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UCRL-TR-227240

Authorized Limit Evaluation of Spent Granular Activated Carbon Used for Vapor-Phase Remediation at the Lawrence Livermore National Laboratory Livermore, California

R. Devany, T. Utterback

January 12, 2007

This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

Weiss Associates *Environmental Science, Engineering and Management*

5801 Christie Avenue, Suite 600, Emeryville, CA 94608-1939 Fax: 510-547-5043 Phone: ***510-450-6000***

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at the

Lawrence Livermore National Laboratory
Livermore, California

prepared for

Lawrence Livermore National Laboratory
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February 2, 2007

Weiss Associates Environmental Science, Engineering and Management
5801 Christie Avenue, Suite 600, Emeryville, CA 94608-1939 Fax: 510-547-5043 Phone: **510-450-6000**

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Weiss Associates
5801 Christie Avenue, Suite 600
Emeryville, CA 94608

WA Job # 010-2031-4802-01

2/2/2007
Timothy Utterback, P.E. Date
Project Engineer

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2/2/2007
Robert Devany, P.G., C.E.G., C.H.G. Date
Senior Project Manager

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SUMMARY

This report provides a technical basis for establishing radiological release limits for granular activated carbon (GAC) containing very low quantities of tritium and radon daughter products generated during environmental remediation activities at Lawrence Livermore National Laboratory (LLNL). This evaluation was conducted according to the Authorized Limit procedures specified in United States Department of Energy (DOE) Order 5400.5, Radiation Protection of the Public and the Environment (DOE, 1993) and related DOE guidance documents. The GAC waste is currently being managed by LLNL as a Resource Conservation and Recovery Act (RCRA) mixed waste. Significant cost savings can be achieved by developing an Authorized Limit under DOE Order 5400.5 since it would allow the waste to be safely disposed as a hazardous waste at a permitted off-site RCRA treatment and disposal facility.

LLNL generates GAC waste during vapor-phase soil remediation in the Trailer 5475 area. While trichloroethylene and other volatile organic compounds (VOCs) are the primary targets of the remedial action, a limited amount of tritium and radon daughter products are contained in the GAC at the time of disposal.

As defined in DOE Order 5400.5, an Authorized Limit is a level of residual radioactive material that will result in an annual public dose of 100 milliroentgen-equivalent man per year (mrem/year) or less. In 1995, DOE issued additional release requirements for material sent to a landfill that is not an authorized low-level radioactive waste disposal facility. Per guidance, the disposal site will be selected based on a risk/benefit assessment under the As-Low-As-Reasonably-Achievable (ALARA) process while ensuring that individual doses to the public are less than 25 mrem in a year, ground water is protected, the release would not necessitate further remedial action for the disposal site, and the release is coordinated with all appropriate authorities. The 1995 release requirements also state that Authorized Limits may be approved by DOE field office managers without DOE headquarters' (EH-1) approval if a reasonably conservative dose assessment demonstrates that:

- Public doses will not exceed one mrem per year individually or 10 person-rem/year collectively;
- Appropriate record keeping and data collection procedures are in place;
- Copies of the release evaluation and procedures are properly maintained; and
- Coordination with all applicable state and federal agencies is documented.

Based on the above guidelines, this report uses one mrem/year for individual members of the public and 10 person-rem/year for the collective population as upper-bound doses for the determination of Authorized Limits.

Sampling and analysis conducted by LLNL in 2001 and 2006 indicate that the GAC waste stream contains residual radioactive material consisting of tritium and the radon decay products lead-210, bismuth-210 and polonium-210. Historical site information indicates that tritium contained in

the GAC is from releases associated with former DOE operations. The radon decay products appear to originate from the decay of radium-226 which occurs naturally in soil. To develop proposed Authorized Limits, the annual quantity of GAC waste was assumed to be thirty 55-gallon drums (LLNL, 2006c) delivered to the Clean Harbors Deer Park facility in La Porte, Texas. Waste disposal parameters and process information obtained from Clean Harbors' personnel and the facility RCRA permit are used as dose assessment input. Using established dose estimating models, a total effective dose equivalent of 1 mrem/year to the maximally exposed individual (MEI) corresponds to a GAC activity-concentration of 4.4E5 picocuries per gram (pCi/g) for tritium, and 1.1E5 pCi/g for lead-210, bismuth-210 and polonium-210. The MEI dose is the limiting factor in this evaluation since the collective dose at these activity-concentrations is less than 10 person- rem/year. The MEI was identified as a receiving and sampling worker at the Clean Harbors Deer Park facility.

The social, technical, economic, practical, and public policy considerations of releasing the waste GAC at an activity-concentration corresponding to the 1 mrem/year MEI dose limit were evaluated according to the ALARA process. Based on the evaluation the calculated Authorized Limits could be reduced by two orders of magnitude and still be well above the anticipated radionuclide activity-concentrations in the GAC waste stream. Reductions beyond two orders of magnitude provide diminishing value to members of the public since the excess dose at this limit is only 0.01% of the average annual radiation dose from natural sources for a typical resident in the United States (NCRP, 1987). No significant social or public policy issues were identified that would prevent a reduction in Authorized Limits. Based on DOE guidelines of $6,000 per person-rem (DOE, 1997), a two order of magnitude reduction in Authorized Limits would reduce the potential dose-based cost burden by approximately $45,000. There are no apparent added waste disposal costs or administrative burdens associated with this lower release limit. Thus, Authorized Limits of 4,400 pCi/g for tritium and 1,100 pCi/g for lead-210, bismuth-210 and polonium-210 are proposed under the ALARA process.

Release of the GAC waste at the proposed Authorized Limits poses no significant threat to ground water resources. The radionuclide mass (i.e., fractions of a gram per year) that may be released from incinerator stack emissions is not large enough to impact ground water quality. The radionuclides captured by the incinerator emission control systems and disposed in the onsite engineered land disposal unit will likely be contained until long after their decay to stable isotopes. A plausible worst-case release from the landfill was modeled by assuming failure of the landfill liners. This simulation predicts that the maximum tritium concentration in ground water due to presumed liner failure would be well below State of Texas regulatory limits. Lead-210, bismuth-210 and polonium-210 are predicted to decay completely before reaching ground water.

Future closure of the Clean Harbors land disposal unit should not necessitate remediation under DOE Order 5400.5 as a result of disposal of the GAC waste. The onsite land disposal unit is designed such that the limited quantity of residual tritium, lead-210, bismuth-210 and polonium-210 should be retained until long after their decay to stable isotopes. Dose and human health risk were calculated for a hypothetical residential receptor residing above the land disposal unit in the event of presumed landfill liner failure. The receptor was assumed to ingest contaminated ground water drawn from below the landfill and ingest agricultural products grown and raised using the ground water. The maximum estimated individual dose was less than 0.1 mrem/yr and the maximum estimated risk was less than 10^{-6}.

Based on discussions with representatives from the Deer Park facility (LLNL, 2006a, Clean Harbors, 2006), consultation with appropriate State of Texas agencies on the acceptability of receiving the GAC waste stream under their RCRA permit would be required. DOE headquarters personnel indicate that DOE has successfully addressed Authorized Limits with the State of Texas for other waste streams (LLNL, 2006b).

Based on this evaluation, the proposed Authorized Limits for the GAC waste stream result in a maximum dose of less than 0.1 mrem/yr to a member of the public. Disposal of the waste GAC at the Deer Park facility would be a restricted release under DOE Order 5400.5 and must conform to the assumptions and exposures scenarios used in this report. As such, the GAC must be:

- Treated and disposed at the Clean Harbors (or any future operator) facility in Deer Park Texas provided that it continues to handle, process and dispose the GAC waste in a manner consistent with the current practices and permit requirements as they are currently understood and documented in this report.

- Stored for a minimum of 24-hours after being removed from the vapor-phase treatment train to allow short-lived radon daughter products to decay.

- Shipped for disposal in amounts no greater than one 30-drum shipment in a twelve month period.

Further coordination with the disposal facility and the State of Texas is required to address the administrative feasibility of the proposed authorized release. Additionally, administrative plans will need to be developed and implemented by LLNL to ensure that appropriate record keeping and data collection procedures are in place, and copies of the release evaluation and procedures are properly maintained.

1. INTRODUCTION

This report provides a technical basis for establishing radiological release limits for a granular activated carbon (GAC) waste stream containing very low quantities of tritium and radon daughter products generated during environmental remediation activities at Lawrence Livermore National Laboratory (LLNL). This evaluation was conducted according to the Authorized Limit procedures specified in United States Department of Energy (DOE) Order 5400.5, Radiation Protection of the Public and the Environment (DOE, 1993) and related DOE guidance documents (DOE, 1995, DOE, 1997 and DOE, 2002).

LLNL generates GAC waste during vapor-phase soil remediation in the Trailer 5475 area. While trichloroethylene and other volatile organic compounds (VOCs) are the primary targets of the remedial action, a limited amount of tritium and radon daughter products are contained in the GAC at the time of disposal.

1.1 Purpose

The GAC waste is currently being managed by LLNL as a Resource Conservation and Recovery Act (RCRA) mixed waste. Significant cost savings can be achieved by developing an Authorized Limit under DOE Order 5400.5 since it would potentially allow the waste to be safely disposed as a hazardous waste at a permitted off-site RCRA treatment and disposal facility.

This report:

- Summarizes applicable DOE guidelines for Authorized Limits for GAC waste containing residual radioactive material, and
- Provides technical basis for Authorized Limits applicable to incineration and permanent disposal at a specific Resource Conservation and Recovery Act (RCRA)-permitted treatment, storage and disposal facility.

This information is being provided to LLNL to support a formal Authorized Limit Application to the DOE field office managers for the subject GAC waste stream.

2. BACKGROUND

LLNL currently generates GAC waste as a result of vapor-phase soil remediation in the Trailer 5475 area at the Livermore Site. While trichloroethylene (TCE) and other volatile organic compounds (VOCs) are the primary targets of the remedial action, a limited amount of tritium from DOE releases is retained in the waste GAC. Future ground water remediation activities may generate an additional GAC waste stream containing VOCs and tritium. Isotopic analyses of the GAC waste suggest that there are no isotopes other than tritium that may be attributed to environmental releases from DOE operations. However, the data indicate that naturally occurring radon decay products are retained on the GAC as a result of operations. Per draft DOE guidance, if DOE activities or processes significantly enhance the concentration of radionuclides in a material, the material must be evaluated under the DOE as-low-as-reasonably-achievable (ALARA) process to determine whether it is acceptable for general release (DOE, 2002).

Because the GAC waste contains a listed hazardous waste and residual radioactivity from DOE operations, LLNL currently manages the spent GAC as a mixed waste. LLNL anticipates that it will generate up to thirty 55-gallon drums of this waste per year for 20 years or more. Thus, significant cost savings may be achieved by developing an Authorized Limit under DOE Order 5400.5 since it would allow the waste to be disposed as a hazardous waste at a permitted off-site treatment and disposal facility rather than as mixed waste. As defined in DOE Order 5400.5, an Authorized Limit is a level of residual radioactive material that will result in an annual public dose of 100 milliroentgen-equivalent man per year (mrem/year) or less.

In 1995, DOE's Office of the Assistant Secretary of Environment, Safety and Health, Office of the Environment, issued additional guidelines regarding the release of material containing residual radioactive material (DOE, 1995). This guidance provides specific release requirements for material sent to a non-DOE land disposal unit that is not an authorized low-level radioactive waste disposal facility. Per guidance, the disposal site will be:

- Selected (and approved by DOE) on the basis of an assessment under the ALARA process to optimize the balance between risks and benefits including costs and collective doses, and to ensure that individual doses to the public are less than 25 mrem in a year with a goal of a few mrem in a year or less.
- Evaluated to ensure that ground water will be protected in a manner consistent with the objectives of applicable state regulations and guidelines.
- Assessed to ensure that release of the land disposal unit property would not be expected to require remediation under DOE Order 5400.5 or other applicable requirements for release of property containing residual radioactive material as a result of DOE disposals.
- Coordinated with and acceptable to the land disposal unit operator implementing the acceptance criteria, and state representatives responsible for implementing

solid waste regulations, to ensure that DOE releases do not violate land disposal unit-specific radiological protection requirements.

The 1995 guidance indicates that DOE headquarters' (EH-1) approval of Authorized Limits is generally required for volumetric residual radioactive material. However, the guidance states that Authorized Limits for volumetric residual radioactive material may be approved by DOE field office managers if:

1. The applicable criteria above are appropriately addressed;
2. Based on a realistic but reasonably conservative assessment of potential doses, it is demonstrated to the satisfaction of the responsible field office manager that:
   - The release or releases of the subject material will not cause a maximum individual dose to a member of the public in excess of one mrem or a collective dose of more than 10 person-rem in a year;
   - A procedure is in place to maintain records of the releases consistent with DOE Order 5400.5 requirements, and that survey or measurement results are reported consistent with the data reporting guidelines in the November 1992 DOE radiological survey guidance and DOE/EH-173T; and
3. A copy of the Authorized Limits, measurements/survey protocols and procedures, supporting documentation including a statement that the ALARA process requirements have been achieved, and appropriate material documenting any necessary coordination with the state or Nuclear Regulatory Commission (NRC) are provided to the Office of Environment, EH-4 at least 40-working days prior to the effective date of the Authorized Limits.

The remaining sections of this document present characterization data, a determination of Authorized Limits, ALARA and ground water impact evaluations, future remediation liability assessment and recommendations for the GAC waste stream.

3. WASTE STREAM CHARACTERIZATION

In 2001 and 2006, LLNL sampled GAC used for vapor-phase soil remediation in the Trailer 5475 area at the Livermore Site. The samples were analyzed by General Engineering Laboratories (GEL) of Charleston, South Carolina. GEL performed analytical tests for a wide-spectrum of natural and anthropogenic radionuclides (Appendix A). GEL is a certified laboratory under the California Department of Health Service, and Texas Commission on Environmental Quality environmental laboratory accreditation programs.

Radionuclide results received from GEL for the 2001 samples showed tritium activities ranging from 8.38 ± 1.12 pCi/g to 15 ± 1.39 pCi/g and gross beta activities ranging from 11.6 ± 3.34 pCi/g to 19.4 ± 3.88 pCi/g. Gross alpha activities ranged from 7.42 ± 2.52 pCi/g to 12.3 ± 3.35 pCi/g, and gamma spectroscopy lead-210 results ranged from 7.92 ± 4.33 pCi/g to 14.5 ± 2.76 pCi/g. The analytical results for other isotopes were either not detected or present in very low activities which appeared to represent background activities. However, no analyses of unused carbon were conducted in 2001.

On September 20, 2006, LLNL collected two samples of spent GAC from the Trailer 5475 vapor-phase soil remediation system and two samples of unused vapor-phase GAC. The unused GAC was collected from virgin material provided by two suppliers, Carbon Activated Corp. and Carbitrol. The spent GAC samples were derived from the same carbon purchased from Carbitrol.

The 2006 GAC samples were analyzed by GEL. Tritium activities in the spent GAC were 12.7 ± 7.64 pCi/g and 24.6 ± 8.51 pCi/g and gross beta activities were 31.9 ± 2.14 pCi/g and 26.0 ± 1.97 pCi/g. Gross alpha activities in the spent GAC were 13.2 ± 1.58 pCi/g and 10.1 ± 1.44 pCi/g. No other results for spent GAC samples collected in 2006 indicated significant radioactivity. However, the 2006 samples were not initially analyzed for lead-210. To confirm that lead-210 is the source of the elevated gross beta activity in the 2006 spent GAC samples, LLNL is analyzing these samples for lead-210.

Tritium was not detected in the unused GAC. Gross beta activities in unused GAC were 9.99 ± 1.31 pCi/g and 5.49 ± 1.47 pCi/g, and gross alpha activities were 0.978 ± 0.512 pCi/g and 7.19 ± 1.29 pCi/g in the Carbon Activated Corp and Carbitrol products, respectively.

The analytical results indicate used GAC contains up to 24.6 pCi/g of added tritium. Spent GAC also appears to contain up to 20 pCi/g of radon decay products (lead-210, bismuth-210 and polonium-210) based on the difference in gross beta activity between unused and spent GAC. Between 1999 and 2005, LLNL collected 21 additional GAC waste characterization samples that were analyzed for a limited suite of radiological parameters (i.e., tritium, gross alpha and beta) by their onsite California-certified laboratory. Tritium activity in the 21 additional samples ranged from 2.1 ± 60 pCi/g to 160 ± 7.1 pCi/g. The majority of the tritium results were less than 50 pCi/g, with 160 pCi/g representing the historical maximum tritium activity detected in the spent GAC.

4. AUTHORIZED LIMITS DETERMINATION

Based on DOE guidelines, this report uses one mrem/year for individual members of the public, and 10 person-rem/year for the collective population as upper-bound doses for the determination of Authorized Limits. Based on analytical data for the GAC waste generated in 2001 and 2006 (Appendix A), the GAC waste stream was assumed to contain residual radioactive material in the form of tritium and the radon decay products lead-210, bismuth-210 and polonium-210. The annual quantity of GAC waste was assumed to be thirty 55-gallon drums (LLNL, 2006c) delivered to the hazardous waste treatment, storage and disposal (TSD) facility in one shipment. Each drum was assumed to contain a net GAC weight of 106 kilograms based on the average GAC drum weight disposed by LLNL in 2005.

This evaluation is for a restricted release scenario since this report only evaluates public doses associated with the transportation to, and processing and disposal, at the Clean Harbors Deer Park facility in La Porte, Texas, and that the materials are processed in a manner that is consistent with current operations at the Deer Park facility. The current operations of the facility are documented in its RCRA permit (Appendix B), as clarified by discussions with facility personnel (Clean Harbors, 2006).

4.1 Shipment, Storage, Incineration and Disposal

The DOE-developed model TSD-DOSE version 2.22 (ANL, 1998) was used to calculate dose to drivers, treatment, storage and disposal (TSD) facility workers and members of the public exposed to incinerator emissions. TSD-DOSE is designed to incorporate waste-specific and site-specific data to estimate potential radiological doses to TSD facility workers and the off-site public from waste-handling operations. The code is intended to help develop appropriate authorized release limits for DOE waste (DOE, 2002 and ANL, 2006). The simulated exposures in this calculation included:

- Shipment of the GAC from LLNL to the Clean Harbors Deer Park facility in La Porte, Texas;
- Unloading and sampling the GAC upon arrival at the facility;
- Storage of the GAC;
- Mixing the GAC before incineration,
- Incineration of the GAC;
- Burial of the incineration waste at an on-site land disposal unit; and
- Incinerator maintenance.

The total activity (without background subtraction) per shipment per radionuclide was used as input for dose calculations. The total shipment activity per radionuclide was determined from assumed Authorized Limits (activity-concentrations) and the mass of GAC in the shipment.

The TSD-DOSE parameter assumptions are shown in Table 1. Shipment duration was based on the distance between LLNL and the Deer Park facility in La Porte, Texas (1,912 miles) and an average highway speed of 55 miles per hour. The resulting travel time (35 hours) was assumed to be distributed over four days and three nights. The driver sleeping area was assumed to be located in the tractor unit with the driver resting eight hours per night in the cab in proximity to the shipment. The GAC drums were assumed to be loaded on an open trailer bed or within a van compartment such that ten rows consisting of three drums each were packed in a staggered array with dimensions 17.6 feet long by seven feet wide by three feet tall based on standard 55-gallon drum dimensions. Only one driver was assumed to be necessary to complete the delivery and the TSD-Dose default parameters for shielding thickness and distance between the driver and the drums were used as reasonable conservative assumptions.

Weiss Associates reviewed the RCRA permit issued by the State of Texas and contacted the Clean Harbors Deer Park facility to discuss their waste process and parameters specific to their operation (Clean Harbors, 2006). Deer Park facility receiving and sampling is generally consistent with the process and assumptions in TSD-Dose. Based on the discussion with Clean Harbors the only change to receiving and sampling parameters was to reduce the five-minute sample collection time per drum to 3 minutes per drum.

Storage before processing was adjusted to reduce the distance between the worker and drum from three feet to one foot and reduce the cumulative worker time in the storage area from 60 hours to 25 hours. The facility partially inventories their waste on a weekly basis and conducts a full inventory on a monthly basis. Waste can be stored at the Clean Harbors Deer Park facility for no more than one year.

The GAC waste was assumed to undergo a mixing process prior to incineration. However, Clean Harbors indicated the drums would likely be dropped directly into the incinerator without a mixing step. If mixing were to occur, Clean Harbors said the drums would be opened remotely using a mechanical grappler with an 18-foot arm and the grappler operator would be protected from inhalation exposure with a supplied air respirator. Supplied air respirators have a minimum respiratory protection factor of 10, which was used in the mixing calculation. The grappler operator was assumed to open and empty each drum within a two-minute period and the distance between the operator and drum was assumed to equal the length of the grappler arm. The facility mixing pit has a 75-cubic yard capacity and is operated from a separate room. Mixing pit operators were assumed located 40 feet from the pit.

Two nearly identical incinerators (Trains 1 and 2) with the same stack height and diameter, and similar maximum allowable flow rates are licensed at the Clean Harbors Deer Park facility. Train 1 was selected for the model because it has the highest allowable flow rate (49,845 cubic feet per minute) based on the facility RCRA permit. Default parameters were used for incineration residue collection, but the residue collection bin dimensions were adjusted upward based on discussion with Clean Harbors.

TSD-Dose assumes emissions from the stack are released to an urban area with a population density of 10,000 persons per square mile (ppsm). According to the 2000 Census, the population densities of La Porte and Deer Park, Texas were 1,683 ppsm and 2,753 ppsm, respectively. Collective dose to the public is directly proportional to population density. A conservative population density of 3,000 ppsm was assumed to account for potential population increases between the time of the census and incineration of the GAC. Because population density parameter adjustment is not available within TSD-Dose, the collective public dose from stack emissions was adjusted in proportion to the assumed population density.

TSD-Dose default parameters were used for burial of incineration waste at the onsite land disposal unit and for incinerator maintenance. According to Clean Harbors personnel, the incinerator ash is transported by truck to their onsite land disposal unit without the need for respirators or dust suppression during disposal because the incinerator ash has a high moisture content when it is removed from the incinerator and frequent local precipitation reduces land disposal unit dust. The Clean Harbors Deer Park facility installs a land disposal unit cover over the buried waste upon final land disposal unit closure. TSD-Dose incinerator maintenance procedures and default parameters were consistent with the description of incinerator maintenance, which is performed on a bi-annual basis.

4.2 Dose to the Public along the Transportation Route

The DOE-developed programs RESRAD version 6.3 (ANL, 2005) and Riskind version 1.11 (ANL, 1995) were used to calculate dose to the public along the transportation route. Two types of public receptors were assumed:

- Persons passed by the shipment during transport and
- Persons exposed to the stationary shipment at rest stops.

RESRAD was used to determine the gamma radiation dose rate from the shipment based on the GAC density and assumed geometry of the loaded drums (Table 2). Tritium activity was not used in this calculation because it emits only beta radiation that would be shielded by the drums. Only radon decay products (lead-210 and progeny) were assumed in the RESRAD calculation. No decay products between radon and lead-210 were assumed because the GAC waste is assumed to remain in storage at LLNL until the short-lived intermediate progeny have decayed (i.e., less than 24 hours).

The gamma radiation dose rate determined from RESRAD was used as Riskind input for public dose calculations. Riskind was designed by DOE to calculate radiological dose to members of the public along a transportation route from a shipment of radioactive material. Riskind can be used for routine transportation calculations and to determine radiological consequences in the event of an accidental collision and release of radioactive material. Only the routine transportation feature was used in this evaluation. Input parameters for the Riskind calculation are shown in Table 3. The dose to the public along the transportation route was assumed to result solely from exposure to gamma radiation. Shipment geometry was adjusted in the Riskind calculation to approximate the geometry used in RESRAD because Riskind assumes the shipment is transported in a cylinder. The same shipment length was used, but the cylinder radius was adjusted to give a volume equal to the rectangular volume used in RESRAD. A 55-mile per hour (88.5 kilometer per hour) travel speed was assumed to be consistent with the speed used for the driver dose calculation and the Riskind default for interstate highway travel. The assumed distance between members of the public and passing shipments was two meters. At rest stops, members of the pubic were assumed located two meters from the shipment for one hour.

4.3 Results

The results of these calculations are summarized in Table 4. The calculations indicate that a tritium activity of 4.4E5 pCi/g and lead-210, bismuth-210 and polonium-210 activities of 1.1E5 pCi/g will produce a 1 mrem/year total effective dose equivalent to the maximally exposed individual (TSD receiving and sampling worker). A breakdown of the dose to each receptor after ALARA considerations (see Section 5) is shown in Table 5. The receiving and sampling worker dose is primarily due to tritium (78%) and secondarily due to lead-210 (14%) and polonium-210 (8%). The offsite individual dose (0.60 mrem/year) is slightly more than half the maximally exposed individual dose, followed by the mixing pit worker dose (0.15 mrem/year). The offsite individual dose is almost entirely due to emissions from the incinerator stack with lead-210 contributing 85% of the dose, polonium-210 contributing 15% and tritium contributing only 0.2%. The mixing pit worker dose is also due to lead-210 and polonium-210 with no significant contribution from tritium.

Based on the proposed ALARA-modified Authorized Limits, the collective public dose is 0.075 person-rem/year and the collective worker dose is 9.9E-6 person-rem/year (Table 5). The collective public dose is almost entirely due to lead-210 and polonium-210 emitted from the incinerator stack.

The dose calculations and outputs from TSD-Dose, RESRAD and Riskind calculations are provided in Appendix C.

4.4 Uncertainty

TSD-Dose version 2.22, RESRAD version 6.3 and Riskind version 1.11 are validated models that estimate dose in a conservative manner. All of the simulated exposures were well within the predictive capabilities of these programs, and conservative values were used for the modeling parameters (Tables 1 through 3). Default values were replaced with more conservative quantities when more conservative assumptions were reasonable. For example, based on descriptions of actual conditions at the Deer Park facility, the distance between workers and drums in the TSD storage area, time to open drums and empty contents into the mixing pit, the mixing pit size and residue collection bin size were given more conservative parameter values. The fraction of time spent outdoors was increased to 100% for the RESRAD calculation so that a maximum dose rate without building shielding would be used. The passing distance and rest stop distance between the shipment and public was reduced in the Riskind calculation to estimate worst-case dose rates. In addition, the dose estimates included worker exposure during sampling and mixing of the waste at the TSD facility. Based on discussions with Clean Harbors personnel (Clean Harbors, 2006), these steps will be bypassed since the drums will likely be dropped into the incinerator without opening or mixing.

These extra steps were included to ensure that the dose estimate represents a plausible worst case condition.

Default values were only replaced with less conservative values if substantial information was available to demonstrate that the replacement was reasonable and conservative. Less conservative replacements were given to the waste density, time to load and secure the shipment, time to inspect, sample and inventory drums, the distance between workers and drums/waste in the mixing process, the population density surrounding the disposal site and the source area used in RESRAD to determine dose rate input for Riskind. A lower waste density was used because the model default densities are based on heavier soil/solid matricies than the LLNL-measured GAC density. The time to load and secure the shipment was reduced from the TSD-Dose default of three hours to a more realistic one hour period for the small quantity of drums involved. The time to inspect and sample drums upon receipt, and the time for workers to inspect and inventory drums in the storage area was reduced based on the process description provided by Clean Harbors (Clean Harbors, 2006). The distances between workers and the drums/waste during drum opening and waste mixing was also increased based on Clean Harbors process information. According to Clean Harbors, the drums would be opened and emptied remotely with a mechanical grappling arm if mixing is performed prior to incineration. The population density of 10,000 ppsm used in TSD-Dose was not a realistic representation of population in the industrial area surrounding the Clean Harbors Deer Park facility. US Census data from the surrounding cities of Deer Park and La Porte were compared and the highest density value was rounded up to the nearest 1,000 ppsm to conservatively estimate collective dose. The default source area used in RESRAD to determine dose rate from the drum shipment was more accurately reduced to a few square meters because the RESRAD default is 10,000 square meters.

Site-specific values gathered from the Deer Park facility RCRA permit and Houston meteorological station were used for the incinerator stack height, wind speed, exit velocity, stack diameter and surrounding building height. Doses from these specific radionuclides were not significantly sensitive to the incineration process parameters. Thus, the values used for these parameters were neither more nor less conservative than defaults. The site-specific incineration process values were used because they are well established values that accurately represent the disposal site.

Based on the discussion above, the doses derived from these calculations are expected to overestimate the actual individual and collective doses.

5. ALARA EVALUATION

DOE requires that radiological exposures to the work force and to the general public are ALARA. The ALARA process, as required by DOE (DOE, 1997), takes into account social, technical, economic, practical, and public policy considerations. Based on data provided by LLNL, the expected GAC waste activity-concentrations are expected to be three or more orders of magnitude below the calculated Authorized Limit. Thus, the Authorized Limits could be lowered below the one mrem/year individual dose threshold (i.e., 4.41E5 pCi/g tritium and 1.1E5 pCi/g lead-210, bismuth-210, polonium-210) if ALARA considerations indicate justifiable reason to lower them.

Public perception is a social consideration under ALARA that may favor high Authorized Limits. The public will have a better sense of safety if the GAC waste activity-concentrations are several orders of magnitude below the Authorized Limit. There are no technical or practical considerations that favor a lower Authorized Limit. Analytical data provided by LLNL indicate the maximum tritium activity in GAC was 160 pCi/g. Based on analytical data, the Authorized Limit could be lowered by two orders of magnitude without apparent economic or technical impacts.

A lower Authorized Limit would not improve public policy compliance because the calculated limit already meets public policy goals. For example, the excess dose at a two order of magnitude reduction is only 0.01% of the average annual radiation dose from natural sources for a typical resident in the United States (NCRP, 1992). An economic evaluation of the calculated Authorized Limit and three reduced Authorized Limits is shown in Table 6. DOE recommends a cost of $6,000 per person-rem for economic evaluations (DOE, 1997). As shown, the only cost that varies under reduced Authorized Limits is the converted dose cost. Shipping and incineration costs do not vary under lower Authorized Limits. The cost difference between alternative Authorized Limits spans approximately $45,000.

Based on this ALARA evaluation, there are no apparent additional waste disposal costs or administrative burdens associated with lowering the release limit by two orders of magnitude. Thus, Authorized Limits of 4,400 pCi/g for tritium and 1,100 pCi/g for lead-210, bismuth-210 and polonium-210 are proposed under the ALARA process.

6. GROUND WATER IMPACT EVALUATION

Potential sources of ground water impacts were evaluated to determine whether release of the GAC waste at the proposed Authorized Limits poses a significant threat to ground water resources. The sources that may release radionuclides for potential future ground water impacts are:

- Radionuclides released from the incinerator stack when the GAC shipment is incinerated, and;
- Placement of GAC incineration waste in the facility landfill with potential future release due to failure of the landfill liner.

Emissions from the incinerator stack are addressed first, followed by an evaluation of landfill failure.

6.1 Incineration

The GAC waste stream will be treated by incineration prior to land disposal. In this process, part of the tritium, lead-210, bismuth-210 and polonium-210 mass will be emitted in highly diluted concentrations as a stack emission and part will be retained by emission controls and disposed in the facility land disposal unit. Based on the proposed tritium Authorized Limit of 4,400 pCi/g, and assuming 100% of the tritium is discharged from the stack, the annual stack discharge would be about 0.014 Curies or 1.46E-6 grams of tritium. Likewise, 100% stack discharge of lead-210, bismuth-210 and polonium-210 at the Authorized Limit of 1,100 pCi/g would result in a release of 0.0035 Curies per isotope and mass releases of:

- 4.58E-5 grams of lead-210,
- 2.82E-8 grams of bismuth-210, and;
- 7.78E-7 grams of polonium-210.

Based on these worst-case stack emissions, tritium, lead-210, bismuth-210 and polonium-210 would be sufficiently dispersed to prevent ground water impacts.

The Clean Harbors Deer Park facility incinerators are equipped with emissions control devices that will reduce the mass of lead-210 prior to release from the stack. The facility RCRA permit shows that the allowable lead feed rate into the incinerator system would be greater than the allowable emission rate by a factor of approximately 112. Thus, most of the lead entering the incinerator system would be removed by emission controls. Based on the lead Authorized Limit and 112-fold emission control reduction, the annual lead-210 stack discharge may be only 0.000031 Curies and 4.09E-7 grams. As shown in the Deer Park facility RCRA permit Table V.H.4 (Appendix

B), the mass of lead-210 that could be emitted based on the GAC Authorized Limit is insignificant compared to the 11.1 ton per year maximum allowable lead emission rate from the incinerator system. The remaining 0.00347 Curies and 4.54E-5 grams of lead-210 retained by emission controls are assumed to be diverted to the onsite land disposal unit. The concentration of lead in incinerator waste originating from the GAC would be far below the toxicity characterization leaching procedure limit of five milligrams per liter specified in the RCRA permit.

No information on emission control reductions is available in the Deer Park Facility RCRA permit for tritium, bismuth or polonium. The RCRA permit indicates emission control reductions are specific to the chemistry of each element and cannot be extrapolated between elements.

6.2 Landfilling

The Clean Harbors, Deer Park land disposal units are designed according to the RCRA permit with a cap, liners, and leachate collection system to prevent ground water impacts (Appendix B Section V.G). To evaluate potential ground water impacts that may result from land disposal of GAC waste, a worst-case ground water simulation was performed using RESRAD. The simulation was based on a presumed failure of a land disposal unit at the end of the permit-specified 30-year post-closure monitoring and maintenance period. The following assumptions were made:

- Complete failure of the cover drainage layer, leachate collection system and 60-mil high density polyethylene plastic (HDPE) liners at the end of the landfill post-closure monitoring and maintenance period.

- The landfill contains 70 shipments of GAC waste at the time of closure and no radioactive decay occurs between the time of disposal and landfill closure. Radioactive decay during the 30 year post-closure period was assumed.

- All of the GAC waste contains activity-concentrations equal to the proposed authorized limits.

The ground water impact simulation was based on failure of the proposed East Landfill at the Clean Harbors Deer Park Facility. Simulation was not based on the South or North Landfills because the South Landfill is closed and the North Landfill is approaching capacity and will receive little, if any incinerated GAC waste.

RESRAD was selected to estimate ground water impacts from landfill leachate. RESRAD uses a sorption-desorption, ion-exchange leaching model to estimate radionuclide leaching from the contaminated zone. The layered characteristics of a landfill including a cover, waste layer, liner, vadose zone strata and saturated zone are supported in RESRAD.

The site-specific modeling parameters used in this simulation are shown in Table 7 and the RESRAD default parameters are tabulated in the model output presented in Appendix D. Parameter values for the cover depth, source area, source thickness, landfill length parallel to aquifer flow, unsaturated Zone 1 (clay liner) thickness, clay liner hydraulic conductivity, and unsaturated Zone 2 (vadose zone soil) thickness were obtained from specifications provided in the facility RCRA permit for the East Landfill. The cover at the time of failure was assumed to consist of a three foot thick clay liner overlain by a two foot thick protective soil layer. The drainage layer and 60 mil HDPE liner are not included. All of the water infiltrating through the protective soil layer is assumed to infiltrate past the HDPE liner and into the clay layer without diversion by the drainage system. The source area (landfill area) is equivalent to the dimensions of the proposed East Landfill. The source thickness was calculated by dividing the East Landfill rated capacity (volume) by the landfill area. The longest dimension of the proposed East Landfill was used for the landfill length parallel to aquifer flow. Two unsaturated zones (Zone 1 and Zone 2) were simulated below the waste. Site-specific Zone 1 parameter values were based on the clay liner minimum thickness (three feet) and maximum allowable hydraulic conductivity (10^{-7} centimeters per second) specified in the RCRA permit. The bottom HDPE liner and landfill leachate collection system were not included in the simulation because they were assumed failed. Leachate from the waste cell was assumed to pass through the HDPE liner without diversion by the leachate collection system. The thickness of unsaturated Zone 2 located between the clay liner and the water table was based on the permit-specified ten-foot minimum allowable distance between the lowest landfill liner and the water table.

Infiltration is a function of precipitation. The default precipitation rate of one meter per year was increased to a site-specific value of 1.29 meters per year based on the average annual rainfall in Houston between 1961 and 1990. The activity-concentrations of tritium and lead-210 in landfill waste were calculated from the total activity in seventy waste shipments containing GAC activity-concentrations equal to the authorized limits of 4,400 pCi/g and 1,100 pCi/g, respectively. The activity was assumed to be evenly distributed throughout the landfill volume. No radioactive decay was assumed between the first and last shipments. Radioactive decay was assumed to occur between landfill closure and the end of the 30 year post-closure period. Lead-210 is the longest lived isotope with a half-life of 22.3 years, followed by tritium with a 12.3 year half-life. Bismuth-210 and polonium-210 half lives are five and 138 days, respectively. Bismuth-210 and polonium-210 were assumed to each be present at a activity-concentration of 1,100 pCi/g.

The default non-dispersion modeling option was used in RESRAD to determine peak ground water concentrations from leachate impact. Under the non-dispersion assumption, leachate from the source area is delivered to ground water directly below the landfill and the activity-concentration is determined without dispersive dilution.

The ground water model results are shown in Table 8. The RESRAD results predict that tritium would reach a peak activity-concentration of 566 pCi/L in four years while lead-210 and daughters would never reach ground water before decaying completely. The difference between tritium and lead-210 concentrations in ground water is primarily due to the effects of soil/water partitioning. Tritium is modeled as tritiated water, which has no sorptivity to landfill waste or underlying soil. In the absence of a HDPE liner, tritiated water would migrate to ground water according to the infiltration rate, without sorptive retardation. Lead-210 in incinerated GAC waste is chemically identical to lead and would partition into the waste and underlying soil. Lead-210 transport rates are several orders of magnitude slower than tritium. Bismuth-210 and polonium-210 have different soil/water partitioning coefficients, but they will decay to stable lead before separating by a measurable distance in front or behind lead-210.

Texas uses the federal maximum contaminant level (MCL) of 20,000 pCi/l as their ground water goal for tritium. The model results indicate that tritium concentrations in ground water directly below the landfill will remain significantly below the MCL in the event of a major landfill failure.

As discussed above, lead-210, bismuth-210 and polonium-210 are not expected to reach ground water prior to decaying to a stable isotope of lead.

The results of this ground water evaluation indicate release of the GAC waste at the proposed Authorized Limits poses no significant threat to ground water resources.

7. ASSESSMENT OF FUTURE REMEDIATION LIABILITIES

As discussed above, future remediation liabilities will be assessed in the Authorized Limits Application to ensure that release of the land disposal unit would not necessitate remediation under DOE Order 5400.5 or other applicable requirements for release of property containing residual radioactive material as a result of DOE disposals. An assessment of the potential future remediation liabilities is discussed below.

As discussed in Section 6, Ground Water Impact Evaluation, tritium, lead-210, bismuth-210 and polonium-210 contained in the GAC waste may be captured by incinerator emission controls and diverted to the land disposal unit. These isotopes will likely be contained within the RCRA permitted land disposal unit until they decay to extremely low masses of stable helium and lead.

The proposed East Land Disposal Unit is the likely location that most of the GAC incineration waste would be placed. The South Landfill will not be used because it is already closed and the North Landfill might not receive any GAC waste because it is approaching capacity. As stated in Section V.G and Table V.G.3 of the RCRA permit, the East Land Disposal Unit will be constructed with a 3-foot minimum thickness clay liner and primary and secondary 60 mil high density polyethylene (HDPE) liners. The permit minimum permeability specification is 10E-7 centimeters per second. In addition, as stated in Section V.G and Table V.G.4, the East Land Disposal Unit is designed with primary and secondary leachate collection systems consisting of 8-ounce geotextile filter fabric, sand drainage media, 8-inch HDPE leachate collection pipes and risers, and gravel sumps. The East Land Disposal Units will be designed such that the tritium, lead-210, bismuth-210 and polonium-210 will likely remain within the land disposal unit and decay to stable isotopes. The landfill will be actively monitored and maintained for 30 years after closure (post closure period). However, it is possible that the landfill could release radionuclides to the environment if the HDPE liners fail over time.

In order to assess whether a future failure of the landfill liners will result in unacceptable human exposure and result in future remediation liabilities for DOE, RESRAD dose and risk modeling was conducted. The same site-specific physical parameters and radionuclide concentrations used in the ground water modeling (Table 7) were coupled with a worst-case hypothetical residential scenario to calculate maximum potential dose and risk. The hypothetical residential receptor was assumed to reside above the East Landfill immediately after the post-closure period. RESRAD's template for a residential farmer was used to account for all possible forms of exposure. All of the drinking water used by the hypothetical resident was assumed drawn from a well with its screened interval intercepting the shallowest water bearing unit below the landfill. Home grown produce and livestock fodder were assumed grown on top of the landfill and irrigated with the ground water. Plants were assumed to absorb contamination dissolved in ground water and uptake contamination in the root zone. Livestock were assumed to ingest ground water, soil, fodder irrigated with ground water, fodder grown in contaminated root zone soil, and fodder contaminated by foliar deposition. Contaminated ground water was assumed to seep into a nearby pond and transfer to aquatic organisms. The hypothetical resident was assumed to drink ground water from the well, consume produce grown onsite, consume meat and milk from the livestock raised onsite, inhale wind blown dust from the site, ingest soil through incidental ingestion, and eat aquatic foods from a nearby pond. All of the possible exposures available in the RESRAD program were used. The default residential farm exposure parameters used in these calculations are shown in the RESRAD output presented in Appendix D.

The estimated dose and risk results for this hypothetical residential receptor are shown in Table 8. As shown, the estimated tritium dose is 0.024 mrem/yr and the estimated risk is 2.7 x 10^{-7}. The tritium dose is primarily due to ground water ingestion (78%), with secondary contributions from home grown agricultural products (milk 10%, vegetables 8% and meat 4%,) irrigated with ground water. The model predicts rapid tritium migration to ground water as discussed above in the ground water evaluation. Peak exposure occurs at four years and is due to the ground water dependent exposure pathways. The hypothetical resident receives no tritium dose or risk from soil ingestion, particulate inhalation, or ingestion of agricultural products in contact with foliar deposition and root zone uptake. The model predicts an insignificant dose and risk due to ingestion of aquatic foods obtained from the assumed nearby pond ($<10^{-5}$ mrem/yr dose and $<10^{-10}$ risk).

The predicted doses and risks from lead-210, bismuth-210 and polonium-210 are zero. RESRAD predicts that lead-210 and its daughters decay to zero activity-concentration before reaching ground water as discussed in Section 6. The soil/dust exposure pathways contribute no measurable dose or risk.

The results of this highly conservative dose and risk assessment indicate that DOE faces no future remediation liabilities if incinerated GAC waste is disposed in the RCRA permitted landfills at the Clean Harbors Deer Park Facility.

8. COORDINATION WITH LAND DISPOSAL UNIT OPERATOR AND STATE AGENCIES

As discussed above, a release needs to be coordinated with and acceptable to the land disposal unit operator implementing the waste acceptance criteria, and with state representatives responsible for implementing solid waste regulations to ensure that DOE releases do not violate land disposal unit-specific radiological protection requirements. Additionally, DOE Order 5400.5 requires that Authorized Limits "shall be consistent with limits and guidelines established by other applicable federal and state laws."

Based on preliminary discussion with representatives from the Deer Park TSD (LLNL, 2006a, Clean Harbors, 2006), the proposed facility is not able to receive NRC-licensed material. The GAC waste stream is not an NRC-licensed material. However, DOE guidance (DOE, 1995) indicates that coordination be conducted with state representatives responsible for land disposal acceptance criteria to help insure that all state requirements are met. To date, Weiss understands that coordination with the State of Texas on this matter has not been conducted. However, DOE headquarters personnel indicate that DOE has successfully addressed Authorized Limits with the State of Texas for other waste streams (LLNL, 2006b). This criterion will need to be evaluated further if LLNL decides to complete an Authorized Limit Application.

9. RECOMMENDATIONS

Based on this evaluation, the proposed Authorized Limits for the LLNL GAC waste stream are shown in Table 4 and result in a maximum dose of less than 0.1 mrem/yr to a member of the public. Disposal of the waste GAC at the Deer Park facility would be a restricted release under DOE Order 5400.5 and must conform to the assumptions and exposure scenarios used in this report. As such, the GAC must be:

- Treated and disposed at the Clean Harbors (or any future operator) facility in Deer Park Texas provided that it continues to handle, process and dispose the GAC waste in a manner consistent with the current practices and permit requirements as they are currently understood and documented in this report.

- Stored for a minimum of 24-hours after being removed from the vapor-phase treatment train to allow short-lived radon daughter products to decay.

- Shipped for disposal in amounts no greater than one 30-drum shipment in a twelve month period.

Further coordination with the disposal facility and the State of Texas is required to address the administrative feasibility of the proposed authorized release. Additionally, administrative plans will need to be developed and implemented by LLNL to ensure that appropriate record keeping and data collection procedures are in place, and copies of the release evaluation and procedures are properly maintained.

10. REFERENCES

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TABLES

Table 1. TSD-Dose Input Parameters

Parameter [a]	Value
Transport to Incineration Facility	
Fraction solid waste	1.0
Fraction liquid waste	0.0
Waste density (g/cu cm)	0.51 [b]
Number of drivers	1
Truck bed length (feet)	17.6 [c]
Truck bed width (feet)	7 [c]
Truck bed height (feet)	3 [c]
Load and secure waste, average worker distance (feet)	3
Load and secure waste, duration per truckload (hours)	1 [d]
Load and secure waste, shielding thickness (inches)	0.0625
Driving, average worker distance (feet)	7
Driving, duration per truckload (hours)	35 [e]
Driving, shielding thickness (inches)	0.125
Resting, average worker distance (feet)	2
Resting, duration per truckload (hours)	24 [f]
Resting, shielding thickness (inches)	0.125
Maintenance in transit, average worker distance (feet)	3
Maintenance in transit, duration per truckload (hours)	2
Maintenance in transit, shielding thickness (inches)	0.0625
Receiving and Sampling Waste	
Number of workers	2 [g]
Weigh truck and inspect manifest, average worker distance (feet)	5
Weigh truck and inspect manifest, duration per truckload (hours)	1
Unload drums, average worker distance (feet)	3
Unload drums, duration per drum (hours)	0.0833
Inspect and sample drums, average worker distance (feet)	0.5
Inspect and sample drums, duration per drum (hours)	0.05 [h]
Inspect and sample drums, respirable dust concentration (mg/cu m)	10
Inspect and sample drums, respiratory protection factor	10
Transfer solids to storage, average worker distance (feet)	3
Transfer solids to storage, duration per drum (hours)	0.167
Storage Before Processing	
Workers in storage area, average worker distance (feet)	1 [i]
Workers in storage area, duration (hours)	25 [j]
Transfer solids out of storage, average worker distance (feet)	3
Transfer solids out of storage, duration per drum (hours)	0.0833
Mixing	
Unload waste to pit, average worker distance (feet)	18 [k]
Unload waste to pit, duration (hours)	1 [l]
Unload waste to pit, shielding thickness (inches)	0.125
Unload waste to pit, respirable dust concentration (mg/cu m)	1
Unload waste to pit, respiratory protection factor	10 [m]
Mix waste in pit, average worker distance (feet)	40 [n]
Mix waste in pit, duration (hours)	0.5
Mixing pit length (feet)	12.7 [o]
Mixing pit width (feet)	12.7 [o]
Mixing pit depth (feet)	12.7 [o]

Table 1. TSD-Dose Input Parameters (continued)

Parameter [a]	Value
Mixing pit cover thickness (inches)	2
Incineration of Waste	
Stack height (feet)	100 [p]
Wind speed (miles per hour)	8 [q]
Exit velocity (miles per hour)	20 [r]
Stack diameter (feet)	6 [r]
Surrounding building height (feet)	36 [s]
Collect residue in bin, average worker distance (feet)	2
Collect residue in bin, duration (hours)	0.25
Collect residue in bin, shielding thickness (inches)	0.125
Collect residue in bin, number of workers	2
Residue collection bin length (feet)	20 [t]
Residue collection bin width (feet)	7 [t]
Residue collection bin height (feet)	4 [t]
Burial of Incineration Waste at Onsite Landfill	
Number of workers	1
Truck bed length (feet)	25
Truck bed width (feet)	6
Truck bed height (feet)	3
Load and transport waste, average worker distance (feet)	5
Load and transport waste, duration per truckload (hours)	0.25
Load and transport waste, shielding thickness (inches)	0.125
Unload waste, average worker distance (feet)	5
Unload waste, duration per truckload (hours)	0.25
Unload waste, shielding thickness (inches)	0.125
Incinerator Maintenance	
Number of workers	1
Time per maintenance (hours)	12
Liquids mass (pounds)	2.5E+7
Solids mass (pounds)	2.5E+7
Airborne respirable dust concentration (mg/cu m)	10
Respiratory protection factor	50

Note

[a] TSD-DOSE default parameters used.
[b] Average net weight of carbon (105,725 g) per 55-gallon drum based on average net weight of drums disposed by LLNL in 2005.
[c] 30 drums with standard dimensions (2 ft diameter, 3 ft tall) loaded in 10 rows of 3 drums/row resulting in 17.6 feet long by seven feet wide by three feet tall load.
[d] No more than 1 hour necessary to load and secure 30 drums.
[e] 35 hours to travel 1,912 mile distance between LLNL and Clean Harbors Deer Park facility in La Porte Texas at an average speed of 55 miles per hour.
[f] Three 8 hour-rest periods based on four days travel. Rest area located in tractor unit.
[g] Two workers unload, inventory, inspect and sample shipment based on discussion with Clean Harbors Deer Park facility.
[h] Three minutes to inspect and sample drums based on discussion with Clean Harbors Deer Park facility.
[i] Workers stand within one foot of drum to scan or inventory drums.
[j] 30 second scan per drum on weekly basis and two minute monthly inventory per drum based on discussion with Clean Harbors Deer Park facility.
[k] Drum opened and emptied remotely using mechanical grappler. Eighteen-foot distance between worker and waste based on length of grappler arm.
[l] Two minutes per drum to unload waste with grappler.
[m] Grappler operator required to use supplied air respirator based on discussion with Clean Harbors Deer Park facility.
[n] Waste mixed remotely.

Table 1. TSD-Dose Input Parameters (continued)

[o] 75 cubic yard mixing pit based on discussion with Clean Harbors Deer Park facility.
[p] Stack Train one and two heights at Clean Harbors Deer Park facility.
[q] Average annual wind speed at Houston International Airport reported by the National Climatic Data Center.
[r] 49,845 cfm stack flow rate and six foot stack diameter specified in Clean Harbors Deer Park facility permit.
[s] Highest surrounding building is three story equivalent based on discussion with Clean Harbors Deer Park facility.
[t] 20-cubic yard bin based on discussion with Clean Harbors Deer Park facility.

Abbreviations

cfm	cubic feet per minute
ft	feet
g	grams
g/cu cm	grams per cubic centimeter
LLNL	Lawrence Livermore National Laboratory
mg/cu m	milligrams per cubic meter

Table 2. RESRAD Input Parameters for External Gamma Dose Rate during Shipment

Input Parameter [a]	Value
Source area (m^2)	4.91 [b]
Thickness of source area (m)	2.13 [b]
Source area density (g/cm^3)	0.51 [c]
Lead-210 + daughters activity-concentration (pCi/g)	110,000 [d]
Fraction of time spent indoors	0 [e]
Fraction of time spent outdoors	1 [e]

Notes

[a] RESRAD version 6.3 default parameters used unless specified.
[b] Side view area and width of 5.4 m (17.6 feet) long, 0.91 m (3 feet) high, 2.13 m (7 feet) wide truck trailer load. Load dimensions are consistent with dimensions used in driver dose calculations (Table 1).
[c] Source material density from average net weight of granular activated carbon (105,725 g) per 55-gallon drum based on drum net weights provided by LLNL.
[d] Radon gas retained on carbon will leave lead-210 and daughters. Allowable activity-concentration is driven by individual dose to treatment storage and disposal facility receiving worker.
[e] Public assumed to be outdoors during passing shipment and stops for maximum gamma radiation exposure.

Abbreviations

g/cm^3	grams per cubic centimeter
m	meters
m^2	square meters
pCi/g	picocuries per gram

Table 3. Riskind Input Parameters for Shipment

Parameter [a]	Value
Dose rate from shipment at one meter distance (mrem/yr)	218.1 [b]
Gamma fraction	1.0 [c]
Neutron fraction	0 [c]
Cask length (m)	5.4 [d]
Cask radius (m)	0.788 [d]
Traveling speed (km/hr)	88.5 [e]
Individual type	Public
Rest stop distance (km)	0.002 [f]
Rest stop time (hr)	1 [f]
Passing distance (km)	0.002 [g]

Notes

[a] Riskind default parameter, unless otherwise noted.
[b] Gamma radiation dose rate one meter from shipment determined using RESRAD.
[c] Shipments contain no significant neutron sources.
[d] Cylinder (cask) payload is required by model. Specified cask length and radius results in a payload volume equal to the volume used in RESRAD and TSD-DOSE.
[e] 55-mile per hour truck travel speed assumed. Consistent with driver dose calculation (Table 1).
[f] Member of public at rest stop assumed to remain two-meters from shipment for one hour.
[g] Two-meter distance between truck shipment and public is assumed while passing public.

Abbreviations

hr	hours
km	kilometers
km/hr	kilometers per hour
m	meters
mrem/yr	one-thousandth of a Roentgen equivalent man per year

Table 4. Proposed Authorized Limits

Isotope	1 mrem/yr Dose Limit[1] (pCi/g)	Proposed Authorized Limits[2] (pCi/g)
Tritium	440,000	4,400
Lead-210	110,000	1,100
Polonium-210	110,000	1,100
Bismuth-210	110,000	1,100

Note
[1] Based on 1 mrem/year individual dose to TSD facility receiving and sampling worker.
[2.] Includes dose reduction under the ALARA Process. (See Section 5)

Abbreviations

mrem/year	milli roentgen-equivalent man per year
pCi/g	picocuries per gram
TSD	treatment storage and disposal

Table 5. Estimated Public Doses at the Proposed Authorized Limits

Dose to:	Individual Dose [1] (mrem/year)	Collective Dose [1,2] (person-rem/year)
Driver	9.7E-05	NA
Public from passing shipments	1.2E-08	NA
Public from shipments at rest stops	1.2E-04	NA
TSD receiving worker	0.01	NA
TSD mixing pit worker	1.5E-03	NA
TSD incineration worker	9.5E-04	NA
TSD landfill worker	2.7E-04	NA
TSD offsite individual	6.0E-03	NA
Offsite population	NA	0.075
TSD worker population	NA	9.9E-06
Dose from:		
Transport to TSD facility	9.7E-05	NA
Receiving and sampling waste	9.4E-03	NA
Storage before processing	2.5E-04	NA
Mixing prior to incineration	1.5E-03	NA
Incineration of waste	2.7E-04	NA
Burial at onsite landfill	2.3E-07	NA
Incinerator maintenance	4.3E-04	NA

Note

[1] Includes dose reduction under the ALARA Process (See Section 5).

[2] Dose to general public primarily due inhalation of effluent from an incineration stack with secondary exposure through deposition on surrounding ground and subsequent ingestion. Collective worker population dose is the sum of individual dose to truck driver and TSD workers.

Abbreviations

mrem/year	milli roentgen-equivalent man per year
NA	not applicable
person-rem/year	person roentgen-equivalent man per year
TSD	treatment storage and disposal

Table 6. Comparative Costs for Alternative Authorized Limits

	Alternative Authorized Limits			
Cost Item	441,000 pCi/g	44,100 pCi/g	4,410 pCi/g	441 pCi/g
Shipping ($6/ft^3)	NA	NA	NA	NA
Incineration ($8/ft^3)	NA	NA	NA	NA
Converted Dose[1] ($6,000/person-rem)	$45,000	$4,500	$450	$45
Total	$45,000	$4,500	$450	$45

Note
[1]Dollar-to-dose conversion from DOE, 1997.

Abbreviations

DOE	U.S. Department of Energy
ft^3	cubic feet
NA	not applicable because shipping and incineration costs are independent of alternative authorized limit levels.
pCi/g	picocuries per gram
person-rem	person Roentgen equivalent man

Table 7. RESRAD Input Parameters for Worst Case Landfill Exposure and Ground Water Impact

Input Parameter [a]	Value
Cover depth (m)	1.5 [b]
Precipitation (m)	1.29 [c]
Source area (m^2)	55,798 [d]
Thickness of source area (m)	9.02 [e]
Length parallel to aquifer flow (m)	436 [f]
Unsaturated Zone 1 thickness (m)	0.914 [g]
Unsaturated Zone 1 hydraulic conductivity (m/yr)	0.0316 [h]
Unsaturated Zone 2 thickness (m)	3.05 [i]
Tritium activity-concentration (pCi/g)	0.23 [j]
Lead-210 + daughters[k] activity-concentration (pCi/g)	0.12 [j]

Notes

[a] RESRAD version 6.3 default parameters used unless specified.
[b] Thickness of clay liner specified in facility RCRA permit (three feet) combined with protective cover layer required by RCRA (2 feet).
[c] Average annual precipitation in Houston Texas between 1961 and 1990.
[d] Area based on proposed East Landfill dimensions (420 feet by 1,430 feet) specified in facility RCRA permit.
[e] Thickness of proposed East Landfill based on volume (658,000 yd^3) and area (420 feet by 1,430 feet) specifications in RCRA permit.
[f] Longest dimension (1,430 feet) of proposed East Landfill based on RCRA permit specification.
[g] Thickness of clay liner specified in facility RCRA permit (three feet).
[h] Maximum allowable hydraulic conductivity of clay liner (1×10^{-7} cm/sec) specified in facility RCRA permit.
[i] Minimum distance from lowest liner to ground water (ten feet) specified in facility RCRA permit.
[j] Maximum tritium and lead-210 activity-concentrations in proposed East Landfill after completion of 30 year post-closure maintenance and monitoring period. Landfill assumed to contain incineration waste from 70 annual GAC shipments. Incinerator emission controls assumed to capture all tritium and lead-210 for disposal in landfill. No radioactive decay assumed prior to landfill closure. Radioactive decay assumed during 30-year post-closure period.
[k] polonium-210 and bismuth-210.

