ALARA Remedial Action for the SAEP Causeway and Radiation Final Status Survey

STB-393, Docket 040-02917

Honeywell

STRATFORD ARMY ENGINE PLANT
550 MAIN STREET
STRATFORD, CT 06498-7593

July 2000

SAEP Causeway Radiation Final Status Survey
STB-393, Docket 040-02917

Table of Contents

Tables

Figure

Photos

Appendices

Summary

The requirement for implementing ALARA remedial actions and the final status radiological survey are complete. For the remedial action, 31 fifty-five gallon drums were generated as radioactive waste. The radiation levels in remediated survey units average less than the background reference area. Data from the final status survey indicate that for the defined critical group the highest annual dose from average exposure rates for all survey units was less than 1 mrem. This value does not include any reduction factor for shielding from proposed cover material which will be considerable if three feet or more of clay/dirt is added.

The final status survey was oriented towards MARSSIM techniques and gamma radiation levels because of the inability to collect samples with ordinary hand-auger efforts. Results of post remediation soil average concentrations indicate that the survey units are 30% or less of a unity guideline for Th-232 and U-238.

The survey units meet the release criterion established by the State of Connecticut Department of Environmental Protection regarding a soil surface radiation level of 30 μR/h. The maximum surface rate surveyed was 17.8 μR/h.

The remediation efforts did not contaminate the drum storage area.

RADIATION FINAL STATUS SURVEY
STB-393, Docket 040-02917

1. GENERAL INFORMATION

1.1 License to Be Terminated

The Stratford Army Engine Plant (SAEP) is undergoing closure under the Base Realignment and Closure (BRAC) program. The license termination objective is that the site be removed safely from service and that any residual radioactivity be reduced to levels that permit release of the property for unrestricted use. The desired endpoint is unconditional license termination for NRC Source Material License No. STB-393 with an expiration date of August 31, 2002.

SAEP is located in Stratford Connecticut, on the Stratford Point peninsula which is in the southeast corner of Fairfield County. Most of SAEP is paved or covered with buildings. The property consists of approximately 127 acres, of which about 76 acres are improved land and 51 acres are riparian rights. The riparian rights property consists of intertidal flats of the Housatonic River which includes a causeway of about 2 acres constructed in the 1930's. The 76 acres of improved land include an estimated 10 acres along the Housatonic River where fill was placed over tidal flats during the early development of SAEP.

Currently the Causeway is the single remaining part of the facility not yet released for unrestricted use. The Causeway is co-located with Building 59 on the riverside of the dike (flood wall). It is a totally man-made facility built in various stages through the years.

1.2 Licensee Name and Address

Honeywell (Formerly AlliedSignal, Inc.)
550 Main Street
Stratford, CT 06497-7593

1.3 Requirement for ALARA Remediation

The need for ALARA remediation of the Causeway was discussed in detail in the Addendum to License Termination Plan[1] (ALTP). Only thorium-232 and uranium-238 are identified in soil samples as potential concerns from operations or licensed activities. Because both of them are naturally occurring radionuclides, there is question as to exactly what is residual versus natural. The location of the source of the initial fill material, circa 1930, and thereafter is not known. Possible sources include exempted radioactive material from licensing such as those materials used in sandblasting or polishing material for engine parts. Regardless of how the material actually got there, three small areas were identified for simple remediation because of radiation dose rates being greater than 30 μR/h at the ground surface. This survey occurred in January 2000 with assistance of the State of Connecticut Department of Environmental Protection (CT DEP). Remedial action was not deemed difficult because a visual spill pattern (grayish-white layer of material about 1-2 inches thick) had been identified which was also readily verified with hand held radiation survey instruments.

The areas for remedial actions were as agreed with the CT DEP and as discussed with them and representatives of the US Nuclear Regulatory Commission, US Environmental Protection Agency, US Army COE and US Army TACOM at a meeting held at Stratford Connecticut on January 6, 2000. The designated remedial areas comprised a total surface area of less than 70 m^2 with their boundaries having radiation dose rates of 20 μR/h at the ground surface. Photographs of the three areas before remediation follow. Note that the remediation was conducted in two of the designated Survey Units discussed later in paragraph 1.5 and 4.0.

[1] Addendum to License Termination Plan, Revision 0, 2/2/00, Honeywell, Stratford, CT.

Photo 1- Survey Unit 1, Larger Portion of First Area

Photo 2- Survey Unit 1, Smaller Nearby Portion of First Area

Photo 3- Survey Unit 1, Second Area

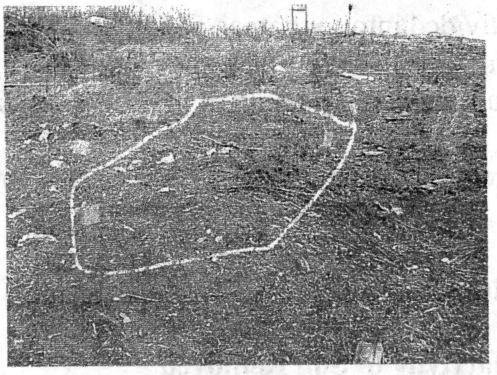
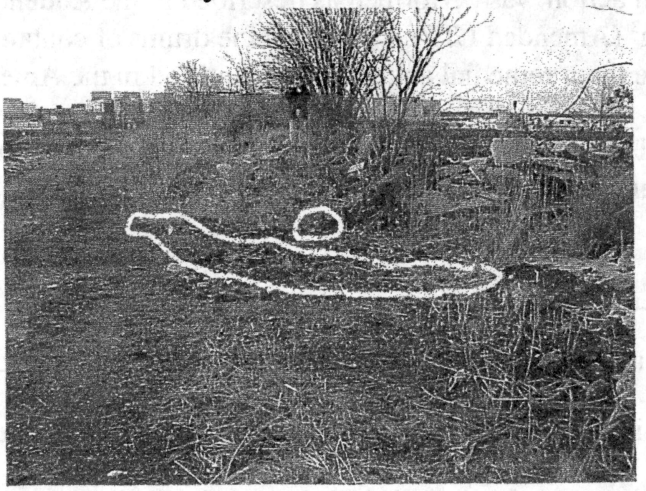


Photo 4- Survey Unit 2, Two Adjacent Areas



1.4 Derived Concentration Guideline Levels (DCGLs)

An ALARA goal guideline for surface dose rate was established as 30 μR/h during the meeting described above. This DCGL included contributions from background radiations.

DCGLs for U-238 as 35 pCi/g and for Th-232 as 10 pCi/g were previously established[2]. Because there are two radionuclides involved, the Unity Guideline must be met. The sum of (^{232}Th concentration/10 pCi/g) + (^{238}U concentration/35 pCi/g) ≤ 1.

Elevated residual radioactivity areas may not exceed the average guideline by greater than a factor of $(100/A)^{½}$, where A is the area in m^2).

1.5 Description of Areas

The Causeway was divided into four areas of which three are survey units and one as a background reference area. The survey units are generally described and referenced to the Causeway sketch found in Section 4 of this report.

The areas which were remediated were confined to those areas generally indicated in the Photos 1 - 4.

2. ALARA REMEDIAL ACTION

2.1 Quantity and Radioactivity of Soil Removed

ALARA remedial action was performed as described in the Addendum to the License Termination Plan[3] (Amended LTP) . Twenty nine drums of contaminated soil were removed from the three remedial action areas identified in the Amended TLP. The results of gamma spectrometry[4] of composite samples collected from the waste per area are presented in Table 1 below. An additional two drums of personnel protective equipment and samples were generated during the remedial action.

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[2] License Termination Plan, Revision 0, 7/20/98. AlliedSignal, Inc., Stratford, CT.

[3] Addendum to License Termination Plan, Revision 0, 2/2/00, Honeywell, Stratford, CT.

[4] Gamma spectrometry performed by ATL International, Germantown, MD

Table 1. Radioactivity Concentration Levels in Removed Soil

Area	Composite Sample Number	Number of 55-Gallon Drums	Sample Concentrations *			
			K-40 (pCi/g)	U-238 (pCi/g)	Th-232 (pCi/g)	Unity Guideline
1	1	2	10.1	34	6.1	1.6
	2	2	9.1	34	5.7	1.5
2	1	3	N/D	38	6.6	1.8
	2	3	N/D	38	7.9	1.9
3	1	3	5.8	22	8.0	1.4
	2	3	5.5	35	10	2.0
	3	3	N/D	33	11	2.0
	4	3	2.8	29	11	1.9
	5	3	N/D	43	11	2.3
	6	2	7.6	18	6.0	1.1
	7	2	N/D	36	9.4	2.0

* A correction for background was not made. See Appendix A, Page A-3 for Errors and MDAs.

