TA-21

Los Alamos National Laboratory/University of California
Risk Reduction & Environmental Stewardship (RRES)
Remediation Services (RS), MS M992
Los Alamos, New Mexico 87545
(505) 667-0808/FAX (505) 665-4747

National Nuclear Security Administration.
Los Alamos Site Operations, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
(505) 667-7203/FAX (505) 665-4504

Date: March 11, 2004
Refer to: ER2004-0109

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: CORRECTION TO THE INTERIM ACTION COMPLETION REPORT FOR SOLID WASTE MANAGEMENT UNIT 21-024(i) AT TECHNICAL AREA 21

Dear Mr. Young:

The purpose of this letter is to update and correct information that was originally provided in the Interim Action Completion Report for Solid Waste Management Unit (SWMU) 21-024(i) at Technical Area 21. After the subject report was submitted to NMED, Los Alamos National Laboratory (LANL) Risk Reduction and Environmental Stewardship-Remediation Services (RRES-RS) project personnel discovered errors in Table 2.5-3, "Comparison of Radionuclides to SALSs, SWMU 21-024(i)," on page 75. These errors also affect the text on three pages within the report and a table in Appendix F.

Although these errors do not affect the overall conclusions of this report, we wish to provide corrected tables and text to your office. Also enclosed attachment 1 to this letter includes pages of corrected text highlighted to show where changes were made with this letter are two sets of four replacement pages that may be inserted in your copies of the IA completion report for SWMU 21-024(i). If you have any questions or concerns regarding these corrections, please feel free to call Becky Coel-Roback at (505) 665-5011. We apologize for any inconvenience this may cause you or your staff.

Sincerely,

David McInroy, Deputy Project Director
Remediation Services
Los Alamos National Laboratory

Sincerely,

Thomas J. Wheeler for

David Gregory, Federal Project Director
Department of Energy
Los Alamos Site Operations

DM/DG/BCR/th

Enclosure: Attachments
Replacement Pages

Cy:(w/enc)
B. Coel-Roback, RRES-RS, MS M992
N. Quintana, RRES-RS, MS M992
M. Wetovsky, RRES-RS, MS M992
W. Woodworth, LASO, MS A316
M. Leavitt, NMED-SWQB
S. Yanicak, NMED-OB
L. King, EPA Region 6
RRES-RS File, MS M992
IM-5, MS A150
RPF MS M707

Cy:(w/o enclosure)
D. McInroy, RRES-RS, MS M992
B. Ramsey, RRES-DO, MS J591
D. Gregory, LASO, MS A316
S. Martin, NMED-HWB
C. Voorhees, NMED-OB

Attachment 1
Highlighted Corrections

Table 2.5-3
Comparison of Radionuclides to SALs, SWMU 21-024(i)

Analyte	Sample ID	Location ID	Depth (ft)	Exposure Point Concentration[a] (pCi/g)	SAL[b] (pCi/g)	Dose[c] (mrem/y)	BV[d] (pCi/g)	BV Dose[c] (mrem/y)
Americium-241	N/A	N/A	N/A	0.0612	39	0.024	N/A	N/A
Cesium-137	N/A	N/A	N/A	0.294	5.3	0.83	N/A	N/A
Plutonium-238	AAA4040	21-01606	1.0–1.33	0.024	49	0.0073	N/A	N/A
Plutonium-239	N/A	N/A	N/A	1.03	44	0.35	N/A	N/A
Thorium-228	N/A	N/A	N/A	1.64	2.0	12	2.28	17
Thorium-230	N/A	N/A	N/A	1.11	5.0	3.3	1.98	5.9
Tritium	N/A	N/A	N/A	400	890	6.7	N/A	N/A
Uranium-234	N/A	N/A	N/A	2.09	63	0.50	1.98	0.47
Uranium-235	N/A	N/A	N/A	0.107	17	0.094	0.09	0.079
Uranium-238	N/A	N/A	N/A	1.39	86	0.24	1.93	0.34
					Total Dose	24		24

[a] All exposure point concentrations are $UCLs_{95}$ with the exception of plutonium-238, which is the maximum sample value.

[b] SALs were obtained from LANL (2002, 73705).

[c] The calculation of dose is the exposure point concentration or background value divided by the SAL multiplied by 15 mrem/yr.

[d] The BVs shown are for Qbt 2,3,4 because they are the lesser values for soil and tuff. The exception is thorium-228 where the soil BV was used because it is less than the Qbt 2,3,4 BV. No fallout BVs are provided for the fallout radionuclides because the contribution to the dose is very small.

The $UCLs_{95}$ or maximum sample concentrations for radionuclide COPCs were less than the respective SALs. The total estimated radiological dose is approximately 24 mrem/yr (Appendix F) compared to the DOE acceptable dose for free release of property of 15 mrem/yr (DOE 2000, 67489) (Table 2.5-3). Radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment," which states that the incremental dose over background is to be evaluated (i.e., the 15 mrem/yr dose for free release of property is the incremental dose above background). The background dose for the radionuclides was calculated to be approximately 24 mrem/yr using the BVs presented in LANL (1998, 59730). Therefore, the dose from exposure to the radionuclide COPCs is similar to the dose from background and satisfies the DOE target dose limit requirement.

(c) Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. The uncertainties associated with the data evaluation, exposure assessment, toxicity assessment, and the additive approach may affect the results.

Data Evaluation and COPC Identification Process. Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this SWMU, these uncertainties are expected to have little effect on the results even though the detected concentrations of some organic COPCs were qualified J, indicating that the values were less than EQLs and could only be estimated.

