcting downward from exposure to an infinite plane and hemispherical source). The site area correction factors, developed by Napier, Peloquin, and Kennedy (1984) are shown in Table 6.

TABLE 6. Site Area Correction Factors for the Fire and Explosion Route

Site Area, m^2	Correction Factor
>1000	1.0
500 - 1000	0.8
300 - 500	0.6
100 - 300	0.4
<100	0.2

DRAFT

038386

3.3.4 Estimating Waste Concentrations for the Direct Contact Route

The unmodified HRS computes a score for the direct route in a manner similar to that done for the other routes of exposure. An estimate of the radiological hazard is based on a measured or calculated concentration of the radionuclides in the pathway of concern. Similar to the fire and explosion route, the radionuclides are assumed to be distributed over an infinite plane at the maximum known concentration in the waste site. Exposure calculations to develop the radionuclide groupings were done assuming an acute exposure to an atmosphere containing a moderate quantity of resuspended material. The concentration used in the matrix table (and hence dose) is revised downward based on the site size correction factors developed by Kennedy and Napier (1984) and shown in the previous section.

4.0 SUMMARY AND CONCLUSIONS

A method for evaluating the relative potential hazard of radioactive and mixed hazardous waste sites, compatible with the existing EPA Hazards Ranking System, has been developed. The method incorporates most of the HRS structure for waste site and exposed population determination, while adding a technically defensible subcategory for radionuclides. The combination given results comparable to the existing HRS for chemical hazards, without overplaying potential radiological hazards.

The modified HRS still contains the major deficiencies inherent in a simple ranking system. The system cannot account for the myriad site-specific circumstances that ultimately define whether remedial actions are required and what they should be. A more comprehensive modeling system is still required. However, as a preliminary screening tool, the m HRS can be useful in the determination of hazards due to mixed radiological and chemical wastes.

5.0 REFERENCES

Adam, J. A., and V. L. Rogers. 1978. A Classification System for Radioactive Waste Disposal-What Waste Goes Where? NUREG-0456, FBDU-224-10, U.S. Nuclear Regulatory Commission, Washington, D.C.

Gray, D. M., ed. 1973. Handbook on the Principles of Hydrology. Water Information Center, Inc., Port Washington, New York.

Hansen, W. 1984. Personal communication.

Macbeth, P. J., G. Wehmann, B. J. Turner, and D. H. Card. 1979. Evaluation of Alternative Methods for the Disposal of Low-Level Radioactive Wastes. NUREG/CR-0680, FBDU-209-03, prepared by Ford, Bacon and Davis, Utah, for U.S. Nuclear Regulatory Commission, Washington, D.C.

Murphy, E.S., and G. M. Holter. 1980. Technology, Safety, and Costs of Decommissioning a Reference Low-Level Waste Burial Ground Vols. 1&2. NUREG/CR-0570, prepared by Pacific Northwest Laboratory for U.S. Nuclear Regulatory Commission, Washington, D.C.

Napier, B. A. 1984. Personal communication.

Napier, B. A., R. A. Peloquin, and W. E. Kennady, Jr. 1984 *Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXI Computer Program*. NUREG/CR-3620, PNL-4054, Pacific Northwest Laboratory, Richland, Washington.

Oztunali, O. I., G. C. Re, P. M. Moskowitz, E. D. Picazo, and C. J. Pitt. 1981. *Data Base for Radioactive Waste Management, Volume 3 - Impacts Analysis Methodology Report*. NUREG/CR-1759, Vol. 3. Prepared by Dames and Moore, Inc. for U.S. Nuclear Regulatory Commission, Washington, D.C.

Rogers, V. C. 1979. *A Radioactive Waste Disposal Classification System*. NUREG/CR-1005. Prepared by Ford, Bacon, and Davis, Utah, for U.S. Nuclear Regulatory Commission, Washington, D.C.