Abbreviations

cm/sec	centimeters per second
GAC	granular activated carbon
m	meters
m/yr	meters per year
m^2	square meters
pCi/g	picocuries per gram
RCRA	Resource Conservation and Recovery Act
yd^3	cubic yards

Table 8. RESRAD Results for Worst Case Landfill Exposure and Ground Water Impact

Output Parameter	Result	Peak Time (yr)
Maximum tritium activity-concentration in ground water (pCi/l)	566	4
Maximum lead-210 activity-concentration in ground water (pCi/l)	0 [a]	NA [a]
Maximum individual dose from tritium (mrem/yr)	0.024 [b]	4
Maximum individual dose from lead-210 + d (mrem/yr)	0 [c]	NA
Maximum hypothetical resident risk from tritium	2.7E-07	1
Maximum hypothetical resident risk from lead-210 + d	0 [c]	NA

Notes
[a] lead-210 and daughters decay before reaching ground water.
[b] Individual tritium dose primarily due to ground water ingestion (78%), with secondary contributions from home grown agricultural products (milk 10%, vegetables 8%, meat 4%,) irrigated with ground water.
[c] Lead-210 and daughters decay before exposure can occur.

Abbreviations

+ d	plus daughter products (polonium-210 and bismuth-210)
mrem/yr	milli-Roentgen equivalent man per year
NA	not applicable
pCi/l	picocuries per liter
yr	year

APPENDIX A

CERTIFIED LABORATORY RESULTS FOR GRANULAR ACTIVATED CARBON SAMPLES

COC
Version 2.3
05/09/00

CES Chain of Custody

CES COC #
9766

Send Results to: SuSan Gagner
L- 546 phone 2-6508
Copy:
L-

Turnaround Time
☐ E
☐ R
☒ N

Field Contact: Coune
LLNL Account # 6319 - 22
Project Name/DQO: SAW # 00-025 REV.1
Tank Volume ______ liters

Issue Reports ☒ COC ☐ Sample
Data Package Required: ☒ Normal ☐ CLP
☐ SPECIAL PROJECT
Client ID HWM
FOR CES USE ONLY
Condition Upon Receipt: ☐ No Discrepancies
☒ Condition/Variance See green sheet

Client Sample Identification	#	Date Sampled	Time Sampled	Bldg	RAD (Y or N)	Matrix Code	Gen Code	# Bottles	8260VOL TOTAL	8270 Semi Vol	STLC Met Hg	PCB 8080	GAB	Alpha Spec	Gamma Spec	H3	Tritium	Sample Composition
W 208027RP	1	2/17/01	0600	612	Y	XX	WS	10	N	N	N	N	N	N	N		N	~~LAB TRASH~~ Wc
W 202975	2	2/17/01	0645	612	Y	XX	WS	10	N	N	N	N	N	N	N		N	SPENT CARBON
W 208027	3	2/17/01	715	612	Y	XX	WS	10	N	N	N	N	N	N	N	/	N	↓
	4																	
TB 021701CC	5	2/17/01	0600	151	Y	FQC	AQ	2	R									NO SCREEN REQ'D →
	6																	
	7																	
	8																	
	9																	
	10																	

Additional Instructions: Extended Compound list for Method 8260 for Volatiles
Not TCLP
106.2

	Signature	Date	Time		Signature	Date	Time
Sampled and Relinquished by:	[signature]	2-20-00	1030	Received by:	[signature]	2/20/01	1115
Relinquished by				Received by:			
Relinquished by:				Received by:			

57566
57567
57568
57569

CES phone # (925) 424-. (925) 423-8626
ELAP Certifications #1554
See page 2 for codes and additional instructions.
For document control purposes, user SHALL ensure that all working copies are identical to current electronic version.
http://.cms.llnl.gov/ces/QA_docs/List_of_QA_Docs.html

CES Chain of Custody

COC Version 2.3 05/09/00

Send Results to: S. SanGagner
L- 546 phone 2-6528
Copy:
L-

Turnaround Time
- ☐ E
- ☐ R
- ☒ N

Field Contact: Council
LLNL Account # 6319 - 22
Project Name/DQO: SAW # 00 025 REV 1
Tank Volume ______ liters

Issue Reports: ☒ COC ☐ Sample
Data Package Required: ☒ Normal ☐ CLP
☐ SPECIAL PROJECT
Client ID: HWM

FOR CES USE ONLY
Condition Upon Receipt: ☐ No Discrepancies
☐ Condition/Variance

	Client Sample Identification	Date Sampled	Time Sampled	Bldg	RAD (Y or N)	Matrix Code	Gen Code	# Bottles	TCLP Met	TTLC Met	Paint Soil Filter & PH	Tox 9020 9022	Reactive CN- S=	% Moisture				Additional Instructions: 2 of 2 / Sample Composition
57566	W 208027RP 1	2/17/01	0600	612	Y	XX	WS	40	N	N	N	N	N	N				
57567	W 202975 2	2/17/01	0645	612	Y	XX	WS	40	N	N	N	N	N	N				
57568	W 208027 3	2/17/01	0715	612	Y	XX	WS	40	N	N	N	N	N	N				
	4																	
	~~TB 021701CC~~ MC 5																	
	6																	
	7																	
	8																	
	9																	
	10																	

Signature	Date	Time	Signature	Date	Time
Sampled and Relinquished by: Matthew Conner	2-20-00	1030	Received by:		
Relinquished by:			Received by:		
Relinquished by:			Received by:		

CES phone (925) 424-5355 or (925) 423-8626 ELAP Certifications #1554 See page 2 for codes and additional instructions.
For document control purposes, user SHALL ensure that all working copies are identical to current electronic version http://cms.llnl.gov/ces/QA_docs/List_of_QA_Docs.html

COC Sample ID Listing

CES COC # 9766

57566 to 57569

CES Sample ID	Client Sample ID
57566	W208027RP
57567	W202975
57568	W208027
57569	TB021701CC

COC Sample ID Listing

CES COC # 9766

CES Sample ID	Client Sample ID
57566	W208027RP
57567	W202975
57568	W208027
57569	TB021701CC

57566

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Rad Screening

CES Sample ID: **57566**

Client Sample ID: W208027RP

Result	MDC	Units	Date Counted	Analyst
Not Detectable	3000	dpm/g	02-20-01	cox

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:
Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

GENERAL ENGINEERING LABORATORIES

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : PO Box 808
Mailstop L-232
Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID:	57566	Project:	LLNL00399
Sample ID:	38223001	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ercury Analysis Federal											
TCLP Hg in Solid											
Mercury	J	0.00178	0.00073	0.200	mg/L	1	AW2	03/02/01	1134	67214	1
etals Analysis-ICP Federal											
TCLP ICP Metals for Solid											
Arsenic	J	0.108	0.0333	5.00	mg/L	10	JAB	03/03/01	2004	67348	2
Barium	J	0.926	0.00101	100	mg/L	10					
Cadmium	U	-0.000987	0.00319	1.00	mg/L	10					
Chromium	U	0.00231	0.00691	5.00	mg/L	10					
Lead	J	0.0248	0.0172	5.00	mg/L	10					
Se'-~ium	U	0.0114	0.0492	1.00	mg/L	10					
S	U	0.00207	0.00448	5.00	mg/L	10					

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
;W846 1311	SW846 1311 TCLP Leaching -FEDERAL	JL	02/27/01	1615	66726
:W846 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	03/02/01	1500	67027
:W846 7470A	EPA 7470 Mercury Prep TCLP Liquid Federa	ARD	03/01/01	1830	67031

The following Analytical Methods were performed

Method	Description
	SW846 7470A
•	SW846 3010/6010B

Notes:
The Qualifiers in this report are defined as follows :

:* Indicates the analyte is a surrogate compound.
: Actual result is less than amount reported
• Actual result is greater than amount reported
Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
J Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
(843) 556-8171 • Fax (843) 766-1178

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Address : PO Box 808
Mailstop L-232
Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID:	57566	Proiect:	LLNL00399
Sample ID:	38223001	Client ID:	LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones at 843-556-8171 Ext. 4243.

Cheryl Jones

Reviewed by

GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Certificate of Analysis

Company :	Lawrence Livermore Nat'l Lab (		
Address :	PO Box 808		
	Mailstop L-232		
	Livermore, CA 94551	Report Date:	March 20, 2001
Contact:	Debbie Montero		
Project:	CES		Page 1 of 2

Client Sample ID:	57566	Project:	LLNL00399
Sample ID:	38225001	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Mercury Analysis Federal											
STLC Hg in Solid											
Mercury	U	-0.00381	0.00146	0.004	mg/L	1	AW2	03/02/01	1222	67215	1
Metals Analysis-ICP Federal											
STLC ICP Metals for Solids											
Antimony	J	0.0538	0.0269	1.00	mg/L	10	JAB	03/08/01	1525	67052	2
Arsenic		0.345	0.0333	0.100	mg/L	10					
Barium		1.57	0.00101	0.050	mg/L	10					
Beryllium	J	0.0165	0.00155	0.050	mg/L	10					
Cadmium	U	-0.000826	0.00319	0.050	mg/L	10					
Chromium		0.0507	0.00691	0.050	mg/L	10					
C[illegible]	J	0.0141	0.00632	0.050	mg/L	10					
Co[illegible]	U	0.00722	0.00774	0.050	mg/L	10					
Nickel		0.0706	0.0186	0.050	mg/L	10					
Potassium		31.9	0.115	1.00	mg/L	10					
Selenium	U	0.0224	0.0492	0.100	mg/L	10					
Silver	J	0.0198	0.00448	0.050	mg/L	10					
Thallium	U	-0.00179	0.0446	0.200	mg/L	10					
Vanadium	J	0.0126	0.00702	0.050	mg/L	10					
Zinc	J	0.0275	0.0169	0.050	mg/L	10					
Molybdenum	U	-0.755	0.179	2.00	mg/L	200	HSC	03/08/01	2204	67052	3
Lead	U	-0.0563	0.0861	0.250	mg/L	50	RMJ	03/09/01	1605	67052	4

ıe following Prep Methods were performed

ethod	Description	Analyst	Date	Time	Prep Batch
ifornia Code of	California Wet Method STLC Leaching	JL	02/25/01	1235	66475
846 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	02/28/01	1500	66976
846 7470A	EPA 7470 Mercury Prep TCLP Liquid Federa	ARD	03/01/01	1830	66977

e following Analytical Methods were performed

thod	Description
	SW846 7470A
	SW846 3010/6010B
	SW846 3010/6010B
	SW846 3010/6010B

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Project: CES

Report Date: March 20, 2001

Client Sample ID:	57566	Project:	LLNL00399
Sample ID:	38225001	Client ID:	LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

Notes:
The Qualifiers in this report are defined as follows :

** Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
J Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones at 843-556-8171 Ext. 4243.

evi. J by

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Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID:	57566	Project:	LLNL00399
Sample ID:	38226001	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
lectrode Analysis Federal												
SW9045C Corrosivity(pH<2or>14)												
Corrosivity		9.75		0.010	0.100	SU	1	VH1	02/24/01	1345	66453	1
ravimetric Solids												
ASTM D 2216 % Moisture Federal												
Moisture		1.81				percent		COB1	02/26/01	1714	66601	2
alogen Analysis Federal												
SW9023 TOX (Extract. Halogen)												
Extractable Organic Halogens		18600		179	750	mg/kg	50	LS	03/01/01	1645	66816	3
erc Analysis Federal												
747. ld Vapor Hg in Solid												
Mercury	U	-0.0673		0.044	0.100	mg/kg	10	AW2	02/28/01	1520	66867	4
etals Analysis-ICP Federal												
5010 TAL Metals Soil Federal												
Antimony	U	0.0608		0.456	5.00	mg/kg	2	HSC	03/07/01	0012	66844	5
Barium		69.2		0.0285	1.00	mg/kg	2					
Beryllium		3.46		0.0147	0.481	mg/kg	2					
Cadmium	U	-0.0243		0.0249	1.00	mg/kg	2					
Chromium		5.20		0.419	3.00	mg/kg	2					
Cobalt	J	4.54		0.105	5.00	mg/kg	2					
Copper	J	3.69		0.0483	5.00	mg/kg	2					
Lead	J	1.13		0.327	5.00	mg/kg	2					
Molybdenum	J	0.533		0.122	3.00	mg/kg	2					
Nickel		22.2		0.191	3.00	mg/kg	2					
Potassium	J	20.8		1.66	50.0	mg/kg	2					
Selenium	J	0.336		0.260	1.00	mg/kg	2					
Silver	U	0.0589		0.111	2.00	mg/kg	2					
Thallium	U	-0.0374		0.908	5.00	mg/kg	2					
Vanadium		6.89		0.114	5.00	mg/kg	2					
Arsenic	J	4.93		0.263	5.00	mg/kg	2	JAB	03/07/01	1159	66844	6
Zinc	J	4.71		0.260	5.00	mg/kg	2	HSC	03/09/01	0403	68154	8
d Alpha Spec												
lphaspec Am241, Cm, solid												
Americium-241	U	0.0374	+/-0.0718	0.153	1.00	pCi/g		JLE	03/05/01	1133	66949	9
Curium-242	U	0.0464	+/-0.076	0.139	1.00	pCi/g						
Curium-243/244	U	0.00689	+/-0.0533	0.171	1.00	pCi/g						
Curium-245/246	U	-0.00685	+/-0.0137	0.151	1.00	pCi/g						

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Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57566
Sample ID: 38226001

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ad Alpha Spec												
Alphaspec Pu, solid												
Plutonium-238	U	0.00941	+/-0.0243	0.0451	0.100	pCi/g		JLE	03/03/01	1238	66950	10
Plutonium-239/240	U	0.00314	+/-0.0188	0.0386	0.100	pCi/g						
Alphaspec Th, solid												
Thorium-228		0.428	+/-0.144	0.121	1.00	pCi/g		JLE	03/06/01	1823	66952	11
Thorium-230		0.941	+/-0.219	0.0718	1.00	pCi/g						
Thorium-232		0.309	+/-0.110	0.0251	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.571	+/-0.248	0.199	1.00	pCi/g		HOT1	03/05/01	1119	66956	12
Uranium-235/236	U	0.0998	+/-0.107	0.162	1.00	pCi/g						
Uranium-238		0.472	+/-0.221	0.161	1.00	pCi/g						
ad Gamma Spec												
Gammaspec, Gamma, solid												
A m-228	U	0.00	+/-0.213	0.248	0.500	pCi/g		CRB	03/05/01	2318	67061	13
An. .ium-241	U	-0.0213	+/-0.0375	0.0539	0.200	pCi/g						
Antimony-124	U	-0.0104	+/-0.035	0.0558	0.050	pCi/g						
Antimony-125	U	0.0219	+/-0.0731	0.121	0.100	pCi/g						
Barium-133	U	-0.0121	+/-0.0356	0.0512	0.050	pCi/g						
Barium-140	U	-0.0148	+/-0.228	0.369	0.200	pCi/g						
Beryllium-7	U	-0.159	+/-0.269	0.430	0.500	pCi/g						
Bismuth-212		0.468	+/-0.307	0.403	0.500	pCi/g						
Bismuth-214		0.568	+/-0.161	0.096	0.100	pCi/g						
Cerium-139	U	-0.0282	+/-0.020	0.030	0.050	pCi/g						
Cerium-141	U	0.0352	+/-0.0793	0.0607	0.050	pCi/g						
Cerium-144	U	0.0797	+/-0.123	0.198	0.500	pCi/g						
Cesium-134	U	0.00304	+/-0.0333	0.0471	0.050	pCi/g						
Cesium-136	U	-0.0727	+/-0.0983	0.157	1000	pCi/g						
Cesium-137	U	0.0232	+/-0.0324	0.0532	0.050	pCi/g						
Chromium-51	U	-0.232	+/-0.302	0.452	0.500	pCi/g						
Cobalt-56	U	-0.0199	+/-0.0346	0.0566	0.050	pCi/g						
Cobalt-57	U	0.00	+/-0.0195	0.0241	0.050	pCi/g						
Cobalt-58	U	-0.00464	+/-0.0335	0.056	0.050	pCi/g						
Cobalt-60	U	-0.00431	+/-0.033	0.054	0.050	pCi/g						
Europium-152	U	0.0364	+/-0.0775	0.121	0.100	pCi/g						
Europium-154	U	0.0505	+/-0.0908	0.155	0.500	pCi/g						
Europium-155	U	0.0323	+/-0.0588	0.0948	0.500	pCi/g						
Iridium-192	U	0.0108	+/-0.0271	0.0422	0.100	pCi/g						
Iron-59	U	-0.0366	+/-0.0727	0.118	0.100	pCi/g						
Lead-210		12.3	+/-1.61	0.536	5.00	pCi/g						
Lead-212		0.366	+/-0.088	0.0612	0.100	pCi/g						
Lead-214		0.686	+/-0.139	0.0815	0.100	pCi/g						
Manganese-54	U	-0.00853	+/-0.0313	0.0519	0.100	pCi/g						

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : PO Box 808
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Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57566 Project: LLNL00399
Sample ID: 38226001 Client ID: LLNL001

Parameter	Qualifier	Result		DL	RL	Units	DF	AnalystDate		Time	Batch	Method
tad Gamma Spec												
Gammaspec, Gamma, solid												
Mercury-203	U	0.00174	+/-0.0303	0.0471	0.050	pCi/g						
Neodymium-147	U	0.0936	+/-0.495	0.810	1000	pCi/g						
Neptunium-239	U	0.116	+/-0.111	0.177	5.00	pCi/g						
Niobium-94	U	0.0267	+/-0.035	0.0486	1.00	pCi/g						
Niobium-95	U	0.0251	+/-0.0439	0.0713	0.050	pCi/g						
Potassium-40	U	0.340	+/-0.702	0.493	0.500	pCi/g						
Promethium-144	U	-0.0158	+/-0.0368	0.0501	0.050	pCi/g						
Promethium-146	U	-0.0113	+/-0.0352	0.0569	0.050	pCi/g						
Radium-228	U	0.00	+/-0.213	0.248	0.500	pCi/g						
Ruthenium-106	U	-0.101	+/-0.278	0.441	0.500	pCi/g						
Silver-110m	U	-0.0159	+/-0.0296	0.0465	0.050	pCi/g						
Sodium-22	U	0.0181	+/-0.0325	0.0554	0.050	pCi/g						
Thallium-208	U	0.00	+/-0.0714	0.0654	0.050	pCi/g						
T n-230		0.568	+/-0.161	0.096	1.00	pCi/g						
Th...um-234	U	0.00	+/-1.95	0.973	5.00	pCi/g						
Tin-113	U	-0.00656	+/-0.0333	0.0545	0.050	pCi/g						
Uranium-235	U	0.153	+/-0.248	0.237	0.500	pCi/g						
Uranium-238	U	0.00	+/-1.95	0.973	1.00	pCi/g						
Yttrium-88	U	-0.00366	+/-0.030	0.0513	0.050	pCi/g						
Zinc-65	U	-0.0472	+/-0.0794	0.109	0.100	pCi/g						
Zirconium-95	U	-0.00703	+/-0.064	0.102	0.100	pCi/g						
ad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		12.3	+/-3.35	3.08	4.00	pCi/g		JEN	03/12/01	1902	66939	14
Beta		19.4	+/-3.88	5.63	10.0	pCi/g						
ad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium		8.38	+/-1.12	1.38	2.00	pCi/g		CAF1	03/03/01	1001	66518	15
apid Flow Analysis Federal												
SW 7.3.3 Reactivity, Releasabl												
Reactive Releasable Cyanide	U	-5.1		13.8	25000	ug/kg	1	ADF	03/01/01	1056	66815	16
:mi-Volatiles-GC/MS Federal												
TCLP BNA SOLID 8270C 3510C												
1,2-Dichlorobenzene		0.00		8.15	50.0	ug/L	1	JWF	03/05/01	2009	67149	17
1,4-Dichlorobenzene		0.00		0.00915	0.750	mg/L	1					
2,3,4,6-Tetrachlorophenol		0.00		5.65	50.0	ug/L	1					
2,4,5-Trichlorophenol		0.00		0.0059	40.0	mg/L	1					
2,4,6-Trichlorophenol		0.00		0.0056	0.200	mg/L	1					
2,4-Dinitrotoluene		0.00		0.00485	0.130	mg/L	1					
Hexachlorobenzene		0.00		0.00535	0.130	mg/L	1					

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : PO Box 808
Mailstop L-232
Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57566 — Project: LLNL00399
Sample ID: 38226001 — Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
;emi-Volatiles-GC/MS Federal											
TCLP BNA SOLID 8270C 3510C											
Hexachlorobutadiene		0.00	0.0088	0.100	mg/L	1					
Hexachloroethane		0.00	0.0085	0.300	mg/L	1					
Methoxychlor		0.00	5.10	50.0	ug/L	1					
Nitrobenzene		0.00	0.0071	0.200	mg/L	1					
Pentachlorophenol		0.00	0.0079	10.0	mg/L	1					
Phenol		0.00	4.20	50.0	ug/L	1					
Pyridine		0.00	0.011	0.500	mg/L	1					
bis(2-Chloroethyl) ether		0.00	7.00	50.0	ug/L	1					
m,p-Cresols		0.00	0.00535	20.0	mg/L	1					
o-Cresol		0.00	0.0063	20.0	mg/L	1					
:mi-Volatiles-PCB Federal											
8082/3550B PCB soil-Fed											
Ar -1016	U	0.00	0.790	3.33	ug/kg	1	MM	03/02/01	0700	67057	18
A -1221	U	0.00	2.82	3.33	ug/kg	1					
Aroclor-1232	U	0.00	0.727	3.33	ug/kg	1					
Aroclor-1242	U	0.00	1.67	3.33	ug/kg	1					
Aroclor-1248	U	0.00	0.907	3.33	ug/kg	1					
Aroclor-1254	U	0.00	1.37	3.33	ug/kg	1					
Aroclor-1260	U	0.00	1.43	3.33	ug/kg	1					
lids Analysis Federal											
:PA 160.3 Mod. Solids, Total											
Total Solids		973000	120	200	mg/kg		TSM	02/26/01	1412	66511	22
ectrometric Analysis Federal											
'W846-7.3.4 Sulfide, Reactive											
Reactive Releasable Sulfide	U	0.010	0.115	50.0	mg/kg	1	AAT	02/26/01	1602	66609	23
latile Organics Federal											
:EL 8260B Method List Soil Fed											
1,1,1,2-Tetrachloroethane	U	0.00	40.0	100	ug/kg	50	CDS1	03/01/01	1359	66921	24
1,1,1-Trichloroethane	J	56.4	29.0	100	ug/kg	50					
1,1,2,2-Tetrachloroethane	U	0.00	30.0	100	ug/kg	50					
!,1,2-Trichloroethane	U	0.00	36.0	100	ug/kg	50					
',1-Dichloroethylene	U	0.00	26.2	100	ug/kg	50					
,1-Dichloropropene	U	0.00	32.0	100	ug/kg	50					
,2,3-Trichlorobenzene	U	0.00	47.0	100	ug/kg	50					
,2,3-Trichloropropane	U	0.00	31.0	100	ug/kg	50					
,2,4-Trichlorobenzene	U	0.00	40.0	100	ug/kg	50					
,2,4-Trimethylbenzene	U	0.00	41.0	100	ug/kg	50					
,2-Dibromo-3-hloropropane	U	0.00	47.0	100	ug/kg	50					
,2-Dibromoethane	U	0.00	32.0	100	ug/kg	50					

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Project: CES

Report Date: March 20, 2001

Client Sample ID: 57566
Sample ID: 38226001

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
'olatile Organics Federal										
GEL 8260B Method List Soil Fed										
1,2-Dichlorobenzene	U	0.00	44.0	100	ug/kg	50				
1,2-Dichloropropane	U	0.00	32.0	100	ug/kg	50				
1,3,5-Trimethylbenzene	U	0.00	42.0	100	ug/kg	50				
1,3-Dichlorobenzene	U	0.00	42.0	100	ug/kg	50				
1,3-Dichloropropane	U	0.00	33.0	100	ug/kg	50				
1,4-Dichlorobenzene	U	0.00	40.0	100	ug/kg	50				
2,2-Dichloropropane	U	0.00	30.0	100	ug/kg	50				
2-Butanone	U	0.00	76.0	500	ug/kg	50				
2-Chloroethylvinyl ether	U	0.00	93.0	500	ug/kg	50				
2-Chlorotoluene	U	0.00	42.0	100	ug/kg	50				
2-Hexanone	U	0.00	94.0	500	ug/kg	50				
4-Chlorotoluene	U	0.00	40.0	100	ug/kg	50				
4-I[illegible]opyltoluene	U	0.00	40.0	100	ug/kg	50				
4- [illegible]l-2-pentanone	U	0.00	134	500	ug/kg	50				
Ace[illegible]e	U	0.00	100	500	ug/kg	50				
Benzene	U	0.00	39.0	100	ug/kg	50				
Bromobenzene	U	0.00	41.0	100	ug/kg	50				
Bromochloromethane	U	0.00	46.0	100	ug/kg	50				
Bromodichloromethane	U	0.00	35.0	100	ug/kg	50				
Bromoform	U	0.00	36.0	100	ug/kg	50				
Bromomethane	U	0.00	31.0	100	ug/kg	50				
Carbon disulfide	U	0.00	62.0	500	ug/kg	50				
Carbon tetrachloride		1350	26.0	100	ug/kg	50				
Chlorobenzene	U	0.00	40.0	100	ug/kg	50				
Chloroethane	U	0.00	28.0	100	ug/kg	50				
Chloromethane	U	0.00	35.0	100	ug/kg	50				
Dibromochloromethane	U	0.00	41.0	100	ug/kg	50				
Dibromomethane	U	0.00	34.0	100	ug/kg	50				
Dichlorodifluoromethane		526	18.0	100	ug/kg	50				
Ethylbenzene	U	0.00	35.0	100	ug/kg	50				
Hexachlorobutadiene	U	0.00	41.0	100	ug/kg	50				
sopropylbenzene	U	0.00	35.0	100	ug/kg	50				
Methylene chloride		828	44.0	500	ug/kg	50				
Naphthalene	U	0.00	29.0	100	ug/kg	50				
Styrene	U	0.00	32.0	100	ug/kg	50				
Tetrachloroethylene	U	0.00	40.0	100	ug/kg	50				
Toluene	U	0.00	50.0	100	ug/kg	50				
Trichlorofluoromethane		515	37.0	100	ug/kg	50				
Vinyl acetate	U	0.00	77.0	500	ug/kg	50				
Vinyl chloride		371	30.0	100	ug/kg	50				
cis-1,2-Dichloroethylene		1960	41.0	100	ug/kg	50				
cis-1,3-Dichloropropylene	U	0.00	28.0	100	ug/kg	50				

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Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57566 Project: LLNL00399
Sample ID: 38226001 Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
olatile Organics Federal										
GEL 8260B Method List Soil Fed										
m,p-Xylenes	U	0.00	70.0	200	ug/kg	50				
n-Butylbenzene	U	0.00	41.0	100	ug/kg	50				
n-Propylbenzene	U	0.00	35.0	100	ug/kg	50				
o-Xylene	U	0.00	36.0	100	ug/kg	50				
sec-Butylbenzene	U	0.00	44.0	100	ug/kg	50				
tert-Butylbenzene	U	0.00	30.0	100	ug/kg	50				
trans-1,2-Dichloroethylene		848	37.0	100	ug/kg	50				
trans-1,3-Dichloropropylene	U	0.00	24.0	100	ug/kg	50				
1,1-Dichloroethane		74900	16400	40000	ug/kg	20000	CDS1 03/02/01	1410	66921	25
1,2-Dichloroethane		53200	10800	40000	ug/kg	20000				
Chloroform		2720000	18800	40000	ug/kg	20000				
Tric[illegible]roethylene	J	31500	28800	40000	ug/kg	20000				
T[illegible] otrifluoroethane	U	0.00	180000	200000	ug/kg	20000				
'et Cuemistry General Federal										
SW9095 Paint Filter Test Feder										
Paint Filter		PASS					AAT 03/01/01	1609	67131	26

The following Prep Methods were performed

lethod	Description	Analyst	Date	Time	Prep Batch
sh Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	02/28/01	1026	66623
ry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	02/26/01	0842	66493
W846 1311	SW846 1311 TCLP Leaching	JL	02/27/01	1615	66727
W846 3050B	846 3050BS PREP	HSC	03/08/01	1400	68021
W846 3050B	846 3050BS PREP	KLD1	02/27/01	1300	66677
W846 3510C	3510C BNA TCLP Prep-8270C Analysis Fed	AEJ	03/01/01	0800	67016
W846 3550B	3550B PCB Prep Soil FED	RDH	02/28/01	2140	66920
W846 3550B	3550B PCB Prep Soil FED	RDH	03/02/01	1919	67197
W846 7.3.3 Pr	SW 7.3.3 Reactivity, Releasable Cyanide-	TEMP	02/26/01	1717	66523
W846 7.3.4 Mod	SW846-7.3.4 Sulfide, Reactive-Releasabl	AAT	02/26/01	1403	66608
W846 7471A	EPA 7471 Mercury Prep Soil	ARD	02/27/01	1800	66624
W846 9023 Pr	SW 9023 Halogen, Extractable(TOX) Prep	LS	02/26/01	1400	66569

'he following Analytical Methods were performed

lethod	Description
	SW846 9045C
	ASTM D 2216

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	Livermore, CA 94551
Contact:	Debbie Montero
Project:	CES

Report Date: March 20, 2001

Client Sample ID:	57566	Proiect:	LLNL00399
Sample ID:	38226001	Client ID:	LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
	SW846 9023									
	SW846 7471A									
	SW846 3050B/6010B									
	SW846 3050B/6010B									
	SW846 3050B/6010B									
	SW846 3050B/6010B									
	DOE EML HASL 300									
0	DOE EML HASL 300									
1	DOE EML HASL 300									
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	EPA 900.0									
5	EPA 906.0									
6	SW846 7.3.3									
7	SW846 8270C									
8	SW846 8082									
9	SW846 8082									
0	SW846 8082									
1	SW846 8082									
2	SM 2540G									
3	SW846 7.3.4 Modified									
4	SW846 8260B									
5	SW846 8260B									
6	SW846 9095									

Surrogate recovery	Test	Recovery%	Acceptable Limits
4,6-Tribromophenol	TCLP BNA SOLID 8270C 3510C	81%	(33%-121%)
Fluorobiphenyl	TCLP BNA SOLID 8270C 3510C	79%	(39%-109%)
-Fluorophenol	TCLP BNA SOLID 8270C 3510C	47%	(16%-83%)
itrobenzene-d5	TCLP BNA SOLID 8270C 3510C	78%	(34%-111%)
henol-d5	TCLP BNA SOLID 8270C 3510C	28%	(14%-65%)
Terphenyl-d14	TCLP BNA SOLID 8270C 3510C	98%	(29%-132%)
:mx	8082/3550B PCB soil-Fed	5% *	(41%-132%)
ecachlorobiphenyl	8082/3550B PCB soil-Fed	71%	(44%-127%)
romofluorobenzene	GEL 8260B Method List Soil Fed	119%	(61%-146%)
ibromofluoromethane	GEL 8260B Method List Soil Fed	87%	(54%-144%)

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Project: CES

Report Date: March 20, 2001

Client Sample ID: 57566
Sample ID: 38226001

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
oluene-d8	GEL 8260B Method List Soil Fed		99%		(61%-131%)					

Notes:
The Qualifiers in this report are defined as follows :

* Indicates the analyte is a surrogate compound.
Actual result is less than amount reported
Actual result is greater than amount reported
Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc.
tandard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones at 843-556-8171 Ext. 4243.

:viewed by

COC Sample ID Listing

CES COC # 9766

CES Sample ID	Client Sample ID
57566	W208027RP
57567	W202975
57568	W208027
57569	TB021701CC

57567

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Rad Screening

CES Sample ID: **57567**

Client Sample ID: W202975

Result	MDC	Units	Date Counted	Analyst
Not Detectable	3000	dpm/g	02-20-01	cox

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:
Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

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Project: CES

Report Date: March 20, 2001

Client Sample ID: 57567
Sample ID: 38223002
Matrix: Misc Solid
Collect Date: 17-FEB-01
Receive Date: 23-FEB-01
Collector: Client

Proiect: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
lercury Analysis Federal											
TCLP Hg in Solid											
Mercury	U	-0.00079	0.00073	0.200	mg/L	1	AW2	03/02/01	1137	67214	1
letals Analysis-ICP Federal											
TCLP ICP Metals for Solid											
Arsenic	J	0.0797	0.0333	5.00	mg/L	10	JAB	03/03/01	2022	67348	2
Barium	J	0.491	0.00101	100	mg/L	10					
Cadmium	U	0.000539	0.00319	1.00	mg/L	10					
Chromium	U	0.00451	0.00691	5.00	mg/L	10					
Lead	J	0.0231	0.0172	5.00	mg/L	10					
Selenium	U	0.0222	0.0492	1.00	mg/L	10					
Sil	U	0.000111	0.00448	5.00	mg/L	10					

he following Prep Methods were performed

'ethod	Description	Analyst	Date	Time	Prep Batch
'846 1311	SW846 1311 TCLP Leaching -FEDERAL	JL	02/27/01	1615	66726
'846 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	03/02/01	1500	67027
'846 7470A	EPA 7470 Mercury Prep TCLP Liquid Federa	ARD	03/01/01	1830	67031

ie following Analytical Methods were performed

:thod	Description
	SW846 7470A
	SW846 3010/6010B

tes:
he Qualifiers in this report are defined as follows :

Indicates the analyte is a surrogate compound.
Actual result is less than amount reported
Actual result is greater than amount reported
Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
Indicates the compound was analyzed for but not detected above the detection limit

e above sample is reported on an "as received" basis.

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Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57567 Project: LLNL00399
Sample ID: 38223002 Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones at 843-556-8171 Ext. 4243.

Cheryl Jones

Reviewed by

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Company : Lawrence Livermore Nat'l Lab (
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Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57567
Sample ID: 38225002
Matrix: Misc Solid
Collect Date: 17-FEB-01
Receive Date: 23-FEB-01
Collector: Client

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
lercury Analysis Federal											
STLC Hg in Solid											
Mercury	U	-0.003	0.00146	0.004	mg/L	1	AW2	03/02/01	1224	67215	1
'etals Analysis-ICP Federal											
STLC ICP Metals for Solids											
Antimony	U	-0.000044	0.0269	1.00	mg/L	10	JAB	03/08/01	1532	67052	2
Arsenic		0.355	0.0333	0.100	mg/L	10					
Barium		1.32	0.00101	0.050	mg/L	10					
Beryllium	J	0.0112	0.00155	0.050	mg/L	10					
Cadmium	U	0.00152	0.00319	0.050	mg/L	10					
Chromium	J	0.0149	0.00691	0.050	mg/L	10					
Cot	J	0.0141	0.00632	0.050	mg/L	10					
Cop,	J	0.020	0.00774	0.050	mg/L	10					
Nickel		0.074	0.0186	0.050	mg/L	10					
Potassium		31.2	0.115	1.00	mg/L	10					
Selenium	J	0.0496	0.0492	0.100	mg/L	10					
Silver	J	0.0233	0.00448	0.050	mg/L	10					
'hallium	U	-0.0105	0.0446	0.200	mg/L	10					
'anadium	J	0.0423	0.00702	0.050	mg/L	10					
'inc	J	0.0175	0.0169	0.050	mg/L	10					
1olybdenum	U	-0.489	0.448	5.00	mg/L	500	RMJ	03/09/01	1558	67052	3
ead	U	-0.142	0.0861	0.250	mg/L	50	MNC	03/08/01	1709	67052	4

: following Prep Methods were performed

hod	Description	Analyst	Date	Time	Prep Batch
'ornia Code of	California Wet Method STLC Leaching	JL	02/25/01	1235	66475
46 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	02/28/01	1500	66976
46 7470A	EPA 7470 Mercury Prep TCLP Liquid Federa	ARD	03/01/01	1830	66977

following Analytical Methods were performed

1od	Description
	SW846 7470A
	SW846 3010/6010B
	SW846 3010/6010B
	SW846 3010/6010B

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Company : Lawrence Livermore Nat'l Lab (
Address : PO Box 808
Mailstop L-232
Livermore, CA 94551

Report Date: March 20, 2001

Contact: Debbie Montero

Project: CES

Client Sample ID: 57567 Project: LLNL00399
Sample ID: 38225002 Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

Notes:

The Qualifiers in this report are defined as follows :

** Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
J Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones at 843-556-8171 Ext. 4243.

Cheryl Jones
eviewed by

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Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID:	57567	Project:	LLNL00399
Sample ID:	38226002	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
:lectrode Analysis Federal												
SW9045C Corrosivity(pH<2or>14)												
Corrosivity		9.51		0.010	0.100	SU	1	VH1	02/24/01	1345	66453	1
;ravimetric Solids												
ASTM D 2216 % Moisture Federal												
Moisture		4.52				percent		COB1	02/26/01	1714	66601	2
Ialogen Analysis Federal												
SW9023 TOX (Extract. Halogen)												
Extractable Organic Halogens		20500		179	750	mg/kg	50	LS	03/01/01	1655	66816	3
Ierc·· ·· Analysis Federal												
74. ·ld Vapor Hg in Solid												
Mercury	U	-0.0763		0.0425	0.100	mg/kg	10	AW2	02/28/01	1522	66867	4
Ietals Analysis-ICP Federal												
6010 TAL Metals Soil Federal												
Antimony	U	-0.117		0.456	5.00	mg/kg	2	HSC	03/07/01	0018	66844	5
Arsenic		5.91		0.263	5.00	mg/kg	2					
Barium		46.7		0.0285	1.00	mg/kg	2					
Beryllium		2.08		0.0147	0.481	mg/kg	2					
Cadmium	U	-0.218		0.0249	1.00	mg/kg	2					
Chromium	J	2.98		0.419	3.00	mg/kg	2					
Cobalt	J	4.12		0.105	5.00	mg/kg	2					
Copper		5.00		0.0483	5.00	mg/kg	2					
Lead	J	0.617		0.327	5.00	mg/kg	2					
Molybdenum		21.1		0.122	3.00	mg/kg	2					
Nickel		21.1		0.191	3.00	mg/kg	2					
Potassium	J	17.4		1.66	50.0	mg/kg	2					
Selenium	U	-0.423		0.260	1.00	mg/kg	2					
Silver	U	0.0541		0.111	2.00	mg/kg	2					
Thallium	U	0.710		0.908	5.00	mg/kg	2					
Vanadium		6.41		0.114	5.00	mg/kg	2					
Zinc	J	1.24		0.258	5.00	mg/kg	2	HSC	03/09/01	0410	68154	8
ad Alpha Spec												
Alphaspec Am241, Cm, solid												
Americium-241	U	-0.00445	+/-0.00893	0.098	1.00	pCi/g		JLE	03/05/01	1133	66949	9
Curium-242	U	0.00	+/-2.00	0.0597	1.00	pCi/g						
Curium-243/244	U	0.0141	+/-0.0383	0.0981	1.00	pCi/g						
Curium-245/246		0.0646	+/-0.0751	0.0646	1.00	pCi/g						

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Project: CES

Report Date: March 20, 2001

Client Sample ID: 57567
Sample ID: 38226002

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Pu, solid												
Plutonium-238	U	0.00	+/-2.00	0.0515	0.100	pCi/g		JLE	03/03/01	1238	66950	10
Plutonium-239/240		0.0269	+/-0.0205	0.0115	0.100	pCi/g						
Alphaspec Th, solid												
Thorium-228		0.263	+/-0.100	0.0997	1.00	pCi/g		JLE	03/06/01	1823	66952	11
Thorium-230		0.927	+/-0.200	0.0939	1.00	pCi/g						
Thorium-232		0.354	+/-0.106	0.019	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.837	+/-0.285	0.144	1.00	pCi/g		HOT1	03/05/01	1123	66956	12
Uranium-235/236	U	0.0475	+/-0.0745	0.145	1.00	pCi/g						
Uranium-238		0.748	+/-0.265	0.0623	1.00	pCi/g						
Rad Gamma Spec												
Gammaspec, Gamma, solid												
A[illegible]m-228		0.261	+/-0.121	0.0824	0.500	pCi/g		CRB	03/05/01	2319	67061	13
Americium-241	U	-0.0306	+/-0.0837	0.128	0.200	pCi/g						
Antimony-124	U	-0.0428	+/-0.0203	0.0307	0.050	pCi/g						
Antimony-125	U	0.0257	+/-0.030	0.0674	0.100	pCi/g						
Barium-133	U	-0.00638	+/-0.0222	0.0308	0.050	pCi/g						
Barium-140	U	-0.00632	+/-0.127	0.201	0.200	pCi/g						
Beryllium-7	U	0.0848	+/-0.147	0.239	0.500	pCi/g						
Bismuth-212	U	0.134	+/-0.213	0.183	0.500	pCi/g						
Bismuth-214		0.604	+/-0.105	0.0526	0.100	pCi/g						
Cerium-139	U	-0.00634	+/-0.0141	0.0227	0.050	pCi/g						
Cerium-141	U	-0.0162	+/-0.0329	0.0492	0.050	pCi/g						
Cerium-144	U	-0.0412	+/-0.102	0.153	0.500	pCi/g						
Cesium-134	U	0.000677	+/-0.0182	0.0264	0.050	pCi/g						
Cesium-136	U	-0.0491	+/-0.0515	0.0796	1000	pCi/g						
Cesium-137	U	-0.00604	+/-0.0182	0.0259	0.050	pCi/g						
Chromium-51	U	0.160	+/-0.291	0.288	0.500	pCi/g						
Cobalt-56	U	-0.000615	+/-0.0177	0.0293	0.050	pCi/g						
Cobalt-57	U	0.0059	+/-0.0126	0.0195	0.050	pCi/g						
Cobalt-58	U	-0.0063	+/-0.0168	0.0273	0.050	pCi/g						
Cobalt-60	U	0.0112	+/-0.0169	0.030	0.050	pCi/g						
Europium-152	U	-0.0364	+/-0.0443	0.0691	0.100	pCi/g						
Europium-154	U	0.0346	+/-0.0458	0.0816	0.500	pCi/g						
Europium-155	U	0.0435	+/-0.0746	0.0831	0.500	pCi/g						
Iridium-192	U	-0.00647	+/-0.0187	0.026	0.100	pCi/g						
Iron-59	U	-0.00155	+/-0.0361	0.0594	0.100	pCi/g						
Lead-210		7.92	+/-4.33	3.94	5.00	pCi/g						
Lead-212		0.238	+/-0.0657	0.0409	0.100	pCi/g						
Lead-214		0.821	+/-0.118	0.0488	0.100	pCi/g						
Manganese-54	U	0.000827	+/-0.0161	0.0267	0.100	pCi/g						

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Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57567
Sample ID: 38226002
Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
ad Gamma Spec												
Gammaspec, Gamma, solid												
Mercury-203	U	0.0187	+/-0.0199	0.0327	0.050	pCi/g						
Neodymium-147	U	-0.131	+/-0.267	0.415	1000	pCi/g						
Neptunium-239	U	0.0814	+/-0.104	0.143	5.00	pCi/g						
Niobium-94	U	0.00675	+/-0.015	0.0254	1.00	pCi/g						
Niobium-95	U	0.00454	+/-0.0339	0.0318	0.050	pCi/g						
Potassium-40		0.548	+/-0.387	0.245	0.500	pCi/g						
Promethium-144	U	0.00839	+/-0.032	0.0265	0.050	pCi/g						
Promethium-146	U	0.0209	+/-0.0201	0.0331	0.050	pCi/g						
Radium-228		0.261	+/-0.121	0.0824	0.500	pCi/g						
Ruthenium-106	U	0.0313	+/-0.138	0.233	0.500	pCi/g						
Silver-110m	U	0.00539	+/-0.0145	0.0246	0.050	pCi/g						
Sodium-22	U	0.0124	+/-0.0164	0.0293	0.050	pCi/g						
Thallium-208	U	0.00	+/-0.0399	0.041	0.050	pCi/g						
Thorium-230		0.604	+/-0.105	0.0526	1.00	pCi/g						
Thorium-234	U	0.00	+/-0.896	1.23	5.00	pCi/g						
Tin-113	U	-0.0128	+/-0.021	0.0329	0.050	pCi/g						
Uranium-235	U	0.00	+/-0.112	0.170	0.500	pCi/g						
Uranium-238	U	0.00	+/-0.896	1.23	1.00	pCi/g						
Yttrium-88	U	0.016	+/-0.0173	0.0317	0.050	pCi/g						
Zinc-65	U	0.0363	+/-0.0396	0.060	0.100	pCi/g						
Zirconium-95	U	0.0122	+/-0.0284	0.0483	0.100	pCi/g						
ad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		8.01	+/-2.99	3.18	4.00	pCi/g		JEN	03/12/01	1902	66939	14
Beta		11.6	+/-3.34	5.52	10.0	pCi/g						
ad Liquid Scint												
LSC, Tritium Dist, solid												
Tritium		15.0	+/-1.39	1.48	2.00	pCi/g		CAF1	03/03/01	1304	66518	15
apid Flow Analysis Federal												
SW 7.3.3 Reactivity, Releasabl												
Reactive Releasable Cyanide	U	-1.8		13.8	25000	ug/kg	1	ADF	03/01/01	1058	66815	16
mi-Volatiles-GC/MS Federal												
TCLP BNA SOLID 8270C 3510C												
1,2-Dichlorobenzene		0.00		8.15	50.0	ug/L	1	JWF	03/05/01	2039	67149	17
1,4-Dichlorobenzene		0.00		0.00915	0.750	mg/L	1					
2,3,4,6-Tetrachlorophenol		0.00		5.65	50.0	ug/L	1					
2,4,5-Trichlorophenol		0.00		0.0059	40.0	mg/L	1					
2,4,6-Trichlorophenol		0.00		0.0056	0.200	mg/L	1					
2,4-Dinitrotoluene		0.00		0.00485	0.130	mg/L	1					
Hexachlorobenzene		0.00		0.00535	0.130	mg/L	1					

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Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
emi-Volatiles-GC/MS Federal											
TCLP BNA SOLID 8270C 3510C											
Hexachlorobutadiene		0.00	0.0088	0.100	mg/L	1					
Hexachloroethane		0.00	0.0085	0.300	mg/L	1					
Methoxychlor		0.00	5.10	50.0	ug/L	1					
Nitrobenzene		0.00	0.0071	0.200	mg/L	1					
Pentachlorophenol		0.00	0.0079	10.0	mg/L	1					
Phenol		0.00	4.20	50.0	ug/L	1					
Pyridine		0.00	0.011	0.500	mg/L	1					
bis(2-Chloroethyl) ether		0.00	7.00	50.0	ug/L	1					
m,p-Cresols		0.00	0.00535	20.0	mg/L	1					
ɔ-Cresol		0.00	0.0063	20.0	mg/L	1					
ni-Volatiles-PCB Federal											
282/3550B PCB soil-Fed											
\ro 016	U	0.00	0.790	3.33	ug/kg	1	MM	03/02/01	0722	67057	18
\roc 1221	U	0.00	2.82	3.33	ug/kg	1					
\roclor-1232	U	0.00	0.727	3.33	ug/kg	1					
\roclor-1242	U	0.00	1.67	3.33	ug/kg	1					
.roclor-1248	U	0.00	0.907	3.33	ug/kg	1					
roclor-1254		4.00	1.37	3.33	ug/kg	1					
roclor-1260	U	0.00	1.43	3.33	ug/kg	1					
ls Analysis Federal											
A 160.3 Mod. Solids, Total											
otal Solids		977000	120	200	mg/kg		TSM	02/26/01	1412	66511	22
trometric Analysis Federal											
846-7.3.4 Sulfide, Reactive											
active Releasable Sulfide	U	-0.01	0.115	50.0	mg/kg	1	AAT	02/26/01	1602	66609	23
ile Organics Federal											
8260B Method List Soil Fed											
,1,2-Tetrachloroethane	U	0.00	16000	40000	ug/kg	20000	CDS1	03/02/01	1344	66921	24
.1-Trichloroethane	U	0.00	11600	40000	ug/kg	20000					
2,2-Tetrachloroethane	U	0.00	12000	40000	ug/kg	20000					
2-Trichloroethane	U	0.00	14400	40000	ug/kg	20000					
Dichloroethane		51100	16400	40000	ug/kg	20000					
Dichloroethylene		1290000	10500	40000	ug/kg	20000					
Dichloropropene	U	0.00	12800	40000	ug/kg	20000					
3-Trichlorobenzene	U	0.00	18800	40000	ug/kg	20000					
3-Trichloropropane	U	0.00	12400	40000	ug/kg	20000					
-Trichlorobenzene	U	0.00	16000	40000	ug/kg	20000					
-Trimethylbenzene	U	0.00	16400	40000	ug/kg	20000					
Dibromo-3-opropane	U	0.00	18800	40000	ug/kg	20000					

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Client Sample ID: 57567
Sample ID: 38226002

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
olatile Organics Federal										
GEL 8260B Method List Soil Fed										
1,2-Dibromoethane	U	0.00	12800	40000	ug/kg	20000				
1,2-Dichlorobenzene	U	0.00	17600	40000	ug/kg	20000				
1,2-Dichloroethane	J	33700	10800	40000	ug/kg	20000				
1,2-Dichloropropane	U	0.00	12800	40000	ug/kg	20000				
1,3,5-Trimethylbenzene	U	0.00	16800	40000	ug/kg	20000				
1,3-Dichlorobenzene	U	0.00	16800	40000	ug/kg	20000				
1,3-Dichloropropane	U	0.00	13200	40000	ug/kg	20000				
1,4-Dichlorobenzene	U	0.00	16000	40000	ug/kg	20000				
2,2-Dichloropropane	U	0.00	12000	40000	ug/kg	20000				
2-Butanone	U	0.00	30400	200000	ug/kg	20000				
2-Chloroethylvinyl ether	U	0.00	37200	200000	ug/kg	20000				
2-Chlorotoluene	U	0.00	16800	40000	ug/kg	20000				
2-Hex-none	U	0.00	37600	200000	ug/kg	20000				
4-C oluene	U	0.00	16000	40000	ug/kg	20000				
4-Iso-opyltoluene	U	0.00	16000	40000	ug/kg	20000				
4-Methyl-2-pentanone	U	0.00	53600	200000	ug/kg	20000				
Acetone	U	0.00	40000	200000	ug/kg	20000				
Benzene	U	0.00	15600	40000	ug/kg	20000				
Bromobenzene	U	0.00	16400	40000	ug/kg	20000				
Bromochloromethane	U	0.00	18400	40000	ug/kg	20000				
romodichloromethane	U	0.00	14000	40000	ug/kg	20000				
romoform	U	0.00	14400	40000	ug/kg	20000				
romomethane	U	0.00	12400	40000	ug/kg	20000				
arbon disulfide	U	0.00	24800	200000	ug/kg	20000				
arbon tetrachloride	U	0.00	10400	40000	ug/kg	20000				
hlorobenzene	U	0.00	16000	40000	ug/kg	20000				
hloroethane	U	0.00	11200	40000	ug/kg	20000				
hloroform		1630000	18800	40000	ug/kg	20000				
hloromethane	U	0.00	14000	40000	ug/kg	20000				
bromochloromethane	U	0.00	16400	40000	ug/kg	20000				
bromomethane	U	0.00	13600	40000	ug/kg	20000				
chlorodifluoromethane	U	0.00	7200	40000	ug/kg	20000				
ylbenzene	U	0.00	14000	40000	ug/kg	20000				
xachlorobutadiene	U	0.00	16400	40000	ug/kg	20000				
propylbenzene	U	0.00	14000	40000	ug/kg	20000				
thylene chloride	U	0.00	17600	200000	ug/kg	20000				
hthalene	U	0.00	11600	40000	ug/kg	20000				
rene	U	0.00	12800	40000	ug/kg	20000				
rachloroethylene	U	0.00	16000	40000	ug/kg	20000				
uene	U	0.00	20000	40000	ug/kg	20000				
hloroethylene		54400	28800	40000	ug/kg	20000				
hlorofluoromethane	U	0.00	14800	40000	ug/kg	20000				

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Report Date: March 20, 2001

Client Sample ID: 57567 Project: LLNL00399
Sample ID: 38226002 Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
'olatile Organics Federal										
GEL 8260B Method List Soil Fed										
Trichlorotrifluoroethane	U	0.00	180000	200000	ug/kg	20000				
Vinyl acetate	U	0.00	30800	200000	ug/kg	20000				
Vinyl chloride	U	0.00	12000	40000	ug/kg	20000				
cis-1,2-Dichloroethylene	U	0.00	16400	40000	ug/kg	20000				
cis-1,3-Dichloropropylene	U	0.00	11200	40000	ug/kg	20000				
m,p-Xylenes	U	0.00	28000	80000	ug/kg	20000				
n-Butylbenzene	U	0.00	16400	40000	ug/kg	20000				
n-Propylbenzene	U	0.00	14000	40000	ug/kg	20000				
o-Xylene	U	0.00	14400	40000	ug/kg	20000				
sec-Butylbenzene	U	0.00	17600	40000	ug/kg	20000				
tert-Butylbenzene	U	0.00	12000	40000	ug/kg	20000				
trans-1,2-Dichloroethylene	U	0.00	14800	40000	ug/kg	20000				
tr? ',3-D opropylene	U	0.00	9600	40000	ug/kg	20000				
Vet Cnemistry General Federal										
SW9095 Paint Filter Test Feder										
Paint Filter		PASS					AAT 03/01/01	1609	67131	25

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
ʌsh Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	02/28/01	1026	66623
)ry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	02/26/01	0842	66493
:W846 1311	SW846 1311 TCLP Leaching	JL	02/27/01	1615	66727
:W846 3050B	846 3050BS PREP	HSC	03/08/01	1400	68021
·W846 3050B	846 3050BS PREP	KLD1	02/27/01	1300	66677
·W846 3510C	3510C BNA TCLP Prep-8270C Analysis Fed	AEJ	03/01/01	0800	67016
W846 3550B	3550B PCB Prep Soil FED	RDH	02/28/01	2140	66920
W846 3550B	3550B PCB Prep Soil FED	RDH	03/02/01	1919	67197
W846 7.3.3 Pr	SW 7.3.3 Reactivity, Releasable Cyanide-	TEMP	02/26/01	1717	66523
W846 7.3.4 Mod	SW846-7.3.4 Sulfide, Reactive-Releasabl	AAT	02/26/01	1403	66608
W846 7471A	EPA 7471 Mercury Prep Soil	ARD	02/27/01	1800	66624
W846 9023 Pr	SW 9023 Halogen, Extractable(TOX) Prep	LS	02/26/01	1400	66569

The following Analytical Methods were performed

Method	Description
	SW846 9045C
	ASTM D 2216

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GENERAL ENGINEERING LABORATORIES

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Certificate of Analysis

Company :	Lawrence Livermore Nat'l Lab (
Address :	PO Box 808
	Mailstop L-232
	Livermore, CA 94551
Contact:	Debbie Montero
Project:	CES

Report Date: March 20, 2001

Client Sample ID:	57567	Project:	LLNL00399
Sample ID:	38226002	Client ID:	LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
'	SW846 9023									
.	SW846 7471A									
'	SW846 3050B/6010B									
'	SW846 3050B/6010B									
'	SW846 3050B/6010B									
:	SW846 3050B/6010B									
'	DOE EML HASL 300									
0	DOE EML HASL 300									
1	DOE EML HASL 300									
2	DOE EML HASL 300									
3	DOE EML HASL 300									
4	EPA 900.0									
5	EPA 906.0									
6	SW846 7.3.3									
7	SW846 8270C									
8	SW846 8082									
9	SW846 8082									
0	SW846 8082									
1	SW846 8082									
2	SM 2540G									
3	SW846 7.3.4 Modified									
4	SW846 8260B									
5	SW846 9095									

Surrogate recovery	Test	Recovery%	Acceptable Limits
,4,6-Tribromophenol	TCLP BNA SOLID 8270C 3510C	83%	(33%-121%)
-Fluorobiphenyl	TCLP BNA SOLID 8270C 3510C	85%	(39%-109%)
-Fluorophenol	TCLP BNA SOLID 8270C 3510C	48%	(16%-83%)
litrobenzene-d5	TCLP BNA SOLID 8270C 3510C	81%	(34%-111%)
henol-d5	TCLP BNA SOLID 8270C 3510C	29%	(14%-65%)
-Terphenyl-d14	TCLP BNA SOLID 8270C 3510C	98%	(29%-132%)
cmx	8082/3550B PCB soil-Fed	4% *	(41%-132%)
'ecachlorobiphenyl	8082/3550B PCB soil-Fed	57%	(44%-127%)
romofluorobenzene	GEL 8260B Method List Soil Fed	105%	(61%-146%)
'ibromofluoromethane	GEL 8260B Method List Soil Fed	86%	(54%-144%)
oluene-d8	GEL 8260B Method List Soil Fed	100%	(61%-131%)

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Sample ID: 38226002
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Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
3	SW846 9023									
4	SW846 7471A									
5	SW846 3050B/6010B									
6	SW846 3050B/6010B									
7	SW846 3050B/6010B									
8	SW846 3050B/6010B									
9	DOE EML HASL 300									
10	DOE EML HASL 300									
11	DOE EML HASL 300									
12	DOE EML HASL 300									
13	DOE EML HASL 300									
14	EPA 900.0									
15	EPA 906.0									
16	SW846 7.3.3									
17	SW846 8270C									
18	SW846 8082									
19	SW846 8082									
20	SW846 8082									
21	SW846 8082									
22	SM 2540G									
23	SW846 7.3.4 Modified									
24	SW846 8260B									
25	SW846 9095									

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ibromofluoromethane	GEL 8260B Method List Soil Fed	86%	(54%-144%)
luene-d8	GEL 8260B Method List Soil Fed	100%	(61%-131%)

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Client Sample ID:	57567	Project:	LLNL00399
Sample ID:	38226002	Client ID:	LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

Notes:
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Actual result is less than amount reported
Actual result is greater than amount reported
Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
Indicates the compound was analyzed for but not detected above the detection limit

The above sample is reported on an "as received" basis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones at 843-556-8171 Ext. 4243.