The exposure point concentrations for all noncarcinogens were less than SAL and less than 0.1 SAL, with the exception of aluminum and antimony. The exposure point concentration of aluminum (8015 mg/kg) is within the range of the background concentrations for aluminum (350 to 8370 mg/kg for Qbt3 and 900 to 61500 mg/kg for soil/fill) (LANL 1998, 59730); therefore, the exposure to aluminum is similar to background. Antimony was only detected once [6.6 (J) in Qbt3] but had DLs of 0.82 to 11.0 mg/kg that exceeded 0.1 SAL (3.0 mg/kg). The detected concentration of antimony and the DLs are less than the SAL of 30 mg/kg. Additionally, more recent sample data had DLs less than or similar to the BV (0.83 mg/kg), indicating that the elevated DLs overestimate the concentration of antimony at this site.

For radionuclides, all of the exposure point concentrations were less than the respective SALs. The concentrations for thorium-228 and thorium-230 were also similar to background concentrations (LANL 1998, 59730). Therefore, the dose for these radionuclides is also similar to background as illustrated in Table 2.5-3. Eliminating the dose contributed by thorium-228 and -230 results in an approximate incremental dose of 8.7 mrem/yr above background.

The exposure point concentrations of all carcinogens were less than SALs, with the exception of arsenic. The exposure point concentration (3.7 mg/kg) is within the range of the background concentrations for arsenic (0.25 to 5.0 mg/kg for Qbt3 and 0.3 to 9.3 mg/kg for soil/fill) (LANL 1998, 59730). Therefore, exposure to arsenic and the potential risk from arsenic across the site is similar to background.

Exposure Assessment: Uncertainties were identified in three areas of the exposure assessment process.

- *Identification of Receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, uncertainties are introduced. Because the potentially exposed individual is an industrial worker, the screening assessment overestimates the exposure and subsequently overestimates the potential hazard, risk, and dose.

- *Exposure Pathway Assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used are consistent with EPA-approved parameters and default values

(d) Interpretation

Based on a residential scenario, the HI (0.6) is less than NMED's target level of 1.0, the carcinogenic risk (1×10^{-5}) is approximately equal to NMED's target risk of 1×10^{-5}, and the radiological dose above background (8.7 mrem/yr) is less than the DOE's target dose of 15 mrem/yr. Although this scenario represents a land use that is unlikely to occur at SWMU 21-024(i), the screening assessments indicate that there is no potential unacceptable risk to human health.

Because the risk, hazard, and dose at this SWMU do not exceed the target levels for NMED and DOE, it was unnecessary to assess the industrial scenario agreed to in the ROC (LANL 2002, 74015). The risk screening assessment indicates that a potential unacceptable risk does not exist under the residential scenario, which is protective of all potential scenarios including the industrial scenario.

2.5.1.2 Ecological

The approach for conducting ecological assessments is described in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783). The assessment consists of four parts: scoping, screening evaluation, uncertainty analysis, and interpretation of the results.

(a) Scoping

The scoping evaluation establishes the breadth and focus of the screening assessment. The ecological scoping checklist is a useful tool for organizing existing ecological information (Appendix F). This information was used to determine whether ecological receptors might be exposed, identify the types of receptors that might be present, and develop the ecological site conceptual model (ESCM) for the SWMU.

SWMU 21-024(i) is located in a moderately disturbed area of the mesa top surrounded by piñon and juniper (Areas 1 and 2). The habitat quality is adequate for supporting a typical piñon-juniper community. The vegetation classes are grassland-scrubland, piñon-juniper/juniper-savannah, and developed. The bench below the mesa top (Area 3), which contains the drainage channel from the outfall, is characterized by exposed tuff and little or no vegetation (primarily clumps of grass). This area is not a suitable habitat to support receptor populations (see Appendix I, Photographs 18 through 21). There are no threatened or endangered species habitats in the vicinity of SWMU 21-024(i); however, it is a potential foraging area for the Mexican spotted owl.

Potential for contamination of surface water or aquatic receptors is not relevant because there are no surface water bodies at this SWMU. There is also no perched or alluvial groundwater at this site. Groundwater transport to the regional aquifer is not applicable because of the depth of the regional aquifer (approximately 700–1000 ft bgs).

The ROC resulting from a June 25, 2002 meeting (LANL 2002, 74015) documents an agreement between the Laboratory and NMED that the ecological screening assessment conducted on characterization and/or confirmation data would be evaluated as follows:

- Area 1 and Area 2 together for the mesa top, and
- Area 3, the geological bench, separately.

Exposure point concentrations are determined only from samples collected between the ground surface and approximately a 5-ft depth (LANL 1999, 64783). The data was separated into two groups: 0 to 5-ft from Areas 1 and 2 and only data from the bench for Area 3.

found that all noncarcinogenic COPCs had UCL_{95} or maximum concentrations less than one-tenth their individual SALs, with the exception of aluminum and antimony. Only one chemical carcinogen (arsenic) had a UCL_{95} greater than the SAL. The HI for noncarcinogenic COPCs was less than 1.0 (0.6) and the total incremental cancer risk was $1x10^{-5}$. These values do not exceed NMED's target levels for systemic hazard and cancer risk (NMED 2000, 68554) and therefore do not pose an unacceptable risk to human health under residential exposure conditions.