Staley, G. B., G. P. Turi, and D. L. Schreiber. 1979. "Radionuclide Migration from Low-Level Waste: A Generic Overview," in M. W. Carter, A. A. Moglissi, and B. Kotn, eds., *Management of Low-Level Radioactive Waste, Vol. 2*, Pergamon Press.

U.S. Department of Energy (DOE). 1982. *Environmental Evaluation of Alternatives for Long-Term Management of Defense High-Level Radioactive Wastes at the Idaho Chemical Processing Plant*. U.S. Department of Energy, Idaho Falls, ID.

U.S. Nuclear Regulatory Commission (NRC). 1981. *Draft Environmental Impact Statement on 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste,"* Appendix G. NUREG-0782, Vol. 4, U.S. Nuclear Regulatory Commission, Washington, D.C.

[illegible]ce, R. W., et al. 1980. *Topical Report on Release Scenario Analysis [illegible] Long-Term Management of High-Level Defense Waste at the Hanford Site*. PNL-3363, Pacific Northwest Laboratory, Richland, Washington.

038386

Enclosure 2

Lake Ontario Ordinance Works, Lewiston/Porter, New York

1. Status of Environmental Assessments

The 1,511 acre portion of the former Lake Ontario Ordinance works, which was controlled by the Atomic Energy Commission (AEC) through 1954, and the 191 acre portion of the AEC area, which is now controlled by the Department of Energy (DOE), are shown on Figure 1. The current 191 acre DOE-controlled site is referred to as the Niagara Falls Storage Site (NFSS). The remaining properties in the 1,511 acre former AEC-controlled site are referred to as vicinity properties. DOE has performed radiological surveys and we have reports for all 26 of these vicinity properties that comprise the 1,511 acres around the NFSS, except the Air Force property known as the Nike 03 location shown on Figure 2. The Air Force is giving DOE permission to survey the Nike 03 property and a survey is scheduled for May 1985. We do not have any information on the 40th Explosive Detachment Model City, New York, that you requested. This property may have been part of the Nike site and we suggest you contact the Air Force for information.

Cleanup was needed for 22 of the 26 vicinity properties and areas along Pletcher Road as listed in Table 1. A sample survey report is attached herewith (Attachment 1). DOE has completed cleanup of radiological contamination on about one-half of the vicinity properties as of January 1, 1985. The remaining vicinity properties will be cleaned up by January 1, 1986. The post-remedial surveys will be included in the project final report to be issued in 1986. An environmental assessment was performed for the 1984 cleanup of vicinity properties (Attachment 2).

There are two large drainage ditches (the West and the Central ditches) which drain the NFSS and vicinity properties into Lake Ontario. These ditches became contaminated from the AEC-operated site to the extent shown in Figure 3 for radium-226 (1980 status). Cleanup of the West ditch was completed in 1983. Cleanup of the Central ditch was completed to Lutts Road by December 1984. Cleanup of a few small areas of contamination in the Central ditch beyond Lutts Road will be completed in 1985. The cleanup was performed to the standard for radium-226 provided in 40 CFR 192: averaged over areas of 100 square meters, no more than 5 pCi/g radium-226 in the first 15 cm below the surface and 15 pCi/g in any 15 cm layer which is more than 15 cm below the surface.

2. Reports on DOE Control Program

The cleanup and control actions for the NFSS vicinity properties are managed under the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP). Environmental monitoring of the NFSS vicinity properties and the NFSS site is described in Attachment 3. The monitoring report for calendar year 1984 is scheduled to be completed by July 1985.

038386

.achments to Enclosure 2:

1. Comprehensive Radiological Survey Off-Site Property C Niagara Falls Storage Site, Lewiston, New York, March 1984.

2. Addendum to Action Description Memorandum Niagara Falls Storage Site Proposed Interim Remedial Actions for FY 1983-85 Accelerated Program (1984 Vicinity Properties Cleanup), July 1984.

