STATE OF COLORADO

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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

March 4, 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

This letter acknowledges receipt of your application on January 31, 2005 for a radioactive materials license to establish and operate a low-level waste disposal facility in Colorado. Additionally, aspects related to your request to accept some radioactive materials under the RCRA permit are acknowledged and addressed here. Your application was not complete. In order to properly proceed with your request, additional information must be provided to this Department.

1. Your application describes in general and broad terms the radioactive materials to be authorized. However a detailed description of the types and quantities of radioactive materials is needed by the Department to assess other aspects of your radiation protection program. Please provide a specific listing of each radionuclide to be authorized for disposal. Describe in detail the chemical and physical form of the materials that will contain these radionuclides (for example: dry soils, dried sludge from waste water treatment facilities, etc.). Provide an estimate for the total weight and total volume of materials to be authorized on the license. Specify an upper concentration limit in pCi/g for each of each of the principle radionuclides to be authorized (i.e. Unat, ^{238}U, ^{235}U, ^{234}U, ^{232}Th, ^{230}Th, ^{228}Th, ^{228}Ra, ^{226}Ra, ^{210}Pb, etc).

2. Appendix K of the Waste Analysis Plan submitted as part of the RCRA permit renewal application includes a request for authorization to accept products exempted from license requirements, such as smoke detectors. A partial listing of items/materials to be accepted for disposal was included in that appendix. Please provide a complete listing of all radionuclides that may be contained in the exempt products and/or materials that you will receive under the RCRA permit.

Prepared by:_____ Reviewed by:_____ Reviewed by:_____ Mailed by:_____
Date:_____ Date:_____ Date:_____ Date Mailed:_____
File: Clean Harbors Deer Trail, 3.2

3. Your application describes the receipt, processing, and disposal of radioactive materials by using the same facilities and disposal cell as those used for the processing and disposal of other hazardous wastes (non-radioactive). RH 14.25.1.11 places limitations on the disposal of other wastes at a licensed low-level waste facility. Please describe how your proposed operations will provide equivalent protection. The treatment and disposal of radioactive wastes in the same areas as hazardous waste would potentially lead to the generation of co-mingled hazardous and radioactive wastes. Provide detailed written procedures for safe handling, processing, and disposal of materials containing both radioactive materials and other hazardous materials that may be generated on site. These procedures must specifically address the collection and processing of leachate collected from landfill cells containing both radioactive wastes and hazardous wastes as well as other wastewater streams such as water from the truck wash.

4. Please provide detailed written procedures for treatment processes for radioactive material received at your site under both the license and the permit.

5. Please provide a complete list of the radiation detection instruments that will be used on site including gate monitors, portable instruments and probes, liquid scintillation counters, gamma spectroscopy units, etc. For each instrument please provide information on efficiency, count geometry, count time and minimum detectable activity. Included in this list should be a dedicated instrument and probe for alpha detection.

6. It is our expectation that the facility will have a full-time Radiation Safety Officer (RSO) on-site. Please describe the availability and level of supervision for the RSO. There are many places in the application where the RSO can designate another unspecified employee to perform radiation safety functions. Please provide the name(s) and qualifications of the person(s) who will perform as an assistant to the RSO by performing these designated radiation safety functions.

7. The application does not contain information on the preoperational monitoring for specific radioactive isotopes, other than radium as required by RH 14.26.1. The background concentrations of the uranium and thorium decay series are not described. Concentration descriptions are needed for all environmental media: air, soil, and water.

   You need to start taking samples and producing a statistical population of independent measurements over time for air and water media. A background, or ambient, description of soil concentrations can be initially performed in one sampling event.

   The suggested initial analytical suite for radioactive isotopes is:

Thorium-232	Uranium-238	Radium-228	Lead-210
Thorium-230	Uranium-234	Radium-226	Gross Alpha
Thorium-228.	Uranium-235		Gross Beta

   Other analyses may be required.

The Department suggests you begin taking ground water samples each month for analysis. It is also suggested you set up an initial air sampling program of several monitoring stations about the facility. Gamma spectroscopy analytical techniques may be used. Air sampling should be conducted at 20-40 cubic feet per minute (CFM). The sampling filters should be changed twice a week and filters from each station composited monthly for analysis. The data should be reviewed at three-month intervals.

The Department invites you to come in and discuss these environmental monitoring issues at more length. There are options which you may wish to consider.

8. The following Standard Operating Procedures (SOP) were referenced in SOPs contained in Attachment A of the license application but were not included as part of the application:

   A. Standard Operating Procedure on Air Sampling
   B. Standard Operating Procedure Screening Waste Samples for Radioactivity in the Laboratory

   Please forward these SOPs with your response to this letter.

The above items describe essential missing information and/or inadequate program components that have been identified thus far in the review process. As the review process proceeds, it is likely that additional information will be needed to finalize the application. The Department will provide additional written requests for information as needed.

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. In your response to this request, please reference docket number 5873.

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

108555 East Highway 36
Deer Trail, CO 80105
970.386.2293
Fax 970.386.2262

April 7, 2005

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

Dear Mr. Tarlton,

I received your letter dated March 4, 2005, which contained comments on the Clean Harbors Deer Trail, LLC, *Radioactive Materials License Application*, dated January 2005. I appreciate your cooperation in reviewing our application in such a timely manner. In developing our responses, we have expanded the descriptions and justifications of how several requirements under RCRA, which are reflected in our RCRA Permit, also meet the requirements of 6 CCR 1007-1, Part 14. In addition, because of the site location, the engineered design of the disposal cells, and the low concentrations of naturally occurring radioactive materials (NORM) and technologically enhanced radioactive materials (TENORM) to be disposed under our license, we are confident that the performance objectives in 6 CCR 1007-1, Part 14 will be met. In the text that follows, your comment is shown in bold face type followed by Clean Harbors response in italics.