No radiological COPC had a UCL_{95} or maximum concentration greater than SAL. The calculated dose for the exposure point concentrations was approximately 24 mrem/yr. However, the dose contributed by background concentrations of isotopic thorium is approximately 15.3 mrem/yr. Because the UCL_{95} concentrations of thorium-228 and thorium-230 are similar to background, the dose is comparable to the background dose. The dose from the remaining COPCs is approximately 8.7 mrem/yr, which is less than the target dose limit of 15 mrem/yr set forth by DOE for the free release of property (DOE 2000, 67489). This assessment, with its use of SALs based on the residential exposure scenario, found that the residual concentrations of radionuclides at this SWMU do not pose an unacceptable dose to human receptors.

The ecological screening assessment identified Aroclor-1254, Aroclor-1260, and several inorganic chemicals as COPECs. The COPECs were evaluated in the context of exposure and background and were found not to pose a potential for adverse impacts to ecological receptors. In addition, Area 3 does not provide a suitable habitat to support receptor populations so potential risk to receptors is unlikely.

The screening assessments for human health and the environment do not indicate a potential unacceptable risk to human or ecological receptors. Therefore, SWMU 21-024(i) is recommended for no further action (NFA) based on Criterion 5, "The SWMU has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57897).

3.0 WASTE MANAGEMENT

The waste streams generated and managed during this IA included the following:

- pumpable septic tank liquids;
- sludge and absorbed wash waters (from septic tank);
- mixed debris (tank contents and contaminated items);
- concrete debris (septic tank);
- vitrified clay pipe, personal protective equipment (PPE), plastic, and other investigation-derived wastes (IDW); and
- miscellaneous uncontaminated solid wastes.

All wastes were managed in accordance with applicable Federal, State, DOE, and Laboratory requirements. Waste streams, regulatory classification, amounts, and disposal pathways are shown in Table 3.1-1.

Pumpable liquids from the septic tank, sludge, absorbed wash waters, and other "contact" debris (wood baffles, plastic contamination barriers, etc.) were managed as MLLW due to the presence of listed hazardous solvents and radionuclides (principally tritium) in the waste streams. EPA Hazardous Waste Numbers F002 and F005 were applied to the MLLW streams.

Table 2.0-2
Calculation of Carcinogenic Human Health Risk

Analyte	Exposure Point Concentration	SAL	Cancer Risk
Aroclor-1254	0.12	0.22	8.9×10^{-7}
Aroclor-1260	0.18	0.22	8.1×10^{-7}
Arsenic	3.7	0.39	9.5×10^{-6}
Chromium	12.4	210	5.9×10^{-8}
4,4'-DDT	0.0028	1.7	1.6×10^{-9}
		Total ICR =	**1.1×10^{-5}**

Table 2.0-3
Calculation of Radionuclide Dose

Radionuclide	UCL_{95} (pCi/g)	SAL (pCi/g)	Dose (mrem/yr)
Americium-241	0.0612	39	0.024
Cesium-137	0.294	5.3	0.83
Plutonium-238	0.024[a]	49	0.0073
Plutonium-239	1.03	44	0.35
Thorium-228	1.64	2	12
Thorium-230	1.11	5	3.3
Tritium	400	890	6.7
Uranium-234	2.09	63	0.50
Uranium-235	0.107	17	0.094
Uranium-238	1.39	86	0.24
		Total Dose =	24.0

[a] The maximum sample value was used instead of a 95% UCL for the plutonium-238 exposure point concentration. There was an insufficient number of detections to calculate a 95% UCL.

Table 2.5-3
Comparison of Radionuclides to SALs, SWMU 21-024(i)

Analyte	Sample ID	Location ID	Depth (ft)	Exposure Point Concentration[a] (pCi/g)	SAL[b] (pCi/g)	Dose[c] (mrem/y)	BV[d] (pCi/g)	BV Dose[c] (mrem/y)
Americium-241	N/A	N/A	N/A	0.0612	39	0.024	N/A	N/A
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Tritium	N/A	N/A	N/A	400	890	6.7	N/A	N/A
Uranium-234	N/A	N/A	N/A	2.09	63	0.50	1.98	0.47
Uranium-235	N/A	N/A	N/A	0.107	17	0.094	0.09	0.079
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					Total Dose	**24**		**24**

[a] All exposure point concentrations are $UCLs_{95}$ with the exception of plutonium-238, which is the maximum sample value.

[b] SALs were obtained from LANL (2002, 73705).

[c] The calculation of dose is the exposure point concentration or background value divided by the SAL multiplied by 15 mrem/yr.

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The $UCLs_{95}$ or maximum sample concentrations for radionuclide COPCs were less than the respective SALs. The total estimated radiological dose is approximately 24 mrem/yr (Appendix F) compared to the DOE acceptable dose for free release of property of 15 mrem/yr (DOE 2000, 67489) (Table 2.5-3). Radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment," which states that the incremental dose over background is to be evaluated (i.e., the 15 mrem/yr dose for free release of property is the incremental dose above background). The background dose for the radionuclides was calculated to be approximately 24 mrem/yr using the BVs presented in LANL (1998, 59730). Therefore, the dose from exposure to the radionuclide COPCs is similar to the dose from background and satisfies the DOE target dose limit requirement.

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For radionuclides, all of the exposure point concentrations were less than the respective SALs. The concentrations for thorium-228 and thorium-230 were also similar to background concentrations (LANL 1998, 59730). Therefore, the dose for these radionuclides is also similar to background as illustrated in Table 2.5-3. Eliminating the dose contributed by thorium-228 and -230 results in an approximate incremental dose of 8.7 mrem/yr above background.