3. DOE/OR/20722-18, Niagara Falls Storage Site Environmental Monitoring Report Calendar Year 1983, July 1984.

Figure 1 038386

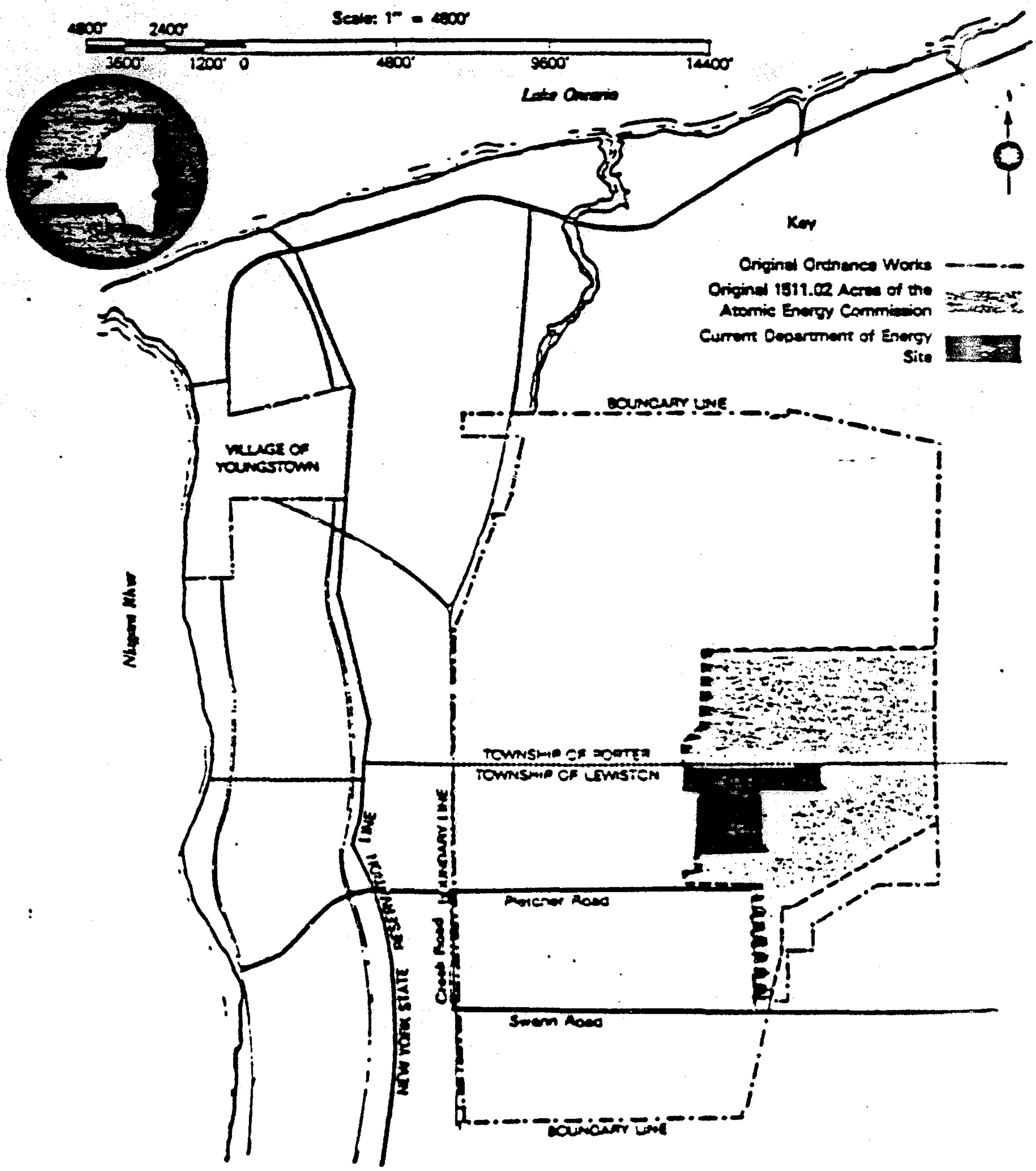

Figure 1. Former Lake Ontario Ordnance Works and the Area Controlled by the Department of Energy

