STATE OF COLORADO

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Douglas H. Benevento, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

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Colorado Department
of Public Health
and Environment

May 24, 2005

Attention: David B. Nielsen, Director of Landfill Compliance
Clean Harbors Deer Trail, LLC
2500 West Lokern Road
PO Box 787
Buttonwillow, CA 93206

Re: Request for License-Concerns Regarding Radiation Protection Program and Operational Procedures

This letter is sent as a follow-up to meetings on May 10-11, 2005 with David Nielsen, Bill Kennedy representing Clean Harbors and Tom Pentecost and Jennifer Opila of the Department. These meetings discussed the operational procedures that pertain to radioactive materials disposal submitted in the Radioactive Materials License Application and the RCRA permit renewal application. This letter outlines issues that were discussed during the meetings and requests additional documentation to resolve issues and deficiencies identified with your April 26, 2005 procedures submittal relevant to your radioactive materials license application and RCRA permit renewal application.

The review of your application is ongoing and this list of issues/deficiencies is not comprehensive. The Department will provide additional requests for information as needed during the review process. Please provide appropriate documentation and revisions to plans and procedures to resolve each of the following items. .

1. Throughout the revised section 7 of the application, the revised Radiation Protection Program, the Operational Procedures and Appendix K of the Waste Analysis Plan of the RCRA permit renewal application, the applicant refers to the material the facility will be accepting as NORM/TENORM. These procedures also contain conflicting and erroneous statements pertaining to these materials. Please be advised that the Department considers the materials to be authorized on the license and the permit to be radioactive materials containing naturally occurring radionuclides with concentrations <2000 pCi/g and with specific concentrations of Ra-226 <400 pCi/g. Your radiation protection program, operational procedures and waste analysis plan should reflect similar language to properly encompass all of the applicable materials. Specifically, we ask that you strike the terms NORM, TENORM and source material from your procedures and replace them with the term radioactive materials or radioactive waste. If you feel you must provide a restatement of definitions, they should be provided in a single place in the document and terms should be used consistent with those definitions throughout the document.

Prepared by:_____ Reviewed by:_____ Reviewed by:_____ Mailed by:_____
Date:_____ Date:_____ Date:_____ Date Mailed:_____
File: CHDT, ****, 3.2

These definitions should be consistent with the definitions provided in the Colorado Rules and Regulations Pertaining to Radiation Control and Parts 1 and 2 of the Radiation Control Act.

Issues pertaining to the Contingency Plan

2. Release of a reportable quantity is one criterion for implementing your contingency plan. In consideration of the RQ values for radioactive materials, an unreasonably large quantity of material would have to be spilled for implementation of the plan.

Issues pertaining to the Radiation Protection Plan

3. In the purpose and scope CHDT considers workers at the site to be members of the public. RH 1.4 defines a member of the public as someone who does not receive an occupational dose. In the same part of the Regulations, occupational dose is defined as a dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material. In light of these definitions, the Department will consider CHDT employees who come in contact with radioactive materials while performing their assigned duties occupationally exposed workers, even though your plan intends to limit their doses to 100 mR/year.

4. CHDT requests a license to accept, treat and dispose of NORM/TENORM waste at concentrations that are less than the activity definition of Low-level Radioactive Waste in Colorado (i.e. 2000 pCi/g). This contradicts the definition of low-level radioactive waste provided in Part 14 of the Regulations and other aspects of your application that include plans for the disposal of Denver Radium Streets wastes that have clearly been designated as low-level radioactive waste. Please note 25-11-201 (1) (c).

5. The plan indicates that CHDT does not intend to accept man-made radionuclides. This contradicts Appendix K of the Waste Analysis Plan which states that some man-made radionuclides will be accepted as exempt materials.

6. Under General Record-Keeping Requirements the list of required records is not comprehensive. Several items are missing from your list, for example, records for annual ALARA program audits, incident investigation, declarations of pregnancy, environmental monitoring, contamination surveys for release of equipment, etc. The duration for personnel records is inappropriate. These records should be maintained for at least a year post termination of the employee.

Issues pertaining to Individual and Area Dosimetry

7. In section 6.1, it is inappropriate to use area dosimeters to confirm contamination control in lunchrooms, change rooms and maintenance areas. However, dosimeters may be used in these areas to assess ambient gamma dose rates.

8. Please provide a copy of the map referenced in section 6.2 for the locations of the area dosimeters during start-up and initial operations of the facility.

9. Dosimetry record forms in attachments 1, 2 and 3 are acceptable for CHDT internal assessment and tracking, but do not meet the reporting requirements of RH 4.46.3.

Issues pertaining to Airborne Monitoring

10. Please provide the RSO established criteria referenced in section 5.1 for the current facility assuming receipt of the types of materials requested in your application including Denver Radium Streets waste.

11. CHDT indicated that samples will be evaluated on a quarterly basis. Please specify the parameters for collecting a sample (i.e. duration of sample, sample air flow rates, size of the sample filter and a description of the air sampling equipment itself).

12. Please provide a facility map showing the airborne monitoring locations for the current facility.

13. Please provide a description of the ventilation for the waste treatment facility and an estimation based on proposed activities of the effluent levels that will be generated at that location. Also provide a description of your sampling and analysis for that stack location to demonstrate compliance with effluent limits.

14. In 5.3, please provide a better description of the preliminary assessment of the air filter including the type of instrument used, what is meant by sample receipt criteria and what actions will be taken if that criteria is exceeded.

15. In 5.4, please list the specific radionuclides that will be measured by the laboratory for analysis of the filter.

16. The air monitoring record should include columns for the measured activity for each radionuclide and the background activity as well as the net activity for the same radionuclide.

17. What air concentration level will trigger additional sampling locations, more frequent sampling, or other investigation by the Radiation Safety Officer as to the cause?

Issues pertaining to Estimating Inhalation Doses

18. Please provide a description of how the RSO will determine the duration of airborne NORM/TENORM hazard.

19. The equation to calculate airborne concentration is specific to the location of each air sampler. Please specify how the RSO will determine worker's exposure duration for various specific work locations.

Issues pertaining to Radiation Protection Training

20. Please specify the duration of the Radiation Protection Training provided for all employees at the site. Please also provide a copy of a sample quiz that is going to be completed by employees with answers.

21. Please provide a detailed description of the training for staff that will perform specific radiation protection duties which might bring them in direct contact with radioactive materials such as collecting air filters, decontaminating and surveying equipment, etc.

Issues pertaining to the Use of the Gate Monitoring System

22. The MicroShield analysis provided in Attachment B of the application provides an assessment of the exposure from radium-bearing soil-like materials brought into the facility. Please provide the modeling analysis used to determine that a gate monitor alarm set point of 100 uR/hr above background is sufficient and appropriate to identify and reject waste materials having radionuclide concentrations in excess of 2000 pCi/g for uranium and thorium-bearing materials. In general, the use of a uR/hr measurement at the gate will be an unreliable and inconsistent method for verifying compliance with a pCi/g limit for waste streams that are not homogeneous and well characterized.

23. Please provide procedures and criteria for establishing alternate alarm set points by the RSO for long-term clients and episodic wastes.

24. The procedure requires the truck to remain stationary for 10 seconds and during that time it is surveyed. Please amend the procedure to read that, in addition, the truck will be monitored continuously as it passes through the monitor and specify the maximum speed of the truck during the survey.

25. Please provide the specific manufacturer, model number and radiological capabilities for the gate monitor. Also provide a diagram showing the geometry and distances between the truck and the detector.

Issues pertaining to Routine Radiation Surveys

26. Please provide the probe manufacturer and model number for the Ludlum Model 3 survey instrument that will be used for localized measurements.

27. How will the RSO evaluate the instrument response and confirm or modify the detector efficiency and determine the appropriate alarm setting for the Ludlum Model 193-6 survey wand?

Issues pertaining to Personnel Surveys

28. In section 5.3, it is unclear when removable contamination surveys (smear samples) will be conducted. Is this every time someone leaves the NORM/TENORM area, or only if elevated counts are found with a portable survey instrument?

29. What level of alpha contamination is detectable using the methods described?

Issues pertaining to Equipment Surveys

30. In section 5.2, the example neglects to add a correction factor for the area of the probe. Survey forms and instructions to the surveyors should include the specific probes being used and the precise calculation parameters that will be used to convert cpm into dpm.

31. Using the screening levels provided in Table 1 the surveyor would have to know which specific radionuclides comprised the potential contamination on the equipment. How will this information be determined and conveyed to the person conducting the survey?

32. The Department has historically used the release criteria established in USNRC Regulatory Guide 1.86. Please provide your rationale for the screening levels selected in Table 1 or adopt the criteria established in Regulatory Guide 1.86. Release criteria should address screening levels for both fixed and removable contamination. Please explain the use of volume screening levels provided in Table 1, as this doesn't appear to be applicable to the release of equipment.

33. Please provide a facility diagram indicating the locations for surveys and decontamination of vehicles, personnel and equipment exiting the treatment building and the active disposal cell.

34. Please provide a detailed description of the equipment and facilities operated at the decontamination station. Also provide detailed procedures for decontamination including how wash fluids and contaminated materials resulting from decontamination will be managed.

35. The procedure for surveying vehicles should include documentation of each survey and not just the vehicles that were decontaminated.

Issues pertaining to Surveys Following Spills

36. In section 5.2, the example neglects to add a correction factor for the area of the probe. Survey forms and instructions to the surveyors should include the specific probes being used and the precise calculation parameters that will be used to convert cpm into dpm. This appears to be the same paragraph as the procedure for equipment and truck surveys. This needs to be corrected to indicate that the surveys are being performed on spill areas.

37. Which specific screening value is being applied to spills (surface levels or volume screening levels)? Using the screening levels provided in Table 1 the surveyor would have to know which specific radionuclides comprised the potential contamination in the spill area. How will this information be determined and conveyed to the person conducting the survey? If the volume screening levels will be used, how will a hand-held instrument taking a surface measurement reading convert the cpm measurement to pCi/g?

38. It is not clear how the smear samples and analysis described in your procedure will be used for dirt roads and other areas of the facility where spills can occur.

Issues pertaining to Gamma Spectra Analysis

39. In section 5.0, it states that an Exploranium GR-135 Identifier will be used to determine the relative contributions of radionuclides in the wastes received at the facility. Please document the ability of this instrument to perform such analysis on a large container or truckload of waste similar to those anticipated to be received. Specifically, is it your intent to verify total pCi/g activity levels and/or specific pCi/g levels of particular radionuclides such as Ra-226 with this instrument?

40. Using the screening levels provided in Table 1 the person performing the analysis would have to know which specific radionuclides comprised the potential contamination in the spill area. How will this information be determined and conveyed to the person performing the analysis?

Issues pertaining to Landfill Operations (Waste Cell)

41. As a licensed low-level radioactive waste disposal facility it will be your responsibility to ensure that all equipment leaving the facility meet Department approved release criteria for contamination. Your procedures for surveying vehicles must ensure that any vehicle leaving your restricted area that has a potential for contamination is adequately and appropriately surveyed, regardless of the type of waste the vehicle carried. Your operational procedures assume that the haul road between where the truck dumps the material in the cell and the point where the truck is surveyed (outside of the cell) remains free of contamination.

Issues pertaining to Waste Tracking

42. Please provide a copy of the Uniform Radioactive Waste Manifest that will be used to track radioactive waste shipments to the facility.

Issues pertaining to the Waste Analysis Plan Appendix K of the permit renewal application

43. Based on our discussion and a review of this document, it is not clear how the Waste Analysis Plan for radioactive materials (appendix K) will be applied to activities under both the permit and the radioactive materials license. If separate methods and criteria will be applied to waste streams coming in under the RCRA permit and under the radioactive materials license, the criteria in both cases must be sufficient for the facility to demonstrate compliance under the radioactive materials license (for example, the receipt of Am-241 containing smoke detectors that might be received as part of a shipment of building debris under the RCRA permit).

44. The use of definitions in section I of this Appendix is problematic and should be deleted from this document.

45. Appendix K, Item II. A refers to materials “otherwise exempted or as described in Table 1”. Table 1 was not provided for review. This statement is too broad and too ambiguous to evaluate. Clean Harbors should describe in detail what specific “exempt material” will be acceptable at the site for disposal.

46. Appendix K, Items III. C and D refer to acceptance of manufactured items. Item II should contain a detailed description of the types and specifications of the manufactured items to be accepted for disposal. Additionally, in other correspondence to the Department, Clean Harbors has committed to not accepting exempt items or items containing man-made radionuclides. Please rectify this inconsistency in all documents.

47. In Appendix K, Item II. B there needs to be description of the form of materials that can be accepted in drums and other containers. For example, how much free liquid is acceptable in a drum of materials?

48. Appendix K, Item II. B refers to acceptance of radioactive liquids and sludges for treatment and landfill. Clean Harbors needs to submit detailed procedures describing the treatment of these materials.

49. In Appendix K, Item III. A, the specifications and requirements for the "generator provided waste characterization" need to be spelled out in detail. The requirements for the generator would include such items as the number of samples needed to have a statistically representative sampling of the materials, the types of radiological analysis to be performed, LLD in the analysis, physical and chemical form of the material, amount of free liquids, units for reporting data, etc. A waste characterization form and instructions would be an efficient way to standardize this information from the waste generator and would facilitate the review of waste acceptance criteria by this Department.

50. In Appendix K, Item III. D, the disposal of manufactured items must be described in greater detail. Dose rates from the manufactured items can and should be measured at the facility. Does the use of the term "specific activity" apply to the entire device or just the radioactive source? The documents reviewed should include device sheets and manufacturer specification sheets for the items to be disposed. The process for review of these documents and record keeping should be described. Will Clean Harbors track the serial number, manufacturer, model, radionuclide, and activity for each device?

51. The Movement Request Form described in the Waste Analysis Plan defines hazards and personal protective equipment. Will the RSO be completing this form or someone else? If someone besides the RSO is completing it, what will his or her radiation safety qualifications be?

52. It is the responsibility of CHDT in the operation of a low-level radioactive waste disposal facility to ensure compliance with the authorizations in the radioactive materials license, including limitations placed upon the types and quantities of materials that can be disposed at the facility. The gate monitor and portable gamma spectrometer are not sufficient to evaluate and verify that the total activity of the materials received is not greater than 2000 pCi/g and that the Ra-226 activity is not greater than 400 pCi/g. After a thorough review of the license application including the operating procedures it is unclear how CHDT will ensure compliance with their license limitations. Please provide additional information regarding this issue.

Based on our discussions and examination of the operating procedures, it appears that the signatures of the CHDT corporate staff and Radiation Safety Officer are electronic signatures. In addition, the staff we met with were not completely familiar with all of the recent documents provided by Clean Harbors Deer Trail submitted in support of the license application, most notably Appendix K of the Waste Analysis Plan. It is very important that the management and radiation safety staff at the facility are all in agreement as to the content and requirements of the procedures to be implemented. Please ensure that the Department is given an original copy with original signatures when submitting revised procedures. Pursuant to RH 12.2.1 of the Regulations, the Department will consider an application abandoned if it does not receive a reply within forty-five (45) days to its most recent request for additional information.

If you have any questions regarding your license or this letter, please contact Jennifer Opila of this Division at (303) 692-3403.

Steve Tarlton, Unit Leader
Radiation Management Unit
Hazardous Materials and Waste Management Division

Clean Harbors Deer Trail, LLC
108555 East Highway 36
Deer Trail, CO 80105
Telephone: (970) 386-2293
Facsimile: (970) 386-2262

July 7, 2005

Mr. Steve Tarlton, Unit Leader
Radiation Management Unit
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

RE: Response to Comments on Clean Harbors Deer Trail, LLC, Radioactive Materials License Application, Docket Number 5873 by the Colorado Department of Public Health and Environment Request for Information May 24, 2005

Dear Mr. Tarlton:

We received your letter dated May 24, 2005, which contained comments on the Clean Harbors Deer Trail LLC, *Radioactive Materials License Application*, dated January 2005. Enclosed is Clean Harbor's response to those comments regarding the Radiation Protection Plan (RPP) and the Standard Operating Procedures (SOPs). In developing these responses, we have revised the RPP and SOPs in a consistent manner; however, they are currently in the final review and signature process. We will forward to you the original signed copies of the updated RPP and SOPs under separate cover early next week.

If you have any questions, please feel free to me at (803) 691-3427.

Sincerely,

Phillip G. Retallick
Senior Vice President
Compliance and Regulatory Affairs
Clean Harbors Environmental Services, Inc.

PGR:pgr

Enclosures:

1. Response to Comments;
2. Attachment 1: Waste Analysis Plan Appendix K, Waste Analysis Plan for Waste Contaminated with Radioactive Material.
3. Attachment 2: Summary of Emission Calculations – Deer Trail, Colorado Facility by ENSR Corporation.
4. Attachment 3: Example Quiz on Part 1: Basic Radiation Protection Training.

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information May 24, 2005

CDPHE Comment 1 – Throughout the revised section 7 of the application, the revised Radiation Protection Program, the Operational Procedures and Appendix K of the Waste Analysis Plan of the RCRA permit renewal application, the applicant refers to the material the facility will be accepting as NORM/TENORM. These procedures also contain conflicting and erroneous statements pertaining to these materials. Please be advised that the Department considers the materials to be authorized on the license and the permit to be radioactive materials containing naturally occurring radionuclides with concentrations <2000 pCi/g and with specific concentrations of Ra-226 <400 pCi/g. Your radiation protection program, operational procedures and waste analysis plan should reflect similar language to properly encompass all of the applicable materials. Specifically, we ask that you strike the terms NORM, TENORM and source material from your procedures and replace them with the term radioactive materials or radioactive waste. If you feel you must provide a restatement of definitions, they should be provided in a single place in the document and terms should be used consistent with those definitions throughout the document. These definitions should be consistent with the definitions provided in the Colorado Rules and Regulations Pertaining to Radiation Control and Parts 1 and 2 of the Radiation Control Act.

Clean Harbors Response: The following term "regulated material" and support definition has been included in the RPP and used to replace the terms NORM/TENORM in the procedures:

"Regulated Material" Definition:

For purposes of this RPP and associated SOPs, regulated material is defined as to include: a) NORM/TENORM radionuclides in solid waste; b) NORM/TENORM radionuclides in material licensed by CDPHE (including natural levels that meet the definition of source material); c) NORM/TENORM radionuclides mixed with RCRA hazardous wastes; and d) radium processing wastes."

Copies of the revised RPP and SOPs, including revisions made in response to all of the following requests for information, are in the signature process and will be submitted in a future submittal.

Issues pertaining to the Contingency Plan:

CDPHE Comment 2 - Release of a reportable quantity is one criterion for implementing your contingency plan. In consideration of the RQ values for radioactive materials, an unreasonably large quantity of material would have to be spilled for implementation of the plan.

Clean Harbors Response: The general issue here is how to define spills and associated actions, given a potential range of spill conditions, to ensure contamination control and protection of environment, health and safety. It is recognized that spills may follow specific events including simple process upsets (accidental dumping of small quantities), fires, or truck accidents. Spill response generally follows a graded approach based on the magnitude of the event. All spills, big or small, will have a response in terms of cleaning up material. At the highest level, spill procedures include isolation of the spill area, evacuating all non-essential personnel from the immediate area, prevention of contact with surface

waters, and prevention of wind blown hazards. For small spills (involving far less than the RQ values), cleanup may consist of manually shoveling material for decontamination with disposal in the landfill followed by conducting radiation surveys as outlined in the SOP on Surveys Following Spills. For larger spills, though still less than the RQ values, use of heavy equipment may be required followed by application of the SOP of Surveys Following Spills. For both of these cases, contamination control is likely the overriding concern.

For larger spills, the RQ is used to trigger required notifications and does not dictate the response provided by the facility. Additional responses include: notification of the Emergency Coordinator; prevention of any spilled liquids from draining into ditches or streams using temporary dams, booms, or dikes; covering readily dispersed material to prevent wind dispersion; cleaning (decontaminating) surfaces and equipment; conducting appropriate radiation surveys; and conducting a complete investigation of the event.

Issues pertaining to the Radiation Protection Plan:

CDPHE Comment 3 - In the purpose and scope CHDT considers workers at the site to be members of the public. RH 1.4 defines a member of the public as someone who does not receive an occupational dose. In the same part of the Regulations, occupational dose is defined as a dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material. In light of these definitions, the Department will consider CHDT employees who come in contact with radioactive materials while performing their assigned duties occupationally exposed workers, even though your plan intends to limit their doses to 100 mR/year.

Clean Harbors Response: CHDT understands and accepts the determination that Deer Trail workers will be occupational radiation workers under the license. However, CHDT intends to use 100 mrem/y as the self-imposed dose limit, with an ALARA goal of 25 mrem/y or less. As actual operational data are generated, a determination will be made regarding the appropriateness of the ALARA goal. It is understood that exceeding this goal is not necessarily in itself a cause for license amendment, but may be considered as part of an overall operational revision, if appropriate.

CDPHE Comment 4 - CHDT requests a license to accept, treat and dispose of NORM/TENORM waste at concentrations that are less than the activity definition of Low-level Radioactive Waste in Colorado (i.e. 2000 pCi/g). This contradicts the definition of low-level radioactive waste provided in Part 14 of the Regulations and other aspects of your application that include plans for the disposal of Denver Radium Streets wastes that have clearly been designated as low-level radioactive waste. Please note 25-11-201 (1) (c).

Clean Harbors Response: As noted in the response to Comment 1 above, Clean Harbors understands the definitions of low-level radioactive waste in Part 14 of the Regulations and has provided consistent definitions for use in the RPP and SOPs.