2.1.1 Radioactive Waste Minimization

The areas were remediated with minimal effort through ordinary techniques, i.e., back hoe and hand shoveling into 55 gallon drums. The top layers of soil were removed and only contaminated soil with an elevated radiation level was removed for disposal when possible. Attempts were made to segregate concrete blocks, rocks greater than 1 inch in diameter, and other rubble from the contaminated soil to minimize waste.

2.1.2 Comparison to Characterization Study

Composite radioactivity concentration averages of removed soil are considerably higher than the reported average of 145 samples which were collected during site characterization by a factor of 14.2 for U-238 and a factor of 6.5 for Th-232. These multiple factors are an indicator of the effectiveness of the remediation technique.

2.2 Post Excavation Sampling

2.2.1 Laboratory Samples

Following excavation, soil samples were collected from each area. Gamma spectrometry results are given in the table below.

Table 2. Results of Post Remediation Sampling

Elevated Area	Sample Number	Sample Concentration*			
		K-40 (pCi/g)	U-238 (pCi/g)	Th-232 (pCi/g)	Unity Guideline
1	1	10.5	9.6	2.2	0.5
	2	13.8	8.5	2.1	0.5
2	1	15.4	0.6	0.8	0.1
	2	10.9	15.0	2.4	0.7
3	1	5.7	11.0	3.9	0.7
	2	11.0	2.0	0.9	0.1

* A correction for background was not made. See Appendix A, Page A-3 for Errors and MDAs.

2.2.2 Post Remediation Scanning

The remediated areas were scanned with no results being greater than twice background radiation levels. The scanning was performed at approximately 6 cm from the soil surface with a Ludlum M2350-1 Digital Rate Meter/Scaler combined with an M44-20, 3"x3" Sodium Iodide Detector. See paragraph 3.1 below for a further description of instruments and techniques.

2.2.3 Determining Post Remediation Concentration Levels

Results of the post remediation samples indicated in Table 2 above were included with data presented in Table 3 and Appendix A to establish the existing concentration average levels. Results of 29 samples collected in the immediate area of remediation during characterization were removed from this analysis; these sample numbers were 145-160, 202, 211-212, 349, 353-354, and 373-378. The data is reported to be a combination of random and bias (> 2 times background levels) sampling which implies that resulting averages will err on the conservative side.

Table 3. Post Remediation Status of the Survey Units

Survey Unit		Concentration*			
		K-40 (pCi/g)	Th-232 (pCi/g)	U-238 (pCi/g)	Unity Guideline
1- North End (16 Samples)	Average	10.3	2.8	1.0	0.3
	Sigma	4.4	4.3	1.2	
2- East Side (19 Samples)	Average	8.0	1.6	1.3	0.2
	Sigma	5.3	2.4	1.6	
3-North of B-59 & South of Areas 1 and 2. (90 samples)	Average	8.6	2.2	3.4	0.3
	Sigma	5.4	3.1	5.2	

* A correction for background was not made.

2.3 Post Shipment Smear Survey of Storage Area

Building 59 was previously designated as a non-impacted area and its loading dock was used to temporarily store the waste drums until shipment. Following shipment of the radioactive waste, a check of removable surface contamination was made of the loading dock. This check consisted of 4 smear samples being collected from the storage area and 4 smear samples to be used as a background reference from an unused room of Building 59. The smears were taken to represent an area of 100 cm^2 and two blanks were included for quality control. All results for smears and blanks were less than the MDAs of 0.7 dpm/100 cm^2 and 1.7 dpm/100 cm^2 for alpha and beta contamination; respectively. The smear samples were analyzed by ATL International, Inc. of Germantown, MD.

2.4 Shipment of Waste Drums

The drums were moved on June 6, 2000 from Building 59 by Environmental and Technical Solutions and were loaded onto a tractor trailer provided by US Ecology. US Ecology was unable to obtain the required transportation permits from the State of Connecticut on June 6, and the loaded trailer was secured and remained at SAEP until June 7. A survey of the trailer while parked at SAEP indicated that radiation on all sides of the trailer were less than 0.01 mR/hour at a distance of 1 foot. Note that the highest level noted on waste drums was less than 0.2 mR/hour and the low dose rates around the trailer reflect self shielding and distance from the drums. Following are photos showing (1) the vehicle used to transport, (2) the loading dock of Building 59 with filled drums (3)

the loading process, (4) bracing used inside the trailer, (5) the emptied loading dock and (6) performance of the unrestricted area survey. Thirty-one drums were removed from the site. Appendix B contains the (1) NRC Forms 540, Uniform Low-Level Radioactive Waste Manifest; and (2) NRC Form 541, Waste Manifest.

Photo 5, Dart Transport Vehicle

Photo 6, Loading Dock of Building 59 With Drums

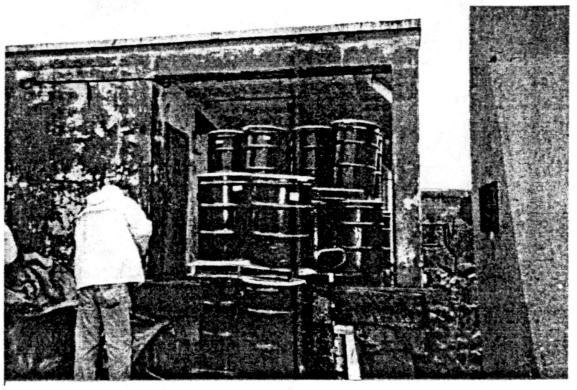


Photo 7, Loading

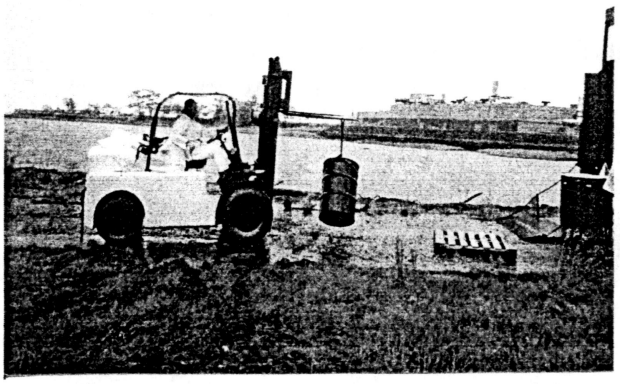


Photo 8, Drums Braced for Shipment

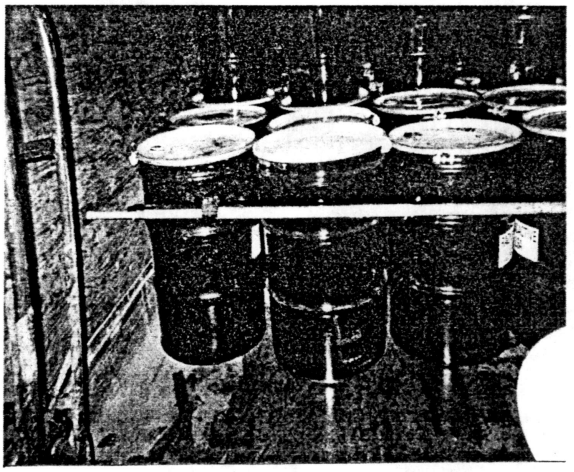


Photo 9, Emptied Loading Dock

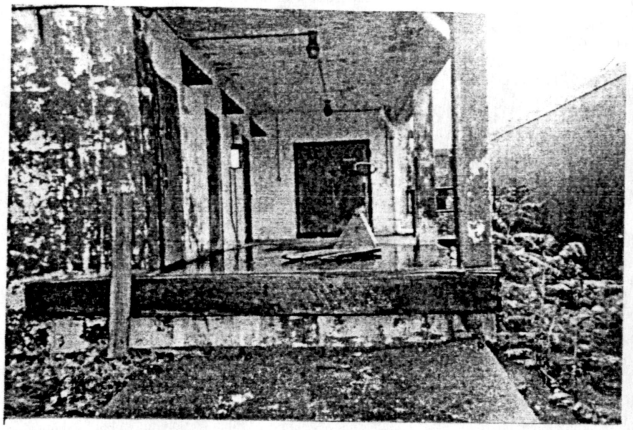
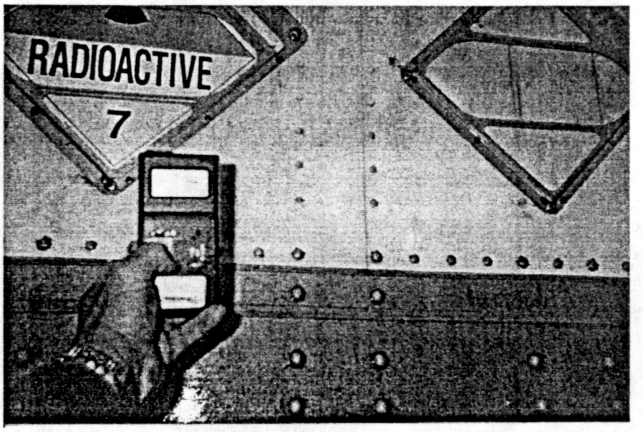


Photo 10, Performance of Unrestricted Area Survey



3. PLANNING THE FINAL STATUS RADIATION SURVEY

The final status survey for the Causeway required focus on the inability to collect physical samples because of the concrete and rubble deposited there. Survey guidelines stated in the *NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination*[5] were not reasonable for ALARA purposes because of the potential exposure to chemical agents and a high probability of not being able to collect soil samples because of rubble and objects being in the way.