The exposure point concentrations of all carcinogens were less than SALs, with the exception of arsenic. The exposure point concentration (3.7 mg/kg) is within the range of the background concentrations for arsenic (0.25 to 5.0 mg/kg for Qbt3 and 0.3 to 9.3 mg/kg for soil/fill) (LANL 1998, 59730). Therefore, exposure to arsenic and the potential risk from arsenic across the site is similar to background.

Exposure Assessment: Uncertainties were identified in three areas of the exposure assessment process.

- *Identification of Receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, uncertainties are introduced. Because the potentially exposed individual is an industrial worker, the screening assessment overestimates the exposure and subsequently overestimates the potential hazard, risk, and dose.

- *Exposure Pathway Assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used are consistent with EPA-approved parameters and default values

(EPA 2002, 73691). When several upper-bound values are combined to estimate exposure for any one pathway, the resulting risks can be in excess of the 99th percentile and therefore outside the range that may be reasonably expected.

Exposure pathways at this SWMU are likely incomplete unless the site is excavated. The land use for this SWMU and the surrounding area (i.e., industrial land use) precludes this activity from occurring. Therefore, the potential hazard, dose, and risk at this site are overestimates of the potential exposure to COPCs.

- *Derivation of Exposure Point Concentrations.* Maximum detected concentrations used for comparison to SALs (i.e., lithium, perchlorate, strontium, and plutonium-238) leads to an overestimation of the exposure across the entire site. It also results in an overestimation of the potential risk to human health and radiological dose.
- *Extrapolation of low frequency-of-detect concentrations to the entire site.* COPCs such as Aroclor-1254 and -1260 were detected at a relatively low frequency (17% and 14%, respectively). However, the screening assessment assumes that the COPC concentrations are uniform (i.e., 100%) throughout the site. This leads to an overestimation of the exposure and subsequently overestimates the potential risk.

Toxicity Values. The primary uncertainty associated with the SALs is related to derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the nonradiological SALs used in this risk screening assessment (EPA 2001, 70109; EPA 1997, 58968). Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- *Extrapolation from Animals to Humans.* The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The EPA takes into account differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship; however, more conservatism is usually incorporated in these steps.
- *Extrapolation from One Route of Exposure to Another Route of Exposure.* The SFs and RfDs can often contain extrapolations from one route of exposure to another. This extrapolation from the oral route to the inhalation and/or the dermal route is used and is based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the two exposure pathways could result in an overestimation of the risk.
- *Interindividual Variability in the Human Population.* For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the no observed adverse effect level (NOAEL). The NOAEL/uncertainty factor approach incorporates a 10-fold factor to reflect the possible interindividual variability in the human population and is generally considered a conservative estimate.

Additive Approach. For noncarcinogens, the effects of a mixture of chemicals are generally unknown and possible interactions could be synergistic or antagonistic, thereby overestimating or underestimating the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

(d) Interpretation

Based on a residential scenario, the HI (0.6) is less than NMED's target level of 1.0, the carcinogenic risk (1×10^{-5}) is approximately equal to NMED's target risk of 1×10^{-5}, and the radiological dose above background (8.7 mrem/yr) is less than the DOE's target dose of 15 mrem/yr. Although this scenario represents a land use that is unlikely to occur at SWMU 21-024(i), the screening assessments indicate that there is no potential unacceptable risk to human health.

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SWMU 21-024(i) is located in a moderately disturbed area of the mesa top surrounded by piñon and juniper (Areas 1 and 2). The habitat quality is adequate for supporting a typical piñon-juniper community. The vegetation classes are grassland-scrubland, piñon-juniper/juniper-savannah, and developed. The bench below the mesa top (Area 3), which contains the drainage channel from the outfall, is characterized by exposed tuff and little or no vegetation (primarily clumps of grass). This area is not a suitable habitat to support receptor populations (see Appendix I, Photographs 18 through 21). There are no threatened or endangered species habitats in the vicinity of SWMU 21-024(i); however, it is a potential foraging area for the Mexican spotted owl.

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found that all noncarcinogenic COPCs had UCL_{95} or maximum concentrations less than one-tenth their individual SALs, with the exception of aluminum and antimony. Only one chemical carcinogen (arsenic) had a UCL_{95} greater than the SAL. The HI for noncarcinogenic COPCs was less than 1.0 (0.6) and the total incremental cancer risk was $1x10^{-5}$. These values do not exceed NMED's target levels for systemic hazard and cancer risk (NMED 2000, 68554) and therefore do not pose an unacceptable risk to human health under residential exposure conditions.

No radiological COPC had a UCL_{95} or maximum concentration greater than SAL. The calculated dose for the exposure point concentrations was approximately 24 mrem/yr. However, the dose contributed by background concentrations of isotopic thorium is approximately 15.3 mrem/yr. Because the UCL_{95} concentrations of thorium-228 and thorium-230 are similar to background, the dose is comparable to the background dose. The dose from the remaining COPCs is approximately 8.7 mrem/yr, which is less than the target dose limit of 15 mrem/yr set forth by DOE for the free release of property (DOE 2000, 67489). This assessment, with its use of SALs based on the residential exposure scenario, found that the residual concentrations of radionuclides at this SWMU do not pose an unacceptable dose to human receptors.

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The screening assessments for human health and the environment do not indicate a potential unacceptable risk to human or ecological receptors. Therefore, SWMU 21-024(i) is recommended for no further action (NFA) based on Criterion 5, "The SWMU has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57897).