CDPHE Comment 5 - The plan indicates that CHDT does not intend to accept man-made radionuclides. This contradicts Appendix K of the Waste Analysis Plan which states that some man-made radionuclides will be accepted as exempt materials.

Clean Harbors Response: Appendix K has been revised, as shown in Attachment 1. The new version of Appendix K requires the waste generator to submit a waste material profile sheet for review. This profile

includes a box for radioactive materials. If a generator checks the radioactive box on the profile, they then must submit a supplemental radioactive material questionnaire (Attachment 1 to Appendix K) as part of the waste stream pre-acceptance documentation. The generator will then supply documentation of the regulated waste radionuclides present and their specific activity. They will certify that there is no byproduct material, manmade radionuclides, or special nuclear material present in their waste. The generator will describe the process that generated the waste, provide the NRC or Agreement State license number, if applicable, and provide analytical data from a laboratory analysis supporting the description of radionuclides present in the waste. The required analysis, in units of pCi/g, will include: gross alpha, gross beta, uranium-234, 235, 238 assay, thorium-228, 230, 232 assay, gamma spectrometry results (including radium-226, 228 content).

CDPHE Comment 6 - Under General Record-Keeping Requirements the list of required records is not comprehensive. Several items are missing from your list, for example, records for annual ALARA program audits, incident investigation, declarations of pregnancy, environmental monitoring, contamination surveys for release of equipment, etc. The duration for personnel records is inappropriate. These records should be maintained for at least a year post termination of the employee.

Clean Harbors Response: The information in Section 8.0 – Record Keeping – of the RPP has been reviewed and revised as follows:

"**General Record-Keeping Requirements**

1. The Deer Trail RSO shall maintain the following records in a clear, concise and orderly format. Retention periods are included in parentheses.
    a. Radiation surveys, as required (3 years)
        i. Radiation field surveys for areas in proximity to regulated waste for disposal,
        ii. Ambient radiation field surveys in unaffected areas, and
        iii. Contamination surveys for release of trucks and equipment.
    b. Survey instrument calibrations, as required by the manufacturer (3 years)
    c. Personnel records (1 year post termination of employment)
        i. Worker/user lists, and
        ii. Training records
    d. Annual ALARA program audits (duration of license)
    e. Incident investigation reports (duration of license)
    f. Declarations of pregnancy (3 years)
    g. Environmental monitoring data and reports (duration of license)
    h. Operating and emergency procedures (current)
    i. Procedure manuals from Deer Trail RSO (current)"

Issues pertaining to Individual and Area Dosimetry

CDPHE Comment 7 - In section 6.1, it is inappropriate to use area dosimeters to confirm contamination control in lunchrooms, change rooms and maintenance areas. However, dosimeters may be used in these areas to assess ambient gamma dose rates.

Clean Harbors Response: This comment is correct and the words "to confirm contamination control" have been deleted from Section 6.1. However, CHDT plans to use the ambient gamma dose rates in a

trending analysis to inspect for potential long-term increases in ambient gamma dose rates, which could be an indication of general loss of contamination control.

CDPHE Comment 8 - Please provide a copy of the map referenced in section 6.2 for the locations of the area dosimeters during start-up and initial operations of the facility.

Clean Harbors Response: As part of the area dosimetry program, CHDT will distribute TLDs in the following approximate locations (shown on the map that follows):

1) *Near the intersection of Highway 36 and the landfill access road (background location).*
2) *At the guard house near the facility entrance.*
3) *At the contractor gate, north of the Operations Building (background location).*
4) *In the Men's Change Room of the Operations Building*
5) *In the Women's Change Room of the Operations Building.*
6) *In the CHDT Laboratory in the Operations Building.*
7) *In the Maintenance Building.*
8) *At the Decontamination Area adjoining the Maintenance Building.*
9) *At the Decontamination Area of the Treatment Building.*
10) *At the Regulated Waste loading and unloading area of the Treatment Building.*
11) *At the Regulated Waste Treatment Basin of the Treatment Building.*
12) *In the Waste Water Treatment Building.*
13) *At the Contaminated Water Storage Tanks.*
14) *At the Decontamination Area near Cell No. 2.*

In addition, a TLD will be co-located with each of the air monitoring stations shown on the map provided in response to Comment 12 below.

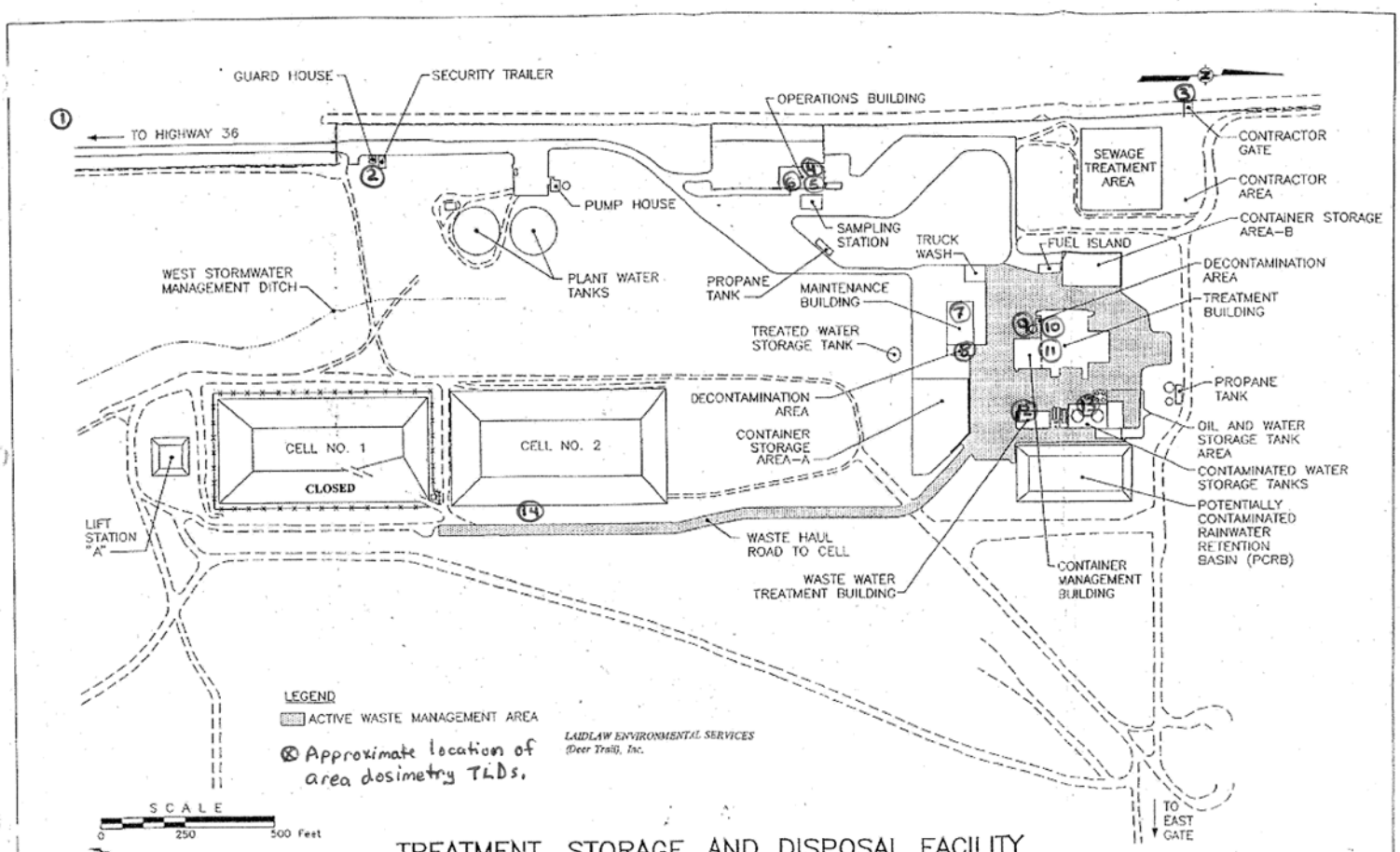


Figure 1.2 General Layout of the Deer Trail Facility

CDPHE Comment 9 - Dosimetry record forms in attachments 1, 2 and 3 are acceptable for CHDT internal assessment and tracking, but do not meet the reporting requirements of RH 4.46.3.

Clean Harbors Response: The SOP on Individual and Area Dosimetry has been expanded to include use of a form with equivalent information as found of State Form OR-RH-17 for purposes of recording and reporting occupational exposures to the Department.

Issues pertaining to Airborne Monitoring

CDPHE Comment 10 - Please provide the RSO established criteria referenced in section 5.1 for the current facility assuming receipt of the types of materials requested in your application including Denver Radium Streets waste.

Clean Harbors Response: The original intent of this requirement was to provide operational flexibility so that the RSO could modify the air monitoring program to meet any specific conditions encountered for specific types of waste. This was coupled with the requirement to keep a current map of the locations of the airborne monitoring program on file, available for CDPHE inspection. However, these procedures have been modified since all of the regulated waste will have similar properties (i.e., solid waste meeting the RCRA and regulated waste acceptance criteria. The text of the SOP on Airborne Monitoring has been revised as follows:

"5.1 Airborne Monitoring Requirements: The Deer Trail RSO shall:

- Oversee and operate the airborne monitoring program according to the following specifications:
    - Sample volume requirements are based on the optimum flow rate of the pump combined with the collection media calibrated to sample 4.0 ±0.4 cubic feet of air per minute [roughly $0.1m^3$/min]. Note: the total volume of air sampled can be calculated from the start and stop readings from the timer and the magnahelic gauge.
    - The samplers are operated continuously and consist of a vacuum pump, flow metering valve, timer, and sample trains.
    - Stations will be designed to collect samples of ambient air in the breathing zone (four to six feet above ground).
    - The samplers will be fitted with wind direction controllers, so that the samples are collected when the wind is from the direction that is most advantageous to collecting meaningful data.
    - Sample filters will be collected approximately every two weeks.
    - Quarterly composites of the sample filters will be sent to a laboratory for analysis as described in the revised SOP.

- Ensure that airborne monitoring samples are evaluated and documented on a weekly and quarterly basis, or more frequently for dusty locations or special operations, as necessary, and

- Oversee the use of the airborne monitoring results in the quarterly estimation of radiation doses to Deer Trail workers."

CDPHE Comment 11 - CHDT indicated that samples will be evaluated on a quarterly basis. Please specify the parameters for collecting a sample (i.e. duration of sample, sample air flow rates, size of the sample filter and a description of the air sampling equipment itself).

Clean Harbors Response: When at all practical the TSP/Radionuclide (TSPR) instrumentation specified will be selected and designed to comply with the requirements of the EPA 40 CFR 50 Appendix B, "Reference Method for the Determination of Particulate Matter in the Atmosphere." The meteorological instrumentation specified complies with the requirements of the EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV, Meteorological Measurements. CHDT has made some modifications based upon ambient air sampling being conducted at the Los Alamos National Laboratory and the Idaho National Laboratory.

Four environmental ambient air stations have been established (see the map included with the response to Comment 12 that follows). One TSPR sampler located down wind of the facility is designated as an official sampler, and a second sampler is located at the same location and is designated as a collocated sampler. One collocated sample is collected during every sampling event. The third sampler is located at a location that is rarely down wind of the facility. The fourth sampler will be located in the area of the active cells and used to establish potential worker inhalation intakes. The samplers are operated continuously and consist of a vacuum pump, flow metering valve, timer, and sample trains. Stations will be designed to collect samples of ambient air in the breathing zone (four to six feet above ground). The samplers will be fitted with wind direction controllers, so that the samples are collected when the wind is from the direction that is most advantageous to collecting meaningful data. Sample filters will be collected approximately every two weeks. In addition to the environmental samplers, a fifth sampler will be located in the treatment building and operated whenever regulated waste is present. Quarterly composites of the sample filters will be sent to a laboratory for analysis as described in the revised SOP.

Although high-volume samplers are recommended by EPA (Appendix A, "Guidance on Implementing the Radionuclide NESHAPS"), in dusty locations they cannot operate for the two-week sampling period without plugging the filter materials. This two week sampling period is necessary to collect enough sample volume to meet the required detection limits. CHDT has therefore chosen to use "medium volume" samplers. Sample volume requirements are based on the optimum flow rate of the pump combined with the collection media. The TSPR sampler will be calibrated to sample 4.0 ±0.4 cubic feet of air per minute [roughly 0.1m^3/min]. The total volume of air sampled can be calculated from the start and stop readings from the timer and the magnahelic gauge.

The meteorological equipment will be calibrated and audited annually. TSP / Radionuclide samplers will be calibrated quarterly and audited annually. Severn Trent Laboratories or an approved laboratory will perform analysis of collected composite quarterly samples and analyzed using the information provided in response to Comment 15 (below). Reduction of data will be performed by CHDT or an outside engineering consulting firm.

<u>TSPR Samplers</u>

Each TSPR sampler will consist of a flow-metering unit, an oil less, constant flow vacuum pump, all enclosed in a lockable weather-tight housing. Included in the housing assembly are various connecting and exhaust hoses and a 117 volt electrical supply circuit. All equipment will meet the following requirements:

Vacuum Pump

The air sampling pump must be capable of running continuously without overheating should the filter material become mostly plugged. The vacuum pump used is a vane-type, oil less, 117-volt, 3/4 hp, electrically powered constant flow air vacuum pump from Gast Manufacturing Company or equivalent.

Filter holder

The particulate filter assembly consists of a 47-mm particulate filter supported on wire mesh in an aluminum housing that can be disconnected without tools from the air suction tube by a mechanical quick-disconnect fitting. The filter holders are commercially available items. The aluminum three-part holders can be screwed apart and have an O-ring seal at the joints. The flow control assembly must regulate the flow of air as the filter becomes loaded with captured particles over the two-week sampling period. The current assembly (SAIC Model LANL 420 or equivalent) consists of flow regulator valves and a pressure-activated timer assembly to record the actual pump run time. This assembly is connected to the sample holders and to the vacuum pump by laboratory-grade tubing of the appropriate size.

Flow meters

A magnahelic gauge is used to measure start and stop flow through filters.

Timer assembly

A vacuum-activated digital timer will be used to record the actual run time of the pump. This device will record the true sampling time to allow calculation of true sampled air volume if a pump does not operate for the full sampling period because of power outages, pump failure, or other causes. Because the timer is battery-powered and is activated by the vacuum created by the proper operation of the pump, it will accurately record the true sampling duration, even for rare problems such as pump failure or connecting-hose breakage.

Meteorological Sensors

Temperature and Relative Humidity

- *Model: Vaisala HMP45C Probe or equivalent*
- *Sensor Height: 1.5 meters*
- *Temperature Specs*
    - *Temperature Measurement Range: -35 to 50 °C*
    - *Thermistor Interchangeability Error: Typically <+-0.2 °C over 0 °C to 60 °C; +-0.4 °C at -35 °C*
    - *Polynomial Linearization Error: <+-0.5 °C over -35 °C to 50 °C*
- *Relative Humidity Specs*
    - *RH Measurement Range: 0% to 100%*
    - *RH Accuracy (at 20 °C) +- 2%, 0% - 90%; +-3% > 90%*
    - *Temperature Dependence of RH Measurement: +-0.04% RH/°C*

Wind

- *Model: R.M. Young 05103 Wind Monitor or equivalent*
- *Sensor Height: 2 meters*
- *Wind Speed Specs*
    - *Range: 0-60 m/s*
    - *Starting Threshold: 1.0 m/s*
    - *Distance Constant (63% recovery): 2.7 m.*
- *Wind Direction Specs*
    - *Range: 0-360 Deg. (355-360 open)*
    - *Starting Threshold 10° displacement: 0.9 m/s*
    - *Starting Threshold 5° displacement: 1.3 m/s*

Solar Radiation

- *Model: Licor 200S Pyranometer or equivalent*
- *Specs*
    - *Sensor Height ~2m*
    - *0-10 mv output range*
    - *Sensitivity typically 80 microamp/1000 W/m2*
    - *Linearity Maximum deviation 1% up to 3000 W/m2*
    - *Spectral response from 0.4 to 1.1 mu*
    - *Typical error under natural daylight +-3%, maximum +-5%*

Precipitation

- *Model: TE525 tipping bucket raingage or equivalent*
- *Specs*
    - *Sensor height >1m*
    - *Collector diameter - 154mm*
    - *0.254mm/tip*
    - *accuracy +- 1% for precip of 50mm/hr or less*
    - *Operating temperature 0 to 50 °C (not accurate during winter)*

Data Logger

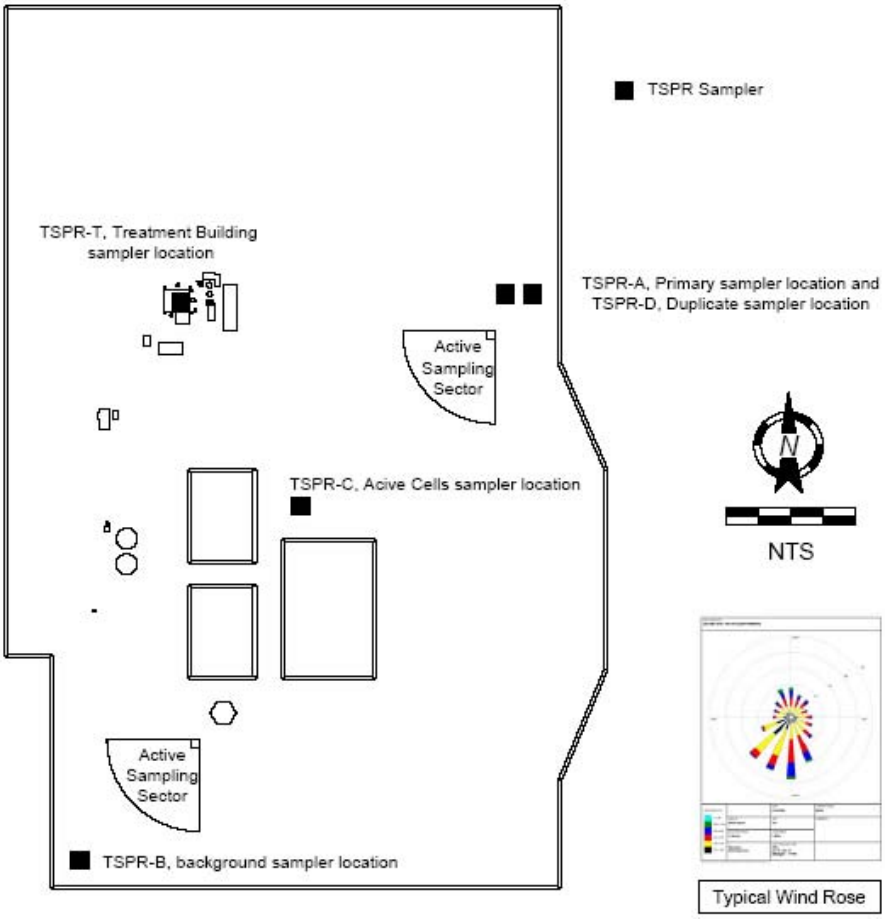
- *Model: Campbell Scientific CR10*

CDPHE Comment 12 - Please provide a facility map showing the airborne monitoring locations for the current facility.

Clean Harbors Response: Please see the following map for air monitoring locations.

TSPR Sampler Locations

TSPR-A is the designated primary sampler used for data statistical analysis
TSPR-B is the sampler designated to measure background concentrations
TSPR-C is the sampler designated to the active secure cell area
TSPR-D is the designated collocated sampler used to measure the precision and accuracy of the samplers
TSPR-T is the sampler designated to the Treatment Building



CDPHE Comment 13 - Please provide a description of the ventilation for the waste treatment facility and an estimation based on proposed activities of the effluent levels that will be generated at that location. Also provide a description of your sampling and analysis for that stack location to demonstrate compliance with effluent limits.