CDPHE Comment 1 -

Your application describes in general and broad terms the radioactive materials to be authorized. However a detailed description of the types and quantities of radioactive materials is needed by the Department to assess other aspects of your radiation protection program. Please provide a specific listing of each radionuclide to be authorized for disposal. Describe in detail the chemical and physical form of the materials that will contain these radionuclides (for example: dry soils, dried sludge from waste water treatment facilities, etc.). Provide an estimate for the total weight and total volume of materials to be authorized on the license. Specify an upper concentration limit in pCi/g for each of each of the principle radionuclides to be authorized (i.e. Unat, 238U, 235U, 234U, 232Th, 230Th, 228Th, 228Ra, 226Ra, 210Pb, etc).

Clean Harbors Response: Clean Harbors Deer Trail (CHDT) is requesting a license to accept and dispose NORM/TENORM waste at concentrations that are less than the definition of Low Level Radioactive Waste in Colorado (i.e., 2,000 pCi/g). An upper concentration limit of ^{226}Ra of 400 pCi/g was provided to assure that external dose rates for workers would be maintained. There is no need to

specify the upper limits for other radionuclides since the total activity of 2,000 pCi/g is specified, and the sum of fractions for the relevant NORM/TENORM radionuclides will be imposed, ensuring that this upper limit is not exceeded. This allows for flexibility in operations since the isotopic ratios of the NORM/TENORM radionuclides present will vary for the different types of waste encountered. In addition, these proposed concentrations disposed in the Deer Trail secure cells have been shown through our Safety Assessment to meet the Performance Objective in 6 CCR 1007-1, Part 14.

The Deer Trail facility is permitted under RCRA for seven secure (double-lined) disposal cells. The cells have the following capacities: Cell 1 - 173,000 yds^3, Cell 2 - 220,600 yds^3, Cell 3 - 480,240 yds^3, Cell 4 - 491,840 yds^3, Cell 5 - 472,120 yds^3, Cell 6 - 433,840 yds^3, Cell 7 - 466,320 yds^3. The total maximum permitted capacity is 2,737,960 yds^3 of which there are approximately 2,374,360 yds^3 remaining. Over the projected lifetime of the facility, Clean Harbors is requesting authorization to accept 2,374,360 yds^3 of chemically hazardous waste or NORM/TENORM types of waste and any combination thereof. The amount of NORM/TENORM and chemically hazardous waste will depend on future market conditions and the development of new regulations. Thus, it is extremely difficult for Clean Harbors to provide information of the quantities of different types of materials to be managed at the facility over the entire operational lifetime.

Specifically over the next five years, the facility is projected to receive enough chemically hazardous or NORM/TENORM waste to fill Cell 3 – or about 480,240 yds^3. Although it is difficult to predict the exact quantities and types of waste, our best current upper estimate is shown in Table 1, which is attached to this letter. This upper estimate is based on the assumption that all of the waste to fill the cell is NORM/TENORM waste. Table 1 also includes an estimated concentration range of the radionuclides that would be accepted by the Facility.

Clean Harbors recognizes that some of the radionuclides concentrations shown in the waste streams in Table 1 could exceed the regulatory definition of "source material". Source material is defined as greater than 0.05 percent by weight of uranium and thorium. Since some of these waste streams listed in Table 1 have the potential to be classified as "source material", CHDT proposes to accept naturally occurring uranium and thorium concentrations (e.g., source material) at a radionuclide concentration of up to 2,000 pCi/g. Please note that although this material may be classified as source material, it would not be considered low-level radioactive waste since the waste accepted by CHDT will be below 2,000-pCi/g total in concentration.

CDPHE Comment 2 -

Appendix K of the Waste Analysis Plan submitted as part of the RCRA permit renewal application includes a request for authorization to accept products exempted from license requirements, such as smoke detectors. A partial listing of items/materials to be accepted for disposal was included in that appendix. Please provide a complete listing of all radionuclides that may be contained in the exempt products and/or materials that you will receive under the RCRA permit.

Clean Harbors Response: At this time, Clean Harbors does not propose to accept exempted material such as smoke detectors. A letter will be submitted in the near future requesting that this section (Table 1 referred to in II.A.) of Appendix K be removed from the Waste Analysis Plan (WAP).

CDPHE Comment 3 -

Your application describes the receipt, processing, and disposal of radioactive materials by using the same facilities and disposal cell as those used for the processing and disposal of other hazardous wastes (non-radioactive). RH 14.25.1.11 places limitations on the disposal of other wastes at a licensed low-level waste facility. Please describe how your proposed operations will provide equivalent protection.

Clean Harbors Response: RH 14.25.1.1 states the reason for segregation of wastes as being:

> *"… any interaction between Class A wastes and other wastes will not result in the failure to meet the performance objectives of this part. This segregation is not necessary for Class A wastes if they meet the stability requirement in Part 4, Appendix E, II (b) of these regulations."*

Performance Objectives as referred to above are listed in RH 14.18 through RH 14.22. These are:

> *RH 14.18, General Requirements for siting, operation and closure;*
> *RH 14.19 Protection of the General Population and the environment;*
> *RH 14.20 Protection of Individuals From Inadvertent Intrusion;*
> *RH 14.21 Protections of Individuals During Operations;*
> *RH 14.22 Stability of the Disposal Site After Closure.*

The following describes how Clean Harbors meets the performance objectives specified above:

> *RH 14.18 specifies the general requirements for siting, operation and closure of a land disposal facility. Clean Harbors believes that the Deer Trail facility is located, designed and operated to meet these requirements. The Colorado Geologic Survey (CGS), Department of Natural Resources, conducted an evaluation to find a suitable low-level radioactive disposal sites in Colorado. This evaluation was the initial step in a site selection process conducted by the Rocky Mountain Low-Level Radioactive Waste Compact. For its evaluation, the CGS used a comprehensive process to identify and select candidate areas and representative sites based on a detailed technical analysis of geologic, geohydrologic, and geotechnical parameters important to radioactive waste disposal. The evaluation gave primary emphasis to natural mechanisms that would promote long-term isolation of the waste from man and the environment. It identified areas of Colorado that had stable geology, with thick layers of relatively impermeable shale containing little, if any, useable ground water. The CGS established a Geotechnical Rating Matrix system that considered various important geologic factors, assigned a ranking for each factor, and translated the ranking into a numeric score to provide a comparison among candidate sites. The matrix scores could range from a perfect score of 120 down to zero (a highly unsuitable site). According to this information, the general location of Deer Trail facility was in the Central Plains Candidate Area identified by the CGS, underlain with the Pierre Shale formation. The site ranked with the highest of the scoring sites and the CGS indicated that it should be considered as having a very high potential for safe,*

long-term disposal of radioactive wastes (CGS 1986 – see Volume 3 of the Radioactive Materials License Application). The Deer Trail facility is located in this area.