3.0 WASTE MANAGEMENT

The waste streams generated and managed during this IA included the following:

- pumpable septic tank liquids;
- sludge and absorbed wash waters (from septic tank);
- mixed debris (tank contents and contaminated items);
- concrete debris (septic tank);
- vitrified clay pipe, personal protective equipment (PPE), plastic, and other investigation-derived wastes (IDW); and
- miscellaneous uncontaminated solid wastes.

All wastes were managed in accordance with applicable Federal, State, DOE, and Laboratory requirements. Waste streams, regulatory classification, amounts, and disposal pathways are shown in Table 3.1-1.

Pumpable liquids from the septic tank, sludge, absorbed wash waters, and other "contact" debris (wood baffles, plastic contamination barriers, etc.) were managed as MLLW due to the presence of listed hazardous solvents and radionuclides (principally tritium) in the waste streams. EPA Hazardous Waste Numbers F002 and F005 were applied to the MLLW streams.

Table 3.1-1
Waste Streams from SWMU 21-024(i) Interim Action

Waste Stream	Waste Type	Volume	Shipped To
Septic tank liquids	Liquid, MLLW	220 gal.	Diversified Scientific Services, Inc. (DSSI) Kingston, TN
Sludge and absorbed wash waters	Solid, MLLW	180 ft^3	Applied Technologies Group (ATG) Inc., Richland, WA
Mixed Debris (tank contents and contaminated items)	Solid, MLLW	53 ft^3	The Laboratory, TA-54, Area L
Concrete Debris	Hazardous waste containing residual radioactive material	972 ft^3	Waste Control Specialists (WCS), Andrews, TX
Vitrified clay pipe, PPE, plastic, disposable sampling supplies, and other IDW	Low-level waste (LLW)	48 ft^3	The Laboratory, TA-54, Area G
Uncontaminated solids (miscellaneous items)	Commercial solid waste	2360 lb	Los Alamos County Landfill

Initially, the waste characterization strategy for the concrete septic tank was to pressure wash it in accordance with the RCRA alternate debris treatment standards (40 CFR 268.45) and sample it for residual radioactive constituents. After the sludge was removed from the tank, the internal tank walls were cleaned several times with a pressure washer. The wash water was absorbed onto vermiculite for ease of handling. Even after several cleaning cycles, significant staining remained evident on the tank walls. The tank was inspected and it was determined the "clean debris surface" criteria were not met because of residual staining on the concrete walls. The concrete walls were subsequently sampled and found to contain slightly elevated tritium levels as well as trace amounts of VOCs.

As an alternative approach, the tank was proposed for disposal as hazardous waste containing residual radioactive material under the DOE's Authorized Limits Process (DOE 1997, 74061). This approach provides for DOE sites to release waste materials to unlicensed off-site disposal facilities after performing an as-low-as-reasonably-achievable (ALARA) analysis that demonstrates minimal impacts to the workers, transporters, public and environment. A formal proposal was submitted to the DOE Albuquerque Operations Office on June 28, 2001. The proposal was subsequently reviewed and approved by the DOE, Texas Department of Health, and Waste Control Specialists (WCSs). Following regulatory approvals, the tank was excavated and placed in two rolloff containers. These containers were shipped to the WCS facility in Andrews, Texas on September 5, 2001.

4.0 REFERENCES

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the singly-charged zinc hydroxide species (i.e., Zn[OH]+). The amount of zinc in solution generally increases when the pH is > 7 in soils high in organic matter. This is probably a result of either the release of organically complexed zinc, reduced zinc adsorption at higher pH, or an increase in the concentration of chelating agents in soil. Consequently, movement towards groundwater is expected to be slow (ATSDR 1997, 56531). Zinc would most likely be bound to the soil and move in the system by way of transport of soil particles by water as opposed to movement in the air because of volatilization or movement in the water as dissolved chemicals.

Bioavailability. With respect to bioconcentration from soil by terrestrial plants, invertebrates, and mammals, bioconcentration factors of 0.4, 8, and 0.6, respectively, have been reported. The concentration of zinc in plants depends on the plant species, soil pH, and the composition of the soil. Ordinarily, at pH values of 6.5 and above, zinc tends to be only slowly available to plants, especially if the zinc is present in their high-valent or oxidized forms. Consequently, most soils will tie up relatively large quantities of zinc if the soil pH is high and the drainage good (Brady 1974, 57672). Plant species do not concentrate zinc above the levels present in soil (ATSDR 1997, 56531).

2.0 HUMAN HEALTH RISK CALCULATIONS

Table 2.0-1 presents the calculation of the noncarcinogenic human health hazard. Table 2.0-2 presents the calculation of the carcinogenic human health risk. Table 2.0-3 presents the calculation of the radionuclide dose.