Clean Harbors Response: The following analysis of the potential dose to the nearest resident from emissions from the waste treatment facility was conducted to evaluate the need for stack monitoring. The waste treatment facility ventilation is through a HEPA filter to a stack on the building. An analysis of the potential emissions from the Deer Trail facility was conducted by ENSR Corporation using conservative assumptions and standard methods and models. A copy of their summary report is provided in

Attachment 2. Although most of the emissions are for dust suspended in air during landfill or maintenance operations, the summary report does address radioactive emissions from the treatment building. On page 1 of Attachment 1 to the ENSR Corporation report, they indicate PM_{10} emissions from the solidification building of 0.003 lb/hr for radioactive material. This estimate is based on processing 33,000 tons of material in a year. Of this total estimated quantity, 15,000 tons would be radioactive waste, and 18,000 tons would be solidification agents (cement-like materials). The treatment building is equipped with an air exhaust system that has a HEPA filter with an estimated efficiency of 99.85%. Note that although ENSR indicated that there would be two stacks, the total estimated PM_{10} dust emission of 0.003 lb/hr is the combined total from both stacks, not the emission from each stack. ENSR estimated that the total PM_{10} emissions from all operations was estimated to be 3.68 lb/hr. In Table 1 on page 4 of the ENSR Corporation report, the estimated maximum 24-hour impact air concentration at the approximate distance to the nearest resident for this annual release was 43.4 $\mu g/m^3$, again estimated for the total PM_{10} emissions from all operations. It is noted that this location is basically upwind from the facility (i.e., the wind rarely blows in this direction). The fraction of this air concentration associated with radioactive material from the treatment facility is found by ratio:

$$[(43.4\ \mu g/m^3)/(3.68\ lb/hr)] \times [(0.003\ lb/hr) \times (15{,}000\ tons/33{,}000\ tons)] = 0.016\ \mu g/m^3$$

Assuming that this air concentration is from radioactive material with an activity of 2,000 pCi/g (the upper total activity limit for Deer Trail), the bounding air concentration is 3.2×10^{-5} pCi/m^3. Further, it is assumed that an individual inhales at the rate of 1.2 m^3 per hour for the entire year (8,760 hr), resulting in an estimated intake of 0.34 pCi/yr of radioactive material. If the entire activity were ^{234}U (the uranium isotope with the highest dose per unit intake factor – see Attachment 1 to the Deer Trail SOP on estimating inhalation doses), the resulting bounding dose to the nearest resident is about 0.044 mrem/yr. This is a bounding estimate of the potential inhalation dose for the following reasons:

- *It is unlikely that 15,000 tons/yr of radioactive waste would be treated: a more likely number would be about 5,000 tons/yr – thus reducing the estimated doses by a factor of 3.*
- *The estimate highest 24-hour air concentration was used as an annual average, without accounting for the actual time that the wind blows in the direction of the nearest resident. It is estimated that the wind blows in this direction less than 10% of the time – thus reducing the individual dose by a factor of 10.*
- *The resident would likely spend some portion of a year away from home, and some portion of the year indoors (where the air concentration would be reduced compared to the outdoor dusty air). The combined would reduce the inhalation dose by over a factor of 3.*
- *The actual mixture of radionuclides would include several decay progeny of uranium with lower inhalation dose conversion factors. In equilibrium, uranium would account for no more than about 50% of the total activity, thus reducing the estimated dose by about a factor of 2.*
- *The actual waste concentration, on an annual average basis, would likely be much less than the maximum concentration allowed under the license: a more likely average concentration would be about 500 pCi/g, reducing the estimated dose by a factor of 4.*

Combining these factors indicates that the best estimate of potential inhalation dose would be about a factor of 700 less than the bounding estimate, or about 0.000061 mrem/yr. From this analysis, CHDT concludes that stack monitoring is not required for the waste treatment facility when ever regulated waste is present. The ambient air monitoring program will include sampling inside the waste treatment facility, and at environmental locations around the facility. Further, the annual environmental monitoring program will collect soil samples in the vicinity of the facility. Evaluations of these monitoring data can be used to verify that stack monitoring is not needed.

CDPHE Comment 14 - In 5.3, please provide a better description of the preliminary assessment of the air filter including the type of instrument used, what is meant by sample receipt criteria and what actions will be taken if that criteria is exceeded.

Clean Harbors Response: The intent of the preliminary assessment is so that the filter can be properly labeled for laboratory analysis. Most of the samples received at the laboratory are of environmental levels. If higher radiation levels are present, the RSO must be notified to ensure that the filter can be sent safely to the laboratory. The SOP has been revised as follows:

> "Preliminary Assessment: Upon removal of the air filter, a preliminary assessment shall be conducted using the Ludlum Model 3 survey meter with a Ludlum 44-9 Pancake G-M probe to determine gross contamination levels. If background levels of radon or thoron progeny interfere, prompt field assessments may not be possible. In this situation, the sample will be allowed to decay for one week before the preliminary assessment is conducted. If the preliminary assessment indicates radioactive contamination levels in excess of two times background, the Deer Trail RSO shall evaluate the need for additional dust suppression activities. All air filters shall be sent CHDT laboratory for analysis using the Ludlum Model 3030 Alpha Beta Counter and the results recorded using the form in Attachment 1. These airborne monitoring results shall be plotted using the form in Attachment 1 on a weekly basis for purposes of trending. Such trending shall:

- Provide indication of the continued effectiveness of the existing exposure controls,
- Warn of localized deterioration of control equipment or operating procedures, and
- Identify long-term variations in airborne radioactivity levels."

CDPHE Comment 15 - In 5.4, please list the specific radionuclides that will be measured by the laboratory for analysis of the filter.

Clean Harbors Response: Filters from the airborne monitoring program will be analyzed for the following radioactive constituents:

- *Gamma Spectra Analysis, including $^{226, 228}$Ra plus progeny, and man-made photon emitters with a detection limit of 0.2 pCi/g*
- *Gross Alpha with a detection limit of 10 pCi/g*
- *Gross Beta with a detection limit of 10 pCi/g*
- *$^{228, 230, 232}$Th with a detection limit of 1 pCi/g*
- *$^{234, 235, 238}$U with a detection limit of 1 pCi/g*

CDPHE Comment 16 - The air monitoring record should include columns for the measured activity for each radionuclide and the background activity as well as the net activity for the same radionuclide.

Clean Harbors Response: The monitoring record has been revised to include the requested information and split into two forms, one for the first and second quarters, and one for the third and fourth quarters during a year. Note that the forms may be used to record information for monitors placed during specific or special campaigns by noting the information in the comment section of the form.

CDPHE Comment 17 - What air concentration level will trigger additional sampling locations, more frequent sampling, or other investigation by the Radiation Safety Officer as to the cause?

Clean Harbors Response: The SOP has been modified for environmental airborne monitors to note that if air concentrations are twice background, the RSO shall conduct and document an investigation as to the cause, and recommend either more frequent sampling to evaluate the situation, or recommend other methods, such as more frequent use of clean cover materials in the cell.

Issues pertaining to Estimating Inhalation Doses

CDPHE Comment 18 - Please provide a description of how the RSO will determine the duration of airborne NORM/TENORM hazard.

Clean Harbors Response: For simplicity, this SOP has been modified to indicate that, for purposes of estimating inhalation doses, standard durations for air monitor operation and inhalation of 2,000 hr/yr will be used. The initial concern was that the air concentrations during work involving regulated waste might be underestimated if continuous air samplers are used (i.e., their dust loading would reflect periods of time when there is no potential for radionuclides from regulated airborne waste; thus the average concentration might be low compared to the concentration when work is conducted). The new modification to the SOP requires that the RSO ensure that the estimated air concentrations do not underestimate the concentrations encountered by workers during their routine work day. This will be done by using 2,000 hr/yr (or 500 hr per quarter) as the duration for monitor operation (not 8,760 hr/yr or 2,190 hr per quarter for continuous air monitors). It is recognized that the corrections will need to match the filter exchange frequency (i.e., every two weeks), but will be used to estimate inhalation doses on a quarterly basis.

To test the validity of this approach, a bounding analysis of potential worker inhalation doses was conducted. For the bounding analysis, assume that the quarterly air sample results reflect a dusty operation, corrected to 500 hours of exposure, with an air concentration of 1×10^{-4} g/m^3. Further assume that the dust on the filter is regulated waste with the peak concentration of 2,000 pCi/g, which gives an air concentration of 0.2 pCi/m^3. Breathing this concentration at a rate of 1.2 m^3/hr for 500 hr per quarter, and assuming a protection factor of 50 for the required full face masks, the estimated quarterly intake would be 2.4 pCi. Assuming the intake is ^{234}U with a dose conversion factor of 0.13 mrem per pCi inhaled (the uranium isotope with the highest dose per unit intake factor – see Attachment 1 to the Deer Trail SOP on estimating inhalation doses), the quarterly dose to a worker would be 0.31 mrem. For a year, the dose to a worker would be 1.25 mrem. It is noted that this is likely an overestimate of the potential inhalation dose to a worker for the following reasons:

- *It is unlikely that all of the dust on the filter will be from radioactive waste – the majority will likely be form ambient dust sources. This could reduce the estimated intakes and doses by up to a factor of 10.*
- *The actual mixture of radionuclides would include several decay progeny of uranium with lower inhalation dose conversion factors. In equilibrium, uranium would account for no more than about 50% of the total activity, thus reducing the estimated dose by about a factor of 2.*
- *The actual waste concentration, on an average basis, would likely be much less than the maximum concentration allowed under the license: a more likely average concentration would be about 500 pCi/g, reducing the estimated dose by a factor of 4.*

Combining these factors indicates that the best estimate of potential inhalation doses to workers would be about a factor of 80 less than the bounding estimate, or about 0.0039 mrem per quarter (0.016 mrem/yr).

From this analysis, CHDT concludes that the simplified approach to estimating the duration of the inhalation hazard is warranted.

CDPHE Comment 19 - The equation to calculate airborne concentration is specific to the location of each air sampler. Please specify how the RSO will determine worker's exposure duration for various specific work locations.

Clean Harbors Response: For simplicity, the SOP has been modified to indicate that workers will be assumed to work in the vicinity of the air sampler with the highest quarterly air concentration. This sampler will likely be at the active cell location or in the treatment facility, as shown in the map provided in response to Comment 12 above. This approach is justified based on the bounding inhalation dose analysis provided in response to Comment 18 above.

Issues pertaining to Radiation Protection Training

CDPHE Comment 20 - Please specify the duration of the Radiation Protection Training provided for all employees at the site. Please also provide a copy of a sample quiz that is going to be completed by employees with answers.

Clean Harbors Response: CHDT will have three specific training sessions for landfill workers. Each session will be approximately four hours in length. The first will be training on the basic principles of radiation and radiation protection, and consist of the following modules:

- *Basics of Radioactivity and Radiation*
- *Naturally Occurring Radioactivity*
- *NORM and TENORM*
- *Health Effects of Radiation*
- *Basic Radiation Safety*
- *Radiation Protection: Guidelines, Standards, & Regulations*

This training will be provided by Dade Moeller & Associates, and recorded by the interim RSO. A copy of a sample quiz for the first course is provided in Attachment 3.

The second training session will be for the SOPs for radioactive waste, and the third will be specific training for use of the instruments, including a practicum testing instrument operation against the SOPs. These training programs will be developed and provided prior to receipt of radioactive waste based on the final approved SOPs.

CDPHE Comment 21 - Please provide a detailed description of the training for staff that will perform specific radiation protection duties which might bring them in direct contact with radioactive materials such as collecting air filters, decontaminating and surveying equipment, etc.

Clean Harbors Response: This information will be provided in the second and third training sessions. The second training session will be for the SOPs for radioactive waste, and the third will be specific training for use of the instruments, including a practicum testing instrument operation against the SOPs. These training programs will be developed and provided prior to receipt of radioactive waste based on the final approved SOPs.

Issues pertaining to the Use of the Gate Monitoring System

CDPHE Comment 22 - The MicroShield analysis provided in Attachment B of the application provides an assessment of the exposure from radium-bearing soil-like materials brought into the facility. Please provide the modeling analysis used to determine that a gate monitor alarm set point of 100 uR/hr above background is sufficient and appropriate to identify and reject waste materials having radionuclide concentrations in excess of 2000 pCi/g for uranium and thorium-bearing materials. In general, the use of a uR/hr measurement at the gate will be an unreliable and inconsistent method for verifying compliance with a pCi/g limit for waste streams that are not homogeneous and well characterized.

Clean Harbors Response: Determination of the 2,000 pCi limit for total activity and the 400 pCi limit for ^{226}Ra will primarily be made during the pre-acceptance process as detailed in WAP Appendix K. This process includes the review of documentation and lab analysis. Waste that is approved in the pre-acceptance process will be subjected to screening procedures when it arrives at the facility. The purpose of the screening procedures is not to re-characterize the waste, but instead, to make sure the waste is consistent with the pre-acceptance sample and previous waste shipments, as appropriate. In addition to the gate monitor results, radiological screening will be done using dose rate survey, gamma spectrum analysis and random sampling of gross alpha and beta. The waste will also be subjected to the chemical and physical "fingerprint" tests mandated by the RCRA permit. A discrepancy in any of these tests is reason to suspect that the shipment does not match the waste profile. If the discrepancies cannot be easily resolved, the waste may be subjected to re-characterization including off site lab analysis, or rejection.

It is recognized that the gate monitor alone will not be sufficient to assay incoming waste; however, when used as part of an overall waste acceptance process, it can provide useful information. The gate monitor has several purposes: 1) it will be used as a screen for determining consistency with the pre-acceptance waste characterization, 2) it will be used as a screen for worker protection in order to meet the ALARA goal of 25mR per year for CHDT workers (i.e., checking to assure acceptable dose rates for Deer Trail workers), 3) it will provide for detection of lost sources, and 4) it will detect high activity waste that the facility will not be permitted to accept.

CDPHE Comment 23 - Please provide procedures and criteria for establishing alternate alarm set points by the RSO for long-term clients and episodic wastes.

Clean Harbors Response: Because of the variability of waste loads both in content and geometry, the Deer Trail RSO shall evaluate, confirm, or modify the alarm set point used for different waste shipments. The evaluation shall consist of recording the gate monitor response, comparing the concentrations shown on the shipping manifest, considering external dose rates measured with the Ludlum Model 19 MicroR meter or supplied by the generator, and/or obtaining waste samples for analysis. The alarm set point for the specific waste will then be confirmed or modified and documented by the Deer Trail RSO, as appropriate, using the procedures in the revised Standard Operating Procedure on Use of the Gate Monitoring System.

<u>Long-Term Clients</u>: For clients that deliver a consistent, stable waste form and concentration resulting from industrial or other operations on a long-term basis, the alarm set point shall be established annually or more frequently through sampling, or using the manifest information at the direction of the Deer Trail RSO using the evaluation form provided in the Standard Operating Procedure on Use of the Gate Monitoring System. Note that more frequent analytical sampling may be performed at the discretion of the Deer Trail RSO when there is reason to believe that the routine operations that generate the waste have changed or been modified.

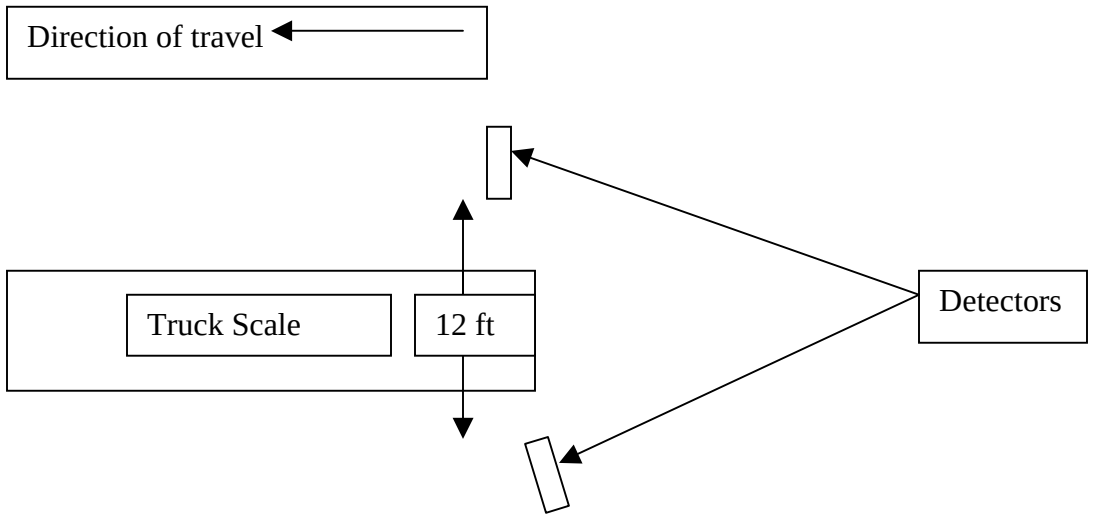
<u>Episodic Wastes</u>: For episodic wastes, such as arising from CERCLA cleanup operations, the Deer Trail RSO shall evaluate, confirm, or modify and document the appropriate alarm set point based on the pre-acceptance evaluation of the regulated waste or additional sample analysis using the evaluation form provided in the Standard Operating Procedure on Use of the Gate Monitoring System.

CDPHE Comment 24 - The procedure requires the truck to remain stationary for 10 seconds and during that time it is surveyed. Please amend the procedure to read that, in addition, the truck will be monitored continuously as it passes through the monitor and specify the maximum speed of the truck during the survey.

Clean Harbors Response: The SOP will be revised to indicate that each truck will be continuously monitored as it passes slowly (at a speed less than 5 miles per hour) through the gate monitor detectors.

CDPHE Comment 25 - Please provide the specific manufacturer, model number and radiological capabilities for the gate monitor. Also provide a diagram showing the geometry and distances between the truck and the detector.

Clean Harbors Response: The gate monitor is a Ludlum Model 3502 Gate Monitor. It utilizes two 2" x 2" Sodium Iodide Crystals. They are located 7 feet above the ground and 12 feet apart. One points 90 degrees to the truck and one points about 70 degrees from the truck. See the attached sketch. The truck drives through the two monitors and parks on the scale. In this way, the entire truck has gone past the monitors. The monitor will be set to alarm at the specified set point. A diagram showing the geometry and distances between the truck and detector array is provided below.



Issues pertaining to Routine Radiation Surveys

CDPHE Comment 26 - Please provide the probe manufacturer and model number for the Ludlum Model 3 survey instrument that will be used for localized measurements.

Both the Ludlum Model 3 Survey Meter and the Ludlum Model 177 Alarm Ratemeter (Stationary) will equipped with a Ludlum Model 44-9 Pancake G-M probe. The Ludlum Model 3 Survey meter with the Ludlum Model 44-9 pancake G-M probe is a general-purpose survey meter used for measuring count rates of alpha beta, and gamma radiation. This meter will be used to conduct a variety of radiation surveys, as defined in the Deer Trail Standard Operating Procedures. Range: 50 to 100,000 dpm/cm^2, 0.1 mrem/h to 1,000 rem/h, ± 15%. The instrument response is typically 3,300 cpm per mR per hr for ^{137}Cs.

CDPHE Comment 27 - How will the RSO evaluate the instrument response and confirm or modify the detector efficiency and determine the appropriate alarm setting for the Ludlum Model 193-6 survey wand?

Clean Harbors Response: The procedure on radiation surveys has been modified as follows:

"6.0 <u>EVALUATION OF DETECTOR EFFICIENCIES</u>

Based on information from the manufacturer, the estimated detection efficiency for both the Ludlum Model 3 with Ludlum Model 44-9 Pancake G-M probe and the Ludlum Model 193-6 Survey Wand is about 0.2 (i.e., a 10 cpm reading would equate to 50 dpm). On a periodic basis, (initially at operations and as needed based on changing types of wastes and conditions), the Deer Trail RSO shall conduct an evaluation of the detector efficiency and modify the assumed efficiencies and alarm set points established in this procedure. To conduct the evaluation, the Deer Trail RSO shall obtain uniform samples of waste, determine the instrument readings in units of cpm using standard survey methods described in Section 5.4 of this procedure, and send the samples offsite to a laboratory for comparative analysis. Using the procedure outlined in Attachment 3, the Deer Trail RSO shall confirm/modify the instrument response information. It is noted that, because of variable geometries and waste forms encountered under actual field conditions, it may not be possible to accurately define instrument responses for all conditions. Therefore, the Deer Trail RSO shall provide a discussion of the evaluation, with commentary on the instrument response versus waste concentrations, and a final determination either confirming or modifying the detector efficiencies used for performing radiation surveys at Deer Trail. It is also noted that an onsite verification of instrument response can be made using smear samples analyzed with the survey instruments and the Ludlum Model 3030 Alpha Beta Sample counter, with a comparison of the results using these two methods."

The procedure and form provided in Attachment 3 from this SOP follows:

ATTACHMENT 3 – EVALUATION OF DETECTOR EFFICIENCIES

Clean Harbors Deer Trail LLC
DETECTOR EFFICIENCY EVALUATION FORM

Date	Purpose of Evaluation

Procedure: This procedure/form is to be used to confirm/modify instrument response information from the instrument manufacturer. Establish background readings for the instrument(s) under evaluation. Obtain about a 200 gram dry sample of waste with uniform particle size (roughly equal to or less than that of construction sand). Measure out about 100 grams of waste and spread uniformly over a surface area of about 300 cm^2 (roughly 10 inches by 10 inches) and record the sample weight and gross cpm readings below. Determine the net count rate in cpm. Divide cpm readings by the sample weight. Record the total weight of the remaining sample (about 100 grams) and send to an offsite laboratory for analysis (may include gross alpha and beta-gamma and/or radionuclide analyses to determine total activity per sample). Use generator supplied waste characterization information for reference/discussion only. Follow footnotes below.

Instrument/Probe Model	Ludlum Model 3 With Model 44-9 Pancake G-M Probe	Ludlum Model 3 With Model 44-9 Pancake G-M Probe Corrected to cpm/g	Ludlum Model 193-6 Survey Wand	Ludlum Model 193-6 Survey Wand Corrected to cpm/g
Serial No.				
Background Reading	cpm	N/A	cpm	N/A
Gross Reading	cpm	cpm/g	cpm	cpm/g
Net Reading	cpm	cpm/g	cpm	cpm/g

Radionuclide[1]	Generator Supplied Waste Characterization, by Radionuclide and Total	Additional Sample Analysis, by Radionuclide and Total (If available)
	pCi/g	pCi/g
	pCi/g	pCi/g
	pCi/g	pCi/g
	pCi/g	pCi/g
	pCi/g	pCi/g
	pCi/g	pCi/g
	pCi/g	pCi/g
	pCi/g	pCi/g
Total Activity[2]	pCi/g	pCi/g
Converted to dpm[3]	dpm	dpm
Determination of cpm/dpm for Instrument 1[4]		
Determination of cpm/dpm for Instrument 2[4]		

Total Sample Weight: _____ grams

Onsite Analysis Sample Weight: _____ grams

Sample Weight Sent to Lab: _____ grams

Weight of Sample Analyzed by Lab: _____ grams

Discussion of Instrument Response versus Waste Concentrations: (Note, the RSO may elect to continue using the manufacturer's recommendations, or an alternative efficiency factor based on this evaluation)

Evaluation Conducted By:

Name (Print) _____

Signature _____

Issues pertaining to Personnel Surveys

CDPHE Comment 28 - In section 5.3, it is unclear when removable contamination surveys (smear samples) will be conducted. Is this every time someone leaves the NORM/TENORM area, or only if elevated counts are found with a portable survey instrument?