A great deal of data has been reported and this knowledge was incorporated into the final status survey requirements:

- Data presented above indicates that small elevated areas have been removed. The survey data indicates that for NUREG-5849 purposes, the average concentrations will meet regulatory requirements for unrestricted use. Only exposure rate measurements are needed to demonstrate that the ALARA goal guideline of 30 μR/h was met.

- A one hundred percent scan survey was previously performed on the Causeway. Areas that were remediated for ALARA were re-scanned with negative results, see paragraph 2.2.2 above.

[5] NUREG/CR-5849, ORAU-92/C57, 1 June 1992, Manual for Conducting Radiological Surveys in Support of License Termination.

- The 1997 CHPPM survey incorporated into the License Termination Plan did not indicate any elevated areas or residual contamination for the area designated as the background reference area.

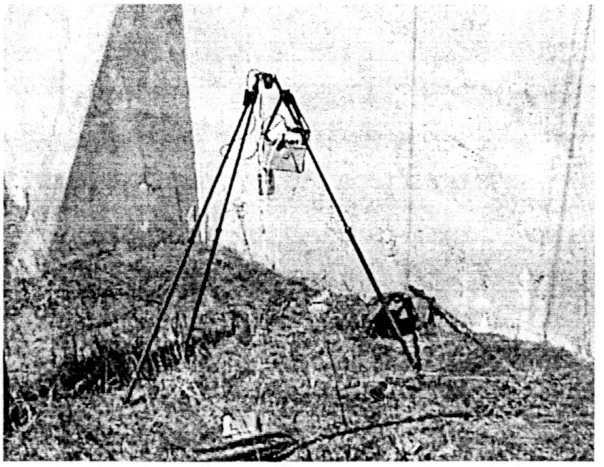
- The License Termination Plan survey data indicated that measurement of gamma radiation levels are acceptable as contamination indicators in lieu of additional detailed soil sampling. Further soil sampling was to be limited to remediation areas and collected only for confirmatory measurements.

3.1 Selection of Instruments

As NaI survey instrumentation can readily detect the required level, a Ludlum M2350-1 Digital Rate Meter/Scaler with internal storage capability of up to 1,000 Data Points combined with an M44-20, 3"x3" Sodium Iodide Detector was selected for this work. This instrument also has a visual display in μR/h or cpm for confirmation or scanning work.

The goal for radiation levels for soil surfaces was to be evaluated at a 6 cm distance and this distance was assumed to be at the center of the NaI crystal and not the face of the detector. The face of the detector was approximately 2 cm from the soil surface for the 6 cm measurements and similar distance corrections (center of crystal) were made for the 1 m measurements. Below is a photograph of the tripod and NaI detector arrangement at the 1 m distance.

Photo 11. Tripod with NaI Detector at 1 m



3.2 Other Data Quality Objectives and MARSSIM Parameters

Following the techniques described in MARSSIM, parameters were generated to determine the number of measurements required and the distance between them. The selection criteria are discussed below and the results are presented in the following table.

- **Area Classifications**: Areas with remedial activity (Survey Units 1 and 2) were established as Class 1 as defined in NRC NUREG DG-4006 paragraph 2.1. Survey Unit 3 was not likely to have concentrations that exceed the DCGL and was considered a Class 2.

- **Survey Unit Areas**: Class 1 survey units were limited to a maximum of 2,000 m^2 and the Class 2 survey unit to a maximum of 10,000 m^2 as defined in NRC NUREG DG-4006 paragraph 2.1.

- **Relative Shift Δ/σ_s**: This is a ratio involving the concentration to be measured relative to the variability in the concentration. This ratio is used as defined in NRC NUREG DG-4006 paragraph 2.7.1; with delta being one-half of the derived concentration guideline. To have an acceptable probability of passing the test (1-β), the survey unit must have been cleaned to at least 0.5 DCGL. The DCGL for MARRSIM data is 30 μR/h less the background of 8.2 μR/h equaling 21.8 μR/h. The delta is one- half of this DCGL or 10.9 μR/h. Per the example given in MARSSIM paragraph 5.5.2.2 when the standard deviation in the reference area and the survey units are different, the larger value should be used to calculate the relative shift. Knowing that the standard deviations were 1.6 μR/h., 3.3 μR/h, 3.4 μR/h, and 3.5 μR/h for Survey Units 1, 2, and 3 and the Reference Area, 3.5 μR/h was selected for calculations.

- **Acceptable Decision Errors**: The alpha decision error is the probability of passing a survey unit whose actual concentration exceeds the release criterion. A decision error α of 0.05 was accepted per NRC NUREG DG-4006 paragraph 2.7.2. For this survey, the β decision error is the probability of failing a survey unit whose actual concentration is equal to 0.5 DCGL. Any value of β is acceptable to the NRC per NRC NUREG DG-4006 paragraph 2.7.2.

- **P_r (random measurement probability)**: This is the probability that a random measurement from the survey unit exceeds a random measurement from the background reference area by less than the DCGL when the survey unit median is equal to the 0.5 DCGL (for this survey) above background. Used in determining the number of measurements to be performed and is obtained from Table 5.1 of MARSSIM.

- **Decision Error Percentiles, $Z_{1-\alpha}$ and $Z_{1-\beta}$**: These are percentiles represented by the selected decision error levels, α and β. They are standard statistical values obtained from Table 5.2 of MARSSIM.

- **Number of Data Points**: The number of data points, N, to be obtained from each reference area/survey unit pair for the Wilcoxon Rank Sum (WRS) test may be determined from Table 5.3 of MARSSIM or calculated using:

  $$N = 1.2 * (Z_{1-\alpha} + Z_{1-\beta})^2 / 3(P_r - 0.5)^2$$

  The calculated value must be rounded upward to the next even number as the N_{total} in Table 4 is to be equally split between the reference unit and the survey unit. However, the total number of measurements in each survey unit and the reference unit was set higher than that required by MARSSIM for even better survey statistics and assurance that the field site would be visited only once. To keep distances between field measurements easy to assess, the number of measurements made in each Survey Unit was established as not less than 10 in each of the Survey Units and the Reference Area.

- **Area, A:** The areas of each survey were estimated. The area available at mean tide was used.

- **Spacing L:** The number of calculated survey locations, n, based on the statistical tests, is used to determine the spacing, L, of a systemic pattern by:

  $L = \sqrt{\frac{A}{n}}$ for a square grid where A is the area of the survey unit.

  The calculated values of L are given in Table 4 below. The number of measurements used in the calculation was per the established goals. The actual spacing between sampling points was rounded downward to10 m for Survey Units 1 and 2 while the spacing for Survey Unit 3 was rounded downward to 20 m. These spacings are more adaptable to field work.