Table 2.0-1 Calculation of Hazard Index

Analyte	95% UCL (mg/kg)	SAL (mg/kg)	0.1 SAL (mg/kg)	HQ
Acetone	0.039	1600	160	2.4E-05
Aluminum	8015	74000	7400	0.1
Antimony	4.37	30	3	0.1
Barium	89.3	5200	520	0.017
2-Butanone	0.016	7300	730	2.2E-06
Cobalt	1.69	4500	450	0.0004
Copper	7.4	2800	280	0.0026
Fluoranthene	0.36	2300	230	0.0002
Lead	25.66	400	40	0.06
Lithium	14.8	1600	160	0.009
Mercury	2.22	23	2.3	0.097
Nickel	6.6	1500	150	0.004
Perchlorate	0.05	7.8	0.78	0.006
Pyrene	0.29	1800	180	0.0002
Selenium	0.532	380	38	0.001
Silver	0.85	380	38	0.002
Strontium	415	37000	3700	0.01
Thallium	0.56	6.1	0.61	0.09
Toluene	0.004	180	18	2.2E-05
Vanadium	8.29	530	53	0.02
Zinc	62	23000	2300	0.003
HI	—	—	—	0.58

Table 2.0-2
Calculation of Carcinogenic Human Health Risk

Analyte	Exposure Point Concentration	SAL	Cancer Risk
Aroclor-1254	0.12	0.22	8.9×10^{-7}
Aroclor-1260	0.18	0.22	8.1×10^{-7}
Arsenic	3.7	0.39	9.5×10^{-6}
Chromium	12.4	210	5.9×10^{-8}
4,4'-DDT	0.0028	1.7	1.6×10^{-9}
		Total ICR =	**1.1×10^{-5}**

Table 2.0-3
Calculation of Radionuclide Dose

Radionuclide	UCL_{95} (pCi/g)	SAL (pCi/g)	Dose (mrem/yr)
Americium-241	0.0612	39	0.024
Cesium-137	0.294	5.3	0.83
Plutonium-238	0.024[a]	49	0.0073
Plutonium-239	1.03	44	0.35
Thorium-228	1.64	2	12
Thorium-230	1.11	5	3.3
Tritium	400	890	6.7
Uranium-234	2.09	63	0.50
Uranium-235	0.107	17	0.094
Uranium-238	1.39	86	0.24
		Total Dose =	24.0

[a] The maximum sample value was used instead of a 95% UCL for the plutonium-238 exposure point concentration. There was an insufficient number of detections to calculate a 95% UCL.

Table 2.5-3
Comparison of Radionuclides to SALs, SWMU 21-024(i)

Analyte	Sample ID	Location ID	Depth (ft)	Exposure Point Concentration[a] (pCi/g)	SAL[b] (pCi/g)	Dose[c] (mrem/y)	BV[d] (pCi/g)	BV Dose[c] (mrem/y)
Americium-241	N/A	N/A	N/A	0.0612	39	0.024	N/A	N/A
Cesium-137	N/A	N/A	N/A	0.294	5.3	0.83	N/A	N/A
Plutonium-238	AAA4040	21-01606	1.0–1.33	0.024	49	0.0073	N/A	N/A
Plutonium-239	N/A	N/A	N/A	1.03	44	0.35	N/A	N/A
Thorium-228	N/A	N/A	N/A	1.64	2.0	12	2.28	17
Thorium-230	N/A	N/A	N/A	1.11	5.0	3.3	1.98	5.9
Tritium	N/A	N/A	N/A	400	890	6.7	N/A	N/A
Uranium-234	N/A	N/A	N/A	2.09	63	0.50	1.98	0.47
Uranium-235	N/A	N/A	N/A	0.107	17	0.094	0.09	0.079
Uranium-238	N/A	N/A	N/A	1.39	86	0.24	1.93	0.34
					Total Dose	**24**		**24**

[a] All exposure point concentrations are $UCLs_{95}$ with the exception of plutonium-238, which is the maximum sample value.

[b] SALs were obtained from LANL (2002, 73705).

[c] The calculation of dose is the exposure point concentration or background value divided by the SAL multiplied by 15 mrem/yr.

[d] The BVs shown are for Qbt 2,3,4 because they are the lesser values for soil and tuff. The exception is thorium-228 where the soil BV was used because it is less than the Qbt 2,3,4 BV. No fallout BVs are provided for the fallout radionuclides because the contribution to the dose is very small.

The $UCLs_{95}$ or maximum sample concentrations for radionuclide COPCs were less than the respective SALs. The total estimated radiological dose is approximately 24 mrem/yr (Appendix F) compared to the DOE acceptable dose for free release of property of 15 mrem/yr (DOE 2000, 67489) (Table 2.5-3). Radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment," which states that the incremental dose over background is to be evaluated (i.e., the 15 mrem/yr dose for free release of property is the incremental dose above background). The background dose for the radionuclides was calculated to be approximately 24 mrem/yr using the BVs presented in LANL (1998, 59730). Therefore, the dose from exposure to the radionuclide COPCs is similar to the dose from background and satisfies the DOE target dose limit requirement.

(c) Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. The uncertainties associated with the data evaluation, exposure assessment, toxicity assessment, and the additive approach may affect the results.

Data Evaluation and COPC Identification Process. Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this SWMU, these uncertainties are expected to have little effect on the results even though the detected concentrations of some organic COPCs were qualified J, indicating that the values were less than EQLs and could only be estimated.

The exposure point concentrations for all noncarcinogens were less than SAL and less than 0.1 SAL, with the exception of aluminum and antimony. The exposure point concentration of aluminum (8015 mg/kg) is within the range of the background concentrations for aluminum (350 to 8370 mg/kg for Qbt3 and 900 to 61500 mg/kg for soil/fill) (LANL 1998, 59730); therefore, the exposure to aluminum is similar to background. Antimony was only detected once [6.6 (J) in Qbt3] but had DLs of 0.82 to 11.0 mg/kg that exceeded 0.1 SAL (3.0 mg/kg). The detected concentration of antimony and the DLs are less than the SAL of 30 mg/kg. Additionally, more recent sample data had DLs less than or similar to the BV (0.83 mg/kg), indicating that the elevated DLs overestimate the concentration of antimony at this site.