Clean Harbors Response: The text of Section 5.3 has been modified as follows:

"If elevated contamination is found on personnel, determination of removable contamination shall be made using a two inch … Verification of positive contamination, if encountered, shall be accomplished by sending the smear samples to the CHDT laboratory for analysis using the Ludlum 3030 Alpha Beta Sample counter."

Also note that the text has been modified to recognize the variability of background, and the potential difficulty to determine a positive detection of contamination. To account for this situation, the text has been modified as follows:

- *"If the count rates consistently 1.5 times of background are detected, decontamination according to the procedure in Section 5.4 shall be followed prior to re-surveying."*

CDPHE Comment 29 - What level of alpha contamination is detectable using the methods described?

Clean Harbors Response: The Ludlum Model 44-9 Pancake G-M probe is a multi-purpose probe, generally suitable for most situations. The technical specifications of the Model 44-9 Pancake G-M probe indicate a typical 4π geometry response for ^{239}Pu of 15%, with a typical sensitivity of 3,300 cpm/mR/hr for the ^{137}Cs gamma. It is noted that both ^{239}Pu and ^{238}U have soft gamma as well as alpha emissions, so comparisons with the technical specifications for ^{239}Pu are appropriate. It is also noted that there will be a strong beta gamma signature to most waste because of the presence of other decay chain radionuclides; thus the instrument response will not be limited to alpha detection alone and will approach a total of 20%; however, for this example an efficiency of 10% is assumed. At the detection level of 1.5 times background, assuming uniform contamination over an area greater than 100 cm^2, background of 20 cpm, and using the approximate efficiency for natural uranium mixtures of 10% with an approximate active probe area of 15 cm^2, the detection level would be:

$$[(10\ cpm)/(0.1\ cpm/dpm)] = 100\ dpm\ per\ probe\ area\ (i.e.\ 15\ cm^2)$$

Correcting for 100 cm^2 of surface:

$$100\ dpm \times (100\ cm^2/15\ cm^2) = 667\ dpm/100\ cm^2$$

Note that this level is sufficiently less than the surface screening level of 6,000 dpm/100 cm^2 defined for Group 2 uranium and natural uranium radionuclide mixtures in ANSI/HPS N13.12. Also note that the Deer Trail RSO will be confirming the instrument responses and detection efficiencies for waste by comparison against laboratory analysis of specific samples.

Issues pertaining to Equipment Surveys

CDPHE Comment 30 - In section 5.2, the example neglects to add a correction factor for the area of the probe. Survey forms and instructions to the surveyors should include the specific probes being used and the precise calculation parameters that will be used to convert cpm into dpm.

Clean Harbors Response: The SOP has been modified as follows:

> "For example, using a detector efficiency of 0.1 for the Ludlum Model 3 survey meter and Model 44-9 G-M probe for uranium mixtures, and an average background rate of 20 cpm, the ANSI/HPS N13.12 Group 2 value for uranium mixtures of 6,000 dpm per 100 cm^2 from Table 1 would equate to an instrument reading of:
>
> (6,000 dpm per 100 cm^2) x (15 cm^2/100 cm^2) x (0.1) = 90 cpm above background
>
> For radium and decay chain only mixtures, the reading on the Ludlum Model 3 survey meter with the Model 44-9 G-M probe with beta gamma efficiency of 20% for ANSI/HPS N13.12 Group 1 radionuclides would be 20% of this value, or 18 cpm above background. Note that this level would result in an instrument reading about twice the average background count rate.
>
> For the Ludlum Model 193-6 Survey Wand, the plastic scintillation detector has a surface area of about 180 cm^2 and an efficiency for uranium mixtures of about 12%. The ANSI/HPS N13.12 Group 2 value for uranium mixtures would equate to an instrument reading of:
>
> (6,000 dpm per 100 cm^2) x (180 cm^2/100 cm^2) x (0.12) = 1,300 cpm above background
>
> For radium and decay chain only mixtures, the reading on the Ludlum Model 193-6 Survey Wand for ANSI/HPS N13.12 surface contamination levels would be 20% of this value, or about 260 cpm above background."

In addition, the survey forms have been updated to provide additional information on the cpm to dpm conversions for the specific instruments used.

CDPHE Comment 31 - Using the screening levels provided in Table 1 the surveyor would have to know which specific radionuclides comprised the potential contamination on the equipment. How will this information be determined and conveyed to the person conducting the survey?

Clean Harbors Response: The SOP has been revised to include the following:

> "For simplicity, surveys shall be conducted using ANSI/HPS N13.12, Group 1 levels for both instruments. If contamination levels are detected in excess of these values, the Deer Trail RSO shall be notified and a determination of the radionuclide mixture shall be made using the waste profile information for the specific shipment. If the radionuclide mixture is consistent with ANSI/HPS N13.12 Group 2 for uranium mixtures, the RSO shall authorize use of the Group 2 values for the release survey. If the survey results exceed the appropriate limits, the equipment shall be decontaminated using Section 5.3 of this procedure."

CDPHE Comment 32 - The Department has historically used the release criteria established in USNRC Regulatory Guide 1.86. Please provide your rationale for the screening levels selected in Table 1 or adopt the criteria established in Regulatory Guide 1.86. Release criteria should address screening levels for both fixed and removable contamination. Please explain the use of volume

screening levels provided in Table 1, as this doesn't appear to be applicable to the release of equipment.

Clean Harbors Response: CHDT has requested using the screening levels adopted from ANSI/HPS N13.12 instead of those established in Regulatory Guide 1.86 for the following reasons:

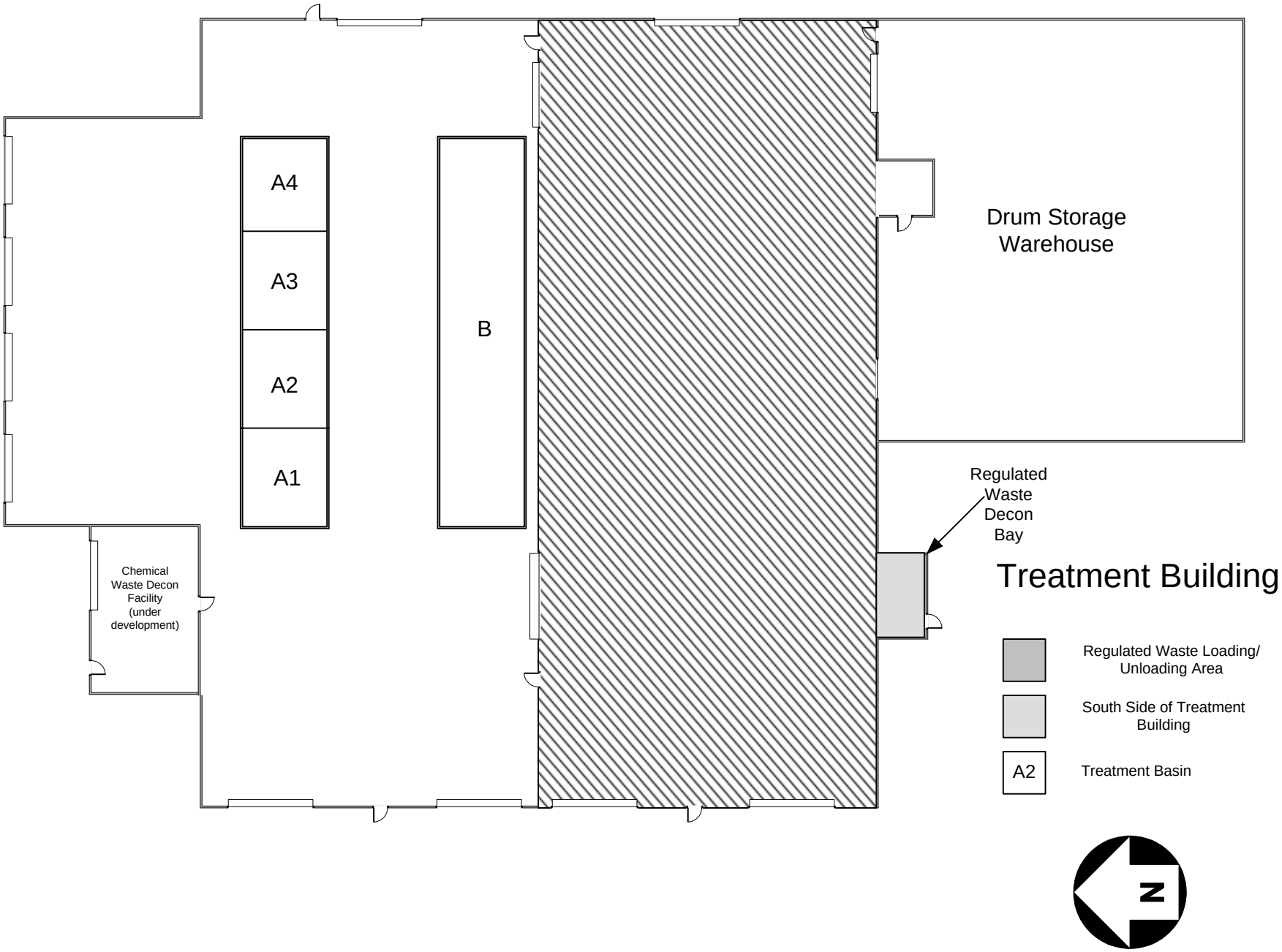
- *The values in ANSI/HPS N13.12 are based on dose response, while those in Regulatory Guide 1.86 were largely based on instrument response. Although radionuclide groups are used in both, groups based on dose response are more appropriate to assuring uniform radiation protection across a variety of situations. As an example of the potential differences, Regulatory Guide 1.86 includes both ^{60}Co and ^{99}Tc in the same group (beta-gamma emitters), even though an inspection of the potential doses delivered by these two radionuclides through all exposure pathways differ by more than four orders of magnitude. CHDT therefore concluded that it is more appropriate to use the dose-based ANSI/HPS N13.12 screening values.*
- *Regulatory Guide 1.86 provides both removable and fixed contamination values that are based on a single assignment of removal efficiency to all situations. Removal efficiency is dependent on many factors including the nature of the surface and the chemical/physical properties of the contamination. This is an oversimplification that could lead to conditions that are not necessarily protective if the amount removed is under predicted. Further, depending on the radionuclide, the most significant pathways may be associated with either fixed or removable contamination. Both fixed and removable contamination conditions were considered in the development of ANSI/HPS N13.12; that is, a worst case was assumed with all of the contamination being fixed and removable, and the highest result used to determine the dose response and associated radionuclide group. As a result, the ANSI/HPS N13.12 values represent both fixed and removable contamination. It is recognized that measurements of removable contamination are important to maintaining contamination control – but the same limit applies to both. Therefore, a single screening limit is appropriate for both fixed and removable contamination..*
- *Release of equipment will generally involve the identification of surface contamination levels; thus, the volume screening levels have been removed from Table 1.*

CDPHE Comment 33 - Please provide a facility diagram indicating the locations for surveys and decontamination of vehicles, personnel and equipment exiting the treatment building and the active disposal cell.

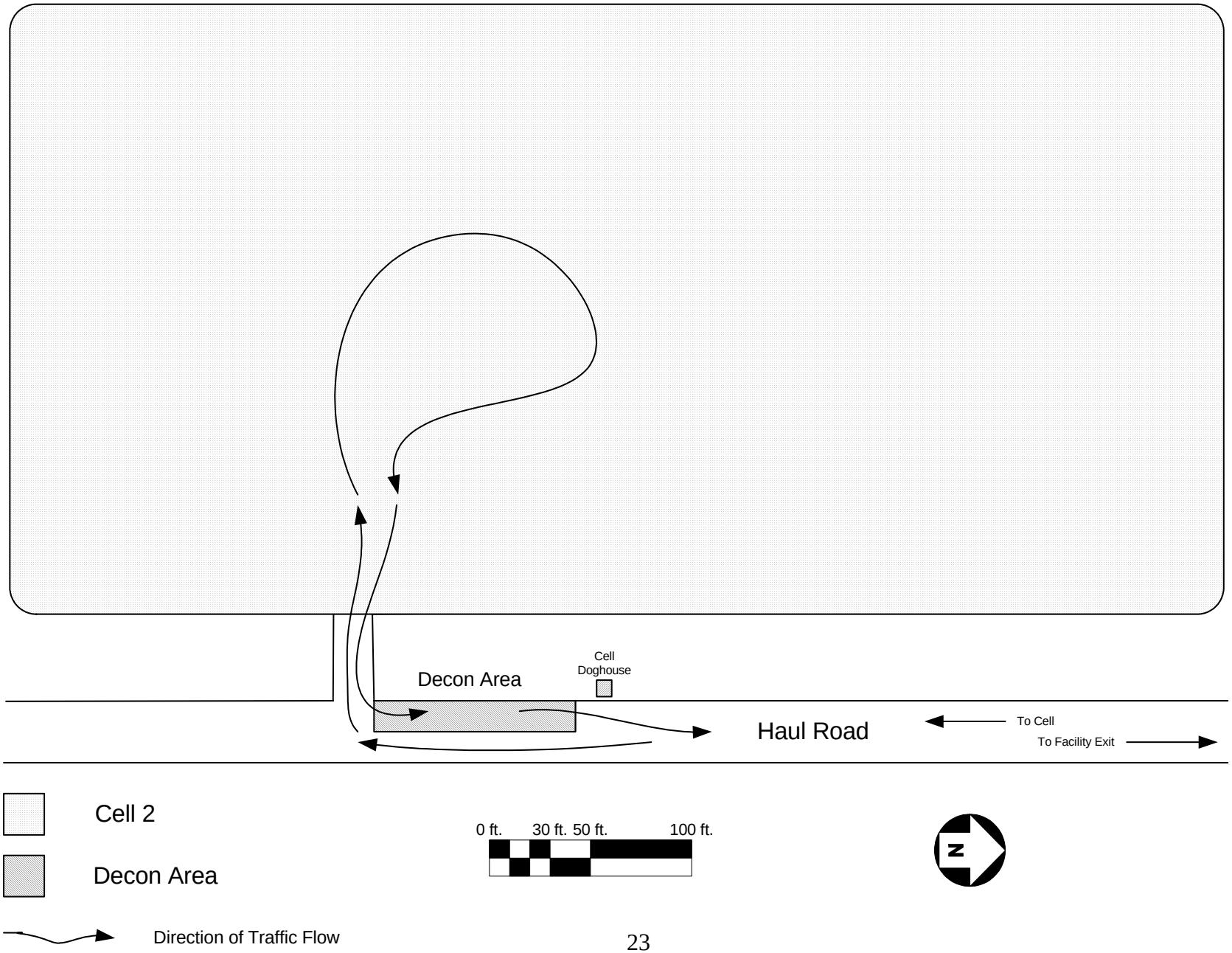
Clean Harbors Response:

<u>Treatment Building Decon Area</u>: All treatment operations of Regulated Waste will take place in the south side of the treatment building. The south side of the treatment building is separated form other parts of the treatment building by walls and rollup doors. Decon of vehicles will take place in the Regulated Waste Loading/Unloading Area. Decon of personnel will take place in the Regulated Waste Decon Bay. These areas are shown on the attached diagram.

<u>Landfill Decon Area</u>: Decon of vehicles and equipment will take place in the Landfill Decon Area. Supplies and equipment will be stored in the Landfill Doghouse. These are shown on the diagrams that follow.


A4
A3
A2
A1
B
Drum Storage Warehouse
Regulated Waste Decon Bay
Chemical Waste Decon Facility (under development)
Treatment Building
Regulated Waste Loading/ Unloading Area
South Side of Treatment Building
A2
Treatment Basin
N

Cell 2 and Decon Area



CDPHE Comment 34 - Please provide a detailed description of the equipment and facilities operated at the decontamination station. Also provide detailed procedures for decontamination including how wash fluids and contaminated materials resulting from decontamination will be managed.

Clean Harbors Response: There will be two decontamination stations, one located at the landfill and one located in the unloading area of the treatment building.

Landfill Decontamination: Possible sources of radioactive contamination in the landfill will be only from dry, solid materials, hence the principle methods of decon will be dry methods such as sweeping with a broom, or wiping off visible contamination with a rag. If mud is present, it will be removed using a trowel or a shovel. If these methods are not sufficient, cleaning with a rag and a cleaning compound such as Radiac Wash will be utilized. Removal of all visible waste materials will take place in the landfill. Equipment will consist of brooms, shovels, trowels, and rags. All recovered materials at the landfill will be solid materials, which will be disposed of in the landfill. Only after all visible waste materials have been removed will the truck exit the landfill and proceed into the decontamination area. The decontamination area will be used principally for the exit surveys of trucks. If additional decontamination is necessary, it will occur in the decontamination area. The landfill decontamination area will consists of a section of the haul road adjacent to the entrance of the landfill. The haul road is a concrete surfaced roadway. Barriers or traffic cones will demarcate an area approximately 15 feet wide and 90 feet long.

Treatment building. As defined in the CHDT SOP for Treatment Operations, decontamination in the treatment building will be done principally using water. Truck beds will be inspected for the presence of visible waste residue at the time of unloading. If waste has contacted the truck bed, the bed will be washed with water with the wash water directed into the treatment basin. Exit surveys, when necessary, will take place in the unloading area using the CHDT SOP of Equipment Surveys.

CDPHE Comment 35 - The procedure for surveying vehicles should include documentation of each survey and not just the vehicles that were decontaminated.

Clean Harbors Response: The SOP has been modified to require documentation of the survey results for each survey for equipment (trucks). A daily survey log will be maintained showing survey results for all trucks/equipment leaving the landfill.

Issues pertaining to Surveys Following Spills

CDPHE Comment 36 - In section 5.2, the example neglects to add a correction factor for the area of the probe. Survey forms and instructions to the surveyors should include the specific probes being used and the precise calculation parameters that will be used to convert cpm into dpm. This appears to be the same paragraph as the procedure for equipment and truck surveys. This needs to be corrected to indicate that the surveys are being performed on spill areas.

Clean Harbors Response: Consistent with the response to Comment 30 above, the following revision to the SOP on Surveys Following Spills has been made:

- "The survey limits shall be set to meet the levels in ANSI/HPS N13.12-1999, "Surface and Volume Radioactivity Standards for Clearance." These values are summarized in

Table 1 for radium and uranium radionuclides or radionuclide mixtures. For example, using a detector efficiency of 0.1 for the Ludlum Model 3 survey meter and Model 44-9 G-M probe for uranium mixtures, and an average background rate of 20 cpm, the ANSI/HPS N13.12 Group 2 value for uranium mixtures of 6,000 dpm per 100 cm^2 from Table 1 would equate to an instrument reading of:

(6,000 dpm per 100 cm^2) x (15 cm^2/100 cm^2) x (0.1) = 90 cpm above background

For radium and decay chain only mixtures, the reading on the Ludlum Model 3 survey meter with the Model 44-9 G-M probe with a beta-gamma efficiency of 20% for ANSI/HPS N13.12 Group 1 radionuclides would be 20% of this value, or 18 cpm above background. Note that this level would result in an instrument reading about twice the average background count rate.

For the Ludlum Model 193-6 Survey Wand, the plastic scintillation detector has a surface area of about 180 cm^2 and an efficiency for uranium mixtures of about 12%. The ANSI/HPS N13.12 Group 2 value for uranium mixtures would equate to an instrument reading of:

(6,000 dpm per 100 cm^2) x (180 cm^2/100 cm^2) x (0.12) = 1,300 cpm above background

For radium and decay chain only mixtures, the reading on the Ludlum Model 193-6 Survey Wand for ANSI/HPS N13.12 surface contamination levels would be 20% of this value, or about 260 cpm above background."

CDPHE Comment 37 - Which specific screening value is being applied to spills (surface levels or volume screening levels)? Using the screening levels provided in Table 1 the surveyor would have to know which specific radionuclides comprised the potential contamination in the spill area. How will this information be determined and conveyed to the person conducting the survey? If the volume screening levels will be used, how will a hand-held instrument taking a surface measurement reading convert the cpm measurement to pCi/g?

Clean Harbors Response: The SOP has been revised as follows:

- "The Deer Trail RSO will evaluate the instrument response and confirm or modify the detector efficiency, and determine the appropriate alarm setting for the survey instruments. For simplicity, surveys shall be conducted using ANSI/HPS N13.12, Group 1 levels for both instruments. If contamination levels are detected in excess of these values, the Deer Trail RSO shall be notified and a determination of the radionuclide mixture shall be made using the waste profile information for the specific shipment. If the radionuclide mixture is consistent with ANSI/HPS N13.12 Group 2 for uranium mixtures, the RSO shall authorize use of the Group 2 values for the release survey. If the survey results exceed the appropriate limits, the equipment shall be decontaminated using Section 5.3 of this procedure."

In addition, the procedure has been simplified to consider surface contamination instrument responses, with confirmation using smear sample results.

CDPHE Comment 38 - It is not clear how the smear samples and analysis described in your procedure will be used for dirt roads and other areas of the facility where spills can occur.

Clean Harbors Response: The intent of the smear sample analysis is simply to confirm uranium and decay chain radionuclides at levels consistent with the levels found in background samples. This can be done by "soiling" a smear and sending it to the CHDT Ludlum Model 3030 Alpha Beta Sample Counter. The procedure has been modified as follows:

- "Determination of alpha contamination (Group 2 radionuclides in Table 1), when appropriate, shall be accomplished by sending samples soiled with material in the area of the spill to the CHDT laboratory for analysis using the Ludlum 3030 Alpha Beta Sample counter with comparison to the surface contamination values in Table 1, Group 2, for the uranium decay chain. Note that the intent of this analysis is to determine contamination levels for alpha emitters in excess of background."