Cheryl Jones
Reviewed by

COC Sample ID Listing

CES COC # 9766

CES Sample ID	Client Sample ID
57566	W208027RP
57567	W202975
57568	W208027
57569	TB021701CC

57568

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Rad Screening

CES Sample ID: **57568**

Client Sample ID: W208027

Result	MDC	Units	Date Counted	Analyst
Not Detectable	3000	dpm/g	02-20-01	cox

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:

Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

COC Sample ID Listing

CES COC # 9766

CES Sample ID	Client Sample ID
57566	W208027RP
57567	W202975
57568	W208027
57569	TB021701CC

57568

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Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID:	57568	Project:	LLNL00399
Sample ID:	38223003	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
'lercury Analysis Federal											
TCLP Hg in Solid											
Mercury	U	-0.000994	0.00073	0.200	mg/L	1	AW2	03/02/01	1139	67214	1
letals Analysis-ICP Federal											
TCLP ICP Metals for Solid											
Arsenic	J	0.0615	0.0333	5.00	mg/L	10	JAB	03/03/01	2027	67348	2
Barium	J	0.489	0.00101	100	mg/L	10					
Cadmium	U	-0.000014	0.00319	1.00	mg/L	10					
Chromium	U	0.00172	0.00691	5.00	mg/L	10					
Lead	U	0.0134	0.0172	5.00	mg/L	10					
Selenium	U	0.00574	0.0492	1.00	mg/L	10					
Silver	U	0.00263	0.00448	5.00	mg/L	10					

he following Prep Methods were performed

ethod	Description	Analyst	Date	Time	Prep Batch
'846 1311	SW846 1311 TCLP Leaching -FEDERAL	JL	02/27/01	1615	66726
'846 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	03/02/01	1500	67027
'846 7470A	EPA 7470 Mercury Prep TCLP Liquid Federa	ARD	03/01/01	1830	67031

ie following Analytical Methods were performed

:thod	Description
	SW846 7470A
	SW846 3010/6010B

·tes:
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Project: CES

Report Date: March 20, 2001

Client Sample ID: 57568
Sample ID: 38223003

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

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Cheryl Jones
Reviewed by

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Project: CES

Report Date: March 20, 2001

Client Sample ID:	57568	Project:	LLNL00399
Sample ID:	38225003	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
1ercury Analysis Federal											
STLC Hg in Solid											
Mercury	U	-0.00384	0.00146	0.004	mg/L	1	AW2	03/02/01	1226	67215	1
1etals Analysis-ICP Federal											
STLC ICP Metals for Solids											
Antimony	J	0.0396	0.0269	1.00	mg/L	10	JAB	03/08/01	1539	67052	2
Arsenic		0.323	0.0333	0.100	mg/L	10					
Barium		1.26	0.00101	0.050	mg/L	10					
Beryllium	J	0.015	0.00155	0.050	mg/L	10					
Cadmium	U	-0.000218	0.00319	0.050	mg/L	10					
Chromium	J	0.013	0.00691	0.050	mg/L	10					
Cobalt	J	0.00998	0.00632	0.050	mg/L	10					
C[illegible]	U	0.00639	0.00774	0.050	mg/L	10					
Ni[illegible]		0.0656	0.0186	0.050	mg/L	10					
Potassium		30.4	0.115	1.00	mg/L	10					
Selenium	U	0.0271	0.0492	0.100	mg/L	10					
Silver	J	0.0184	0.00448	0.050	mg/L	10					
Thallium	U	0.0334	0.0446	0.200	mg/L	10					
Vanadium	J	0.0141	0.00702	0.050	mg/L	10					
Zinc	U	0.0152	0.0169	0.050	mg/L	10					
Molybdenum	U	-1.17	0.224	2.50	mg/L	250	HSC	03/08/01	2218	67052	3
Lead	U	-0.0979	0.0861	0.250	mg/L	50	MNC	03/08/01	1722	67052	4

'he following Prep Methods were performed

1ethod	Description	Analyst	Date	Time	Prep Batch
alifornia Code of	California Wet Method STLC Leaching	JL	02/25/01	1235	66475
W846 3010A	ICP-TRACE TCLP by SW846 3010A	KLD1	02/28/01	1500	66976
W846 7470A	EPA 7470 Mercury Prep TCLP Liquid Federa	ARD	03/01/01	1830	66977

'he following Analytical Methods were performed

1ethod	Description
	SW846 7470A
	SW846 3010/6010B
	SW846 3010/6010B
	SW846 3010/6010B

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Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57568
Sample ID: 38225003

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

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Report Date: March 20, 2001

Client Sample ID:	57568	Project:	LLNL00399
Sample ID:	38226003	Client ID:	LLNL001
Matrix:	Misc Solid		
Collect Date:	17-FEB-01		
Receive Date:	23-FEB-01		
Collector:	Client		

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
lectrode Analysis Federal												
SW9045C Corrosivity(pH<2or>14)												
Corrosivity		9.82		0.010	0.100	SU	1	VH1	02/24/01	1345	66453	1
ravimetric Solids												
ASTM D 2216 % Moisture Federal												
Moisture		1.45				percent		COB1	02/26/01	1714	66601	2
lalogen Analysis Federal												
SW9023 TOX (Extract. Halogen)												
Extractable Organic Halogens		19100		179	750	mg/kg	50	LS	03/01/01	1707	66816	3
lercury Analysis Federal												
74 ld Vapor Hg in Solid												
M ry	U	-0.0765		0.0419	0.100	mg/kg	10	AW2	02/28/01	1524	66867	4
letals Analysis-ICP Federal												
6010 TAL Metals Soil Federal												
Antimony	J	0.466		0.447	5.00	mg/kg	2	HSC	03/07/01	0023	66844	5
Barium		60.4		0.028	1.00	mg/kg	2					
Beryllium		4.88		0.0145	0.472	mg/kg	2					
Cadmium	U	-0.0282		0.0245	1.00	mg/kg	2					
Chromium		3.35		0.411	3.00	mg/kg	2					
Cobalt		5.76		0.103	5.00	mg/kg	2					
Copper	J	3.88		0.0474	5.00	mg/kg	2					
Lead	J	1.96		0.321	5.00	mg/kg	2					
Molybdenum	J	0.767		0.119	3.00	mg/kg	2					
Nickel		26.2		0.188	3.00	mg/kg	2					
Potassium	J	35.6		1.63	50.0	mg/kg	2					
Selenium	J	0.408		0.255	1.00	mg/kg	2					
Silver	U	0.0625		0.109	2.00	mg/kg	2					
Thallium	U	0.0541		0.891	5.00	mg/kg	2					
Vanadium	J	4.61		0.112	5.00	mg/kg	2					
Arsenic	J	4.41		0.258	5.00	mg/kg	2	JAB	03/07/01	1222	66844	6
Zinc	J	2.37		0.241	5.00	mg/kg	2	HSC	03/09/01	0416	68154	8
d Alpha Spec												
lphaspec Am241, Cm, solid												
Americium-241	U	0.0185	+/-0.0752	0.221	1.00	pCi/g		JLE	03/05/01	1133	66949	9
Curium-242	U	0.029	+/-0.0786	0.201	1.00	pCi/g						
Curium-243/244	U	0.0271	+/-0.0734	0.188	1.00	pCi/g						
Curium-245/246	U	0.0413	+/-0.0829	0.124	1.00	pCi/g						

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Client Sample ID: 57568
Sample ID: 38226003

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Pu, solid												
Plutonium-238	U	0.00668	+/-0.0134	0.0256	0.100	pCi/g		JLE	03/03/01	1238	66950	10
Plutonium-239/240	U	0.010	+/-0.015	0.0255	0.100	pCi/g						
Alphaspec Th, solid												
Thorium-228		0.348	+/-0.182	0.252	1.00	pCi/g		JLE	03/06/01	1805	66952	11
Thorium-230		1.05	+/-0.285	0.115	1.00	pCi/g						
Thorium-232		0.347	+/-0.143	0.0757	1.00	pCi/g						
Alphaspec U, solid												
Uranium-233/234		0.650	+/-0.269	0.269	1.00	pCi/g		HOT1	03/05/01	1123	66956	12
Uranium-235/236	U	0.0122	+/-0.0668	0.187	1.00	pCi/g						
Uranium-238		1.01	+/-0.322	0.135	1.00	pCi/g						
ad Gamma Spec												
Gammaspec, Gamma, solid												
Ac n-228	U	0.00	+/-0.114	0.142	0.500	pCi/g		CRB	03/05/01	2319	67061	13
An ium-241	U	0.029	+/-0.0507	0.0741	0.200	pCi/g						
Antimony-124	U	-0.00267	+/-0.0218	0.0299	0.050	pCi/g						
Antimony-125	U	0.00486	+/-0.0451	0.0642	0.100	pCi/g						
Barium-133	U	-0.00884	+/-0.0213	0.0298	0.050	pCi/g						
Barium-140	U	0.0876	+/-0.109	0.190	0.200	pCi/g						
Beryllium-7	U	-0.0149	+/-0.139	0.223	0.500	pCi/g						
Bismuth-212		0.258	+/-0.236	0.184	0.500	pCi/g						
Bismuth-214		0.521	+/-0.0964	0.0523	0.100	pCi/g						
Cerium-139	U	-0.0179	+/-0.014	0.0208	0.050	pCi/g						
Cerium-141	U	0.00471	+/-0.0455	0.0433	0.050	pCi/g						
Cerium-144	U	-0.0258	+/-0.092	0.143	0.500	pCi/g						
Cesium-134	U	0.00766	+/-0.00792	0.0259	0.050	pCi/g						
Cesium-136	U	-0.00702	+/-0.0509	0.0829	1000	pCi/g						
Cesium-137	U	-0.015	+/-0.015	0.0238	0.050	pCi/g						
Chromium-51	U	-0.00412	+/-0.165	0.270	0.500	pCi/g						
Cobalt-56	U	0.00125	+/-0.0174	0.0289	0.050	pCi/g						
Cobalt-57	U	0.00517	+/-0.0112	0.0177	0.050	pCi/g						
Cobalt-58	U	-0.0125	+/-0.0164	0.0261	0.050	pCi/g						
Cobalt-60	U	0.00526	+/-0.0161	0.028	0.050	pCi/g						
uropium-152	U	-0.046	+/-0.0435	0.0679	0.100	pCi/g						
uropium-154	U	-0.0318	+/-0.046	0.0749	0.500	pCi/g						
uropium-155	U	0.0314	+/-0.0481	0.0678	0.500	pCi/g						
idium-192	U	-0.011	+/-0.015	0.0239	0.100	pCi/g						
on-59	U	0.0167	+/-0.0358	0.0605	0.100	pCi/g						
ead-210		14.5	+/-2.76	1.51	5.00	pCi/g						
ead-212		0.279	+/-0.0654	0.0389	0.100	pCi/g						
ead-214		0.593	+/-0.0966	0.049	0.100	pCi/g						
anganese-54	U	0.00742	+/-0.0159	0.0269	0.100	pCi/g						

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Company : Lawren
Address : PO Bo
Mailst
Liver
Contact: Debb
Project: CES

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4010-00

Report Date: March 20, 2001

Client Sample ID:
Sample ID:

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Gamma Spec												
Gammaspec, Gamma, solid												
Mercury-203	U	0.00795	+/-0.0176	0.0292	0.050	pCi/g						
Neodymium-147	U	0.0932	+/-0.247	0.403	1000	pCi/g						
Neptunium-239	U	0.0127	+/-0.0839	0.132	5.00	pCi/g						
Niobium-94	U	0.00977	+/-0.0147	0.0251	1.00	pCi/g						
Niobium-95	U	0.0198	+/-0.0236	0.0356	0.050	pCi/g						
Potassium-40	U	0.190	+/-0.386	0.248	0.500	pCi/g						
Promethium-144	U	0.00676	+/-0.0157	0.0266	0.050	pCi/g						
Promethium-146	U	0.0144	+/-0.0183	0.0303	0.050	pCi/g						
Radium-228		0.276	+/-0.114	0.088	0.500	pCi/g						
Ruthenium-106	U	0.187	+/-0.144	0.224	0.500	pCi/g						
Silver-110m	U	0.00447	+/-0.0135	0.023	0.050	pCi/g						
Sodium-22	U	-0.0125	+/-0.0165	0.0268	0.050	pCi/g						
Thallium-208		0.0731	+/-0.0361	0.0242	0.050	pCi/g						
Tho -230		0.521	+/-0.0964	0.0523	1.00	pCi/g						
Thc -234		0.644	+/-0.770	0.621	5.00	pCi/g						
Tin-113	U	-0.0169	+/-0.0192	0.030	0.050	pCi/g						
Jranium-235	U	0.0176	+/-0.170	0.159	0.500	pCi/g						
Jranium-238		0.644	+/-0.770	0.621	1.00	pCi/g						
Yttrium-88	U	0.00524	+/-0.0166	0.0299	0.050	pCi/g						
Zinc-65	U	0.0284	+/-0.0395	0.0613	0.100	pCi/g						
Zirconium-95	U	-0.00738	+/-0.0292	0.0481	0.100	pCi/g						
Gas Flow												
GPC, Gross A/B, solid												
lpha		7.42	+/-2.52	2.47	4.00	pCi/g		JEN	03/12/01	1855	66939	14
eta		13.0	+/-3.19	4.87	10.0	pCi/g						
Liquid Scint												
C, Tritium Dist, solid												
itium		9.84	+/-1.21	1.46	2.00	pCi/g		CAF1	03/03/01	1505	66518	15
l Flow Analysis Federal												
7.3.3 Reactivity, Releasabl												
active Releasable Cyanide	U	0.200		13.8	25000	ug/kg	1	ADF	03/01/01	1100	66815	16
Volatiles-GC/MS Federal												
P BNA SOLID 8270C 3510C												
-Dichlorobenzene		0.00		8.15	50.0	ug/L	1	JWF	03/05/01	2109	67149	17
Dichlorobenzene		0.00		0.00915	0.750	mg/L	1					
4,6-Tetrachlorophenol		0.00		5.65	50.0	ug/L	1					
5-Trichlorophenol		0.00		0.0059	40.0	mg/L	1					
5-Trichlorophenol		0.00		0.0056	0.200	mg/L	1					
Dinitrotoluene		0.00		0.00485	0.130	mg/L	1					
achlorobenzene		0.00		0.00535	0.130	mg/L	1					

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GENERAL ENGINEERING LABORATORIES

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : PO Box 808
Mailstop L-232
Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57568
Sample ID: 38226003

Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate		Time	Batch	Method
emi-Volatiles-GC/MS Federal											
TCLP BNA SOLID 8270C 3510C											
Hexachlorobutadiene		0.00	0.0088	0.100	mg/L	1					
Hexachloroethane		0.00	0.0085	0.300	mg/L	1					
Methoxychlor		0.00	5.10	50.0	ug/L	1					
Nitrobenzene		0.00	0.0071	0.200	mg/L	1					
Pentachlorophenol		0.00	0.0079	10.0	mg/L	1					
Phenol		0.00	4.20	50.0	ug/L	1					
Pyridine		0.00	0.011	0.500	mg/L	1					
bis(2-Chloroethyl) ether		0.00	7.00	50.0	ug/L	1					
m,p-Cresols		0.00	0.00535	20.0	mg/L	1					
o-Cresol		0.00	0.0063	20.0	mg/L	1					
ni-Volatiles-PCB Federal											
082/3550B PCB soil-Fed											
Aroc' 1016	U	0.00	0.790	3.33	ug/kg	1	MM	03/02/01	0745	67057	18
Aro 221	U	0.00	2.82	3.33	ug/kg	1					
Aroclor-1232	U	0.00	0.727	3.33	ug/kg	1					
Aroclor-1242	U	0.00	1.67	3.33	ug/kg	1					
Aroclor-1248	U	0.00	0.907	3.33	ug/kg	1					
Aroclor-1254	U	0.00	1.37	3.33	ug/kg	1					
Aroclor-1260	U	0.00	1.43	3.33	ug/kg	1					
ds Analysis Federal											
'A 160.3 Mod. Solids, Total											
otal Solids		975000	120	200	mg/kg		TSM	02/26/01	1412	66511	22
trometric Analysis Federal											
'846-7.3.4 Sulfide, Reactive											
eactive Releasable Sulfide	U	-0.015	0.115	50.0	mg/kg	1	AAT	02/26/01	1602	66609	23
tile Organics Federal											
L 8260B Method List Soil Fed											
,1,2-Tetrachloroethane	U	0.00	16000	40000	ug/kg	20000	CDS1	03/02/01	1441	66921	24
,1-Trichloroethane	U	0.00	11600	40000	ug/kg	20000					
,2,2-Tetrachloroethane	U	0.00	12000	40000	ug/kg	20000					
,2-Trichloroethane	U	0.00	14400	40000	ug/kg	20000					
-Dichloroethane		65500	16400	40000	ug/kg	20000					
-Dichloroethylene		1350000	10500	40000	ug/kg	20000					
-Dichloropropene	U	0.00	12800	40000	ug/kg	20000					
3-Trichlorobenzene	U	0.00	18800	40000	ug/kg	20000					
3-Trichloropropane	U	0.00	12400	40000	ug/kg	20000					
4-Trichlorobenzene	U	0.00	16000	40000	ug/kg	20000					
4-Trimethylbenzene	U	0.00	16400	40000	ug/kg	20000					
Dibromo-3-ropropane	U	0.00	18800	40000	ug/kg	20000					

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Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57568
Sample ID: 38226003
Project: LLNL00399
Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
olatile Organics Federal										
GEL 8260B Method List Soil Fed										
1,2-Dibromoethane	U	0.00	12800	40000	ug/kg	20000				
1,2-Dichlorobenzene	U	0.00	17600	40000	ug/kg	20000				
1,2-Dichloroethane	J	38400	10800	40000	ug/kg	20000				
1,2-Dichloropropane	U	0.00	12800	40000	ug/kg	20000				
1,3,5-Trimethylbenzene	U	0.00	16800	40000	ug/kg	20000				
1,3-Dichlorobenzene	U	0.00	16800	40000	ug/kg	20000				
1,3-Dichloropropane	U	0.00	13200	40000	ug/kg	20000				
1,4-Dichlorobenzene	J	17900	16000	40000	ug/kg	20000				
2,2-Dichloropropane	U	0.00	12000	40000	ug/kg	20000				
2-Butanone	U	0.00	30400	200000	ug/kg	20000				
2-Chloroethylvinyl ether	U	0.00	37200	200000	ug/kg	20000				
2-Chlorotoluene	U	0.00	16800	40000	ug/kg	20000				
2-Hexanone	U	0.00	37600	200000	ug/kg	20000				
4-Cl oluene	U	0.00	16000	40000	ug/kg	20000				
4-Isc yltoluene	U	0.00	16000	40000	ug/kg	20000				
-Methyl-2-pentanone	U	0.00	53600	200000	ug/kg	20000				
cetone	U	0.00	40000	200000	ug/kg	20000				
enzene	U	0.00	15600	40000	ug/kg	20000				
romobenzene	U	0.00	16400	40000	ug/kg	20000				
romochloromethane	U	0.00	18400	40000	ug/kg	20000				
romodichloromethane	U	0.00	14000	40000	ug/kg	20000				
romoform	U	0.00	14400	40000	ug/kg	20000				
omomethane	U	0.00	12400	40000	ug/kg	20000				
rbon disulfide	U	0.00	24800	200000	ug/kg	20000				
rbon tetrachloride	U	0.00	10400	40000	ug/kg	20000				
lorobenzene	U	0.00	16000	40000	ug/kg	20000				
loroethane	U	0.00	11200	40000	ug/kg	20000				
loroform		2340000	18800	40000	ug/kg	20000				
loromethane	U	0.00	14000	40000	ug/kg	20000				
romochloromethane	U	0.00	16400	40000	ug/kg	20000				
romomethane	U	0.00	13600	40000	ug/kg	20000				
hlorodifluoromethane	U	0.00	7200	40000	ug/kg	20000				
ylbenzene	U	0.00	14000	40000	ug/kg	20000				
achlorobutadiene	U	0.00	16400	40000	ug/kg	20000				
ropylbenzene	U	0.00	14000	40000	ug/kg	20000				
hylene chloride	U	0.00	17600	200000	ug/kg	20000				
hthalene	U	0.00	11600	40000	ug/kg	20000				
ene	U	0.00	12800	40000	ug/kg	20000				
achloroethylene	U	0.00	16000	40000	ug/kg	20000				
ene	U	0.00	20000	40000	ug/kg	20000				
loroethylene	J	34500	28800	40000	ug/kg	20000				
lorofluoromethane	U	0.00	14800	40000	ug/kg	20000				

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Livermore, CA 94551
Contact: Debbie Montero
Project: CES

Report Date: March 20, 2001

Client Sample ID: 57568 Project: LLNL00399
Sample ID: 38226003 Client ID: LLNL001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
'olatile Organics Federal											
GEL 8260B Method List Soil Fed											
Trichlorotrifluoroethane	U	0.00	180000	200000	ug/kg	20000					
Vinyl acetate	U	0.00	30800	200000	ug/kg	20000					
Vinyl chloride	U	0.00	12000	40000	ug/kg	20000					
cis-1,2-Dichloroethylene	U	0.00	16400	40000	ug/kg	20000					
cis-1,3-Dichloropropylene	U	0.00	11200	40000	ug/kg	20000					
m,p-Xylenes	U	0.00	28000	80000	ug/kg	20000					
n-Butylbenzene	U	0.00	16400	40000	ug/kg	20000					
n-Propylbenzene	U	0.00	14000	40000	ug/kg	20000					
o-Xylene	U	0.00	14400	40000	ug/kg	20000					
sec-Butylbenzene	U	0.00	17600	40000	ug/kg	20000					
tert-Butylbenzene	U	0.00	12000	40000	ug/kg	20000					
trans-1,2-Dichloroethylene	U	0.00	14800	40000	ug/kg	20000					
trans-1,3-Di·opropylene	U	0.00	9600	40000	ug/kg	20000					
/et nistry General Federal											
SW9095 Paint Filter Test Feder											
Paint Filter		PASS					AAT	03/01/01	1609	67131	25

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
sh Soil Prep	Ash Soil Prep EPI A-021,A-021B,A-026	CCM1	02/28/01	1026	66623
ry Soil Prep	Dry Soil Prep EPI A-021,A-021B,A-026	WEO	02/26/01	0842	66493
W846 1311	SW846 1311 TCLP Leaching	JL	02/27/01	1615	66727
W846 3050B	846 3050BS PREP	HSC	03/08/01	1400	68021
W846 3050B	846 3050BS PREP	KLD1	02/27/01	1300	66677
W846 3510C	3510C BNA TCLP Prep-8270C Analysis Fed	AEJ	03/01/01	0800	67016
W846 3550B	3550B PCB Prep Soil FED	RDH	02/28/01	2140	66920
W846 3550B	3550B PCB Prep Soil FED	RDH	03/02/01	1919	67197
W846 7.3.3 Pr	SW 7.3.3 Reactivity, Releasable Cyanide-	TEMP	02/26/01	1717	66523
W846 7.3.4 Mod	SW846-7.3.4 Sulfide, Reactive-Releasabl	AAT	02/26/01	1403	66608
W846 7471A	EPA 7471 Mercury Prep Soil	ARD	02/27/01	1800	66624
W846 9023 Pr	SW 9023 Halogen, Extractable(TOX) Prep	LS	02/26/01	1400	66569

he following Analytical Methods were performed

Method	Description
	SW846 9045C
	ASTM D 2216

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COC
Version 5.0
2/15/2006

CES Chain of Custody

CES COC #
16462

ROBERT FISCHER
L80 2-3004

☐ E
☐ R
☒ N

DQO: N/A

Chad Davis
4839 - 85
DDC 06-025
N/A

☒
☐ RETURN UNUSED SAMPLES TO CLIENT
☐
E&D

FOR CAS USE ONLY

								GAB	ALPHA ISO PAC	GAMMA SPEC	H3	% MOIST (ASTM D2216)					
82092	GAC-1	9/20/06	0800	NTS	N	XX	WS	2	R	R	R	R	R				GAC FROM CARBON ACTIVATED CORP UNUSED
82093	GAC-2	9/20/06	0800	SNS	N	XX	WS	2	R	R	R	R	R				GAC FROM CARBON ACTIVATED CORP CARBON UNUSED
82094	W305993	9/20/06	0540	SNS	Y	XX	WS	2	R	R	R	R	R				GAC FROM VTF-5475 VES 1
82095	W305994	9/20/06	0540	SNS	Y	XX	WS	2	R	R	R	R	R				GAC FROM VTF-5475 VES 1

9/20/06 11 20 Alvarquee R. Ap 9/20/06 11 20

CES	**CSF** Version 1.2 10/13/04	**CES CASE SUMMARY FORM**

Laboratory Identification:
C&MS Environmental Services
Lawrence Livermore National Laboratory
7000 East Avenue, L-Code 251
Livermore, CA 94550-9234
(925) 423-6008
ELAP Certification No. 1554

Packet Completion Date

November 8, 2006

Client: Robert Fischer/RHWM

Sample Receipt:

Four (4) samples were received on 20 September 2006 by CES for analysis. The samples were delivered with CES chain of custody, WDR and SHA documentation. Sample containers were intact and without any visible sign of tampering.

Project Name: DQO 06-025

CES DQO #: n/a
Client DQO #: DQO 06-025

Client COC Number n/a   CES COC Number 16462

Client ID	CES ID	Requested Analyses
GAC-1	82092	GAB, Alpha TUPAC, Gamma Spec, Tritium, % Moisture
GAC-2	82093	GAB, Alpha TUPAC, Gamma Spec, Tritium, % Moisture
W305993	82094	GAB, Alpha TUPAC, Gamma Spec, Tritium, % Moisture
W305994	82095	GAB, Alpha TUPAC, Gamma Spec, Tritium, % Moisture

Case Narrative:

Analyses performed at LLNL were conducted using methodology as detailed in CES SOPs. Any technical or administrative problems encountered during analysis or other relevant comments are listed below. QC data for analytical batches are provided with data packet. All radiochemical data is reported as of the time of assay, and is not decay-corrected.

Additional Comments:
Analyses were performed by General Engineering Laboratories, LLC of Charleston, SC. See off-site laboratory case narrative and validation checklist provided with this report for additional information.

I certify that this data package is complete as per the customer's request and compliant with technical and administrative requirements. All analytical work performed by outside contract laboratories is reported on their letterhead and released by the associated laboratory, independent of CES. The Laboratory Director (or designee) as verified by the following signature authorizes release of this data package.

David Wruck

David Wruck, ext. 2-3413
CES Customer Representative

Date November 8, 2006

COC Sample ID Listing

CES COC # 16462

CES Sample ID	Client Sample ID
82092	GAC-1
82093	GAC-2
82094	W305993
82095	W305994

82092

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Low Rad Screening

CES Sample ID: **82092**

Client Sample ID: GAC-1

Result	MDC	Units	Date Counted	Method	Analyst
Not Detectable	100	dpm/g	09-20-06	LSC	emst

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:

Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

GENERAL ENGINEERING LABORATORIES, LLC

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Montero
Project: **CES - Normal Deliverable**

Report Date: October 7, 2006

Client Sample ID: 82892
Sample ID: 172471001
Matrix: XX
Collect Date: 20-SEP-06 12:00
Receive Date: 22-SEP-06
Collector: Client

Project: LLNL00201
Client ID: LLNL002

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst Date	Time	Batch	M
Solids Analysis Federal										
EPA 160.5 Mod. Solids, Total										
Total Solids		925000	20.3	43.9	mg/kg		OXA2 09/25/06	1622	572357	

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SM 2540G	

Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Montero
Project: CES - Normal Deliverable

Report Date: October 25, 2006

Client Sample ID: 82092
Sample ID: 172471001
Matrix: XX
Collect Date: 20-SEP-06
Receive Date: 22-SEP-06
Collector: Client

Project: LLNL00201
Client ID: LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd
Gravimetric Solids													
ASTM D 2216 % Moisture Federal													
Moisture		7.80					percent		JMB1	09/23/06	1648	572083	1
Rad Alpha Spec Analysis													
Alphaspec Am243, Solid													
Americium-241	U	0.00626	+/-0.0357	0.102	+/-0.0358	0.100	pCi/g		RDD	10/04/06	2226	577228	2
Americium-243	U	0.0136	+/-0.0716	0.0628	+/-0.0717	0.100	pCi/g						
Curium-242	U	0.00	+/-0.0362	0.0553	+/-0.0362	1.00	pCi/g						
Curium-243/244	U	-0.00875	+/-0.038	0.102	+/-0.0381	1.00	pCi/g						
Alphaspec Pu, Solid													
Plutonium-238	U	0.0154	+/-0.0471	0.0985	+/-0.0471	0.100	pCi/g		RDD	10/06/06	0753	577231	3
Plutonium-239/240	U	-0.0136	+/-0.0252	0.0738	+/-0.0252	0.100	pCi/g						
Alphaspec Th, Solid													
Thorium-228	U	0.119	+/-0.110	0.153	+/-0.111	0.200	pCi/g		DDR1	10/16/06	0852	577987	4
Thorium-230		0.274	+/-0.140	0.0864	+/-0.148	0.200	pCi/g						
Thorium-232		0.150	+/-0.104	0.0561	+/-0.107	0.200	pCi/g						
Alphaspec U, Solid													
Uranium-233/234		0.226	+/-0.131	0.0922	+/-0.135	0.200	pCi/g		DDR1	10/10/06	0745	576575	5
Uranium-235/236	U	0.107	+/-0.105	0.132	+/-0.106	0.200	pCi/g						
Uranium-238	U	0.0823	+/-0.0857	0.117	+/-0.0865	0.200	pCi/g						
Rad Gamma Spec Analysis													
Gammaspec, Gamma, Solid (Standard List)													
Americium-241	U	-0.00489	+/-0.013	0.0402	+/-0.013	0.200	pCi/g		MJH1	10/02/06	1753	574848	10
Beryllium-7	U	0.0171	+/-0.098	0.325	+/-0.098	0.500	pCi/g						
Cesium-137	U	0.0159	+/-0.0131	0.0443	+/-0.0131	25.0	pCi/g						
Cobalt-60	U	0.0170	+/-0.0133	0.0475	+/-0.0133	0.050	pCi/g						
Potassium-40		11.9	+/-0.512	0.406	+/-0.512	0.500	pCi/g						
Sodium-22	U	-0.0126	+/-0.014	0.0466	+/-0.014	0.050	pCi/g						
Thorium-228	UI	0.00	+/-0.0196	0.0654	+/-0.0196		pCi/g						
Uranium-235	U	0.0779	+/-0.0595	0.189	+/-0.0595	0.500	pCi/g						
Uranium-238	UI	0.00	+/-0.151	0.531	+/-0.151	1.00	pCi/g						
Rad Gas Flow Proportional Counting													
GFPC, Gross A/B, solid													
Alpha		0.978	+/-0.512	0.631	+/-0.529	0.500	pCi/g		JXS4	10/11/06	1913	577752	11
Beta		9.90	+/-1.31	1.65	+/-1.30	1.50	pCi/g						
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Solid													

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Livermore, California 94551
Contact: Ms. Debbie Monteiro
Project: CES - Normal Deliverable

Report Date: October 25, 2006

Client Sample ID: 82092 | Project: LLNL00201
Sample ID: 172471001 | Client ID: LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Solid													
Tritium	U	3.87	+/-7.03	12.2	+/-7.03	20.0	pCi/g		ATH2	09/29/06	0641	572521	13

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep, GL-RAD-A-021B	LXM2	10/02/06	1355	571849
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	JMB1	09/23/06	1648	571848

The following Analytical Methods were performed

Method	Description
1	ASTM D 2216 (Modified)
2	DOE EML HASL-300, Am-05-RC Modified
3	DOE EML HASL-300, Pu-11-RC Modified
4	DOE EML HASL-300, Th-01-RC Modified
5	DOE EML HASL-300, Th-01-RC Modified
6	DOE EML HASL-300, Th-01-RC Modified
7	DOE EML HASL-300, Th-01-RC Modified
8	DOE EML HASL-300, U-02-RC Modified
9	DOE EML HASL-300, U-02-RC Modified
10	EML HASL 300, 4.5.2.3
11	EPA 900.0 Modified
12	EPA 900.0 Modified
13	EPA 906.0 Modified

Surrogate/Tracer recovery	Test	Recovery%	Acceptable Limits
Curium-244	Alphaspec Am243, Solid	53	(15%-125%)
Curium-244	Alphaspec Am243, Solid	53	
Plutonium-242	Alphaspec Pu, Solid	74	(15%-125%)
Carrier/Tracer Recovery	Alphaspec Th, Solid	65	(15%-125%)
Uranium-232	Alphaspec U, Solid	89	(25%-125%)

Notes:
The Qualifiers in this report are defined as follows :

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Contact: Ms. Debbie Montero
Project: CES – Normal Deliverable

Report Date: October 25, 2006

Client Sample ID:	82092	Project:	LLNL00201
Sample ID:	172471001	Client ID:	LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst Date	Time Batch	Mtd

* A quality control analyte recovery is outside of specified acceptance criteria
< Result is less than value reported
> Result is greater than value reported
A The TIC is a suspected aldol-condensation product
B Target analyte was detected in the associated blank
BD Results are either below the MDC or tracer recovery is low
C Analyte has been confirmed by GC/MS analysis
D Results are reported from a diluted aliquot of the sample
H Analytical holding time was exceeded
J Value is estimated
N/A Spike recovery limits do not apply. Sample concentration exceeds spike concentration by 4X or more
R Sample results are rejected
U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD
UI Gamma Spectroscopy—Uncertain identification
X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y QC Samples were not spiked with this compound
Z Paint Filter Test—Particulates passed through the filter, however no free liquids were observed.
^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL
d 5-day BOD—The 2:1 depletion requirement was not met for this sample
h Preparation or preservation holding time was exceeded
The above sample is reported on a dry weight basis.

COC Sample ID Listing

CES COC # 16462

CES Sample ID	Client Sample ID
82092	GAC-1
82093	GAC-2
82094	W305993
82095	W305994

82093

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Low Rad Screening

CES Sample ID: **82093**

Client Sample ID: GAC-2

Result	MDC	Units	Date Counted	Method	Analyst
Not Detectable	100	dpm/g	09-20-06	LSC	ernst

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:

Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

GENERAL ENGINEERING LABORATORIES, LLC

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab (
Address : 7000 East Avenue
Mailstop L-222
Livermore, California 94551

Report Date: October 3, 2006

Contact: Ms. Debbie Montero

Project: **CES - Normal Deliverable**

Client Sample ID:	82093	Project:	LLNL00201
Sample ID:	172471002	Client ID:	LLNL002
Matrix:	XX		
Collect Date:	20-SEP-06 12:00		
Receive Date:	22-SEP-06		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Solids Analysis Federal										
EPA 160.3 Mod. Solids, Total										
Total Solids		985000	25.9	30.8	mg/kg		GXA2 09/25/06	1622	572357	1

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SM 2540G	

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Certificate of Analysis

Company: Lawrence Livermore Nat'l Lab.
Address: 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Montlew
Project: CES - Normal Deliverable

Report Date: October 23, 2006

Client Sample ID:	82093	Project:	LLNL00201
Sample ID:	172471002	Client ID:	LLNL007
Matrix:	XX		
Collect Date:	20-SEP-06		
Receive Date:	22-SEP-06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd
Gravimetric Solids													
ASTM D 2216 % Moisture Federal													
Moisture		1.08					percent		JMB1	09/23/06	1648	572083	1
Rad Alpha Spec Analysis													
Alphaspec Am243, Solid													
Americium-241	U	-0.00424	+/-0.013	0.0636	+/-0.013	0.100	pCi/g		RDD	10/03/06	2226	572128	2
Americium-243	U	0.0583	+/-0.0291	0.0981	+/-0.0291	0.100	pCi/g						
Curium-242	U	0.0116	+/-0.0227	0.0348	+/-0.0228	1.00	pCi/g						
Curium-243/244	U	-0.0111	+/-0.0303	0.095	+/-0.0303	1.00	pCi/g						
Alphaspec Pu, Solid													
Plutonium-238	U	0.0161	+/-0.0413	0.0865	+/-0.0413	0.100	pCi/g		RDD	10/06/06	0733	572131	3
Plutonium-239/240	U	0.00537	+/-0.0238	0.0677	+/-0.0238	0.100	pCi/g						
Alphaspec Th, Solid													
Thorium-228		0.340	+/-0.148	0.110	+/-0.158	0.200	pCi/g		DDR1	10/16/06	0852	577987	4
Thorium-230		0.440	+/-0.221	0.108	+/-0.259	0.200	pCi/g						
Thorium-232		0.233	+/-0.120	0.103	+/-0.125	0.200	pCi/g						
Alphaspec U, Solid													
Uranium-233/234		0.863	+/-0.295	0.143	+/-0.322	0.200	pCi/g		DDR1	10/10/06	0745	576535	9
Uranium-235/236	U	0.0836	+/-0.0862	0.0955	+/-0.0887	0.200	pCi/g						
Uranium-238		0.898	+/-0.299	0.123	+/-0.327	0.200	pCi/g						
Rad Gamma Spec Analysis													
Gammaspec, Gamma, Solid (Standard List)													
Americium-241	U	0.0672	+/-0.0496	0.131	+/-0.0496	0.200	pCi/g		MJH1	10/02/06	1754	574348	10
Beryllium-7	U	-0.0828	+/-0.121	0.384	+/-0.121	0.500	pCi/g						
Cesium-137	U	0.0622	+/-0.0166	0.0467	+/-0.0166	25.0	pCi/g						
Cobalt-60	U	0.0214	+/-0.0147	0.0545	+/-0.0147	0.050	pCi/g						
Potassium-40		0.844	+/-0.282	0.435	+/-0.282	0.500	pCi/g						
Sodium-22	U	-0.0105	+/-0.0146	0.0488	+/-0.0146	0.050	pCi/g						
Thorium-228		0.356	+/-0.0471	0.0665	+/-0.0471		pCi/g						
Uranium-235	U	0.055	+/-0.133	0.232	+/-0.133	0.500	pCi/g						
Uranium-238	U	1.06	+/-0.590	1.09	+/-0.590	1.00	pCi/g						
Rad Gas Flow Proportional Counting													
GFPC, Gross A/B, solid													
Alpha		7.19	+/-1.29	1.27	+/-1.40	0.500	pCi/g		JXS4	10/11/06	2009	577752	11
Beta		5.46	+/-1.43	2.22	+/-1.46	1.50	pCi/g						
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Solid													
Tritium	U	2.16	+/-6.54	11.6	+/-6.54	20.0	pCi/g		ATH2	09/29/06	0658	572521	13

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Certificate of Analysis

Company:	Lawrence Livermore Nat'l Lab (		
Address:	7000 East Avenue		
	Mailstop L-232		
	Livermore, California 94551	Report Date:	October 25, 2006
Contact:	Ms. Debbie Montero		
Project:	CES - Normal Deliverable		

Client Sample ID:	82093	Project:	LLNL00201
Sample ID:	172471002	Client ID:	LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep, GL-RAD-A-021B	LXM2	10/02/06	1355	571849
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	JMB1	09/23/06	1848	571848

The following Analytical Methods were performed

Method	Description
1	ASTM D 2216 (Modified)
2	DOE EML HASL-300, Am-05-RC Modified
3	DOE EML HASL-300, Pu-11-RC Modified
4	DOE EML HASL-300, Th-01-RC Modified
5	DOE EML HASL-300, Th-01-RC Modified
6	DOE EML HASL-300, Th-01-RC Modified
7	DOE EML HASL-300, Th-01-RC Modified
8	DOE EML HASL-300, U-02-RC Modified
9	DOE EML HASL-300, U-02-RC Modified
10	EML HASL 300, 4.5.2.3
11	EPA 900.0 Modified
12	EPA 900.0 Modified
13	EPA 906.0 Modified

Surrogate/Tracer recovery	Test	Recovery %	Acceptable Limits
Curium-244	Alphaspec Am243, Solid	86	(15%-125%)
Curium-244	Alphaspec Am243, Solid	86	
Plutonium-242	Alphaspec Pu, Solid	76	(15%-125%)
Carrier/Tracer Recovery	Alphaspec Th, Solid	80	(15%-125%)
Uranium-232	Alphaspec U, Solid	66	(25%-125%)

Notes:

The Qualifiers in this report are defined as follows :

- * A quality control analyte recovery is outside of specified acceptance criteria
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B Target analyte was detected in the associated blank

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Certificate of Analysis

Company: Lawrence Livermore Nat'l Lab (
Address: 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Moreno
Project: CBS – Normal Deliverable

Report Date: October 25, 2006

Client Sample ID: 82093
Sample ID: 172471002

Project: LLNL00201
Client ID: LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst Date	Time Batch	Mtd

BD Results are either below the MDC or tracer recovery is low
C Analyte has been confirmed by GC/MS analysis
D Results are reported from a diluted aliquot of the sample
H Analytical holding time was exceeded
J Value is estimated
N/A Spike recovery limits do not apply. Sample concentration exceeds spike concentration by 4X or more
R Sample results are rejected
U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.
UI Gamma Spectroscopy—Uncertain identification
X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y QC Samples were not spiked with this compound
Z Paint Filter Test—Particulates passed through the filter, however no free liquids were observed.
^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL
d 5-day BOD—The 2:1 depletion requirement was not met for this sample
h Preparation or preservation holding time was exceeded
The above sample is reported on a dry weight basis.

COC Sample ID Listing

CES COC # 16462

CES Sample ID	Client Sample ID
82092	GAC-1
82093	GAC-2
82094	W305993
82095	W305994

82094

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Low Rad Screening

CES Sample ID: **82094**

Client Sample ID: W305993

Result	MDC	Units	Date Counted	Method	Analyst
Not Detectable	100	dpm/g	09-20-06	LSC	ernst

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:

Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

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Certificate of Analysis

Company: Lawrence Livermore Nat'l Lab
Address: 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Mantero
Project: **CES - Normal Deliverable**

Report Date: October 2, 2006

Client Sample ID:	82094	Project:	LLNL00201
Sample ID:	172471003	Client ID:	LLNL002
Matrix:	XX		
Collect Date:	20-SEP-06 12:00		
Receive Date:	22-SEP-06		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Solids Analysis Federal										
EPA 160.3 Mod. Solids, Total										
Total Solids		980000	23.8	39.3	mg/kg		GXA2 09/25/06	1632	572357	1

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SM 2540G	

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Company : Lawrence Livermore Nat'l Lab
Address : 7000 East Avenue
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Livermore, California 94551
Contact: Ms. Debbie Montero
Project: CES – Normal Deliverable

Report Date: October 25, 2006

Client Sample ID:	82094	Project:	LLNL00201
Sample ID:	172471003	Client ID:	LLNL002
Matrix:	XX		
Collect Date:	20-SEP-06		
Receive Date:	22-SEP-06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd
Gravimetric Solids													
ASTM D 2216 % Moisture Federal													
Moisture		0.905					percent		JMB1	09/23/06	1648	572983	1
Rad Alpha Spec Analysis													
Alphaspec Am241, Solid													
Americium-241	U	-0.0201	+/-0.0239	0.0699	+/-0.0239	0.100	pCi/g		RDD	10/04/06	2226	572128	2
Americium-243		0.108	+/-0.0631	0.0645	+/-0.0639	0.100	pCi/g						
Curium-242	U	0.00	+/-0.0207	0.0317	+/-0.0207	1.00	pCi/g						
Curium-243/244	U	-0.01	+/-0.0139	0.070	+/-0.0139	1.00	pCi/g						
Alphaspec Pu, Solid													
Plutonium-238	U	-0.000101	+/-0.0244	0.0715	+/-0.0244	0.100	pCi/g		RDD	10/06/06	0733	572131	3
Plutonium-239/240	U	-0.00512	+/-0.0223	0.0595	+/-0.0223	0.100	pCi/g						
Alphaspec Th, Solid													
Thorium-228		0.346	+/-0.169	0.151	+/-0.179	0.200	pCi/g		DDR1	10/16/06	0852	577987	4
Thorium-230		0.678	+/-0.224	0.131	+/-0.252	0.200	pCi/g						
Thorium-232		0.416	+/-0.175	0.109	+/-0.189	0.200	pCi/g						
Alphaspec U, Solid													
Uranium-233/234		0.599	+/-0.234	0.160	+/-0.249	0.200	pCi/g		DDR1	10/10/06	0345	576535	5
Uranium-235/236	U	0.0282	+/-0.0553	0.0847	+/-0.0555	0.200	pCi/g						
Uranium-238		0.502	+/-0.210	0.0685	+/-0.222	0.200	pCi/g						
Rad Gamma Spec Analysis													
Gammaspec, Gamma, Solid (Standard List)													
Americium-241	U	-0.03	+/-0.0352	0.044	+/-0.0352	0.200	pCi/g		MJH1	10/02/06	1808	574348	10
Beryllium-7	U	-0.0166	+/-0.0999	0.340	+/-0.0999	0.500	pCi/g						
Cesium-137	U	-0.00947	+/-0.0129	0.0365	+/-0.0129	25.0	pCi/g						
Cobalt-60	U	0.0259	+/-0.0183	0.0423	+/-0.0183	0.050	pCi/g						
Potassium-40		0.658	+/-0.271	0.372	+/-0.271	0.500	pCi/g						
Sodium-22	U	0.0136	+/-0.0109	0.0403	+/-0.0109	0.050	pCi/g						
Thorium-228		0.341	+/-0.0346	0.0522	+/-0.0346		pCi/g						
Uranium-235	U	0.111	+/-0.101	0.193	+/-0.101	0.500	pCi/g						
Uranium-238	UI	0.00	+/-0.610	0.817	+/-0.616	1.00	pCi/g						
Rad Gas Flow Proportional Counting													
GFPC, Gross A/B, solid													
Alpha		13.2	+/-1.35	1.01	+/-1.88	0.500	pCi/g		DIRS	10/11/06	2009	577757	11
Beta		31.9	+/-2.14	2.33	+/-2.48	1.50	pCi/g						
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Solid													
Tritium		12.7	+/-7.64	12.0	+/-7.65	30.0	pCi/g		ATH2	09/29/06	0714	572521	12

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Certificate of Analysis

Company : Lawrence Livermore Nat'l Lab)
Address : 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Montero
Project: CES - Norma Deliverable

Report Date: October 25, 2006

Client Sample ID: 82004
Sample ID: 172471003

Project: LLNL00201
Client ID: LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst Date	Time Batch	Mtd

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep, GL-RAD-A-021B	LXM2	10/02/06	1355	571849
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	JMB1	09/23/06	1648	571848

The following Analytical Methods were performed

Method	Description
1	ASTM D 2216 (Modified)
2	DOE EML HASL-300, Am-05-RC Modified
3	DOE EML HASL-300, Pu-11-RC Modified
4	DOE EML HASL-300, Th-01-RC Modified
5	DOE EML HASL-300, Th-01-RC Modified
6	DOE EML HASL-300, Th-01-RC Modified
7	DOE EML HASL-300, Th-01-RC Modified
8	DOE EML HASL-300, U-02-RC Modified
9	DOE EML HASL-300, U-02-RC Modified
10	EML HASL 300 4.5.2.3
11	EPA 900.0 Modified
12	EPA 901.0 Modified
13	EPA 906.0 Modified

Surrogate/Tracer recovery	Test	Recovery %	Acceptable Limits
Curium-244	Alphaspec Am243, Solid	89	(15%-125%)
Curium-244	Alphaspec Am243, Solid	89	
Plutonium-242	Alphaspec Pu, Solid	77	(15%-125%)
Carrier/Tracer Recovery	Alphaspec Th, Solid	62	(15%-125%)
Uranium-232	Alphaspec U, Solid	77	(25%-125%)

Notes:
The Qualifiers in this report are defined as follows :

* A quality control analyte recovery is outside of specified acceptance criteria
< Result is less than value reported
> Result is greater than value reported
A The TIC is a suspected aldol-condensation product
B Target analyte was detected in the associated blank

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Certificate of Analysis

Company: Lawrence Livermore Nat'l Lab (

Address: 7000 East Avenue

Mailstop L-232

Livermore, California 94551

Contact: Ms. Debbie Montano

Project: CES - Normal Deliverable

Report Date: October 25, 2006

Client Sample ID:	82084	Project:	LLNL00201
Sample ID:	172471003	Client ID:	LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPC	RL	Units	DF	Analyst Date	Time	Batch	Mtd

BD Results are either below the MDC or tracer recovery is low

C Analyte has been confirmed by GC/MS analysis

D Results are reported from a diluted aliquot of the sample

H Analytical holding time was exceeded

J Value is estimated

N/A Spike recovery limits do not apply. Sample concentration exceeds spike concentration by 4X or more

R Sample results are rejected

U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD.

UI Gamma Spectroscopy—Uncertain identification

X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier

Y QC Samples were not spiked with this compound

Z Paint Filter Test—Particulates passed through the filter, however no free liquids were observed

* RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL

d 5-day BOD—The 2:1 depletion requirement was not met for this sample

h Preparation or preservation holding time was exceeded

The above sample is reported on a dry weight basis

COC Sample ID Listing

CES COC # 16462

CES Sample ID	Client Sample ID
82092	GAC-1
82093	GAC-2
82094	W305993
82095	W305994

82095

CES ANALYSIS REPORT

Lawrence Livermore National Laboratory
C&MS Environmental Services

Low Rad Screening

CES Sample ID: **82095**

Client Sample ID: W305994

Result	MDC	Units	Date Counted	Method	Analyst
Not Detectable	100	dpm/g	09-20-06	LSC	ernst

MDC: Minimum Detectable Concentration

CES Procedure: SOP-CES-P541

ELAP Certification 1554

Please Note:

Rad Screening is a tool used in the CES analytical laboratory which allows for the identification of possible radioactive samples. This, in turn, helps the technical staff reduce the possibility of cross contamination through the early segregation of samples and glassware. It also identifies samples with high activity, which may require special handling or exceed building limits.
The result is not meant to be an absolute unbiased measurement since a complex sample matrix can cause significant interference (such as chemiluminescence).

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Certificate of Analysis

Company:	Lawrence Livermore Nat'l Lab (
Address:	7000 East Avenue
	Mailstop L-232
	Livermore, California 94551
Contact:	Ms. Debbie Monnin
Project:	**CES - Normal Deliverable**

Report Date: October 2, 2006

Client Sample ID:	82095	Project:	LLNL00201
Sample ID:	172471004	Client ID:	LLNL002
Matrix:	XX		
Collect Date:	20-SEP-06 12:00		
Receive Date:	22-SEP-06		
Collector:	Client		

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method
Solids Analysis Federal										
EPA 160.3 Mod. Solids, Total										
Total Solids		977000	24.6	41.0	mg/kg		GXA2 09/25/06	1622	572393	1

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	SM 2540G	

GENERAL ENGINEERING LABORATORIES, LLC

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Certificate of Analysis

Company: Lawrence Livermore Nat'l Lab ( )
Address: 7000 East Avenue
Mailstop L-232
Livermore, California 94551
Contact: Ms. Debbie Monson
Project: CES – Normal Deliverable

Report Date: October 25, 2006

Client Sample ID:	82095	Project:	LLNL00251
Sample ID:	172471004	Client ID:	LLNL002
Matrix:	XX		
Collect Date:	20-SEP-06		
Receive Date:	22-SEP-06		
Collector:	Client		

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd
Gravimetric Solids													
ASTM D 2216 % Moisture Federal													
Moisture		1.04					percent		JMR1	09/23/06	1648	572083	1
Rad Alpha Spec Analysis													
Alphaspec Am243, Solid													
Americium-241	U	0.00563	+/-0.0259	0.0587	+/-0.0259	0.100	pCi/g		RDD	10/06/06	0801	572129	1
Americium-243	U	0.0119	+/-0.0245	0.0424	+/-0.0245	0.100	pCi/g						
Curium-242		0.0216	+/-0.0245	0.0216	+/-0.0248	1.00	pCi/g						
Curium-243/244	U	0.0200	+/-0.0028	0.0425	+/-0.0281	1.00	pCi/g						
Alphaspec Pu, Solid													
Plutonium-238	U	0.0134	+/-0.0343	0.0718	+/-0.0343	0.100	pCi/g		RDD	10/06/06	0734	572131	1
Plutonium-239/240	U	0.0134	+/-0.0343	0.0718	+/-0.0343	0.100	pCi/g						
Alphaspec Th, Solid													
Thorium-228		0.277	+/-0.135	0.111	+/-0.142	0.200	pCi/g		DDR1	10/16/06	0852	577967	4
Thorium-230		0.442	+/-0.167	0.122	+/-0.182	0.200	pCi/g						
Thorium-232		0.229	+/-0.116	0.0458	+/-0.127	0.200	pCi/g						
Alphaspec U, Solid													
Uranium-233/234		0.461	+/-0.139	0.0950	+/-0.171	0.200	pCi/g		DDR1	10/10/06	0745	576533	8
Uranium-235/236		0.101	+/-0.0809	0.0506	+/-0.0821	0.200	pCi/g						
Uranium-238		0.293	+/-0.126	0.0755	+/-0.132	0.200	pCi/g						
Rad Gamma Spec Analysis													
Gammaspec, Gamma, Solid (Standard List)													
Americium-241	U	0.00796	+/-0.0204	0.0403	+/-0.0204	0.200	pCi/g		MJH1	10/02/06	1822	574548	10
Beryllium-7	U	-0.0744	+/-0.146	0.257	+/-0.146	0.500	pCi/g						
Cesium-137	U	0.000215	+/-0.0181	0.0336	+/-0.0181	25.0	pCi/g						
Cobalt-60	U	0.0188	+/-0.0225	0.0429	+/-0.0225	0.050	pCi/g						
Potassium-40		1.12	+/-0.366	0.356	+/-0.366	0.500	pCi/g						
Sodium-22	U	-0.000289	+/-0.0204	0.0373	+/-0.0204	0.050	pCi/g						
Thorium-228		0.415	+/-0.0467	0.0387	+/-0.0467		pCi/g						
Uranium-235	U	0.0282	+/-0.0736	0.129	+/-0.0736	0.500	pCi/g						
Uranium-238		1.05	+/-0.279	0.306	+/-0.279	1.00	pCi/g						
Rad Gas Flow Proportional Counting													
GFPC, Gross A/B, solid													
Alpha		10.1	+/-1.44	1.14	+/-1.38	0.500	pCi/g		JXS4	10/11/06	2006	577752	11
Beta		28.0	+/-1.97	2.08	+/-2.93	1.50	pCi/g						
Rad Liquid Scintillation Analysis													
LSC, Tritium Dist, Solid													
Tritium		24.6	+/-8.51	11.9	+/-8.52	20.0	pCi/g		ATH2	09/29/06	0730	572531	11

Livermore, California 94551 Report Date: October [illegible]
Contact: Ms. Debbie Montero
Project: CES -- Normal Deliverable

Client Sample ID: 82095 Project: LLNL00201
Sample ID: 172471004 Client ID: LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst Date	Time	Batch	Mtd

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep, GL-RAD-A-021B	LXM2	10/02/06	1356	571849
Dry Soil Prep	Dry Soil Prep GL-RAD-A-021	JMB1	09/23/06	1648	571848

The following Analytical Methods were performed

Method	Description
1	ASTM D 2216 (Modified)
2	DOE EML HASL-300, Am-05-RC Modified
3	DOE EML HASL-300, Pu-11-RC Modified
4	DOE EML HASL-300, Th-01-RC Modified
5	DOE EML HASL-300, Th-01-RC Modified
6	DOE EML HASL-300, Th-01-RC Modified
7	DOE EML HASL-300, Th-01-RC Modified
8	DOE EML HASL-300, U-02-RC Modified
9	DOE EML HASL-300, U-02-RC Modified
10	EML HASL 300, 4.5.2.3
11	EPA 900.0 Modified
12	EPA 900.0 Modified
13	EPA 906.0 Modified

Surrogate/Tracer recovery	Test	Recovery%	Acceptable Limits
Curium-244	Alphaspec Am241, Solid	87	(15%-125%)
Curium-244	Alphaspec Am243, Solid	87	
Plutonium-242	Alphaspec Pu, Solid	83	(15%-125%)
Carrier/Tracer Recovery	Alphaspec Th, Solid	73	(15%-125%)
Uranium-232	Alphaspec U, Solid	90	(25%-125%)

Notes:
The Qualifiers in this report are defined as follows:

- * A quality control analyte recovery is outside of specified acceptance criteria
- < Result is less than value reported
- > Result is greater than value reported
- A The TIC is a suspected aldol-condensation product
- B Target analyte was detected in the associated blank

GENERAL ENGINEERING LABORATORIES, LLC
2040 Savage Road Charleston SC 29407 – (843) 556–8171 – www.gel.com

Certificate of Analysis

Company :	Lawrence Livermore Nat'l Lab (
Address :	7000 East Avenue
	Mailstop L–232
	Livermore, California 94551
Contact:	Ms. Debbie Montero
Project:	CES – Normal Deliverable

Report Date: October 25, 2008

Client Sample ID:	82095	Project:	LLNL00201
Sample ID:	172471004	Client ID:	LLNL002

Parameter	Qualifier	Result	Uncertainty	DL	TPU	RL	Units	DF	Analyst	Date	Time	Batch	Mtd

BD Results are either below the MDC or tracer recovery is low
C Analyte has been confirmed by GC/MS analysis
D Results are reported from a diluted aliquot of the sample
H Analytical holding time was exceeded
J Value is estimated
N/A Spike recovery limits do not apply. Sample concentration exceeds spike concentration by 4X or more
R Sample results are rejected
U Analyte was analyzed for, but not detected above the MDL, MDA, or LOD
UI Gamma Spectroscopy—Uncertain identification
X Consult Case Narrative, Data Summary package, or Project Manager concerning this qualifier
Y QC Samples were not spiked with this compound
Z Paint Filter Test—Particulates passed through the filter, however no free liquids were observed.
^ RPD of sample and duplicate evaluated using +/-RL. Concentrations are <5X the RL.
d 5-day BOD—The 2:1 depletion requirement was not met for this sample
h Preparation or preservation holding time was exceeded
The above sample is reported on a dry weight basis.