The Deer Trail facility will be operated in a manner so that exposure of individuals to radionuclides will remain within acceptable levels as required by the public protection performance objectives in RH 14.19. The first step in this process was the development of a risk assessment to evaluate and limit exposure from radionuclides. Based on the risk assessment, which is contained in Section 6.0 of the application, Clean Harbors has elected to limit the concentration of the radionuclides accepted at the facility to 2,000 pCi/g of total NORM/TENORM radionuclides and 400 pCi/g of ^{226}Ra to reduce and minimized short term and long term exposure of human health and the environment. Clean Harbors has prepared a health and safety program to minimize and monitor exposure of employees. In addition, Clean Harbors has prepared a series of Standard Operating Procedures to minimize exposure of employees and the public to radionuclides. A multi-media (e.g., soil, ground water, air) environmental monitoring program will be implemented to assess exposure monitoring of radionuclides. In summary, through a combination of facility design criteria, limitations on the concentrations of radionuclides, health & safety programs, and monitoring, exposure to individuals will be maintained at or below acceptable levels.

The hazardous waste regulations (e.g., 40 CFR 264.111) require that hazardous waste landfills be closed in a manner that

a) Minimizes the need for further maintenance; and
b) Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or the atmosphere.

To meet this criteria, the Deer Trail landfills are designed with a final cover system that will provide long-term minimization of migration of liquids into the underlying waste, function with minimum maintenance, promote drainage and minimize erosion, accommodate settlement and subsidence, and have a permeability less than or equal to 1×10^{-7} cm/s.

Each disposal cell final cover system will consist of the following layers, from top to bottom:

- *An 8-inch vegetative cover (with topsoil);*
- *A 3-foot general fill soil cover to protect the underlying geomembrane from frost and erosion;*
- *A geocomposite drainage layer consisting of geonet with nonwoven geotextile thermally bonded to both sides;*
- *An 80-mil textured high density polyethylene (HDPE) geomembrane;*
- *A geosynthetic clay liner (GCL); and*
- *A 0.5-foot (minimum) interim soil cover.*

Section 3.0 of Clean Harbors Radioactive Materials License application contains further information on the design and construction of the disposal unit covers.

RH 14.19 requires protection of the general population and environment. As discussed in Section 6.0 of the application, the general population and the environment will be protected via a combination of features that include its remote location, design features, and operational controls. The Deer Trail facility will provide this protection based on the following considerations:

- *The site is at a remote location and sparsely populated area (95 people within a 10 mile radius from the facility). (See Section 2.1.4, page 2-3 of the Radioactive Materials License Application);*
- *Limitation on the concentration of radionuclides;*
- *Located in an areas suggest by the CGS as accepted for low-low waste disposal;*
- *Landfills will be lined with a RCRA liner system which will preclude the migration of radionuclides;*
- *The site is located on the Pierre Shale which will also limit the potential for migration of radionuclides;*
- *Administrative procedures to limit spread of radionuclides;*
- *Multi-media monitoring (e.g., soil, air, ground water) for radionuclides; and*
- *Operational and closure requirements under the RCRA permit.*

RH 14.20 requires protection of individuals from inadvertent intrusion. The RCRA hazardous waste management program (40 CFR 264.14) requires that

> *"The owner or operator must prevent unknowing entry, and minimize the possibility for unauthorized entry, of persons or livestock on to the active portion of his facility, unless. . ."*

Clean Harbors prevents unknowing entry or inadvertent intrusion via signage stating "Danger-Unauthorized Personnel Keep Out" and an 8-foot high chain-link fence surrounding the facility, and locked or controlled entrances. The facility security measures are described in Section II.D of the RCRA permit.

RH 14.21 requires protection of individuals during operations. Clean Harbors uses both engineering and administrative controls, and personal protective equipment (PPE) to protect employees from chemical and radiation hazards. The first step in minimizing the risk of radiation exposure was to limit the radionuclide concentrations to 2,000 pCi/g total NORM/TENORM radionuclides and 400 pCi/g of ^{226}Ra. In addition, Clean Harbors requires the use of standard PPE during all operations in the landfill or treatment building. This standard PPE includes full-face air purifying respirators with combination cartridges, which protect against organic vapors, acid gases, and particulates including radionuclides. Disposable coveralls, gloves, and foot protection are also required. This PPE is worn at all times in the landfill and treatment building whether or not radionuclides are present. All Deer Trail personnel working in the landfill or the treatment building will be trained in procedures for radiation protection. Clean Harbors will also monitor dose rates to its workers and contamination levels within the facility according to the provisions of the Radiation Protection Plan. Non Clean Harbors truck drivers delivering waste to the landfill or treatment building

will wear the required PPE, and will be present only under direct supervision of Deer Trail facility personnel. They will also be required to remain in their vehicles at all times when in the landfill or treatment building. Since Clean Harbors will maintain dose rates for all personnel at levels acceptable to the general public, it will not be necessary to monitor truck drivers or other temporary personnel as long as they work under Clean Harbors supervision for short periods of time only.

The RCRA permit also includes other measures, which protect workers the public, and the environment during landfill operations. These permit conditions are shown below:

VI.E.3.c. Daily cover will be placed over the wastes. [6 CCR 1007-3 § 264.301(j)]

VI.E.4. The bed of each truck entering the cell shall be covered with a tight fitting tarp over all waste. The tarp shall not be removed until disposal activities are ready to commence.