Issues pertaining to Gamma Spectra Analysis

CDPHE Comment 39 - In section 5.0, it states that an Exploranium GR-135 Identifier will be used to determine the relative contributions of radionuclides in the wastes received at the facility. Please document the ability of this instrument to perform such analysis on a large container or truckload of waste similar to those anticipated to be received. Specifically, is it your intent to verify total pCi/g activity levels and/or specific pCi/g levels of particular radionuclides such as Ra-226 with this instrument?

Clean Harbors Response: The Exploranium GR-135 Identifier will be used to identify photon emitting radionuclides that may be present in waste and serve as a screening method to keep man-made radionuclides from being disposed at Deer Trail. It will not be used to verify total pCi/g since this unit will not register alpha or beta radiation. It is recognized that with a short count time this unit may not have the sensitivity to identify the radionuclides that are present. For this reason, the SOP has been revised to require a ten minute counting period, while the truck is on the scale and the paperwork is being evaluated. To assure a constant geometry, the Identifier will be on a tripod in a fixed location near the midpoint of the truck.

CDPHE Comment 40 - Using the screening levels provided in Table 1 the person performing the analysis would have to know which specific radionuclides comprised the potential contamination in the spill area. How will this information be determined and conveyed to the person performing the analysis?

Clean Harbors Response: This comment appears to relate to the SOP on Surveys, not the Gamma Spectra Analysis, since there is no Table 1 in the Gamma Spectra Analysis SOP. The general response was provided in response to Comment 31 above on equipment surveys as follows:

> "For simplicity, surveys shall be conducted using ANSI/HPS N13.12, Group 1 levels for both instruments. If contamination levels are detected in excess of these values, the Deer Trail RSO shall be notified and a determination of the radionuclide mixture shall be made using the waste profile information for the specific shipment. If the radionuclide mixture is consistent with ANSI/HPS N13.12 Group 2 for uranium mixtures, the RSO shall authorize use of the Group 2 values for the release survey. If the survey results exceed the appropriate limits, the equipment shall be decontaminated using Section 5.3 of this procedure."

All of the SOPs dealing with surveys have been reviewed, and similar language has been inserted, as appropriate.

Issues pertaining to Landfill Operations (Waste Cell)

CDPHE Comment 41 - As a licensed low-level radioactive waste disposal facility it will be your responsibility to ensure that all equipment leaving the facility meet Department approved release criteria for contamination. Your procedures for surveying vehicles must ensure that any vehicle leaving your restricted area that has a potential for contamination is adequately and appropriately surveyed, regardless of the type of waste the vehicle carried. Your operational procedures assume that the haul road between where the truck dumps the material in the cell and the point where the truck is surveyed (outside of the cell) remains free of contamination.

Clean Harbors Response: CHDT intends to operate the landfill in two modes of operation depending upon the potential for contamination with regulated material: the Regulated Waste Mode, and the RCRA Only Mode. The regulated waste mode presents a greater potential for contamination than the RCRA only mode, therefore the requirements are more stringent than those of the RCRA Only Mode. Dumping and compacting regulated material poses a potential threat of contamination. Once regulated materials are covered and compacted, and no more regulated waste is being worked, the contamination hazard will have been eliminated. CHDT intends to keep the haul road free of regulated waste contamination. This will be done by: covering the haul road with clean soil each day of regulated waste operations, surveying the haul road to check for contamination, and cleaning up any spilled regulated waste from the haul road. Once the regulated waste is covered and the haul road is replaced with clean soil, there is no potential for contamination of waste delivery vehicles, so no surveying of vehicles exiting the cell is necessary. All waste delivery vehicles go through the CHDT washout facility and have their tires washed prior to exiting the facility. This provides additional assurance that no regulated waste will leave the facility.

Issues pertaining to Waste Tracking

CDPHE Comment 42 - Please provide a copy of the Uniform Radioactive Waste Manifest that will be used to track radioactive waste shipments to the facility.

Clean Harbors Response: Clean Harbors Response: Different shipping documents may be used depending upon the regulatory status of the waste. These may include the Uniform Low-Level Radioactive Waste Manifest, the Hazardous Waste Manifest, and or other shipping papers as required by the USDOT. A copy of the Uniform Low-Level Radioactive Waste Manifest, electronically available from the U.S. NRC, is provided in the following pages.

APPROVED BY OMB: NO. 3150-0164
EXPIRES: 08/30/2007

Estimated burden per response to comply with this information collection request: 45 minutes. This uniform manifest is required by NRC to meet reporting requirements of Federal and State Agencies for the safe transportation and disposal of low-level waste. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0164), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

NRC FORM 540
(6-2004)

U.S. NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

SHIPPING PAPER

1. EMERGENCY TELEPHONE NUMBER *(Include Area Code)*

ORGANIZATION

2. IS THIS AN "EXCLUSIVE USE" SHIPMENT?
☐ YES
☐ NO

3. TOTAL NUMBER OF PACKAGES IDENTIFIED ON THIS MANIFEST =====>

4. DOES EPA REGULATED WASTE REQUIRING A MANIFEST ACCOMPANY THIS SHIPMENT? ☐ YES ☐ NO
If "Yes," provide Manifest Number

EPA MANIFEST NUMBER

SHIPPER - NAME AND FACILITY

SHIPPER I.D. NUMBER

☐ COLLECTOR
☐ PROCESSOR
☐ GENERATOR TYPE *(Specify)*

USER PERMIT NUMBER

SHIPMENT NUMBER

CONTACT

TELEPHONE NUMBER *(Include Area Code)*

6. CARRIER - Name and Address

EPA I.D. NUMBER

SHIPPING DATE

CONTACT

TELEPHONE NUMBER *(Include Area Code)*

SIGNATURE - Authorized carrier acknowledging waste receipt

DATE

7. NRC FORM 540 AND 540A PAGE 1 OF ____ PAGE(S)
NRC FORM 541 AND 541A ____ PAGE(S)
NRC FORM 542 AND 542A ____ PAGE(S)
ADDITIONAL INFORMATION ____ PAGE(S)

8. MANIFEST NUMBER
(Use this number on all continuation pages)

9. CONSIGNEE - Name and Facility Address

CONTACT

TELEPHONE NUMBER *(Include Area Code)*

SIGNATURE - Authorized consignee acknowledging waste receipt

DATE

10. CERTIFICATION

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

AUTHORIZED SIGNATURE | TITLE | DATE

11. U.S. DEPARTMENT OF TRANSPORTATION DESCRIPTION (Including proper shipping name, hazard class, UN ID number, and any additional information)	12. DOT LABEL "RADIOACTIVE"	13. TRANSPORT INDEX	14. PHYSICAL AND CHEMICAL FORM	15. INDIVIDUAL RADIONUCLIDES			16. TOTAL PACKAGE ACTIVITY IN SI UNITS	17. LSA/SCO CLASS	18. TOTAL WEIGHT OR VOLUME *(Use appropriate units)*	19. IDENTIFICATION NUMBER OF PACKAGE

FOR CONSIGNEE USE ONLY

NRC FORM 540 (6-2004)

APPROVED BY OMB: NO. 3150-0166
EXPIRES: 06/30/2007

Estimated burden per response to comply with this information collection request: 3.3 hours. This uniform manifest is required by NRC to meet reporting requirements of Federal and State Agencies for the safe transportation and disposal of low-level waste. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0166), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

NRC FORM 541
(6-2004)

U.S. NUCLEAR REGULATORY COMMISSION

UNIFORM LOW-LEVEL RADIOACTIVE WASTE MANIFEST

CONTAINER AND WASTE DESCRIPTION

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

1. MANIFEST TOTALS

NUMBER OF PACKAGES/ DISPOSAL CONTAINERS	NET WASTE VOLUME (m^3)	NET WASTE WEIGHT (kg)	SPECIAL NUCLEAR MATERIAL (grams) U-233	U-235	Pu	TOTAL

ACTIVITY (MBq) ALL NUCLIDES	TRITIUM	C-14	Tc-99	I-129	SOURCE (kg)

2. MANIFEST NUMBER

3. PAGE _____ OF _____ PAGE(S)

4. SHIPPER NAME

SHIPPER I.D. NUMBER

DISPOSAL CONTAINER DESCRIPTION

5. CONTAINER IDENTIFICATION NUMBER/ GENERATOR ID NUMBER(S)	6. CONTAINER DESCRIPTION (See Note 1)	7. VOLUME (m^3)	8. WASTE AND CONTAINER WEIGHT (kg)	9. SURFACE RADIATION LEVEL ☐ (µSv/hr) ☐ (mSv/hr)	10. SURFACE CONTAMINATION MBq/100cm² ALPHA	BETA-GAMMA

WASTE DESCRIPTION FOR EACH WASTE TYPE IN CONTAINER

PHYSICAL DESCRIPTION 11. WASTE DESCRIPTOR (See Note 2)	12. APPROXIMATE WASTE VOLUME(S) IN CONTAINER	13. SORBENT SOLIDIFICATION, STABILIZATION, MEDIA (See Note 3)	14. CHEMICAL DESCRIPTION CHEMICAL FORM/ CHELATING AGENT	WEIGHT % CHELATING AGENT IF > 0.1%	15. RADIOLOGICAL DESCRIPTION INDIVIDUAL RADIONUCLIDES AND ACTIVITY (MBq) AND CONTAINER TOTAL; OR CONTAINER TOTAL ACTIVITY AND RADIONUCLIDE PERCENT	16. WASTE CLASSIFICATION AS-Class A Stable AU-Class A Unstable B-Class B C-Class C

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

1. Wooden Box or Crate
2. Metal Box
3. Plastic Drum or Pail
4. Metal Drum or Pail
5. Metal Tank or Liner
6. Concrete Tank or Liner
7. Polyethylene Tank or Liner
8. Fiberglass Tank or Liner
9. Demineralizer
10. Gas Cylinder
11. Bulk Unpackaged Waste
12. Unpackaged Components
13. High Integrity Container
19. Other. Describe in Item 6, or additional page

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

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

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

Sorption

60. Speedi Dri
61. Celetom
62. Floor Dry/ Superfine
63. Hi Dri
64. Safe T Sorb
65. Safe N Dri
66. Floroc
67. Floroc X
68. Solid A Sorb
69. Chemsil 30
70. Chemsil 50
71. Chemsil 3030
72. Dicapell HP200
73. Dicapell HP500
74. Petroset
75. Petroset II
76. Aquaset
77. Aquaset II
89. Other. Describe in Item 13, or additional page

Solidification

90. Cement
91. Concrete (encapsulation)
92. Bitumen
93. Vinyl Chloride
94. Vinyl Ester Styrene
99. Other. Describe in Item 13, or additional page
100. None Required

NRC FORM 541 (6-2004)

PRINTED ON RECYCLED PAPER

Issues pertaining to the Waste Analysis Plan Appendix K of the permit renewal application

CDPHE Comment 43 - Based on our discussion and a review of this document, it is not clear how the Waste Analysis Plan for radioactive materials (appendix K) will be applied to activities under both the permit and the radioactive materials license. If separate methods and criteria will be applied to waste streams coming in under the RCRA permit and under the radioactive materials license, the criteria in both cases must be sufficient for the facility to demonstrate compliance under the radioactive materials license (for example, the receipt of Am-241 containing smoke detectors that might be received as part of a shipment of building debris under the RCRA permit).

Clean Harbors Response: All waste received at CHDT must meet the requirements of the RCRA permit. Regulated material, whether it is under the license or the RCRA permit, must meet additional waste acceptance criteria as explained in the WAP Appendix K. Procedures for waste containing regulated material will be uniform regardless of its regulatory status; they will be the same weather accepted under the license or the RCRA permit. CHDT will impose a requirement that waste generators must complete and sign a Non-Radioactive Profile Addendum for all non-radioactive waste. This requirement will be added to the RCRA permit WAP. This addendum will ensure that exempt materials such as smoke detectors are not intentionally accepted, and that wastes from industries that use man-made radioactive materials are identified. The Non-Radioactive Profile Addendum is provided the form below.

Non-Radioactive Profile Addendum

Clean Harbors Deer Trail Facility

General Information

Waste Name _____

Profile Number: _____

Generator Name: _____

EPA ID: _____

Mailing Address: _____

_____

Site Address: _____

_____

Waste Information (Please check yes or no)

Does the waste exhibit any radioactivity above background?	Yes ☐	No ☐
Does the waste contain any manmade radioactive material above background even at exempt concentrations?	Yes ☐	No ☐
Does the waste contain smoke detectors?	Yes ☐	No ☐
Does the waste contain any Tritium-filled exit signs or instruments?	Yes ☐	No ☐
Does the waste contain Tritium or Carbon 14 at exempt levels?	Yes ☐	No ☐
Are any other exempt radioactive materials present?	Yes ☐	No ☐

If the answer to any of these questions is yes, please list the radioactive materials which are present and their concentrations below.

_____

_____

_____

_____

_____

Process Information (Please check yes or no)

Was the waste generated at a biomedical research facility?	Yes ☐	No ☐
Was the waste generated at a medical facility utilizing radioactive materials for patient diagnosis or therapy?	Yes ☐	No ☐
Was the waste generated at a nuclear power plant?	Yes ☐	No ☐

Generators Certification

I Hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge. I also certify that any samples submitted are representative of the actual waste.

Authorized Signature	Name (Print)	Title	Date
_____	_____	_____	_____

CDPHE Comment 44 - The use of definitions in section I of this Appendix is problematic and should be deleted from this document.

Clean Harbors Response: Most of the definitions have been deleted except for the inclusion of "regulated material" consistent with the definition provided in response to Comment 1 above.

CDPHE Comment 45 - Appendix K, Item II. A refers to materials "otherwise exempted or as described in Table 1". Table 1 was not provided for review. This statement is too broad and too ambiguous to evaluate. Clean Harbors should describe in detail what specific "exempt material" will be acceptable at the site for disposal.

Clean Harbors Response: All references to "exempt material" have been removed form the WAP Appendix K. Table I as referred to here has been removed as well. It is not the intention of CHDT to knowingly accept any "exempt materials." Since exempt materials are not tracked, it is difficult to anticipate all materials and waste that may contain radioactive materials. However, CHDT will impose a requirement that waste generators must complete and sign a Non-Radioactive Profile Addendum for all non-radioactive waste. This requirement will be added to the RCRA permit WAP. In addition to certifying that radioactive materials are, or are not present, the generator will describe the process used to generate the waste. This addendum will ensure that exempt materials such as smoke detectors are not intentionally accepted, and that wastes from industries that use man-made radioactive materials are identified. The Non-Radioactive Profile Addendum is provided in Attachment 1 of the WAP Appendix K. The intent here is to be able to determine the potential source should man-made radionuclides be encountered in, for example, leachate in a cell, by knowing the processes used to generate the waste. For example, demolition waste may contain smoke detectors that may not have been properly removed.

CDPHE Comment 46 - Appendix K, Items III. C and D refer to acceptance of manufactured items. Item II should contain a detailed description of the types and specifications of the manufactured items to be accepted for disposal. Additionally, in other correspondence to the Department, Clean Harbors has committed to not accepting exempt items or items containing man-made radionuclides. Please rectify this inconsistency in all documents.

Clean Harbors Response: All references to manufactured items have been removed from the WAP Appendix K. CHDT does not intend to accept "exempt materials." As described in response to Comment 43 above, the revised Appendix K includes requirements that regulated material be identified and characterized prior to acceptance for disposal at Deer Trail.

CDPHE Comment 47 - In Appendix K, Item II. B there needs to be description of the form of materials that can be accepted in drums and other containers. For example, how much free liquid is acceptable in a drum of materials?

Clean Harbors Response: Clean Harbors Response: The updated version of WAP Appendix K provides information on the typical physical form of containerized waste materials in Table 1. All waste materials must meet the requirements of the RCRA permit. The RCRA permit forbids any wastes containing free liquids from direct landfill. Containerized waste containing liquids, and sludge's may be accepted only for treatment prior to landfill, and must be treated so that no free liquids are present at the time of landfilling. Waste is disposed in bulk after removal from the container during treatment in the treatment building.

CDPHE Comment 48 - Appendix K, Item II. B refers to acceptance of radioactive liquids and sludges for treatment and landfill. Clean Harbors needs to submit detailed procedures describing the treatment of these materials.

Clean Harbors Response: CHDT intends to treat radioactive liquids and sludges using the same reagent additives and mixing techniques used to treat liquid RCRA (hazardous) wastes. It is assumed that the liquid in question is aqueous based. As stated in the response to Question 47 above, CHDT must be able to effectively treat the waste material for the waste to be approved for disposal at the facility. The primary process used is recognized by the USEPA as the treatment technology known as STABL in 40CFR268.42:

> *"Stabilization with the following reagents (or waste reagents) or combinations of reagents: (1) Portland cement; or (2) lime/pozzolans (e.g., fly ash and cement kiln dust)—this does not preclude the addition of reagents (e.g., iron salts, silicates, and clays) designed to enhance the set/cure time and or compressive strength, or to overall reduce the leachability of the metal or inorganic."*

In brief, the process proceeds as follows: liquid or liquid containing waste is dumped into one of the treatment basins. Reagent material, (usually cement kiln dust) is added to the waste. The waste/reagent mixture is mixed using a backhoe. Reagent is added until the waste is solid. It is then analyzed and sent to the landfill. Treatment using the reagents listed above is an effective means of permanently stabilizing aqueous liquid wastes. The water in the waste is not just absorbed, but is chemically combined with the reagents forming a cement-like material. The pozzolanic matrix also greatly reduces the leachability of metals in the waste mixture. CHDT utilizes written treatment formulas to communicate treatment information to workers, and to provide a record of treatment activities. These formulas are assigned by the General Manger or his designee based either upon knowledge of previous waste treatments or upon experimental formula design. These formulas will vary depending upon the chemical and physical characteristics of the waste to ensure that an acceptable waste form results. An example of a typical treatment formula is presented below:

Stabilization Recipe

RECIPE NAME: **BRPBSOIL1**

Profile # : CH90834B

Campaign Number

Batching Information:

Basin Number

Weight of Campaign 30000 lbs

Addition Order		Reagent	Campaign Weight	Addition Ratio	Conversion Factor	Reagent Amount	Units
1	FRWAT	(Water)	30000	0.20	0.1199	719	gallons
2	CKD	(Cement Kiln Dust)	30000	0.10	0.000884956	3	Cu Yds
3	CASX	(Calcium Polysulfide	30000	0.04	0.094339623	113	gallons
4	CKD	(Cement Kiln Dust)	30000	0.20	0.000884956	5	Cu Yds

DIRECTIONS:
Add water to waste and mix until it is a moist paste. Add 10% CKD. Check pH. Make sure that pH is 9 or higher. If too low, add more CKD. Add the CASX and mix well. Solidify with CKD.

PRECAUTIONS:
Special care should be taken when working with concentrated reagents. CASX must always be kept away from acids. Proper PPE must be worn during stabilization and treatment operations including full face air purifying respirator, white tyvek, and chemically resistant gloves.

ANALYSIS: TCLP UTS Metals

Date Issued _____ 6/20/2005 Approval _____

CDPHE Comment 49 - In Appendix K, Item III. A, the specifications and requirements for the "generator provided waste characterization" need to be spelled out in detail. The requirements for the generator would include such items as the number of samples needed to have a statistically representative sampling of the materials, the types of radiological analysis to be performed, LLD in the analysis, physical and chemical form of the material, amount of free liquids, units for reporting data, etc. A waste characterization form and instructions would be an efficient way to standardize this information from the waste generator and would facilitate the review of waste acceptance criteria by this Department.

Clean Harbors Response: These requirements are spelled out in detail in the new WAP Appendix K, provided in Attachment 1. A waste characterization form titled "Supplemental Radioactive Material Questionnaire" has been created and incorporated into the WAP Appendix K. This form will be used to document radiological properties of the waste and will be used in conjunction with the material profile sheet. Evaluation of statistical validity of sampling plans for waste characterization will be left to the professional judgment of the RSO and General Manager. It is the legal responsibility of the waste generator to properly characterize his waste. Requirements for sampling will vary with the type of waste. A process waste such as drinking water treatment alum sludge will probably be characterized by grab samples, whereas a remediation site may require more in depth sampling and statistical analysis. A copy of the Supplemental Radioactive Material Questionnaire is presented below:

Supplemental Radioactive Material Questionnaire

Clean Harbors Deer Trail Facility

General Information

Waste Name: _____

Profile Number: _____

Generator Name: _____

EPA ID: _____

License Number: _____

Mailing Address: _____

_____

Site Address: _____

_____

Regulatory Information

Is the Waste Subject to an NRC, State or other Radioactive Materials License?	Yes ☐	No ☐
Does the Waste contain NORM (Naturally Occurring Radioactive Material)?	Yes ☐	No ☐
Does the Waste contain TENORM (Techologically Enhanced NORM)?	Yes ☐	No ☐
Does the Waste contain Source Material?	Yes ☐	No ☐
Does the Waste Contain Byproduct Material?	Yes ☐	No ☐
Does the Waste Contain Man Made or Artificial Radionuclides?	Yes ☐	No ☐
Does the Waste Contain Special Nuclear Material?	Yes ☐	No ☐

Please describe the process which produced the waste:

Chemical and Physical Characteristics

% Solids % Liquids %Sludge % Free Water

List % and type of any absorbents present in the waste:

List % and type of any chelating agents present in the waste:

Please describe how the waste will be packaged or shipped:

Radiological Information

What is the maximum dose rate at the surface of the waste (microR/hour)? _____

Please list the isotope, average specific activity, and maximum specific activity for each radionuclide present

Isotope	Ave (pCi/g)	Max (pCi/g)	Isotope	Ave (pCi/g)	Max (pCi/g)

Please describe the basis for the radiological characterization:

CDPHE Comment 50 - In Appendix K, Item III. D, the disposal of manufactured items must be described in greater detail. Dose rates from the manufactured items can and should be measured at the facility. Does the use of the term "specific activity" apply to the entire device or just the radioactive source? The documents reviewed should include device sheets and manufacturer specification sheets for the items to be disposed. The process for review of these documents and record keeping should be described. Will Clean Harbors track the serial number, manufacturer, model, radionuclide, and activity for each device?