Data Quality Objective Process Form

DQO Number 06-025 Date 9-12-06

NOTE
Generator/Responsible Individual (person requesting the DQO) fills out STEP 1 and STEP 3: Section 1 ONLY)

STEP 1: Stating the Problem (may be modified by the QA Chemist for Sampling and Analysis)
LLNL is in the process of developing authorized limits for granular activated carbon (GAC) used in the treatment of soil vapor contaminated with volatile organic compounds. This DQO is being established to provide additional radiological data to support the authorized limit. Specifically data from samples collected under this DQO will be used to 1) establish the radiological background of unspent GAC and 2) Provide a current radiological data package on spent GAC. It should be noted that several historical sampling events have been conducted. The most complete radiological data set was collected in February, 2001 under SAW 00-025. Samples collected after this date in general do not have full radiological data sets, this is due to the fact that radiological analysis was limited to just gross alpha/beta and tritium.

STEP 2: Identifying Decisions to be Made (completed by the QA Chemist for Sampling and Analysis)
Which disposal facility is this waste destined for? A commercial Hazardous Waste Incinerator
Does a profile exist for disposal of this waste? ☒ Yes ☐ No If no, who will be developing the profile? If yes, enter profile number: Standard incinerator profile to be used
Will on-site or off-site analysis be required? off-site at GEL is required

STEP 3: Identifying Input (completed by the QA Chemist for Sampling and Analysis)
Section I: General Information: Generator/Responsible Individual
Section II: Sampling: Sample Team
Section III: Analysis: CES/Analytical Laboratory

Section I: Input from Generator/Responsible Person (completed by the Generator or Responsible Person)
1. Description of waste (e.g. soil, gravel, lab trash, etc.)Granualr Activated Carbon Absorption Media
2. Describe process that generated the waste Soil vapor treatment
3. Waste generation location VTF 5475 soil vapor treatment unit
4. Current location of waste n/a
5. Program that generated the waste ERD
6. Number of containers and sizes of containers n/a
7. What is the total volume of this waste in cubic meters n/a
8. Is this waste: ☐Legacy Waste ☒Newly Generated Waste ☐Other (explain)
9. List requisition numbers and associated container identification (CID) numbers. Attach copies of requisitions, HazTrack or TWMS "screen dumps." Previous analytical, associated memos, and any other pertinent information. Three samples are to be collected: 1) Sample of unspent GAC Activated Corp. Carbon (See Sabra Coleman for sample) 2) Sample of unspent GAC Carbitrol Carbon (see Ben Johnson for sample)

9. Continued
3) Sample of the spent GAC (see Ben Johnson and Nick Bailey for sample)

10. Has this waste been previously treated? ☐Yes ☒No If yes, attach documentation (blending plan, processing information)

11. Does the waste contain any of the following and state how it is known (VI is visual inspection, PK is process knowledge):

a. Grease or Oil	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
b. Hazardous constituents	☒ Yes	☐ No	☐ Unknown	☐ VI	☒ PK
If yes, list: Tetrachloroethylene, chloroform ect					
c. Entrapped Liquids	☐ Yes	☐ No	☒ Unknown	☐ VI	☐ PK
If yes, is the liquid < 0.5% by Volume?	If yes, what is the liquid?				
d. Particulates?	☒ Yes	☐ No	☐ Unknown	☐ VI	☒ PK
If yes, are the particulates > 1% the size of flour or > 15% sand (by weight)? yes					
e. Compressed gases	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
f. Etiological agents	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
g. Chelating agents	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
If yes, are chelating agents <1% by weight?					
h. PCBs (capacitors, etc.)	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
i. Explosives	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
j. Pyrohporics	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
k. Asbestos	☐ Yes	☒ No	☐ Unknown	☐ VI	☒ PK
If yes, is it friable?					

12. If known, list the radionuclides present and estimated activity for each.

☐ Radionuclide content unknown. ☒ Radionuclides listed below are suspected to be present

Radionuclies	Activity (Ci)	Radionuclides	Activity (Ci)
Tritium	33 pCi/gram		
Nat-U			

13. How was activity determined? ☐ N/A

☒ Alpha Spectrometry	☐ Mass-to-Curie Conversion
☐ Gamma Spectroscopy	☐ Tritium Off-Gas Measurement
☒ Liquid Scintillation	☐ Mass Balance
☐ NUQM Method	☐ HSNI
☐ Other, explain:	

14. Any additional specific guidance from Generator/Responsible Person: ☐ N/A
This waste stream has been characterized under IGD 0597-0100-03
The most complete set of anlytical data was collected under SAW00-025

Section I Completed By: (Generator/Responsible Individual)

Print Name: Robert Fischer	Extension: 2-3004
Signature: Robert Fischer	Date: September 8, 2006

Section II: Sampling (completed by the QA Chemist for Sampling and Analysis in conjunction with the Sample Team)
1. Person and Organization responsible for sampling RHWM Sample team
2. Has the responsible person been trained?yes
3. Specific Sampling guidance from the Sample Team: ☒ N/A

Section III: Analysis: CES/Analytical Laboratory (completed by the QA Chemist for Sampling and Analysis in conjunction with CES and the analytical laboratories)	
1. Name and address of the laboratory to be used: GEL	
2. Indicate the reporting level of the analytical report:	
If using CES: (check one) ☐ Level 1: Results and case narrative ☒ Level 2: Results, case narrative and QC ☐ Level 3: Results, case narrative, CQ and additional information described in 5 below.	If using other analytical laboratory: (check one) ☐ CLP Package ☒ Non-CLP Package
3. Specific Analysis Guidance from CES and/or the Analytical Laboratory: ☐ N/A Please send all samples to GEL. Charge analytical costs to ERD account 4839-85. Please send all data to Robert Fischer L-620	

4. The waste will be analyzed by the following methods:		
☐ TCLP 8260 Volatiles	☐ TCLP Metals	☒ Gamma Spectroscopy
☐ Total 8260 Volatiles	☐ TCLP Metals extended list	☒ Alpha Spectrometry (TUPA)
☐ 8270 Semi-volatiles	☐ TTLC Metals	☐ Con Gamma
☐ 8082 PCBs	☐ STLC Metals	☐ Con Alpha (TUPA)
☐ 8015 Alcohols & Ketones	☐ Cyanide (☐reactive ☐total)	☐ Con Alpha (UPA)
☐ Paint Filter Test	☐ Sulfide (☐reactive ☐total)	☒ Gross alpha/beta
☐ pH	☐ Ignitability	☒ Tritium
☐ Flash Point	☐ TOX	☐ C-14
☐ FVL Liquefaction Testing. If checked, CES please forward to the FVL Lab		
☒ Other: % Moisture (GEL gravimetric solids ASTM D 2216 % Moisture Federal). Include Curium in the alpha spec. TUPAC		
5. Additional requirements and/or comments:		

STEP 4: Define the Study Boundaries (completed by the QA Chemist for Sampling and Analysis)
1. Are there any limitations on which waste containers will be included in this DQO population? ☐ Yes ☒ No If yes, discuss:
2. Are there any problems with accessibility of the waste? ☒ Yes ☐ No If yes, discuss: Need to work with ERD to obtain a sample of the spent carbon

STEP 5: Develop the Decision Rules (completed by the QA Chemist for Sampling and Analysis)
1. Prior to sampling and analysis, does the waste carry any RCRA or California waste codes? ☒ Yes ☐ No If yes, list all waste codes: spent carbon is F-Listed
2. Prior to sampling and analysis, does the waste **exceed** Land Disposal Restrictions (LDR)? ☒ Yes ☐ No If yes, list constituents that exceed LDR: Multiple F-listed solvents for a complete list see IGD
NOTE: Generic Decision Rules are discussed in WIC 140, *Data Quality Objectives Process*. List any specific Decision Rules pertaining to this DQO. ☐ There are no specific Decision Rules to discuss. 1) Determination of background concentration of radioactive isotopes in GAC (if any) 2) Comparison of radiological data collected in 2001 with that collected under this DQO

STEP 6: Specify Tolerable Limits on the Decision Errors (completed by the QA Chemist for Sampling and Analysis)
NOTE: Generic Tolerable Limits on Decision Errors are discussed in WIC 140, *Data Quality Objectives Process*. List any specific Tolerable Limits on Decision Errors pertaining to this DQO. ☒ There are no specific Tolerable Limits to discuss.

STEP 7: Optimize Design for Obtaining Data (completed by the QA Chemist for Sampling and Analysis)
1. Containers must be sampled in accordance with: ☒ WIC 110 *Sampling Solid Waste* ☐ WIC 111 *Sampling Liquid Waste*
2. Sampling Strategy: Collect representive samples of carbon
3. Sampling Frequency and Selection: Three samples to be collected, 1) Unspent GAC manufactured by Carbon Activated Corp 2) Unspent GAC manufactured by Carbitrol and 3) spent GAC from treatment process
4. Sampling Methodology: Use standard bulk collection methods
5. Quality Control: QA samples will be taken in accordance with ADM 110, *Waste Sampling Quality Assurance and Control Plan*. Discuss any further QA requirements. ☒ No further requirements.

Completion of Sampling and Analysis Guidance (completed by: QA Chemist for Sampling and Analysis)	
Print Name: Robert Fischer	Extension: 2-3304
Signature: [signature]	Date: September 8, 2006

STEP 8: Data Quality Assessment (completed by the QA Chemist for Sampling and Analysis after receipt of the analytical data package)
1. Is the analytical data valid? ☐ Yes ☐ No If no, comment:
2. "Data Validation" or "Review of Results" Memo Number(s):
3. List any limitations on use of the analytical data:
4. Does this waste need to be resampled? ☐ Yes ☐ No If yes, comment:
5. After examination of the sampling and analysis results, does the waste carry any RCRA or California codes? ☐ Yes ☐ No If yes, list all waste codes which this waste will carry. ☐ Spreadsheet attached
6. After examination of the sampling and analysis results, does the waste **exceed** Land Disposal Restrictions? ☐ Yes ☐ No If yes, list constituents which exceed LDR. ☐ Spreadsheet attached
7. Does this waste meet the Waste Acceptance Guidance for the intended disposal site? ☐ Yes ☐ No If no, discuss what will happen with this waste.
8. Name the disposal facility where waste will be sent:
9. Enter waste disposal profile number:
10. List Usability Memo Number(s):
[illegible] this sampling and analysis activity

DQO/DQA Process Completed (completed by QA Chemist for Sampling and Analysis)	
Print Name:	Extension:
Signature:	Date:

DATA QUALITY OBJECTIVE
(DQO) CHANGE FORM

DQO No. **06-025**

Section(s) affected:

Section I: #9.

Section III, Step 7, #3.

Description of change:

Section I: #9: list W305993 and W305994 as the spent GAC.

Section III, Step 7, #3: list W305993 and W305994 as the spent GAC to be sampled.

Reason for change:

Identifying the spent GAC to be sampled

Requested By: Chad Davis

Authorized by: **Michael D. Gage/** Date: **09/13/06**

WGS 00139, Expiration Date 08/01/09

APPENDIX B

CLEAN HARBORS DEER PARK FACILITY RCRA PERMIT

TABLE OF CONTENTS

PERMIT SECTION I-FACILITY DESCRIPTION

A. SIZE AND LOCATION OF SITE

A permit is issued to Clean Harbors Deer Park, LP, (hereafter called the permittee), to operate a hazardous waste processing, storage, and disposal facility located at 2027 Battleground Road, in Harris County, Texas, drainage area of Segment 1006 of San Jacinto River Basin (North Latitude 29° 43´ 35”, West Longitude 95° 05´ 40”). The legal description of the facility submitted in permit No. 50089 application dated September 15, 1997 is hereby made a part of this permit as “Attachment A”. The hazardous waste management facility as delineated by the permittee’s application map is hereby made a part of this permit as Attachment B”.

B. INCORPORATED APPLICATION MATERIALS

This permit is based on, and the permittee shall follow the Part A and Part B Industrial and Hazardous Waste Application elements listed in “Attachment C”, and provided in the table below, which are hereby approved subject to the terms of this permit and any other orders of the TCEQ. These materials are incorporated into this permit by reference as if fully set out herein. Any and all revisions to these elements shall become conditions of this permit upon the date of approval by the Commission.

Date	Submittal
9/15/97	Permit renewal application and trial burn/risk burn plans
12/31/97	Trial burn/risk burn plans revisions
1/7/98	Permit renewal application administrative notice of deficiency response to TCEQ 12/2/97 letter
3/11/98	Permit renewal application administrative notice of deficiency response to TCEQ 2/6/98 letter
6/3/98	Trial burn/risk burn plans revisions
8/31/98	Trial burn/risk reports
10/19/98	Trial burn/risk reports
1/31/00	Trial burn/risk reports notice of deficiency response
2/3/00	Trial burn/risk reports notice of deficiency response
05/1/00	Trial burn/risk reports notice of deficiency response
1/21/01	Permit renewal application notice of deficiency response
8/20/01	Permit renewal application notice of deficiency response

[I.B.]

Date	Submittal
11/15/01	Landfill information
2/11/02	Permit modifications update
5/24/02	Risk Assessment information
9/6/02	Initial draft permit supplemental information
9/24/02	North Landfill expansion update
11/5/02	Bin storage risk assessment information
10/27/03	Tank Assessment Clarification
1/29/04	Supplement to RCRA Part B Permit Application – Bulk Feed System
1/29/04	MACT compliance revisions
3/24/04	Addition of PCB's to bin Storage Areas 1, 2, and 3
6/16/04	Revised maximum allowable stack gas flow rates
10/22/04	Addition of North Pump Pad as Miscellaneous Unit
11/1/04	Control of fugitive emissions from Incinerator Trains I and II
3/4/05	Revisions to Contingency Plan
3/25/05	Addition of pipeline to transfer waste directly from containers to existing port X-102
8/1/05	Addition of newly listed waste code K181
8/3/05	Addition of new tank T-33 and update of Closure and Post-Closure Cost summaries to 2004 dollars
12/15/05	Expansion of definition of auxiliary fuel

PERMIT SECTION II – GENERAL FACILITY STANDARDS

A. STANDARD PERMIT CONDITIONS

The permittee has a duty to comply with the Standard Permit Conditions under 30 TAC Section 305.125. Moreover, the permittee has a duty to comply with the following permit conditions:

1. Modification of Permitted Facilities

The facility units and operational methods authorized are limited to those described herein and by the application submittals identified in Provision I.B. (Incorporated Application Materials). All facility units and operational methods are subject to the terms and conditions of this permit and TCEQ rules. Prior to constructing or operating any facility units in a manner which differs from either the related plans and specifications contained in the permit application or the limitations, terms or conditions of this permit, the permittee must comply with the TCEQ permit amendment/modification rules as provided in 30 TAC Sections 305.62 and 305.69.

2. Duty to Comply

[30 TAC Section 305.142] The permittee must comply with all the conditions of this permit, except that the permittee need not comply with the conditions of this permit to the extent and for the duration such noncompliance is authorized in an emergency ordered issued by the Commission. Any permit noncompliance, other than noncompliance authorized by an emergency order, constitutes a violation of RCRA and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

[II.A.]

3. Severability

The provisions of this permit are severable, and if any provisions of this permit or the application of any provisions of this permit to any circumstance, is held invalid, the application of such provision to other circumstance, and the remainder of this permit shall not be affected thereby.

4. Definitions

For purposes of this permit, terms used herein shall have the same meaning as those in 30 TAC Chapters 305, 335 and 350 unless this permit specifically provides otherwise; where terms are not defined in the regulations or the permit, the meaning associated with such terms shall be defined by a standard dictionary reference or the generally accepted scientific or industrial meaning of the term.

Application data – data used to complete the final application and any supplemental information.

5. Permit Expiration

In order to continue a permitted activity after the expiration date of the permit the permittee shall submit a new permit application at least 180 days before the expiration date of the effective permit, unless permission for a later date has been granted by the Executive Director. Authorization to continue such activity will terminate upon the effective denial of said application.

6. Certification Requirements

[30 TAC Section 305.144] For a new facility, the permittee may not commence storage, processing, or disposal of solid waste; and for a facility being modified, the permittee may not process, store or dispose of solid waste in the modified portion of the facility, except as provided in 30 TAC Section 305.69 (relating to Solid Waste Permit Modification at the Request of the Permittee) until the following has been accomplished:

a. The permittee has submitted to the Executive Director and the local Regional Office of the TCEQ, by certified mail or hand delivery, a letter signed by the permittee, and signed and sealed by a Texas Licensed Professional Engineer stating that the facility has been constructed or modified in compliance with the permit. If the certification is being provided to document proper closure of a permitted unit, or to certify installation or repair of a tank system, then the certification must be signed and sealed by an independent Texas Licensed Professional Engineer. Required certification shall be in the following form:

[II.A.6.a.]

"This is to certify that the following activity (Specify activity, e.g., construction, installation, closure, etc., of an item) relating to the following item, (Specify the item, e.g., the particular facility, facility unit, unit component, subcomponent part, or ancillary component), authorized or required by TCEQ Permit No. 50089, has been completed, and that construction of said facility component has been performed in accordance with and in compliance with good engineering practices and the design and construction specifications of Permit No. 50089."

b. A certification report has been submitted, with the certification described in Provision II.A.6., which is logically organized and describes in detail the tests, inspections, and measurements performed, their results, and all other bases for the conclusion that the facility unit, unit component, and/or closure have been constructed, installed and/or performed in conformance with the design and construction specifications of this permit and in compliance with this permit. The report shall describe each activity as it relates to each facility unit or component being certified including reference to all applicable permit provision. The report shall contain the following items, at a minimum:

(1) Scaled, as-built plan-view and cross-sectional drawings which accurately depict the facility unit and all unit components and subcomponents and which demonstrate compliance with the design and construction specifications approved and detailed in the terms of this permit;

(2) All necessary references to dimensions, elevations, slopes, construction materials, thickness and equipment; and

(3) For all drawings and specifications, the date, signature, and seal of a Professional Engineer who is Licensed in the State of Texas.

c. The Executive Director has inspected the modified or newly constructed facility and finds it is in compliance with the conditions of the permit; or if within 15 days of submission of the letter required by paragraph (a) of this section, the permittee has not received notice from the Executive Director of the intent to inspect, prior inspection is waived and the permittee may commence processing, storage, or disposal of solid waste.

* 7. Land Disposal Restrictions

The permittee shall comply with the land disposal restrictions as found in 40 CFR 268 and any subsequent applicable requirements promulgated through the Federal Register. Requirements include modifying/amending the permittee's waste analysis plan to include analyses to determine compliance with applicable treatment standards or prohibition levels, pursuant to 40 CFR 268.7(c) and 264.13(a).

[II.A.]

8. Dust Suppression

Pursuant to 40 CFR 266.23(b)/30 TAC Section 335.214(b), the permittee shall not use waste, used oil, or any other material which is contaminated with dioxin, polychlorinated biphenyls (PCBs), or any other hazardous waste (other than a waste identified solely on the basis of ignitability) for dust suppression or road treatment.

9. Permit Reopener

This permit shall be subject to review by the Executive Director five (5) years from the date of permit issuance or reissuance and shall be modified as necessary to assure that the facility continues to comply with currently applicable requirements for the Solid Waste Disposal Act (SWDA) and the rules and regulations of the Commission. The permittee shall submit any information as may be reasonably required by the Executive Director to ascertain whether the facility continues to comply with currently applicable requirements of the SWDA and the rules and regulations of the Commission.

10. Texas Coastal Management Program

The TCEQ has reviewed the permit application for consistency with the goals and policies of the Texas Coastal Management Program (CMP) in accordance with the regulations of the Coastal Coordination Council (CCC) and has determined that the permit is consistent with the applicable CMP goals and policies. [30 TAC Section 281.43 (a)(1)]

11. Monitoring of Commercial Hazardous Waste Management Facility Operations

Within the first year after Commission action on this permit, the permittee shall provide notice to affected persons of the intent to have an independent annual environmental audit of the facility performed. The notice shall be issued in accordance with the requirements of 30 TAC Section 305.147(1). If an affected party requests the audit, then the permittee must follow the requirements of 30 TAC Section 305.147(2)-(6), and (8), for selecting an independent inspector, paying for the notice and audit, submission of a written report, and determining the scope of the inspection.

B. RECORDKEEPING AND REPORTING REQUIREMENTS

1. Monitoring and Records

a. All data submitted to the TCEQ shall be in a manner consistent with the latest version of the Quality Assurance Project Plan for the Texas Commission on Environmental Quality for Environmental Monitoring and Measurement Activities Relating to the Resource Conservation and Recovery Act (TCEQ QAPP).

[II.B.1.]

b. [30 TAC Section 305.125(11)(A)] Monitoring samples and measurements shall be taken at times and in a manner so as to be representative of the monitored activity. The method used to obtain a representative sample of the material to be analyzed shall be the appropriate method form Appendix I of 40 CFR Part 261 or an equivalent method approved by the Executive Director of the TCEQ. Laboratory methods shall be those specified in *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,* SW-846, 1987, as revised; *Standard Methods for the Examination of Water and Wastewater, Fifteenth Edition, 1980, and 1981 supplement, or current adopted edition; RCRA Ground-Water Monitoring: Draft Technical Guidance, 1992*, OSWER Directive 9950.1, *American Society for Testing and Material (ASTM), EPA Methods For Chemical Analysis of Water and Wastes*, or an equivalent method, as specified in the Waste Analysis Plan, Section IV of the Part B Application, and as approved by the Executive Director.

c. [30 TAC Section 305.125(11)(B)] The permittee shall retain in an organized fashion and furnish to the Executive Director, upon request, records of all monitoring information, copies of all reports and records required by this permit, and the certification required by 40 CFR 264.73(b)(9), for a period of at least 3 years from the date of the sample, measurement, report, record, certification, or application.

d. [30 TAC Section 305.125(11)(C)] Records of monitoring shall include the following:

(1) The date, time, and place of sample or measurement;

(2) The identity of individual who collected the sample or measurement;

(3) The dates analyses were performed;

(4) The identity of individual and laboratory who performed the analyses;

(5) The analytical techniques or methods used; and

(6) The results of such analyses or measurements.

2. Operating Record

In addition to the recordkeeping and reporting requirements specified elsewhere in this permit, the permittee shall maintain a written operating record at the facility, in accordance with 40 CFR 264.73. These records will be made available to representatives of the TCEQ upon request.

[II.B.]

3. Retention of Application Data

[30 TAC Section 305.47] A permittee shall keep records throughout the term of the permit of data used to complete the final application and any supplemental information. All copies of renewals, amendments, revisions and modifications must also be kept at the facility such that the most current documents are available for inspection at all times. All materials, including any related information, submitted to complete the application shall be retained, not just those materials which have been incorporated into the permit.

4. Reporting of Noncompliance

The permittee shall report to the Executive Director of the TCEQ information regarding any noncompliance which may endanger human health or the environment. [30 TAC Section 305.125(9)]

a. Report of such information shall be provided orally within 24 hours from the time the permittee becomes aware of the noncompliance.

b. A written submission of such information shall also be provided within five days of the time the permittee becomes aware of the noncompliance. The written submission shall contain the following:

(1) a description of the noncompliance and its cause;
(2) the potential danger to human health or safety, or the environment;
(3) the period of noncompliance, including exact dates and times;
(4) if the noncompliance has not been corrected, the anticipated time it is expected to continue; and
(5) steps taken or planned to reduce, eliminate, and prevent the recurrence of the noncompliance, and to mitigate its adverse effects.

5. Twenty-Four Hour Reporting

The following shall be included as information which must be reported orally within 24 hours pursuant to Title 30 TAC Section 305.125(9): [30 TAC Section 305.145]

a. Information concerning release of any solid waste that may cause an endangerment to public drinking water supplies;

b. Any information of a release or discharge of solid waste, or of a fire or explosion which could threaten the environment or human health or safety, outside the facility. The description of the occurrence and its cause shall include:

[II.B.5.b.]

(1) name, address, and telephone number of the owner or operator;

(2) name, address, and telephone number of the facility;

(3) date, time and type of incident;

(4) name and quantity of material(s) involved;

(5) the extent of injuries, if any;

(6) an assessment of actual or potential hazards to the environment and human health or safety outside the facility, where this is applicable; and

(7) estimated quantity and disposition of recovered material that resulted from the incident.

6. Notice Waiver

[30 TAC Section 305.145(b)] The Executive Director may waive the five-day written notice requirement specified in Provision II.B.4.b (Reporting of Noncompliance) in favor of a written report submitted to the Commission within 15 days of the time the permittee becomes aware of the noncompliance or condition.

7. Biennial Report

The permittee shall prepare and submit to the Executive Director a Biennial Report. One copy of the report shall be submitted to the TCEQ Industrial and Hazardous Waste Permits Section and an additional copy shall be submitted to the appropriate TCEQ Regional Office by March 1st of each even-numbered year for the preceding odd-numbered year's activities. This report shall include, at a minimum, all information and records required by 40 CFR 264.75.

8. Pollution Prevention

Facilities subject to 30 TAC Chapter 335, Subchapter Q – Pollution Prevention: Source Reduction and Waste Minimization, must prepare a five year Source Reduction and Waste Minimization Plan and submit a Source Reduction and Waste Minimization Annual Report (SR/WM Annual Report) to the TCEQ Small Business and Environmental Assistance Division. This report must be submitted annually on the dates specified in the rule.

9. Waste Minimization

The permittee shall annually certify, by January 25th for the previous calendar year, the following information, [40 CFR 264.73(b)(9):

[II.B.9.]

a. that the permittee has a program in place to reduce the volume and toxicity of all hazardous wastes which are generated by the permittee's facility operation to the degree determined to be economically practicable; and

b. that the proposed method of treatment, storage, or disposal is that practicable method currently available to the permittee which minimizes the present and future threat to human health and the environment. This waste minimization certification is to be included in the facility operating records until closure.

10. Annual Detection Monitoring Report

The permittee shall submit an Annual Detection Monitoring Report as required by Provision VI.G. March 1st of each year.

11. Manifest Discrepancy Report

If a significant discrepancy in a manifest is discovered, the permittee must attempt to reconcile the discrepancy. If not resolved within fifteen days, the permittee must submit a report, describing the incident, the Executive Director, as per the requirements of 30 TAC Section 335.12(c)(2). A copy of the manifest must be included in the report.

12. Unmanifested Waste Report

A report must be submitted to the Executive Director within 15 days of receipt of unmanifested waste, as per the requirements of 30 TAC Section 335.15(3).

13. Monthly Summary

[30 TAC Section 335.15(2)] The permittee shall prepare a monthly report, of all manifests received during the month, summarizing the quantity, character, transporter identity, and the method of storage, processing and disposal of each hazardous waste or Class 1 waste shipment received, itemized by manifest document number. This monthly summary report shall be submitted to the TCEQ Waste Evaluation Registration and Reporting Section on or before the 25th day of each month for waste received during the previous month.

C. INCORPORATED REGULATORY REQUIREMENTS

1. State Regulations

The following TCEQ regulations are hereby made provision and of conditions of this permit. Issuance of this permit with incorporated rules in no way exempts the permittee from compliance with any other applicable state statute and/or Commission Rule.

a. 30 TAC Chapter 37, Subchapter P;

b. 30 TAC Chapter 305, Subchapter A: General Provisions;

[II.C.1.]

c. 30 TAC Chapter 305, Subchapter C: Application for Permit;

d. 30 TAC Sections 305.61 – 305.69 (regarding amendments, renewals, transfers, corrections, revocation and suspension of permits);

e. 30 TAC Sections 305.121 – 305.125 (regarding permit characteristics and conditions);

f. 30 TAC Sections 305.127 – 305.129 (regarding permit conditions, signatories and variance procedures);

g. 30 TAC Chapter 305, Subchapter G: Additional Conditions for Hazardous and Industrial Solid Waste Storage, Processing and Disposal Permits;

h. 30 TAC Chapter 305, Subchapter I: Hazardous Waste Incinerator Permits;

i. 30 TAC Chapter 335, Subchapter A;

j. 30 TAC Chapter 335, Subchapter B;

k. 30 TAC Section 335.152 – 33.167;

l. 30 TAC Sections 335.173 – 335.179;

m. 30 TAC Chapter 335, Subchapter Q; and

n. 30 TAC Chapter 350.

2. Federal Regulations

To the extent applicable to the activities authorized by this permit, the following provisions of 40 CFR Part 264 and Subpart 268, adopted by reference by 30 TAC Section 335.152 and 335 Subchapter O are hereby made provisions and conditions of this permit, to the extent consistent with the Texas Solid Waste Disposal Act, Texas Health and Safety Code Ann., Chapter 361 (Vernon), and the rules of the TCEQ:

a. Subpart B – General Facility Standards;

b. Subpart C – Preparedness and Prevention;

c. Subpart D – Contingency Plan and Emergency Procedures;

d. Subpart E – Manifest System, Recordkeeping, and Reporting;

e. Subpart G – Closure and Post-closure;

[II.C.2.]

f. Subpart H – Financial Requirements;

g. Subpart I – Use and Management of Containers;

h. Subpart J – Tank Systems;

i. Subpart N – Landfills;

j. Subpart O – Incinerators;

k. Subpart X – Miscellaneous Units;

l. Subpart AA – Air Emission Standards for Process Vents;

m. Subpart BB – Air Emission Standards for Equipment Leaks;

n. Subpart CC – Air Emission Standards for Tanks, Surface Impoundments, and Containers;

o. 40 CFR Part 268 Land Disposal Restrictions.

PERMIT SECTION III – FACILITY MANAGEMENT

A. OPERATION OF FACILITY

The permittee shall construct, maintain, and operate the facility to minimize the possibility of a fire, explosion, or any unplanned, sudden or non-sudden release of hazardous waste constituents to air, soil, or surface water which could threaten human health or the environment, as required by 40 CFR 264.31. All equipment and structures used to manage hazardous waste at the facility shall be maintained in proper operating condition.

B. PERSONNEL TRAINING

The permittee shall ensure that all facility personnel involved with hazardous waste management successfully complete a training program as required by 40 CFR 264.16. The permittee shall maintain training documents and records, as required by 40 CFR 264.16(d) and (e).

C. SECURITY

1. The permittee shall provide a 24-hour surveillance system which continuously monitors and controls entry onto the active portion of the facility; or an artificial or natural barrier which completely surrounds the active waste management portion(s) of the facility and shall have a means to control entry, at all times, through gates or other entrances to these same facility areas.

[III.C.]

2. The permittee shall post warning signs at all points of access to the active waste management portion(s) of the facility and along the natural and/or artificial barriers in sufficient numbers to be seen from any approach to that (those) portion(s) of the facility. The signs shall be printed so that they may be clearly read from a distance of at least 25 feet, and shall state "Danger – Unauthorized Personnel Keep Out" in English.

D. GENERAL INSPECTION REQUIREMENTS

The permittee shall follow the inspection schedule contained in the permit application submittals identified in Provision I.B. (Incorporated Application Material) and as set out in Table III.D. – Inspection Schedule. The permittee shall remedy any deterioration or malfunction discovered by an inspection, as required by 40 CFR 264.15(c). Records of inspection shall be kept, as required by 40 CFR 264.15(d). Any remedial actions taken in response to facility inspections and the date of the remediation shall be included in the inspection records.

E. CONTINGENCY PLAN

1. The permittee shall follow the Contingency Plan, developed in accordance with 40 CFR Part 264 Subpart D, and contained in the permit application submittals identified in Provision I.B. (Incorporated Application Material). Copies of this plan shall be available to all employees involved in waste management at the facility.

2. The permittee shall immediately initiate clean-up procedures for removal of any spilled hazardous or industrial nonhazardous wastes and waste residues and shall take all steps necessary to prevent surface-water or groundwater contamination as a result of any spills.

3. Collected hazardous or industrial nonhazardous wastes, spills, leaks, clean-up residues, and contaminated rainfall runoff, including contaminated stormwater from the drainage control system(s) associated with the permitted units, shall be removed promptly after the spillage and/or rainfall event in as timely a manner as is necessary to prevent overflow of the system by the following method(s):

    a. Removal to an on-site authorized facility unit;

    b. Removal to an authorized industrial solid waste management facility or authorized off-site facility; or

    c. Discharge in accordance with a wastewater discharge permit.

4. The permittee shall ensure that any equipment or vehicles which have come in contact with waste in the loading/unloading, storage, processing, and/or disposal areas have been decontaminated prior to their movement into designated uncontaminated areas of the site property. At a minimum, all contaminated equipment shall be externally decontaminated and contaminated vehicles shall have their undercarriages and tires or tracks decontaminated to remove all waste residues and to prevent contamination of uncontaminated areas. All wash water generated shall be collected and disposed of in accordance with Provision III.E.3..

[III.E.]

5. Preparedness and Prevention

a. At a minimum, the permittee shall equip the facility as set forth in Table III.E.2 – Emergency Equipment, as required by 40 CFR 264.32.

b. All sumps, pumps, fire- and spill-control equipment, decontamination equipment, and all other equipment and structures authorized or required through the Contingency Plan shall be tested and maintained, as necessary, to assure its proper operation in time of emergency, as required by 40 CFR 264.33.

c. The permittee shall maintain access to the communications or alarm system, as required by 40 CFR 264.34.

d. A trained emergency coordinator shall be available at all times in case of an emergency and will have the responsibility for coordinating all emergency response measures as required by 40 CFR 264.55 and 264.56. Emergency number(s) shall be posted in all waste management portions of the facility and all employees in those areas shall be trained in the location of those postings.

PERMIT SECTION IV – WASTES AND WASTE ANALYSIS

A. WASTE ANALYSIS PLAN

The permittee shall follow the Waste Analysis Plan, developed in accordance with 40 CFR 264.13 and the permit application identified in Provision I.B. (Incorporated Application Material).

B. AUTHORIZED WASTES

1. The permittee is authorized to manage hazardous and non-hazardous industrial solid wastes listed in Table IV.B. – Wastes Managed in Permitted Units, subject to the limitations provided herein.

   Waste authorized for storage, processing, and disposal include those generated from facility sources and from off-site sources.

2. Hazardous Waste Received From Off-Site Sources

   When the permittee is to receive hazardous or nonhazardous waste from an off-site source (except where the permittee is also the generator), the permittee shall inform the generator in writing that the permittee has the appropriate permits and will accept the waste the generator is shipping. The permittee shall keep a copy of this written notice as part of the operating record. [40 CFR 264.12(b)]

[IV.B.]

3. The wastes authorized in Table IV.B. shall not contain any of the following:

   a. Polychlorinated biphenyls (PCBs), as defined by the EPA in regulations issued pursuant to the Toxic Substances Control Act under Title 40 Code of Federal Regulations (CFR) Part 761, unless the permittee is complaint with the federal requirements for PCB storage and processing as specified in 40 CFR Part 761;

   b. Radioactive wastes unless the permittee is authorized to store, process and dispose of these wastes in compliance with specific licensing and permitting requirements under Chapter 401 of the Texas Health and Safety Code and the rules of the Texas Commission on Environmental Quality or Texas Department of Health or Texas Railroad Commission, and/or any other rules of state or federal authorities;

   c. Explosive material, as defined by the Department of Transportation under 49 CFR Part 173;

   d. Dioxin-containing wastes, identified by EPA as F020, F021, F022, F023, F026, and F027 wastes in 40 CFR 261.31, except for storage only in authorized units;

   e. Municipal garbage;

   f. Special Waste from Health-Care Related Facilities subject to 25 TAC Chapter 1 and TAC Chapter 330 (except when processed immediately in Permit Units No. 03 or 04 only);

   g. Pyrophorics (except when processed immediately in Permit Units No. 03 or 04 only;

   h. Cyanide or sulfide compounds with ten (10) percent or greater concentrations of CN^- or S^- (except in lab packs, compressed cylinders, and liquid storage containers); or

   i. Liquid organic peroxides (except when stored for a period up to 14 calendar days in Permit Unit No. 77, as described in the application, or processed immediately in Permit Units No. 03 or 04 only);

4. Prior to accepting any additional wastes not authorized in Table IV.B, the permittee shall follow the permit amendment or modification requirements listed in 30 TAC Section 305.62 and 305.69.

5. The permittee may store wastes restricted under 40 CFR Part 268 solely for the purpose of accumulating quantities necessary to facilitate proper recovery, treatment, or disposal provided that it meets the requirements of 40 CFR 268.50(a)(2) including, but not limited to the following:

   a. Clearly marking each container to identify its contents and the date each period of accumulation begins;

[IV.B.5.]

b. Clearly marking each tank with a description of its contents, the quantity of each hazardous waste received, and the date each period of accumulation begins, or such information for each tank is recorded and maintained in the operating record at that facility.

C. SAMPLING AND ANALYTICAL METHODS

1. Table IV.C. – Sampling and Analytical Methods, shall be used in conjunction with the Waste Analysis Plan referenced in Provision IV.A., in performing all waste analyses.

2. The permittee shall ensure that all waste analyses utilized for waste identification or verification have been performed in accordance with methods specified in the current editions of "Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods", (SW-846), ASTM or other methods as specified in the Waste Analysis Plan. The permittee shall have a QA/QC program that is consistent with EPA SW 846 and the TCEQ RCRA QAPP.

3. The permittee shall not place liquid or waste containing free liquids, whether or not sorbents have been added (except lab waste in overpacked containers), in landfill cells. "Free liquids" are liquids which readily separate from the solid portion of a waste when the waste mixture is at a temperature above 32°F and ambient pressure.

4. An absorbent is defined as a material that is capable of physically holding a liquid within pores or interstices by such physical forces as tension or capillary action. An absorbent is defined as a material that is capable of physically adhering a liquid to its (the material's) surface(s) through molecular polar forces. The terms "absorbent" and "adsorbent" shall both be indicated whenever the term "sorbent" is used in this permit.

5. The permittee shall test a sufficient number of representative waste samples to assure that free liquids are not placed in the landfill. Process knowledge and/or existing waste sampling and analysis data may be substituted for testing, in accordance with the procedures in the Waste Analysis Plan, if the process generating the waste has not changed. Bulk and containerized hazardous wastes for which it is not obviously clear that the waste does contain free liquids shall be tested for free liquids at a minimum rate of one (1) test per 25 tons of waste or one (1) test per waste as identified by TCEQ Waste Classification Code Number, whichever yields a greater number of analyses. All testing for free liquids shall be according to Test Method 9095 (Paint Filter Liquids Test) as a described in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA Publication No. SW-846).

6. If the sampling required in Provision IV.C.5. indicates that a waste contains free liquids, the waste should be treated prior to landfilling using a treatment technology that does not solely involve the use of a material that functions primarily as a sorbent. In order to verify that chemical stabilization has taken place (i.e., if there are any concerns that "stabilization" is occurring primarily due to the addition of sorbents), a representative sample of the treated waste should be collected from each batch of solidified and/or stabilized waste. Each sample shall be tested by an appropriate procedure as described in Provisions IV.C.7.-9., in order to verify that chemical stabilization has taken place.

[IV.C.7]

7. For chemical stabilization process based solely in a pozzolanic reaction between the aqueous portion of a waste and an appropriate admix ration of calcium hydroxide (e.g., lime) and silicates (e.g., fly ash), an unconfined compressive strength test shall be used to verify successful stabilization. Each sample taken in accordance with Provision IV.C.6. shall be prepared into a remolded specimen as described in Section 4.3 of ASTM Test Method D-2166. After curing of not less than 24 hours and not more than 7 days, the unconfined compressive strength of a specimen (Specimen 2) shall be determined by D-2166.

8. A minimum of 3 samples per month collected in accordance with Provision IV.C.6 shall be analyzed for the primary contaminant(s) which are to be stabilized for a minimum period of one year from the date of issuance of this permit. Upon direction by the Executive Director the sampling and analysis requirements of this provision shall be extended for no more than one additional year. The permittee shall notify the local District Office of the TCEQ at least 10 days prior to obtaining each sample in order to allow TCEQ input into which waste streams are sampled. The Toxicity Characteristic Leaching Procedure (TCLP) (as published in 40 CFR 268, Appendix I) shall be used to determine the fraction of contaminant which is extracted. Acetic acid shall not be required to be added to the leaching medium. The data collected by the activities required by Provisions IV.C.7 and 8., and any data characterizing the waste prior to stabilization shall be included in a bound report which shall be provided to the TCEQ. The report shall include an evaluation of the data and include an assessment of the effectiveness of the stabilization process of the tested samples and waste. The report shall be updated to include an assess all available data on a semi-annual basis.

9. If stabilized hazardous waste has been tested in accordance with Provision IV..C.7., then the waste shall not be landfilled unless the compressive strength of Specimen 2 is at least 25% greater than Specimen 1. At a minimum, the compressive strength of Specimen 2 shall be at least 50 psi. If hazardous waste tested in accordance with Provision IV.C.7. does not attain the required unconfined compressive strength (50 psi) or the required increase in strength then the waste shall not be landfilled if greater than ten (10) percent (by mass) of the organic constituents in the liquid portion of the unstabilized waste is extracted in the TCLP leaching medium.

10 Once it has been demonstrated in accordance with Provision IV.C.9. that a particular stabilization process used for a particular waste will result in a treated product that passes the unconfined compressive strength test or TCLP leaching procedure (as applicable), then samples of each batch are only required to pass the Paint Filter Liquids Test prior to placement in the landfill. If there are any changes in the treatment process (e.g., admix ratios and stabilization material composition) and/or composition of the waste to be treated, stabilization testing shall be repeated.

[IV.C]

11. All semi-solid waste (waste which passes the free liquids test specified in Provision IV.C.5. but which has a liquid component greater than 30 percent) shall be solidified with an appropriate inorganic absorbent before placement into the landfill so that the liquids are not released from the solidified waste subjected to the maximum overburden pressure expected in the landfill cell.

12. Prior to first receipt of Land Disposal Restricted (LDR) wastes stabilized off-site or wastes which do not require stabilization or treatment on-site, the permittee shall perform corroborative sampling and analysis on those wastes for all applicable LDR constituents in accordance with 40 CFR Part 268. In lieu of corroborative sampling and analysis, the generator may provide a certification, including analytical results, to the permittee verifying the waste meets all applicable LDR standards. Such analysis by the permittee of certification by the generator shall be repeated annually. Additionally, a minimum of 10% of the waste streams received during each calendar year shall be randomly sampled and analyzed for all LDR constituents applicable to that waste stream in accordance with 40 CFR Part 268. Records shall be maintained demonstrating compliance with the above requirements and shall be kept on site and available for review by TCEQ representatives. Compliance with this provision does not, in any manner, relieve the permittee of the responsibility to ensure that all wastes subject to LDRs meet all LDR requirements prior to disposal.

13. Subject to the terms and conditions of this Permit, the Permittee shall only store, process, or dispose of wastes, including but not limited to "Sample Exemption" waste identified in Section 3.2.2.2 of the Waste Analysis Plan, that are fully characterized to meet all limitations contained in the Permit. Records of the waste characterization information shall be maintained at the facility in accordance with 40 CFR 264.73.

D. WASTE ANALYSIS AND VERIFICATION

Except for waste contained in "lab-packs", waste from small quantity generators, and waste which is excepted for sampling and analysis by the Waste Analysis Plan, each waste stream of hazardous waste material shall be sampled and analyzed according to Provisions IV.D.1.-5. prior to approval for land disposal at the facility, except as provided in Provision IV.D..7., below. The permittee shall certify that the sampling and analysis of the waste material is performed according to the procedures specified below. A written proposed description of any deviation from the sampling or analytical procedures specified in this permit condition shall be presented to the Executive Director of the TCEQ. The Executive Director must approve the alternate method of sampling or analysis before it is implemented. Land disposal units subject to these requirements include the North Landfill.

1. Prior to agreeing to accept a stream of waste material from off-site sources, including containerized material, for land disposal, a representative sample of the waste stream shall be taken and quantitatively analyzed by a laboratory in accordance with methods specified in EPA Publication SW-846, "Testing Methods for Evaluating Solid Waste, Physical/Chemical Methods" and according to a strict quality control and quality assurance program as specified in SW-846 referenced above. A quantitative analysis of the waste material shall be performed such that the specific volatile and semi-volatile organic chemical compounds present in concentrations greater than one percent by weight of the

[IV.D.1]

total waste stream, or the concentration of the total organic carbon, if no single compound is expected to be greater than one percent, shall be identified. If process knowledge indicates the presence of waste constituents listed in "Attachment G" in concentrations of less than one percent, these must also be identified in the waste data sheets supplied by the generator. This analysis shall include the identification of specific potential air contaminants and their concentrations in the waste. In addition, headspace analysis or organic screening analysis of a representative sample of waste in the form destined for land disposal shall be done according to Provision IV.D.10. below.

2. The waste stream shall not be accepted for disposal in a land disposal unit if it is found to contain greater than the allowable percentage by weight of any substance found in the list of acceptable wastes as provided for in "Attachment G", except as provided for in Provision IV.D.8..

3. For the purposes of this permit "allowable percentage by weight" will be based on a correlation of actual percentage by weight in the waste to the concentration determined by head space analysis or organic screening analysis described in Provision IV.D.10.. This correlation will be developed after permit issuance for each constituent identified in a waste stream during pre-acceptance analysis described in Provision IV.D.1..

4. If a waste stream which contains constituents identified in "Attachment G" that has been accepted for direct land disposal is 1) frequently received from the same generator and 2) if its composition will not vary significantly between shipments, then the waste stream shall be sampled for head space analysis or organic screening analysis in a random manner according to the procedures specified in Provision IV.D.10.. All waste streams described in this Provision (IV.D.4.) must be analyzed at a minimum, once per year in accordance with Provision IV.D.1. and must meet the requirements of Provision IV.D.2..

5. For waste stabilized in the mixing facility, verification analysis of the head space or organic screening analysis will be required only on the stabilized batch of waste. Verification analysis will be conducted on every fifth load of stabilized waste destined for the landfill. The concentration of potential contaminants detected during head space analysis or organic screening analysis on these samples must comply with the requirements of Provision IV.D.2..

6. If the requirements of Provision IV.D.2. are not met, the stabilized waste materials must be containerized or remixed and sampled to verify compliance with Provision IV.D.2., prior to placement in the landfill cell.

7. For random loads of waste accepted from off-site sources destined for direct landfill and stabilized waste for landfill, the applicant shall take a representative sample of the waste as provided for in Provision IV.D.1. The applicant shall then perform a head space analysis or organic screening analysis of the sample to verify that the stabilize waste does not contain higher than the "allowable percentage by weight" of pre-identified potential air contaminants as described in Provision IV.D.2.. The procedures for the head space analysis and organic screening analysis shall be that specified on Provision IV.D.10., below.

[IV.D.]

8. If a waste stream to be landfilled contains greater than the "allowable percentage by weight" of any constituent and it is a waste which is not amenable to treatment by incineration, it may be placed in the landfill only if the following requirements are met;

   a. Personnel from the TCEQ regional office and Harris County Pollution Control Department are notified.

   b. It can be demonstrated that the applicable TCEQ screening level will not be exceeded at the property boundary.

9. If a load of waste cannot be unloaded in accordance with Provision IV.D.8. above, then the load shall either not be authorized for land disposal at the facility, the load shall be reanalyzed and proved to be acceptable for disposal at the facility according to Provision IV.D.1.-2. or the waste shall be containerized or reprocessed as provided for in Provision IV.D.6. or incinerated. Incinerator residues designated for land disposal shall follow a Sampling and Analysis Plan for Incineration Residues as described in the Waste Analysis Plan instead of the analysis requirements in Provision IV.D..

10. For the purpose of verification, either the organic screening analysis or the headspace analysis shall be performed. The organic screening analysis is a combination of volatile and semi-volatile analyses using GC or GC/MS as described in the Waste Analysis Plan. The procedure for headspace analysis is described below:

    a. A five gram aliquot of a sample shall be placed in a 10 milliliter serum bottle and capped. Using a 10 milliliter syringe, the bottle shall be evacuated once.

    b. The serum bottle shall then be placed in a 70-75°C bath for 30 minutes.

    c. Using a gas-tight syringe, an appropriate volume compatible with the GC system (injector, column) of the head space vapor shall be withdrawn and injected in a GC or a GC/mass spectrometer for analysis.

    d. A printout or computer file of the GC or the reconstructed ion chromatogram shall be produced and retained.

11. Recordkeeping of information and data concerning the analyses and the concentrations of the organic constituents of the material to be processed at the facility for disposal as put forth in Provision IV.D. shall be maintained in the operating record at the plant site and made available for inspection by TCEQ personnel upon their request. This recorded information shall include waste compositions that are currently being received at the facility. The information and data concerning the concentrations of the organic material shall be retained for at least three years following testing.

PERMIT SECTION V – AUTHORIZED UNITS AND OPERATIONS

A. AUTHORIZED UNITS

1. The permittee is authorized to operate the facility units listed in “Attachment D” for storage, processing, and disposal subject to the limitation herein. All waste management activities not otherwise exempted from permitting under 30 Texas Administrative Code (TAC) Section 335.2 shall be confined to the authorized facility units listed in “Attachment D”. References hereinafter in this permit to “TCEQ Permit Unit No.___” shall be to the facility units listed in “Attachment D”. All authorized units must be clearly identified as numbered in “Attachment D”. These units must have signs indicating “TCEQ PERMIT UNIT NO.____”. All existing signs shall be changed in compliance with this provision within one (1) year of the permit issuance date.

2. The permittee shall comply with 40 CFR 264.17, relating to general requirements for ignitable, reactive, or incompatible wastes.

3. The permittee shall prevent inundation of any permitted units and prevent any discharges of any waste or runoff of waste contaminated stormwater from permitted units. Additionally, each loading or unloading area, associated with a permitted hazardous or nonhazardous waste management unit, shall be provided with a drainage control system which will collect spills and precipitation in such a manner as to satisfy the following:

   a. Preclude the release from the system of any collected spills, leaks or precipitation;

   b. Minimize the amount of rainfall that is collected by the system; and

   c. Prevent run-on into the system from other portions of the facility.

4. The permittee shall operate and maintain the facility to prevent washout of any hazardous waste by a 100-year flood, as required by 40 CFR 264.18(b)(1).

B. CONTAINER STORAGE AREAS

1. Container storage areas and their approved waste types are shown in Table V.B. – Container Storage Areas. The permittee is authorized to operate the facility container storage areas for storage subject to the limitations contained herein.

2. Containers holding hazardous waste shall be managed in accordance with 40 CFR 264.171, Condition of containers; 40 CFR 264.172, Compatibility of waste with containers; and 40 CFR 264.173, Management of containers.

3. The permittee shall construct and maintain the containment systems for the container storage areas in accordance with the drawings and details included in the Part B Application. At a minimum, the containment system must meet the requirements of 40 CFR 264.175.

[V.]

C. TANKS AND TANK SYSTEMS

1. The permitted tank units and their approved waste types are shown in Table V.C. – Tanks and Tank Systems. The permittee is authorized to operate the permitted tank units for storage and processing subject to the limitations contained herein.

2. The permittee shall not place hazardous waste or treatment reagents in the tank system if they could cause the tank, its ancillary equipment, or a containment system to rupture, leak, corrode, or otherwise fail. [40 CFR 264.194(a)]

3. The permittee shall prevent spills and overflows from the tank or containment system as per the requirements of 40 CFR 264.194(b).

4. Secondary containment systems must be provided with a leak-detection system that is operated so that it will detect the failure of either the primary or secondary containment structure or the presence of any release of hazardous waste or accumulated liquid in the secondary containment system within 24 hours.

5. The permittee shall report to the Executive Director within 24 hours of detection when a leak or spill occurs from the tank system or secondary containment system to the environment. [40 CFR 264.196(d)(1)] A leak or spill of one pound or less of hazardous waste that is immediately contained and cleaned-up need not be reported. [40 CFR 264.196(d)(2)] Releases that are contained within a secondary system need not be reported.

6. Within 30 days of detecting a release to the environment from the tank system or secondary containment system, the permittee shall report the following information to the Executive Director: [40 CFR 264.196(d)(3)]

   a. Likely route of migration of the release;

   b. Characteristics of the surrounding soil (including soil composition, geology, hydrology, and climate);

   c. Results of any monitoring or sampling conducted in connection with the release. If the permittee finds it will be impossible to meet this time period, the permittee shall provide the Executive Director with a schedule of when the results will be available. This schedule must be provided before the required 30-day submittal period expires;

   d. Proximity of downgradient drinking water, surface water, and populated areas; and

   e. Description of response actions taken or planned.

[V.C.]

7. The permittee shall submit to the Executive Director all certifications of major repairs to correct leaks within seven days of returning the tank system to use. [40 CFR 264.196(f)]

D. SURFACE IMPOUNDMENTS

Not Applicable.

E. WASTE PILES

Not Applicable.

F. LAND TREATMENT UNITS

Not Applicable.

G. LANDFILLS

1. There are three (3) hazardous waste landfills in existence at this facility, as specified in Table V.G.1. – Landfills and Provisions V.G.1.a. – c. below:

   a. Permit Unit No. 1 (closed), above- and below-grade, total fill capacity not exceeding 1,500,000 cubic yards, identified as the South Landfill, authorized for post-closure only (Provision VII). Except for the leak detection and leachate collection systems requirements under Provision V.G.4., the rest of Provision V.G. does not apply to Permit Unit No. 1.

   b. Permit Unit No. 2, six (6) cells, above- and below-grade, total fill capacity not exceeding 815,000 cubic yards, identified as the North Landfill, authorized for operation and waste disposal subject to the limitations contained herein (Provision V.G.)..

   c. Permit Unit No. 98, four (4) cells, above- and below-grade, total fill capacity not exceeding 658,000 cubic yards, identified as the East Landfill, authorized for operation and waste disposal subject to the limitations contained herein (Provision V.G.)..

2. Test Fill

   a. Prior to construction of any new landfill or landfill cell, the permittee shall construct and evaluate a test fill(s) to verify that material specifications, and construction specifications, methodology and equipment proposed to construct a full-scale compacted clay liner achieve a field hydraulic conductivity of 1 x 10^{-7} cm/sec or less in the testfill(s). The test fill construction plans, specifications and documentation procedures shall conform with the guidance described in Section 2.3.4.1.2. (Test Fill Construction) of “Construction Quality Assurance For

[V.G.2.a.]

Hazardous Waste Land Disposal Facilities" (EPA Publication No. 530-SW-021, dated October, 1985) and "Quality Assurance and Quality Control for Waste Containment Facilities" (EPA/600/R-93/182). Hydraulic conductivity of the test fill pad shall be determined using the sealed double-ring infiltrometer (ASTM D 5093), or an equivalent method approved by the Executive Director.