038386

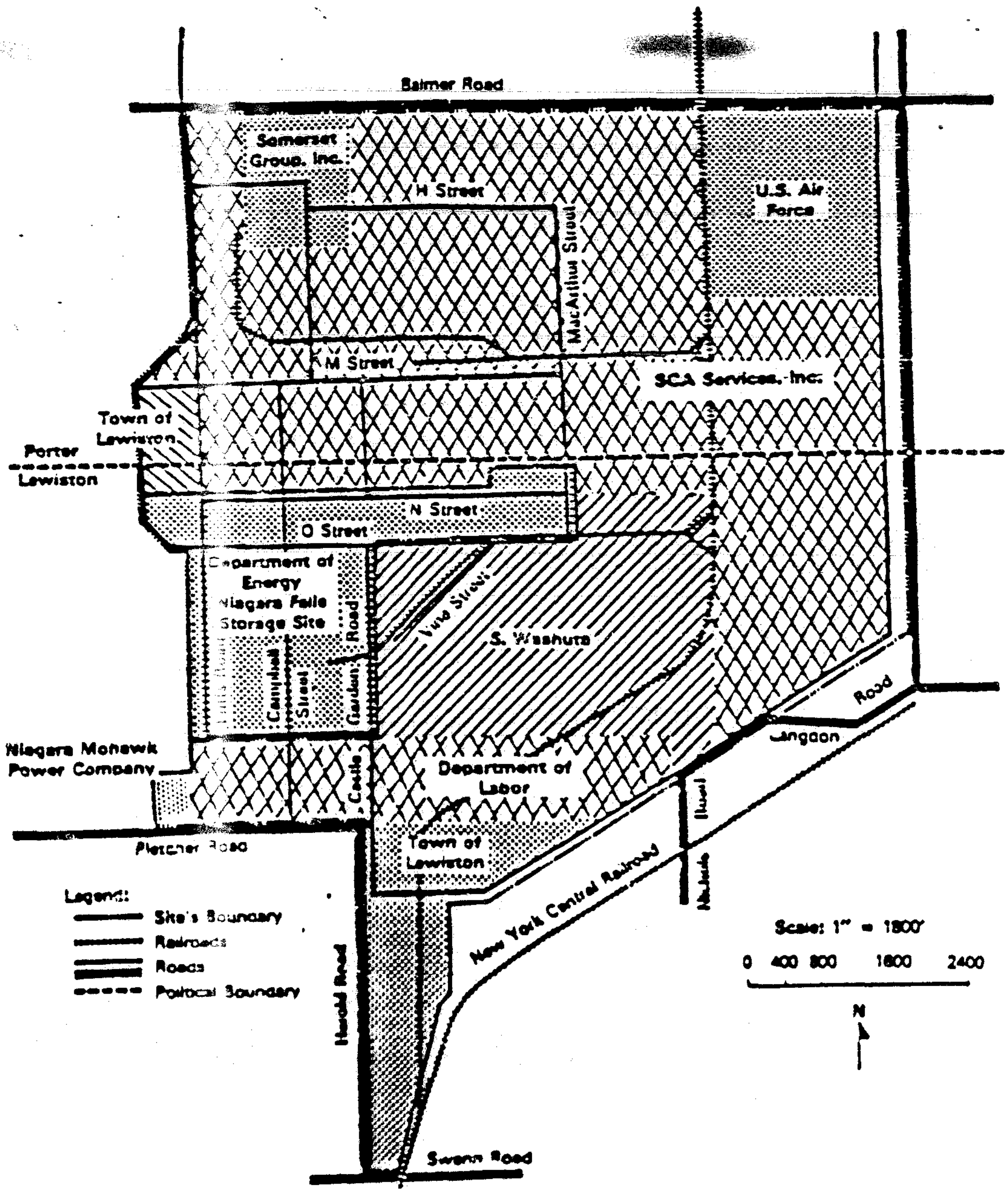

Figure 2 Land Ownership in the Former Atomic Energy Commission Portion on the Lake Ontario Ordnance Works