Clean Harbors Response: Again, these are not items manufactured with radioactive materials or sources. They are simply consumer product materials such as bricks or ceramic products that contain NORM/ TENORM radionuclides at some low concentration (i.e., not licensed). The term "manufactured items" has been replaced with "Refractory Brick" in the table. All references to manufactured items have been removed from the WAP Appendix K. CHDT does not intend to knowingly accept any exempt manufactured items.

CDPHE Comment 51 - The Movement Request Form described in the Waste Analysis Plan defines hazards and personal protective equipment. Will the RSO be completing this form or someone else? If someone besides the RSO is completing it, what will his or her radiation safety qualifications be?

Clean Harbors Response: The Movement Request Form or Waste Tracking Form will be completed by site personnel based upon the instructions in the Pretreatment and Disposal Recommendation (PDR) form. For Each waste stream accepted for disposal at CHDT, a PDR form will be filled out detailing instructions for handling and disposition. The PDR form mandates the type of protective equipment and monitoring necessary. The instructions on the PDR form will be completed and signed off on by the RSO, the General Manager, and the Environmental Manager. A copy of the PDR form follows:

Clean Harbors Deer Trail, LLC

Pretreatment and Disposal Recommendation

Profile # **Generator**

Waste Name

Profile Review:

Documentation is complete?	Y	N	
The site has the capabilities to manage the waste?	Y	N	
Physical and chemical characteristics reviewed?	Y	N	
Waste management byproducts reviewed?	Y	N	
Waste is not prohibited?	Y	N	
LDR status and documentation complete?	Y	N	

Required LDR documentation:

Waste management method:

EPA Waste Codes

EPA Handling Codes:

Incompatability and special handling:

Physical Properties:

Physical State: Color

Density: pH

% Solids: %Aqueous Liquids: % Organic Liquids

Other:

Safety Precautions:

Required PPE:

Monitoring:

Fire Fighting:

Equipment Needed:

Washout Requirements:

Other Comments:

Laboratory and Treatment Instructions

Incoming Lab Analysis

Annual Verification Testing

Post Treatment Analysis

Treatment Formula and Instructions

Approvals:

General Manager or Designee: Date:

RSO Date:

Environmental Health and Safety Manager Date:

CDPHE Comment 52 - It is the responsibility of CHDT in the operation of a low-level radioactive waste disposal facility to ensure compliance with the authorizations in the radioactive materials license, including limitations placed upon the types and quantities of materials that can be disposed at the facility. The gate monitor and portable gamma spectrometer are not sufficient to evaluate and verify that the total activity of the materials received is not greater than 2000 pCi/g and that the Ra-226 activity is not greater than 400 pCi/g. After a thorough review of the license application including the operating procedures it is unclear how CHDT will ensure compliance with their license limitations. Please provide additional information regarding this issue.

Clean Harbors Response: Procedures for acceptance and characterization of wastes are detailed in the revised WAP Appendix K (provided in Attachment 1). Determination of waste acceptability is made primarily in the pre-qualification process. Testing on waste arrival at the facility is done not to re-characterize the waste, but to make sure that the waste matches the sample previously qualified.

<u>Pre-Qualification Process:</u> CHDT will require documentation of waste characteristics from waste generators. Waste generators will have to complete a Waste Material Profile Sheet as well as a Supplemental Radioactive Materials Questionnaire. Waste generators will have to supply lab analysis from a qualified lab to support their waste characterizations. CHDT will evaluate this documentation to see if it meets CHDT Waste Acceptance Criteria. CHDT will then request a sample of the waste. CHDT will evaluate the sample for chemical, physical and radiological parameters which form a tell tale "fingerprint" of the waste.

<u>Load Acceptance</u>: Once waste is accepted at the facility, lab analysis will be done primarily to ensure the waste matches the parameters identified in the pre-qualification. The fingerprint radiological analysis done on site will include gamma spectrum analysis using the Exploranium 135G, as well as dose rate. The gamma spectrum will be compared to that on file to ensure that it is a match. CHDT will also test for the "fingerprint" chemical and physical tests to ensure the waste matches the profile. A discrepancy in any of these areas may be cause to reject the load.

<u>Random Sampling and Annual Recertification</u>: CHDT will also conduct a random sampling program whereby 1 in 20 shipments of each waste stream will be analyzed for gross alpha and gross beta using the onsite alpha/beta counter. This will help ensure that the waste is the same as that identified in the prequalification. CHDT also will conduct an annual recertification program. Each waste stream acceptance will be good only for a one-year period. At the end of one year, the generator will be contacted to ensure the waste characteristics remain the same, and a sample of the waste will be re-analyzed for the original profile parameters. The sample results will be re-evaluated in order to make sure the waste continues to meet the CHDT Waste Acceptance Parameters.

Based on our discussions and examination of the operating procedures, it appears that the signatures of the CHDT corporate staff and Radiation Safety Officer are electronic signatures. In addition, the staff we met with were not completely familiar with all of the recent documents provided by Clean Harbors Deer Trail submitted in support of the license application, most notably Appendix K of the Waste Analysis Plan. It is very important that the management and radiation safety staff at the facility are all in agreement as to the content and requirements of the procedures

to be implemented. Please ensure that the Department is given an original copy with original signatures when submitting revised procedures.

Clean Harbors Response: All SOPs are undergoing final internal review and signature and an original copy with original signatures will be submitted under separate cover when they are completed.

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information May 24, 2005

ATTACHMENT 1:

WASTE ANALYSIS PLAN APPENDIX K
WASTE ANALYSIS PLAN FOR WASTE CONTAMINATED WITH RADIOACTIVE MATERIAL

Waste Analysis Plan Appendix K
Waste Analysis Plan for Regulated Waste

I. Definitions

1. Regulated Waste: Waste that includes: a) NORM/ TENORM radionuclides in solid waste; b) NORM/TENORM radionuclides in material licensed by CDPHE (including natural levels that meet the definition of source material); c) NORM/TENORM radionuclides mixed with RCRA hazardous wastes; and d) radium processing wastes.
2. Suitable Laboratory: A suitable laboratory is one that is certified by NELAC or other certifying body to be qualified for the analysis which it performs, or which can demonstrate its data quality to be suitable by other means.

II. Scope

The procedures of this WAP Appendix K apply only to Waste Contaminated with Radioactive Materials.

III. Waste Acceptance Criteria for Waste Contaminated with Radioactive Materials

Waste Acceptance Criteria (WAC) defines the limits of material that may be accepted for treatment storage and disposal at CHDT (Clean Harbors Deer Trail). Some of these criteria are defined in the RCRA permit WAP (Waste Analysis Plan). Wastes must be capable safe handling and long-term stability in the landfill. Wastes must also meet the RCRA Land Disposal Restrictions. The RCRA Permit WAP also lists some types of waste that are not acceptable at the facility. These include:

- Compressed gases
- Air Reactive Materials
- Shock Sensitive Materials
- Infectious Wastes
- Explosives

All waste accepted at CHDT must meet the basic requirements of the RCRA permit WAP. Waste Contaminated with Radioactive Materials must also meet additional Waste Acceptance Criteria. These are:

1. Total Activity. Total activity from all sources (alpha, beta, gamma must be equal to or less than 2,000 pCi per gram, and must be essentially uniformly distributed throughout the waste.
2. Acceptable Radionuclides. Acceptable radionuclides are those in the natural Uranium, Actinium and Thorium decay chains as well as naturally occurring Potassium 40. Acceptable radionuclides and typical waste forms are presented in Table 1.
3. Acceptable Waste Forms. Acceptable waste forms will consist of bulk solid materials, debris type wastes, monolithic materials and drums or other containerized wastes. Liquids and sludge may be accepted for treatment and landfill as well.
4. Radium-226. Radium-226 content must be less than or equal to 400 pCi per gram essentially uniformly distributed throughout the waste.
5. Dose Rate. Waste shipments should have a dose rate of less than 116 µR per hour as measured by the portal monitors at the entrance to the facility or other suitable dose rate instrumentation using equivalent geometry. Waste greater than 116 µR per hour may be accepted only at the discretion of the RSO, as long as it meets all other Waste Acceptance Criteria.

IV. Waste Stream Pre-Acceptance Documentation

Any waste generator proposing to send waste to CHDT must provide documentation of its chemical and physical properties and its regulatory status. A Waste Material Profile Sheet is required. An example if this form is located in the RCRA Permit WAP. The Waste Material Profile Sheet provides information on: physical properties, chemical composition, trace chemical and elemental constituents, hazards, regulatory status, shipping description, transportation requirements, and a generators certification. For Waste

Contaminated with Radioactive Material, additional documentation is required. The following documentation will be required:

1. Waste Material Profile Sheet. The waste generator will submit a Waste Material Profile Sheet for review. If the generator checks the box for radioactive, he will be required to complete the Supplemental Radioactive Material Questionnaire. A copy of this questionnaire is presented in **Attachment 1**
2. Supplemental Radioactive Material Questionnaire. The generator will supply documentation of the radionuclides present, and their specific activity. They will certify that there is no Byproduct material, Manmade radionuclides, or Special Nuclear Material present. The generator will describe the process whereby the waste was generated. The generator will supply the NRC or Agreement State license number if applicable. The generator will document the characterization method and sampling protocol for remediation wastes.
3. Laboratory Analysis. The generator will supply analytical data from a suitable laboratory that supports the description of radionuclides present on the Supplemental Radioactive Material Questionnaire. Other information may be submitted in order to document the radiological information. Required analysis will include: total Uranium, total Thorium, total Radium, a gamma spectrum, gross alpha, and gross beta; reported in units of pCi/g. Modifications to the analytical requirements must be approved based upon the professional judgment of the RSO.

V. Waste Stream Pre-Acceptance Sample

Once the Waste Profile and Supplemental Radioactive Material Questionnaire have been evaluated and it has been determined that the waste, as documented, meets CHDT radiological waste acceptance criteria, a sample of the waste will be sent to CHDT. At the discretion of the RSO, the first sample may be taken from the initial waste shipment. The sample will be evaluated by radiological and chemical testing in order to determine waste screening criteria and evaluate its chemical and physical properties. These pre-approval tests serve as benchmarks against the properties of incoming waste shipments can be compared.

1. Pre-acceptance Sample. A representative sample of the waste shall be shipped to CHDT for analysis.
2. Radiological Screening Analysis. The sample will be analyzed for its gamma spectrum using the Exploranium 134G analyzer. The spectrum will be retained and used as a gamma fingerprint in order to compare the original sample waste with incoming waste shipments. This analysis will also be used to screen for the presence of unauthorized radionuclides. A gross alpha and gross Beta Survey will be done on the waste using the Alpha Beta counter. The gross alpha and gross beta count will be used as a baseline for the waste in order to evaluate waste shipments under the random sample program.
3. Chemical Screening Analysis. The sample will be tested for the following parameters required by the RCRA Permit WAP.
   a. Water Reactivity
   b. Air reactivity
   c. Color
   d. % Solids
   e. % Liquids
   f. % Organic
   g. pH
   h. Bulk density or specific gravity
   i. Load bearing strength
   j. Flash Point
   k. Reactive sulfides screen
   l. Reactive cyanide screen
   m. Reactive ammonia screen
   n. Reagent compatibility
   o. Land Disposal Restriction parameters as applicable.

VI. Waste Stream Pre-Acceptance Evaluation

Before a waste stream is approved to come to CHDT, it will be carefully evaluated to ensure it meets the Waste Acceptance Criteria. The Waste Profile, the Supplemental Radioactive Material Questionnaire, and the laboratory analysis will be used to determine acceptability of the waste. The RSO, the General Manager or his designee, and the Environmental Manager will evaluate Waste Streams for approval. Waste will be evaluated for the following Waste Acceptance Criteria elements:

1. Radiological Properties of the Waste. CHDT will evaluate the radiological characteristics of the waste to determine safe management practices and compliance with the waste acceptance criteria. The following areas will be evaluated.
    a. Regulatory Information. Regulatory information will be reviewed in order to ensure that the facility has the proper permits and licenses to accept the waste.
    b. Profiled Isotopes and Activities. The Isotopes and activities listed on the profile will be reviewed to determine if the facility is permitted to accept them. They also will be used to ensure that the waste has less than or equal to 2,000 pCi per gram total activity, and less than or equal to 400 pCi per gram Radium-226.
    c. Basis for Radiological characterization. The basis for characterization will be reviewed in order to ensure that there is an accurate basis for determining the radiological characteristics of the waste.
    d. Sampling Information. If the waste is from a remediation project, the sampling information will be reviewed in order to ensure that sufficient representative sampling has been done to properly characterize the waste.
    e. Laboratory Analysis. Laboratory analysis will be reviewed to determine the accuracy of the profiled information. The following analysis will be required. Alternative analysis will be used at the discretion of the RSO as long as they provide sufficient data to ensure that the waste meets the Waste Acceptance Criteria.
        i. Total Uranium or Uranium by Isotope or a Combination.
        ii. Total Thorium or Thorium by Isotope or a Combination.
        iii. Total Radium or Radium by Isotope or a Combination.
        iv. Gamma Spectrum.
        v. Gross Alpha
        vi. Gross Beta.
2. Other Waste Acceptance Criteria
    a. Documentation Review. Documentation will be reviewed in order to ensure that it is complete, that it is accurate, that it properly represents the characteristics of the waste, and is adequate for decision making.
    b. Capability of the Facility to Manage the Waste. Before a waste stream is approved, CHDT will make sure that it has the resources and ability to properly manage the waste in a safe and compliant manner.
    c. Chemical Characteristics of the Waste. CHDT will evaluate the chemical and physical characteristics of the waste to determine safe and proper management and compliance with the waste acceptance criteria. Chemical constituents will be evaluated to determine if they require treatment and are capable of long-term chemical stability in the landfill. Waste will be evaluated to determine if the chemical constituents are capable of adverse reactions that may produce toxic or flammable gas, cause fires or explosions, or increase the mobility of other waste constituents in the landfill.
    d. Physical Properties of the Waste. CHDT will evaluate the physical characteristics of the waste to determine safe and proper management and compliance with the waste acceptance criteria. Physical properties will be evaluated to determine if treatment is required and to ensure that the waste will be physically stable in the landfill after placement and compaction.
    e. Waste Management Byproducts. CHDT will review treatment and/or landfill operations to ensure that the management of the waste produces no deleterious byproducts.

f. RCRA Permit Limits. The waste properties and constituents will be reviewed to determine if the waste is acceptable under the RCRA permit.
g. Treatment Method. CHDT will determine the treatment method and treatment formula prior to accepting the waste.
h. Land Disposal Restrictions. The waste will be evaluated to determine if it meets the USEPA and Colorado Land Disposal Restrictions, or can be treated to meets the requirements.
i. Safety Requirements. The waste will be evaluated in order to determine proper safety precautions, monitoring, and protective equipment. CHDT will not accept the waste unless it can be managed safely.
j. Lab Analysis Requirements, The waste will be evaluated to determine laboratory analysis requirements both upon arrival at the facility, after treatment, and upon annual recertification.

3. Documentation of Waste Acceptance Criteria. Documentation of the review process is maintained on the PDR (Pretreatment and Disposal Recommendation) form. This is presented in **Attachment 2.** The General Manager, the Environmental Manager, and the RSO must approve the PDR. If the waste does not meet the waste acceptance criteria in the pre-acceptance process, it will not be approved to come to CHDT. CHDT may request additional information in order to clarify waste areas of concern. Once a waste stream is evaluated in the pre-acceptance process and found to meet the waste acceptance criteria, it will be approved to come to the facility.
4. Annual Recertification. An acceptable waste stream is approved to come into the facility for a one-year period. After one year, the waste stream must be reevaluated. The waste generator must certify that the waste stream has not changed or must document any changes. The original radiological analysis will be repeated. The generators certification and the results of the radiological analysis will be evaluated. If the waste is consistent with the previous characterization, the waste will be re-approved for another year. If the waste has changed, the profile will be modified and the original waste pre-acceptance procedure will start over again.
5. Profile Deactivation. If at any time, the waste steam is found not to meet the waste acceptance criteria, the profile will be deactivated.

VII. On-Site Acceptance: Inspection, Evaluation and Analysis

When approved waste arrives at the facility, the chemical and physical properties of the waste will be verified and the shipment documentation will be reviewed. If the waste shipment matches the properties determined in the pre-acceptance process and has the proper documentation, it will be accepted for treatment storage and disposal at CHDT. If a discrepancy is found, the waste generator will be contacted to explain the discrepancy. If the discrepancy can be resolved and the waste meets the Waste Acceptance Criteria, the waste may be accepted for disposal. If the discrepancy cannot be resolved, or the shipment does not meet the Waste Acceptance Criteria, the shipment will be rejected back to the original generator, or at his request, to an alternate waste facility.

1. Dose Rate Survey. All waste shipments will be screened for dose rate at the outside of the package either using the portal monitors at the entrance of the facility or other instrumentation. Waste shipments should have a dose rate of less than 116 μR per hour as measured by the portal monitors at the entrance to the facility, or using hand held instruments at an equivalent distance and geometry. Procedures for use of the portal monitors and hand held detectors are detailed in the SOP for Surveys. If the shipment exceeds the dose rate limits, the RSO will investigate the shipment to determine if the waste meets the Waste Acceptance Criteria. At the discretion of the RSO, the waste may be accepted though alternative handling procedures may be mandated.
2. Weights. All waste shipments will be weighed at CHDT. CHDT has a certified truck scale at the entrance to the facility.
3. Gamma Isotopic Survey. Each shipment of Waste Contaminated with Radioactive Material will be surveyed for gamma activity using the SAIC Exploranium Model GR 135D according to the SOP for Surveys. If man-made radionuclides are detected above background, the waste shipment will be rejected to the waste generator. If the radionuclide activity or composition is different than stated on

the profile, the RSO will attempt to contact the waste generator to resolve the discrepancy. If the discrepancy cannot be resolved, the waste will be returned to the custody of the waste generator.

4. Samples. Waste shipments will be sampled according to the requirements of the RCRA WAP using the methods in the RCRA Permit WAP Appendix B. Some waste streams such as large debris type wastes are not sampled. A visual description of the waste is used in place of a sample.
5. Lab Analysis. Lab analysis will be done on a waste shipment sample according to the frequency mandated by the RCRA WAP. The RCRA WAP mandates analytical testing requirements. The tests may include:
    a. Water Reactivity
    b. Air reactivity
    c. Color
    d. % Solids
    e. % Liquids
    f. % Organic
    g. pH
    h. Bulk density or specific gravity
    i. Load bearing strength
    j. Flash Point
    k. Reactive sulfides screen
    l. Reactive cyanide screen
    m. Reactive ammonia screen
    n. Reagent compatibility
    o. Land Disposal Restriction parameters as applicable.

6. Documentation Review. Documentation accompanying the shipment will be reviewed in order to make sure that it accurately represents the waste shipment and that it is complete. Documentation may include: hazardous waste manifests, radioactive waste manifests, LDR notification or certification forms, etc.
7. On Site Tracking. On site tracking forms will be generated for each waste shipment. These forms are prepared based upon the instructions in the PDR form. These forms will provide instructions for workers and will document the disposition of each waste shipment.

VIII. Random Sample Program

Each Waste Contaminated with Radioactive Material waste stream will be subject to the random sample program. For each waste stream, 1 shipment out of 20 shipments will be sampled for the random sampling program.

1. Sampling. A representative sample of the waste will be taken from the shipment according to the procedures in the RCRA Permit WAP Appendix B.
2. Analysis. The sample will be analyzed for gross alpha and gross beta using the alpha beta counter, or at an offsite lab.
3. Comparison. The results of the analysis will be compared to the results of the pre-acceptance sample and subsequent samples. The RSO will determine if the results are consistent with the profile. If results are consistent with previous results, no action will be taken.
4. Profile Deactivation. If the results differ significantly from the profile, the RSO will contact the waste generator and attempt to resolve the discrepancy. If the results cannot be reconciled, the waste stream will be deactivated until it can be resolved.

Attachment 1

Supplemental Radioactive Material Questionnaire

Clean Harbors Deer Trail Facility

General Information

Waste Name: _____

Profile Number: _____

Generator Name: _____

EPA ID: _____

License Number: _____

Mailing Address: _____

_____

Site Address: _____

_____

Regulatory Information

Is the Waste Subject to an NRC, State or other Radioactive Materials License?	Yes ☐	No ☐
Does the Waste contain NORM (Naturally Occurring Radioactive Material)?	Yes ☐	No ☐
Does the Waste contain TENORM (Techologically Enhanced NORM)?	Yes ☐	No ☐
Does the Waste contain Source Material?	Yes ☐	No ☐
Does the Waste Contain Byproduct Material?	Yes ☐	No ☐
Does the Waste Contain Man Made or Artificial Radionuclides?	Yes ☐	No ☐
Does the Waste Contain Special Nuclear Material?	Yes ☐	No ☐

Please describe the process which produced the waste:

Chemical and Physical Characteristics

% Solids % Liquids %Sludge % Free Water

List % and type of any absorbents present in the waste:

List % and type of any chelating agents present in the waste:

Please describe how the waste will be packaged or shipped:

Radiological Information

What is the maximum dose rate at the surface of the waste (microR/hour)? _____

Please list the isotope, average specific activity, and maximum specific activity for each radionuclide present

Isotope	Ave (pCi/g)	Max (pCi/g)

Isotope	Ave (pCi/g)	Max (pCi/g)

Please describe the basis for the radiological characterization:

Supplemental Radioactive Material Questionnaire

Clean Harbors Deer Trail Facility

Waste Name: _____

Profile Number: _____

Generator Name: _____

Sampling Information

If this waste is from a remediation project, please describe the number of samples and the sampling methodology.