The permittee shall complete construction and evaluation of the test fill in accordance with the terms of this permit and shall submit certification of proper construction and evaluation in accordance with Provision II.A.6.. This certification shall be signed by both the permittee and a qualified, licensed Professional Engineer competent in geotechnical engineering with experience in construction of compacted clay liners and evaluation of field permeabilities of compacted clay liners.

b. The test fill certification report shall include the following information:

(1) Results of all preconstruction, construction, and postconstruction quality assurance inspections and testing performed;

(2) A summary of material specifications and construction specifications, methodology and equipment necessary to construct a full-scale compacted clay liner or cover achieving a field hydraulic conductivity of 1×10^{-7} cm/sec or less;

(3) Complete documentation, including a summary of raw data, detailing how the field hydraulic conductivity of the compacted test fill clay liner was measured and calculated; and

(4) The qualifications of the engineer certifying proper test fill construction and testing.

3. General Landfill design and Construction Requirements

a. The landfill liner system shall consist of at least two liners which meet the requirements of 40 CFR 264.301(c)(1)(I)(A) and (B). In addition, a leachate collection/leak detection system which meets the requirements of 40 CFR 264.301(c)(2) and (3) shall be installed above and between the liners. The landfill liner system and leachate collection/leak detection system shall meet the specifications listed in Table V.G.3. – Landfill Liner System and Table V.G.4 – Landfill Leachate Collection System.

b. Soil Liner

All constructed clay-rich soil structures (liners, dikes, and cover) shall be constructed according to the specifications and methodologies established for the soil liner test fill and shall meet or exceed the following minimum specifications:

[V.G.3.b.]

(1) Materials for all constructed clay-rich structures shall be excavated, broken down, hydrated to the proper moisture content (if necessary) and then recompacted in loose lifts not less than 6.0 inches nor greater than 9.0 inches in thickness. If the soils are significantly below optimum moisture content (> 3%) the maximum clod size of the soils will be reduced to less than 2 inches so that hydration can occur uniformly. Each lift shall be scarified to a depth no greater than 2.0 inches nor less than 0.5 inches prior to placement of the following lift.

(2) Compaction shall be to at least 95% Standard Proctor Density at or slightly above optimum moisture content. The permittee shall compact each clay-rich structure with a sheepsfoot-type roller of the same drum diameter and length, empty and/or ballasted weight, length and face area of the feet, and yoking arrangement as used to construct the test fill required in this section. For areas inaccessible to a sheepsfoot roller, a tamping foot-type compactor, smooth-drum roller or vibrating-plate compactor having foot pressures of at least 250 pounds per square inch (psi) shall be substituted.

(3) The term "clay-rich soil," as described in this permit, shall be defined as soil exhibiting the following minimum characteristics:

(a) Plasticity index greater than or equal to 15.

(b) Liquid limit greater than or equal to 30.

(c) Percent passing No. 200 sieve greater than or equal to 30.

(4) Laboratory Standard Proctor Density and optimum moisture content tests performed in accordance with ASTM D-698 for a minimum of one (1) representative sample from each 5000 cubic yards of soil;

(5) Field density and moisture control tests on constructed soil liners performed in accordance with ASTM D-1556, ASTM D-2167, ASTM D-2922, or an equivalent method at a frequency of at least one per every 10,000 square feet of each lift placed;

(6) Atterberg Limits performed in accordance with ASTM D-4318 at a frequency of at least on per every 1000 cubic yards of soil and for a minimum of two (2) tests per layer per cell;

(7) Percent passing No. 200 sieve performed in accordance with ASTM D-1140 at a frequency of at least one per every 1000 cubic yards of soil and for a minimum of two (2) tests per layer per cell;

[V.G.3.b.]

(8) Soil liner thickness and slope determinations at a rate of at least one (1) determination by appropriate surveying techniques per every 10,000 square feet of soil liner installed; and

(9) Hydraulic conductivity measurements expressed in terms of cm/sec for representative undisturbed core samples of the constructed soil liner system components at a frequency of one per acre per lift.

c. Geomembrane Liner

(1) The following conditions shall be satisfied prior to the installation of any geomembrane liner:

(a) The upper four (4) inches of the supporting soil for the liner shall not contain any stones, roots, or foreign objects having a dimension greater than one (1) inch.

(b) The surface to be lined shall be prepared so as to provide a surface that is free of irregularities, loose earth, desiccation cracks, and abrupt changes in grade.

(c) The compacted clay liner shall be maintained at or slightly above optimum moisture content and free of desiccation cracks prior to placement of any overlying geomembrane liner. Verification testing an modifications to moisture content shall be performed for the compacted clay liner during soil compaction activities and hence at least every seven (7) days until placement of the overlying component of the liner system. Final soil moisture content determinations must be performed for the clay liner within twenty-four (24) hours of placement of the overlying component of the liner system. At a minimum, soil moisture content shall be measured at six (6) inch depths at a minimum rate of one (1) test per 10,000 square feet of soil liner. The date, location, and results of all soil moisture measurements and the date and location of the synthetic liner placement shall be included in the required certification report. The results of a visual inspection made by the certifying engineer, noting the presence or absence of desiccation cracks and any remedial measures taken to remove these features, must also be included in the landfill certification report.

(2) During installation, all persons walking on the liner shall wear shoes which will not damage the liner.

(3) The geomembrane shall not be installed during rainfall or in an area of pooled water.

[V.G.3.c.]

(4) The geomembrane shall be installed so that there will not be tension or wrinkles at the anticipated average temperature for its final use.

(5) All personnel seaming the geomembrane shall have previous project experience in field seaming geomembrane liner using similar seaming methods.

(6) An anchor trench having minimum dimensions of two (2) feet in width and two (2) feet in depth shall be constructed along the perimeter of the landfill trench.

(7) The geomembrane panel shall be secured at the ground surface in the anchor trench specified in Provision V.G.3.c.(6) and shall be installed such that field seams, to the extent possible, are aligned parallel to the landfill sidewall slope.

(8) Adjacent panels of the geomembrane shall be overlapped at least three (3) inches.

(9) All seam areas of the geomembrane shall be clean and free of moisture, dust, dirt, and any other foreign material of any kind.

(10) Each seaming unit for extrusion welding shall have temperature gauges that indicate the temperature of the extrudate in the machine and at the nozzle.

(11) Field seaming shall not be done if the ambient temperature is below 34°F.

(12) Field seaming shall not be done if the ambient temperature is below 50°F, but greater than 34°F, unless the geomembrane is preheated above that temperature by either the sun or a hot air device.

(13) Prior to field seaming the geomembrane each day, all personnel responsible for seaming shall prepare a test seam of at least two (2) feet in length. These test seams shall be tested for adequate strength (seam peel stress equal to 100 percent of the tensile strength of the geomembrane used) prior to field seaming the geomembrane. All test seaming shall be performed under the same conditions as production seaming. Any problems with equipment or test seam strength shall be corrected prior to field seaming the geomembrane.

(14) All seam and nonseam areas of the geomembrane shall be visually inspected for signs of defective seams, blisters, punctures, undispersed raw materials, and any sign of contamination by foreign matter. Any problems discovered shall be marked, repaired, and retested or re-evaluated. The geomembrane surface shall be clean at the time of these inspections.

[V.G.3.c.]

(15) All field seams shall be nondestructively tested over their entire length. Seam testing shall be performed as field seaming progresses. Any defects shall be marked, repaired, and retested.

(16) Field seams shall be tested using, at a minimum, an ultrasonic tester, a pressure tester, or a vacuum tester suited for this purpose. All testing equipment shall be calibrated or properly adjusted prior to use each day.

(17) All field seams shall be destructively tested at a minimum frequency of one sample for every 500 feet of weld for adequate strength as defined above. Areas of removed samples shall be patched and the patched seams non-destructively tested in accordance with Provision V.G.3.c.(15) above.

(18) If any seam tested in accordance with Provisions V.G.3.c.(15)(16), and (17) is shown to be defective, the permittee shall evaluate the entire length of seam represented by the defective test results to determine the extent of the defect(s): The permittee shall replace or repair defective seams prior to progressing with field seaming operations.

d. Leachate Collection/Leak Detection System

(1) Sieve analysis tests in nonsynthetic material at a minimum rate of one (1) test per 400 cubic yards;

(2) Hydraulic conductivity measurements expressed in units of cm/sec at a frequency of at least four (4) representative samples collected from each compacted drainage layer;

(3) Drainage layer thickness determinations at a rate of at least one (1) determination by appropriate surveying techniques per every 10,000 square feet of drainage layer installed;

(4) Drainage pipe slope determinations at a rate at least one determination by appropriate surveying techniques per every 20 feet of drainage pipe and an overall visual inspection of all pipes for sagging and improper bedding.

e. Run-On and Run-Off Control System

The permittee shall design and construct a run-on control system and a run-off management system as specified in the approved permit application Sections V.G.10. and 11. [30 TAC Sections 335.173(g) and (h)]

f. The permittee shall submit certification of proper landfill construction prior to the placement of waste in a landfill or landfill cell. The certification shall be submitted in accordance with Provision II.A.6.. Within thirty (30) days of submittal of such certification, the permittee shall submit a certification report which contains the results of all tests conducted. The permittee shall conduct any tests, inspection, or measurements that are deemed necessary in the judgement of the registered professional engineer supervising the cell construction, for the engineer to certify that the landfill cell has been constructed in conformance with the design and construction specification of this permit. The certification report shall, at a minimum, contain the following drawings ant test results:

(1) Scaled plan-view and cross-sectional drawings that accurately depict the aerial boundaries and dimensions of the cell; separation distance(s) of the cell from the property boundary; minimum, maximum, and representative elevations of the excavation of the cell; minimum, maximum, and representative elevations of the cell as component parts of the liner system; location, site, volume, materials of construction, and slope, as applicable, of all soil and synthetic liners and leachate collection and leak detection system components.

(2) For the soil liner, geomembrane liner, and leachate collection/leak detection system; all observations, test, and analyses required to ensure that installation has been completed in accordance with the terms of this permit and the incorporated design plans.

4. General Landfilling Operations

The permittee shall conduct landfilling operations according to the following requirements:

a. The initial two (2) feet of waste or soil placed in a landfill cell shall be placed with a tracked vehicle (D-6 Caterpillar size or smaller) and shall be composed of bulk or processed non-containerized waste. Rubber-tired vehicles and roller-type compaction equipment shall not drive on any portion of the leachate collection system in a landfill cell until the initial two (2) foot layer of waste or soil has been placed.

b. Upon compliance with Provision V.G.4.a., all subsequent waste, except containerized waste, shall be applied in lifts not greater that eighteen (18) inches and compacted sufficiently to minimize settlement of landfilled waste.

c. [30 TAC Section 335.173(i)] All collection and holding facilities (e.g., tanks or basins) associated with run-on and run-off control systems shall be maintained and must be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.

d. All rainwater that collects in an active landfill cell, including rainwater that drains into the landfill cell from interior access roads, shall be managed as contaminated water and disposed of accordingly at an authorized on-site waste management unit or at an authorized off-site facility.

e. While a landfill cell is in operation, it must be inspected at least weekly and after rainfall events in accordance with 40 CFR 264.303(b).

[V.G.4.]

f. The permittee shall remove leachate from collection sumps as often as necessary to ensure that the leachate depth in the leachate collection/leak detection system is always less than the thickness of the drainage material and never exceeds 12 inches.

g. The permittee shall inspect each leak detection system and record the amount of liquids removed from each leak detection system sump at least once each week during the active life and closure period of the landfill.

h. Liquids removed from the leachate collection/leak detection systems shall be classified in accordance with 30 TAC Chapter 335, Subchapter R (Waste Classification) and shall be managed accordingly at an authorized on-site waste management unit or at an authorized off-site facility.

i. Control of Wind Dispersal of Particulate Matter

[30 TAC Section 335.173(j)] The permittee shall cover or otherwise manage the landfill to control wind dispersal of particulate matter in accordance with the procedures described in Section V.G.12. of the permittee's approved permit application.

j. The permittee shall construct an interim cover specified in Provision VII.E.2.a and b. during landfill operation progressing continuously as the waste material reached the levels specified in the permit application.

k. Requirements for Ignitable, Reactive or Incompatible Wastes

The permittee shall manage ignitable, reactive incompatible wastes in accordance with the following conditions:

(1) [40 CFR 264.312] Ignitable or reactive wastes shall not be placed in a landfill, unless the waste and landfill meet all applicable requirements of 40 CFR 268, and the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable or reactive waste under 40 CFR 261.21 or 261.23; and

(2) Ignitable wastes in containers may be disposed in the landfill cells in accordance with 40 CFR 264.312(b).

(3) Incompatible wastes, or incompatible wastes and materials must not be placed in the same landfill cell unless the permittee complies with 40 CFR 264.17(b).

l. Special Requirements for Hazardous Waste Codes F020, F021, F022, F023, F026, and F027

None of these wastes are authorized for disposal at this facility.

[V.G.4.]

m. Stabilization of Liquid Wastes

(1) The permittee shall not place liquids or waste containing free liquids, whether or not sorbents have been added (except lab waste in overpacked containers, as described in 40 CFR 264.316) in landfill cells. "Free liquids" are liquids which readily separate from the solid portion of a waste when the waste mixture is at a temperature above 32°F and ambient pressure.

(2) An absorbent is defined as a material that is capable of physically holding a liquid within pores or interstices by such physical forces as tension or capillary action. An absorbent is defined as a material that is capable of physically adhering a liquid to its (the material's) surface(s) through molecular polar forces. The terms "absorbent" and "adsorbent" shall both be indicated whenever the term "sorbent" is used in this permit.

n. Stabilization of LDR Wastes

Appropriate stabilization methods shall be used for waste streams requiring treatment to meet the 40 CFR Part 268 treatment standards. Successful stabilization is said to be achieved if post-treatment analyses demonstrate that applicable treatment standards will be achieved in accordance with the land disposal restrictions of 40 CFR Part 268.

o. Special Requirements for Containers

[40 CFR 264.315] All containers, unless they are very small, such as an ampule, must be either at least 90 percent full when placed in the landfill, or crushed, shredded or similarly reduced in volume to the maximum practical extent before burial and the landfill.

p. Special Requirements for the Disposal of Lab Packs

[30 TAC 335.175(e)] The permittee shall not place containers holding liquid waste, or waste containing free liquids in a landfill, unless the following conditions apply:

(1) The container is very small, such as an ampule;

(2) The container is designed to hold free liquids for use other than storage, such as a battery or capacitor; or

(3) The container is a lab pack as defined and managed in accordance with 40 CFR 264.316.

[V.G.4.]

q. Waste Liner Compatibility

The permittee shall ensure that wastes to be landfilled will not impair the function of the synthetic liner. At a minimum, waste to liner compatibility testing shall be conducted for those wastes whose compatibility with the selected membrane liner have not been conducted and the effects are unknown. For wastes and liners upon which tests have been conducted and the results and/or effects are known (manufacturer's literature, other experimental literature, etc.), additional testing is not required. The permittee shall maintain test results and/or documentation that confirms waste to liner compatibility at the facility. The waste liner compatibility shall be conducted in accordance with the following provisions:

(1) Waste to liner compatibility testing shall be conducted for all wastes, as identified by TCEQ Waste Classification Code Number, which will contain a total (additive) concentration of the compounds listed in "Attachment F" of more than or equal to five (5) percent by weight when placed in a landfill cell. For those wastes which will be landfilled directly without processing, this percentage determination shall be based on the raw wastes. For wastes which will be processed prior to landfilling, this percentage determination shall be based on the product from the mixer.

(2) Waste to liner compatibility testing required pursuant to Provision V.G.4.q. shall be performed in accordance with EPA Test Method 9090 or other test method approved by the Executive Director using leachate derived from representative samples of the waste to be placed in a landfill cell. The Toxicity Characteristic Leaching Procedure (TCLP) [as published in the 40 CFR Part 268, Appendix I] shall be used to generate leachate for liner compatibility testing, except that acetic acid shall not be added to the leaching medium. If the waste will be landfilled directly without processing, leachate will be generated using the raw wastes. If the waste will be processed, then leachate generated from the same waste to admix ration as is proposed for the product from the mixer shall be used.

(3) The permittee shall reject any waste tested pursuant to this Provision shown to affect a ten (10) percent or greater change in the synthetic liner's physical dimensions, mass, tear resistance (ASTM D-1004), puncture resistance (FTMS 101B, Method 2065), tensile properties (ASTM D-638), hardness (ASTM D-2240), and elongation at break. The synthetic liner material tested shall have equivalent physical and chemical properties and dimensions as that used in secure cell construction. The permittee may process the waste at a higher admix/waste ratio and repeat the waste to liner compatibility testing procedure using leachate from the processed waste. The admix materials and admix/waste ratio which are determined to produce a waste which does not significantly affect (less that ten (10) percent change) the liner shall be the minimum (for liner compatibility purposes) used on future shipments of the particular waste.

[V.G.4.q.]

(4) The permittee shall not place in any landfill cell any waste containing more than ten (10) percent by weight of those constituents listed in “Attachment F”. This percentage determination shall be based on raw wastes only.

(5) The waste to liner compatibility requirements of this Provision shall be waived for wastes received from small quantity generators (as defined by 40 CFR Part 261.5).

r. The permittee shall only dispose of on-site processed waste (i.e., stabilized on-site incinerator ash) directly below stability dike extensions 1 through 5 of the North Landfill within the volume expansion proposed in the Part B permit application. Commercial waste may be placed within the center part of the landfill outside of the stability dike footprint.

5. East Landfill Action Leakage Rate and Response Action Plan [40 CFR 264.302 and 264.304.]

a. The permittee shall establish an Action Leakage Rate (ALR) pursuant to 40 CFR 264.302. The permittee shall determine if the ALR, given in gallons per acre per day, for each sump has been exceeded by converting the weekly or monthly flow rate from the monitoring data obtained to an average daily flow rate (gallons per acre per day) for each sump. The permittee shall calculate the average daily flow rate for each landfill sump on a weekly basis during the active life and closure period. The ALR for the sumps in each landfill cell is given in Table V.G.1.

b. Prior to receipt of waste, the permittee shall have in place an approved Response Action Plan (RAP) which meets the requirements of 40 CFR 264.304. The RAP shall set forth the actions to be taken if the ALR is exceeded.

6. Cell Location Survey

The permittee shall maintain the following items in the operating record:

a. A map with the exact location and dimensions (including depth) of each cell with respect to permanently surveyed benchmarks.

b. A record of the areal and vertical location of each waste placed into a landfill cell.

7. Solid waste, solid waste residues, or contaminated soils encountered upon excavation of any new landfill cell must be removed to a distance of 10 feet prior to construction of the cell in accordance with 30 TAC Chapter 350. At a minimum, one soil sample shall be tested for every 10,000 square feet of excavation area and analyzed for 40 CFR Part 264 Appendix VIII constituents reasonably expected to be present in the excavation area. Sampling shall be evenly distributed over the entire excavation surface area and shall be representative of soil remaining at the excavation base and sidewalls. The engineer certifying construction shall specify additional sampling points within the excavation of visual evidence indicates

[V.G.7.]

additional samples are needed to adequately determine the limits of contamination. The excess void created by removal of contaminated soils, solid waste or solid waste residues shall be replaced by soils having properties equivalent to soils approved for liner construction in Provision V.G.3.b. The backfill material shall be compacted to at least 95% Standard Proctor Density at or slightly above optimum moisture content.

8. Pressure relief wells installed at the perimeter of North Landfill cells 1 through 4 shall be constructed in accordance with the design specifications of Provision VI.B. These pressure relief wells shall not be plugged or otherwise taken out of service without written approval by the Executive Director. The permittee shall use a total of seventeen (17) pressure relief wells installed as indicated in “Attachment E” or an existing ground water recovery system in conjunction with one or more relief wells in order to depress piezometric water levels to no more than 3.0 feet above MSL during construction of a cell. Piezometric water levels shall be maintained in the area of each North Landfill cell such that hydraulic uplift will not exceed overburden pressure on each cell liner.

9. Pressure relief wells installed at the perimeter of the East Landfill shall be constructed in accordance with the design specifications of Provision VI.B. These pressure relief wells shall not be plugged or otherwise taken out of service without written approval by the Executive Director. The Permittee shall use a minimum of thirteen (13) pressure relief wells in Zone 1 (Stratum 1) and nineteen (19) pressure relief wells in Zone 3 (Stratum 3) to depress the piezometric water levels during construction activities for the East Landfill. Piezometric water levels shall be maintained at an elevation that will insure that hydraulic uplift will not exceed overburden pressure at any time in any area of the East Landfill. Any changes in this pressure relief system must be approved in writing by the Executive Director.

10. Against the interior of the perimeter containment levee of each cell, waste shall be placed no higher than three (3) feet below the lowest crest elevation of the perimeter levee, and sloped up at no more than 3% for the North and East Landfills from the interior side of the perimeter containment levee toward the opposite side or end of the landfill cell. No portion of waste shall be higher than the lowest elevation of the crest of the perimeter containment levee.

11. Leachate Monitoring System Operational Requirements

The permittee shall determine leachate quality in the primary and secondary leachate collection system of each East Landfill cell throughout the active life of the facility and the post closure care period in accordance with the parameter list and sampling schedule specified in the Groundwater Detection Monitoring Plan in Section VI of the Part B application.

H. INCINERATORS

1. The incinerators and their approved waste types are shown in Table V.H.1 – Incinerators. The permittee is authorized to operate the incinerators for processing subject to the limitations contained herein.

2. Limitations on Wastes Burned

a. The feed rate of total hazardous wastes shall not exceed the limitations set out in Tables V.H.2 (I) and V.H.2 (II) – Incinerator Permit Conditions, Monitoring and Automatic Waste Feed Cutoff Systems for Train I and Train II [40 CFR §264.345(b)(2)]

b. The total feed rate of metals, ash and chlorine (Train I plus Train II) shall not exceed the limitations set out in Table V.H.3 – Maximum Constituent Feed Rates", at any time. [40 CFR §264.345(b) and TAC §305.127]

c. The hazardous waste feeds to the Incinerator shall not contain greater than 100 ppm of organic hazardous constituent listed in 40 CFR Part 261 Appendix VIII, unless the constituent has a thermal stability Class ranking equal to or less than Class 1 (demonstrated with 1,2-Dichlorobenzene and 1,2,4,5-Tetrachlorobenzene) [40 CFR §264.341(b)]

d. Compliance with the ash and chlorine feed rate limits identified in Table V.H.3. shall be evaluated using both detected an non-detected analytical results for ash and chlorine in the feed streams to the unit. Detections are analytical results equal to or greater than the statistically-derived Method Detection Limit (MDL) as adjusted to account for sample-specific characteristics and actions, including sample matrix, sample size, preparation or cleanup procedures performed, and any concentration or dilution of the sample by the laboratory. If ash or chlorine is not detected, the results shall be reported at the value equal to the MDL, adjusted as described above to reflect sample-specific characteristics and action, and shall be flagged with a notation, such as "<" or "U", to indicate that the constituent was not detected in the sample. Feedrate calculations for ash and chlorine shall us the full value of the detected analytical results and one-half (1/2) the value of the non-detected results. [30 TAC Section 305.127(2)]

3. Incinerator Area Operating Conditions

a. Compliance with the permit conditions specified in Provisions V.H.2 of this permit will be generally regarded as compliance with the performance standards of 40 CFR §264.343 as adopted by reference in Provision II.C.. However any evidence that compliance with Provision V.H.2 is insufficient to ensure compliance with the referenced performance standards, may be "good cause" justifying initiation of an amendment pursuant to 30 TAC §305.62(d), or permit revocation or suspension pursuant to 30 TAC §305.66.

b. The permittee may not feed hazardous wastes to the permitted units listed in Table V.H.1 unless the following operating conditions are satisfied:

(1) The unit meets the conditions specified in Tables V.H,2 (I) and V.H.2 (II) – Incinerator Permit Conditions, Monitoring and Automatic Waste Feed Cutoff System. [40 CFR §264.345]

(2) The air pollution control equipment shall be operated in accordance with the conditions specified in the Table V.H.2 (I) and V.H. 2 (II) – Incinerator Permit Conditions, Monitoring and Automatic Waste Feed Cutoff Systems. [40 CFR §264.345(b)(5) and (6)]

(3) The permittee maintains and operates an automatic waste feed cut-off system which shall activate under the conditions listed in Tables V.H.2 (I) and V.H. 2 (II) – Incinerator Permit Conditions, Monitoring and Automatic Waste Feed Cutoff Systems. [40 CFR §264.345(e)]

c. The permittee shall comply with the emission rate limits in Table V.H.4. Maximum Allowable Emission Rates when burning hazardous waste. [40 CFR §264.343(b), §264.343(c), and 30 TAC §305.127]

d. The incinerator units must be operated in accordance with Provision V.H.3.b at all times when hazardous wastes remains in the units. [40 CFR §264.345(a)]

e. Throughout normal operation, the permittee must conduct sufficient waste analysis in accordance with the Waste Analysis Plan adopted by reference in Provision I.B to verify that wastes fed to the incinerator units are within the physical and chemical composition limits specified in the permit. [40 CFR §264.341(b)]

f. An incinerator shall cease burning hazardous wastes when changes in waste feed, incinerator design, or operating conditions deviate from the limits specified herein. [40 CFR 264.345(f)]

g. The Permittee shall calculate hourly rolling averages and in accordance with the requirements in 40 CFR §266.102(e)(6). The Permittee shall ignore periods of time when one-minute values are not available for calculating the hourly rolling average. When one-minute values become available again, the most recent one-minute average value is added to the previous 59 values to calculate the hourly rolling average. [30 TAC §305.127(2)]

4. Trial Burn Requirements - Not Applicable

5. Short-Term Incinerator Operating Conditions – Not Applicable

6. Incinerator Sampling Requirements

a. The permittee may conduct additional shakedown and testing in accordance with a test plan or Trial Burn Plan approved by the Executive Director. The permittee may conduct 720 hours of additional shakedown prior to conducting the test. The results from the additional trial burn testing shall be used for the purpose of

[V.H.6.a.]

determining compliance with the performance standards of 40 CFR Part 63, Subpart EEE, and for determining adequate operating conditions under 40 CFR 264.345 or 40 CFR Part 63, Subpart EEE. After the approved testing is completed, the unit shall be operated in accordance with the operating conditions in effect prior to the commencement of the testing. The permittee may request a permit modification or amendment pursuant to 30 TAC §305.69 or §305.62 to incorporate the new operating conditions demonstrated by the trial burn results.

b. The permittee shall conduct an initial sampling and analysis of the waste and stack emissions prior to March 30, 2005, and at least every two and one-half years thereafter, and upon request of the Executive Director. Sampling and analysis of the waste and exhaust emissions shall be conducted to verify compliance with the feed rate limits in Table V.H.3. and the emission limits in Table V.H.4. and to ensure achievement of the performance standards 40 CFR 364.343 under normal operating conditions. Under normal operating conditions, each of the operating parameters specified in Tables V.H.2(I) and (II). must be held within the range of the average value over the previous 12 months and the maximum or minimum allowable limit, as appropriate. The average value is defined as either the mean of all values recorded over the previous 12 months or the sum of the rolling average values recorded over the previous 12 months divided by the number of rolling averages recorded during that time. The average value must not include calibration data, malfunction data, and data obtained when not burning hazardous waste. Conflicting parameters shall be identified in association with the targeted operating parameter ranges for the testing in the sampling plan. [40 CFR 264.347(a)(3)]

(1) The permittee shall submit an original and four copies of a stack test plan to the TCEQ Executive Director at least 180 days prior to sampling and analysis. At a minimum, the test plan shall include the following, prepared in accordance with EPA guidance:

- A sampling and analysis plan describing the parameters to be tested, monitored and/or analyzed and;

- A Quality Assurance Project Plan.

(2) At a minimum, the incinerator shall be tested for emissions of carbon monoxide, particulate matter, oxygen, other constituents listed in Table V.H.4., and other constituents as requested by the Executive Director.

(3) The operating parameters listed in Table V.H.2., shall be monitored and recorded during the stack test.

(4) The Waste Section of the local TCEQ regional office shall be contacted a minimum of 60 days prior to sampling to schedule a pretest meeting.

[V.H.6.b.]

(5) An original and four copies of the final sampling report shall be forwarded to the Executive Director within 90 days after receipt of the sampling results.

7. Incinerator Monitoring, Testing and Inspection Requirements

a. The permittee shall monitor and record the parameters listed in Tables V.H.2.(I) and V.H.2 (II) – Incinerator Permit Conditions, Monitoring and Automatic Waste Feed Cutoff Systems. All monitors shall record data in the units corresponding to the permit limits unless otherwise specified herein. Data compression techniques for recording will not be accepted. [40 CFR §264.347(c) and (d)]

b. Stack oxygen and carbon monoxide concentrations shall be measured using Continuous Emissions Monitoring Systems (CEMS). [40 CFR §264.347 (a)(2)]

(1) The oxygen and carbon monoxide CEMS shall meet the installation, performance and equipment specifications in 40 CFR Part 266, Appendix IX, Section 2.1.

(2) Oxygen concentration shall be quantified and reported as percent by volume (%) on a dry basis. Carbon monoxide concentrations shall be quantified and reported as parts per million by volume (ppmv), corrected to 7% by volume oxygen, on a dry basis.

c. The permittee shall properly calibrate, maintain, and operate all CEMS and establish a quality assurance program to evaluate and monitor the CEMS performance in accordance with Appendix IX of 40 CFR Part 266. [30 TAC §305.127]

d. The waste feed cut-off system and associated alarms for the Incinerators must be tested at least weekly when hazardous waste is burned to verify operability. In addition, a complete inspection and function test shall be performed on all system alarms and emergency control devices at least annually. [40 CFR §264.347(c), 30 TAC §305.127]

(1) System testing will be accomplished by activating (i.e., closing) the waste feed cutoff valve and by checking all inputs and their associated alarms, to the waste feed cutoff system. A check of every input to the waste feed cutoff system does not have to activate the waste feed cutoff. If the permittee maintains a "fail safe" valve (i.e., remains in the closed position in event of failure), only the control panel circuits and associated alarms need testing each 7-day period. This may be accomplished using an electronic loop test for the components of the system, including sensors, which test the operability of the circuit without actually closing the "fail safe" valve.

[V.H.7.d.]

(2) If the waste feed cutoff system "trips" (i.e., waste feed is cut off due to a process operations excursion from specified limits) during the weekly period prior to testing, the actual trip will satisfy the need to test the waste feed cutoff valves and non-pumpable waste feed cutoff systems. However, the other components of the cutoff system still need to be tested to ensure they are functioning properly.

e. The monitoring and inspection data collected in Provisions V.H.7.a-c shall be recorded and placed in the operating log as required by 40 CFR §264.347(d). In addition to the specific requirements of that paragraph, the permittee shall also record:

(1) All occasions when waste is being fed to the Incinerator units and the operating limits specified in Provision V.H.2 are exceeded;

(2) All occasions when the waste feed is cut off by the automatic waste feed cut-off system, including the date, time and cause of the incident that triggered the cut-off; and

(3) All occasions when uncontrolled fugitive emissions from the Incinerator unit(s) are detected.

f. During an automatic waste feed cut-off, the permittee shall continue to monitor the operating parameters for which permit limits are established. [40 CFR §264.347]

g. For each set of ten exceedances of an emission standard or operating limit while hazardous waste remains in the combustion chamber during a 30-day block period, the Permittee must submit a written report within 5 calendar days of the tenth exceedance documenting the exceedances and results of the investigation and corrective measures. The report shall include the reason for the cut-offs and actions taken by the permittee to address the problem. The Executive Director of the TCEQ shall take appropriate action based on the results of the report. [30 TAC §305.127]

h. Except for an instrument during its calibration period, the Permittee shall continuously record all monitoring data as required in Tables V.H.2 (I) and V.H.2 (II) – Incinerator Permit Conditions, Monitoring and Automatic Waste Feed Cutoff Systems. Waste may continue to be fed to the incinerator during CEMS calibration check periods no exceeding 20 minutes in duration. Each CO and oxygen CEMS shall operate at a minimum of 90% uptime, based on a 24-hour period of operation.

i. Auxiliary fuel fired while operating any primary or secondary combustion device is limited to natural gas, or No. 2 Fuel Oil containing less than 0.50% sulfur by weight, or Used Oil meeting the specifications in 40 CFR 279.11, 30 TAC Chapter 324, Subchapter A, and the Part B permit application. Auxiliary fuel is also that fuel exempted in 40 CFR 261.2 or 40 CFR 261.38 (Comparable Fuels), when fired at or above 1500º F with an emissions limit of either of <100 ppm (HRA) Carbon Monoxide or <10 ppm (HRA) Total Hydrocarbon.

[V.H.7.j.]

j. The permittee shall control fugitive emissions by use of kiln shrouds at both ends of the rotary kilns in Train I and Train II incinerators. Under normal operations, the induced draft fan shall maintain the maximum combustion zone pressure below the ambient pressure. The permittee shall inject air into the inlet and outlet shrouds to maintain approximately 0.2 inches of water pressure in the shrouds. During transient pressure spikes, the pressurized shrouds shall act as barriers to prevent any gas leaks from the combustion zone. The following conditions shall apply to the shrouds:

(1) The permittee shall inject air into the inlet and exit shrouds such that the difference between pressure in each shroud and the secondary combustion chamber (SCC) will be a minimum of 0.2 inches of water column.

(2) The permittee shall measure pressures in the SCC and in both shrouds of the rotary kilns on a continuous basis. The pressure differential Operating Parameter Limit (OPL) and automatic waste feed cut-off for each inlet and outlet shall be set independent of each other;

(3) If at any time the pressure differential between each shroud and the SCC is less than 0.2 inches of water column, and the pressure in the SCC is equal to zero or higher, the automatic waste feed cut-off shall be triggered instantaneously;

(4) The automatic waste feed cut-off shall not be triggered if the shroud fan fails, and the pressure in the SCC is lower than the ambient pressure; and

(5) If the pressure difference in each shroud and the SCC is at least 0.2 inches water column, and the pressure in the SCC is higher than the ambient pressure for more than 10 seconds, the automatic waste feed cut-off shall be triggered instantaneously.

(6) The “instantaneous automatic waste feed cut-off” in all the above conditions means that the waste feed shall be cut-off within one second of any pressure OPL exceedance, provided the pressure is measured on a continuous basis in the Train I and Train II Incinerators and the shrouds.

[V.H.]

8. Indirect Risk Provisions

a. The feed rates of the constituents of concern shall not exceed the limitations set out in Table V.H.3. – Maximum Constituent Feed Rates.

b. Compliance with the hourly feed rate limits in Table V.H.3. – Maximum Constituent Feed Rates shall be determined using hourly rolling average feed rates.

c. Metals concentrations of the constituents of concern in Table V.H.3. – Maximum Constituent Feed Rates shall be determined according to the methods in the Waste Analysis Plan adopted by reference in Provision IV.A., and by the appropriate SW-846 Method for metals not listed in the Waste Analysis Plan.

d. Compliance with the annual feed rate limits (*i.e.*, tons/year) in Table V.H.3. – Maximum Constituent Feed Rates shall be determined by using the hourly rolling averages for a distinct year beginning with the date (or anniversary, as appropriate) of permit issuance and continuing for one calendar year. When the hourly feed rate limit for a metal is less than or equivalent to the annual feed rate specified on an hourly basis and the permittee has not exceeded the hourly feed rate limit during a calendar year, compliance with the annual feed rate limit may be assumed.

e. Compliance with the metals feed rate limits identified in Table V.H.3. for each incinerator shall be evaluated using both detected and non-detected analytical results for metals in the feed streams to the unit. Detections are analytical results equal to or greater than the statistically-derived Method Detection Limit (MDL) as adjusted to account for sample-specific characteristics and actions, including sample matrix, sample size, preparation or cleanup procedures performed, and any concentration or dilution of the sample by the laboratory. If a metal is not detected, the results shall be reported at the value equal to the MDL, adjusted as described above to reflect sample-specific characteristics and actions, and shall be flagged with a notation, such as “<” or “U”, to indicate that the constituent was not detected in the sample.

Feed rate calculations for each metal shall use the full value of the detected analytical results and one-half (1/2) the value of the non-detected results. The feed rates of metals shall be determined in accordance with 40 CFR 266.102(e)(6).

f. Pumpable bulk liquid wastes containing any of the chemicals listed in Table V.H.5. with a represented concentration or concentration range in excess of 10 percent by weight, as determined by process knowledge or by sampling and analyzing a representative sample of the waste, shall only be fed through Permit Unit Nos. 99 and 103. The number and type of Fugitive Components associated with Permit Unit Nos. 99 – and 103 shall conform to those specified in the Part B permit application submittals dated September 6, 2002.

[V.H.8.]

g. The permittee shall monitor all equipment associated with the incinerator tank farm, loading and unloading operations, and the incinerator direct feed systems, on a quarterly basis, in accordance with Method 21 in 40 CFR Part 60, perform an audio/visual/olfactory (AVO) walkthrough inspection of all associated equipment at least weekly, and control fugitive emissions of volatile organic compounds (VOCs) from such equipment by implementing a leak detection and repair program as required by TCEQ Air Permit No. 5064. For the purpose of compliance with this provision, a leak is detected if an instrument reading of 200 ppm or greater is measured above background in accordance with Method 21.

h. Emissions from bulk liquids tanker/truck sampling area(s) must be collected by a device with a collection efficiency of at least 95 percent and vented to a control device with a VOC control efficiency of at least 90 percent. The permittee shall submit certification of construction/installation of the control device to the TCEQ in accordance with the requirements of <u>Provision II.A.6.</u>, within 120 days of the permit issuance date.

i. Rolloffs containing waste must remain covered at all times during storage by a rubberized tarp, rigid cover, or a rigid, gasketed cover (vacuum boxes). The total number of rolloffs containing waste that are covered using a non-gasketed cover (e.g., tarped cover) shall not exceed 300 after the first year, 200 after the second year, and 130 after the third year of the permit issuance date. Rolloffs containing incineration residue wastes streams which have been certified to meet 40 CFR Part 268 treatment standards for hazardous organic compounds and waste streams known to contain only chemicals with a vapor pressure less than 0.1 mm Hg at 100 degrees Fahrenheit may be excluded from the rolloff limitation.

j. The permittee shall demonstrate compliance with the metals feed rate limits and short-term emission rate limits specified in Tables V.H.3. and V.H.4. for Mercury and Thallium by conducting appropriate waste feed and emission sampling and analysis no later than 60 days after the date of completion for the initial comprehensive performance testing required by 40 CFR Part 63, Subpart EEE. An original and four copies of a test report providing the necessary data demonstrating compliance with this provision shall be forwarded to the Executive Director within 90 days after receipt of the sampling results. If changes to the operating conditions specified in this permit are needed to reflect the results of the test, a request for a permit modification or amendment pursuant to 30 TAC Section 305.69 or Section 305.62 shall be submitted with the test report.

I. <u>BOILERS</u>

Not Applicable.

J. <u>DRIP PADS</u>

Not Applicable.

[V.]

K. MISCELLANEOUS UNITS

Miscellaneous units and their approved waste types are shown in Table V.K. – Miscellaneous Units. The permittee is authorized to operate the miscellaneous units subject to the limitations contained in the permit application submittals referenced in Provision I.B. (Incorporated Application Materials), 40 CFR Part 264, Subpart X., and the following minimum conditions:

1. Trucks shall only be placed into the areas and shall only remain in the areas described by Permit Unit No. II.B.103 while preparing the waste for direct feed to the incinerator, while piping is being fitted in order to directly feed waste into the appropriate incinerator process, while feeding the waste into an incinerator process, and while removing piping. Each of these activities must be performed so as to minimize the amount of time that the truck is in the direct burn area.

2. Each miscellaneous unit shall be provided with secondary containment systems which meet the following minimum requirements:

   a. The secondary containment systems shall have a sloped base or shall be otherwise designed or operated to drain and remove liquids resulting from leaks, spills, or precipitation unless the containers are elevated or are otherwise protected from contact with accumulated liquids.

   b. The secondary containment systems shall be maintained free of cracks or gaps and must be sufficiently impervious to contain leaks, spills, or precipitation until the collected material is detected and removed.

3. A container holding hazardous waste must always be closed except when it is necessary to add or remove waste.

4. Containers (55-gallon) shall be stacked no greater than two containers high. Other containers shall be stacked no higher than the equivalent height of two 55-gallon containers.

5. Inspection aisles, at least two (2) feet wide, shall be maintained so that each row of containers has an adjacent aisle space to allow for the inspection of each container.

6. Pallets, which are capable of supporting the intended load, shall be placed between stacked layers of containers.

7. The permittee shall maintain a fifty-foot buffer zone between containers that store ignitable or reactive waste and the property boundary.

8. The permittee shall separate containers holding hazardous wastes which are incompatible with other containerized wastes by means of a dike, berm, wall, or other impermeable barrier.

[V.]

L. CONTAINMENT BUILDINGS

Not Applicable.

PERMIT SECTION VI – GROUNDWATER DETECTION MONITORING

A. GROUNDWATER MONITORING PROGRAM

The permittee shall design, construct and maintain a ground-water monitoring program to monitor area ground water throughout the active life of the facility and any post-closure care period. Groundwater monitoring at the facility shall at a minimum consist of a Detection Monitoring System for the permitted units noted in Provision VI.A.1.. The Detection Monitoring System shall yield groundwater samples from the uppermost aquifer which is identified in Provision VI.C.1. that represent the quality of background water and the quality of ground water at the point of compliance.

1. Identification of Detection Monitoring Program Units

The Detection Monitoring Program is specific to the RCRA-regulated unit (East Landfill; Permit Unit No. 98) listed in Table VI.B.3.b – Unit Groundwater Detection Monitoring System and as authorized by Provision V.G.1.c. for which groundwater detection monitoring requirements apply pursuant to 30 TAC Section 335.164. Permit Units No. 1 and 2 authorized by Provision V.G.1.a. and b. are subject to the requirements of Compliance Plan No. 580089.

2. Capabilities of Detection Monitoring Systems

The Detection Monitoring System shall yield groundwater samples from the uppermost aquifer/water-bearing zone that represent the quality of background water that has not been affected by operation of the regulated unit(s) and that represent the quality of ground water passing the point of compliance. This system shall be capable of detecting a release from the regulated unit to the ground water.

3. Point of Compliance

The point of compliance for the Detection Monitoring System is defined by a vertical plane, located along the entire periphery of each permitted unit, that extends down into the uppermost aquifer/water bearing zone underlying the regulated unit.

4. Detection Monitoring Program

The permittee is required to install and operate a Detection Monitoring System subject to the limitations contained herein. The Detection Monitoring System wells for each unit/area are listed in Table VI.B.3.b – Unit Groundwater Detection Monitoring System.

a. A Detection Monitoring System shall, at a minimum, consist of two categories of wells, Primary and Supplemental Background and Point of Compliance Wells, which will be used to establish groundwater quality for each RCRA-regulated unit.

[VI.A.4.a.]

(1) Background Wells are those wells that are unaffected by the operations of the unit. The Background Wells are depicted on the maps in Attachment VI.B.3. of the Park B Application (East Landfill Monitor Well Locations) and are also listed in Table VI.B.3.b – Unit Groundwater Detection Monitoring System.

(2) Point of Compliance (POC) Wells are used to demonstrate compliance with the Detection Monitoring Parameters which are depicted on the maps in Attachment VI.B.3. of the Part B application (East Landfill Monitor Well Locations) and are also listed in Table VI.B.3.b. – Unit Groundwater Detection Monitoring System.

b. The permittee shall determine groundwater quality in the uppermost aquifer throughout the active life of the facility and any post-closure care period in accordance with the parameter list and sampling schedule specified in Provisions VI.C.2. and VI.D.2., respectively.

c. The design, construction, maintenance and operation of the authorized components of the Detection Monitoring Program must be in accordance with this permit and approved Part B Permit Application Section VI.B., which is incorporated into this permit through permit Provision I.B..

B. CONSTRUCTION, CERTIFICATION, AND PLUGGING

Wells shall be constructed and maintained so groundwater samples are representative of the aquifer's water quality. A record of drilling and construction details demonstrating compliance with the terms of this permit section shall be prepared in accordance with Attachment E (Well Design and Construction Specifications). Wells constructed prior to issuance of this permit may be utilized as groundwater monitoring wells if they meet the standards of Attachment E (Well Design and Construction Specifications).

1. Well Construction

a. For all groundwater monitor wells to be constructed in accordance with this permit, the permittee shall notify the Executive Director to report the proposed monitor well location and screened interval at least thirty (30) days in advance of the anticipated date of installation or in accordance with an approved schedule for installation. Alternatively, a schedule for installation issued as part of an approved work plan shall constitute such notification. New well construction shall commence upon written approval of the Executive Director within the timeframes specified in this permit.

b. The permittee shall install the wells of the Detection Monitoring System and submit certification of this installation within sixty (60) days of installation, as described in Attachment E (Well Design and Construction Specifications). The Detection Monitoring Wells shall be installed in accordance with the schedule outlined in Attachment E (Well Design and Construction Specifications).

[VI.B.]

2. Replacement Wells

Prior to installation of a replacement well, the permittee shall submit to the Executive Director for approval, the replacement will specifications and an explanation of why the well is being replaced. For any Detection Monitoring System well to be considered a replacement well and not a new well, the well shall have no design changes from the well being replaced; shall be drilled within fifteen (15) feet of the well being replaced; and shall be installed in accordance with this Provision and Attachment E (Well Design and Construction Specifications).

3. Well Management Activities Requiring Permit Modification

a. If the permittee or the Executive Director determines that the well integrity, materials of construction, or well placement no longer enable a well to yield samples representative of groundwater quality from the desired aquifer(s), then the permittee shall submit a permit modification or amendment request to the Executive Director in accordance with the provisions of 30 TAC Sections 305.62 and 305.69, respectively, describing actions the permittee will take to remedy the situation. The permittee shall also notify the Executive Director within fifteen (15) days of such determination regarding a well.

b. The permittee shall submit a permit modification or amendment request to the Executive Director in accordance with the provisions of 30 TAC Sections 305.62 and 305.69, respectively, when new POC or Background Wells are to be constructed after issuance of this permit (i.e., if the wells have not been included in the approved Park B Permit Application materials referenced in permit Provision I.B.).

c. The permittee shall submit a permit modification or amendment request, for installation of a new well, to the Executive Director in accordance with the provisions of 30 TAC Sections 305.62 and 305.69, respectively, when any wells being replaced do not meet the requirements of Provision VI.B.2.for a replacement well.

4. Plugging and Abandonment Procedures

a. If a Detection Monitoring Well listed in Table VI.B.3.b – Unit Groundwater Detection Monitoring System is plugged and abandoned and a replacement well is not installed in accordance with this permit, then a modification request shall be submitted in accordance with 30 TAC Section 305.69 within 90 days of the plugging and abandonment procedure to update Table VI.B.3.b. – Unit Groundwater Detection Monitoring System of the permit.

b. For all wells to be plugged and abandoned after issuance of this permit, the permittee shall follow the procedures specified in Attachment E (Well Design and Construction Specifications).

[VI.B.4.]

c. The following existing supplemental monitoring wells shall be plugged in accordance with Provision VI.B.4.b. prior to construction of the East Landfill cells indicated below:

(1) Supplemental monitoring well MW-314.1 prior to construction of cell 1 of the East Landfill;

(2) Supplemental monitoring well MW-310.1 prior to construction of cell 2 of the East Landfill;

(3) Supplemental monitoring well MW-305.1 prior to construction of cell 4 of the East Landfill.

C. DETECTION MONITORING SYSTEM: OPERATION

1. Uppermost Aquifer/Water-Bearing Zone Monitored by the Detection Monitoring System

The Detection Monitoring System shall be designed to monitor the ground water in the uppermost aquifer/water-bearing zone. The term uppermost aquifer, as referenced by this permit, refers to significant transmissive strata in Zone 1/2, Zone 1/1A, and Zone 3, which are identified below, according to Section IV. (Geology Report) of the Part B application. Significant transmissive strata are defined herein as strata composed of soils which have a Unified Soil Classification of GW, GP, GM, GC, SW, SP, or SM, or a hydraulic conductivity greater than 1×10^{-5} cm/sec and which exceed two (2) feet in thickness.

Zone 1/2 — Zone 1/2 is the strata identified in the application as separate Zones 1 and 2 in the application which consist of interbedded lenticular deposits of gray and tan silty and sandy clay, clayey silt, sandy silt and clayey sand and which occur between the approximate elevation range of the surface at 25 feet above mean sea level (MSL) to 5 feet above MSL with some discontinuous sandy and clayey silt lenses to a depth of 20 feet below MSL,

Zone 1/1A — Zone 1A consists of channel deposits that are incised into Zones 2 and 3. Zone 1A deposits consist of loose to firm deposits of sandy silt, sandy clay, silty sand, clayey sand, sand and clay.

Zone 3 — Zone 3 consists of interbedded lenticular deposits of gray and tan sandy clay, clayey silt, silty sand and clayey sand with thin seams of fine sand. Zone 3 which is also described in the permit application as Stratum 3 varies in thickness from 13 to 28 feet, the top of which occurs between the approximate elevation range of 20 feet below mean sea level (MSL) to 40 feet below MSL.

[VI.C.]

2. Groundwater Detection Monitoring Parameters and Compliance

a. [30 TAC Section 335.164(1)] The permittee shall monitor wells listed in Table VI.B.3.b. – Unit Groundwater Detection Monitoring System. The uppermost aquifer's groundwater quality shall be evaluated based on the parameters listed in Table VI.B.3.c. – Groundwater Sample Analysis. Sampling and analysis for the Groundwater Detection Monitoring Parameters of Table VI.B.3.c. shall be conducted in accordance with analytical methods listed in the United States Environmental Protection Agency publication SW-846 Test Methods for Evaluating Solid Waste, Third Edition, November 1986, (U.S.EPA SW-846) and as listed in July 8, 1987 edition of the Federal Register and later editions.[30 TAC Section 335.164(1)]

b. Background groundwater quality for a monitoring parameter or constituent shall be based on a sequence of at least four samples, taken at an interval that assures, to the greatest extent technically feasible, that an independent sample is obtained. The permittee shall determine the concentrations of the detection monitoring parameters and water quality parameters listed in Table VI.B.3.c. – Groundwater Detection Monitoring Parameters for each sample collected.

c. Compliance with the Groundwater Detection Monitoring Parameters listed in Table VI.B.3.c is defined by the results of the data evaluation of Provision VI.D.4. wherein the groundwater monitoring data for each well does not exhibit evidence of contamination over background values. If any POC Well is determined to be noncompliant with Table VI.B.3.c. – Groundwater Detection Monitoring Parameters at any time during the Detection Monitoring Program, the permittee shall respond and report according to Provision VI.E.1..

3. Post-Closure Care Period

The regulated unit(s) listed in Provision VI.A.1. which are subject to detection monitoring shall remain in the Detection Monitoring Program during the active life of the unit(s) and during any applicable Post-Closure Care Period. After closure activities are completed for a specified unit and certification of closure is received by the Executive Director, any applicable Post-Closure Care Period shall begin. If the Post-Closure Care Period has expired and a Statistically Significant Increase (SSI) of the Groundwater Detection Monitoring Parameters of Table VI.B.3.c. has not been confirmed in the ground water, then the permittee shall notify the Executive Director in writing at least 30 days prior to discontinuing the Detection Monitoring Program for the specified unit. Within 90 days of the notification, the permittee shall submit a final report to the Commission for the specified unit. The final report shall include the information required by the annual report of Provision VI.G..

[VI.C.]

4. Waste Management of Recovered Groundwater

a. Recovered ground water from a Detection Monitoring Well may be managed as uncontaminated unless the permittee determines that a Table VI.B.3.c. – Groundwater Detection Monitoring Parameter has an SSI over background values.

b. Recovered ground water with known contamination which exceeds the Table VI.B.3.c. – Groundwater Detection Monitoring Parameters shall be managed as contaminated water.

D. SAMPLING AND ANALYSIS

1. Sampling and Analysis

The permittee shall follow the methods set out in EPA's RCRA Groundwater Monitoring Draft Technical Guidance Document (November 1992) or an alternate method approved by the Executive Director to collect and preserve samples withdrawn from groundwater monitoring wells. The collected samples shall be managed (i.e., Chain of Custody and handling procedure), analyzed, and statistically evaluated (i.e., Quality Assurance/Quality Control (QA/QC)) in accordance with the current edition of U.S. EPA Publication SW-846, Test Methods for Evaluating Solid Waste and American Society for Testing and Materials (ASTM) Standard Test Methods or other equivalent methods accepted by the Executive Director.

a. All groundwater analyses required by this permit shall be performed by a laboratory that uses a QA/QC program where all information, data, and resulting decisions are technically sound, statistically valid, and properly documented. All QA/QC program details shall be put in writing and assignments made to qualified personnel. At a minimum, the laboratory shall conform to the QA/QC program details described in the current edition of U.S. EPA Publication SW-846, Test Methods for Evaluating Solid Waste and American Society for Testing and Materials (ASTM) Standard Test Methods or other equivalent methods accepted by the Executive Director.

b. Groundwater analyses required by this permit shall utilize laboratory methods which are capable of measuring concentrations equal to or less than established background values.

c. Wells shall be sampled according to the Sampling and Analysis Plan (SAP) presented in approved Part B Application Section VI, which is hereby incorporated into this permit by reference. The Permittee or the Executive Director shall propose modifications, as necessary, to the SAP in order to achieve the Detection Monitoring Program objectives. Any and all revisions to the plan shall become conditions of this permit at the beginning of the next full quarter after approval by the Executive Director.

2. Sampling and Analysis Frequencies and Parameters

a. Frequencies of sampling shall be monthly, quarterly, semiannually or yearly, depending on the sampling objective. These periods of time are defined below:

(1) "Month" shall be a calendar month;

(2) "Quarter" shall be based on division of the calendar year (i.e., January through March, April through June, July through September, October through December);

(3) "Semiannual" shall be based on divisions of the calendar year (i.e., January through June, July through December) and consist of two consecutive quarters;

(4) "Annual" or "Year" shall be four consecutive quarters, beginning with the first quarter. Years shall be designated consecutively, beginning with the "first year", "second year", etc,; and,

(5) "Calendar year" shall be based on divisions of the calendar (i.e. January through December).

b. Sampling of wells shall commence during the first complete quarter after issuance of this permit, or during the first quarter of operation if the permit is issued for a new unit. Samples shall be collected during the first thirty (30) days of the specified sampling frequency.

c. In the first and subsequent years of the Detection Monitoring Program, the wells of Table VI.B.3.b. – Unit Groundwater Detection Monitoring System shall be sampled and analyzed according to the schedule listed in Table VI.B.3.c.

d. Field determination requirements for wells listed in Table VI.B.3.b – Unit Groundwater Detection Monitoring System consist of the following measurements or observations which shall be established during each sampling event:

(1) Water level measurements relative to Mean Sea Level measured to within 0.01 foot.

(2) Determination of pH, temperature, Specific Conductivity and Turbidity in nephelometric turbidity units (Note: Turbidity is only required is metals are being monitored in the GMDP in Table II), for each well.

(3) Descriptions of water sample appearance (clarity, color, etc.) shall be recorded.

[VI.D.2.d.]

(4) The total depth of each well, which is not equipped with a dedicated pump, shall be measured during each sampling event. The total depth of each well equipped with a dedicated pump shall be measured when pumps are removed for maintenance. At a minimum, the wells with dedicated pumps will be measured for depth every 3 years. The measured total depth shall be compared to the total depth recorded on the well construction log. Should an analysis of the measured and the recorded total depth reveal that the well is silting in, the permittee shall perform such actions necessary (redevelopment, replacement, etc.) to enable the well to function properly.

(5) All wells specified in this permit shall be inspected during each sampling event. Repairs or a proposal for replacement for any affected well shall be performed within (90) days of the routine sampling event inspection which identified the problem well.

3. Statistical Procedures for Data Evaluation

a. For each POC Well sampled during each sampling event, the permittee shall determine whether there is evidence of an SSI in the concentrations of each Groundwater Detection Monitoring Parameter of Table VI.B.3.c., when compared to the Background Well groundwater quality data. In determining whether or not an SSI has occurred for a Groundwater Detection Monitoring Parameter of Table VI.B.3.c. the permittee shall establish if the background values have been exceeded by utilizing the statistical procedures and data evaluation described in the following guidance:

(1) Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Interim Final Guidance, U.S. EPA, April 1989; and

(2) Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Addendum to Interim Final Guidance, U.S. EPA, June 1992.

b. The statistical procedures that shall be used to determine if an SSI has occurred over background valves in accordance with the approved statistical procedure described in Groundwater Monitoring Program of Section VI of the Part B Application for the East Landfill (Permit Unit No. 98) identified in Provision VI.A.1. To employ the approved statistical procedure, the permittee is required to collect a minimum of two (2) samples from each Background and POC Wells during each semi-annual sampling event.

c. If it is determined that the selected statistical procedure is not appropriate to conduct data evaluation for a specified unit, then the permittee shall select an alternate statistical procedure. Prior to using a statistical procedure which is different than the one identified in Provision VI.D.3.b. the permittee shall obtain approval from the Executive Director through a permit amendment or modification as specified in 30 TAC Sections 305.62 and 305.69, respectively.

[VI.D.]