Table 4. MARSSIM Statistics

Parameter	Survey Unit (SU)		
	North - SU 1	**East - SU 2**	**West and South - SU 3**
α and β	0.05	0.05	0.05
Δ/σ	3.1	3.1	3.1
P_r	0.983	0.983	0.983
$Z_{1-\alpha}$ or $Z_{1-\beta}$	1.645	1.645	1.645
$N_{total}/2$	10	10	10
Area	~1790 m^2	~1720 m^2	~7000 m^2
L	13.4 m	13.1 m	26.5 m

4.0 LAYOUT OF THE SURVEY AND MEASUREMENTS

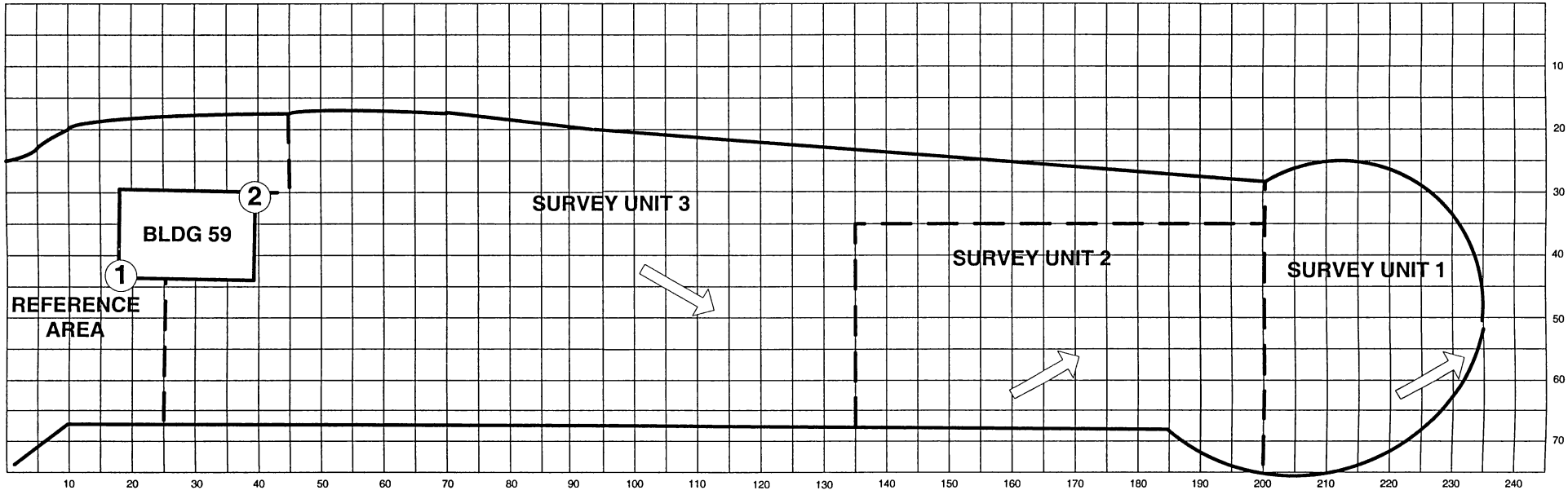
4.1 Random Starting Points and References

During characterization surveys, nails had been driven every 10 m parallel to the x axis shown in Figure 1 on the 65 m line and several were still in place. The random generated start points were referenced to certain of these nails as follows: Reference Area: 0 m, 65; Survey Unit 1: 215 m, 65 m; Survey Unit 2: 190 m 65 m; and Survey Unit 3: 45 m, 65 m.

GPS locations for two corners of Building 59 are listed on Figure 1 also.

Each grid on the Causeway sketch, Figure 1, represents a distance of 5 m on each edge. A computer generated random start point was created for Survey Unit 1 at 237 m, 52 m; Survey Unit 2 at 171 m, 56 m; and Survey Unit 3 at 113 m, 53 m.

Figure 1, Causeway Sketch



Building 59 GPS Locations

1: 657616.73, 4559545.76

2: 657617.83, 4559571.31

⇨ Random Start Points

——— Approximate boundary at high tide

— — — Boundary of survey unit

NO SCALE: EACH GRID ~ 5 M

4.2 Reference Area Measurement Locations

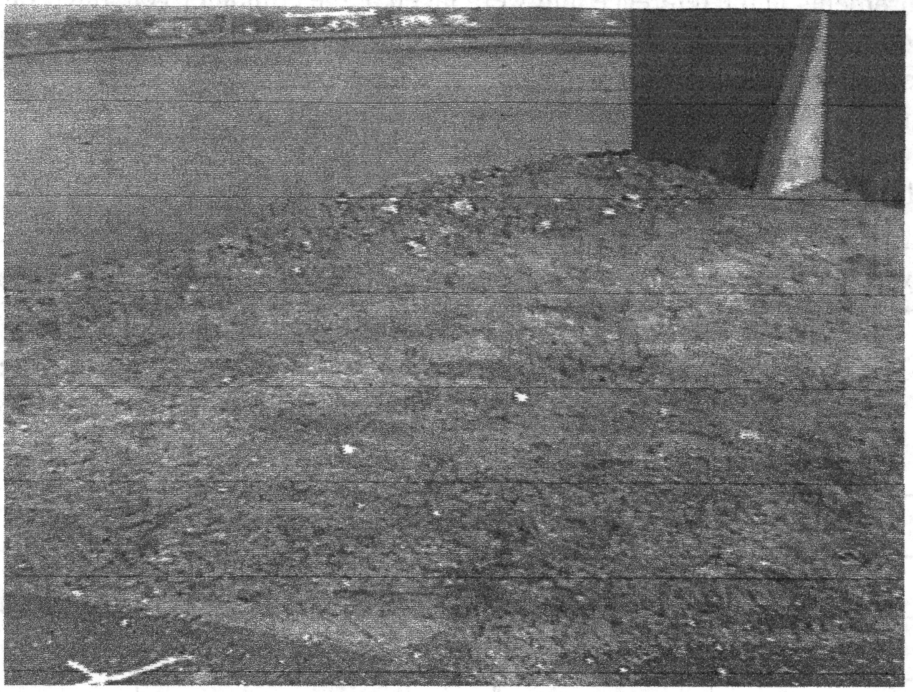
Measurements in the reference unit were taken at the computer generated random locations shown in Table 5 below. Locations 8, 10, 12, 13, 20, 22, and 26 were inaccessible as being either outside the actual area of the reference unit or physically part of Building 59. Nineteen locations were used.

Table 5. Reference Unit Random Locations

Number	X Coordinate	Y Coordinate	Number	X Coordinate	Y Coordinate
1	22	45	14	14	38
2	6	38	15	9	42
3	17	41	16	40	29
4	18	39	17	24	59
5	13	44	18	8	31
6	1	31	19	10	52
7	22	55	20	27	35
8	27	38	21	6	43
9	13	50	22	1	22
10	8	22	23	21	50
11	2	45	24	9	38
12	20	37	25	17	53
13	19	43	26	25	39

The construction flags in Photo 12 below indicate some of the measurement locations for the random survey points in the Reference Area.

Photo 12. Random Survey Locations in Reference Area



4.3 Survey Unit Measurement Locations

Personnel used construction flags or poles as a means to designate the survey locations. To keep the locations in a square pattern, a transit, visual line-of-site techniques, and field measurements including a test for equal diagonals were used. From the random start points for Survey Units 1 and 2, measurement locations were identified on a square grid system with 10 m between each point. Although 20 m was the planned distance between measurements in Survey Unit 3, the Causeway was not wide enough to accommodate three rows so the distance was reduced to 15 m; the grid pattern was made smaller to 20 m by 15 m.

In all survey units, the upper left (x,y) sampling location was designated as No. 1 and increasing in number moving to the right or parallel to the x axis. Survey Unit 1 had four measurements in four rows while Survey Units 2 and 3 had a five measurements in three rows.

Photo 13 illustrates how measurement locations were identified and is oriented looking from the mainland to the water. The markers are on a line designated as 63 m which is 2 m to the left of the primary location line of 65 m discussed earlier.

Photo 13. Survey Unit 2 Measurement Locations 1 m right of 65 m Line

Survey Unit 1 had a row of measurement location markers two meters to the right of the primary location Line 65 m. Survey Unit 3 had a row of measurement location markers two meters to the left of the primary location Line 65m. All other rows were parallel to these.

4.4 Results of Exposure Rate Measurements

The results with averages and standard deviations for both 6 cm and 1 m measurements are shown in Table 6 below. A smaller survey rate at the 6 cm level than that for the 1 m level may be partly attributable to the very rocky conditions and shielding provided by these rocks at the 6 cm level.