_____

_____

_____

_____

Laboratory Analytical Information

Please attach a copy of a laboratory analysis on which the radiological charaterization of the waste is based. Please use additional sheets if necessary. Analysis should be from a NELAC certified lab or equivalent. Please contact CHDT to make arrangeme

Analysis Requirements:

The following analysis are needed for approval of radioactive material into Clean Harbors Deer Trail:

Analyte	Method	Detection Limit
Gamma (b), Ra226/228	HASL-300	0.2 pCi/g
Gross Alpha	SW846 9310	10 pCi/g
Gross Beta	SW846 9310	10 pCi/g
Thorium-228, 230, 232	HASL-300	1 pCi/g
Uranium-234, 235, 238 (c)	Extraction Chromatography (d)	1 pCi/g
Total Uranium	ASTM D5174	100ug/kg
Gamma Spectrum with Isotope Identification		

Generators Certification

I Hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge. I also certify that any samples submitted are representative of the actual waste.

Authorized Signature	Name (Print)	Title	Date
_____	_____	_____	_____

Attachment 2

Clean Harbors Deer Trail, LLC

Pretreatment and Disposal Recommendation

Profile # **Generator**

Profile Review:

Documentation is complete?	Y	N	
The site has the capabilities to manage the waste?	Y	N	
Physical and chemical characteristics reviewed?	Y	N	
Waste management byproducts reviewed?	Y	N	
Waste is not prohibited?	Y	N	
LDR status and documentation complete?	Y	N	

Required LDR documentation:

Waste management method:

EPA Waste Codes

EPA Handling Codes:

Incompatability and special handling:

Physical Properties:

Physical State: Color

Density: pH

% Solids: %Aqueous Liquids: % Organic Liquids

Other:

Safety Precautions:

Required PPE:

Monitoring:

Fire Fighting:

Equipment Needed:

Washout Requirements:

Other Comments:

Laboratory and Treatment Instructions

Incoming Lab Analysis

Annual Verification Testing

Post Treatment Analysis

Treatment Formula and Instructions

Approvals:

General Manager or Designee: Date:

RSO Date:

Environmental Health and Safety Manager Date:

Table 1

Waste Description	Constituents	Physical Form	Quantity (Tons)	NORM/TENORM Content (pCi/g) [1,2,3]	Disposal Method
Denver Radium	Asphalt pavement and road base material	Bulk dry solid granular and monolithic	60,000	0-1,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-1,000 pCi/g ^{228}Ra and its daughter products; 0-1,000 pCi/g U-natural and its daughter products.	Direct landfill. Some size reduction in the landfill will be done via compaction equipment.
Water purification filter cake – dry	Iron hydroxide Alum and/or Lime filter cake	Bulk and containerized dry solid filter cake	50,000	0-2,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g U-natural and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Direct landfill. Containerized materials will be packaged in appropriate containers and will have all voids filled.
Water purification filter cake - wet	Iron hydroxide, Alum and/or Lime filter cake.	Bulk and containerized moist solid/ sludge. May contain free water	50,000	0-2,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g U-natural and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Solidification using cement kiln dust and/or fly ash followed by landfill
Water purification resins - dry	Ion exchange resins, synthetic plastic or inorganic zeolites	Bulk or containerized dry solids	10,000	0-2,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g U-natural and daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Direct landfill. Containerized materials will be packaged in appropriate containers and will have all voids filled.
Water purification resins - wet	Ion exchange resins, synthetic plastic or inorganic zeolites containing free water	Bulk or containerized solids containing free water	10,000	0-2,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g U-natural and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Solidification using cement kiln dust and/or fly ash followed by landfill

Waste Description	Constituents	Physical Form	Quantity (Tons)	NORM/TENORM Content (pCi/g) [1,2,3]	Disposal Method
Dry Oil/Gas Waste Pipe Plus Scale	Pipes and pipe scale and other associated debris	Bulk and containerized dry solid debris	50,000	0-2000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Direct landfill. Containerized materials will be packaged in appropriate containers and will have all voids filled
Oil/Gas Waste Pipe Plus Scale and Sludge	Pipes and pipe scale and other associated debris	Bulk and containerized debris with associated sludges	50,000	0-2000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Solidification using cement kiln dust and/or fly ash followed by landfill
Oil/Gas Waste Pipe Scale and sludges	Pipe scale and sludges containing calcium sodium and silicate salts, silt, sand, petroleum and water	Bulk and containerized moist solid/ sludge. May contain free water	10,000	0-2000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products 0-2,000 pCi/g of other naturally occurring radionuclides.	Solidification using cement kiln dust and/or fly ash followed by landfill
Geothermal Energy Production Solids	Calcium, Sodium, Potassium and silicate salts, silt, sand, and other solids from geothermal water resources along with associated debris	Bulk dry granular solids and dried sludges with scrap metal and other debris	50,000	0-2000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Direct landfill. Containerized materials will be packaged in appropriate containers and will have all voids filled.
Geothermal Energy Production Sludges	Calcium, Sodium, Potassium and silicate salts, silt, sand, and other solids from geothermal water resources along with associated debris	Bulk wet granular solids and wet sludges with scrap metal and other debris	50,000	0-2000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Solidification using cement kiln dust and/or fly ash followed by landfill

Waste Description	Constituents	Physical Form	Quantity (Tons)	NORM/TENORM Content (pCi/g) [1,2,3]	Disposal Method
Industrial Debris (Bulk Solids)	Bulks solids and debris and soil	Bulks solids, debris and soil	180,000	0-2,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g U-natural and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides.	Direct landfill. Some size reduction in the landfill will be done via compaction equipment.
Refractory Brick	Clay, silica, heavy metals, etc.	Solid, brick, debris like material, some could be granular in natural	10,000	0-2,000 pCi/g total NORM/TENORM radionuclide content. This may include: 0-400 pCi/g ^{226}Ra and its daughter products; 0-2,000 pCi/g ^{228}Ra and its daughter products; 0-2,000 pCi/g U-natural and its daughter products; 0-2,000 pCi/g Th-natural and its daughter products; 0-2,000 pCi/g of other naturally occurring radionuclides	Usually direct landfill unless RCRA hazardous for heavy metals. Then the waste would require stabilization prior to landfilling.

Notes:

1. Other naturally occurring radionuclides include all of the radionuclides found in the natural uranium, thorium, actinium, and potassium decay series.
2. CHDT will accept up to 2,000 pCi/g of NORM/TENORM related source material.
3. The sum of the fractions will not exceed 2,000 pCi/g.

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information May 24, 2005

ATTACHMENT 2:

SUMMARY OF EMISSION CALCULATIONS – DEER TRAIL, COLORADO FACILITY

by ENSR Corporation, April 2005

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado

Summary of Emission Calculations – Deer Trail, Colorado Facility

ENSR Corporation
April 2005
Document Number 01691-025-100

01691-025-100

SUMMARY OF EMISSION CALCULATIONS
DEER TRAIL, COLORADO FACILITY

Prepared for

CLEAN HARBORS DEER TRAIL, LLC
Deer Trail, Colorado

Prepared by

ENSR CORPORATION
Fort Collins, Colorado

April 2005

Clean Harbors Deer Trail, LLC
Summary of Emission Calculations
Deer Trail, Colorado Facility

The following narrative describes the estimation methods and assumptions used to calculate particulate (TSP and PM10) emissions from the Clean Harbors Deer Trail facility. The resulting spreadsheets are attached to this description.

Landfill Truck Drop/Unloading

TSP and PM_{10} emissions will be generated when material generated in the solidification building is unloaded at the landfill from the trucks which haul the material to the landfill cells. TSP and PM_{10} emissions during unloading operations are based on the maximum amount of material that would potentially be unloaded on an hourly and annual basis. The maximum hourly emission rate for unloading activities is based on 21 tons/hour. The maximum annual emission rate for unloading activities is based on 33,000 tons/year. Emissions from unloading operations are calculated using the equation in AP-42, Chapter 13.2.4, *Aggregate Handling and Storage Piles*. An emission factor of 1.25E-03 pound/ton was used to estimate TSP emissions and an emission factor of 5.92E-04 pound/ton was used to estimate PM_{10} emissions. An estimated mean wind speed of 10 miles per hour (mph), and estimated material moisture content of 6 percent was used in the calculation. No control efficiency was used for water spraying, since the current RCRA permit does not allow watering in the landfill.

PM_{10} Emissions from Landfill Truck Unloading

E_{PM10} (pound/hour) = (5.92E-04 pound/ton) * (21 tons/hour)
E_{PM10} (pound/hour) = 0.012
E_{PM10} (ton/year) = (5.92E-04 pound/ton) * (33,000 tons/year) / (2,000 pounds/ton)
E_{PM10} (ton/year) = 0.01

Landfill Cell Bulldozing/Maintenance

Emissions from maintenance activities on the active landfill cell are calculated using the equation in AP-42, Chapter 11.9, *Western Surface Coal Mining*. Hourly emissions are based upon the equation for bulldozing of overburden as provided in Table 11.9-1, using an estimated material moisture content of 6 percent, and a silt content of 15.1 percent. Annual emissions assume bulldozing activities will occur a maximum of 561 hours/year. No control efficiency was used for water spraying, since the current RCRA permit does not allow watering in the landfill.

PM_{10} Emissions from Landfill Maintenance (Bulldozing)

E_{PM10} (pound/hour) = $[(1.0) * (15.1^{1.5})] / (6^{1.4}) * (0.75\ PM_{10}$ scaling factor)
E_{PM10} (pound/hour) = 3.58
E_{PM10} (ton/year) = (3.58 pounds/hour) * (561 hours/year) / (2,000 pounds/ton)
E_{PM10} (ton/year) = 1.00

Landfill Cell Wind Erosion

Emissions have been calculated for wind erosion from the active landfill cell (Cell #2). Emissions are calculated using an emission factor from AP-42, Chapter 11.9, *Western Surface Coal Mining*, Table 11.9-4, Wind Erosion of Exposed Areas. The emission factor of 0.38 tons/acre-year was used to calculate TSP emissions, and an emission factor of 0.18 tons/acre-year was used to calculate PM_{10} emissions. The area of landfill cell #2 was measured to be 4.73 acres. A control efficiency of 50 percent was used.

PM_{10} Emissions from Landfill Wind Erosion

E_{PM10} (ton/year) = (0.18 pound/ton) * (4.73 acres exposed surface area) * (1-50/100)
E_{PM10} (ton/year) = 0.43
E_{PM10} (pound/hour) = (0.43 ton/year) / (8,760 hours/year) * (2,000 pounds/ton)
E_{PM10} (pound/hour) = 0.10

Paved Roadways

Emissions were estimated from the paved roadways that will be used by trucks transporting solidified material to the on-site landfill. Emissions from the paved haul roads were calculated based on an emission factor developed from Equation 2 in AP-42, Chapter 13.2.1, *Paved Roads*. The maximum number of daily trips was conservatively estimated at 25 trips/day, and the maximum number of annual trips is 1,650 trips/year, which is based on the maximum annual throughput of material.

A detailed breakdown of emission calculations is found in the supporting documentation attached to this narrative description. The emission calculations identify different truck weights, and vehicle miles traveled (VMT) for the trucks transporting the solidification material. The overall summary of emission rates is shown below.

PM_{10} Emissions from Paved Haul Roads

E_{PM10} (pound/hour) = (pound/VMT) * (VMT/day) / (24 hours/day)
E_{PM10} (pound/hour) = 0.36
E_{PM10} (ton/year) = (pound/VMT) * (VMT/year) / (2,000 pounds/ton)
E_{PM10} (ton/year) = 0.27

Reagent Storage Silo Baghouses

Storage silos are located on-site for storage and handling of stabilization material, typically cement kiln dust (CKD), for use in mixing with the chemical wastes in the solidification building. TSP and PM_{10} emissions potentially occur when the reagent material is off-loaded pneumatically from trucks into the storage silos. Since the transfers to the solidification building will be controlled and accounted for by the solidification building baghouses, only emissions from truck unloading activities are discussed here. Emissions from the unloading of the reagent material from trucks to the storage silos are controlled by baghouses. Emissions are calculated using the uncontrolled emission factor of 0.72 pound/ton for TSP and 0.46 pound/ton for PM_{10} from AP-42, Chapter 11.12, *Concrete Batching*, Table 11.12-2, Cement Unloading to Elevated Storage Silo (pneumatic), and the maximum annual throughput of reagent material of 18,000 tons/year. A control efficiency of 99.5 percent is then applied to take account for control from the baghouses.

PM_{10} Emissions from Reagent Storage Silos

E_{PM10} (ton/year) = (0.46 pound/ton) * (18,000 tons/year) / (2,000 pounds/ton) * (1-99.5/100)
E_{PM10} (ton/year) = 0.032
E_{PM10} (pound/hour) = (0.032 tons/year) * (2,000 pounds/ton) / (8760 hours/year)
E_{PM10} (pound/hour) = 0.007

Note: Above emissions are for one reagent storage silo. Three reagent storage silos are located at the facility.

Solidification Building Baghouses

TSP and PM_{10} emissions potentially occur when the reagent material is mixed with chemical wastes in the solidification building. Emissions from the mixing of materials in the solidification building are controlled by baghouses. Emissions are calculated using the uncontrolled emission factor of 0.72 pound/ton for TSP and 0.46 pound/ton for PM_{10} from AP-42, Chapter 11.12, *Concrete Batching*, Table 11.12-2, Cement Unloading to Elevated Storage Silo (pneumatic), and the maximum annual throughput of waste material generated of 33,000 tons/year. A control efficiency of 99.85 percent is then applied to take account for control from the baghouses.

PM_{10} Emissions from Solidification Building

E_{PM10} (ton/year) = (0.46 pound/ton) * (33,000 tons/year) / (2,000 pounds/ton) * (1-99.85/100)
E_{PM10} (ton/year) = 0.011
E_{PM10} (pound/hour) = (0.011 tons/year) * (2,000 pounds/ton) / (8760 hours/year)
E_{PM10} (pound/hour) = 0.003

Note: Above emissions are for one solidification building baghouse. Two baghouses are located on the solidification building.

SCREEN3 Modeling Results

A preliminary SCREEN3 modeling run was conducted using the PM_{10} emission rate from the potential NORM/T-NORM portion of waste material of 3.68 lbs/hour. This emission rate was modeled as an area source, with the area the size of the landfill cell #2. A 10-meter release height was assumed. The maximum 24-hour impact of 89.92 $\mu g/m^3$ occurs at a distance of 586 meters. The 24-hour impact at the nearest property line, which is approximately 600 meters, was 89.84 $\mu g/m^3$, and the 24-hour impact at the nearest residence, located approximately 1676 meters from the landfill cell, is 43.4 $\mu g/m^3$. A summary of the 24-hour impacts from various distances is shown in Table 1 below.

Table 1
SCREEN3 Modeling Results

Distance (meters)	24-hour Impact (µg/m^3)	Notes
200	80.24	
600	89.84	Approximate property line
900	77.36	
1200	61.6	
1676	43.4	Approximate distance to nearest residence
3000	21.23	
10,000	4.56	

ATTACHMENT 1

FACILITY EMISSIONS

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Summary of Facility Emissions - Total TSP/PM10

Source	TSP		PM10	
	lb/hr	TPY	lb/hr	TPY
Reagent Silo #1	0.01	0.03	0.005	0.02
Reagent Silo #2	0.01	0.03	0.005	0.02
Reagent Silo #3	0.01	0.03	0.005	0.02
Solidification Bldg. Baghouse Stack #1	0.004	0.02	0.003	0.01
Solidification Bldg. Baghouse Stack #2	0.004	0.02	0.003	0.01
Paved Roadways	1.85	1.38	0.36	0.27
Landfill Wind Erosion	0.21	0.90	0.10	0.43
Landfill Maintenance/Bulldozing	14.42	4.05	3.58	1.00
Landfill Truck Drop/Unloading	0.03	0.02	0.01	0.01
TOTALS	**16.53**	**6.48**	**4.07**	**1.79**

Summary of Facility Emissions - Total TSP/PM10
Potential NORM / TNORM Emissions

Source	TSP		PM10	
	lb/hr	TPY	lb/hr	TPY
Reagent Silo #1	n/a	n/a	n/a	n/a
Reagent Silo #2	n/a	n/a	n/a	n/a
Reagent Silo #3	n/a	n/a	n/a	n/a
Solidification Bldg. Baghouse Stack #1	0.004	0.02	0.003	0.01
Solidification Bldg. Baghouse Stack #2	0.004	0.02	0.003	0.01
Paved Roadways	0.41	0.31	0.08	0.06
Landfill Wind Erosion	n/a	n/a	n/a	n/a
Landfill Maintenance/Bulldozing	14.42	4.05	3.58	1.00
Landfill Truck Drop/Unloading	0.03	0.02	0.01	0.01
TOTALS	**14.87**	**4.41**	**3.68**	**1.10**

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Baghouse Source Emission Rates

Typical ENSR Methodology

Unit	Unit Description	Design	Flow Rates		Emission Rate
S001	Reagent Silo #1	0.01 gr/scf	1,300 acfm	1,087 scfm	0.09 lb/hour
S002	Reagent Silo #2	0.01 gr/scf	1,300 acfm	1,087 scfm	0.09 lb/hour
S003	Reagent Silo #3	0.01 gr/scf	1,300 acfm	1,087 scfm	0.09 lb/hour
S004	Solidification Bldg. BH Stack #1	0.01 gr/scf	50,000 acfm	41,814 scfm	3.58 lb/hour
S005	Solidification Bldg. BH Stack #2	0.01 gr/scf	50,000 acfm	41,814 scfm	3.58 lb/hour
					7.45

$E_{lb/hour}$ = (gr/scf) * (scfm) * (60 min/hour) / (7000 grains/pound)

Unit	Unit Description	Emission Rate	Annual Operating Rate	Emission Rate
S001	Reagent Silo #1	0.09 lb/hour	8,760 hrs/year	0.41 tons/year
S002	Reagent Silo #2	0.09 lb/hour	8,760 hrs/year	0.41 tons/year
S003	Reagent Silo #3	0.09 lb/hour	8,760 hrs/year	0.41 tons/year
S004	Solidification Bldg. BH Stack #1	3.58 lb/hour	8,760 hrs/year	15.70 tons/year
S005	Solidification Bldg. BH Stack #2	3.58 lb/hour	8,760 hrs/year	15.70 tons/year
				32.62

$E_{tons/year}$ = (lb/hour) * (hrs/year) / (2000 lbs/ton)

Existing Clean Harbors Methodology

Using AP-42, Chapter 11, Section 11.12 - Concrete Batching

Annual Reagent Tonnage = 18,000 TPY
Annual Solidification Tonnage = 33,000 TPY

Unit	Unit Description	Emission Factor	Control Efficiency	Emission Rates	
				tons/year	**lbs/hour**
S001	Reagent Silo #1	0.72 lb/ton TSP	99.5 %	0.032 TPY	0.007 lb/hour
S002	Reagent Silo #2	0.72 lb/ton TSP	99.5 %	0.032 TPY	0.007 lb/hour
S003	Reagent Silo #3	0.72 lb/ton TSP	99.5 %	0.032 TPY	0.007 lb/hour
S004	Solidification Bldg. BH Stack #1	0.72 lb/ton TSP	99.85 %	0.018 TPY	0.004 lb/hour
S005	Solidification Bldg. BH Stack #2	0.72 lb/ton TSP	99.85 %	0.018 TPY	0.004 lb/hour
				0.13	**0.03**

Unit	Unit Description	Emission Factor	Control Efficiency	Emission Rates	
				tons/year	**lbs/hour**
S001	Reagent Silo #1	0.46 lb/ton PM10	99.5 %	0.021 TPY	0.005 lb/hour
S002	Reagent Silo #2	0.46 lb/ton PM10	99.5 %	0.021 TPY	0.005 lb/hour
S003	Reagent Silo #3	0.46 lb/ton PM10	99.5 %	0.021 TPY	0.005 lb/hour
S004	Solidification Bldg. BH Stack #1	0.46 lb/ton PM10	99.85 %	0.011 TPY	0.003 lb/hour
S005	Solidification Bldg. BH Stack #2	0.46 lb/ton PM10	99.85 %	0.011 TPY	0.003 lb/hour
				0.08	**0.02**

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Calculation of Paved Roadway Emissions

Equation from AP-42 Chapter 13.2.1, December 2003

Equation 2 - Annual Emissions
$E_{(lb\ PM10/VMT)} = [k(sL/2)^{0.65} * (W/3)^{1.5} - C] * [1-P/4N] * [1-CE]$

Equation 3 - Daily/Hourly Emissions
$E_{(lb\ PM10/VMT)} = [k(sL/2)^{0.65} * (W/3)^{1.5} - C] * [1-CE]$