VI.E.5. Each truck exiting a cell shall be inspected for visible wastes; visible particles of wastes shall be swept, brushed or otherwise cleaned to remove all visible particles of waste from the tires and frame.

VI.E.7. Shipments of wastes to a secure cell shall be halted during any time period whenever wind speed is high enough to blow wastes out of a cell. At a minimum, shipments of wastes to a secure cell shall be halted during any time wind speeds reach thirty-five miles per hour.

VI.E.7.a. Intermediate cover application shall commence or continue during periods of such high wind.

VI.F.2. The Permittee must design, construct, operate, and maintain the run-off management system to collect and control at least the water volume resulting from a 24-hour, 1000 year storm event which has been defined as an 8.2 inch storm. [6 CCR 1007-3 § 264.301(h)]

VI.F.3. The Permittee must follow the Surface Water Management plan for the site as shown and specified in Permit Attachment 9, and comply with the requirements of this Section.

These requirements prevent the release of waste materials into the environment via wind or water dispersal and are protective of workers and the public. Clean Harbors does not believe that the interaction between NORM/TENORM wastes and other wastes in the landfill will create any new hazardous that will adversely impact workers, the public, and the environment during landfill operations. All the measures described above to protect for chemical hazards will also provide protection from radionuclides hazards.

RH 14.22 requires stability of the disposal site after closure. Detailed engineering analysis and operations control have been prepared as part of the RCRA permitting process to control landfill stability. The Deer Trail landfills will be stable after closure. Specifications to maintain

stability are discussed in Section 5.0 and in a Facility Closure Plan provided in Volume 5 of the application.

Clean Harbors engineering analysis for landfill design, construction, operation and closure analysis is contained in the following RCRA permit sections:

- *VI.C. DESIGN REQUIREMENTS*
  (e.g. base of the landfill must be in bedrock, engineered fill must be compacted to 90% of modified protector test, etc.)

- *VI.D. CONSTRUCTION REQUIREMENTS*
  (e.g., includes a quality control program that requires test at specified frequencies to ensure the landfill is built according to the design specification, soil classified coarser than USC SM shall be removed at the time of cell excavation for a distance of 100 feet from the nearest point of the secure cell secondary liner, replace remove soil with recompacted soil which is of equal or lower hydraulic conductivity than adjacent soil, provide adequate construction inspection and moisture, density and hydraulic conductivity testing of both undisturbed and replaced soil).

- *VI.K. CLOSURE PLAN and POST CLOSURE*
  (e.g., 30-year inspection and maintenance plan to ensure the landfill integrity).

The operational controls that ensure landfill stability included the following:

- *Bulk solid materials will be unloaded in the landfill, and compacted with a self-propelled sheepsfoot roller to meet the compaction standards of the RCRA permit (e.g. 0.33tons/square foot). The waste compaction standards are specified in Section VI.E.8.a of the RCRA permit;*
- *Waste will be placed in horizontal lifts and compacted in place. See Section VI.E.8 of the RCRA permit;*
- *Materials containing free liquid can not be disposed in the landfill (VI.B.5 of the RCRA permit). Materials with free-liquid must be treated to remove all free liquid and meet Deer Trail facility load bearing strength requirements as specified in Section VI.E.8.a of the RCRA permit;*
- *Bulk materials that do not meet the landfill load bearing strength (e.g., sludge) must be solidified in the stabilization treatment unit until they meet all load bearing strength requirements (WAP Section III.E.4); and*
- *Containerized waste is placed in the landfill only if it has all void space filled or it is crushed with all spaces between containers filled. All other containers are crushed, ruptured, mangled in the stabilization unit prior to being placed in the landfill. After placement in the landfill, they are compacted. (VI.E.3.b. of the RCRA permit).*

The RCRA permit contains other requirements that ensure proper long-term stability of the landfill. These include restrictions on the type of materials that can be placed in the landfill.

These restrictions are designed to ensure that only stable chemical forms are placed in the cell. The restrictions will prevent interactions between NORM/TENORM waste in the landfill and other waste. The RCRA permit conditions include:

VI.B.2. Hazardous wastes must meet all applicable land disposal restrictions prior to disposal. [This means all wastes must meet CO and USEPA standards for Ignitability, Corrosivity, Reactivity, and Toxicity.]

VI.B.5. The following wastes are prohibited from disposal in secure cells, or require treatment or special handling such as segregation or containerization as noted:

- *Any waste containing free liquids as determined according to EPA Method 9095;*
- *Hydrophobic or pyrophoric wastes;*
- *DOT Forbidden Explosives;*
- *Shock Sensitive Materials;*
- *Polychlorinated Biphenyls (PCBs) > 50 ppm;*
- *Radioactive Materials > 16 uR/hr, or as approved by the Department;*
- *Infectious Wastes;*
- *Compressed Gases;*
- *Wastes which are ignitable below 140°F;*
- *Wastes exhibiting a pH less than 2.5 or pH greater than 12.5, including containerized wastes;*
- *Wastes that release greater than 500-ppm sulfide or 250-ppm cyanide when subjected to a change in pH. Wastes that release greater than 20-ppm sulfide or greater than 10-ppm cyanide shall be segregated from other wastes which have a pH < 5.0; and*
- *Lab packs that do not meet the requirements of 6 CCR 1007-3 § 268.*

VI.E.3.b. Waste materials to be placed in the secure cells will be bulk solids, solidified blocks, and drummed solids. The bulk solids will consist of solidified sludges, treated material and direct landfilled solids. Any intact drums will be filled with solids or crushed to eliminate significant voids to the extent practical, space between drums will be filled with bulk solids to eliminate void space.