Table 6. Results of Exposure Rate Measurements

Reference Area			Survey Unit 1			Survey Unit 2			Survey Unit 3		
Location	Rate at 6 cm (µR/h)	Rate at 1 m (µR/h)	Location	Rate at 6 cm (µR/h)	Rate at 1 m (µR/h)	Location	Rate at 6 cm (µR/h)	Rate at 1 m (µR/h)	Location	Rate at 6 cm (µR/h)	Rate at 1 m (µR/h)
1	7.9	9.1	1	7.6	7.5	1	7.8	7.2	1	17.8	16.7
2	6.7	7.4	2	6.9	7.0	2	7.4	7.2	2	15.6	9.3
3	14.2	13.1	3	7.7	7.3	3	7.2	7.9	3	10.3	10.3
4	14.0	11.7	4	9.2	7.6	4	9.3	7.4	4	6.2	6.3
5	12.8	10.9	5	6.4	6.9	5	6.4	6.1	5	8.9	7.7
6	4.3	3.4	6	5.2	6.8	6	n/a	6.1	6	9.7	9.0
7	4.1	4.1	7	10.8	8.5	7	6.1	6.6	7	6.4	6.8
9	6.3	6.0	8	6.4	6.2	8	12.8	12.4	8	6.8	6.8
11	8.4	6.6	9	7.9	9.9	9	16.7	17.1	9	7.2	6.8
14	14.0	12.0	10	9.3	11.0	10	8.0	8.4	10	7.0	6.4
15	10.0	9.2	11	8.6	10.1	11	5.6	5.9	11	9.3	9.8
16	5.5	6.3	12	5.5	6.0	12	5.3	5.6	12	7.9	6.5
17	8.1	7.5	13	5.8	6.4	13	6.0	6.4	13	7.6	6.8
18	4.4	5.5	14	6.4	8.4	14	4.8	6.0	14	7.0	6.1
19	4.6	4.1	15	7.7	8.2	15	5.4	5.9	15	6.8	6.3
21	8.6	8.4	16	5.7	5.8	**Average**	**7.8**	**7.7**	**Average**	**9.0**	**8.1**
23	10.4	6.0	**Average**	**7.3**	**7.7**	**Std. Dev**	**3.3**	**3.1**	**Std. Dev.**	**3.4**	**2.8**
24	7.5	7.1	**Std.Dev.**	**1.6**	**1.5**						
25	4.4	4.3									
Average	**8.2**	**7.5**									
Std.Dev.	**3.5**	**2.9**									

4.5 Connecticut DEP Confirmatory Survey

Representatives from the State of Connecticut DEP Protection performed a confirmatory survey of the Causeway on March 23, 2000. While on site, they verbally confirmed that they did not measure any radiation levels above the DCGL.

5.0 INTERIM DOSE ASSESSMENT AND COMPLIANCE

"In March of 2000, a draft Engineering Evaluation/Cost Analysis (EE/CA) for the SAEP Causeway was completed. The EE/CA is a document that identifies cleanup (or removal action) goals for the Causeway, evaluates different removal action alternatives, and finally selects a removal action alternative based on protection of human health and the environment, implementability, and cost effectiveness. The removal action objectives presented in the Causeway EE/CA are designed to prevent exposure to contaminated soils, and to prevent the discharge of contaminants in soils into the ground water." [6]

The preferred alternative, still in the review process, is an Erosion Control Cover System to prevent any direct human contact with the contaminated soils present in the Causeway. The erosion control system also provides long term effectiveness by protecting contaminated soil from erosion due to storms or waves.[6] This document was developed because of identified chemical contamination and not radiation.

5.1 Dose Assessment

Since the Causeway is to become a recreational site, the mean time expected to be on the Causeway from the EPA Factors Handbook[7] is 2 hours per day. This reflects that the critical group as recreational. Modeling of the dose assessment was performed considering that the primary exposure pathway was external gamma:

- Ingestion/Inhalation. No crops are expected to be grown on site. The site could be developed into a fishing pier or park. Chemical contamination issues will most probably exclude any residential scenarios and the development of plans is ongoing which include the possible capping of the entire Causeway with up to 4 feet of clay/dirt. With capping, the potential for inhalation of radioactive material is removed.

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[6] Stratford Army Engine Plant Environmental News, Spring 2000, Issue 4. Community Outreach Office, SAEP, 550 Main Street, Building 1, Room 30, Stratford, Ct.

[7] EPA Exposures Factor Handbook, EPA/600/P-95/002, Office of Research and Development, August 1997.

- Water pathways. Per the historical assessment, there are no potable wells within a 0.5 mile radius of the site. A fresh pond is not expected to be placed on the Causeway as the site is not large enough and it would probably become contaminated with salt water. The area is not amenable to the production of meat and milk products without an indigenous freshwater supply.

- Soil ingestion and inhalation. This is not expected as the Causeway is anticipated to be covered with up to 4 feet of clay/dirt for protection of the public from chemical contamination. Additional shielding provided from the anticipated earth covering was not included in this assessment.

The average exposure rate for Survey Unit 3 was higher than the background exposure rate by 0.6 μR/h at the 1 m measurement distance. This equates to a radiation dose of approximately 0.4 mrem per year if a person spent 2 hours of every day at the site. Doses for each of the other two Survey Units were evaluated as approximately 0.15 mrem per year.

The upper bound for a dose assessment would be if an individual were to be on the Causeway continuously 24 hours of every day. For the upper bound dose assessment, the calculated annual dose from average exposure rates for Survey Unit 3 is approximately 5.3 mrem.

5.2 Determination of Compliance

Per Table 2.4 of MARSSIM, a survey unit meets release criterion when the difference between the maximum measured in the survey unit and the minimum measured in the reference area is less than the DCGL. At 6 cm, the maximum for all Survey Units was 17.8 μR/h and the minimum for the Reference Area was 4.1 μR/h (See Table 6), with the difference being 13.7 μR/h. This difference is less than the DCGL of 21.8 μR/h and all survey units meet release criterion. No other tests or comparisons are required.

APPENDIX A

EXISTING CONCENTRATIONS

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SAEP CAUSEWAY -SURVEY UNIT 1
With Background

Sample Number	K-40 pCi/g	Th-232 pCi/g	U-238 pCi/g
41	11.2	1.0	1.4
200	11.6	0.8	0.0
203	12.8	0.5	0.6
209	0.0	0.9	0.0
217	0.0	1.0	0.0
222	9.8	0.7	0.9
346	12.8	0.9	1.5
352	7.6	2.8	4.0
362	12.2	0.7	0.8
363	12.1	1.1	0.0
364	12.9	0.8	0.0
365	11.4	0.0	0.0
Post	10.5	9.6	2.2
Post	13.8	8.5	2.1
Post	15.4	0.6	0.8
Post	10.9	15.0	2.4
Avg	10.3	2.8	1.0
sigma	4.4	4.3	1.2
count	16		

SAEP CAUSEWAY- SURVEY UNIT 2
With Background

Sample Number	K-40 pCi/g	Th-232 pCi/g	U-238 pCi/g
138	12.2	1.4	2.3
139	0.0	2.1	0.0
140	0.0	0.6	0.0
141	13.8	1.3	0.0
142	15.0	0.7	0.0
143	0.0	1.7	0.0
144	0.0	0.0	0.0
161	9.0	1.9	2.1
162	9.9	1.1	1.6
163	12.2	0.9	1.3
164	11.1	1.1	1.5
205	0.0	0.9	2.2
214	9.7	0.7	0.0
347	9.4	1.7	5 4
348	8.3	1.2	0.0
350	12.7	0.0	0.0
351	12.0	0.0	3.6
Post	5.7	11.0	3.9
Post	11.0	2.0	0.9
Avg	8.0	1.6	1.3
sigma	5.3	2.4	1.6
count	19		