4. Data Evaluation

a. Data evaluations shall be completed within (60) days of the sampling date unless QA/QC procedures show that data is unacceptable and re-analysis or resampling must be performed. In such cases, the Executive Director will be notified as soon as it becomes apparent that the 60-day time limit to conduct data evaluation cannot be met.

b. Data evaluation shall determine whether there is evidence of an SSI for Groundwater Detection Monitoring Parameters listed in Table VI.B.3.c. each time groundwater quality is determined at the POC in accordance with 30 TAC Section 335.163(7).

E. RESPONSE REQUIREMENTS FOR SSI

1. If the permittee has determined an SSI over background values for any of the Groundwater Monitoring Parameters identified in Table VI.B.3.c., in accordance with statistical procedures authorized by Provision VI.D.3. and specified by the permittee, the permittee shall perform the following actions;

a. Notify the Executive Director in writing, within seven (7) days. The notification must indicate which Groundwater Detection Monitoring Parameter(s) of Table VI.B.3.c. has exhibited an SSI.

b. Immediately sample the ground water in all wells of Table VI.B.3.b. – Unit Groundwater Detection Monitoring System which exhibit an SSI for the specified unit and determine whether constituents of Appendix IX of 40 CFR 264 are present, and if so, in what concentrations.

c. For any Appendix IX hazardous constituent found in the analysis pursuant to Provision VI.E.1.b., the permittee may resample for hazardous constituents within one month and repeat the analysis for those compounds detected. If the results of the second analysis confirm the initial results, then these detected constituents will form the basis for a Compliance Monitoring Program. If the permittee does not resample for the constituents found pursuant to Provision VI.E.1.b., the hazardous constituents found during the initial Appendix IX analysis will form the basis for the Compliance Monitoring Program.

d. Upon establishing that a release has occurred from a unit(s), the permittee shall submit to the Executive Director a permit amendment or modification to modify the Detection Monitoring Program and a compliance plan application to initiate a Compliance Monitoring Program and/or a Corrective Action Program for the specified unit(s). The permit and compliance plan applications must be submitted based on the following schedule:

[VI.E.1.d.]

(1) If ground water downgradient of the specified unit does not exceed the requirements in 30 TAC Section 335.158 for the proposed groundwater protection standard (GWPS), then within ninety (90) days, the permittee shall submit a permit amendment and a compliance plan application to establish a Compliance Monitoring Program for the specified unit;

(2) If ground water downgradient of the specified unit exceeds the requirements in 30 TAC Section 335.158 for the proposed GWPS requested in the application for a specified unit, and an Alternate Concentration Limit (ACL) is not being proposed in the application in accordance with 30 TAC Section 335.160(b) to establish the GWPS, then within 180 days, the permittee shall submit a permit amendment or modification and a compliance plan application to establish a Corrective Action Program for specified unit.

(3) If ground water downgradient of the specified unit exceeds the requirements in 30 TAC Section 335.158 for the proposed GWPS requested in the application for a specified unit, and an ACL is being proposed in the application in accordance with 30 TAC Section 335.160(b) to establish the GWPS, then within 180 days, the permittee shall submit a permit amendment or modification and a compliance plan application with an ACL demonstration to establish a Corrective Action Program for the specified unit.

2. If the permittee determines that there is an SSI above (or for pH, a statistically significant variation from) background values for the Groundwater Detection Monitoring Parameters specified in Table VI.B.3.c., the permittee may demonstrate a source other than the RCRA-regulated unit caused the increase or that the increase resulted form error in sampling, analysis, or evaluation. In such cases, the permittee shall perform the following actions:

a. Notify the Executive Director in writing within seven (7) days that the permittee intends to make a demonstration.

b. Within ninety (90) days, submit a report to the Executive Director which demonstrates that a source other than a RCRA-regulated unit caused the increase, or that the increase resulted from error in sampling, analysis, or evaluation.

c. Submit to the Executive Director an application for a permit amendment or modification and a compliance plan application to make any appropriate changes to the Detection Monitoring Program at the facility. The applications shall be submitted in accordance with Provision VI.E.1.d..

d. Continue to monitor ground water in accordance with the Detection Monitoring Program at the facility.

[VI.]

F. REVISED DETECTION MONITORING PROGRAM

If the permittee of the Executive Director determines that the Detection Monitoring Program no longer satisfies the requirements of 30 TAC Section 335.164, the permittee must, within ninety (90) days of either the permittee’s determination or Executive Director’s notification, submit a permit amendment or modification request to make any appropriate changes to the Detection Monitoring Program which will satisfy with the regulations.

G. ANNUAL DETECTION MONITORING REPORTING REQUIREMENTS

The permittee shall submit an Annual Detection Monitoring Report which shall include the following information determined since the previously submitted report:

1. A statement whether an SSI has occurred over background values in any well during the previous calendar year period and the status of any SSI events.

2. The permittee shall include the results of all monitoring, testing, and analytical work obtained or prepared pursuant to the requirements of this permit, including a summary of background groundwater quality values, groundwater monitoring analyses, statistical calculations, graphs and drawings.

3. The groundwater flow rate and direction in the uppermost aquifer. The groundwater flow rate and direction of ground water flow shall be established using the data collected during the preceding calendar year’s sampling events from the monitoring wells of the Detection Monitoring Program. The permittee shall also include in the report all documentation used to determine the groundwater flow rate and direction of ground water flow.

4. A contour map of piezometric water levels in the uppermost aquifer based at a minimum upon concurrent measurement in all monitoring wells. All data or documentation used to establish the contour map should be included in the report.

5. Recommendation for any changes

6. Any other items requested by the Executive Director.

H. RECORD KEEPING REQUIREMENTS

1. The permittee shall enter all monitoring, testing, analytical, statistical test computation data in evaluating groundwater monitoring data, and inspection data obtained or prepared pursuant to the requirements of this permit, including graphs and drawings, in the operating record at the facility.

2. The operating record at the facility shall be made available for review by the staff of the Commission upon request.

PERMIT SECTION VII – CLOSURE AND POST - CLOSURE REQUIREMENTS

A. FACILITY CLOSURE

1. The permittee shall follow the closure plan, developed in accordance with 40 CFR Part 264 Subpart G, 30 TAC Chapter 350, and contained in the permit application submittals identified in Provision I.B. (Incorporated Application Material).

   Additionally, facility closure shall also commence:

   a. Upon direction of the TCEQ for violation of the permit, TCEQ Rules, or State Statutes; or

   b. Upon suspension, cancellation, or revocation of the terms and conditions of this permit concerning the authorization to receive, store, process, or dispose of waste materials; or

   c. upon abandonment of the site; or

   d. Upon direction of the TCEQ for failure to secure and maintain an adequate bond or other financial assurances as required by Provision VII.B.1.; or

2. Request for Permit Modification or Amendment

   The permittee shall submit a written request for a permit modification or amendment to authorize a change in the approved Closure Plan(s), in accordance with 40 CFR 264.112 (c). The written request shall include a copy of the amended Closure Plan(s) for approval by the Executive Director.

3. Time Frames for Modification\Amendment Request Submittal

   The permittee shall submit a written request for a permit modification or amendment in accordance with the time frames in 40 CFR 264.112 (c)(3).

4. Closure Notice and Certification Requirements

   a. The permittee shall notify the Executive Director, in writing, at least 60 days prior to the date on which he expects to begin partial or final closure of a surface impoundment, or landfill unit or final closure of a facility with such a unit; or at least 45 days prior to the days on which he expects to begin partial or final closure of a facility with processing or storage tanks, container storage, or incinerator units; or at least 45 days prior to the date on which he expects to begin partial or final closure of a boiler or industrial furnace, whichever is earlier. A copy of the notice shall be submitted to the TCEQ Regional Office.

   b. The permittee shall notify the TCEQ Regional Office at least ten (10) days prior to any closure sampling activity required by the permit in order to afford regional personnel the opportunity to observe these events and collect samples.

[VII.A.]

5. Unless the Executive Director approves an extension to the closure period, as per the requirements of 40 CFR 264.113(b), the permittee must complete partial and final closure activities within 180 days after receiving the final volume of hazardous wastes at the hazardous waste management unit or facility.

6. As per the requirements of 40 CFR 264.115, within 60 days of completion of closure of each permitted hazardous waste surface impoundment, or landfill unit, and within 60 days of the completion of final closure, the permittee shall submit to the Executive Director, by registered mail, with a copy to the TCEQ Regional Office, a certification that the hazardous waste management unit or facility, as applicable, has been closed in accordance with the specifications in the approved Closure Plan and this permit. The certification, which shall be signed by the permittee and by an independent licensed professional engineer, must be in the form described in Provision II.A.6.. A closure certification report shall be submitted with the required certifications which includes a summary of the activities conducted during closure and the results of all analyses performed. The certification report shall contain the information required by Provision II.A.6. and, as may be applicable, 30 TAC §350.32 (Texas Risk Reduction Program [TRRP] Remedy Standard A) and 30 TAC §350.33 (TRRP Remedy Standard B). Documentation supporting the independent registered professional engineer's certification shall be furnished to the Executive Director upon request until the Executive Director releases the permittee from the financial assurance requirements for closure under 40 CFR 264.143(i).

7. For each disposal unit closed after permit issuance, the permittee shall submit documentation to demonstrate compliance with 40 CFR 264.116 (relating to survey plat) and 264.119 (relating to post-closure notices). Documentation to demonstrate compliance with survey plat requirements must be submitted to the TCEQ at the time of submission of the certification of closure. Documentation to show compliance with post-closure notices must be submitted to the TCEQ no later than 60 days after certification of closure.

8. Final closure is considered complete when all hazardous waste management units at the facility have been closed in accordance with all applicable closure requirements so that hazardous waste management activities under 40 CFR Part 264 and 265 are no longer conducted at the facility unless subject to the provisions in 40 CFR 262.34.

9. All units, sumps, pumps, piping and any other equipment or ancillary components which have come in contact with hazardous wastes shall either be decontaminated by removing all waste, waste residues, and sludges or be disposed of in a manner authorized at this facility or disposed of at an authorized off-site facility.

10. All contaminated equipment/structures, liners, dikes, and soils (i.e., debris) intended for land disposal shall be treated in a manner whish meets or exceeds the treatment standards for hazardous debris contained in 40 CFR 268.45 or removed and managed at an authorized industrial solid waste management facility.

[VII.A.]

11. All hard-surfaced areas within the hazardous waste management unit areas shall be decontaminated and the wash water generated treated and/or disposed of in a manner authorized at this facility or at an authorized off-site facility.

12. Verification of decontamination shall be performed by analyzing wash water, and as necessary, soil samples for the hazardous constituents which have been in contact with the particular item being decontaminated. In addition, the permittee shall perform visual inspections of the equipment/structures for visible evidence of contamination.

13. Unless it can be demonstrated that soil contamination is unlikely to have occurred, soils shall be sampled and analyzed. Sufficiently detailed analyses of samples representative of soils remaining in non-hard-surfaced areas of the storage and processing facility area shall be performed to verify removal or decontamination of all waste and waste residues.

14. Soil and/or wash-water samples shall be analyzed in accordance with the methods specified in the current editions of "Test Methods for the Evaluation of Solid Waste" (SW-846) or other methods which are officially recommended by the EPA.

15. Decontamination shall be deemed complete when no visible evidence of contamination is observed and when the results form verification sampling and analyses indicate wash water concentrations and/or soil concentrations are below the applicable critical PCL for Remedy Standard A. If the underlying soils are decontaminated or removed to the PCL for Remedy Standard A, Commercial/Industrial Land use, the permittee shall comply with the institutional controls requirements of 30 TAC Section 350.111 as required.

B. FINANCIAL ASSURANCE FOR CLOSURE

1. The permittee shall provide financial assurance for closure of all existing permitted units covered by this permit in accordance with the form outlined in 40 CFR Part 264, Subpart H in an amount not less than $11,924,766 as shown on Table VII.E.1. – Permitted Unit Closure Cost Summary. Financial assurance shall be secured and maintained in compliance with 30 TAC Chapter 37, Subchapter P, 335.152(a)(6) and 335.171. Financial assurance is subject to the following:

   a. Adjustments to Financial Assurance Amount:

      (1) At least 60 days prior to management of waste in proposed permitted units listed in Table VII.E.1, the permittee shall increase the amount of financial assurance required for closure by the amounts listed in Table VII.E.1. and shall submit additional financial assurance documentation.

[VII.B.1.a.]

(2) The amount of financial assurance for closure of existing units, as listed in TableVII.E.1, may be reduced (if the financial assurance has previously been increased in accordance with Provision VII.A.(1)) upon certification of closure of an existing permitted unit, in accordance with Provision VII.A.4. (Closure Notice and Certification Requirements), and upon written approval of the Executive Director.

b. Inflation Factor Correction

Financial assurance for closure, including any adjustments after permit issuance, shall be corrected for inflation according to the methods described by 30 TAC §37.131 and §37.141.

2. The permittee shall submit to the Executive Director, upon request, such information as may be required to determine the adequacy of the financial assurance.

C. STORAGE PROCESSING, COMBUSTION, AND MISCELLANEOUS UNIT CLOSURE REQUIREMENTS

The permittee shall close the storage, processing, and combustion units identified as in Tables V.B., V.C., V.H.1, and V.K. in accordance with the approved Closure Plans, 40 CFR Part 264, Subpart G, 40 CFR 264.178 (container storage), 264.197 (tanks), 264.351 (incinerators), 264 Subpart X (miscellaneous unit), and the Texas Risk Reduction Program of 30 TAC Chapter 350 and the following requirements.

1. If all contaminated soils cannot be removed or decontaminated to TRRP Remedy Standard A, the permittee shall close the tank system and perform post-closure care in accordance with the closure and post-closure requirements for landfills, 30 TAC §335.152(a)(5) and 30 TAC Chapter 350, Subchapter. A Contingent Closure and Post-Closure Plan must be submitted no later than 60 days (Closure Plan) or 90 days (Post-Closure Care Plan) form the date that the permittee or the Executive Director determines that the hazardous waste management unit must be closed as a landfill, subject to the requirements of 30 TAC 335.174, or no later than 30 days (Closure Plan) from that date if the determination is made during partial or final closure. Within 30 days of determining that the tank system must be closed as a landfill, the permittee shall submit a permit modification for closure and post-closure as a landfill.

2. Until Executive Director accepts certification both by the permittee and an independent licensed professional engineer submitted for Permit Units No. 5-8, these units remain subject to closure and financial assurance requirements of this permit.

D, SURFACE IMPOUNDMENT CLOSURE REQUIREMENTS

Not Applicable.

[VII.]

E. LANDFILL CLOSURE AND CERTIFICATION REQUIREMENTS

The permittee shall close the landfills identified as TCEQ Permit Unit No. 2 (North Landfill) and No. 98 (East Landfill) in accordance with the approved Closure Plan, 40 CFR Part 264, Subpart G, 40 CFR 264.310, TRRP Remedy Standard B of 30 TAC Chapter 350 Subchapter B, 30 TAC Section 335.174, and the following requirements:

1. At least 120 days prior to commencing final closure of the landfills listed in Provision VII.E. above, the permittee shall submit to the TCEQ an Affected Property Assessment Report (APAR), and a Response Action Plan (RAP) report in accordance with the requirements of 30 TAC Sections 350.91 and 94 for review and approval by the Executive Director.

2. Subject to the requirements of Provision VII.E.1., the permittee shall close each landfill cell using a final cover as follows:

   a. An interim cap consisting of a minimum of a two (2) foot thick layer of compacted clay-rich material meeting the material and compaction specifications of Provision V.G.3.b.. This layer shall be sloped upwards from the perimeter of the landfill at greater than 3.0% and less than 5.0% to a crown in the center of the landfill. The cover shall be maintained free of gully erosional features and vegetation.

   b. Interim cover shall be applied continuously during landfill operation progressing continuously as the waste material reaches the grade specified in the Part B permit application.

3. The permittee shall install the remaining final cover according to specifications in the Part B permit application and the following procedures:

   a. For the East Landfill, a minimum three (3) foot thick layer of compacted clay-rich soil meeting the construction, material and compaction specifications of Provision V.G.3.b.. This layer shall be sloped upwards from the perimeter of the landfill at greater than 3.0% and less than 5.0% to a crown in the center of the landfill.

   b. For the North Landfill, a minimum of two (2) foot (including 1-foot of interim cover) thick layer of compacted clay-rich soil meeting the construction, material and specifications of Provision V.G.3.b., overlying a geosynthetic clay liner (GCL) with a permeability of 5×10^{-9} cm/sec or less. This layer shall be sloped upwards from the perimeter of the landfill Cell 5 and 6 stability dike extensions at greater than 3.0% and less than 5.0% to a crown in the center of the landfill.

   c. For both the North and East Landfills, a continuous layer of 60 mil HDPE geomembrane shall be installed on the compacted clay-rich soil cover and shall be secured in an anchor trench at the perimeter dikes. The installation of the geomembrane shall be in accordance with the applicable requirements of Provision V.G.3.c..

[VII.E.3.]

d. For both the North and East Landfill, a drainage layer consisting of a geocomposite (8-oz non-woven geotextile thermally bonded to both sides of geonet) or a geosynthetic drainage net overlain by a protective geotextile filter fabric having a minimum transmissivity of $3x10^{-5}$ m^2/sec shall be installed over the geomembrane.

e. For both the North and East Landfills, a layer of uncompacted fertile cover soil not less than twenty four (24) inches thick shall be placed over the geocomposite layer. The topsoil shall be seeded with a mixture of persistent native grasses to establish a self-sustaining vegetative cover. The 24 inches of cover soil shall be sloped upwards from the perimeter of the landfill to the center of the landfill at greater than 3% and less than 5% and shall consist of the following two components:

i) A minimum of six (6) inches of top soil consisting of a clay loam material (USDA designation C1; USCS designation CL); and

ii) Eighteen (18) inches of fill consisting of sandy clay material (USDA designation SC; USCS designation CH)

f. For both the North and East Landfills, drainage structures shall be constructed around the landfill cell perimeter, along the dikes, in accordance with the specifications in the Part B permit application, and, as necessary, in other parts of the facility to promote drainage, prevent ponding, minimize surface water infiltration into the landfill cell, and minimize erosion of the landfill cell cover and perimeter containment levee.

4. After completion of the interim cover and final cover for a landfill cell, the permittee shall submit certification of proper construction of the cap in accordance with Provision II.A.6.. Each final cover certification shall be accompanied by a certification report which contains the results of all tests performed to verify proper construction. The permittee shall conduct whatever tests, inspections, or measurements are necessary in the judgment of the professional engineer for the engineer to certify that the landfill cap has been constructed in conformance with the design and construction specifications of this permit. The certification report shall, at a minimum, contain the following engineering plans and test results:

a. Scaled plain-view and east-west and north-south cross-sections which accurately depict the area boundaries and dimensions of the cover; surrounding natural ground surface elevation; minimum, maximum, and representative elevations of the base on which the interim cover was placed; minimum, maximum, and representative elevations of the upper surface of the interim and final covers; thickness, extent, and materials of component parts of the cover system.

b. For the compacted clay-rich soil, all tests required and at the frequency specified for constructed soil liners in Provisions V.G.3.b.. Soil moisture content determinations shall be performed on the interim cover during construction at a rate of at least one (1) a month and within 24 hours of installing the final cover.

[VII.E.4.]

c. For the HDPE liner:

All tests required as specified in Provision V.G.3.c..

d. For the sand drainage layer:

All tests required and at the frequency specified for the leachate collection drainage layer in Provision V.G.3.d..

e. For the topsoil layer:

Thickness determinations at a rate of at least one (1) determination by appropriate surveying techniques per every 10,000 square feet of topsoil placed.

5. The Permittee shall install a permanent benchmark at each corner of all closed landfill cells at the site within six (6) months after closure.

6. The Permittee shall install and maintain a permanent type of identification on all leachate riser pipes at the site denoting the landfill cell number as specified on “Attachment D” of this permit, and designation as primary or secondary leachate collection systems.

7. Within 60 days of completion of closure of each cell in the landfill, the Permittee shall submit to the Executive Director documentation demonstrating compliance with 40 CFR Part §264.119, pertaining to deed recordation.

8. Within 60 days of completion of closure of each landfill cell, the Permittee shall submit, as may be applicable, the Response Action Completion Report (RACR), and any additional information as required in 40 CFR Part 264, Subpart G, and by Provision VII.E. to the Executive Director certifying that the landfill has been closed in accordance with the specifications in the approved closure plan as required by 40 CFR §264.115.

F. CONTAINMENT BUILDINGS CLOSURE REQUIREMENTS

This section is not applicable to this facility.

G. FACILITY POST-CLOSURE CARE REQUIREMENTS

For each hazardous waste management unit which is closed as a landfill, the permittee shall conduct post-closure care of the unit for a period of at least 30 years after certification of closure of each respective unit. The post-closure period for each closed unit is specified in Table VII.G – Post-Closure Period. Post-closure care shall be performed in accordance with the Post-Closure Plans referenced in Provision I.B., 40 CFR 264.117, and the following requirements:

1. Maintain all storm water conveyance structures in good functional condition.

[VII.G.]

2. Maintain the cover on Permit Units No. 1, 2, and 98, such that the cover promotes drainage, prevents ponding, minimizes surface water infiltration, and minimizes erosion of the cover. Any desiccation cracks, erosion, gullying, or other damage shall be repaired upon observance.

3. Maintain a self-sustaining vegetative cover on the capped areas by periodic seeding, fertilizing, irrigation, and/or mowing.

4. Maintain all benchmarks at the facility.

5. Maintain the facility perimeter fence, manned or locked gates, and warning signs in good functional condition.

6. Ensure that all entrances to the facility have manned or locked gates.

7. Ensure that the TCEQ has access to the facility.

8. Prepare and submit the Biennial Report required by <u>Provision II.B.7.</u>.

9. Perform all ground-water monitoring and related activities specified in Compliance Plan 50089 (for Permit Units No. 1 and 2) and in <u>Provision VI.A.1.</u> of the permit (For Permit Unit No. 98).

10. Submit as may be applicable, the Post-Response Action Care Plan required by 30 TAC 350.33(k).

11. The permittee shall collect and remove pumpable liquids in the leak detection system sumps to minimize the head on the bottom of the liner.

12. All liquids removed from the leak detection systems shall be managed as hazardous waste.

13. The permittee shall maintain a record of the amount of liquids removed from each leak detection system sump at least monthly during the post-closure period.

14. The permittee may record the amount of liquids removed from the each leak detection system sump quarterly or semi-annually during the post-closure period, after the final cover is installed, provided that the liquid level in the sump stays below the pump operating level for two consecutive months or quarters, respectively.

15. If at any time during the post-closure care period the pump operating level is exceeded at units on quarterly or semi-annual recording schedules, the permittee shall return to monthly recording of amounts of liquids removed from each leak detection system sump until the liquid level again stays below the pump operating level for two consecutive months.

[VII.G.]

16. The permittee shall determine if all the action leakage rate specified for Permit Unit No. 98 in Table V.G.1 has been exceeded by converting the monthly flow rate from the monitoring data obtained under Provisions VII.G.13. to an average daily flow rate (gallons per acre per day) for each sump. The permittee shall calculate the average daily flow rate for each sump on a monthly basis during the post-closure care period.

17. If the action leakage rate is exceeded at any time during the post-closure period, the permittee shall perform the following minimum activities:

    a. Notify the Executive Director in writing of the exceedence within seven (7) days of the determination;

    b. Submit a preliminary written assessment to the Executive Director within fourteen (14) days of the determination, as to the amount of liquids, likely sources of liquids, possible location, size, and cause of any leaks, and short-term actions taken and planned;

    c. Determine to the extent practicable the location, size and cause of any leak;

    d. Determine whether any waste should be removed from the unit for inspection, repairs, or controls;

    e. Determine any other short-term and longer-term actions to be taken to mitigate or stop any leaks; and

    f. Within 30 days after the notification that the action leakage rate has been exceeded, submit to the Executive Director the results of the analyses specified in Provisions VII.G.17.c., d., and e. the results of actions taken, and actions planned. Monthly thereafter, as long as the flow rate in the leak detection system exceeds the action leakage rate, the permittee shall submit to the Executive Director a report summarizing the results of any remedial actions taken and actions planned.

18. To make the leak and/or remediation determinations in Provisions VII.G.16.c.d., and f. the permittee shall:

    a. Assess the source of liquids and amounts of liquids by source;

    b. Conduct a fingerprint, hazardous constituent, or other analyses of the liquids in the leak detection system to identify the source of liquids and possible location of any leaks, and the hazard and mobility of the liquid; and

    c. Assess the seriousness of any leaks in terms of potential for escaping into the environment; or

    d. Document why such assessments are not needed.

[VII.G.]

19. General Post-Closure Requirements

Request for Permit Modification or Amendment
The permittee shall submit a written request for a permit modification or amendment to authorize a change in the approved Post-Closure Plan(s) in accordance with 40 CFR 264.118(d)(2). The written request shall include a copy of the amended Post-Closure Plan(s) for approval by the Executive Director.

Time Frames for Modification/Amendment Request
The permittee shall submit a written request for a permit modification or amendment in accordance with the time frames in 40 CFR 264.118 (d)(3).

20. Post-Closure Notice and Certification Requirements

No later than 60 days after completion of the established post-closure period for each unit, the owner or operator shall submit to the Executive Director, by registered mail with a copy to the TCEQ Regional Office, a certification that the post-closure period for the unit was performed in accordance with the specifications of the approved Post-Closure Plan and this permit. The certification shall be signed by the permittee and a licensed professional engineer. Documentation supporting the independent licensed professional engineer's certification must be furnished to the Executive Director upon request until the Executive Director releases the owner or operator from the financial assurance requirements for post-closure under 40 CFR 264.145 (i).

H. POST-CLOSURE FINANCIAL ASSURANCE REQUIREMENTS

1. The permittee shall provide financial assurance for post-closure care of all existing units required by this permit in an amount no less than $5,234,159 as shown on Table VII.E.2. – Permitted Unit Post Closure Cost Summary. Financial assurance shall be secured and maintained in compliance with 30 TAC Chapter 37 Subchapter P, 335.152(a)(6) and 335.179.

   a. At least 60 days prior to management of waste in proposed permitted units listed in Table VII.E.2, the permittee shall increase the amount of financial assurance required for closure by the amounts listed in Table VII.E.2. and shall submit additional financial assurance documentation.

   b. Inflation Factor Correction

   During the active life of each disposal unit or unit required to have contingent post closure care, financial assurance for post-closure care shall be corrected for inflation according to the methods described by 30 TAC §37.131 and §37.141.

2. The permittee shall submit to the Executive Director, upon request, such information as may be required to determine the adequacy of the financial assurance.

PERMIT SECTION VIII – LIABILITY REQUIREMENTS

A. SUDDEN AND NONSUDDEN ACCIDENTAL OCCURRENCES

1. The permittee shall demonstrate continuous compliance with the requirements of 30 TAC Chapter 37, Subchapter P, and §335.152(a)(6) to maintain liability coverage for sudden and accidental occurrences of at least $1 million per occurrence, with an annual aggregate of at least $2 million, exclusive of legal defense costs.

2. The permittee also shall demonstrate continuous compliance with the 30 TAC Chapter 37, Subchapter P, and §335.152(a)(6) requirement to have and maintain liability coverage for nonsudden accidental occurrences in the amount of at least $3 million per occurrence, with an annual aggregate of at least $6 million, exclusive of legal defense costs.

3. The permittee may combine the required per-occurrence coverage levels for sudden and nonsudden accidental occurrences into a single per-occurrence level, and combine the required annual aggregate coverage levels for sudden and nonsudden accidental occurrences into a single annual aggregate level. Owners or operators who combine coverage levels for sudden and nonsudden accidental occurrences shall maintain liability coverage in the amount of at least $4 million per occurrence and $8 million annual aggregate.

B. INCAPACITY OF OWNERS OR OPERATORS, GUARANTORS, OR FINANCIAL INSTITUTIONS

The permittee shall comply with 40 CFR 264.148, regarding bankruptcy, whenever necessary.

PERMIT SECTION IX – CORRECTIVE ACTION FOR SOLID WASTE MANAGEMENT UNITS

Reserved – Corrective Action for Solid Waste Management Units are addressed through the facility Compliance Plan.

PERMIT SECTION X – AIR EMISSION STANDARDS

A. PROCESS VENTS AND EQUIPMENT LEAKS

1. Emissions from this facility must not cause or contribute to a condition of “Air Pollution” as defined in Section 382.003 of the Texas Health and Safety Code Ann. or violate Section 382.085 of the Texas Health and Safety Code Ann. If the Executive Director of the TCEQ determines that such a condition or violation occurs, the permittee shall implement additional abatement measures as necessary to control or prevent the condition or violation.

2. Requirements for Subpart AA and BB

    a. The permittee must comply with the requirements of 30 TAC Sections 335.152(a)(17)/40 CFR Part 264 Subpart AA and 30 TAC Section 335.152(a)(18)/40 CFR Part 264 Subpart BB, as applicable.

[X.A.2.]

b. The permittee shall include in the Biennial Report, required in Provision II.B.7., a statement that hazardous waste management units or associated ancillary equipment at this facility are not subject to any of the requirements in Provision X.A.2.a., if these requirements are not applicable to any hazardous waste management units or associated ancillary equipment at this facility. If at any time any hazardous waste management units or associated ancillary equipment become subject to the requirements in Provision X.A.2.a., the permittee must immediately comply with these requirements.

c. Requirements for Subpart CC

The permittee must comply with the requirements of 40 CFR Part 264 Subpart CC, as applicable.

PERMIT SECTION XI – LIST OF ATTACHMENTS

A – Legal Description of Facility

B – Facility Map

C – List of Incorporated Application Materials

D – List of Permitted Facility Units

E – Well Design and Construction Specifications

F – Compounds Detrimental to HDPE Liners

G – Waste Constituents Subject to TCEQ Air Quality Headspace Analysis Limitations

TABLE III.D INSPECTION SCHEDULE

Facility Unit(s) and Basic Elements	***Possible Error, Malfunction, or Deterioration***	***Frequency of Inspection***
Closed South Landfill (Permit Unit 01)	• Cap: Deterioration, cracks, cave-in, ponding • Banks: Deterioration, cracks, cave-in • Run-On/Run-Off Control Systems: Deterioration, malfunction, improper operation • Leachate Collection/Removal System: Presence of leachate, improper operation	• Weekly and After Storms
Active North Landfill (Permit Unit 02) East Landfill (when constructed) (Permit Unit 98)	• Cap: Deterioration, cracks, cave-in, ponding • Banks: Deterioration, cracks, cave-in • Run-On/Run-Off Control Systems: Deterioration, malfunction, improper operation • Leachate Collection/Removal System: Presence of leachate, improper operation ♦ Leak Detection System: Amount of liquids removed	• Weekly and After Storms ♦ Weekly (During the Active Life and Closure Period); Monthly (After Closure)
Train I and Train II Incinerators (Permit Unit 03 and 04)	• Pumps, Valves, Piping, air pollution control equipment: Presence of leaks, spills, fugitive emissions, evidence of tampering • CO and O_2 CEMS: Calibration check and system audit ♦ Automatic Waste Feed Cutoff and Alarms: Operation malfunction ■ CO and O_2 CEMS: calibration error test ► CO and O_2 CEMS: calibration drift test, response time test, and alternative relative accuracy test	• Daily ♦ Weekly (When burning hazardous waste) ■ Quarterly ► Annual • Daily (calibration drift test)

TABLE III.D INSPECTION SCHEDULE (CON'D)

Facility Unit(s) and Basic Elements	***Possible Error, Malfunction, or Deterioration***	***Frequency of Inspection***
Container Storage Areas (Permit Units 76a-h, 77-79, 90-92, 101,104,105)	• Wet spots in loading and unloading areas ♦ Leaks, seeps, wet spots in other areas ♦ Labels legible ♦ Containment integrity ♦ Container deterioration	• Daily ♦ Weekly
Tanks (Permit Units 09-31, 37-41, 44-46, 87-89, 93-96 and 100)	• Overfill Control Equipment: Deterioration, clogging, sticking, alarm malfunction • Instrumentation: Alarms and level devices verified • Foundation: Cracks, settlement, erosion, wet spots • Structural Support: Cracks, deterioration, damage • Piping Connections: Deterioration, cracks, leaks • Protective Coating: Rust spots, blisters • Tank Exterior: Cracks, Deterioration, damage, buckles, bulges, leaks • Containment: Cracks, erosion, deterioration • Sump Area: Cracks, settlement, erosion, wet spots • Secondary Containment: Leak detection system • Pumps: Leaks, deterioration, power supply • Piping: Leaks, deterioration • Valves: Leaks, deterioration • Structural Supports: Deterioration, cracks, damage ♦ Leak Collection/Removal System: Presence of liquids, improper operation ► Corrosion Protection System: Operation malfunction and/or deterioration ► Tank Shell: Thinning, pitting, weld attack * Tank Shell: Structural integrity	• Daily ♦ Weekly ► Annually * First year and every 5 yrs. thereafter

TABLE III.D INSPECTION SCHEDULE (CON'D)

Facility Unit(s) and Basic Elements	***Possible Error, Malfunction, or Deterioration***	***Frequency of Inspection***
Miscellaneous Units Pug Mill (Permit Unit 97) PCB Shredder (Permit Unit Number 106)	• Control Equipment: Deterioration, clogging, sticking, alarm malfunction • Instrumentation: Alarms and level devices verified • Foundation: Cracks, settlement, erosion, wet spots • Structural Support: Cracks, deterioration, damage • Connections: Deterioration, cracks, leaks • Unit Exterior: Cracks, Deterioration, damage, buckles, bulges, leaks • Containment: Cracks, erosion, deterioration • Sump Area: Cracks, settlement, erosion, wet spots • Secondary Containment: Leak detection system • Structural Supports: Deterioration, cracks, damage ♦ Leak Collection/Removal System: Presence of liquids, improper operation ► Corrosion Protection System: Operation malfunction and/or deterioration ► Unit Shell: Thinning, pitting, weld attack * Unit Shell: Structural integrity	• Daily ♦ Weekly ► Annually * Annually First year and every 5 yrs. Thereafter

TABLE III.D INSPECTION SCHEDULE (CON'D)

Facility Unit(s) and Basic Elements	***Possible Error, Malfunction, or Deterioration***	***Frequency of Inspection***
Miscellaneous Units Railcar Unloading Pad (Permit Unit 99) Container QC Area (Permit Unit 102) Direct Burn Pads (Permit Unit 103)	• Wet spots in loading and unloading areas ♦ Leaks, seeps, wet spots in other areas ♦ Labels legible ♦ Containment integrity ♦ Container deterioration	• Daily ♦ Weekly
General Facility: Emergency Response/Safety Equipment	• Alarm systems: Power failure, verified • Emergency Eyewash/Showers: Water pressure, leakage, drainage • Self-Contained Breathing Apparatus: Tank empty, delivery system, quantity ► Respirators/Gas Masks: Seals, valves, appropriate quantity and sizes ► Fire extinguishers	• Monthly ► Monthly/after use
Security	• Fence: Breach, damage • Gates: Damage, operable • Warning Signs: Deterioration, missing, legible	• Monthly

TABLE III.E.2 EMERGENCY EQUIPMENT

Equipment	***Location***	***Physical Description***	***Capabilities***
Fire Extinguishers	Landfill	10,20,30-lb, Class ABC	Extinguish small fires
Safety Shower/Eye Wash Station	Landfill	Emergency shower and eye wash station	Personnel Decontamination
Fire Extinguishers	Administration Building	10,20,30-lb, Class ABC	Extinguish small fires
Fire Extinguishers	Laboratory	10,20,30-lb, Class ABC	Extinguish small fires
Safety Shower/Eye Wash Station	Laboratory	Emergency shower and eye wash station	Personnel Decontamination
Scott Air Pack	Laboratory	Cyl. With 30 min. of air supply	Entry to specific areas
5 Min. Escape Pack	Laboratory	5 minute unit	Escape
Fire Extinguishers	S & E Building	10,20,30-lb, Class ABC	Extinguish small fires
Safety Shower/Eye Wash Station	S & E Building	Emergency shower and eye wash station	Personnel Decontamination
Fire Extinguishers	Process Area	10,20,30-lb, Class ABC	Extinguish small fires
Safety Shower/Eye Wash Station	Process Area	Emergency shower and eye wash station	Personnel Decontamination
Scott Air Pack	Process Area	Cyl. With 30 min. of air supply	Entry to specific areas
5 Min. Escape Pack	Process Area	5 minute unit	Escape
Spill Response Equip.	Process Area	Varies	Contain & clean spills

TABLE III.E.2 EMERGENCY EQUIPMENT (CONT'D)

Equipment	***Location***	***Physical Description***	***Capabilities***
Pumper Truck	On-Site	Foam/water Pumper – 5 man cab	1500 gpm pump – 1250 gpm deck gun, 500 gallons foam – 1000 gallons water, 1000 feet 5" hose plus 500 feet 2.5" hose, 300 feet 1.5" reconnects
Emergency Response Truck	On-Site	4 wheel drive ¾ ton	6 person cab, front winch – rear hoist, 6 SCBA and 6 spare bottles, First aid and rescue equipment
Emergency Response Truck	On-Site	Ford Pickup – 4 passenger	CIMA, SK, Mutual Aid Radio, Cellular phone, Emergency support documentation and equipment
First Aid Room	On-Site	--	A complete TRAUMA kit (bandaging supplies, splints, cold packs, air way devices), non-prescription medications and ointments, back board
Fire Extinguishers	Plant Wide	10,20,30-lb, Class ABC	Extinguish small fires
Safety Shower/Eye Wash Station	Plant Wide	Emergency shower and eye wash station	Personnel Decontamination
Scott Air Pack	Plant Wide	Cyl. With 30 min. of air supply	Entry to specific areas

TABLE III.E.2 EMERGENCY EQUIPMENT (CONT'D)

Equipment	***Location***	***Physical Description***	***Capabilities***
5 min. Escape Pack	Plant Wide	5 minute unit	Escape
Emergency Communication System	Plant Wide	Code horns accessed by plant phone system	Alerts personnel of location of fire or spill
Plant Radio System	Plant Wide	----	Communication with personnel
Portable, Hand Held Radios	Plant Wide	----	For communication purposes
Intercom	Plant Wide	Phones/Speakers	Communications
Fire Extinguishers	Operations Building	10,20,30-lb, Class ABC	Extinguish small fires
Scott Air Pack	Operations Building	Cyl. with 30 min. of air supply	Entry to specific areas

TABLE IV.B WASTES MANAGED IN PERMITTED UNITS

No.	*Waste*	*EPA Hazardous Waste Numbers*	*TCEQ Waste Form Codes and Classification Codes*
1	Plant Refuse / Office Trash	None	9032
2	Lab Waste	All acceptable EPA waste numbers*	009H
3	PCB Contaminated Truck Washings	None	2191
4	Water Treatment Sludge (Filter Cake)	All acceptable EPA waste numbers except D001-D003*	504H
5	Leachate	F039	116H
6	Incinerator Ash	All acceptable EPA waste numbers except D001-D003*	303H
7	Lubricating Oil	None	2061
8	Hazardous Sludges – Tank Cleanouts	All acceptable EPA waste numbers*	695H
9	Spent Solvents	F001-F005	204H
10	Liquid, Listed Hazardous, Combustible, Flammable, Corrosive	F001-F005	219H
11	PCB Transformers	None	3961
12	Construction Debris	None	3903
13	PCB Contaminated PPE/Spill Cleanup	None	3941
14	PCB Contaminated Containers	None	3081
15	Scrubber Blowdown Process Wastewater	All acceptable EPA waste numbers except D001-D043*	115H
16	RCRA – Empty Crushed Drums	None	3081
17	PCB Coupling, Capacitors, Bushings	None	397H
18	Wooden Pallets	None	4882

TABLE IV.B WASTES MANAGED IN PERMITTED UNITS

No.	***Waste***	***EPA Hazardous Waste Numbers***	***TCEQ Waste Form Codes and Classification Codes***
19	Tellerettes	None	4031
20	Spent Carbon	D001	404H
21	Recovered Groundwater	F039	116H
22	Stabilized Incineration Residuals	All acceptable EPA waste numbers except D001-D043*	303H
23	Stormwater Runoff	None	1191
24	PCB Decontamination Water	None	1141
25	RCRA Decontamination Washwater (Active Landfill)	All acceptable EPA waste numbers except D001-D043*	114H
26	Construction Debris	None	3902
27	Contaminated Construction Debris	All acceptable EPA waste numbers*	319H
28	RCRA Decontamination Washwater (Mix Building)	All acceptable EPA waste numbers*	219H
29	Contaminated PPE, Spill Cleanup, Satellite Accumulation Waste	All Acceptable EPA waste numbers*	319H
30	Recovered Groundwater	None	1191
31	Tellerette Rinsate	All acceptable EPA waste numbers except D001-D003*	119H

TABLE IV.B WASTES MANAGED IN PERMITTED UNITS

No.	***Waste***[1]	***EPA Hazardous Waste Numbers***	***TCEQ Waste Form Codes and Classification Codes***
101	Inorganic Liquids	All permitted EPA waste numbers	H, 1, 2, 3
102	Organic Liquids	All permitted EPA waste numbers	H, 1, 2, 3
103	Water-based Sludges	All permitted EPA waste numbers	H, 1, 2, 3
104	Inorganic Sludges	All permitted EPA waste numbers	H, 1, 2, 3
105	Organic Sludges	All permitted EPA waste numbers	H, 1, 2, 3
106	Inorganic Solids	All permitted EPA waste numbers	H, 1, 2, 3
107	Organic Solids	All permitted EPA waste numbers	H, 1, 2, 3
108	PCB Wastes[2]	N/A	N/A
109	Contaminated Gases	All permitted EPA waste numbers	H, 1, 2, 3
110	Contaminated Soils	All permitted EPA waste numbers	H, 1, 2, 3
111	Incinerator Ash	All permitted EPA waste numbers	H, 1, 2, 3
112	Dioxin Wastes	F020, F021, F022, F023, F026, F027, F028	H, 1, 2, 3

[1]includes both on-site and off-site wastes
[2]PCB’s or non-hazardous industrial solid waste contaminated only with PCB’s

TABLE IV.C. SAMPLING AND ANALYTICAL METHODS

Waste No.[1]	*Sampling Location*[2]	*Sampling Method*[3]	*Frequency*	*Parameter*[4]	*Test Method*[3]	*Desired Accuracy Level*[7]
101 102	Truck sampling rack Railcar area Warehouse Tank farm Direct Burn area QA/QC area	COLIWASA, tubing, thief, or sampling valve (for tank samples)	One per shipment or blend/batch unless exempted by WAP.	**Fingerprint analyses:**		
				Physical description	ASTM D4979	duplicates must match
				pH / water reactivity	SW-846 9045C	Ck Std ± 1.0 S.U.
				Ignitability screen	ASTM D4982	duplicates must match
				Viscosity	ASTM D4212	Ck Std ± 20%
				Radioactivity screen	Manufacturer manual	Source check must meet manufacturer specifications
				Process analyses for incineration:		
				Heat of combustion	ASTM D240	Ck Std ± 5%
				Ash content	ASTM D5468	Ck Std ± 20% or Duplicates RPD =< 20%
				Chlorides	ASTM D2361 SW-846 9056	Ck Std ± 10% MS Recovery ± 10%
				Metals	SW-846 6010B SW-846 7470A	MS Recovery ± 25% MS Recovery ± 25%
				Supplemental analyses:		
				Specific gravity	ASTM D1298	Ck Std ± 0.1
				Bulk density	ASTM D5057	Duplicates RPD =<20%
				Halogens	SW-846 9056	MS Recovery ± 10%
				Acid scrub	EPA 305.2	Duplicates RPD =<20%
				Total organic carbon	EPA 415.1	MS Recovery ± 20%
				Reactive cyanides / sulfides,	SW-846 9010 / 9030	Ck Std ± 15%
				Organic screen by GCMS	SW-846 8260B SW-846 8270C	MS recovery within lab limits* MS recovery within lab limits*

1 From Table IV.B, first column
2 These are the primary sampling locations only.
3 See WAP for additional methods.
4 Not all parameters apply to each sample. See WAP for more details
7 Ck Std – check standard; MS – matrix spike; RPD – relative percent difference *Organic methods QC sample recovery limits are analyte specific and are determined using EPA guidelines.

TABLE IV.C. SAMPLING AND ANALYTICAL METHODS (Cont'd)

Waste No.[1]	***Sampling Location***[2]	***Sampling Method***[3]	***Frequency***	***Parameter***[4]	***Test Method***[3]	***Desired Accuracy Level***[7]
103 104 105	Bin storage area Receiving area Warehouse Truck sampling rack QA/QC area	COLIWASA, tubing, or thief	One per shipment or blend/batch unless exempted by the WAP.	*see waste #101 above*	*see waste #101 above*	*see waste #101 above*
106 110 111	Bin storage area Receiving area Warehouse Truck sampling rack Railcar area QA/QC area	Tubing, thief, trier, auger, scoop, or shovel	One per shipment or blend/batch unless exempted by the WAP.	*see waste #101 above* If applicable: **Process Analyses for landfill:** Organic screening by GCMS TCLP metals Free liquids test[5]	*see waste #101 above* *above* SW-846 8260B SW-846 8270C SW-846 1311 SW-846 6010B SW-846 7470A SW-846 9095	*see waste #101 above* MS recovery within lab limits* MS recovery within lab limits* Not applicable MS Recovery $\pm$ 25% MS Recovery $\pm$ 25% duplicates must match

1 From Table IV.B, first column
2 These are the primary sampling locations only.
3 See WAP for additional methods
4 Not all parameters apply to each sample. See WAP for more details
5 Free liquids test is rum on each bin if a visual inspection is inconclusive.
7; MS – matrix spike; *organic methods QC sample recovery limits are analyte specific and are determined using EPA guidelines.

TABLE IV.C. SAMPLING AND ANALYTICAL METHODS (Cont'd)

Waste No.[1]	*Sampling Location*[2]	*Sampling Method*[3]	*Frequency*	*Parameter*[4]	*Test Method*[3]	*Desired Accuracy Level*[7]
107	Bin storage area Receiving area Warehouse Truck sampling rack Railcar area QA/QC area	Tubing, thief, trier, auger, scoop, or shovel	One per shipment or blend/batch unless exempted by the WAP.	*see waste #101 above*	*see waste #101 above*	*see waste #101 above*
108	Tank farm Direct burn area Receiving area PCB warehouse Truck sampling rack Railcar area QA/QC area	COLOWASA, Tubing, thief, trier, auger, scoop, or shovel	One per shipment or blend/batch unless exempted by the WAP.	*see waste #101 above* Plus: PCBs	*see waste #101 above* ASTM D4059	*see waste #101 above* MS Recovery ± 20%
112	Warehouse QA/QC area	COLOWASA, Tubing, thief, trier, auger, scoop, or shovel	One per shipment or blend/batch unless exempted by the WAP.	Fingerprint analyses: physical description pH/ water reactivity Ignitability screen Radioactivity screen	 ASTM D4979 SW-846 9045C ASTM D4982 Manufacturer manual	 duplicates must match Ck Std ± 1.0 S.U. duplicates must match Source check must meet manufacturer specifications

1 From Table IV.B, first column
2 These are the primary sampling locations only.
3 See WAP for additional methods.
4 Not all parameters apply to each sample. See WAP for more details
7 MS – matrix spike

TABLE IV.C. SAMPLING AND ANALYTICAL METHODS (Cont'd)

Waste No.[1]	*Sampling Location*[2]	*Sampling Method*[3]	*Frequency*	*Parameter*[4]	*Test Method*[3]	*Desired Accuracy Level*[7]
3,24	Truck sampling rack	COLIWASA or tubing	As needed	PCBs	ASTM 4059	MS Recovery ± 20%
4	Filter press area, bin storage area	Scoop, or shovel	1/quarter	Full Organic Analysis		
				Volatile organics	SW-846 8260B	MS recovery within lab limits*
				Semivol. organics	SW-846 8270C	MS recovery within lab limits*
				Amenable cyanide	SW-846 9012A	MS Recovery ± 25%
				Chlorinated herbicides	SW-846 8151A	MS recovery within lab limits*
				Cyanide, total	SW-846 9012A	MS Recovery ± 25%
				Dioxins/Furans	SW-846 8280A	MS recovery within lab limits*
				Nonhalogenated organics	SW-846 8015B	MS recovery within lab limits*
				Organochlorine pesticides	SW-846 8081A	MS recovery within lab limits*
				PCB's	SW-846 8082	MS recovery within lab limits*
				Carbamates	SW-846 8321A	MS recovery within lab limits*
			3/ week	Organic Screening By GC or GCMS		
				Volatile organics	EL8021S	MS recovery within lab limits*
					EL8260S	MS recovery within lab limits*
				Semivol. organice	EL8080S	MS recovery within lab limits*
					EL8270S	MS recovery within lab limits*
			1/ bin or 1/ mix batch	TCLP metals	SW-846 1311	Not applicable
					SW-846 6010B	MS Recovery ± 25%
					SW-846 7470A	MS Recovery ± 25%
				Free liquids test[5]	SW-846 9095	Duplicates must match

1 From Table IV.B, first column
2 These are the primary sampling locations only.
3 See WAP for additional methods
4 Not all parameters apply to each sample. See WAP for more details
5 Free liquids test is run on each bin if a visual inspection is inconclusive.
7 MS – matrix spike; *organic methods QC sample recovery limits are analyte specific and are determined using EPA guidelines.

TABLE IV.C. SAMPLING AND ANALYTICAL METHODS (Cont'd)

Waste No.[1]	*Sampling Location*[2]	*Sampling Method*[3]	*Frequency*	*Parameter*[4]	*Test Method*[3]	*Desired Accuracy Level*[7]
5	Leachate collection tanks	COLIWASA or Tubing	As needed	TOC Metals	EPA 415.1 SW-846 6010B SW-846 7470A	MS Recovery ± 20% MS Recovery ± 25% MS Recovery ± 25%
6	Rotary Reactor ash dropout 3.6m kiln ash dropout 4.4m kiln ash dropout Bin storage area	Scoop, or shovel	1/ quarter	Full Organics Analysis	*See Waste #4 above*	*See Waste #4 above*
			1/bin[6]	Organics Screening By GC or GCMS	*See Waste # 4 above*	*See Waste # 4 above*
			1/bin or 1/ mix batch	TCLP metals Free liquids test[5]	SW-846 1311 SW-846 6010B SW-846 7470A SW-846 9095	Not applicable MS Recovery ± 25% MS Recovery ± 25% Duplicates must match
22	Bin storage area S&E Building	Scoop, or Shovel	1/ batch	TCLP metals	SW-846 1311 SW-846 6010B SW-846 7470A	Not applicable MS Recovery ± 25% MS Recovery ± 25%

1 From Table IV.B, first column
2 These are the primary sampling locations only.
3 See WAP for additional methods.
4 Not all parameters apply to each sample. See WAP for more details
5 Free liquids test is run on each bin if a visual inspection is inconclusive.
6 Volatile organics are run on one bin per day. Semivolatile organics are run on every bin except Rotary Reactor Ash which is run on one bin per day.
7 MS – matrix spike; *organic methods QC sample recovery limits are analyte specific and are determined using EPA guidelines.

TABLE IV.C. SAMPLING AND ANALYTICAL METHODS

Waste No.[1]	*Sampling Location*[2]	*Sampling Method*[3]	*Frequency*	*Parameter*[4]	*Test Method*[3]	*Desired Accuracy Level*[7]
27	Point of generation	Scoop or shovel	1/ event	Volatile organics	SW-846 8260B	MS recovery within lab limits*
				Semivol. Organics	SW-846 8270C	MS recovery within lab limits*
				PCBs	ASTM D4059	MS recovery within lab limits*
				Plus either:		
				Process analyses for incineration:		
				Metals	SW-846 6010B	MS Recovery ± 25%
					SW-846 7471A	MS Recovery ± 25%
				Heat of Combustion	ASTM D240	Ck Std ± 5%
				Or:		
				Process analyses for landfill:		
				pH	SW-846 9045C	Ck Std ± 1.0 S.U.
				Ignitability screen	ASTM D4982	Duplicates must match
				TCLP metals	SW-846 1311	Not applicable
					SW-846 6010B	MS Recovery ± 25%
					SW-846 7470A	MS Recovery ± 25%
				Free liquids test[5]	SW-846 9095	Duplicates must match

1 From Table IV.B, first column
2 These are the primary sampling locations only.
3 See WAP for additional methods. Certain test methods have been modified as indicated in the WAP.
4 Not all parameters apply to each sample. See WAP for more details
5 Free liquids test is run on each bin if a visual inspection is inconclusive.
7 Ck Std – check standard; MS – matrix spike; *organic methods QC sample recovery limits are analyte specific and are determined using EPA guidelines.

TABLE V.B CONTAINER STORAGE AREAS

Permit Unit No.	*Container Storage Area*	*N.O.R. Unit #*	*WASTE NUMBER**	*Rated Capacity*	*Dimensions*	*STACKING HEIGHT*	*AISLE SPACING*	*Containment Volume (including rainfall for unenclosed areas) gallons*	*Unit will manage Ignitable, [1] Reactive, [1] or Incompatible[1] Waste (state all that apply)*
76a	DSP-1	36	101-107, 109-111	30,250 gal	30’x84.5’ = 2535 sq ft	3 pallets	2 feet/4 feet**	6,084	Yes
76b	DSP-2	37	101-107, 109-111	37,060 gal	34’x114.25’=3885 sq ft	3 pallets	2 feet/4 feet**	13,088	Yes
76c	DSP-3	38	101-107, 109-111	113,870 gal	59.33’x125.62’=7453 sq ft	3 pallets	2 feet/4 feet**	13,991	Yes
76d	DSP-4	39	101-111	136,680 gal	irregular-4,708 sq ft	3 pallets	2 feet	15,198	Yes
76e	DSP-5	40	101-111	151,800 gal	irregular-6,993 sq ft	3 pallets	2 feet	28,137	Yes
76f	DSP-6	41	101-107, 109-111	170,000 gal	irregular-11,280 sq ft	3 pallets	2 feet	26,565	Yes
76g	DSP-7	42	101-111	19,800 gal	irregular-1,404 sq ft	3 pallets	2 feet	2,429	Yes
76h	Warehouse	43	101-111, 112	212,520 gal	irregular-12568 sq ft	4 pallets/racks	2 feet	64,761	Yes
77	Transformer/Drum handling Bldg.	34	101-111	163,980 gal	irregular-9,090 sq ft	3 pallets	2 feet	25,726	Yes
78	Container Storage Warehouse	7	101-107, 109-111	587,520 gal	22,963 sq ft	4 pallets/racks	2 feet/4 feet**	68,655	Yes
79[a]	Tank Truck Storage Pad	168	101-111	71,500 gal	irregular-6,954 sq ft	1 bin or trailer	2 feet	56,766	Yes
90	BSA-1[c]	69	103-108, 110,111	1,500 Cubic yds	75’x350’=26,250 sq ft	3 bins or 1 trailer	2 feet	None	Yes
91	BSA-2[c]	70	103-108, 110,111	4,650 Cubic yds	irregular-73,028 sq ft	3 bins or 1 trailer	2 feet	None	Yes
92	BSA-3[c]	71	103-108, 110,111	1,650 Cubic yds	101[1]x317’=32,017 sq ft	3 bins or 1 trailer	2 feet	None	Yes
101[b]	DSP-8	74	101-107, 109-111	23,700 gal	16.33’x87.91’=1,436 sq ft	3 pallets	2 feet	2,370	Yes
104	Front-line storage pad	035	101-111	60,500 gal	irregular-6,996 sq ft	1 bin or 1 trailer	2 feet	52,474	Yes
106	Waste Receiving Pad	167	103-107 110,111	212,100 gal	irregular-12,939 sq ft	1 bin or 1 trailer	2 feet	103,590	Yes

*Waste Numbers From Table IV.B, includes both on-site and off-site generated wastes.
** per NFPA Code

[a]Drummed or other containerized wastes (except wastes stored in tank trailers) shall be stored on Permit Unit No. 79 for a maximum of 90 days and only if waste containers remain on trailers until such time as the containers are transferred to another permitted treatment, storage, or disposal unit.

[b]Containerized waste shall only be placed into Permit Unit No. 101 while the Train I or Train II is operational and shall not be allowed to remain in Permit Unit No. 101 longer than 24 hours.

[c]All wastes must pass the paint filter test (EPA SW-846, Method 9095).