As part of the siting criteria, RH 14.23 specifies disposal site suitability to ensure long-term performance and isolation of the waste. The following describes how the Deer Trail Facility meets these criteria:

- *The underlying Pierre Shale provides natural geologic protection against radionuclide migration. In addition, the Deer Trail facility has been geologically and hydrogeologically investigated, modeled, and monitored under the RCRA hazardous waste program. A summary of the site characterization information is provided in Section 2.3 (page 2-11) of the application, consistent with the requirements of RH 14.23.1.*

- *The Facility is not located in an area of projected population growth. This information is provided in Section 2.1 (page 2-2) of the application, consistent with the requirements of RH 14.23.2.*

- *There are no natural resources that could be exploited such that the exploitation of the resource would affect the containment ability of the Deer Trail site. This conclusion is supported by the discussion of the lack of natural gas resources beneath the facility (Section 2.3.1.2, page 2-12 of the application) and the lack of usable ground water beneath the facility (Section 2.4.2.1, page 2-20 of the application). This conclusion is consistent with the requirements of RH 14.23.3.*

- *The Deer Trail facility is located in a well-drained area free of flooding or frequent ponding. None of the disposal areas are within a 100-year floodplain. This is described in Section 2.4.1 (page 2-19) of the application, consistent with the requirements of RH 14.23.4.*

- *As described in Section 3.1.5 (page 3-6) of the application, the landfills are located in area of the property and designed such that run-off will be minimized which could erode or inundate the landfills. In addition, run-on and run-off controls have been designed as required by RCRA (40 CFR 264.301(g) and (h) to prevent run-on from entering the landfill, to prevent run-off from leaving the landfill, to prevent erosion, or inundation. These controls are consistent with the requirements of RH 14.23.5.*

- *As discussed in Section 2.4.2.2 (page 2-21) of the application, due to the unique geological setting in the vicinity of the facility, the underlying deposits are hydraulically isolated from the regional aquifers. In a classical sense, there are no major ground water "aquifers" in either unconsolidated surficial deposits or the underlying bedrock (the Pierre Shale) in the vicinity of the site. In addition, the landfill will be lined with a RCRA landfill liner system that consists of multiple layers of clay, synthetic liners, and leachate collection and removal systems that will prevent release of hazardous waste constituents as well as radionuclides. The RCRA landfill liner design criteria are specified in 40 CFR 264.301. Additionally, RCRA requires that no more than one foot of head be placed on the liner system. This means that liquid (leachate) has to be periodically removed from the landfill. By maintain a one foot head or less as specified in the RCRA permit, there is not driving force to cause radionuclides to migrate or be released from the bottom of the landfill which could cause ground water contamination. This is consistent with the requirements of RH 14.23.6.*

- *As discusses in Section 2.4.2.2 (page 2-21) of the application, there is no ground water and thus there are no artesian springs that discharge ground water to the ground surface in the area of the Deer Trail facility. This is consistent with the requirements of RH 14.23.7.*

- *According to the National Earthquake Information Center, as discussed in Section 2.3.4 (page 2-19) of the application, there are no tectonic processes that would affect the ability of the site to meet the performance objectives. This is consistent with the requirements of RH 14.23.8.*

- *As discussed in Section 2.3.1 (page 2-19) of the application, the Deer Trail facility is not located in an area of rapid geologic change (e.g., landslides, settling, subsidence, etc.). This is consistent with the requirements of RH 14.23.9.*

- *As described in Section 2.1.3 (page 2-3) of the application, the Deer Trail facility is not located near any industrial facility or activity that could adversely impact the ability of the site to meeting the performance objects or significantly mask the environmental monitoring program. This is consistent with the requirements of RH 14.23.1.10.*

CHDT believes that waste disposal requirements of the RCRA permit, and the State of Colorado regulations governing hazardous waste landfill operations will enable the facility to meet the performance objectives of this part, and requests CDPHE to waive the segregation requirement of RH 14.25.1.11.

CDPHE Comment 3 – continued
The treatment and disposal of radioactive wastes in the same areas as hazardous waste would potentially lead to the generation of co-mingled hazardous and radioactive wastes. Provide detailed written procedures for safe handling, processing, and disposal of materials containing both radioactive materials and other hazardous materials that may be generated on site. These procedures must specifically address the collection and processing of leachate collected from landfill cells containing both radioactive wastes and hazardous wastes as well as other wastewater streams such as water from the truck wash.

Clean Harbors Response: All waste disposed at Deer Trail, including NORM/TENORM waste, must meet the CHDT permit requirements as directed by U.S. Environmental Protection Agency regulations. This means that all waste will have similar chemical and physical properties so that there will be no synergistic effects of mixing NORM/TENORM waste with hazardous chemical waste. As discussed in the Safety Assessment provided in the application, and because of the site location, the engineered design of the disposal cells, and the low concentrations of NORM/TENORM waste to be disposed, we have shown that the performance objectives in 6 CCR 1007-1, Parts 14.18 through 14.21 will be met.

Minimization of Commingled Waste

CHDT will institute operational procedures to help prevent cross contamination of wastes. Areas used for treating NORM/TENORM waste will be limited. By regulation, the landfill cells are considered a restricted access area; entry by workers requires specific procedures including the use of protective clothing and respiratory protection. All vehicles and persons leaving the landfill will undergo decon and/or frisk out procedures to assure contamination control. This procedure is under development and will be complete for review prior to receipt of waste. A portion of the treatment building will be dedicated for NORM/TENORM campaigns as needed. This area of the treatment building will be controlled and require decon/frisk out procedures, again to assure contamination control. This procedure is also under development and will be complete for review prior to receipt of waste. These procedures will minimize com-mingled waste. Frisk out of vehicles and equipment before they enter the truck wash should ensure minimal cross contamination of the truck wash. Similarly, equipment used for

waste processing in the treatment building will be washed and frisked out prior to leaving the controlled area of the treatment building.