SAEP CAUSEWAY - Survey Unit 3
With Background

Sample Number	K-40 pCi/g	Th-232 pCi/g	U-238 pCi/g
39	0.0	5.3	3.8
136	12.9	4.4	8.8
137	12.0	2.3	5.5
165	12.2	1.1	1.5
166	9.4	1.6	5.1
167	10.6	1.6	4.1
168	9.9	4.4	7.8
169	10.4	3.4	6.0
170	9.4	0.9	0.0
171	13.4	0.0	2.2
172	8.0	0.0	3.4
174	12.3	1.7	0.0
175	12.3	1.7	4.5
176	6.3	0.0	4.8
177	13.4	0.0	0.0
178	13.4	0.0	0.0
179	11.8	1.4	2.1
180	10.0	1.4	2.1
181	11.1	1.3	1.5
182	11.7	1.1	1.3
183	9.6	1.5	2.6
184	13.2	0.0	3.7
185	0.0	2.9	7.3
186	11.9	0.0	3.9
187	0.0	0.0	0.0
188	12.3	1.7	0.0
189	15.0	2.0	0.0
190	0.0	0.0	0.0
191	0.0	1.2	0.0
192	11.8	0.6	2.7
193	11.9	5.7	0.0
194	13.0	0.7	0.7
195	10.2	1.1	0.0
196	0.0	0.0	0.0
197	0.0	0.0	0.0
198	10.3	0.6	0.9
199	10.3	0.7	0.0
201	12.0	1.5	0.0
204	0.0	0.0	0.0
206	6.8	0.7	2.2
207	0.0	0.6	0.0
208	8.4	0.0	0.0
210	3.7	1.6	0.0
213	10.6	0.7	0.0
215	12.0	4.1	9.1
216	8.6	11.2	26.7
218	0.0	1.1	0.0
219	11.6	1.3	0.0
220	0.0	0.0	0.0
221	13.0	0.6	0.0
223	12.0	0.9	1.4
224	11.5	0.0	0.0
225	0.0	0.0	2.1
226	6.0	2.5	2.5
227	7.0	2.6	4.3
232	6.7	3.7	9.8
336	0.0	4.9	0.0
337	12.5	1.1	0.0
338	12.5	1.1	0.0
339	10.9	1.1	0.0
340	12.8	0.7	0.0
341	15.2	1.1	1.3
342	12.7	1.9	0.0
343	12.1	2.1	3.6
344	11.7	1.8	0.8
345	11.7	2.1	1.3
355	12.7	2.4	0.0
356	4.0	9.5	26.3
357	8.7	4.1	9.6
358	13.5	1.3	0.0
359	12.0	2.6	0.0
360	9.4	14.9	12.3
361	7.0	11.4	25.0
366	10.7	3.3	7.6
367	0.0	4.2	6.9
368	12.8	1.3	7.6
369	29.0	1.6	1.5
370	11.7	0.0	1.3
371	0.0	0.0	6.5
372	0.0	0.0	2.6
379	8.8	2.5	5.3
380	9.5	1.6	2.9
381	0.0	0.0	3.6
382	0.0	2.0	3.6
383	10.9	1.2	1.7
384	0.0	2.6	6.3
385	10.9	4.0	9.7
386	8.1	3.7	6.4
387	0.0	6.7	0.0
398	12.0	17.9	6.0
Avg	8.6	2.2	3.4
Sigma	5.4	3.1	5.2
Count	90		

REPORT OF ANALYTICAL RESULTS

	Derived Sample Activities (results in units of pCi/g)								
Waste Container Sample #	K-40	2-Sigma Error	MDA	U-238	2-Sigma Error	MDA	Th-232	2-Sigma Error	MDA
SAEP-01-C1/2	10.1	2.4	1 2	34.0	6.1	0.3	6.1	1.5	0.4
SAEP-01-C3/4	9.1	1.7	1 2	34.0	5.2	0.2	5.7	1 5	0.4
SAEP-02-C1/2/3	N/D		1 3	38.0	6 8	0.3	6.6	1 7	0.5
SAEP-02-C4/5/6	N/D		1.3	38.0	6.8	0.3	7.9	1.9	0.4
SAEP-03-C1/2/3	5.8	1.8	1 1	22.0	4.0	0 2	8.0	1 9	0.4
SAEP-03-C4/5/6	5.5	1 7	1 2	35.0	5.3	0.2	10.0	2 4	0.4
SAEP-03-C8/9	N/D		1 3	33.0	4.0	0 3	11.0	2 8	0.6
SAEP-03-C10/11/12	2.8	1.8	1 3	29.0	5.2	0.3	11.0	1.3	0.2
SAEP-03-C13/14/15	N/D		1.2	43.0	6.5	0.3	11.0	2.6	0.4
SAEP-03-C16/17	7.6	1.9	1.0	18.0	3.3	0.2	6.0	1.5	0.3
SAEP-03-C18/19	N/D		1 3	36.0	5.4	0.2	9.4	2.3	0.4
Soil Sample #									
Area 1 No.1	10.5	1.7	0.6	9.6	1 7	0.1	2.2	0.6	0.2
Area 1 No.2	13.8	1.8	0 7	8.5	1.3	0.1	2.1	0.6	0.2
Area 2 No.1	15.4	2.1	0.4	0.6	0.1	0.1	0.8	0.3	0.1
Area 2 No.2	10.9	1.8	0.9	15.0	2.7	0.2	2.4	0.7	0.2
Area 3 No.1	5.7	1.5	0.8	11.0	2.0	0.2	3.9	1.0	0.3
Area 3 No.2	11.0	1.5	0.4	2.0	0.3	0.1	0.9	0.3	0.1

U-238 quantified using average of Bi-214 and Pb-214 concentrations.
Th-232 with progeny in equilibrium was calculated based on averages of Th-232 and Ac-228 calculations.
Two-sigma errors and MDAs were proportioned to quantified values.

APPENDIX B

NRC FORMS 540 AND 541

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NRC FORM 540 (5-1998) — US NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER (INCLUDE AREA CODE)	865) 599-9417 or (865) 482-5532
ORGANIZATION	US Ecology Security
2. IS THIS AN "EXCLUSIVE USE" SHIPMENT?	[X] YES [ ] NO
3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST ==>	31
4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT?	[ ] YES [X] NO
If "Yes," provide Manifest Number ========>	EPA MANIFEST NUMBER: NA
5. SHIPPER- NAME AND FACILITY	US Ecology for Honeywell @ Stratford Army Engine Plant, 550 Main Street, Stratford, CT 06498
USER PERMIT NUMBER / SHIPMENT NUMBER	N/A
CONTACT	Robert J. Ford
6. CARRIER NAME AND ADDRESS	Dart Trucking Company, 61 Railroad Street, Canfield, OH 44406
CONTACT	Dean DeSantes
SIGNATURE-Authorized carrier acknowledging waste receipt	Bradley A Hawke
SHIPPER ID #	N/A
X COLLECTOR / PROCESSOR	X COLLECTOR
GENERATOR TYPE (SPECIFY)	
TELEPHONE #	(904) 953-8978
EPA ID #	OH0009685875
SHIPPING DATE	6/7/00 ~~6/6/00~~ 3rd
TELEPHONE #	(800) 541-8206
DATE	6/7/00
7. NRC FORM 540 AND 540A PAGE 1 OF	3 PAGE(S)
NRC FORM 541 AND 541A	16 PAGE(S)
NRC FORM 542 AND 542A	___ PAGE(S)
ADDITIONAL INFORMATION	1 PAGE(S)
8. Manifest Number (Use this number on all continuation pages)	060600
9. CONSIGNEE-NAME AND FACILITY ADDRESS	US Ecology, 109 Flint Road, Oak Ridge, TN 37830
Contact	Donna Williams
Telephone Number (include area code)	(865) 482-5532
SIGNATURE-Authorized consignee acknowledging waste receipt	
Date	

10. Certification

This is to certify that the herein named materials are properly classified described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified, packaged, marked and labeled and are in proper condition for transportation and disposal as described in accordance with the applicable requirements of 10 CFR parts 20 and 61, or equivalent state regulations.

AUTHORIZED SIGNATURE: Glenda Wible — TITLE: Health Physicist — DATE: 6/7/00 ~~6/6/00~~ c.

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12 DOT LABEL "RADIOACTIVE"	13 TRANSPORT INDEX	14 PHYSICAL AND CHEMICAL FORM	15 INDIVIDUAL RADIONUCLIDES			16 TOTAL PACKAGE ACTIVITY (MBq)	17 LSA/SCO CLASS	18 TOTAL WEIGHT OR VOLUME (lbs. / kg)	19. ID NUMBER OF PACKAGE
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.97E-01	LSA-I	717 325.2	1
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			1.66E-01	LSA-I	121 54.9	2
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.30E-01	LSA-I	597 270.8	3
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			1.08E+00	LSA-I	775 351.5	4
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.29E-01	LSA-I	668 303.0	5
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			5.51E-01	LSA-I	396 179.6	6
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			1.01E+00	LSA-I	728 330.2	7
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.22E-01	LSA-I	591 268.1	8

FOR CONSIGNEE USE ONLY

Mailing Address: Honeywell, 101 Columbia Road, Box 1057, Morristown, NJ 07962

GENERATOR'S CERTIFICATION

This is to certify that the herein named materials are properly identified, represented, and classified, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. This also certifies that the materials are classified and are in proper condition for transportation and disposal as described in accordance with the applicable requirements of 10 CFR parts 20 and 61, equivalent state regulations, and of the Environmental Protection Agency

Signature: Glenda Wible Date: 6/6/00 c.