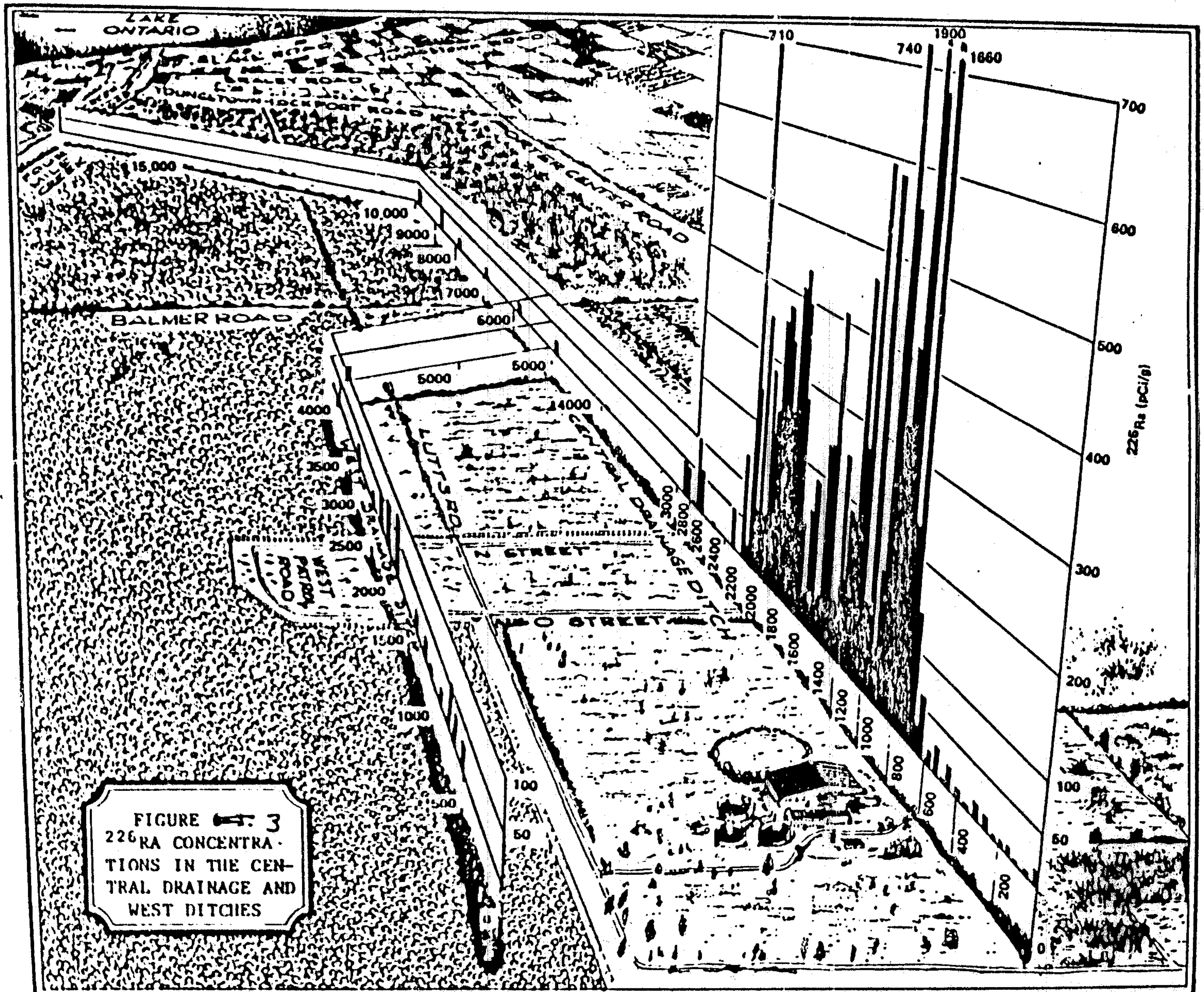

FIGURE 3
^{226}RA CONCENTRATIONS IN THE CENTRAL DRAINAGE AND WEST DITCHES

038386

038386

TABLE I

NFSS Vicinity Properties Designated for Remedial Action

A		N-North
B	ONE PROPERTY	N'-North
C'		N/N'-South
D		P
E		Q
E'		R
F		S
G		T
H		U
H'		V
L		W
M		X
		Areas Along Pletcher Road