Handling and Processing of Co-mingled Waste

Co-mingled waste should have similar properties as non-co-mingled waste. General requirements of the facility will protect workers and the public during operations. CHDT requires the use of standard personal protective equipment (PPE) during all operations in the landfill or treatment building or when working with any non-containerized waste. This standard PPE includes full-face air purifying respirators with combination cartridges that protect against organic vapors, acid gases, and particulates including radionuclides. Disposable coveralls, gloves, and foot protection are also required. This PPE is worn at all times in the landfill and treatment building whether or not radionuclides are present. All CHDT personnel working in the landfill or the treatment building will be trained in procedures for radiation protection. CHDT will also monitor dose rates to its workers according to the provisions of the Radiation Protection Plan. Solid waste streams generated at the facility are normally accumulated in containers and treated in the treatment building prior to disposal. During storage, all waste containers must be closed at all time, and be properly labeled. Co-mingled waste such as PPE and bag house dust will be labeled appropriately. Processing of co-mingled waste will be done in a similar manner to non co-mingled waste. Solid wastes are either treated in the treatment building or directly landfilled.

Disposal of commingled waste

Most waste generated at CHDT currently is, and will continue to be, disposed of at CHDT. Some co-mingled waste may be produced during treatment, but it can be properly disposed of on site. Solid waste materials that require treatment are treated in the treatment building, and then land filled. Some site-generated wastes are disposed via direct landfill. Some additional treatment, such as size reduction and compaction, occurs in the disposal cells. If waste is to be disposed of at off-site facilities, it will be tested in order to determine if it is co-mingled.

Leachate and Truck Wash Liquids - Generation

Leachate and other aqueous wastes produced on site are normally consolidated, treated in the wastewater treatment plant, and discharged after meeting the appropriate effluent limitations. The leachate is tested quarterly for radioactivity. CHDT believes that radionuclide concentrations in the leachate at Deer Trail will be very low. There are several reasons for this. First, total radionuclide concentration in raw waste must not exceed 2,000 pCi/g. Second, only a portion of the all waste in the landfill cell will be NORM/RENORM waste. This strictly limits the potential radiation hazards. Leachate concentration will always be at least two or three orders of magnitude lower in concentration than the raw waste due to diffusion and dispersion factors alone. This leaves us under worse case scenarios, assuming all of the radionuclides are completely water soluble, with a maximum concentration of 2-20 pCi/ml, which is at background level. These levels are consistent with those encountered in leachate from the Buttonwillow landfill in California, which disposes of geothermal and oilfield NORM/TENORM waste in similar concentrations proposed for the Deer Trail facility. The peak total uranium found in leachate in a recent analysis indicated a concentration of about 0.8 pCi/mL, with a peak radium concentration less than 1% of the total uranium concentration. In fact, based on past experience and operational practices at Deer Trail, CHDT believes that most radionuclides in the landfill will be very insoluble. This depends on the chemical and physical form of the waste. Wastes

such as Denver Radium consist of asphalt and road base which strictly limits its solubility as the radionuclides are encapsulated in the asphalt. Wastes that are treated at CHDT will have low solubility as well. CHDT treatment is designed to render toxic metals insoluble. This is accomplished through raising the pH to a very alkaline level where metal solubility's are low, encapsulating the waste in pozzolanic (cement-like) materials, and through the addition of chemicals to form insoluble salts. When low solubility of the waste is added to diffusion and dispersion, potential radionuclide concentration in the leachate should be at or near background. Radionuclide contamination of truck wash liquids will be minimized or eliminated through the use of frisk out procedures in the landfill or the treatment building before any vehicle or equipment utilizes the truck wash.

Leachate and Truck Waste Liquids - Management

Leachate is either pumped through pipes directly to the leachate storage tanks, or is pumped into portable tanks or tank trucks and transported to the leachate storage tanks. Leachate and other aqueous liquids are normally treated in the wastewater treatment plant. The plant utilizes coagulation and settling using ferric sulfate, lime and polymer. Effluent water is then filtered in a mixed media filter and an activated carbon filter. After pH adjustment, the effluent water is sent to an effluent storage tank. Discharges of wastewater are governed by the CHDT NPDES Permit. The wastewater discharge effluent is monitored for radioactivity. All batches are tested prior to discharge, and during discharge as well. The Wastewater treatment plant is capable of removing most NORM/TENORM radionuclides, and can be modified for greater removal efficiency, if necessary. Site generated aqueous wastes are also sometimes treated on the treatment building using pozzolanic materials so solidify the waste. CHDT believes that current procedures supporting the RCRA Permit are adequate for handling and treating the leachate, even if NORM/TENORM radionuclides are present. CHDT personal protective equipment is adequate to protect workers against both radionuclides and RCRA wastes.

The leachate collection and treatment standard operating procedures are under development and will be complete for review prior to receipt of waste. The truck wash water collection and treatment standard operating procedures is under development and will be complete for review prior to receipt of waste.

CDPHE Comment 4 -

Please provide detailed written procedures for treatment processes for radioactive material received at your site under both the license and the permit.

Clean Harbors Response: Clean Harbors has well-established processes and standard operating procedures to treat chemically hazardous wastes. It is anticipated that these processes and procedures will also apply to NORM/TENORM waste, as appropriate, because of the requirement that all waste must meet the CHDT RCRA Permit requirements. No additional treatment processes or procedures are anticipated. NORM and/or TENORM waste will go directly to the landfill for disposal or may have to be treated for chemical hazards if required by the RCRA regulations. It is recognized that there potentially are wastes that could be chemically hazardous as defined by RCRA, and also contain some level of NORM/TENORM radionuclides, which would require treatment. An example is a wastewater treatment sludge that is RCRA hazardous for arsenic, which also contains NORM or TENORM radionuclides. Depending on the concentrations of arsenic, the waste could go directly to the landfill or

may have to be treated as defined in the RCRA regulations. In this example, the waste would be treated for arsenic, with no special treatment of NORM/TENORM in the waste. CHDT utilizes a wide variety of industry standard treatment formula for different types of waste. Specific treatment formulas and mixed designs for each waste batch are assigned by general manager or designee.