For radionuclides, all of the exposure point concentrations were less than the respective SALs. The concentrations for thorium-228 and thorium-230 were also similar to background concentrations (LANL 1998, 59730). Therefore, the dose for these radionuclides is also similar to background as illustrated in Table 2.5-3. Eliminating the dose contributed by thorium-228 and -230 results in an approximate incremental dose of 8.7 mrem/yr above background.

The exposure point concentrations of all carcinogens were less than SALs, with the exception of arsenic. The exposure point concentration (3.7 mg/kg) is within the range of the background concentrations for arsenic (0.25 to 5.0 mg/kg for Qbt3 and 0.3 to 9.3 mg/kg for soil/fill) (LANL 1998, 59730). Therefore, exposure to arsenic and the potential risk from arsenic across the site is similar to background.

Exposure Assessment: Uncertainties were identified in three areas of the exposure assessment process.

- *Identification of Receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, uncertainties are introduced. Because the potentially exposed individual is an industrial worker, the screening assessment overestimates the exposure and subsequently overestimates the potential hazard, risk, and dose.

- *Exposure Pathway Assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used are consistent with EPA-approved parameters and default values

(EPA 2002, 73691). When several upper-bound values are combined to estimate exposure for any one pathway, the resulting risks can be in excess of the 99th percentile and therefore outside the range that may be reasonably expected.

Exposure pathways at this SWMU are likely incomplete unless the site is excavated. The land use for this SWMU and the surrounding area (i.e., industrial land use) precludes this activity from occurring. Therefore, the potential hazard, dose, and risk at this site are overestimates of the potential exposure to COPCs.

- *Derivation of Exposure Point Concentrations.* Maximum detected concentrations used for comparison to SALs (i.e., lithium, perchlorate, strontium, and plutonium-238) leads to an overestimation of the exposure across the entire site. It also results in an overestimation of the potential risk to human health and radiological dose.
- *Extrapolation of low frequency-of-detect concentrations to the entire site.* COPCs such as Aroclor-1254 and -1260 were detected at a relatively low frequency (17% and 14%, respectively). However, the screening assessment assumes that the COPC concentrations are uniform (i.e., 100%) throughout the site. This leads to an overestimation of the exposure and subsequently overestimates the potential risk.

Toxicity Values. The primary uncertainty associated with the SALs is related to derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the nonradiological SALs used in this risk screening assessment (EPA 2001, 70109; EPA 1997, 58968). Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- *Extrapolation from Animals to Humans.* The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The EPA takes into account differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship; however, more conservatism is usually incorporated in these steps.
- *Extrapolation from One Route of Exposure to Another Route of Exposure.* The SFs and RfDs can often contain extrapolations from one route of exposure to another. This extrapolation from the oral route to the inhalation and/or the dermal route is used and is based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the two exposure pathways could result in an overestimation of the risk.
- *Interindividual Variability in the Human Population.* For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the no observed adverse effect level (NOAEL). The NOAEL/uncertainty factor approach incorporates a 10-fold factor to reflect the possible interindividual variability in the human population and is generally considered a conservative estimate.

Additive Approach. For noncarcinogens, the effects of a mixture of chemicals are generally unknown and possible interactions could be synergistic or antagonistic, thereby overestimating or underestimating the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

(d) Interpretation

Based on a residential scenario, the HI (0.6) is less than NMED's target level of 1.0, the carcinogenic risk (1×10^{-5}) is approximately equal to NMED's target risk of 1×10^{-5}, and the radiological dose above background (8.7 mrem/yr) is less than the DOE's target dose of 15 mrem/yr. Although this scenario represents a land use that is unlikely to occur at SWMU 21-024(i), the screening assessments indicate that there is no potential unacceptable risk to human health.

Because the risk, hazard, and dose at this SWMU do not exceed the target levels for NMED and DOE, it was unnecessary to assess the industrial scenario agreed to in the ROC (LANL 2002, 74015). The risk screening assessment indicates that a potential unacceptable risk does not exist under the residential scenario, which is protective of all potential scenarios including the industrial scenario.

2.5.1.2 Ecological

The approach for conducting ecological assessments is described in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783). The assessment consists of four parts: scoping, screening evaluation, uncertainty analysis, and interpretation of the results.

(a) Scoping

The scoping evaluation establishes the breadth and focus of the screening assessment. The ecological scoping checklist is a useful tool for organizing existing ecological information (Appendix F). This information was used to determine whether ecological receptors might be exposed, identify the types of receptors that might be present, and develop the ecological site conceptual model (ESCM) for the SWMU.

SWMU 21-024(i) is located in a moderately disturbed area of the mesa top surrounded by piñon and juniper (Areas 1 and 2). The habitat quality is adequate for supporting a typical piñon-juniper community. The vegetation classes are grassland-scrubland, piñon-juniper/juniper-savannah, and developed. The bench below the mesa top (Area 3), which contains the drainage channel from the outfall, is characterized by exposed tuff and little or no vegetation (primarily clumps of grass). This area is not a suitable habitat to support receptor populations (see Appendix I, Photographs 18 through 21). There are no threatened or endangered species habitats in the vicinity of SWMU 21-024(i); however, it is a potential foraging area for the Mexican spotted owl.

Potential for contamination of surface water or aquatic receptors is not relevant because there are no surface water bodies at this SWMU. There is also no perched or alluvial groundwater at this site. Groundwater transport to the regional aquifer is not applicable because of the depth of the regional aquifer (approximately 700–1000 ft bgs).