TABLE V.C TANKS AND TANK SYSTEMS

Permit Unit No.	*Tank*	*N.O.R. Unit #*	*Storage and/or Processing*	*Waste No.s[1]*	*Rated Capacity[3]*	*Dimensions*	*Containment Volume (including rainfall for unenclosed areas) Gallons*	*Unit Will Manage Ignitable, Reactive, or Incompatible Waste (State all that apply)*
09	T-1	84	STORE	101,102,108	20,000 g	12’x25’6”	418,721	YES
10	T-2	85	STORE	101,102,108	24,000 g	13’x25’6”	418,721	YES
11	T-11	86	STORE	101,102,108	15,000 g	10’x25’6”	418,721	YES
12	T-12	87	STORE	101,102,108	15,000 g	10’x25’6”	418,721	YES
13	T-18	88	STORE	101,102,108	24,000 g	13’x25’6”	418,721	YES
14	T-19	89	STORE	101,102,108	20,000 g	12’x25’6”	418,721	YES
15	T-20	90	STORE	101,102,108	7,000 g	7’7 ½”x22’0”	418,721	YES
16	T-21	91	STORE	101,102,108	7,000 g	7’7 ½”x22’0”	418,721	YES
17	T-27	92	STORE	101,102,108	14,600 g	11’6”x18’	418,721	YES
18	T-28	93	STORE	101,102,108	14,600 g	11’6”x18’	418,721	YES
19	T-31	94	STORE	101,102,108	27,000 g	12’x32’	418,721	YES
20	T-32	95	STORE	101,102,108	27,000 g	12’x32’	418,721	YES
21	T-60	96	STORE	101,102,108	100,000 g	25’x27’6”	418,721	YES
22	T-61	97	STORE	101,102,108	2000,00 g	33’x32’	418,721	YES
23	V-101	21	STORE	101,102,108	10,000 g	8’x29’8”	418,721	YES

TABLE V.C TANKS AND TANK SYSTEMS (CONT'D)

Permit Unit No.	*Tank*	*N.O.R. Unit #*	*Storage and/or Processing*	*Waste No.s[1]*	*Rated Capacity[3]*	*Dimensions*	*Containment Volume (including rainfall for unenclosed areas) Gallons*	*Unit Will Manage Ignitable, Reactive, or Incompatible Waste (State all that apply)*
24	V-103	22	STORE	101,102,108	10,500 g	8'x30'	418,721	YES
25	V-104	23	STORE	101,102,108	22,400 g	12'x26'	418,721	YES
26	V-105	98	STORE	101,102,108	22,400 g	12'x26'	418,721	YES
27	V-106	99	STORE	101,102,108	22,400 g	12'x26'	418,721	YES
28	V-107	100	STORE	101,102,108	22,400 g	12'x26'	418,721	YES
29	V-108	101	STORE	101,102,108	22,400 g	12'x26'	418,721	YES
30	V-109	102	STORE	101,102,108	21,000 g	10'x35'6"	418,721	YES
31	V-110	103	STORE	101,102,108	21,000 g	10'x35'6"	418,721	YES
37	T-29	109	STORE	101,102,108	6,400 g	7'3"x19'8"	27,590	YES
38	T-30	110	STORE	101,102,108	6,400 g	7'3"x19'8"	27.590	YES
39	T-70	111	STORE	101,102,108	22,200 g	10'4"x30'	418,721	YES
40	T-71	112	STORE	101,102,108	22,000 g	10'4"x30'	418,721	YES
41	T-72	113	STORE	101,102,108	22,000 g	10'4"x30'	418,721	YES
44	T-75	116	STORE	101,102,108	22,000 g	10'4"x30'	418,721	YES
45	T-76	117	STORE	101,102,108	22,000 g	10'4"x30'	418,721	YES

TABLE V.C TANKS AND TANK SYSTEMS (CONT'D)

Permit Unit No.	***Tank***	***N.O.R. Unit #***	***Storage and/or Processing***	***Waste No.s[1]***	***Rated Capacity[3]***	***Dimensions***	***Containment Volume (including rainfall for unenclosed areas) Gallons***	***Unit Will Manage Ignitable, Reactive, or Incompatible Waste (State all that apply)***
46	T-77	118	STORE	101,102,108	22,000 g	10'4"x30'	418,721	YES
87	T-1001-1	81	STORE/PROCESS	101-107, 109-111	75 yd^3	41.8'x10'x7.9'	128,902	YES
88	T-1001-2	82	STORE/PROCESS	101-107, 109-111	75 yd^3	41.8'x10'x7.9'	128,902	YES
89	T-1001-3	83	STORE/PROCESS	101-107, 109-111	75 yd^3	Irregular	128,902	YES
93	V-1204	121	STORE	101-105	13,500 g	12'x4'	30,661	NO
94[3]	T-1202	122	STORE/PROCESS	101-107, 109-111	125 yd^3	29.2'x19.5'x5.9'	Double Walled	NO
95[3]	T-1203	123	STORE/PROCESS	101-107, 109-111	125 yd^3	29.2'x19.5'x5.9'	Double Walled	NO
96[4]	T-1204	124	STORE/PROCESS	101-107, 109-111	350 yd^3	58'x60'x7.5'	NONE-no liquid	NO
107	T-201	Proposed	STORE/PROCESS	101-108. 110-111	7,198 g	Irregular	22,986	IGNITABLE
109	T-33	Proposed	STORE/PROCESS	101-107	21,000 g	12' x 24'	51,212	YES

1 – Waste Numbers From Table IV.B

2 – In accordance with permit Provision VII.A.

3 – Processing of wastes in Permit Units No. 94 or 95 is limited to a maximum of 60 working days annually, when Permit Unit No. 97 is out of service due to malfunction and/or regularly scheduled maintenance.

4 – No chemical or biological processing of wastes is authorized in Permit Unit No. 96.

TABLE V.G.1. LANDFILLS

Permit Unit No.	***Landfill***	***N.O.R. Unit #***	***Waste No.s[1]***	***Rated Capacity***	***Dimensions***	***Distance from lowest liner to groundwater***	***Action Leakage Rate (if required)[1]***	***Unit Will Manage Ignitable, Reactive, Incompatible, or F020, F021, F022, F023, F026, and F027 Waste (State all that apply)***
01	South (constructed)	001	N/A	1,500,000	1450 x 750’	10 feet (min)	NOT REQUIRED	NO
02	North (constructed)	134	103-107, 109-111	815,000 cubic yards	660 x 475	10 feet (min)	NOT REQUIRED	NO
98	East (proposed)	135	103-107, 109-111	658,000 cubic yards	420’ x 1430 irregular’	10 feet (min)	500 gpad*	NO

[1]from Table IV.B, first column

[2]If not required in accordance with 40 CFR 264.302, state “NOT REQUIRED”

*gpad = gallon per acre per day.

TABLE V.G.3. LANDFILLS

Permit Unit No.	***Landfill***	***Primary Liner***			***Secondary Liner***			***Clay Liner***		
		Material	Permeability (cm/sec)	Thickness	Material	Permeability (cm/sec)	Thickness	Material	Permeability (cm/sec)	Thickness
01	North (constructed)	HDPE	$\leq 1 \times 10^{-7}$	60mil	HDPE	$\leq 1 \times 10^{-7}$	60mil	Clay	$\leq 1 \times 10^{-7}$	3 feet (min)
02	South (constructed)	--	--	--	--	--	--	Clay	--	5 feet (min)
98	East (proposed)	HDPE	$\leq 1 \times 10^{-7}$	60mil	HDPE	$\leq 1 \times 10^{-7}$	60mil	Clay	$\leq 1 \times 10^{-7}$	3 feet (min)

TABLE V.G.4. LANDFILL LEACHATE COLLECTION SYSTEM

Landfill	**Primary Leachate Collection System**					**Secondary Leachate Collection System**				
	Drainage Media	Collection Pipes (including risers)	Filter Fabric	Geofabric	Sump Material	Drainage Media	Collection Pipes (including risers)	Filter Fabric	Geofabric	Sump Material
East (proposed)	Sand	8” HDPE	8 oz. Geotextile	Geonet	Gravel	Sand	8” HDPE	8 oz. Geotextile	Geonet	Gravel
North (constructed)	Sand	8” HDPE	8 oz. Geotextile	Geonet	Gravel	Sand	8” HDPE	8 oz. Geotextile	Geonet	Gravel
South (constructed)	Sand	8” HDPE	--	--	Gravel	--	--	--	--	--

TABLE V.H.1 INCINERATORS

Permit Unit No.	***Incinerator***	***N.O.R. Unit #***	***Waste No.s[1]***	***Waste Physical Form***	***Unit Will Manage Reactive, Incompatible, or F020, F021, F022, F023, f026, or F027 Waste*** *(State all that apply)*
03	Train I Kiln 3.6 m diameter Afterburner Loddby Liquids Burner	5	101-111	Liquids Solids Sludges Gases	Reactive
04	Train II Kiln 4.4 m diameter Afterburner Rotary Reactor	31	101-111	Liquids Solids Sludges Gases	Reactive

[1]from Table IV.B, first column

TABLE V.H.2.(I) TRAIN I INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
OPERATING PARAMETERS					
Maximum Total Hazardous Waste Feed Rate			Drawing No.		
Kiln I	HRA	FE-404 Liquid Tanks-27/28 and Waste liquid V-109/V-110 (load cell/Coriolis meter) FE-4244 Railcar Direct Burn (load cell/Coriolis meter) FE-4253 PCB Tanks-31/32 (load cell/Coriolis meter) WE-4275 High Pressure Cylinder (load cell/Coriolis meter) FCV-101 Direct-Burn Sludge FCV-102 " (Flow calculated by DCS FCV-201 " from cycle, volume FCV-202 " and density) WT-4031 Barrel Feeder (load cell/Coriolis meter)	H-006-PI-205-D H-006-PI-205-D H-006-PI-205-D H-006-PI-205-D H-006-PI-205-D " " " H-006-PI-208-D	13,611 lb/hr (total)	Y
Afterburner I	HRA	FE-202 Liquid Tanks 27/28, Low flash Pt. V-109 and V-110 and Liquid Tanks 29/30 (load cell/Coriolis meter) FE-302 Direct Burn Alkyls, Direct Burn Truck and PCB Tanks 31/32 (load cell/Coriolis meter) FE-502 Direct Burn Tank 29 (load cell/Coriolis meter) WT-902 Direct Burn Tank 29 (load cell/Coriolis meter)	H-006-PI-211-D H-006-PI-211-D H-006-PI-211-D H-006-PI-211-D H-006-PI-211-D	14,349 lb/hr	Y
		WE-402 RI Truck Scale (load cell/Coriolis meter) FE-702 T/OX Railcar, T-Ox Tankfarm, T-Ox	 H-006-PI-209-D		

TABLE V.H.2.(I) TRAIN I INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
		Tank – 18 and Direct Burn T-Ox (load cell/Coriolis meter) FE-802 T-Ox Railcar, T-Ox Tankfarm, T-Ox Tank 18 and Direct Burn T-Ox (load cell/Coriolis meter) WE-4311 Glove Box 1 WE-4321 Glove Box 2 WE-4331 Glove Box 3	H-006-PI-209-D H-006-PI-215-D H-006-PI-216-D H-006-PI-217-D		
Maximum Total Pumpable Hazardous Waste Mass Feed Rate	HRA See Table V.H.3.	N.A.	N.A.	N.A.	N.A.
Minimum Combustion Temperature Kiln I Afterburner I	 Instantaneous Instantaneous	 Thermocouple Thermocouple	 Kiln Exit Kiln Exit	 1618°F 1827°F	 Y Y
Minimum Combustion Temperature Kiln I Afterburner I	 Instantaneous Instantaneous	 Thermocouple Thermocouple	 Kiln Exit Kiln Exit	 2049°F 2238°F	 Y Y
Maximum Flue Gas Temperature at PM Control Device Inlet	N.A. (Wet Quench)	N.A.	N.A.	N.A.	N.A.
Maximum volumetric feed rate, DSCFM (dry) Kiln I Loddby Liquids Burner Afterburner I	Instantaneous	Annubar	Due to Stack	 N.A. N.A. 55,604 DSCFM	Y
Atomization parameters	Instantaneous	Pressure Gauges	Local	> 5 psig	N

TABLE V.H.2.(I) TRAIN I INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis*[1] (State Instantaneous or Hourly Rolling Average (HRA)**	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff* (Y/N)[2]**
Particulate Matter Emission Rate	3-run average	Stack Test	Stack	<0.03 grains/dscf	N
Feed Rates: (Metals, Total Chlorine, and Ash)	HRA	Liquid Flow Meters, solids weigh scales, and compositions	Feed System	Limits Specified in Table V.H.3-Maximum Constituent Feed Rates	Y
Combustion Oxygen	Instantaneous	CEMS in situ	Hot Duct	N.A.	N
Stack CO (use same basis as for stack oxygen)	Instantaneous	CEMS	Sample of gas to stack	100 ppmv 7% O_2, dry basis	Y
Stack Total Hydrocarbons	N.A.	N.A.	N.A.	N.A.	N.A.
Number of Soot Blowing Events per 24 hours	N.A.	N.A.	N.A.	N.A.	N.A.

TABLE V.H.2.(I) TRAIN I INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Combustion Zone Pressure [or other method for fugitive emissions monitoring]	See Provision V.H.7.j.	Pressure Indicator	Kiln Shrouds & Afterburner	Minimum 0" W.C.	Y
Air Pollution Control Device PARAMETERS					
Pressure drop across Baghouse [or fabric filter]	N.A.	N.A.	N.A.	N.A.	N.A.
[Wet Scrubbers:]					
Minimum Water Flows Saturator Condenser	 Instantaneous Instantaneous	 Volumetric Flow Meter Volumetric Flow Meter	 Near Unit Near Unit	 832 gpm 3,865 gpm	 Y Y
Minimum liquid to flue Gas ration (L/G)	N.A.	N.A.	N.A.	N.A.	N.A.
Minimum scrubber blowdown	N.A.	N.A.	N.A.	N.A.	N.A.
Minimum Scrubber Water pH	N.A.	N.A.	N.A.	N.A.	N.A.

TABLE V.H.2.(I) TRAIN I INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
[Calvert Scrubbers:]					
Minimum Calvert water exit pH	Instantaneous	pH meter	water exit	4.0	N
Minimum Calvert water flow	Instantaneous	Volumetric Flow Meter	Near Unit	792 gpm	Y
Minimum differential pressure	Instantaneous	Dp gauge	On unit	41.22 in. W.C.	Y
[Dry Scrubbers:]					
Minimum alkaline reagent flow to the dry scrubber	N.A.	N.A.	N.A.	N.A.	N.A.
Maximum flue gas flow rate	N.A.	N.A.	N.A.	N.A.	N.A.
[Absorbers:]					
Absorber minimum pH of incoming liquid	N.A.	N.A.	N.A.	N.A.	N.A.

TABLE V.H.2.(I) TRAIN I INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Absorber minimum liquid to gas ratio (L/G)	N.A.	N.A.	N.A.	N.A.	N.A.
OTHER MONITORING PARAMETERS					
Electric Power	Instantaneous			Power Outage	Y
Fan Shutdown	Instantaneous			Fan Shutdown	Y

N.A. – Not Applicable

1

- Instantaneous as defined in 40 CFR §266.102(e)(6)(i)(A) shall mean a value which occurs at any time. A value shall be determined by the monitoring device no less than every 15 seconds.
- Continuous monitor is one which continuously samples or measures the regulated parameter without interruption, and evaluates the detector response at least once each 15 seconds, and computes and records the average value at least every 60 seconds.
- Hourly Rolling Average (HRA) as defined in 40 CFR §266.102(e)(6)(i)(B).
- For carcinogenic metals and lead feed rates: Instantaneous as defined above or, rolling average as defined in 40 CFR §266.102(e)(6)(ii).

2 AWFCO: Automatic Waste Feed Cutoff. For AWFCOs indicated by "Y", the Permit Limit in the table triggers an AWFCO.

TABLE V.H.2.(II) TRAIN II INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
OPERATING PARAMETERS					
Maximum Total Hazardous Waste Feed Rate Kiln II	HRA	WT-5020 Drum Conveyor (load cell/Coriolis meter) WT-5073 Box Scale (north)(load cell/Coriolis meter) WT-5470 Shredder Feed (load cell/Coriolis meter) FE-5200 Waste Liquid Tanks 27/28 V-109 and V-110 (load cell/Coriolis meter) FE-5100 Direct burn Trailers (load cell/Coriolis meter) FV-5301 Swap Pot (Sludge Flow calculated by DCS from cycle, volume and density) FE-5320 Direct Burn Truck (load cell/Coriolis meter) WE-4321 Glove Box	Drawing No. H-004-PI-201-D H-004-PI-203-D H-004-PI-214A-D H-004-PI-221-D H-004-PI-221-D H-004-PI-221-D H-004-PI-221-D	17,807 lb/hr	Y
Rotary Reactor	HRA	WT-7098 Contaminated Soil (load cell/Coriolis meter) FE-7304 Waste liquid Tanks 27/28 (load cell/Coriolis Meter) PD Pump (Sludge Flow calculated by DCS from cycle, volume and density) FE-7253 Direct Burn Truck (load cell/Coriolis meter) WE-7355 Direct Burn Truck (load cell/Coriolis meter)	H-007-PI-107-D H-107-PI-110-D H-007-PI-110-D H-007-PI-110-D H-007-PI-111-D	14,508 lb/hr	Y

TABLE V.H.2.(II) TRAIN II INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Afterburner II	HRA	FE-5250 Direct Burn Truck, Waste Liquid Tanks 27/28 and Low Flash V-109 and V-110 (load cell/Coriolis meter) WE-5600 X-406 Line (load cell/Coriolis meter) FE-5700 Direct Burn Truck RCRA Tank 29/30 (load cell/Coriolis meter) FE-5550 Alkyls (load cell/Coriolis meter) Waste Liquid Tank 27/28 Low Flash V-109 and V-110 (load cell/Coriolis meter) FE-5300 Low Flash V-110 Waste Liquid Tank 27/28 Direct Burn Truck RCRA Tank 29/30 (load cell/Coriolis meter) FE-5850 T-Ox (load cell/Coriolis meter) FE-5800 T-Ox (load cell/Coriolis meter)	H-004-PI-208-D H-004-PI-219-D H-004-PI-208-D H-004-PI-208-D H-004-PI-208-D H-004-PI-208-D H-004-PI-209-D H-004-PI-209-D	12,681 lb/hr	Y
Maximum Total Pumpable Hazardous Waste Mass Feed Rate	HRA See Table V.H.3.	N.A.	N.A.	N.A.	N.A.
Minimum Combustion Temperature Kiln II Rotary Reactor Afterburner II	 Instantaneous Instantaneous Instantaneous	 Thermocouple Thermocouple Thermocouple	 Kiln Exit Gas Exit Hot Duct	 1627°F 914°F 1785°F	 Y Y Y

TABLE V.H.2.(II) TRAIN II INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Maximum Combustion Temperature Kiln II Rotary Reactor Afterburner II	Instantaneous Instantaneous Instantaneous	Thermocouple Thermocouple Thermocouple	Kiln Exit Gas Exit Hot Duct	2374°F 1580°F 2240°F	Y Y Y
Maximum Flue Gas Temperature at PM Control Device Inlet	N.A. (Wet Quench)	N.A,	N.A,	N.A,	N.A,
Maximum volumetric flow rate, DSCFM (dry) Kiln II Rotary Reactor Afterburner II	Instantaneous	Annubar	Duct to Stack	N.A. N.A. 49,464 DSCFM	Y
Atomization parameters	Instantaneous	Pressure Gauges	Local	>5 psig	N
Particulate Matter Emission Rate	3-run average	Manual Stack Test	Stack	<0.03 grains/dscf	N
Feed Rates: (Metals, Total Chlorine, and Ash)	HRA	Liquid Flow Meters, solids weigh scales, and compositions	Feed System	Limits Specified in Table V.H.3-Maximum Constituent Feed Rates	Y[2]

TABLE V.H.2.(II) TRAIN II INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Stack Oxygen	Instantaneous	CEMS in situ	Hot Duct	N.A.	N
Stack CO (use same basis as for stack oxygen)	Instantaneous	CEMS	Stack	100 ppmv 7% O_2, dry basis	Y
Stack Total Hydrocarbons	N.A.	N.A.	N.A.	N.A.	N.A.
Number of Soot Blowing Events per 24 hours	N.A.	N.A.	N.A.	N.A.	N.A.
Combustion Zone Pressure [or other method for fugitive emissions monitoring	See Provision V.H.7.j.	Pressure Indicator	Afterburner	Minimum 0" W.C.	Y
Air Pollution Control Device PARAMETERS					
Pressure drop across Baghouse [or fabric filter]	N.A.	N.A.	N.A.	N.A.	N.A.
[Wet Scrubbers:]					

TABLE V.H.2.(II) TRAIN II INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Minimum Water Flows Saturator Condenser	 Instantaneous Instantaneous	 Volumetric Flow Meter Volumetric Flow Meter	 Near Unit Near Unit	 727 gpm 4,019 gpm	 Y Y
Minimum liquid to flue gas ratio (L/G)	N.A.	N.A.	N.A.	N.A.	N.A.
Minimum scrubber Blowdown	N.A.	N.A.	N.A.	N.A.	N.A.
Minimum scrubber Water pH	N.A.	N.A.	N.A.	N.A.	N.A.
[Calvert Scrubbers:]					
Minimum Calvert Water Exit pH	Instantaneous	pH meter	water exit	4.0	N
Minimum calvert Water flow	Instantaneous	Volumetric flow meter	Near Unit	820gpm	Y
Minimum differential pressure	Instantaneous	Dp gauge	On unit	45.08 in. W.C.	Y
[Dry Scrubbers:]					

TABLE V.H.2.(II) TRAIN II INCINERATOR PERMIT CONDITIONS, MONITORING, AND AUTOMATIC WASTE FEED CUTOFF SYSTEMS (CONT'D)

Parameter	***Monitoring Basis***[1] (State Instantaneous or Hourly Rolling Average (HRA)	***Monitoring Device***	***Device Location***	***Permit Condition***	***Automatic Waste Feed Cutoff*** (Y/N)[2]
Minimum alkaline reagent flow to the dry scrubber	N.A.	N.A.	N.A.	N.A.	N.A.
Maximum flue gas flow rate	N.A.	N.A.	N.A.	N.A.	N.A.
[Absorbers:]					
Absorber minimum pH of incoming liquid	N.A.	N.A.	N.A.	N.A.	N.A.
Absorber minimum liquid to gas ratio (L/G)	N.A.	N.A.	N.A.	N.A.	N.A.
OTHER MONITORING PARAMETERS					
Electric Power	Instantaneous		Power Outage		
Fan Shutdown	Instantaneous		Fan shutdown	Y	

N.A. – Not Applicable

1

- Instantaneous as defined in 40 CFR §266.102(e)(6)(i)(A) shall mean a value which occurs at any time. A value shall be determined by the monitoring device no less than every 15 seconds.
- Continuous monitor is one which continuously samples or measures the regulated parameter without interruption, and evaluates the detector response at least once each 15 seconds, and computes and records the average value at least every 60 seconds.
- Hourly Rolling Average (HRA) as defined in 40 CFR §266.102(e)(6)(i)(B).
- For carcinogenic metals and lead feed rates: Instantaneous as defined above or, rolling average as defined in 40 CFR §266.102(e)(6)(ii).

2 AWFCO: Automatic Waste Feed Cutoff. For AWFCOs indicated by "Y", the Permit Limit in the table triggers an AWFCO.

TABLE V.H.3 – MAXIMUM CONSTITUENT FEED RATES

The total feed rate of constituents to the Total Incinerator System (Train I plus Train II) shall not exceed the following limitations in grams per hour (g/hr) or tons per year (t/yr), as noted. The metals and pesticides/herbicides limitations have been evaluated through risk assessment. The ash and chlorine limits are based upon testing or regulatory limits.

Constituent (Tier)[2]	Maximum Allowable Hourly Feed Rate In Total Feedstreams (g/hr)	Maximum Allowable Hourly Feed Rate In Total Hazardous Waste Feedstreams (g/hr)	Maximum Allowable Hourly Feed Rate In Total Pumpable Hazardous Waste Feed (g/hr)[c]	Maximum Allowable Annual Feed Rate In All Feed Streams (t/yr)[c]
Arsenic (risk assessment)	4.86E+03	4.86E+03	1.47E+03	4.69E+01
Beryllium (risk assessment)	6.48E+03	6.48E+03	1.96E+03	6.26E+01
Cadmium (risk assessment)	1.98E+03	1.98E+03	6.29E+03	1.91E+01
Chromium, Total (risk assessment)	3.17E+04	3.17E+04	1.16E+04	3.06E+02
Antimony (risk assessment)	3.96E+05	3.96E+05	9.05E+04	3.82E+03
Lead (risk assessment)	1.28E+05	1.28E+05	3.08E+04	1.24E+03
Barium (risk assessment)	1.58E+06	1.58E+06	2.68E+04	1.53E+04
Mercury (risk assessment)	4.14E+02	4.14E+02	1.37E+01	2.83E-01
Silver (risk assessment)	7.92E+03	7.92E+03	2.51E+03	7.65E+01
Thallium (risk assessment)	7.92E+02	7.92E+02	1.82E+02	7.65E+00
Nickel (risk assessment)	1.19E+05	1.19E+05	3.34E+03	1.74E+02
Selenium (risk assessment)	3.50E+03	3.50E+03	3.34E+02	3.38E+01
Zinc (risk assessment)	1.22E+06	1.22E+06	8.60E+04	1.18E+04
Total Chloride/ Chlorine (Tier 3)[b]	3.93E+06 (1.85E+06/2.08E+06)[b]	Not applicable	Not applicable	Not applicable
Ash (Not Applicable)[b]	1.19E+07 (4.44E+06/7.45E+06)[b]	Not applicable	Not applicable	Not applicable

[a]Metals federates in g/hr and t/year are back-calculating based on actual rates averaged over three runs during Condition 4 of 1998 Trial Burn. Tier 1 adjusted federates in g/hr are based on emission rates which are determined to be acceptable based on results of the acute analysis conducted for Clean Harbors Deer Park, LP facility. Tier 1 adjusted federates in t/year are based on emission rates which are determined to be acceptable based on results of chronic multipathway risk assessment conducted for Clean Harbors Deer Park facility.
[b]Train I/Train II Chloring and Ash federates are based on Conditions 3I and 3II of 1998 Trial Burn.
[c]g/hr denotes grams/hour and t/year denotes tons (2000 pounds)/year.

TABLE V.H.4 – MAXIMUM ALLOWABLE EMISSION RATES

The total emission rate from the Incinerator System (Train I plus Train II) shall not exceed the following limitations, as noted. The metals limitations have been evaluated through risk assessment. The particulate, hydrogen chloride, and free chlorine limits are based upon testing or regulatory limits.

Carcinogenic Constituent (Compliance Tier/Basis)	**Maximum Allowable Emission Rate[1]**	**Units[2]**
Arsenic (risk assessment)	2.92E+01 2.82E-01	g/hr t/y
Beryllium (risk assessment)	6.48E+00 6.26E-02	g/hr t/y
Cadmium (risk assessment)	3.17E+01 3.06E-01	g/hr t/y
Chromium, Total (risk assessment)	3.17E+01 3.06E-01	g/hr t/y
Non-Carcinogenic Constituent (Compliance Tier/Basis)	**Maximum Allowable Emission Rate[1]**	**Units[2]**
Antimony (risk assessment)	1.58E+03 1.53E+01	g/hr t/y
Barium (risk assessment)	1.58E+03 1.53E+01	g/hr t/y
Lead (risk assessment)	1.15E+03 1.11E+01	g/hr t/y
Mercury (risk assessment)	1.66E+02 7.30E-02	g/hr t/y
Nickel (risk assessment)	2.38E+02 3.48E-01	g/hr t/y
Selenium (risk assessment)	6.48E+02 6.26E+00	g/hr t/y
Silver (risk assessment)	1.58E+02 1.53E+00	g/hr t/y
Thallium (risk assessment)	3.17E+02 3.06E+00	g/hr t/y
Zinc (risk assessment)	1.58E+04 1.53E+02	g/hr t/y
Hydrogen Chloride (40 CFR 264.343(b))	1.80E+03	g/hr
Free Chlorine (Tier 3)	1.59E+02	g/hr
Particulate Matter (N.A.)	0.03	Grains/dscf

[1]Tier 3 free chlorine emission rate is based on actual emission measured during the 1998 Trial Burn.
[2]g/hr denotes grams per hour and t/yr denotes tons (2000 pounds)/year. Grains/dscf denotes grains per dry standard cubic foot (standard conditions: 760 mm Hg, 68°F) after correction to a stack gas concentration of 7% oxygen.

Table V.H.5. – "Direct Burn" Chemicals

CAS#	Chemical Name
75365	acetyl chloride
107028	acrolein
140885	Acrylic acid, ethyl ester
107119	allylamine
111364	butyl isocyanate
109795	butyl mercapran,n-
75649	butylamine, tert-
123728	butyraldehyde
79049	chloracetylchloride
107302	chloromethylmethyl ether
4170303	crotonaldehyde
506683	cyanogen bromide
7572294	dichloroacetylene
542881	dichloromethyl ether; bis(chloromethyl)ether
352932	diethyl sulfide; ethyl sulfide
57147	dimethyl hydrazine, 1,1 -
75183	dimethyl sulfide
NOCAS67	dimethyl zinc
541413	ethyl chlorocarbonate
75081	ethyl mercaptan
151564	ethyleneimine
111308	glutraldehyde
592767	heptene
7782798	hydrazoic acid (N3H)
13463406	iron pentacarbonyl (as Fe)

Table V.H.5. – “Direct Burn” Chemicals

CAS#	Chemical Name
78795	isoprene
78853	methacrolein
623427	methyl butyrate
79221	methyl chloroformate
75547	methyl dichlorosilane
1388234	methyl ethyl ketone peroxide
60344	methyl hydrazine
624839	methyl isocyanate
556616	methyl isothiocyanate; methyl mustard oil
75796	methyl trichlorosilane
78794	methyl vinyl ketone
13463393	nickel carbonyl
76062	nitrotrichloromethane; trichloronitromethane
19624227	pentaborane
594423	perchloromethyl mercaptan
382218	perfluoroisobutylene
10025783	phosphorus oxychloride
7719122	phosphorus trichloride
107039	Propyl mercaptan, n-
75592	thtramethyl ammonium hydroxide
75741	tetramethyl lead
509148	tetranitromethane
76028	trichloroacetyl chloride
121437	trimethyl borate
121459	trimethyl phosphate
75503	trimethylamine
100403	vinyl cyclohexend, 4-; ethenylcyclohexend, 4-

TABLE V.K MISCELLANEOUS UNITS

Permit Unit No.	***Miscellaneous Unit***	***N.O.R. Unit #***	***Storage, Processing, and/or Disposal***	***Waste No.s[1]***	***Rated Capacity***	***Dimensions***	***Unit will manage Ignitable, Reactive, or Incompatible Waste*** *(state all that apply)*
97	Pugmill B-1203	125	Process	101-107, 110, 111	22 yd^3	16'x8'x4.5'	No
99	Railcar Unloading Area	130	Storage, Process	101-105, 108	50,000 gal	120'x16'	Yes
100[2]	Rotary Reactor Feed Tower T-638	133	Storage	101-107, 109-111	7,575 gal	11.52'x11.09'x8.02'	Yes
102	Container QC Area	073	Storage	101-107, 109-111	75,000 gal	irregular	Yes
103	Direct Burn Area	131	Storage, Process	101-105, 108, 109	40,000 gal	4 irregular areas	Yes
105	PCB Shredder	015	Process	101-108, 110	3,945 gal	irregular	No
108	North Pad	171	Process	101-105, 108, 109	10,000 gal	irregular	Yes

[1]from Table IV.B, first column

[2] – Waste storage in Permit Unit No. 100 is permitted during operating shifts in which the Train II Incinerator Kiln is operating under normal conditions. Permit Unit No. 100 shall be maintained empty, as soon as practicable, at all other times.

TABLE VI.B.3.b UNIT GROUNDWATER DETECTION MONITORING SYSTEM

Waste Management Unit/Area Name[1] **East Landfill**						
Well Number(s)	MW-302.3	MW-307.3	MW-312.3	MW-316.3	MW-317.3	
Hydrogeologic Unit Monitored	Stratum 3	Stratum 3	Stratum 3	Stratum 3	Stratum 3	
Type (e.g., point of compliance, background, observation, etc.)	Upgradient Background	Upgradient Background	Upgradient Background	Upgradient Background	Upgradient Background	
Up or Down Gradient	Up	Up	Up	Up	Up	
Casing Diameter and Material	4” PVC	4” PVC	4” PVC	4” PVC	4” PVC	
Screen Diameter and Material	4” PVC	4” PVC	4” PVC	4” PVC	4” PVC	
Screen Slot Size (in.)	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch	
Top of Casing Elevation (ft, MSL) – initial	26.58	25.05	23.80	24.42	25.65	
Grade or Surface Elevation (ft, MSL)- initial	23.50	22.15	23.80	21.50	23.50	
Well Depth (ft,)[2] – initial	76.53	77.46	75.31	75.39	70.51	
Screen Interval[2], From (ft) To (ft)	61.0 71.5	59.0 74.0	64.0 74.0	50.0 70.0	45.0 65.0	
Facility Coordinates (e.g., lat/long or company coordinates)	97798.9941N 102449.9861E	97146.9858N 102494.9976E	96550.0032N 102498.9870E	96098.9887N 101899.0095E	96048.9N 102400.8E	
Top of Casing Elevation (ft,MSL)	26.58	24.85	25.94	24.42	25.95	

[1]From Tables in Section V.
[2]Below grade or surface elevation (ft) - initial

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TABLE VI.B.3.b UNIT GROUNDWATER DETECTION MONITORING SYSTEM (CON'D)

Waste Management Unit/Area Name[1] **East Landfill**						
Well Number(s)	MW-300.3	MW-306.3	MW-311.3	PMW* - 319.3	PMW* - 320.3	PMW* - 321.3
Hydrogeologic Unit Monitored	Stratum 3	Stratum 3	Stratum 3	Stratum 3	Stratum 3	Stratum 3
Type (e.g., point of compliance, background, observation, etc.)	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance
Up or Down Gradient	Up	Up	Up	Up	Up	Up
Casing Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Slot Size (in.)	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch
Top of Casing Elevation (ft, MSL) – initial	23.73	22.55	23.70	N/A	N/A	N/A
Grade or Surface Elevation (ft, MSL)- initial	21.50	20.30	21.10	N/A	N/A	N/A
Well Depth (ft,)[2] – initial	74.0	70.0	70.47	N/A	N/A	N/A
Screen Interval[2], From (ft) To (ft)	53 73	39.5 59.5	45.0 65.0	N/A	N/A	N/A
Facility Coordinates (e.g., lat/long or company coordinates)	97749.9111N 101798.9189E	97198.9409N 101798.9189E	96699.0235N 101799.9834E	N/A	N/A	N/A
Top of Casing Elevation (ft,MSL)	26.47	25.11	23.71	N/A	N/A	N/A

[1]From Tables in Section V.
[2]Below grade or surface elevation (ft) - initial
*Proposed Monitoring Well

TABLE VI.B.3.b UNIT GROUNDWATER DETECTION MONITORING SYSTEM (CON'D)

Waste Management Unit/Area Name[1] **East Landfill**						
Well Number(s)	PMW – 322.3*	PMW – 323.3*	PMW – 324.3*	PMW – 325.3*	PMW – 326.3*	PMW – 327.3*
Hydrogeologic Unit Monitored	Stratum 3	Stratum 3	Stratum 3	Stratum 3	Stratum 3	Stratum 3
Type (e.g., point of compliance, background, observation, etc.)	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance	Pt. Of Compliance
Up or Down Gradient	Down	Down	Down	Down	Down	Down
Casing Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Diameter and Material	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC	4" PVC
Screen Slot Size (in.)	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch
Top of Casing Elevation (ft, MSL) – initial	N/A	N/A	N/A	N/A	N/A	N/A
Grade or Surface Elevation (ft, MSL)- initial	N/A	N/A	N/A	N/A	N/A	N/A
Well Depth (ft,)[2] – initial	N/A	N/A	N/A	N/A	N/A	N/A
Screen Interval[2], From (ft) To (ft)	N/A	N/A	N/A	N/A	N/A	N/A
Facility Coordinates (e.g., lat/long or company coordinates)	N/A	N/A	N/A	N/A	N/A	N/A

[1]From Tables in Section V.
[2]Below grade or surface elevation (ft) - initial
*Proposed Monitoring Well

TABLE VI.B.3.b UNIT GROUNDWATER DETECTION MONITORING SYSTEM (CON'D)

Waste Management Unit/Area Name[1] **East Landfill**						
Well Number(s)	PMW – 328.3*	PMW – 329.3*				
Hydrogeologic Unit Monitored	Stratum 3	Stratum 3				
Type (e.g., point of compliance, background, observation, etc.)	Pt. Of Compliance	Pt. Of Compliance				
Up or Down Gradient	Down	Down				
Casing Diameter and Material	4" PVC	4" PVC				
Screen Diameter and Material	4" PVC	4" PVC				
Screen Slot Size (in.)	0.01 inch	0.01 inch				
Top of Casing Elevation (ft, MSL) – initial	N/A	N/A				
Grade or Surface Elevation (ft, MSL)- initial	N/A	N/A				
Well Depth (ft,)[2] – initial	N/A	N/A				
Screen Interval[2], From (ft) To (ft)	N/A	N/A				
Facility Coordinates (e.g., lat/long or company coordinates)	N/A	N/A				

[1]From Tables in Section V.
[2]Below grade or surface elevation (ft) - initial
*Proposed Monitoring Well

TABLE VI.B.3.b UNIT GROUNDWATER DETECTION MONITORING SYSTEM (CON'D)

Waste Management Unit/Area Name[1] **East Landfill**							
Well Number(s)	MW-305.1	MW-310.1	MW-314.1	MW-304.1	MW-309.1	MW-315.1	MW-318.1
Hydrogeologic Unit Monitored	Stratum 1	Stratum 1	Stratum 1	Stratum 1	Stratum 1	Stratum 1	Stratum 1
Type (e.g., point of compliance, background, observation, etc.)	Supplemental: Background	Supplemental: Background	Supplemental: Background	Supplemental	Supplemental	Supplemental	Supplemental
Up or Down Gradient	N/A	N/A	N/A	upgradient	upgradient	upgradient	upgradient
Casing Diameter and Material	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC
Screen Diameter and Material	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC	2" PVC
Screen Slot Size (in.)	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch	0.01 inch
Top of Casing Elevation (ft, MSL)	23.33	22.59	25.28	25.78	24.38	25.43	25.65
Grade or Surface Elevation (ft, MSL)	21.20	21.40	22.20	22.90	21.58	23.60	23.00
Well Depth (ft,)[2]	18.0	19.0	42.5	29.5	22.0	21.5	21.5
Screen Interval[2], From (ft) To (ft)	10.5 15.5	11.5 16.5	25.0 40.0	14.0 27.0	9.5 19.5	14.0 19.0	10.0 20.0
Facility Coordinates (e.g., lat/long or company coordinates)	N97349 E102150	N96849 E102150	N96350 E102150	N97450 E102451	N96897 E102500	N96350 E102499	N95899 E102150
Top of Casing Elevation (ft, MSL) – current	25.72	24.98	25.28	25.78	24.38	27.82	25.65

[1]From Tables in Section V.
[2]Below grade or surface elevation (ft) - initial

TABLE VI.B.3.b UNIT GROUNDWATER DETECTION MONITORING SYSTEM (CON'D)

Waste Management Unit/Area Name[1] **East Landfill**							
Well Number(s)	MW-301.1	MW-303.1	MW-308.1	MW-313.1			
Hydrogeologic Unit Monitored	Stratum 1	Stratum 1	Stratum 1	Stratum 1			
Type (e.g., point of compliance, background, observation, etc.)	Supplemental	Supplemental	Supplemental	Supplemental			
Up or Down Gradient	downgradient	downgradient	downgradient	downgradient			
Casing Diameter and Material	2" PVC	2" PVC	2" PVC	2" PVC			
Screen Diameter and Material	2" PVC	2" PVC	2" PVC	2" PVC			
Screen Slot Size (in.)	0.01 inch	0.01 inch	0.01 inch	0.01 inch			
Top of Casing Elevation (ft, MSL)	23.65	22.09	22.45	24.48			
Grade or Surface Elevation (ft, MSL)	21.5	21.10	21.40	21.50			
Well Depth (ft,)[2]	18.0	17.5	16.5	23.5			
Screen Interval[2], From (ft) To (ft)	10.5 15.5	10.5 15.5	9.0 14.0	11.0 21.0			
Facility Coordinates (e.g., lat/long or company coordinates)	N97800 E102101	N97450 E101799	N96949 E101800	N96400 E101800			
Top of Casing Elevation (ft, MSL) – current	26.06	25.51	22.31	24.48			

[1]From Tables in Section V.
[2]Below grade or surface elevation (ft) - initial

TABLE VI.B.3.c GROUNDWATER SAMPLE ANALYSIS
East Landfill Background and Point of Compliance Wells
For each well or group of wells, specify the suite of parameters for which groundwater samples will be analyzed.

Well No(s).:[1]
MW-302.3, MW-307.3, MW-312.3, MW-316.3, MW-317.3, MW-300.3, MW-306.3, MW-311.3, MW-319.3, PMW-320.3, PMW-321.3, PMW-322.3, PMW-323.3, PMW-324.3, PMW-325.3, PMW-326.3, PMW-327.3, PMW-328.3, PMW-329.3

Parameter	*Sampling Frequency*	*Analytical Method[2]*	*Detection Limits*	*Concentration Limits[3]*
Chlorobenzene	Semi-annually	SW846 8260B	0.005	N/A*
Tetrachloroethene	Semi-annually	SW846 8260B	0.005	N/A*
Trichloroethene	Semi-annually	SW846 8260B	0.005	N/A*
Carbon Tetrachloride	Semi-annually	SW846 8260B	0.005	N/A*
Benzene	Semi-annually	SW846 8260B	0.005	N/A*
1,1,1-Trichloroethane	Semi-annually	SW846 8260B	0.005	N/A*
1,1 Dichloroethane	Semi-annually	SW846 8260B	0.005	N/A*
Chloroform	Semi-annually	SW846 8260B	0.005	N/A*
Total Organic Carbon (TOC)	Semi-annually	SW846 9060	1.0	N/A*
Total Organic Halogen (TOX)	Semi-annually	SW846 9020B	0.100	N/A*

[1]PMW=proposed monitoring well
[2]Clean Harbors Deer Park, LP reserves the right to use alternate approved methods and/or updated methods as they are promulgated.
[3]The concentration limits shall be the basis for determining whether a release has occurred from the waste management unit/area. The concentration limits shall be based on background values for the waste management unit/area, or Practical Quantitation Limit (PLQ) values identified in 40 CFR 264, Appendix IX. If background values are lower that PQLs, the applicant may choose respective PQLs as concentration limits for the hazardous constituent.
*East Landfill is not currently operational or under Detection Monitoring requirements.

TABLE VI.B.3.c GROUNDWATER SAMPLE ANALYSIS (CON'D)
East Landfill Background and Point of Compliance Wells
For each well or group of wells, specify the suite of parameters for which groundwater samples will be analyzed.

Well No(s).:[1]
MW-302.3, MW-307.3, MW-312.3, MW-316.3, MW-317.3, MW-300.3, MW-306.3, MW-311.3, MW-319.3, PMW-320.3, PMW-321.3, PMW-322.3, PMW-323.3, PMW-324.3, PMW-325.3, PMW-326.3, PMW-327.3, PMW-328.3, PMW-329.3

Parameter	*Sampling Frequency*	*Analytical Method[2]*	*Detection Limits*	*Concentration Limits[3]*
Specific Conductance	Semi-annually	SW846 9050	1 umho	N/A*
pH	Semi-annually	SW846 9040	0.01 (s.u.)	N/A*
Sodium	Semi-annually	SW846 6010B/6020	1.0	N/A*
Chloride	Semi-annually	SW846 9056/9251 325.3	3.0	N/A*
Sulfate	Semi-annually	SW846 9056/9038	5.0	N/A*
Nitrate	Semi-annually	SW846 9056 353.2	0.10	N/A*
Arsenic	Semi-annually	SW846 6010B/6020	0.010	N/A*
Cadmium	Semi-annually	SW846 6010B/6020	0.005	N/A*
Chromium	Semi-annually	SW846 6010B	0.020	N/A*
Selenium	Semi-annually	SW846 6020/7741A gaseous hydride/7740 GF	0.002	N/A*

[1]PMW=proposed monitoring well
[2]Clean Harbors Deer Park, LP reserves the right to use alternate approved methods and/or updated methods as they are promulgated.
[3]The concentration limits shall be the basis for determining whether a release has occurred from the waste management unit/area. The concentration limits shall be based on background values for the waste management unit/area, or Practical Quantitation Limit (PLQ) values identified in 40 CFR 264, Appendix IX. If background values are lower that PQLs, the applicant may choose respective PQLs as concentration limits for the hazardous constituent.
*East Landfill is not currently operational or under Detection Monitoring requirements.

TABLE VI.B.3.c GROUNDWATER SAMPLE ANALYSIS
East Landfill Background and Point of Compliance Wells
For each well or group of wells, specify the suite of parameters for which groundwater samples will be analyzed.

Well No(s).:[1]
MW-304.1, MW-309.1, MW-315.1, MW-318.1, MW-301.1, MW-303.1, MW-308.1, MW-313.1

Parameter	*Sampling Frequency*	*Analytical Method[2]*	*Detection Limits*	*Concentration Limits[3]*
Chloroabenzene	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
Tetrachloroethene	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
Trichloroethene	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
Carbon Tetrachloride	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
Benzene	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
1,1,1-Trichloroethane	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
Chloroform	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*
1,1 Dichloroethane	Quarterly first year, Semi-annually thereafter	EPA SW-846 8260B	0.005	N/A*

[1]PMW=proposed monitoring well
[2]Clean Harbors Deer Park, LP reserves the right to use alternate approved methods and/or updated methods as they are promulgated.
[3]The concentration limits shall be the basis for determining whether a release has occurred from the waste management unit/area. The concentration limits shall be based on background values for the waste management unit/area, or Practical Quantitation Limit (PLQ) values identified in 40 CFR 264, Appendix IX. If background values are lower that PQLs, the applicant may choose respective PQLs as concentration limits for the hazardous constituent.
*East Landfill is not currently operational or under Detection Monitoring requirements.

TABLE VII.E.1 PERMITTED UNIT CLOSURE COST SUMMARY

	Existing Unit Closure Cost Estimate	
TCEQ Permit Unit No.	Unit	Cost[1]
02	North Landfill	1,750,441
03	Incinerator Train I	35,247
04	Incinerator Train II	39,712
09	Storage Tank T-1	29,049
10	Storage Tank T-2	17,219
11	Storage Tank T-11	21,919
12	Storage Tank T-12	21,919
13	Storage Tank T-18	17,219
14	Storage Tank T-19	14,441
15	Storage Tank T-20	6,677
16	Storage Tank T-21	6,677
17	Storage Tank T-27	13,778
18	Storage Tank T-28	13,778
19	Storage Tank T-31	38,960
20	Storage Tank T-32	39,026
21	Storage Tank T-60	75,253
22	Storage Tank T-61	88,237
23	Storage Tank V-101	9,492
24	Storage Tank V-103	7,401
25	Storage Tank V-104	15,612
26	Storage Tank V-105	15,612
27	Storage Tank V-106	15,612
28	Storage Tank V-107	15,612
29	Storage Tank V-108	15,612
30	Storage Tank V-109	15,139
31	Storage Tank V-110	15,139

TABLE VII.E.1 PERMITTED UNIT CLOSURE COST SUMMARY

	Existing Unit Closure Cost Estimate	
TCEQ Permit Unit No.	Unit	Cost[1]
37	Storage Tank T-29	9,921
38	Storage Tank T-30	9,921
NA	West Tank Farm Containment	14,828
39	Storage Tank T-70	32,604
40	Storage Tank T-71	31,891
41	Storage Tank T-72	31,891
44	Storage Tank T-75	31,891
45	Storage Tank T-76	31,402
46	Storage Tank T-77	31,402
NA	North Tank Farm Containment	246,678
76a	Container Storage Area DSP-1	110,841
76b	Container Storage Area DSP-2	135,778
76c	Container Storage Area DSP-3	411,920
76d	Container Storage Area DSP-4	494,112
76e	Container Storage Area DSP-5	548,991
76f	Container Storage Area DSP-6	614,651
76g	Container Storage Area DSP-7	72,930
76h	Container Storage Area PCB Warehouse	837,934
77	Trans & Drum Handling Bldg	646,777
78	RCRA Warehouse	2,119,790
79	Tank Truck Storage Pak	117,540
87	Mixing Hoppers T-1001-1	32,235
88	Mixing Hoppers T-1001-2	31,580
89	Mixing Hoppers T-1001-3	31,580
90	Bin Storage Area BSA-1	628,180
91	Bin Storage Area BSA-2	1,750,357
92	Bin Storage Area BSA-3	759,699
93	Storage Tank V-1204	4,100
94	Stabilization Tank T-1202	5,455

TABLE VII.E.1 PERMITTED UNIT CLOSURE COST SUMMARY

	Existing Unit Closure Cost Estimate	
TCEQ Permit Unit No.	Unit	Cost[1]
95	Stabilization Tank T-1203	5,455
96	Stabilization Tank T-1204	7,770
97	Stabilization Tank B-1203	3,327
97	Stabilization Tank B-1203	167,994
99	Rail Car Unloading Area	87,178
100	Rotary Reactor Feed Tower	19,132
101	DSP-8	89,049
102	Container QC Area	273,069
103	Direct Burn Areas	186,459
104	Front-Line Storage Pad	153,013
105	PCB Shredder	43,144
106	Waste Receiving Pad	398,160
107	T-201	17,653
108	North Pad	21,512
03 and 04	MACT air pollution control equipment	16,852
	TOTAL EXISTING UNIT CLOSURE COST ESTIMATE	$13,671,429

	Existing Unit Closure Cost Estimate	
TCEQ Permit Unit No.	Unit	Cost[1]
98	East Landfill (4 Cells)	2,939,147
109	T-33	38,463
	Total Proposed Unit Closure Cost Estimate	$2,977,610

[1] Costs are based on calendar year 2004 dollars

TABLE VII.E.2 PERMITTED UNIT CLOSURE COST SUMMARY

	Existing Unit Closure Cost Estimate	
TCEQ Permit Unit No.	Unit	Cost[1]
01	South Landfill	$2,092,036
02	North Landfill	$3,673,104
-	Leachate Collection Tank*	$22,656
	TOTAL EXISTING UNIT CLOSURE COST ESTIMATE	$5,787,796

*One time cost provided at beginning of post-closure period.

	Existing Unit Closure Cost Estimate	
TCEQ Permit Unit No.	Unit	Cost[1]
98	East Landfill	$1,391,683
	Total Proposed Unit Closure Cost Estimate	$1,391,683

[1]Costs are based on 2004 dollars.

TABLE VII.G. – POST-CLOSURE PERIOD

Unit Name	Date Certified Closed	Permitted Post Closure Period (Yrs)	Date Post Closure Ends
South Landfill (Permit Unit No. 1)	04/26/1996	30	04/26/2026
North Landfill (Permit Unit No. 2)	Active	30	30 years after certified closed
East Landfill (Permit Unit No. 98)	Not Constructed	30	30 years after certified closed

LIST OF INCORPORATED APPLICATION MATERIALS

The following is a list of Part A and Part B Industrial and Hazardous Waste Application elements which are incorporated into all Industrial and Hazardous Waste permits by reference as per Provision I.I.5.

TCEQ PART A Application Form

- I. General Information
  - I.B. – Authorized Agents
  - I.C. – Identify entity who will conduct facility operation.
  - I.D. – Facility Ownership

- III. Wastes and Waste Management
  - III.C.1. – Location of Waste Management Units – Topographic Map extending one mile beyond facility.

TCEQ PART B Application Form

- I. General Information
  - I.A. – Applicant
  - I.C. – Facility Location – Address
  - I.D. – Application Type
  - I.E. – Facility Siting Summary
  - I.F. – Wastewater and Stormwater Disposition
  - I.G. – Adjacent Landowners List

- II. Facility Siting Criteria
  - II.A. – Requirements for Storage or Processing Facilities and Landfills
  - II.F.1 – Flooding
  - II.G. – Additional Information Requirements

- III. Facility Management
  - III.B. – Personnel Training Plan
  - III.C. – Security
  - III.D. – Inspection Schedule
  - III.E. – Contingency Plan
  - III.E.1. – Arrangements with Local Authorities
  - III.E.2. – Emergency Coordinators List
  - III.E.3. – Emergency Equipment List

- IV. Wastes and Waste Analysis
  - IV.B. – Table IV.B. – Waste managed in permitted units
  - IV.C. – Table IV.C. – Sampling and Analytical Methods
  - IV.D. – Waste Analysis Plan

V. Engineering Reports

- V.A.1. – General Information
- V.A.3. – Construction schedules
- V.A.4. – Detailed Plans & Specifications to show facility will be constructed and operated in compliance with all pertinent permitting requirements.

- V.B – Container Storage Areas Engineering Reports – Includes Table V.B. Container Storage Areas Summary

- V.C. – Tanks and Tank Systems Engineering Reports – Includes Table V.C. – Tanks and Tank Systems Summary

- V.G. – Landfill Engineering Report
  - V.G.1. – Table V.G.1. Landfills
  - V.G.5. – Describe the Landfill
  - V.G.6. – Liner System – Includes Table V.G.3. Landfill Liner System
  - V.G.7 – Leachate Collection System – Includes Table V.G.4. Landfill Leachate Collection System
  - V.G.8 – Landfill MTR Plans and Specifications showing Conformity with 31 TAC§335.173
  - V.G.9. – Site Development Plan – Methods used to deposit waste in landfill
  - V.G.10. – Landfill Run-on Control
  - V.G.11 – Landfill Run-off Control
  - V.G.12 – Wind Dispersal
  - V.G.13. – Liquid Waste Stabilization

- V.H. – Incinerator Engineering Report
  - V.H.1. – Table V.H.1. – Incinerators
  - V.H.2. – Table V.H.2. – Incinerator Permit Conditions, Monitoring, and Automatic Waste Feed Cutoff Systems
  - V.H.3. – Maximum Allowable Constituents Feed Rate
  - V.H.4. – Maximum Allowable Emission Rates

- V.K. – Miscellaneous Units – Design Report – Includes Table V.K.1. – Miscellaneous Units

VI. Geology Report

- VI.A. – Geology and Topography
- VI.B. – Facility Ground Water
  - VI.B.3. – Description of Current & Proposed Detection Monitoring System

VI.B.3.a. – Proposed list of waste specific indicator parameters
Describe proposed ground water-monitoring system
Statistical Comparison Procedures to evaluate ground-water monitoring data
Specify statistical method and process for determining whether constituent concentrations exceed background
VI.B.3.b. – Unit Ground-Water Monitoring System
VI.B.3.c. – Ground-Water Sample Analysis
VI.B.3.d. – Drawings Depicting current and proposed monitoring well design
VI.B.3.e – Maps Showing
1) Monitor well location
2) Soil-pore sampling points
3) Waste Management Area
4) Property Boundary
5) Point of Compliance
6) Direction of Ground-Water Flow
7) Extent of any known plume of contamination

VII. Closure and Post-Closure Care Plans
VII.A. – Closure
Table VII.A Unit Closure
VII.B. – Closure Cost Estimate
VII.C. – Post-closure
VII.D. – Post-closure Cost Estimate
VII.E. – Closure and Post-closure Cost Summary
Table VI.E.1 Permitted Unit Closure Cost Summary
Table VI.E.2. Permitted Unit Post-closure Cost Summary

VIII. Financial Assurance
VIII.A.1. – Financial Assurance for Closure
VIII.A.2. – Financial Assurance for Post-Closure
VIII.A.3. – Liability Requirements
VIII.B.1. – Applicant Financial Disclosure Statements
VIII.B.2. – Audited financial statements
VIII.B.4. – Form 10-K
VIII.C. – Applicants Requesting Facility Expansion, Capacity Expansion, or New Construction

IX. Release from Solid Waste Units & Corrective Action

X. Air Emission Standards
X.A. – Process Vents
X.B. – Equipment Leaks
X.C. – Tanks, Surface Impoundments, and Containers

LIST OF PERMITTED FACILITY UNITS

TCEQ Permit Unit No.	Unit Name	NOR No.	Unit Description	Capacity
01	South Landfill (Closed)	001	Secure landfill, above- and below-grade	1,500,000 yd^3
02	North Landfill (Cells 1 – 6)	134	Secure landfill, above- and below-grade	815,000 yd^3
03	Train I Incinerator	005	Incineration System, consisting of a 3.6 meter inner diameter (ID) slagging rotary kiln and mechanical fluidized bed reactor, and a liquid injection furnace with a common afterburner and a pollution abatement system.	216 MM BTU
04	Train II Incinerator	031	Incineration System, consisting of a 4.4 meter ID slagging rotary kiln and a mechanical fluidized bed reactor, with a common afterburner and pollution abatement system.	213.5 MM BTU
09	T-1	084	Tank, closed top, carbon steel	20,000 g
10	T-2	085	Tank, closed top, carbon steel	24,000 g
11	T-11	086	Tank, closed top, carbon steel	15,000 g
12	T-12	087	Tank, closed top, carbon steel	15,000 g
13	T-18	088	Tank, closed top, carbon steel	24,000 g
14	T-19	089	Tank, closed top, carbon steel	20,000 g
15	T-20	090	Tank, closed top, carbon steel	7,000 g
16	T-21	091	Tank, closed top, carbon steel	7,000 g
17	T-27	092	Tank, closed top, carbon steel	14,600 g
18	T-28	093	Tank, closed top, carbon steel	14,600 g
19	T-31	094	Tank, closed top, carbon steel	27,000 g
20	T-32	095	Tank, closed top, carbon steel	27,000 g
21	T-60	096	Tank, closed top, carbon steel	100,000 g
22	T-61	097	Tank, closed top, carbon steel	200,000 g
23	V-101	021	Tank, closed top, carbon steel	10,000 g

TCEQ Permit Unit No.	Unit Name	NOR No.	Unit Description	Capacity
24	V-103	022	Tank, closed top, carbon steel	10,500 g
25	V-104	023	Tank, closed top, carbon steel	22,400 g
26	V-105	098	Tank, closed top, carbon steel	22,400 g
27	V-106	099	Tank, closed top, carbon steel	22,400 g
28	V-107	100	Tank, closed top, carbon steel	22,400 g
29	V-108	101	Tank, closed top, carbon steel	22,400 g
30	V-109	102	Tank, closed top, carbon steel	21,000 g
31	V-110	103	Tank, closed top, carbon steel	21,000 g
37	T-29	109	Tank, closed top, carbon steel	6,400 g
38	T-30	110	Tank, closed top, carbon steel	6,400 g
39	T-70	111	Tank, closed top, carbon steel	22,500 g
40	T-71	112	Tank, closed top, carbon steel	22,000 g
41	T-72	113	Tank, closed top, carbon steel	22,000 g
44	T-75	116	Tank, closed top, carbon steel	22,000 g
45	T-76	117	Tank, closed top, carbon steel	22,000 g
46	T-77	118	Tank, closed top, carbon steel	22,000 g
76a	DSP-1	036	Container Storage Area, covered	30,250 g
76b	DSP-2	037	Container Storage Area, covered	37,060 g
76c	DSP-3	038	Container Storage Area, covered	113,870 g
76d	DSP-4	039	Container Storage Area, covered	136,680 g
76e	DSP-5	040	Container Storage Area, enclosed	151,800 g
76f	DSP-6	041	Container Storage Area, covered	214,200 g
76g	DSP-7	042	Container Storage Area, covered	19,800 g
76h	Warehouse	043	Container Storage Area, enclosed	212,520 g

TCEQ Permit Unit No.	Unit Name	NOR No.	Unit Description	Capacity
77	Transformer & Drum Handling Bldg.	034	Container Storage Area, enclosed	163,980 g
78	Container Storage Warehouse	007	Container Storage Area, enclosed	587,520 g
79	Tank Truck Storage Pad	168	Container Storage Area, open, 11 5,500 trailer	60,500 g
87	T-1001-1	081	Tank, open top, carbon steel	75 yd^3
88	T-1001-2	082	Tank, open top, carbon steel	75 yd^3
89	T-1001-3	083	Tank, open top, carbon steel	75 yd^3
90	BSA-1	069	Container Storage Area	1,500 yd^3
91	BSA-2	070	Container Storage Area	4,650 yd^3
92	BSA-3	071	Container Storage Area	1,650 yd^3
93	V-1204	121	Tank, closed top, carbon steel	13,500 g
94	T-1202	122	Tank, open top	25,312 g
95	T-1203	123	Tank, open top	25,312 g
96	T-1204	124	Tank, open top	70,875 g
97	Pugmill B-1203	125	Miscellaneous Unit, continuous mixer	22 yd^3
98	East Landfill (Cells 1-4)	135	Secure Landfill, above- and below-grade	658,000 yd^3
99	Railcar Unloading Area	130	Miscellaneous Unit, two 25,000 gallon railcars	50,000 g
100	Rotary Reactor Feed Tower, T-638	133	Tank	7,575 g
101	DSP-8	074	Container Storage Area	23,700
102	Container QC Area	073	Miscellaneous Unit	75,000 g

TCEQ Permit Unit No.	Unit Name	NOR No.	Unit Description	Capacity
103	Direct Burn Area	131	Miscellaneous Unit	44,000 g
104	Front-Line Storage Pad	035	Container Storage Area	60,500 g
105	PCB Shredder	015	Miscellaneous Unit	3,945 g
106	Waste Receiving Pad	167	Container Storage Area	212,100 g
107	3.6 Bulk Feed Tank T-201	176	Tank, open top, carbon steel	7,198 g
108	North Pad	171	Miscellaneous Unit	10,000 g
109	T-33	177	Tank, closed top, carbon steel	21,000 g

Well Design and Construction Specifications

1. The permittee shall use well drilling methods that minimize potential adverse effects on the quality of water samples withdrawn from the well, and that minimize or eliminate the introduction of foreign fluids into the borehole.