Input Variables

Description	Variable	Value	
Particle size multiplier for PM10 (lb/VMT)	k	0.016	
Road surface silt loading (g/m^2)	sL	0.56	(As submitted in 1996 T5 application)
Mean vehicle weight (tons)	W	Varies[1]	
Exhaust, Brake Wear & Tire Wear for PM10 (lb/VMT)	C	0.00047	
Number of days in the averaging period	N (days)	365	
Number of hours in the averaging period	N (hrs)	8760	
Number of days with at least 0.254mm (0.01in) of precipitation during the averaging period.	P (days)	80	Number of wet days assumed 80 based on map in figure 13.2.1-2. Based on 0 for worst-case hourly assumption
Number of hours with at least 0.254mm (0.01in) of precipitation during the averaging period.	P (hours)	1920	
Control Efficiency (water washing, cleaning)	CE	50%	

Notes:
[1]Mean vehicle weight (W) varies depending on the vehicles using the road as highlighted below

One-way distance for landfill disposal trucks - solidification building to landfill cell	0.333	miles		
Number of trips	Daily	25	Annual	1,650
Assumes 33,000 ton/year, 20 ton/truck				
One-way distance for trucks - property line to solidification building	1.155	miles		
Number of trips	Daily	25	Annual	1,650
Assumes 33,000 ton/year, 20 ton/truck				

Vehicle Type	Empty Weight (tons)	Loaded Weight (tons)	VMT/day	VMT/yr	Average Vehicle Weight (tons)
Landfill Trucks - solidification bldg. to landfill cell	21	41	16.65	1,099	31
Landfill Trucks - property line to solidification bldg	21	41	57.77	3,813	31

Controlled Paved Roadway Emissions	$E_{(lb/VMT)}$ (daily)	$E_{(lb/VMT)}$ (annual)	PM10 (lb/hr)[1]	PM10 (TPY)
Emissions - solidification bldg. to landfill cell	0.116	0.11	0.08	0.06
Emissions - property line to solidification bldg.	0.116	0.11	0.28	0.21
Total Controlled Paved Roadway Emissions			**0.36**	**0.27**

Notes:
[1]Assume VMTs occur equally over a 24 hour period

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Calculation of Paved Roadway Emissions

Equation from AP-42 Chapter 13.2.1, December 2003

Equation 2 - Annual Emissions
$E_{(lb\ PM10/VMT)} = [k(sL/2)^{0.65} * (W/3)^{1.5} - C] * [1-P/4N] * [1-CE]$

Equation 3 - Daily/Hourly Emissions
$E_{(lb\ PM10/VMT)} = [k(sL/2)^{0.65} * (W/3)^{1.5} - C] * [1-CE]$

Input Variables

Description	Variable	Value	
Particle size multiplier for TSP (lb/VMT)	k	0.082	
Road surface silt loading (g/m^2)	sL	0.56	(As submitted in 1996 T5 application)
Mean vehicle weight (tons)	W	Varies[1]	
Exhaust, Brake Wear & Tire Wear for TSP (lb/VMT)	C	0.00047	
Number of days in the averaging period	N (days)	365	
Number of hours in the averaging period	N (hrs)	8760	
Number of days with at least 0.254mm (0.01in) of precipitation during the averaging period.	P (days)	80	Number of wet days assumed 80 based on map in figure 13.2.1-2. Based on 0 for worst-case hourly assumption
Number of hours with at least 0.254mm (0.01in) of precipitation during the averaging period.	P (hours)	1920	
Control Efficiency (water washing, cleaning)	CE	50%	

Notes:
[1]Mean vehicle weight (W) varies depending on the vehicles using the road as highlighted below

One-way distance for landfill disposal trucks - solidification building to landfill cell	0.333	miles		
Number of trips	Daily	25	Annual	1,650
Assumes 33,000 ton/year, 20 ton/truck				
One-way distance for trucks - property line to solidification building	1.155	miles		
Number of trips	Daily	25	Annual	1,650
Assumes 33,000 ton/year, 20 ton/truck				

Vehicle Type	Empty Weight (tons)	Loaded Weight (tons)	VMT/day	VMT/yr	Average Vehicle Weight (tons)
Landfill Trucks - solidification bldg. to landfill cell	21	41	16.65	1,099	31
Landfill Trucks - property line to solidification bldg	21	41	57.77	3,813	31

Controlled Paved Roadway Emissions	$E_{(lb/VMT)}$ (daily)	$E_{(lb/VMT)}$ (annual)	TSP (lb/hr)[1]	TSP (TPY)
Emissions - solidification bldg. to landfill cell	0.595	0.56	0.41	0.31
Emissions - property line to solidification bldg.	0.595	0.56	1.43	1.07
Total Controlled Paved Roadway Emissions			**1.85**	**1.38**

Notes:
[1]Assume VMTs occur equally over a 24 hour period

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Landfill - Wind Erosion

Typical ENSR Methodology

From Emissions Inventory Guidance, *Mineral Handling and Processing Industries* , Mojave Desert AQMD
(method derived from AWMA Air Pollution Engineering Manual, 1992)

$$E = E_f * A$$

$$E_f = J * 1.7 * ((sL)/1.5) * ((365-P) / 235) * (I/15) * (365/2000)$$

Where,

E = Particulate matter emission rate in tons/yr
E_f = Emission Factor in tons/acre-yr
A = Exposed surface area of stockpile (acres)
J = Particulate aerodynamic factor
J (TSP) = 1.0
J (PM10) = 0.5
J (PM2.5) = 0.2
sL = Average silt loading of storage pile (%)
P = Average number of days/yr with at least 0.01 inch of precipitation
I = Percent of time with unobstructed wind speed > 12 mph (%)

Landfill Wind Erosion Assumptions

Silt Loading =	20	% (default)	
Conservative Days with Precipitation =	20	days (default)	
Conservative Windy Hours =	13.3	% (default)	
Acreage of Landfill Cell =	4.73	acres	(calculated for Cell #2 from site layout drawing)
Exposed Surface Area of Landfill Cell =	4.73	acres	(calculated for Cell #2 from site layout drawing)
Control Efficiency =	50	% (sunken landfill)	

E_f =	2.69E+00	tons/acre-yr	E_f =	5.38E+00	tons/acre-yr
E =	**1.45**	**lb/hr PM10**	**E =**	**2.91**	**lb/hr TSP**
E =	**6.37**	**TPY PM10**	**E =**	**12.74**	**TPY TSP**

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Landfill - Wind Erosion

Existing Clean Harbors Methodology

From AP-42, Chapter 11.9 - Western Surface Coal Mining

E_f =	0.38	tons/acre-year TSP (Table 11.9-4 - Wind Erosion of exposed areas)
E_f =	0.18	tons/acre-year PM10

Landfill Wind Erosion Assumptions

Acreage of Landfill Cell =	4.73	acres	(calculated for Cell #2 from site layout drawing)
Exposed Surface Area of Landfill Cell =	4.73	acres	(calculated for Cell #2 from site layout drawing)
Control Efficiency =	50	%	(sunken landfill)

E =	**0.10**	**lb/hr PM10**	**E =**	**0.21**	**lb/hr TSP**
E =	**0.43**	**TPY PM10**	**E =**	**0.90**	**TPY TSP**

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Landfill - Bulldozing/Maintenance of Material

From AP-42, Chapter 11.9 - Western Surface Coal Mining

E_{PM-10} (lb/hr) = [(1.0) * (s)^1.5] / (M)^1.4 (from AP-42, Table 11.9.1; bulldozing overburden)

E_{TSP} (lb/hr) = [(5.7) * (s)^1.2] / (M)^1.3 (from AP-42, Table 11.9.1; bulldozing overburden)

Where,

E = Emissions for PM-15
s = material silt content (%)
M = Material Moisture Content (%)

Landfill Bulldozing Assumptions

Material Silt Content =	15.1	%	(AP42 Table 11.9-3; upper range of overburden-silt)
Material Moisture Content =	6	%	(estimated; previous Clean Harbors assumption)
Control Efficiency (Wet Suppression) =	0	%	(assumed zero since RCRA permit inhibits watering in landfill)
Maximum Hours/Year of Bulldozing =	561	Hours/Year	(based upon value in draft permit 01AD0713)
Scaling Factor =	0.75	to adjust from PM-15 to PM-10	

E =	**3.58**	**lb/hr PM10**	**E =**	**14.42**	**lb/hr TSP**
E =	**1.00**	**TPY PM10**	**E =**	**4.05**	**TPY TSP**

Clean Harbors Deer Trail, LLC
Deer Trail, Colorado
Landfill - Emissions from Truck Unloading Operations

From AP-42, Chapter 13.2.4 - Aggregate Handling & Storage Piles

EF (lb/ton) = k * (0.0032) * [((u/5)^1.3) / ((M/2)^1.4)]

Where,

EF = Emission Factor
k = Particle Size Multiplier (dimensionless)
U = Mean Wind Speed, [mph]
M = Material Moisture Content (%)

Truck Dumping into Landfill Assumptions

k =	0.35	for PM10	(AP-42)
k =	0.74	for TSP	(AP-42)
Mean Wind Speed =	10	mph	(estimated; previous Clean Harbors assumption)
Material Moisture Content =	6	%	(estimated; previous Clean Harbors assumption)
Control Efficiency (Wet Suppression) =	0	%	(assumed zero since RCRA permit inhibits watering in landfill)

Maximum Hourly Truck Dump Rate =	21	TPH	25	trips/day	20	ton/trip
Maximum Annual Unloading Dump Rate =	33,000	TPY	1,650	trips/year	20	ton/trip

EF =	5.92E-04	lb/ton PM10	EF =	1.25E-03	lb/ton TSP
E =	**0.012**	**lb/hr PM10**	**E =**	**0.026**	**lb/hr TSP**
E =	**0.010**	**TPY PM10**	**E =**	**0.021**	**TPY TSP**

ATTACHMENT 2

SCREEN3 MODELING RESULTS

04/20/05
17:46:21

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

Clean Harbors - Deer Trail

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE                =         AREA
   EMISSION RATE (G/(S-M**2)) =      .242000E-04
   SOURCE HEIGHT (M)          =      10.0000
   LENGTH OF LARGER SIDE (M)  =     198.1200
   LENGTH OF SMALLER SIDE (M) =      96.6200
   RECEPTOR HEIGHT (M)        =        .0000
   URBAN/RURAL OPTION         =        RURAL
THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION


BUOY. FLUX =     .000 M**4/S**3;  MOM. FLUX =     .000 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
100.	152.4	2	1.0	1.0	320.0	10.00	0.
200.	200.6	4	1.0	1.0	320.0	10.00	7.
300.	217.4	5	1.0	1.0	10000.0	10.00	12.
400.	221.3	5	1.0	1.0	10000.0	10.00	0.
500.	219.7	6	1.0	1.0	10000.0	10.00	10.
600.	224.6	6	1.0	1.0	10000.0	10.00	1.
700.	218.5	6	1.0	1.0	10000.0	10.00	0.
800.	206.9	6	1.0	1.0	10000.0	10.00	0.
900.	193.4	6	1.0	1.0	10000.0	10.00	0.
1000.	179.5	6	1.0	1.0	10000.0	10.00	0.
1100.	166.3	6	1.0	1.0	10000.0	10.00	0.
1200.	154.0	6	1.0	1.0	10000.0	10.00	0.
1300.	142.7	6	1.0	1.0	10000.0	10.00	0.
1400.	132.4	6	1.0	1.0	10000.0	10.00	0.
1500.	122.9	6	1.0	1.0	10000.0	10.00	0.
1600.	114.4	6	1.0	1.0	10000.0	10.00	0.
1700.	106.8	6	1.0	1.0	10000.0	10.00	0.
1800.	99.78	6	1.0	1.0	10000.0	10.00	0.
1900.	93.48	6	1.0	1.0	10000.0	10.00	0.
2000.	87.80	6	1.0	1.0	10000.0	10.00	0.
2100.	82.81	6	1.0	1.0	10000.0	10.00	0.
2200.	78.32	6	1.0	1.0	10000.0	10.00	0.
2300.	74.18	6	1.0	1.0	10000.0	10.00	0.
2400.	70.38	6	1.0	1.0	10000.0	10.00	0.
2500.	66.93	6	1.0	1.0	10000.0	10.00	0.
2600.	63.73	6	1.0	1.0	10000.0	10.00	0.
2700.	60.74	6	1.0	1.0	10000.0	10.00	0.
2800.	57.97	6	1.0	1.0	10000.0	10.00	0.
2900.	55.42	6	1.0	1.0	10000.0	10.00	0.

```
  3000.   53.08        6     1.0    1.0 10000.0   10.00      0.
  3500.   43.82        6     1.0    1.0 10000.0   10.00      0.
  4000.   37.07        6     1.0    1.0 10000.0   10.00      0.
  4500.   31.87        6     1.0    1.0 10000.0   10.00      0.
  5000.   27.82        6     1.0    1.0 10000.0   10.00      0.
  5500.   24.61        6     1.0    1.0 10000.0   10.00      0.
  6000.   21.96        6     1.0    1.0 10000.0   10.00      0.
  6500.   19.77        6     1.0    1.0 10000.0   10.00      0.
  7000.   17.94        6     1.0    1.0 10000.0   10.00      0.
  7500.   16.44        6     1.0    1.0 10000.0   10.00      0.
  8000.   15.15        6     1.0    1.0 10000.0   10.00      0.
  8500.   14.03        6     1.0    1.0 10000.0   10.00      0.
  9000.   13.05        6     1.0    1.0 10000.0   10.00      0.
  9500.   12.18        6     1.0    1.0 10000.0   10.00      0.
 10000.   11.40        6     1.0    1.0 10000.0   10.00      0.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND   100. M:
   586.   224.8        6     1.0    1.0 10000.0   10.00      2.

**********************************
*** SCREEN DISCRETE DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

  DIST     CONC             U10M   USTK  MIX HT   PLUME  MAX DIR
   (M)   (UG/M**3)   STAB  (M/S)  (M/S)    (M)   HT (M)   (DEG)
-------  ----------  ----  -----  -----  ------  ------  -------
  1676.   108.5        6     1.0    1.0 10000.0   10.00      0.

     ***************************************
     *** SUMMARY OF SCREEN MODEL RESULTS ***
     ***************************************

 CALCULATION        MAX CONC    DIST TO   TERRAIN
  PROCEDURE        (UG/M**3)    MAX (M)    HT (M)
--------------    -----------   -------   -------
SIMPLE TERRAIN      224.8          586.        0.

***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

ATTACHMENT 3

SITE VICINITY MAP

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information May 24, 2005

ATTACHMENT 3:

CLEAN HARBORS DEER TRAIL LLC
EXAMPLE QUIZ ON PART 1:
BASIC RADIATION PROTECTION TRAINING

CLEAN HARBORS DEER TRAIL LLC
EXAMPLE QUIZ ON PART 1:
BASIS RADIATION PROTECTION TRAINING

(Correct answers are shown in **Bold** text)

1. Alpha radiation is:

a. the nucleus of a helium atom
b. an electron
c. electromagnetic radiation
d. none of the above

2. Beta radiation is:

a. the nucleus of a helium atom
b. an electron
c. electromagnetic radiation
d. none of the above

3. Gamma radiation is:

a. the nucleus of a helium atom
b. an electron
c. electromagnetic radiation
d. none of the above

4. Alpha radiation can penetrate 1/8 inch of steel.

True **False**

5. Beta radiation can penetrate 1/8 inch of steel.

True **False**

6. Gamma radiation can penetrate 1/8 inch of steel.

True False

7. A series of different barriers was placed between a radioactive source and a G-M counter to determine the types of radiation emitted. The results are shown below. Which type or types of radiation were emitted?

EXPERIMENT	COUNT RATE in counts per minute
Background	30
No barrier	2,000
Thin paper	1,500
¼ inch of Aluminum	1,500

a. alpha and beta particles
b. alpha particles and gamma rays
c. gamma rays only
d. beta particles and gamma rays

8. Ionizing radiation:

a. creates ions in matter
b. can create acute effects
c. can cause cancer
d. all of the above

9. X-rays:

a. consist of energy and are similar to gamma rays
b. have an atomic mass of 6
c. come from the nucleus of an atom
d. move at the speed of sound

10. The experimental data below show the amount of radioactivity from a radioactive source as measured by a G-M tube and counter over a time period of 8 hours. What is the half-life of the radioactive source?

Time in hours	0	2	4	6	8
Counts per minute (cpm)	600	450	300	225	150

a. 2 hours
b. 4 hours
c. 6 hours
d. 8 hours

11. Activity is:

a. radioactive decays per time
b. heat loss per unit time
c. associated with alpha radiation only
d. measured in rads

12. Radiation dose is:

a. heat absorbed per unit time
b. energy absorbed per unit mass
c. different for each type of radiation
d. different for natural versus man-made sources

13. Radiation dose is measured in units of:

a. kilograms (kg)
b. rad (R)
c. centimeters (cm)
d. volts (v)

14. Dose equivalent accounts for:

a. different quantities of radioactive material
b. biological damage caused by different types of radiation
c. biological damage caused by natural versus man-made radiation
d. different age groups in an exposed population

15. The unit of radiation dose equivalent is:

a. rad (R)
b. electron volts (eV)
c. rem
d. picocuries

16. Sources of background radiation include:

a. cosmic rays from outer space
b. radiation from materials in the earth
c. radiation from materials taken into the body through breathing and eating or drinking
d. all of the above

17. Background radiation doses are:

a. constant around the world
b. of less consequence than man-made radiation
c. vary with location and lifestyle
d. only associated with gamma radiation

18. NORM stands for:

a. Normal Ordinary Radioactive Material
b. Naturally Occurring Radioactive Material
c. Neutral Operating Radioactive Material
d. Negative Oriented Radiation in Man

19. TENORM stands for:

a. Thermally Excited NORM
b. Technically Elegant NORM
c. Technologically Enhanced NORM
d. Telephone Emitted NORM

20. NORM/TENORM radionuclides:

a. include uranium and its decay products
b. include thorium and its decay products
c. include a natural form of radioactive potassium
d. all of the above

21. Radon-222 is:

a. an inert, radioactive gas produced by the decay of radium
b. considered to be a heavy metal
c. has a half-live of over a million years
d. is a greater hazard outdoors than indoors

22. The decay products of Radon-222:

a. cause no observable health effects
b. emit energetic alpha particles
c. have half-lives > a million years
d. are not found in nature

23. Cigarette smokers receive a higher lung dose from Radon-222 decay products than non-smokers.

True False

24. Background doses in the U.S., including the dose from Radon, is about 300 mrem/year.

True False

25. The background dose in Denver is less than the U.S. average.

True **False**

26. Several NORM and TENORM radionuclides have half-lives in excess of a million years.

True False

27. NORM radionuclides can be found in ceramic products.

True False

28. TENORM radionuclides include man-made radionuclides.

True **False**

29. TENORM waste can include which of the following:

    i. oil field pipe scale
    ii. feedlot waste
    iii. drinking waster purification waste
    iv. mining residuals
    v. household waste

a. i, ii, and v
b. i, iii, and iv
c. ii, iii, and iv
d. all of the above

30. Ionizing radiation can damage DNA in a cell, which can cause cancer or other effects.

True False

31. Humans suffer millions of DNA breaks a day from all sources, most of which are repaired.

True False

32. The most affected cells to radiation damage are:

a. rapidly dividing cells (bone marrow, fetus)
b. slowly dividing cells (brain, nerves)

33. Activity is recorded in units of:

a. the rad (100 ergs of energy per gram of material)
b. the Curie (Ci) or picocurie
c. the rem (= rad x a quality factor)
d. the ton (2,000 pounds)

34. The maximum allowed dose to a worker in a nuclear facility is:

a. 2 rem
b. 4 rem
c . 5 rem
d. 8 rem

35. Doses to Deer Trail workers will be maintained at:

a. 5 rem
b. 4 rem
c. 2 rem
d. 100 mrem

36. ALARA stands for As Low As Reasonable Achievable.

True False

37. The Deer Trail worker radiation dose ALARA goal is:

a. 1 rem
b. 100 mrem
c. 25 mrem
d. 5 mrem

38. There are no observable effects for radiation doses less than 10 rem.

True False

39. The observable effect for radiation exposures in excess of 600 rem is death.

True False

40. Delayed effects can include:

a. cataracts
b. birth defects when the fetus is exposed
c. cancer
d. all of the above

41. Some data indicate that low doses of radiation may be beneficial.

True False

42. Although there is considerable discussion among scientists, radiation protection standards and limits are set assuming that even the smallest dose has some increased risk of health effect.

True False

43. Radiation produces cancer in every exposed person.

True **False**

44. The fundamental principal of radiation protection is to reduce exposures through:

a. width, height, and length
b. volume, mass, and temperature
c. time, distance, and shielding
d. knowledge, common sense, and procedures

45. The person charged with responsibility for maintaining and enforcing the Deer Trail radiation safety program is:

a. the General Manager
b. the Radiation Safety Officer
c. the Environmental Compliance Officer
d. all employees

46. Significant elements of the Deer Trail Radiation Protection Program Include which of the following:

i. radiation surveys
ii. protective clothing
iii. overtime
iv. environmental monitoring
v. medical insurance

a. i, iii, and v.
b. i, ii, and iv
c. ii, iii, and iv
d. iii, iv, and v

47. Under the Deer Trail License, the facility can legally dispose all forms of radioactive waste.

True **False**

48. Colorado is an Agreement State with the U.S. Nuclear Regulatory Commission.

True False

49. License violations include not following established procedures, failure to have trained staff, and improper record keeping.

True False

50. Deer Trail employees have which of the following radiation safety responsibilities?

a. maintaining individual exposures ALARA
b. following established procedures
c. reporting unsafe work conditions
d. all of the above

Tested Individual:

_____ NAME _____ DATE

_____ SCORE

Graded By:

_____ NAME _____ DATE