The ROC resulting from a June 25, 2002 meeting (LANL 2002, 74015) documents an agreement between the Laboratory and NMED that the ecological screening assessment conducted on characterization and/or confirmation data would be evaluated as follows:

- Area 1 and Area 2 together for the mesa top, and
- Area 3, the geological bench, separately.

Exposure point concentrations are determined only from samples collected between the ground surface and approximately a 5-ft depth (LANL 1999, 64783). The data was separated into two groups: 0 to 5-ft from Areas 1 and 2 and only data from the bench for Area 3.

found that all noncarcinogenic COPCs had UCL_{95} or maximum concentrations less than one-tenth their individual SALs, with the exception of aluminum and antimony. Only one chemical carcinogen (arsenic) had a UCL_{95} greater than the SAL. The HI for noncarcinogenic COPCs was less than 1.0 (0.6) and the total incremental cancer risk was $1x10^{-5}$. These values do not exceed NMED's target levels for systemic hazard and cancer risk (NMED 2000, 68554) and therefore do not pose an unacceptable risk to human health under residential exposure conditions.

No radiological COPC had a UCL_{95} or maximum concentration greater than SAL. The calculated dose for the exposure point concentrations was approximately 24 mrem/yr. However, the dose contributed by background concentrations of isotopic thorium is approximately 15.3 mrem/yr. Because the UCL_{95} concentrations of thorium-228 and thorium-230 are similar to background, the dose is comparable to the background dose. The dose from the remaining COPCs is approximately 8.7 mrem/yr, which is less than the target dose limit of 15 mrem/yr set forth by DOE for the free release of property (DOE 2000, 67489). This assessment, with its use of SALs based on the residential exposure scenario, found that the residual concentrations of radionuclides at this SWMU do not pose an unacceptable dose to human receptors.

The ecological screening assessment identified Aroclor-1254, Aroclor-1260, and several inorganic chemicals as COPECs. The COPECs were evaluated in the context of exposure and background and were found not to pose a potential for adverse impacts to ecological receptors. In addition, Area 3 does not provide a suitable habitat to support receptor populations so potential risk to receptors is unlikely.

The screening assessments for human health and the environment do not indicate a potential unacceptable risk to human or ecological receptors. Therefore, SWMU 21-024(i) is recommended for no further action (NFA) based on Criterion 5, "The SWMU has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57897).

3.0 WASTE MANAGEMENT

The waste streams generated and managed during this IA included the following:

- pumpable septic tank liquids;
- sludge and absorbed wash waters (from septic tank);
- mixed debris (tank contents and contaminated items);
- concrete debris (septic tank);
- vitrified clay pipe, personal protective equipment (PPE), plastic, and other investigation-derived wastes (IDW); and
- miscellaneous uncontaminated solid wastes.

All wastes were managed in accordance with applicable Federal, State, DOE, and Laboratory requirements. Waste streams, regulatory classification, amounts, and disposal pathways are shown in Table 3.1-1.

Pumpable liquids from the septic tank, sludge, absorbed wash waters, and other "contact" debris (wood baffles, plastic contamination barriers, etc.) were managed as MLLW due to the presence of listed hazardous solvents and radionuclides (principally tritium) in the waste streams. EPA Hazardous Waste Numbers F002 and F005 were applied to the MLLW streams.

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Concrete Debris	Hazardous waste containing residual radioactive material	972 ft^3	Waste Control Specialists (WCS), Andrews, TX
Vitrified clay pipe, PPE, plastic, disposable sampling supplies, and other IDW	Low-level waste (LLW)	48 ft^3	The Laboratory, TA-54, Area G
Uncontaminated solids (miscellaneous items)	Commercial solid waste	2360 lb	Los Alamos County Landfill

Initially, the waste characterization strategy for the concrete septic tank was to pressure wash it in accordance with the RCRA alternate debris treatment standards (40 CFR 268.45) and sample it for residual radioactive constituents. After the sludge was removed from the tank, the internal tank walls were cleaned several times with a pressure washer. The wash water was absorbed onto vermiculite for ease of handling. Even after several cleaning cycles, significant staining remained evident on the tank walls. The tank was inspected and it was determined the "clean debris surface" criteria were not met because of residual staining on the concrete walls. The concrete walls were subsequently sampled and found to contain slightly elevated tritium levels as well as trace amounts of VOCs.

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Copper	7.4	2800	280	0.0026
Fluoranthene	0.36	2300	230	0.0002
Lead	25.66	400	40	0.06
Lithium	14.8	1600	160	0.009
Mercury	2.22	23	2.3	0.097
Nickel	6.6	1500	150	0.004
Perchlorate	0.05	7.8	0.78	0.006
Pyrene	0.29	1800	180	0.0002
Selenium	0.532	380	38	0.001
Silver	0.85	380	38	0.002
Strontium	415	37000	3700	0.01
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Chromium	12.4	210	5.9×10^{-8}
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		Total ICR =	**1.1×10^{-5}**

Table 2.0-3
Calculation of Radionuclide Dose

Radionuclide	UCL_{95} (pCi/g)	SAL (pCi/g)	Dose (mrem/yr)
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Thorium-230	1.11	5	3.3
Tritium	400	890	6.7
Uranium-234	2.09	63	0.50
Uranium-235	0.107	17	0.094
Uranium-238	1.39	86	0.24
		Total Dose =	24.0

[a] The maximum sample value was used instead of a 95% UCL for the plutonium-238 exposure point concentration. There was an insufficient number of detections to calculate a 95% UCL.