038386

Enclosure 3

Niagara Falls Storage Site (NFSS), Lewiston, New York

1. Status of Environmental Assessments

As explained in Enclosure 1, the NFSS is the 191 acre portion of the former Lake Ontario Ordinance Works which is now controlled by DOE (see Figures 1 and 2 of Enclosure 1).

A comprehensive characterization and hazard assessment of the DOE NFSS was completed by Battelle-Columbus in 1980 (Attachment 1) for DOE. Measurements of radon on and around the site were made by Mound Laboratory for DOE at that time and are still being made (Attachment 2). These reports showed the need for remedial actions to reduce the emissions of radon from the site, and to stabilize the wastes on the site to prevent recontamination of cleaned up areas. In addition to these interim remedial actions, DOE decided to prepare an Environmental Impact Statement (EIS) to examine alternatives for long term management of the wastes at NFSS after completion of the interim remedial actions.

The remedial actions on the site were begun in 1981 with improved security and maintenance at the site. In 1982, work to reduce radon sources was started. Two buildings with pitchblende processing residues (Buildings 413 and 414) were capped. In addition, work was started to stabilize and cover a pile of residues that are stored on the ground (the R-10 area). Environmental assessments were made prior to these actions (Attachments 3 4). In 1983 and 1984, cleanup of onsite areas and some offsite aminated areas was conducted and wastes were stored in the R-10 waste a. Preparations were made to transfer residues from a concrete water ower to a low concrete building and transfer of 95 percent of these residues was completed. Some contaminated buildings were demolished and the waste stored in the R-10 area. Construction of a clay cap on the interim storage pile at the R-10 area was initiated and over 50 percent completed. In 1985, the cleanup of the remaining offsite contaminated areas (vicinity properties) will be completed, the remainder of the residues will be transferred from the concrete tower to the storage building in the R-10 area, the tower will be demolished, and the remainder of the clay cap will be put onto the interim storage pile. An environmental assessment of these actions is provided in Attachment 5.

A draft EIS to examine the options for long term management of these wastes and residues is provided in Attachment 6. The Environmental Protection Agency, Region 2, has commented on this draft. A final EIS is scheduled to be published in 1985.

2. Reports on DOE Control Program

This site is managed under the DOE Surplus Facilities Management Program (SFMP). The environmental monitoring program for the NFSS and vicinity properties is described in Attachment 3 to Enclosure 2 together with 1983 data. Data for 1982 are in Attachment 2 to this enclosure.

Attachments to Enclosure 3

1. BMI-2074, A Comprehensive Characterization and Hazard Assessment of the DOE Niagara Falls Storage Site, June 1981.

2. Niagara Falls Storage Site Environmental Monitoring Report, Calendar Year 1982.

3. Action Description Memorandum NFSS Proposed Interim Remedial Action for Buildings 413 and 414, April 1982.

4. Action Description Memorandum NFSS Proposed 1982 Interim Remedial Action (R-10 Pile Stabilization), April 1982.

5. Action Description Memorandum NFSS Proposed Interim Remedial Action for the FY 1983-85 Accelerated Program, June 20, 1983.