Clean Harbors Deer Trail performs waste treatment operation in a totally enclosed building equipped with an air handling and scrubber system. Treatment takes place in one of the treatment basins. There are nine treatment basins at CHDT and six of these are normally used for treatment. These basins are 150 cubic yard in capacity, and are constructed of a ¾ inch thick steel shell inside a concrete vault. Mixing is done with a tracked excavator (track-hoe). The simplest form of treatment is solidification. In this treatment, liquid or semisolid waste is dumped from a truck or container into the treatment basin. A pozzolanic solidifying reagent is added to the waste in the quantity determined by the CHDT laboratory. The waste, and reagent is mixed with the track-hoe until it is a solid. A sample is taken to the lab for testing to confirm that it meets treatment requirements. The solidified waste is then taken via site haul trucks to the landfill and disposed of. The pozzolanic reagents used at CHDT include cement kiln dust, fly ash, and cement. These reagents act not just as sorbants, but actually chemically combine with the water in waste materials rendering them stable. In addition, the treatment process greatly decreases the solubility of all toxic elements. In the case of RCRA waste treatment, other additives are used in addition to the pozzolanic reagents in order to stabilize certain elements. These additives include phosphates, sulfides, and iron compounds.

CDPHE Comment 5 –

Please provide a complete list of the radiation detection instruments that will be used on site including gate monitors, portable instruments and probes, liquid scintillation counters, gamma spectroscopy units, etc. For each instrument please provide information on efficiency, count geometry, count time and minimum detectable activity. Included in this list should be a dedicated instrument and probe for alpha detection.

Clean Harbors Response: The following instrumentation is proposed for use at the CHDT facility. Equivalent or better substitutions may be made after more in depth evaluation of the equipment capabilities and the needs of the facility.

1 - Ludlum Model 3520 Waste Monitor upgraded with a digital readout and data-logging capabilities equivalent to the Ludlum Model 375-20.

2 - Ludlum Model 193-6 Micro-R Survey Wand with 6" diameter by 1" plastic scintillators.

2 - Ludlum Model 19 Micro-R survey meter or 19A Micro-R Alarm Meter

1 - Ludlum Model 3 Survey Meter with NaI gamma scintillator probe

2 - Ludlum Model 3A Survey Meter with Alarm with pancake GM probe

3 - Ludlum Model 177 Alarm Ratemeter (Stationary) with pancake GM probe

1 - Thermo Electron Corp Mini 1800 Portable Alpha Monitor utilizing a ZnS scintillator

1 - Gross Alpha/Beta Counter, either: Ortec MPC2000 Desktop Gross Alpha/Beta Counter or Ludlum Model 2939 Alpha/Beta Scaler with Model 43-10-1 Alpha Beta Sample Counter

The following describes the specifications of the instruments listed above:

1. Ludlum Model 3520 Waste Monitor

CHDT currently uses a Ludlum model 3520 Waste Monitor at the scales leading into the facility. The Model 3520 Waste Monitor detects gamma and x-ray radiation using two 2" by 2" thallium doped sodium iodide crystal scintillators. These are mounted on poles approximately 6 feet above the ground and approximately two feet distant from both sides of a truck on the scales. The Model 3520 has readouts in µR/h and in CPM. The monitor will be upgraded with a digital readout, a printer, and a data-logging device. Minimum Sensitivity: Must be photon (gamma and x-ray) sensitive. Must alarm on a 100-µCi ^{137}Cs source at 10 feet within 15 seconds in a constant background field of 10 µR/h (characteristic of Ra-226 in equilibrium with progeny).

2. Ludlum Model 193-6 Micro-R Survey Wand

The Model 193-6 is a general-purpose survey instrument for measuring low levels of gamma activity. It utilizes a 6" diameter by 1" thick plastic scintillator on a wand. The dial reads 0-1 µR/h with multipliers of 1, 10, 100, and 1000. The Model 193-6 will be utilized for frisking and surveys of low levels of gamma radiation over large areas such as truck wheels and floors. This model has an alarm, which can be set at any point from 10% to full scale. Range: 0 to 5,000 µR/h

3. Ludlum Model 19 Micro-R Survey Meter or 19A Micro-R Alarm Meter

The Model 19 is a general purpose survey instrument for measuring low levels of gamma activity. It utilizes an internal 1" by 1" NaI Scintillator. The dial reads 1 to 500 µR/h in a logarithmic scale. The 19A has an alarm as well. Range: 50 to 100,000 dpm/cm^2, 0.1 mrem/h to 1000 rem/h, ± 15%.

4. Ludlum Model 3 Survey Meter with NaI Gamma Scintillator Probe

The Model 3 Survey meter with the Model 44-2 NaI gamma scintillator probe is a general-purpose survey meter used for measuring count rates of gamma radiation. Range: 50 to 100,000 dpm/cm^2, 0.1 mrem/h to 1,000 rem/h, ± 15%.

5. Ludlum Model 3A Survey Meter with Alarm with Pancake GM probe

The Model 3 Survey Meter with the Model 44-9 Pancake GM Detector is a general-purpose survey instrument for determining count rates of alpha, beta and gamma radiation. Range: 50 to 100,000 dpm/cm^2, 0.1 mrem/h to 1,000 rem/h, ± 15%.

6. Ludlum Model 177 Alarm Ratemeter (Stationary) with Pancake GM probe

The Model 177 Alarm Ratemeter with the Model 44-9 Pancake GM Detector is a general purpose survey instrument for determining count rates of beta/gamma radiation. These will be utilized as frisk

stations at strategic areas around the facility. Range: 50 to 100,000 dpm/cm^2, 0.1 mrem/h to 1,000 rem/h, ± 15%.

7. Thermo Electron Corp. Mini 1800 Portable Alpha Monitor

The Mini 1800 is a hand held alpha survey instrument, which can be used for sweeping area for contamination. Due to the short distance that alpha particles can travel through the air, this instrument is suitable only for survey of flat surfaces, or for counting smears in the field. The mini 1800 utilizes a ZnS scintillator. The counting efficiency for ^{241}Am is 33%. The counting efficiency for NORM/TENORM alpha emitters will be determined. The sensitivity is 17 cps.