6/7/00

NRC FORM 540 (5-1998)

NRC FORM 540A
(5-1998)

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

U.S. NUCLEAR REGULATORY COMMISSION

8. Manifest Number (Use this number on all continuation pages)
960600
PAGE 2 OF 3 PAGES

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12 DOT LABEL "RADIOACTIVE"	13 TRANSPORT INDEX	14 PHYSICAL AND CHEMICAL FORM		15 INDIVIDUAL RADIONUCLIDES		16 TOTAL PACKAGE ACTIVITY IN MBq	17 LSA/SCO CLASS	18 TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. ID NUMBER OF PACKAGE
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.53E-01	LSA-I	613 278.1	9
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.95E-01	LSA-I	715 324.3	10
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.28E-01	LSA-I	595 269.9	11
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.39E-01	LSA-I	675 306.2	12
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.85E-01	LSA-I	708 321.1	13
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.54E-01	LSA-I	614 278.5	14
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			1.06E+00	LSA-I	760 344.7	15
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.56E-01	LSA-I	687 311.6	16
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.85E-01	LSA-I	636 288.5	17
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			7.54E-01	LSA-I	542 245.8	18
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.26E-01	LSA-I	594 269.4	19
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.40E-01	LSA-I	604 274.0	20
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.61E-01	LSA-I	619 280.8	21
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.63E-01	LSA-I	692 313.9	22
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.60E-01	LSA-I	618 280.3	23

NRC FORM 540A (5-1998)

NRC FORM 540A
(5-1998)

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

U.S. NUCLEAR REGULATORY COMMISSION

8. Manifest Number
(Use this number on all continuation pages)
96600

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12 DOT LABEL "RADIOACTIVE"	13 TRANSPORT INDEX	14 PHYSICAL AND CHEMICAL FORM	15 INDIVIDUAL RADIONUCLIDES			16 TOTAL PACKAGE ACTIVITY IN MBq	17 LSA/SCO CLASS	18 TOTAL WEIGHT OR VOLUME (Use appropriate units)	19. ID NUMBER OF PACKAGE
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.15E-01	LSA-I	658 298.5	24
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			6.52E-01	LSA-I	469 212.7	25
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			9.33E-01	LSA-I	671 304.4	26
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.66E-01	LSA-I	615 279.0	27
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.72E-01	LSA-I	627 284.4	28
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			8.30E-01	LSA-I	597 270.8	29
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 Contaminated Soil	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			1.06E+00	LSA-I	764 346.5	30
Radioactive Material, Low Specific Activity, n.o.s., 7, UN 2912 DAW	NA	NA	Solid / Oxide	Th-230, Th-232, U-Nat, K-40			1.92E-01	LSA-I	138 62.6	31

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NRC FORM 541 (5-1998) — US NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST
CONTAINER AND WASTE DESCRIPTION

Additional Nuclear Regulatory Commission (NRC) Requirements for Control, Transfer and Disposal of Radioactive Waste

1. MANIFEST TOTALS

NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WASTE VOLUME (m3)	NET WASTE WEIGHT (kg)	SPECIAL NUCLEAR MATERIAL (grams) U-233	U-235	Pu	TOTAL
31	6.51E+00	18820.0	NP	NP	NP	NP

ACTIVITY (MBq) ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129	SOURCE (kg)
2.62E+01	NP	NP	NP	NP	1.46E+00

2. MANIFEST NUMBER: 060600

3. PAGE 1 OF 16 PAGE(S)

4. SHIPPER NAME: US Ecology

SHIPPER ID NUMBER

DISPOSAL CONTAINER DESCRIPTION

5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL ___ uSv/hr _X_ mSv/hr	10. SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	PHYSICAL DESCRIPTION 11. WASTE DESCRIPTOR (See Note 2)	12. Approximate WASTE VOLUME(6) IN CONTAINER (m3)	13. SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	14 CHEMICAL DESCRIPTION CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL: OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16. WASTE CLASS A&-A STABLE AU-A UNSTABLE B-CLASS B C-CLASS C
1	4	0.21	717.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	8.18E-02 5.87E-03 1.01E-01	AU
												U-Nat TOTAL:	8.09E-01 9.97E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.56E-09 2.48E-02 3.08E-02	
2	4	0.21	121.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	1.38E-02 9.91E-04 1.71E-02	AU
												U-Nat TOTAL:	1.36E-01 1.68E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	1.28E-09 4.19E-03 5.19E-03	

NOTE 1: Container Description Codes. For containers/ waste requiring disposal in approved structural overpacks, the numerical code must be followed by "OP".

Wooden Box or Crate; Metal Box; Plastic Drum or Pail; Metal Drum or Pail; Metal Tank or Liner; Concrete Tank or Liner; Polyethylene Tank or Liner; Fiberglass Tank or Liner; 9 Demineralizer; 10 Gas Cylinder; 11 Bulk, Unpackaged Waste; 12 Unpackaged Components; 13 High Integrity Container; 19 Other describe in item 6, or additional page

Note 2: Waste Descriptor Codes (Choose up to three which predominate by volume)

20 Charcoal; 21 Incinerator Ash; 22 Soil; 23 Gas; 24 Oil; 25 Aqueous Liquid; 26 Filter Media; 27 Mechanical Filter; 28 EPA or State Hazardous; 29 Demolition Rubble; 30 Cation Ion Exchange Media; 31 Anion Ion Exchange Media; 32 Mixed Bed Ion Exchange Media; 33 Contaminated Equipment; 34 Organic Liquid (Except Oil); 35 Glassware or Labware; 36 Sealed Source/Device; 37 Paint or Plating; 38 Evaporator Bottoms/Sludges/ Concentrates; 39 Compactible Trash; 40 Noncompactible Trash; 41 Animal Carcass; 42 Biological Material (Except Animal Carcass); 43 Activated Material; 69 Other Describe in Item 11, or Additional Page

Note 3: For solidification media that meet disposal site structural stability requirements, the numerical code must be followed by "-S".
For all solidification media, the vendor (manufacturer) and brand name must also be identified in item 13. Code 100 = NONE REQUIRED

Sorption: 60 Speedi Dri; 61 Calcium Silicate; 62 Floor Dry/ Superfine; 63 Hi Dri; 64 Safe-T-Sorb; 65 Safe-N-Dri; 66 Florco; 67 Florco X; 68 Solid-A-Sorb; 69 Chemisorb 30; 70 Chemisorb 50; 71 Chemisorb 3030; 72 Diasperl HP200; 73 Diasperl HP600; 74 Petroset; 75 Petroset II; 76 Aquaset; 77 Aquaset II; 89 Other Describe in item 13, or additional page

Solidification: 90 Cement; 91 Concrete (Encapsulation); 92 Bitumen; 93 Vinyl Chloride; 94 Vinyl Ester Styrene; 99 Other Describe in item 13 or Additional Page; 100 None Required

NRC FORM 541 (5-1998)

NRC FORM 641A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER 060690

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

3 PAGE 2 OF 4 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(6)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(6) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16 WASTE CLASSIFICATION AS-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
3	4	0.21	597.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	6.81E-02 4.89E-03 8.42E-02	AU
												U-Nat TOTAL:	6.73E-01 8.30E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.29E-09 2.07E-02 2.56E-02	
4	4	0.21	775.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	8.84E-02 6.35E-03 1.09E-01	AU
												U-Nat TOTAL:	8.74E-01 1.08E+00	
												kg of Th-230 kg of Th-232 kg of U-Nat	8.17E-09 2.68E-02 3.33E-02	

DRM 541A (5-1998)

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER 060600

3 PAGE 3 OF 16 PAGE(S)

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14 CHEMICAL DESCRIPTION		15 RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr _X_ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16 WASTE CLASSIFICATION AS-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
5	4	0.21	668.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.62E-02 5.47E-03 9.42E-02	AU
												U-Nat TOTAL:	7.53E-01 9.29E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.04E-09 2.31E-02 2.87E-02	
6	4	0.21	396.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	4.52E-02 3.24E-03 5.58E-02	AU
												U-Nat TOTAL:	4.47E-01 5.51E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	4.17E-09 1.37E-02 1.70E-02	

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER 060609

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

3 PAGE 4 OF 16 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							18. WASTE CLASSIFICATION
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(6)	6. CONTAINER DESCRIPTION (See Note 1)	7. VOLUME (m3)	8. WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10. SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	11. WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(6) IN CONTAINER (m3)	13. SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		A-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
7	4	0.21	728.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	8.31E-02 5.96E-03 1.03E-01	AU
												U-Nat TOTAL:	8.21E-01 1.01E+00	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.68E-09 2.52E-02 3.13E-02	
8	4	0.21	591.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	6.74E-02 4.84E-03 8.33E-02	AU
												U-Nat TOTAL:	6.67E-01 8.22E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.23E-09 2.05E-02 2.54E-02	

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER
060609

3
PAGE 5 OF 16 PAGE(S)

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	10 SURFACE CONTAMINATION MBq/100 cm2 BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16 WASTE CLASSIFICATION AS-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
9	4	0.21	613.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.00E-02 5.02E-03 8.64E-02	AU
												U-Nat TOTAL:	6.91E-01 8.53E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.46E-09 2.12E-02 2.63E-02	
10	4	0.21	715.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	8.16E-02 5.86E-03 1.01E-01	AU
												U-Nat TOTAL:	8.06E-01 9.95E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.54E-09 2.48E-02 3.07E-02	