6. Draft EIS Long Term Management of the Existing Radioactive Wastes and Residues at NSFF, August 1984.

038386

Enclosure 4

Ashland Oil I and II and Seaway Industrial Park, Tonawanda, New York

1. Status of Environmental Assessments

These three properties are contaminated with uranium residues originating from processing operations conducted at the Linde Air Products Uranium Processing Facility during 1943 to 1946. Fact sheets for the Ashland I and Seaway properties are provided in Attachments 1 and 2. Radiological surveys of Ashland I and Seaway are provided in Attachments 3 and 4. The contamination on the Ashland II property and the Seaway property appears to have been due to the owner moving the material from Ashland I during construction operations. We have no information on the Ashland II site other than in Attachment 5 which reports the result of a walk-on survey in January 1980.

We have performed an Environmental Protection Agency (EPA) Hazard Ranking System (HRS) calculation for these sites as a unit since they have similar pathways and exposure potential (Attachment 6). We have also included in Attachment 6 a calculation using the DOE modified HRS method described in Enclosure 1.

2. Reports on DOE Control Program

DOE determined it had authority for conducting remedial action at these sites in September 1984. We have assigned these sites a medium to low priority in the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP). No monitoring or control program has been established by DOE. Some advance planning is being done, but remedial action is not scheduled until the early 1990's due to higher priorities and the limitation on funds.

Attachments to Enclosure 4:

1. Fact sheet for the Ashland Oil Company (Former Haist Property), Tonawanda, New York.
2. Fact sheet for the Seaway Industrial Park Site, Tonawanda, New York.
3. DOE/EV-0005/4, FUSRAP, Radiological Survey of the Ashland Oil Company (Former Haist Property), Tonawanda, New York, May 1978.
4. DOE/EV-0005/6, FUSRAP, Radiological Survey of the Seaway Industrial Park, Tonawanda, New York, May 1978.
5. Letter from W. D. Cottrell to A. J. Whitman dated October 17, 1984, on the Ashland No. 2 site, Tonawanda, New York.
6. EPA Hazardous Waste Ranking System Calculations for Ashland Oil, Inc. (Former Haist Property) and Vicinity Properties (Seaway Industrial Park and Ashland II).

038386

Enclosure 5

Linde Air Products Division, Tonawanda, New York

1. Status of Environmental Assessments

The former Linde Uranium Refinery extracted uranium from various ores, concentrates and residues to produce uranium dioxide and tetrafluoride from 1943 to 1946. Residual contamination exists in some buildings, the soil, and in groundwater (from waste injection wells). A radiological survey of the site was conducted in 1976 (Attachment 1). Another survey was performed in 1981 to obtain further data on the liquid waste disposal pathways (Attachment 2). An evaluation of this data is provided in Attachment 3.

We have performed an Environmental Protection Agency (EPA) Hazard Ranking System (HRS) calculation for this site and a calculation using the DOE modified HRS method (Attachment 4). The DOE modified HRS method is described in Enclosure 1.

2. Reports on DOE Control Program

DOE determined it had authority for conducting remedial action at this site in 1981. We have assigned this site a low priority in the DOE Formerly Utilized Sites Remedial Action Program (FUSRAP). No monitoring or control program has been established by DOE. Some advance planning is being done, but remedial action is not scheduled until the mid-1990's due to higher priorities and the limitation on funds.

Att[illegible]nts to Enclosure 5

1. DOE/EV-0005/5, FUSRAP, Radiological Survey of the Former Linde Uranium Refinery, Tonawanda, New York, May 1978.
2. Radiological Survey of the Liquid Effluent Disposal Pathways Formerly Used by Linde Air Products Division, Tonawanda, New York, P. W. Frame, et al. (ORAU), October 8, 1981.
3. Aerospace Report No. ATR-82 (7963-04)-2, Evaluation of the 1943 to 1946 Liquid Effluent Discharge from the Linde Air Products Company Ceramics Plant, December 1981.
4. EPA Hazardous Waste Ranking System Calculations for Linde Air Products Division, Union Carbide Corporation.