2. All wells constructed to meet the terms of this Permit shall be constructed such that the wells can be routinely sampled with a pump, bailer, or alternate sampling device. Piping associated with recovery wells should be fitted with sample ports or an acceptable alternative sampling method to facilitate sampling of the recovered ground water on a well by well basis.

3. Above the saturated zone the well casing may be two (2)-inch diameter or larger schedule 40 or 80 polyvinyl chloride (PVC) rigid pipe or stainless steel or polytetraflouroethylene (PTFE or “teflon") or an approved alternate material. The PVC casing must bear the National Sanitation Foundation logo for potable water applications (NSF-pw). Solvent cementing compounds shall not be used to bond joints and all connections shall be flush-threaded. In and below the saturated zone, the well casing shall be stainless steel or PTFE.

   The Permittee may use PVC or fiberglass reinforced resin as an alternate well casing material below the saturated zone provided that it yields samples for ground-water quality analysis that are unaffected by the well casing material.

4. The permittee shall replace any well that has deteriorated due to incompatibility of the casing material with the ground-water contaminants or due to any other factors. Replacement of the damaged well shall be completed within ninety (90) days of the date of the inspection that identified the deterioration.

5. Well casings and screens shall be steam cleaned prior to installation to remove all oils, greases, and waxes. Well casings and screens made of fluorocarbon resins shall be cleaned by detergent washing.

6. For wells constructed after the date of issuance of this Permit, the screen length shall not exceed ten (10) feet within a given transmissive zone unless otherwise approved by the Executive Director. Screen lengths exceeding ten (10) feet may be installed in ground-water recovery or injection wells to optimize the ground-water remediation process in accordance with standard engineering practice.

7. The Permittee shall design and construct the intake portion of a well so as to allow sufficient water flow into the well for sampling purposes and to minimize the passage of formation materials into the well during pumping. The intake portion of a well shall consist of commercially manufactured stainless steel or PTFE screen or approved alternate material. The annular space between the screen and the borehole shall be filled with clean siliceous granular material (i.e., filter pack) that has a proper size gradation to provide mechanical retention of the formation sand and silt. The well screen slot size shall be compatible with the filter pack size as determined by sieve analysis data. The filter pack should extend no more than three (3) feet above the well screen. A silt trap, no greater than one (1) foot in length, may be added to the bottom of the well screen to collect any silt that enter the well. The bottom of the well casing shall be capped with PTFE or stainless steel or approved alternate material.

   Ground-water recovery and injection wells shall be designed in accordance with standard engineering practice to ensure adequate well production and to accommodate ancillary equipment. Silt traps exceeding one (1) foot may be utilized to accommodate ancillary equipment. Well heads shall be fitted with mechanical wellseals, or equivalent, to prevent entry of surface water debris.

8. A minimum of two (2) feet of pellet or granular bentonite shall immediately overlie the filter pack in the annular space between the well casing and borehole. Where the saturated zone extends above the filter pack, pellet or granular bentonite shall be used to seal the annulus. The bentonite shall be allowed to settle and hydrate for a sufficient amount of time prior to placement of grout in the annular space. Above the minimum two (2)-foot thick bentonite seal, the annular space shall be sealed with a cement/bentonite grout mixture. The grout shall be placed in the annular space by means of a tremie pipe or pressure grouting methods equivalent to tremie grouting standards.

   The cement/bentonite grout mixture of TCEQ approved alternative grout mixture shall fill the annular space to within two (2) feet of the surface. A suitable amount of time shall be allowed for settling to occur. The annular space shall be sealed with concrete, blending into a cement apron at the surface that extends at least two (2) feet from the outer edge of the monitor well borehole for above-ground completions. Alternative annular-space seal material may be proposed with justification and must be approved by the Executive Director prior to installation.

   In cases where flush-to-ground completions are unavoidable, a protective structure such as a utility vault or meter box should be installed around the well casing and the concrete pad design should prevent infiltration of water into the vault. In addition, the Permittee must ensure that 1) the well/cap juncture is watertight; 2) the bond between the cement surface seal and the protective structure is watertight; and 3) the protective structure with a steel lid or manhole cover has a rubber seal or gasket.

9. Water added as a drilling fluid to a well shall contain no bacteriological or chemical constituents that could interfere with the formation or with the chemical constituents being monitored. For ground-water recovery and injection wells, drilling fluids containing freshwater and treatment agents may be utilized in accordance with standard engineering practice to facilitate proper well installation. In these cases, the water and agents added should be chemically analyzed to evaluate their potential impact on in-situ water quality and to assess the potential for formation damage. All such additives shall be removed to the extent practicable during well development.

10. Upon completion of installation of a well, the well must be developed to remove any fluids used during well drilling and to remove fines from the formation to provide a particulate-free discharge to the extent achievable by accepted completion methods and by commercially available well screens. Development shall be accomplished by reversing flow direction, surging the well or by air lift procedures. No fluids other than formation water shall be added during development of a well unless the aquifer to be screened is a low-yielding water-bearing aquifer. In these cases, the water to be added should be chemically analyzed to evaluate its potential impact on in-situ water quality, and to assess the potential for formation damage.

    For recovery and injection wells, well development methods may be utilized in accordance with standard engineering practice to remove fines and maximize well efficiency and specific capacity. Addition of freshwater and treatment agents may be utilized during well development or re-development to remove drilling fluids, inorganic scale or bacterial slime. In these cases, the water and agents added should be chemically analyzed to evaluate their potential impact on in-situ water quality and to assess the potential for formation damage. All such additives shall be removed to the extent practicable during well development.

11. Each well shall be secured and/or designed to maintain the integrity of the well borehole and ground water.

12. The Permittee shall protect the above-ground portion of the well by bumper guards and/or metal outer casing protection.

13. Copies of drilling and construction details demonstrating compliance with the items of this provision shall be kept on site. This record shall include the following information:

    - name/number of well (well designation);
    - intended use of the well (sampling, recovery, etc.);
    - date/time of construction;
    - drilling method and drilling fluid used;
    - well location (± 0.5 ft);

- bore hole diameter and well casing diameter;
- well depth (± 0.1 ft.);
- drilling and lithologic logs;
- depth to first saturated zone;
- casing materials;
- screen materials and design;
- casing and screen joint type;
- screen slot size/length;
- filter pack material/size;
- filter pack volume (how many bags, buckets, etc.)
- filter pack placement method;
- sealant materials;
- sealant volume (how many bags, buckets, etc.);
- sealant placement method;
- surface seal design/construction;
- well development procedure;
- type of protective well cap;
- ground surface elevation (± 0.01 ft. MSL);
- top of casing elevation (± 0.01 ft. MSL); and
- detailed drawing of well (include dimensions).

14. The Permittee shall complete construction or abandonment and plugging of each well in accordance with the requirements of this Permit and 16 TAC § 76.1000 through § 76.1009 and shall certify such proper construction or abandonment within sixty (60) days of installation or abandonment. If the Permittee installs any additional or replacement wells, well completion logs for each well shall be submitted within sixty (60) days of well completion and development in accordance with 16 TAC § 76.700. Certification of each well shall be submitted within sixty (60) days of installation for an individual well project or within (60) days from the date of completion of a multiple well installation project. The certification shall be prepared by a qualified geologist or geotechnical engineer. Each well certification shall be accompanied by a certification report, including an accurate log of the soil boring, which thoroughly describes and depicts the location, elevations, material specifications, construction details, and soil conditions encountered in the boring for the well. A copy of the certification and certification report shall be kept on-site, and a second copy shall be submitted to the Executive Director. Required certification shall be in the following form:

"This is to certify that installation (or abandonment and plugging) of the following facility components authorized or required by TCEQ Permit No. 50089 has been completed, and that construction (or plugging) of said components has been preformed in accordance with and in compliance with the design and construction specification of Permit. No. 50089 (Description of facility components with reference to applicable permit provisions).

15. The Permittee shall clearly mark and maintain the well number on each well at the site.

16. The Permittee shall measure and keep a record of the elevation of the top of each well casing in feet above mean sea level to the nearest 0.01 foot and permanently mark the measuring point on the well. The permittee shall compare old and new elevations from previously surveyed wells and determine a frequency of surveying not to exceed five (5) year intervals.

17. Wells may be replaced at any time the Permittee or Executive Director determines that the well integrity or materials of construction or well placement no longer enable the well to yield samples representative of ground-water quality.

18. The Permittee shall plug soil test borings and wells removed from service with a cement/bentonite grout mixture so as to prevent the preferential migration of fluids in the area of the borehole. Certification of each well plugging shall be reported in accordance with Provision 14 of this attachment to this permit. The plugging of wells shall be in accordance with 16 TAC §76.1000 through §76.1009 dealing with Well Drilling, Completion, Capping and Plugging.

19. A well's screened interval shall be appropriately designed and installed to meet the well's specific objective (i.e., either DNAPL, LNAPL, both, or other objective of the well). All wells designed to detect, monitor, or recover DNAPL must be drilled to intercept the bottom confining layer of the aquifer. The screened interval to detect DNAPL should extend from the top of the lower confining layer to above the portion of the aquifer saturated with DNAPL. The screened interval for all wells designed to detect, monitor, or recover LNAPL must extend high enough into the vadose zone to provide for fluctuations in the seasonal water table. In addition, the sandpacks for the recovery or monitoring well's screened interval shall be coarser than surrounding media to ensure the movement of NAPL to the well.

Attachment F - Compounds Detrimental to HPDE Liners

Acetaldehyde	Acetone
Acetylene tetrabromide	Amyl acetate
Amyl alcohol	Amyl chloride
Aniline	Anisole
Aqua Regia	Benzaldehyde
Benzene	Benzone
Benzyl chloride	Bromobenzene
Calcium sulfide	Butyl Acetate
Carbon tetrachloride	Carbon disulfide
Chlorosulfonic Acid	Chromic acid
Cresylic acid	Dibenzyl ether
Dichlorobenzene	Dichloroethane
Dichloropropane	Dichloropropene
2,2 - Dichloroproprionic Acid	Diesel Oil
Diethyl ether	Diethylene glycol monobutyl ether
Ether ethyl benzene	Ethyl acetate
Ethyl benzene	Ethyl benzoate
Ethyl chloride, liquid	Ethyl Ether
Ethylene chloride	Ethylene glycol monoethyl ether
Ethylene dichloride	Ethylene trichloride
Ethlylene oxide	Fuel oil
Fluoroboric acid	Glacial Acetic acid
Gasoline	n-Heptane
Halothane	Hydraulic fluids
Hexane	Isopropyl benzene
Hydrogen peroxide	Kerosene
Isopropyl ether	Methylene chloride
Lubricating oils	Nitric acid
Naphthalene	n-Octane
Nitrobenzene	Oleic acid
Octyl Cresol	Perchloroethylene
Orange oil	Polychlorinated biphenyls
Pentachlorophenol	Sulfur dioxide
Pseudocumene	Tetrachloroethane
Sulfur salts	Sulfur trioxide
Tetrachlorohydrofuran	Thionyl chloride
Sulfuric Acid	Toluene
Thiophene	Trichloroethane
Trichlorfon (sic)	Trichlorophenol
Trichloroethylene	Vinylidene chloride
Xylene	

APPENDIX C

DOSE CALCULATION OUTPUT

Maximally Exposed Individual Dose Calculation for Disposal of Granular Activated Carbon with Tritium and Radon Daughters

Parameter	Value	Description
Average Mass of Carbon in Drum m (g/drum)	105,725	Average of drum net weights
Tritium activity-concentration $C_{f,H\text{-}3}$ (pCi/g)	441,176	Estimated activity-concentration based on forward calculation
Tritium activity-concentration $C_{f,\ Pb\text{-}210}$ (pCi/g)	110,294	Estimated activity-concentration based on forward calculation
Tritium activity-concentration $C_{f,Po\text{-}210}$ (pCi/g)	110,294	Estimated activity-concentration based on forward calculation
Activity per drum $A_{d,\ H\text{-}3}$ (Ci/drum)	4.66E-02	$A_{d,\ H\text{-}3}$ (Ci/drum) = $C_{f,\ H\text{-}3}$ (pCi/g) x m (g/drum) x (1 Ci / 1E+12 pCi)
Activity per drum $A_{d,\ Pb\text{-}210}$ (Ci/drum)	1.17E-02	$A_{d,\ Pb\text{-}210}$ (Ci/drum) = $C_{f,\ Pb\text{-}210}$ (pCi/g) x m (g/drum) x (1 Ci / 1E+12 pCi)
Activity per drum $A_{d,\ Po\text{-}210}$ (Ci/drum)	1.17E-02	$A_{d,\ Po\text{-}210}$ (Ci/drum) = $C_{f,\ Po\text{-}210}$ (pCi/g) x m (g/drum) x (1 Ci / 1E+12 pCi)
Drums/shipment n_d	30	2 ft diameter drums packed in 7.3 ft x 18.4 ft trailer
Shipment Activity $A_{s,\ H\text{-}3}$ (Ci/shipment)	1.40E+00	$A_{s,\ H\text{-}3}$ (Ci/shipment) = $A_{d,\ H\text{-}3}$ (Ci/drum) x n_d (drums/shipment)
Shipment Activity $A_{s,\ Pb\text{-}210}$ (Ci/shipment)	3.50E-01	$A_{s,\ Pb\text{-}210}$ (Ci/shipment) = $A_{d,\ Pb\text{-}210}$ (Ci/drum) x n_d (drums/shipment)
Shipment Activity $A_{s,\ Po\text{-}210}$ (Ci/shipment)	3.50E-01	$A_{s,\ Po\text{-}210}$ (Ci/shipment) = $A_{d,\ Po\text{-}210}$ (Ci/drum) x n_d (drums/shipment)
Maximum exposed individual dose per shipment D_s (mrem/shipment)	1.0	TSD-Dose output for receiving worker
Individual dose limit D_L (mrem/year)	1.0	DOE limit
Collective public dose per shipment CD_s (person-rem/shipment)	7.5	Sum of public dose (driver, public along route, TSD workers, offsite public)
Collective dose limit CD_L (person-rem/year)	10	DOE limit

Abbreviations:

Ci	Curie
ft	feet
g	grams
LLNL	Lawrence Livermore National Laboratory
mrem	millirem
pCi	picocuries
pCi/g	picocuries per gram
rem	Roentgen equivalent man

TSD-DOSE: A Radiological Dose Assessment Model for Treatment, Storage, and Disposal Facilities

Version 2.22 - September 1998

Site: llnl
Shipment: H3 in Spent Carbon - Individual Back Calculation - without mixing
User: tru

	TOTAL	EXTERNAL	INTERNAL
Dose to:			
Driver:	9.7E-03 mrem	7.0E-03 mrem	2.7E-03 mrem
Receiving worker:	9.9E-01 mrem	3.2E-02 mrem	9.6E-01 mrem
Incineration worker:	9.5E-02 mrem	5.6E-02 mrem	3.9E-02 mrem
Landfill worker:	2.7E-02 mrem	2.3E-05 mrem	2.7E-02 mrem
Offsite individual:	6.0E-01 mrem		
Offsite population:	2.5E+01 p-rem		
Worker Population:	8.4E-04 p-rem	2.5E-04 p-rem	5.9E-04 p-rem
Dose from:			
Transport to TSD facility:	9.7E-03 mrem	7.0E-03 mrem	not applicable
Receiving and sampling waste:	9.4E-01 mrem	7.5E-03 mrem	9.4E-01 mrem
Storage before processing:	2.5E-02 mrem	2.5E-02 mrem	not applicable
Incineration of waste:	2.7E-02 mrem	9.2E-05 mrem	2.7E-02 mrem
Burial at onsite landfill:	2.3E-05 mrem	2.3E-05 mrem	0.0E+00 mrem
Transport to offsite landfill:	not applicable	not applicable	not applicable
Incinerator maintenance:	4.3E-02 mrem	3.2E-02 mrem	1.1E-02 mrem

$\times \dfrac{3{,}00 \text{ person/mi}^2 \text{ Deep Park}}{10{,}000 \text{ person/mi}^2 \text{ (Model Default)}} = 7.5 \text{ p-rem}$

$\rightarrow +1.5E\text{-}4 \approx 9.9E\text{-}4$ p-rem

Doses due to each isotope (mrem - population dose in p-rem).

Isotope	H3	Pb210+D	Po-210
Activity	1.4E+00 Ci	3.5E-01 Ci	3.5E-01 Ci
Release Fraction	9.00E-01	1.00E-02	1.00E-02
Driver	2.7 E-06	5.9 E-03	3.8 E-03
Receiving worker	7.8 E-01	1.4 E-01	7.6 E-02
Incineration worker	2.7 E-05	7.6 E-02	1.9 E-02
Landfill worker	2.7 E-05	1.6 E-02	1.1 E-02
Offsite individual	1.3 E-03	5.1 E-01	9.3 E-02
Offsite population	5.2 E-02	2.1 E+01	3.9 E+00
Worker population	2.8 E-07	5.8 E-04	2.7 E-04

Site Description

Operations included:

Transport to TSD facility
Receiving and sampling waste
Storage before processing
Incineration of waste
Burial at onsite landfill
Incinerator maintenance

Operations excluded:

Transport to offsite landfill

Parameters

The following are the adjustable parameters used to model each operation.
A (D) after a value indicates the default value was used.

Fraction solid waste = 1.000
Fraction liquid waste = 0.000
Pre-processed waste density = 5.1 E-01 g/cc
Post-processed waste density = 5.1 E-01 g/cc

Transport to TSD facility (4 steps)

Number of Workers: 1.0E+00 (D)
Truck bed dimensions (for all steps)
length: 1.76E+01 feet
width: 7.00E+00 feet
height: 3.00E+00 feet

Step A: Load and secure shipment
average distance: 3.00E+00 feet (D)
duration: 1.00E+00 hours
shielding thickness: 6.25E-02 inches (D)

Step B: Drive
average distance: 7.00E+00 feet (D)
duration: 3.50E+01 hours
shielding thickness: 1.25E-01 inches (D)

Step C: Rest
average distance: 2.00E+00 feet (D)
duration: 2.40E+01 hours
shielding thickness: 1.25E-01 inches (D)

Step D: Maintenance in transit
average distance: 3.00E+00 feet (D)
duration: 2.00E+00 hours (D)
shielding thickness: 6.25E-02 inches (D)

Receiving and sampling waste (5 steps)

Number of Workers: 2.0E+00 (D)

Step A: Weight truck, inspect manifest
average distance: 5.00E+00 feet (D)
duration: 1.00E+00 hours (D)

Receiving and sampling waste (cont'd)

Step B: Unload drums
average distance: 3.00E+00 feet (D)
time per drum or pallet: 8.33E-02 hours (D)

Step C: Inspect and sample drums
average distance: 5.00E-01 feet (D)
time per drum: 5.00E-02 hours
airborne respirable dust concentration: 1.0E+01 mg/m3 (D)
respiratory protection factor: 1.0E+01 (D)

Step D: Transfer solids to storage
average distance: 3.00E+00 feet (D)
time per drum or pallet: 1.67E-01 hours (D)

Step E: Pump drummed oil to storage tank
average distance: 5.00E-01 feet (D)
time per drum: 0.00E+00 hours

Storage before processing (3 steps)

Step A: Workers in solid waste storage area
average distance: 1.00E+00 feet
duration: 2.50E+01 hours

Step B: Transfer solids out
average distance: 3.00E+00 feet (D)
time per drum or pallet: 8.33E-02 hours (D)

Step C: Workers in liquid waste storage area
average distance: 3.00E+00 feet (D)
duration: 0.00E+00 hours
shielding thickness: 1.25E-01 inches (D)
Storage tank dimensions:
length: 7.00E+00 feet (D)
width: 7.00E+00 feet (D)
height: 1.20E+01 feet (D)

Incineration of waste (4 steps)

Step A: Incineration of waste
stack height: 1.0E+02 feet
wind speed: 8.0E+00 mph
exit velocity: 2.0E+01 mph
stack diameter: 6.0E+00 feet
surrounding building height: 3.6E+01 feet
Plume entrainment due to building wake effect excluded

Step B: Collect residue in bin
average distance: 2.00E+00 feet (D)
time per bin: 2.50E-01 hours (D)
shielding thickness: 1.25E-01 inches (D)
Number of Workers: 2.00E+00 (D)
Bin dimensions:
length: 2.00E+01 feet
width: 7.00E+00 feet
height: 4.00E+00 feet

Incineration of waste (cont'd)

Step C: Transport bin to storage area

average distance: 2.00E+00 feet (D)
time per bin: 2.50E-01 hours (D)
shielding thickness: 1.25E-01 inches (D)
Number of Workers: 2.00E+00 (D)
Bin dimensions:
length: 2.00E+01 feet
width: 7.00E+00 feet
height: 4.00E+00 feet

Step D: Transport from storage area

average distance: 2.00E+00 feet (D)
time per bin: 2.50E-01 hours (D)
shielding thickness: 1.25E-01 inches (D)
Number of Workers: 2.00E+00 (D)
Bin dimensions:
length: 2.00E+01 feet
width: 7.00E+00 feet
height: 4.00E+00 feet

Burial at onsite landfill (4 steps)

Number of Workers: 1.0E+00 (D)
Dump truck bed dimensions for steps A, C, and D):
length: 2.50E+01 feet (D)
width: 6.00E+00 feet (D)
height: 3.00E+00 feet (D)

Step A: Unload waste to mixing pit

average distance: 5.00E+00 feet (D)
duration: 0.00E+00 hours
shielding thickness: 1.25E-01 inches (D)
airborne respirable dust concentration: 1.0E+00 mg/m3 (D)
respiratory protection factor: 1.0E+00 (D)

Step B: Mix waste in mixing pit

average distance: 1.00E+01 feet (D)
duration: 0.00E+00 hours
cover thickness: 2.00E+00 inches (D)
Mixing pit dimensions:
length: 1.00E+01 feet (D)
width: 1.00E+01 feet (D)
depth: 1.00E+01 feet (D)
cover thickness: 2.00E+00 inches (D)

Step C: Load truck and transport to landfill

average distance: 5.00E+00 feet (D)
duration: 2.50E-01 hours (D)
shielding thickness: 1.25E-01 inches (D)

Step D: Unload truck at landfill

average distance: 5.00E+00 feet (D)
duration: 2.50E-01 hours (D)
shielding thickness: 1.25E-01 inches (D)

Incinerator maintenance (1 steps)

Number of Workers: 1.0E+00 (D)

Step A:

time per maintenance: 1.20E+01 hours (D)
liquids mass: 2.5E+07 lbs (D)
solids mass: 2.5E+07 lbs (D)
airborne respirable dust concentration: 1.0E+01 mg/m3 (D)
respiratory protection factor: 5.0E+01 (D)

TSD-DOSE: A Radiological Dose Assessment Model for Treatment, Storage, and Disposal Facilities

Version 2.22 - September 1998

Site: llnl
Shipment: H3 in Spent Carbon - Individual Back Calculation - mixing only
User: tru

	TOTAL	EXTERNAL	INTERNAL
Dose to:			
Driver:	not applicable	not applicable	not applicable
Receiving worker:	not applicable	not applicable	not applicable
Incineration worker:	not applicable	not applicable	not applicable
Mixing Pit ~~Landfill~~ worker:	1.5E-01 mrem	9.2E-04 mrem	1.5E-01 mrem
Offsite individual:	3.1E-04 mrem	add to doses w/o mixing	
Offsite population:	1.1E-03 p-rem		
Worker Population:	1.5E-04 p-rem	9.2E-07 p-rem	1.5E-04 p-rem

	TOTAL	EXTERNAL	INTERNAL
Dose from:			
Transport to TSD facility:	not applicable	not applicable	not applicable
Receiving and sampling waste:	not applicable	not applicable	not applicable
Storage before processing:	not applicable	not applicable	not applicable
Incineration of waste:	not applicable	not applicable	not applicable
Mixing ~~Burial at onsite landfill~~:	1.5E-01 mrem	9.2E-04 mrem	1.5E-01 mrem
Transport to offsite landfill:	not applicable	not applicable	not applicable
Incinerator maintenance:	not applicable	not applicable	not applicable

Doses due to each isotope (mrem - population dose in p-rem).

Isotope	H3	Pb210+D	Po-210
Activity	1.4E+00 Ci	3.5E-01 Ci	3.5E-01 Ci
Release Fraction	9.00E-01	1.00E-02	1.00E-02
Driver	not applicable		
Receiving worker	not applicable		
Incineration worker	not applicable		
Landfill worker	1.7 E-06	9.0 E-02	6.1 E-02
Offsite individual	7.4 E-09	2.7 E-04	4.9 E-05
Offsite population	2.5 E-08	9.0 E-04	1.7 E-04
Worker population	1.7 E-09	9.0 E-05	6.1 E-05

Site Description

Operations included:

Burial at onsite landfill

Operations excluded:

Transport to TSD facility
Receiving and sampling waste
Storage before processing
Incineration of waste
Transport to offsite landfill
Incinerator maintenance

Parameters

The following are the adjustable parameters used to model each operation.
A (D) after a value indicates the default value was used.

Fraction solid waste = 1.000
Fraction liquid waste = 0.000
Pre-processed waste density = 7.0 E-01 g/cc
Post-processed waste density = 1.4 E+00 g/cc

Burial at onsite landfill (4 steps)

Number of Workers: 1.0E+00 (D)
Dump truck bed dimensions for steps A, C, and D):
length: 2.50E+01 feet (D)
width: 6.00E+00 feet (D)
height: 3.00E+00 feet (D)

Step A: Unload waste to mixing pit

average distance: 1.80E+01 feet
duration: 1.00E+00 hours
shielding thickness: 1.25E-01 inches (D)
airborne respirable dust concentration: 1.0E+00 mg/m3 (D)
respiratory protection factor: 1.0E+01

Step B: Mix waste in mixing pit

average distance: 4.00E+01 feet
duration: 5.00E-01 hours (D)
cover thickness: 2.00E+00 inches (D)
Mixing pit dimensions:
length: 1.27E+01 feet
width: 1.27E+01 feet
depth: 1.27E+01 feet
cover thickness: 2.00E+00 inches (D)

Step C: Load truck and transport to landfill

average distance: 5.00E+00 feet (D)
duration: 0.00E+00 hours
shielding thickness: 1.25E-01 inches (D)

Step D: Unload truck at landfill

average distance: 5.00E+00 feet (D)
duration: 0.00E+00 hours
shielding thickness: 1.25E-01 inches (D)

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Part I: Mixture Sums and Single Radionuclide Guidelines

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Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 MORBIDITY

Menu	Parameter	Current Value	Base Case*	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(1)
D-34	Food transfer factors:			
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(1,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(1,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	4.910E+00	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.130E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.100E+05	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(1)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	5.100E-01	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.574E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.000E+00	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	not used	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	0.000E+00	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	suppressed
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions	
Area:	4.91 square meters
Thickness:	2.13 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g	
Pb-210	1.100E+05

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.181E+02	2.105E+02	1.960E+02	1.527E+02	7.483E+01	6.167E+00	4.931E-03	7.128E-14
M(t):	8.724E+00	8.418E+00	7.839E+00	6.107E+00	2.993E+00	2.467E-01	1.973E-04	2.851E-15

Maximum TDOSE(t): 2.181E+02 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	2.181E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(
Total	2.181E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.181E+02	1.000(
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.181E+02	1.000(

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract
Pb-210	2.105E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(
Total	2.105E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.105E+02	1.000(
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.105E+02	1.000(

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract
Pb-210	1.960E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(
Total	1.960E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.960E+02	1.000(
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.960E+02	1.000(

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	1.527E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(
Total	1.527E+02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.527E+02	1.000(
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.527E+02	1.000(

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	7.483E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000
Total	7.483E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.483E+01	1.000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.483E+01	1.000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	6.167E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000
Total	6.167E+00	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.167E+00	1.000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.167E+00	1.000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	4.931E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(
Total	4.931E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.931E-03	1.000(
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.931E-03	1.000(

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	7.128E-14	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(
Total	7.128E-14	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.000(

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.128E-14	1.000(
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.128E-14	1.000(

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210+D	Pb-210+D	1.000E+00	1.983E-03	1.913E-03	1.782E-03	1.388E-03	6.803E-04	5.607E-05	4.483E-08	6.480E-19

The DSR includes contributions from associated (half-life ó 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	1.261E+04	1.307E+04	1.403E+04	1.801E+04	3.675E+04	4.459E+05	5.576E+08	*7.634E+13

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pb-210	1.100E+05	0.000E+00	1.983E-03	1.261E+04	1.983E-03	1.261E+04

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	Pb-210	1.000E+00	2.181E+02	2.105E+02	1.960E+02	1.527E+02	7.483E+01	6.167E+00	4.931E-03	7.128E-14

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	Pb-210	1.000E+00	1.100E+05	1.061E+05	9.884E+04	7.701E+04	3.774E+04	3.111E+03	2.487E+00	3.596E-11

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 0.38 seconds

```
================= RISKIND Program Output, Version 1.11     ========= Page:   1
 Title       : LLNL GAC shipment
 Date/Time   : 01/02/07 15:20
 Input  File : c:\riskind\input\llnlgac.inp
 Output File : output\llnlgac.out
================================================================================
```

```
================================================================================
========================== RISKIND Computer Program ============================
================================================================================
```

Problem Description

Individual Receptors

Routine Calculations

Note: * next to input description signifies
a data dependent default value

```
================= RISKIND Program Output, Version 1.11     ========= Page:    2
 Title        : LLNL GAC shipment
 Date/Time    : 01/02/07 15:20
 Input  File : c:\riskind\input\llnlgac.inp
 Output File : output\llnlgac.out
==============================   Routine Problem  ==============================

================================================================================
=================== RISKIND Routine Individual Problem Input ===================
================================================================================
```

Shipment Parameters

```
              Transport Mode [IMOD]: Truck
            Population Zone [IZONE]: Suburban
                 Dose at 1 m [TIDX]:    0.02 mrem/hr
          Measurement Offset [TIOFF]:    0.00       m
            Gamma Fraction [FRAD(1)]:    1.00
          Neutron Fraction [FRAD(2)]:    0.00
                 Cask Length [HSIZE]:    5.40       m
                 Cask Radius [RSIZE]:    0.79       m
            Traveling speed [SPEED]*:   88.00   km/hr
           Individual type [INDTYPE]:  Public
        Risk Conversion Factors
              Non-Fatal Cancers/rem: 1.0E-04
                  Fatal Cancers/rem: 5.0E-04
                Genetic Effects/rem: 1.3E-04
```

#	Individual Name	Stop Distance [DISTSTOP] [km]	Stop Time [TSTP] [hr]	Passing Distance [DISTPASS] [km]
1	Individual 1	2.0E-03	1.00	2.0E-03

Title : LLNL GAC shipment
Date/Time : 01/02/07 15:20
Input File : c:\riskind\input\llnlgac.inp
Output File : output\llnlgac.out

============================ Routine Problem ============================

================== RISKIND Routine Individual Problem Results ==================

================ Stop ================

#	Individual Name	Dose (rem)	Expected Non-Fatal Cancers	Expected Cancer Fatalities	Expected Genetic Effects
1	Individual 1	1.2E-05	1.2E-09	6.2E-09	1.6E-09

============== Passing ===============

#	Individual Name	Dose (rem)	Expected Non-Fatal Cancers	Expected Cancer Fatalities	Expected Genetic Effects
1	Individual 1	1.2E-09	1.2E-13	6.2E-13	1.6E-13

Weiss Associates

APPENDIX D

GROUND WATER AND LANDFILL SIMULATION OUTPUT

Table of Contents

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Part I: Mixture Sums and Single Radionuclide Guidelines

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Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 MORBIDITY

Menu	Parameter	Current Value	Base Case*	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	H-3	6.400E-08	6.400E-08	DCF2(1)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(2)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	H-3	6.400E-08	6.400E-08	DCF3(1)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(2)
D-34	Food transfer factors:			
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(1,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(1,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(1,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(1,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	5.580E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	9.020E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	4.360E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	2.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	4.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	4.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): H-3	2.300E-01	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.200E-01	0.000E+00	---	S1(2)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(2)
R013	Cover depth (m)	1.500E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.290E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	2	1	---	NS
R015	Unsat. zone 1, thickness (m)	9.140E-01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.160E-02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	3.050E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.000E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	2.000E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, field capacity	2.000E-01	2.000E-01	---	FCUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.096E-01	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.543E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	5.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	1.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	1.000E+00	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	0.000E+00	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

Contaminated Zone Dimensions	
Area:	55798.00 square meters
Thickness:	9.02 meters
Cover Depth:	1.50 meters

Initial Soil Concentrations, pCi/g	
H-3	2.300E-01
Pb-210	1.200E-01

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	2.000E+00	4.000E+00	1.000E+01	4.000E+01	1.000E+02	1.000E+03
TDOSE(t):	5.576E-15	4.583E-03	1.413E-02	2.355E-02	4.934E-03	1.707E-06	2.052E-13	5.639E-14
M(t):	2.230E-16	1.833E-04	5.651E-04	9.419E-04	1.974E-04	6.828E-08	8.208E-15	2.256E-15

Maximum TDOSE(t): 2.383E-02 mrem/yr at t = 3.775 ñ 0.008 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.775E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	5.210E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	5.210E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.775E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	1.862E-02	0.7813	6.413E-06	0.0003	0.000E+00	0.0000	1.796E-03	0.0754	8.874E-04	0.0372	2.521E-03	0.1058	2.383E-02	1.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.210E-15	0.0
Total	1.862E-02	0.7813	6.413E-06	0.0003	0.000E+00	0.0000	1.796E-03	0.0754	8.874E-04	0.0372	2.521E-03	0.1058	2.383E-02	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	5.576E-15	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	5.576E-15	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.576E-15	1.0
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.576E-15	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	5.477E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	5.477E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	3.634E-03	0.7929	1.208E-06	0.0003	0.000E+00	0.0000	3.251E-04	0.0709	1.432E-04	0.0312	4.795E-04	0.1046	4.583E-03	1.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.477E-15	0.0
Total	3.634E-03	0.7929	1.208E-06	0.0003	0.000E+00	0.0000	3.251E-04	0.0709	1.432E-04	0.0312	4.795E-04	0.1046	4.583E-03	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	5.379E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	5.379E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 2.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	1.108E-02	0.7845	3.781E-06	0.0003	0.000E+00	0.0000	1.048E-03	0.0742	5.025E-04	0.0356	1.490E-03	0.1055	1.413E-02	1.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.379E-15	0.0
Total	1.108E-02	0.7845	3.781E-06	0.0003	0.000E+00	0.0000	1.048E-03	0.0742	5.025E-04	0.0356	1.490E-03	0.1055	1.413E-02	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	5.189E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	5.189E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	1.839E-02	0.7809	6.339E-06	0.0003	0.000E+00	0.0000	1.777E-03	0.0755	8.830E-04	0.0375	2.493E-03	0.1059	2.355E-02	1.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.189E-15	0.0
Total	1.839E-02	0.7809	6.339E-06	0.0003	0.000E+00	0.0000	1.777E-03	0.0755	8.830E-04	0.0375	2.493E-03	0.1059	2.355E-02	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	4.657E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	4.657E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio- Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathway mrem/yr	All Pathway fra
H-3	3.848E-03	0.7798	1.331E-06	0.0003	0.000E+00	0.0000	3.744E-04	0.0759	1.880E-04	0.0381	5.229E-04	0.1060	4.934E-03	1.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.657E-15	0.0
Total	3.848E-03	0.7798	1.331E-06	0.0003	0.000E+00	0.0000	3.744E-04	0.0759	1.880E-04	0.0381	5.229E-04	0.1060	4.934E-03	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	2.713E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Total	2.713E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 4.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathway mrem/yr	All Pathway fra
H-3	1.331E-06	0.7798	4.603E-10	0.0003	0.000E+00	0.0000	1.295E-07	0.0759	6.503E-08	0.0381	1.809E-07	0.1060	1.707E-06	1.0
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.713E-15	0.0
Total	1.331E-06	0.7798	4.603E-10	0.0003	0.000E+00	0.0000	1.295E-07	0.0759	6.503E-08	0.0381	1.809E-07	0.1060	1.707E-06	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-	ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄ	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄ
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	9.217E-16	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
ÍÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍÍÍÍ	ÍÍÍÍÍÍÍÍÍ	ÍÍÍ
Total	9.217E-16	0.0045	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Radio-	ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ		ÄÄÄÄÄÄÄÄÄÄÄÄÄ	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
ÄÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄÄÄÄ	ÄÄÄÄÄÄÄÄÄ	ÄÄÄ
H-3	1.593E-13	0.7763	5.509E-17	0.0003	0.000E+00	0.0000	1.550E-14	0.0755	7.782E-15	0.0379	2.165E-14	0.1055	2.043E-13	0.9
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.217E-16	0.0
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Total	1.593E-13	0.7763	5.509E-17	0.0003	0.000E+00	0.0000	1.550E-14	0.0755	7.782E-15	0.0379	2.165E-14	0.1055	2.052E-13	1.0

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	2.913E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.694E-15	0.1187	2.636E-16	0.0047	1.168E-16	0.0021	0.000E+00	0.0
Total	2.913E-22	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.694E-15	0.1187	2.636E-16	0.0047	1.168E-16	0.0021	0.000E+00	0.0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathway	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fra
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0
Pb-210	4.104E-14	0.7277	3.839E-15	0.0681	0.000E+00	0.0000	3.163E-15	0.0561	7.029E-16	0.0125	5.769E-16	0.0102	5.639E-14	1.0
Total	4.104E-14	0.7277	3.839E-15	0.0681	0.000E+00	0.0000	3.163E-15	0.0561	7.029E-16	0.0125	5.769E-16	0.0102	5.639E-14	1.0

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (mrem/yr)/(pCi/g) 0.000E+00	1.000E+00	2.000E+00	4.000E+00	1.000E+01	4.000E+01	1.000E+02	1.000E+03
H-3	H-3	1.000E+00	0.000E+00	1.993E-02	6.143E-02	1.024E-01	2.145E-02	7.422E-06	8.882E-13	0.000E+00
Pb-210+D	Pb-210+D	1.000E+00	4.647E-14	4.564E-14	4.482E-14	4.324E-14	3.881E-14	2.261E-14	7.681E-15	4.700E-13

The DSR includes contributions from associated (half-life ó 180 days) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	2.000E+00	4.000E+00	1.000E+01	4.000E+01	1.000E+02	1.000E+03
H-3	*9.597E+15	1.255E+03	4.070E+02	2.442E+02	1.165E+03	3.368E+06	2.815E+13	*9.597E+15
Pb-210	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	*7.634E+13	5.320E+13

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 3.775 ñ 0.008 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
H-3	2.300E-01	3.775 ñ 0.008	1.036E-01	2.413E+02	1.036E-01	2.413E+02
Pb-210	1.200E-01	583 ñ 1	1.375E-08	1.818E+09	4.341E-14	*7.634E+13

*At specific activity limit

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	2.000E+00	4.000E+00	1.000E+01	4.000E+01	1.000E+02	1.000E+03
H-3	H-3	1.000E+00	0.000E+00	4.583E-03	1.413E-02	2.355E-02	4.934E-03	1.707E-06	2.043E-13	0.000E+00
Pb-210	Pb-210	1.000E+00	5.576E-15	5.477E-15	5.379E-15	5.189E-15	4.657E-15	2.713E-15	9.217E-16	5.639E-14

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	THF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	2.000E+00	4.000E+00	1.000E+01	4.000E+01	1.000E+02	1.000E+03
H-3	H-3	1.000E+00	2.300E-01	1.763E-01	1.352E-01	7.947E-02	1.614E-02	5.575E-06	6.653E-13	0.000E+00
Pb-210	Pb-210	1.000E+00	1.200E-01	1.163E-01	1.127E-01	1.058E-01	8.754E-02	3.399E-02	5.123E-03	2.414E-15

THF(i) is the thread fraction of the parent nuclide.

RESCALC.EXE execution time = 0.96 seconds

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Part III: Intake Quantities and Health Risk Factors
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Cancer Risk Slope Factors Summary Table
Risk Library: FGR 13 Morbidity

Menu	Parameter	Current Value	Base Case*	Parameter Name
Sf-1	Ground external radiation slope factors, 1/yr per (pCi/g):			
Sf-1	H-3	0.00E+00	0.00E+00	SLPF(1,1)
Sf-1	Pb-210+D	4.21E-09	1.41E-09	SLPF(2,1)
Sf-2	Inhalation, slope factors, 1/(pCi):			
Sf-2	H-3	8.51E-13	8.51E-13	SLPF(1,2)
Sf-2	Pb-210+D	3.08E-08	1.58E-08	SLPF(2,2)
Sf-3	Food ingestion, slope factors, 1/(pCi):			
Sf-3	H-3	1.44E-13	1.44E-13	SLPF(1,3)
Sf-3	Pb-210+D	3.44E-09	1.18E-09	SLPF(2,3)
Sf-3	Water ingestion, slope factors, 1/(pCi):			
Sf-3	H-3	1.12E-13	1.12E-13	SLPF(1,4)
Sf-3	Pb-210+D	2.66E-09	8.81E-10	SLPF(2,4)
Sf-3	Soil ingestion, slope factors, 1/(pCi):			
Sf-3	H-3	1.44E-13	1.44E-13	SLPF(1,5)
Sf-3	Pb-210+D	3.44E-09	1.18E-09	SLPF(2,5)

*Base Case means Default.Lib w/o Associate Nuclide contributions.

Risk Slope and Environmental Transport Factors for the Ground Pathway

Nuclide (i)	Slope(i)*	ETFG(i,t) At Time in Years (dimensionless) t= 0.000E+00	1.000E+00	2.000E+00	4.000E+00	1.000E+01	4.000E+01	1.000E+02	1.000E+03
Bi-210	2.760E-09	5.253E-14	5.359E-14	5.467E-14	5.689E-14	6.413E-14	1.167E-13	3.862E-13	2.424E-05
H-3	0.000E+00	6.000E-01	6.000E-01	6.000E-01	6.000E-01	6.000E-01	6.000E-01	6.000E-01	6.000E-01
Pb-210	1.410E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.401E-45	4.221E-17
Po-210	3.950E-11	8.928E-10	9.050E-10	9.173E-10	9.424E-10	1.022E-09	1.532E-09	3.444E-09	6.512E-04

* - Units are 1/yr per (pCi/g) at infinite depth and area. Multiplication by ETFG(i,t) converts to site conditions.

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 0.000E+00 years

Radio-Nuclide	Water Independent Pathways (Inhalation w/o radon): Inhalation	Plant	Meat	Milk	Soil	Water Dependent Pathways: Water	Fish	Plant	Meat	Milk	Total Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.849E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.849E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All Pathways** risk	All Pathways** fract.
H-3	1.942E-07	0.7350	8.605E-11	0.0003	2.412E-08	0.0913	1.198E-08	0.0453	3.384E-08	0.1281	2.642E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.849E-20	0.0000
Total	1.942E-07	0.7350	8.605E-11	0.0003	2.412E-08	0.0913	1.198E-08	0.0453	3.384E-08	0.1281	2.642E-07	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.849E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.849E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 0.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All pathways risk	All pathways fract.
H-3	1.942E-07	0.7350	8.605E-11	0.0003	0.000E+00	0.0000	2.412E-08	0.0913	1.198E-08	0.0453	3.384E-08	0.1281	2.642E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.849E-20	0.0000
Total	1.942E-07	0.7350	8.605E-11	0.0003	0.000E+00	0.0000	2.412E-08	0.0913	1.198E-08	0.0453	3.384E-08	0.1281	2.642E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+00 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.673E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.673E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	1.954E-07	0.7353	8.650E-11	0.0003	2.422E-08	0.0912	1.200E-08	0.0452	3.402E-08	0.1281	2.657E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.673E-20	0.0000
Total	1.954E-07	0.7353	8.650E-11	0.0003	2.422E-08	0.0912	1.200E-08	0.0452	3.402E-08	0.1281	2.657E-07	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.673E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.673E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	1.954E-07	0.7353	8.650E-11	0.0003	0.000E+00	0.0000	2.422E-08	0.0912	1.200E-08	0.0452	3.402E-08	0.1281	2.657E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.673E-20	0.0000
Total	1.954E-07	0.7353	8.650E-11	0.0003	0.000E+00	0.0000	2.422E-08	0.0912	1.200E-08	0.0452	3.402E-08	0.1281	2.657E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 2.000E+00 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.211E+05	4.103E+01	1.129E+04	5.288E+03	1.620E+04	1.539E+05
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 2.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.501E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.501E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 2.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	1.896E-07	0.7350	8.401E-11	0.0003	2.354E-08	0.0913	1.169E-08	0.0453	3.304E-08	0.1281	2.580E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.501E-20	0.0000
Total	1.896E-07	0.7350	8.401E-11	0.0003	2.354E-08	0.0913	1.169E-08	0.0453	3.304E-08	0.1281	2.580E-07	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 2.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.501E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.501E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 2.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All pathways risk	All pathways fract.
H-3	1.896E-07	0.7350	8.401E-11	0.0003	0.000E+00	0.0000	2.354E-08	0.0913	1.169E-08	0.0453	3.304E-08	0.1281	2.580E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.501E-20	0.0000
Total	1.896E-07	0.7350	8.401E-11	0.0003	0.000E+00	0.0000	2.354E-08	0.0913	1.169E-08	0.0453	3.304E-08	0.1281	2.580E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 4.000E+00 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon) Inhalation	Plant	Meat	Milk	Soil	Water Dependent Pathways Water	Fish	Plant	Meat	Milk	Total Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.882E+05	9.891E+01	2.760E+04	1.352E+04	3.893E+04	3.684E+05
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground risk	fract.	Inhalation risk	fract.	Plant risk	fract.	Meat risk	fract.	Milk risk	fract.	Soil risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.165E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.165E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water risk	fract.	Fish risk	fract.	Plant risk	fract.	Meat risk	fract.	Milk risk	fract.	All Pathways** risk	fract.
H-3	1.359E-07	0.7345	6.029E-11	0.0003	1.692E-08	0.0914	8.436E-09	0.0456	2.370E-08	0.1281	1.850E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.165E-20	0.0000
Total	1.359E-07	0.7345	6.029E-11	0.0003	1.692E-08	0.0914	8.436E-09	0.0456	2.370E-08	0.1281	1.850E-07	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	9.165E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.165E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All pathways risk	All pathways fract.
H-3	1.359E-07	0.7345	6.029E-11	0.0003	0.000E+00	0.0000	1.692E-08	0.0914	8.436E-09	0.0456	2.370E-08	0.1281	1.850E-07	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.165E-20	0.0000
Total	1.359E-07	0.7345	6.029E-11	0.0003	0.000E+00	0.0000	1.692E-08	0.0914	8.436E-09	0.0456	2.370E-08	0.1281	1.850E-07	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+01 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.846E+04	2.368E+01	6.661E+03	3.345E+03	9.304E+03	8.779E+04
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	8.226E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.226E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	2.886E-08	0.7336	1.283E-11	0.0003	3.611E-09	0.0918	1.813E-09	0.0461	5.044E-09	0.1282	3.934E-08	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.226E-20	0.0000
Total	2.886E-08	0.7336	1.283E-11	0.0003	3.611E-09	0.0918	1.813E-09	0.0461	5.044E-09	0.1282	3.934E-08	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	8.226E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.226E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All pathways risk	All pathways fract.
H-3	2.886E-08	0.7336	1.283E-11	0.0003	0.000E+00	0.0000	3.611E-09	0.0918	1.813E-09	0.0461	5.044E-09	0.1282	3.934E-08	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.226E-20	0.0000
Total	2.886E-08	0.7336	1.283E-11	0.0003	0.000E+00	0.0000	3.611E-09	0.0918	1.813E-09	0.0461	5.044E-09	0.1282	3.934E-08	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 4.000E+01 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.368E+01	8.190E-03	2.304E+00	1.157E+00	3.219E+00	3.037E+01
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	4.793E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.793E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	9.985E-12	0.7336	4.440E-15	0.0003	1.249E-12	0.0918	6.272E-13	0.0461	1.745E-12	0.1282	1.361E-11	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.793E-20	0.0000
Total	9.985E-12	0.7336	4.440E-15	0.0003	1.249E-12	0.0918	6.272E-13	0.0461	1.745E-12	0.1282	1.361E-11	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	4.793E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	4.793E-20	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 4.000E+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	9.985E-12	0.7336	4.440E-15	0.0003	0.000E+00	0.0000	1.249E-12	0.0918	6.272E-13	0.0461	1.745E-12	0.1282	1.361E-11	1.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.793E-20	0.0000
Total	9.985E-12	0.7336	4.440E-15	0.0003	0.000E+00	0.0000	1.249E-12	0.0918	6.272E-13	0.0461	1.745E-12	0.1282	1.361E-11	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+02 years

Radio-	Water Independent Pathways (Inhalation w/o radon)					Water Dependent Pathways					Total
Nuclide	Inhalation	Plant	Meat	Milk	Soil	Water	Fish	Plant	Meat	Milk	Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.834E-06	9.801E-10	2.757E-07	1.385E-07	3.852E-07	3.635E-06
Pb-210	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.629E-20	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.629E-20	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Radio-	Water		Fish		Plant		Meat		Milk		All Pathways**	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	1.195E-18	0.7264	5.313E-22	0.0003	1.495E-19	0.0909	7.506E-20	0.0456	2.088E-19	0.1269	1.629E-18	0.9901
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-20	0.0099
Total	1.195E-18	0.7264	5.313E-22	0.0003	1.495E-19	0.0909	7.506E-20	0.0456	2.088E-19	0.1269	1.645E-18	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.629E-20	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.629E-20	0.0099	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+02 years

Water Dependent Pathways

Radio- Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Radon risk	Radon fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All pathways risk	All pathways fract.
H-3	1.195E-18	0.7264	5.313E-22	0.0003	0.000E+00	0.0000	1.495E-19	0.0909	7.506E-20	0.0456	2.088E-19	0.1269	1.629E-18	0.9901
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.629E-20	0.0099
Total	1.195E-18	0.7264	5.313E-22	0.0003	0.000E+00	0.0000	1.495E-19	0.0909	7.506E-20	0.0456	2.088E-19	0.1269	1.645E-18	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides

Amount of Intake Quantities QINT(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As pCi/yr at t= 1.000E+03 years

Radio- Nuclide	Water Independent Pathways (Inhalation w/o radon): Inhalation	Plant	Meat	Milk	Soil	Water Dependent Pathways: Water	Fish	Plant	Meat	Milk	Total Ingestion*
H-3	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Pb-210	0.000E+00	9.334E-13	3.676E-14	1.628E-14	0.000E+00	5.722E-12	5.353E-13	4.410E-13	9.801E-14	8.044E-14	7.863E-12

* Sum of all ingestion pathways, i.e. water independent plant, meat, milk, soil
and water-dependent water, fish, plant, meat, milk pathways

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground risk	Ground fract.	Inhalation risk	Inhalation fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	Soil risk	Soil fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	5.532E-27	0.0000	0.000E+00	0.0000	6.432E-20	0.1423	2.533E-21	0.0056	1.122E-21	0.0025	0.000E+00	0.0000
Total	5.532E-27	0.0000	0.000E+00	0.0000	6.432E-20	0.1423	2.533E-21	0.0056	1.122E-21	0.0025	0.000E+00	0.0000

Excess Cancer Risks CNRS(i,p,t) for Individual Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio- Nuclide	Water risk	Water fract.	Fish risk	Fish fract.	Plant risk	Plant fract.	Meat risk	Meat fract.	Milk risk	Milk fract.	All Pathways** risk	All Pathways** fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	3.046E-19	0.6737	3.688E-20	0.0816	3.039E-20	0.0672	6.753E-21	0.0149	5.543E-21	0.0123	4.521E-19	1.0000
Total	3.046E-19	0.6737	3.688E-20	0.0816	3.039E-20	0.0672	6.753E-21	0.0149	5.543E-21	0.0123	4.521E-19	1.0000

** Sum of water independent ground, inhalation, plant, meat, milk, soil
and water dependent water, fish, plant, meat, milk pathways

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	5.532E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.432E-20	0.1423	2.533E-21	0.0056	1.122E-21	0.0025	0.000E+00	0.0000
Total	5.532E-27	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.432E-20	0.1423	2.533E-21	0.0056	1.122E-21	0.0025	0.000E+00	0.0000

Total Excess Cancer Risk CNRSI(i,p,t)*** for Initially Existent Radionuclides (i) and Pathways (p)
and Fraction of Total Risk at t= 1.000E+03 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All pathways	
Nuclide	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.	risk	fract.
H-3	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	3.046E-19	0.6737	3.688E-20	0.0816	0.000E+00	0.0000	3.039E-20	0.0672	6.753E-21	0.0149	5.543E-21	0.0123	4.521E-19	1.0000
Total	3.046E-19	0.6737	3.688E-20	0.0816	0.000E+00	0.0000	3.039E-20	0.0672	6.753E-21	0.0149	5.543E-21	0.0123	4.521E-19	1.0000

***CNRSI(i,p,t) includes contribution from decay daughter radionuclides