8. Gross Alpha/Beta Counter, either:

Ortec MPC2000 Desktop Gross Alpha/Beta Counter or The MPC2000 is a desktop gross alpha/beta counter, which is suitable for counting smear samples of up to 2 inches in diameter. It can be utilized with either a gas flow proportional detector or a ZnS scintillator. The ZnS detector is preferred for ease of use. The MPC2000 is suitable for counting one sample at a time. The MPC2000 has printing and data-logging capabilities and can interface with a PC. Counting efficiency for ^{239}Pu using the gas flow proportional detector is 95% Counting efficiency for NORM/TENORM alpha and beta emitters will be determined. Alpha background detection is typically 0.1cpm. Count times can be adjusted from 0->9,999 minutes.

Ludlum Model 2939 Alpha/Beta Scaler with Model 43-10-1 Alpha Beta Sample Counter

This unit is a desktop instrument suitable for counting individual smears for alpha and beta activity. The model 43-10-1 alpha beta sample counter utilizes a ZnS scintillator. Typical counting efficiencies for alpha are: 37% - ^{230}Th and for 39% ^{238}U. Counting efficiency for other NORM/TENORM alpha and beta emitters will be determined. Alpha background detection is typically 3 cpm. Count times can be from 0-99 minutes.

CDPHE Comment 6 –

It is our expectation that the facility will have a full-time Radiation Safety Officer (RSO) on-site. Please describe the availability and level of supervision for the RSO. There are many places in the application where the RSO can designate another unspecified employee to perform radiation safety functions. Please provide the name(s) and qualifications of the person(s) who will perform as an assistant to the RSO by performing these designated radiation safety functions.

Clean Harbors Response: CHDT has secured the assistance of Dade Moeller & Associates, on an interim basis, to provide RSO coverage, and to help recruit a full time RSO for Clean Harbors Environmental Services, Inc. The RSO hired by Clean Harbors will be based at the Deer Trail facility. This individual is anticipated to be hired prior to receipt of waste. In the interim, Mr. Tracy A. Ikenberry, CHP, of Dade Moeller & Associates will serve as the Deer Trail RSO. Mr. Ikenberry's full resume is provided in Attachment A.

In developing the application, Clean Harbors has determined that some of the tasks to be performed with regards to radiation safety do not need to be performed by the RSO himself. They could be

performed by a properly trained technician, and, as such, believe these tasks could be delegated by the RSO as indicated in the application. At this time, Clean Harbors has not delegated or trained any of the site employees on these tasks and cannot provide their names and qualifications at this time. Full qualification and training will be in place prior to acceptance of NORM/TENORM waste at the facility.

CDPHE Comment 7 –

The application does not contain information on the preoperational monitoring for specific radioactive isotopes, other than radium as required by RH 14.26.1. The background concentrations of the uranium and thorium decay series are not described. Concentration descriptions are needed for all environmental media: air, soil, and water.

You need to start taking samples and producing a statistical population of independent measurements over time for air and water media. A background, or ambient, description of soil concentrations can be initially performed in one sampling event.

The suggested initial analytical suite for radioactive isotopes is:

Thorium-232	**Uranium-238**	**Radium-228**	**Lead-210**
Thorium-230	**Uranium-234**	**Radium-226**	**Gross Alpha**
Thorium-228.	**Uranium-235**		**Gross Beta**

Other analyses may be required.

The Department suggests you begin taking ground water samples each month for analysis. It is also suggested you set up an initial air sampling program of several monitoring stations about the facility. Gamma spectroscopy analytical techniques may be used. Air sampling should be conducted at 20-40 cubic feet per minute (CFM). The sampling filters should be changed twice a week and filters from each station composited monthly for analysis. The data should be reviewed at three-month intervals.

The Department invites you to come in and discuss these environmental monitoring issues at more length. There are options, which you may wish to consider.

Clean Harbors Response: Clean Harbors has contracted with Cameron-Cole, LLC of Boulder, Colorado and ENSR of Fort Collins Colorado to assist in preparing the background monitoring plans and sample collection for air, soil and groundwater. Mr. Tony Carmeli, P.G., Senior Hydrologist with Cameron-Cole and his staff have been in contact with Mr. Edgar Ethington P.G., Geologist with the Hazardous Materials and Waste Management Division to discuss the groundwater and soil background monitoring plan and sampling. The sampling suite has been amended to include man made radionuclides. Cameron-Cole will present the groundwater and soil sampling plans to Mr. Ethington for review and comment prior to implementing the sampling. CHDT is working with Mr. David Stewart, ENSR Fort Collins in conducting an Air Dispersion Model for the facility. This model will be used to establish sampling locations for the ambient air samplers. These samplers will be high volume TSP samplers that will be designed, operated, maintained and calibrated in accordance with the EPA 40 CFR 50 Appendix B, "Reference Method for the Determination of Particulate Matter in the Atmosphere ". The meteorological instrumentation to be specified will comply with the requirements of the EPA Quality Assurance Handbook for Air Pollution Measurement Systems Volume IV,

Meteorological Measurements. The Ambient Air Plan will be submitted to CDPHE for review and comment prior to implementation.

CDPHE Comment 8 –

The following Standard Operating Procedures (SOP) were referenced in SOPs contained in Attachment A of the license application but were not included as part of the application:

A. Standard Operating Procedure on Air Sampling
B. Standard Operating Procedure Screening Waste Samples for Radioactivity in the Laboratory.

CHDT Response:

Clean Harbors Response: CHDT is in the process of reviewing and correcting "ATTACHMENT A" to the "Radioactive Materials License Application." We have discovered inconsistencies in terminology and references in some of the Standard Operating Procedures contained in this section. Clean Harbors will correct the inconsistencies and resubmit the SOPs for review by the Department in the near future.

If you have any questions, please feel free to call Mike Webb at the facility or me at (661) 762-6200.

Sincerely

David B. Nielsen, PE
Director of Landfill Compliance
Clean Harbors Environmental Services, Inc.

DBN:dbn

Attachments:

Table 1 Radioactive Waste List
Attachment A - RSO Resume

Table 1. Radioactive Waste List
Clean Harbors Deer Trail, LLC

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.

ATTACHMENT A