Enclosure 6

038386

Middlesex Sampling Plant, Middlesex, New Jersey

1. Status of Environmental Assessments

During the period 1943 to 1955, uranium and thorium ores and concentrates were stored and mechanically processed for sampling and analysis at the Middlesex Sampling Plant under the control of the Atomic Energy Commission. As a result of these operations, the plant site and some nearby ("vicinity") properties were contaminated with radioactive residues. In 1980, DOE began cleanup of the vicinity properties and storage of the waste at the Sampling Plant on an impervious asphalt pad with a drainage and collection system. The construction of the storage area and the cleanup of five vicinity properties were completed in 1981 (Phase I). The cleanup of the remaining 28 parcels was completed in January 1982 (Phase II). These properties were cleaned up to the Environmental Protection Agency (EPA) standards for radium-226 and thorium in 40 CFR 192: averaged over areas of 100 square meters, no more than 5 pCi/g in the first 15 cm below the surface and 15 pCi/g in any 15 cm layer which is more than 15 cm below the surface. The final reports for Phase I are provided in Attachments 1, 2, and 3. A draft final report for Phase II is provided in Attachment 4.

In a related action, DOE is cleaning up radioactive contamination from the nearby Middlesex Landfill and is storing the waste on the Middlesex Sampling Plant. This work was begun in 1984 and will be completed in 1985. An estimated 33,000 cubic yards of contaminated material will be brought to the site from the Landfill; about 50 percent was completed in

...ning for cleanup of the Sampling Plant and removal of the 36,000 cubic yards of stored waste (Phase III) is underway. A radiological survey report for the site is provided in Attachment 5. An estimated 91,000 cubic yards of material must be removed from the site to meet the remedial action cleanup guidelines. However, this cleanup and removal will not be implemented by DOE until the State of New Jersey selects candidate disposal sites in the State. Subsequently, DOE will select and acquire one of these sites, construct a disposal site, remove the contaminated materials from the Middlesex Sampling Plant and transport these materials to the new disposal site, and dispose of the materials at the new site. If the State of New Jersey begins promptly on candidate disposal site selection, DOE would plan on initiating Phase III in the early 1990's. An environmental impact statement would probably be prepared prior to initiating Phase III. We have performed an EPA Hazard Ranking System (HRS) calculation for the Middlesex Sampling Plant in its current status and also a calculation by the DOE modified HRS as described in Enclosure 1 (Attachment 8).

2. Reports on DOE Control Program

We have assigned these sites (the Middlesex Sampling Plant and the Middlesex Landfill) to the Formerly Utilized Sites Remedial Action Program (FUSRAP). After completion of cleanup of the Middlesex Landfill, the Phase III action at the Middlesex Sampling Plant will have a low priority. DOE provides maintenance and surveillance of the Sampling Plant, including monitoring and control of wastes on the site. An environmental monitoring report for 1980, 1981, and 1982 is provided in Attachment 6 and for 1983 in Attachment 7.

Attachments to Enclosure 6:

1. Certification Docket for Five Vicinity Properties Associated with the Former Middlesex Sampling Plant, Middlesex, New Jersey.
2. Project Report of Phase I Remedial Action of Properties Associated with the Former Middlesex Sampling Plant Site, NLCO-006EV Rev. 1, April 1982.
3. Radiological/Environmental Support Program Report, Phase I Remedial Action Middlesex Sampling Plant and Vicinity Properties, Eberline.
4. Final Report on Remedial Action at the Former Middlesex Sampling Plant and Associated Properties, DOE/OR/20722-27, September 1984, Volumes I, II, and III (Draft).
5. Radiological Survey Report for the Former Middlesex Sampling Plant, DOE/OR/20722-20, December 1984 (Draft).
6. Environmental Monitoring Report 1980, 1981, 1982, Former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, Middlesex, New Jersey, DOE/OR/20722-3, October 1984.
7. Environmental Monitoring Report for the Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, Middlesex, New Jersey, Calendar Year 1983, DOE/OR/20722-17, October 1984.
8. EPA Hazardous Waste Ranking System Calculations for Middlesex Sampling Plant, Middlesex, New Jersey.