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER 960600

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

3 PAGE 2 OF 6 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		16. RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(6) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		18 WASTE CLASSIFICATION AS-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
15	4	0.21	760.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	8.67E-02 6.23E-03 1.07E-01	AU
												U-Nat TOTAL:	8.57E-01 1.06E+00	
												kg of Th-230 kg of Th-232 kg of U-Nat	8.01E-09 2.63E-02 3.26E-02	
16	4	0.21	687.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.84E-02 5.63E-03 9.69E-02	AU
												U-Nat TOTAL:	7.75E-01 9.56E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.24E-09 2.38E-02 2.95E-02	

NRC FORM 5
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER
060600

3
PAGE 9 OF 16 PAGE(S)

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							16 WASTE CLASSIFICATION A/S-CLASS A STABLE A/U-CLASS A UNSTABLE B-CLASS B C-CLASS C
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ mR/hr ___ mR/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	PHYSICAL DESCRIPTION 11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(6) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	14. CHEMICAL DESCRIPTION CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		
17	4	0.21	636.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.26E-02 5.21E-03 8.97E-02	AU
												U-Nat TOTAL:	7.17E-01 8.85E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.71E-09 2.20E-02 2.73E-02	
18	4	0.21	542.0	0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	6.19E-02 4.44E-03 7.64E-02	AU
												U-Nat TOTAL:	6.11E-01 7.54E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	5.71E-09 1.88E-02 2.33E-02	

DRM 541A (5-1998)

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

2. MANIFEST NUMBER 060600

3 PAGE 10 OF 16 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							16 WASTE CLASSIFICATION
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10. SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13. SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		A-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
19	4	0.21	594.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	6.78E-02 4.87E-03 8.37E-02	AU
												U-Nat TOTAL:	6.70E-01 8.26E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.26E-09 2.06E-02 2.55E-02	
20	4	0.21	604.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	6.89E-02 4.95E-03 8.51E-02	AU
												U-Nat TOTAL:	6.81E-01 8.40E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.37E-09 2.09E-02 2.59E-02	

FORM 541A (5-1998)

NRC FORM 541
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER 060600

3 PAGE 11 OF 16 PAGE(S)

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr _X_ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	10 SURFACE CONTAMINATION MBq/100 cm2 BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16 WASTE CLASSIFICATION A/S-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
21	4	0.21	619.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.06E-02 5.07E-03 8.73E-02	AU
												U-Nat TOTAL:	6.98E-01 8.61E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.53E-09 2.14E-02 2.66E-02	
22	4	0.21	692.0	0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.90E-02 5.67E-03 9.76E-02	AU
												U-Nat TOTAL:	7.80E-01 9.63E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.30E-09 2.40E-02 2.97E-02	

NRM 541A (5-1998)

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

2. MANIFEST NUMBER: QC0602

3. PAGE 12 OF 16 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
4. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	5. CONTAINER DESCRIPTION (See Note 1)	7. VOLUME (m3)	8. WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10. SURFACE CONTAMINATION MBq/100 cm2 ALPHA	10. SURFACE CONTAMINATION MBq/100 cm2 BETA-GAMMA	11. WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13. SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16. WASTE CLASSIFICATION AS-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
23	4	0.21	618.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.05E-02 5.06E-03 8.71E-02	AU
												U-Nat TOTAL:	6.97E-01 8.60E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.52E-09 2.14E-02 2.65E-02	
24	4	0.21	658.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.51E-02 5.39E-03 9.28E-02	AU
												U-Nat TOTAL:	7.42E-01 9.15E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.94E-09 2.28E-02 2.82E-02	

FORM 541A (5-1998)

NRC FORM 8
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBE
060600

3
PAGE 13 OF 16 PAGE(S)

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							16 WASTE CLASSIFICATION A/S-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	10 SURFACE CONTAMINATION MBq/100 cm2 BETA-GAMMA	PHYSICAL DESCRIPTION 11 WASTE DESCRIPTOR (See Note 2)	PHYSICAL DESCRIPTION 12 APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	PHYSICAL DESCRIPTION 13 ©CREENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	14. CHEMICAL DESCRIPTION CHEMICAL FORM / CHELATING AGENT	14. CHEMICAL DESCRIPTION WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT	
25	4	0.21	469.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	5.35E-02 3.84E-03 6.61E-02	AU
												U-Nat TOTAL:	5.29E-01 6.52E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	4.94E-09 1.62E-02 2.01E-02	
26	4	0.21	687.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.66E-02 5.50E-03 9.46E-02	AU
												U-Nat TOTAL:	7.57E-01 9.33E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	7.07E-09 2.32E-02 2.88E-02	

FORM 541A (5-1998)

NRC FORM 541A
(5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUMBER 060600

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

3 PAGE 14 OF 16 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ mSv/hr ___ R mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA- GAMMA	PHYSICAL DESCRIPTION 11 WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	14. CHEMICAL DESCRIPTION CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		16 WASTE CLASSIFICATION AS-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
27	4	0.21	615.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.02E-02 5.04E-03 8.67E-02	AU
												U-Nat TOTAL:	6.94E-01 8.56E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.48E-09 2.13E-02 2.64E-02	
28	4	0.21	627.0	<0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	7.16E-02 5.14E-03 8.84E-02	AU
												U-Nat TOTAL:	7.07E-01 8.72E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.61E-09 2.17E-02 2.69E-02	

FORM 541A (5-1998)

NRC FORM (5-1998)

US NUCLEAR REGULATORY COMMISSION

2. MANIFEST NUM 060600

3 PAGE 15 OF 16 PAGE(S)

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							16 WASTE CLASSIFICATION
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5 CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6 CONTAINER DESCRIPTION (See Note 1)	7 VOLUME (m3)	8 WASTE AND CONTAINER WEIGHT (kg)	9 SURFACE RADIATION LEVEL ___ uSv/hr _X_ mSv/hr	10 SURFACE CONTAMINATION MBq/100 cm2 ALPHA	BETA-GAMMA	11 WASTE DESCRIPTOR (See Note 2)	12 APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13 SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		A5-CLASS A STABLE AU-CLASS A UNSTABLE B-CLASS B C-CLASS C
29	4	0.21	597.0	0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	6.81E-02 4.89E-03 8.42E-02	AU
												U-Nat TOTAL:	6.73E-01 8.30E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	6.29E-09 2.07E-02 2.56E-02	
30	4	0.21	764.0	0.001	<3.34e-7	<1.67e-5	22 Contaminated Soil	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	8.72E-02 6.26E-03 1.08E-01	AU
												U-Nat TOTAL:	8.62E-01 1.06E+00	
												kg of Th-230 kg of Th-232 kg of U-Nat	8.05E-09 2.65E-02 3.28E-02	

FORM 541A (5-1998)

NRC FORM 541A (5-1998) — U.S. NUCLEAR REGULATORY COMMISSION

WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION (CONTINUATION)

2. MANIFEST NUMBER: 0600

3. PAGE 12 OF 12 PAGE(S)

DISPOSAL CONTAINER DESCRIPTION							WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER							19. WASTE CLASSIFICATION
							PHYSICAL DESCRIPTION			14. CHEMICAL DESCRIPTION		15. RADIOLOGICAL DESCRIPTION		
5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6. CONTAINER DESCRIPTION (See Note 1)	7. VOLUME (m3)	8. WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL ___ uSv/hr ___ mSv/hr	10. SURFACE CONTAMINATION MBq/100 cm2 ALPHA	10. SURFACE CONTAMINATION MBq/100 cm2 BETA-GAMMA	11. WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER (m3)	13. SORBENT SOLIDIFICATION STABILIZATION MEDIA (See Note 3)	CHEMICAL FORM / CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT		19. WASTE CLASSIFICATION A=CLASS A STABLE AU=CLASS A UNSTABLE B=CLASS B C=CLASS C
31	4	0.21	138.0	<0.001	<3.34e-7	<1.67e-5	39 Compactible Trash	0.21	100 None Required	Oxide / NA	NA	K-40 Th-230 Th-232	1.57E-02 1.18E-03 1.95E-02	AU
												U-Nat TOTAL:	1.56E-01 1.92E-01	
												kg of Th-230 kg of Th-232 kg of U-Nat	1.45E-09 4.78E-03 5.92E-03	

FORM 541A (5-1998)