

Sandia National Laboratories Albuquerque, New Mexico December 10, 2008

DOE/Sandia Responses to NMED “Notice of Disapproval: Mixed Waste Landfill Corrective Measures Implementation Plan, November 2005 Sandia National Laboratories, NM5890110518 SNL-05-025”

INTRODUCTION

This document responds to comments received in a letter from the New Mexico Environment Department (NMED) to the U.S. Department of Energy (DOE) and Sandia Corporation (Sandia) dated October 10, 2008 regarding the Corrective Measures Implementation (CMI) Plan for the Mixed Waste Landfill (MWL) at Sandia National Laboratories/New Mexico (SNL/NM). The letter is entitled “Notice of Disapproval: Mixed Waste Landfill Corrective Measures Implementation Plan, November 2005 Sandia National Laboratories, NM5890110518 SNL-05-025”. This Notice of Disapproval (NOD) is a result of the NMED review of an earlier DOE/Sandia response to an NOD (dated November 20, 2006). The earlier response by the DOE/Sandia was submitted in two parts dated December 15, 2006, and January 19, 2007. The NMED has identified several deficiencies that required additional information or resolution. The deficiencies are listed in two parts.

This document lists each NMED comment, and the DOE/Sandia response to that comment. The NMED comment is listed in boldface, followed by the DOE/Sandia response, written in normal font under “Response”.

Part 1 Comments

Comment 1: In response to NOD Comment 17, Permittees state that “[t]he mature, secondary plant community will be achieved when greater than 50% of the photosynthesizing foliar coverage is comprised of grass species native to the general TA-III area”. Russian thistle (tumbleweed) should not be allowed to be part of the foliage on the cover and should not count as part foliar coverage used as a measure for acceptable establishment of vegetation. NMED expects any tumbleweed that grows on the cover to be removed periodically as part of the long-term maintenance.

Response 1: DOE/Sandia offer a counterproposal that Russian-thistle, *Salsola tragus* (scientific name change from *Salsola kali*) be allowed as part of the foliage on the cover during the establishment of the mature, secondary plant community. Russian-thistle is a nonnative transitory species, but can be beneficial when rehabilitating disturbed sites. It is frequently an unwanted species on such sites, but disturbed sites often recover more quickly when Russian-thistle is left on-site because its presence accelerates the rate of revegetation (Howard, 1992).

Howard (1992) also states that if topsoil remains on the site, Russian-thistle roots are readily invaded by mycorrhizal fungi harbored in the soil. Russian-thistle does not form mycorrhizal associations, and fungal invasion results in the death of the infected root. The fungi consequently invade other Russian-thistle roots. Russian-thistle populations decline, but mycorrhizal fungus populations increase and subsequently invade the mycorrhizal association-forming species which comprise the next stage of plant succession. These species usually flourish as a consequence of increased mycorrhizal fungus populations. If topsoil is gone, however, Russian-thistle can dominate disturbed sites for up to 10 years. Such sites benefit more from the addition of topsoil than the removal of Russian-thistle. This reference and further information on *Salsola* can be found at <http://www.fs.fed.us/database/feis/plants/forb/salkal/all.html>.

During the establishment of the mature, secondary plant community, the DOE/Sandia propose the use of supplemental watering in order to facilitate the development of the native plant species.

Comment 2: Also in response to NOD Comment 17, the Permittees did not indicate the extent of foliar coverage that would represent acceptable establishment of vegetation on the final landfill cover. Propose a percentage of foliar cover relative to the total surface area of the landfill cover that will be considered as representative of acceptable establishment of foliage. Indicate also the size (in square feet) of any barren areas that would be considered unacceptable and would thus require re-seeding and/or other corrective measures to improve the foliar coverage of the barren areas.

Response 2: As proposed in the Long-Term Monitoring and Maintenance Plan (LTMMMP), the operational criteria for achieving successful revegetation for the MWL cover under average annual precipitation conditions are as follows:

- The proposed percentage of foliar cover relative to the total surface area of the landfill cover that will be considered as representative of acceptable establishment of foliage is 25 percent (i.e., 25 percent of the land surface is covered with living plants). Of the 25 percent total foliar coverage, 50 percent or greater comprises native perennial species and less than 50 percent comprises annual species (including nonnative, transitory species).
- No contiguous bare spots greater than 200 square feet (approximately 14 by 14 feet) would be acceptable, and such bare spots would require re-seeding and/or other corrective measures to improve the foliar coverage.

Part 2 Comments

Comment 1: In response to NOD Comment 4, the Permittees state that future infiltration rates through the MWL cover (based on the natural analogue) would be less than the current infiltration rates (based on the engineered cover). This reduction in the future infiltration rates presumably is due to the increased evapotranspiration caused by increasing porosity and hydraulic conductivity of the landfill cap as it reverts to natural soil conditions. While this process may occur, it is not clear how this conclusion was reached. Clarify if the anticipated increase in evapotranspiration is based on empirical data (i.e., actual infiltration and/or groundwater recharge data from areas with natural soil), modeling simulations, or another method.

Response 1: The anticipated increase in evapotranspiration is based on empirical data and site-specific data that were used in the Unsaturated Water and Heat Flow (UNSAT-H) code model simulations. Daily potential evapotranspiration (PET) values were calculated using the Hydrologic Evaluation of Landfill Performance (HELP) code Version 3 (Schroeder et al. 1994) with its embedded functions and database for Albuquerque, New Mexico (Peace and Goering, 2005). Site-specific data such as root depth, root length density, leaf area index, growing season and percent bare area were used in the vegetative input for the UNSAT-H code. Soil hydraulic properties used in the UNSAT-H code for the natural analogue and the engineered cover were obtained from site-specific empirical data obtained from the instantaneous profile (IP) test site that was located near the MWL.

Comment 2: In response to NOD Comment 6, Section 4, Pages E-59 and E-59a, the Permittees indicate that monitoring triggers are considered preliminary and are to be finalized in the Long-Term Monitoring and Maintenance Plan (LTMMP). This is not an acceptable approach, as the NMED Secretary’s Final Order issued on May 25, 2006 requires that the triggers be developed as part of the CMI Plan. The relevant part of the Final Order states: “As part of the Corrective Measures Implementation Plan that incorporates the remedy (described in the draft permit modification in Paragraph V.3), Sandia shall additionally include the following: ..., b) triggers for future action, that identify and detail specific monitoring results that will require additional testing or the implementation of an additional or different remedy.”

Although the trigger levels and the environmental media that they apply to must be established as part of the CMI Plan, the specific methods, locations, and frequencies

of monitoring, and other related details can be established through approval of the LTMMP. Trigger levels, once accepted by the NMED through its review and approval of the CMI Plan, must be incorporated into the proposed LTMMP.

Additionally, the trigger evaluation process described in Section 4 and in Figure E-25 (of pages E-59 and E-59a), and as revised by the Permittees' response, is not an acceptable approach. In NOD Comment 6, and again through this Notice of Disapproval, the Permittees are instructed to revise the trigger evaluation process to follow the corrective action process described in the Consent Order (April 29, 2004) if a trigger level is exceeded, provided the Consent Order is still in force at the time. If the Consent Order has terminated, the trigger evaluation process should follow the corrective action process described in the Facility Permit. The Permittees should repeat sampling to confirm if a trigger level has been exceeded. Repeat sampling should be the primary means to avoid implementation of corrective action based on false positives.

Response 2: Revisions to trigger levels are discussed in Response 7, below.

In addition, DOE/Sandia would like to withdraw Section 4.1, Appendix E entitled "Trigger Evaluation Process from the CMI Plan". This section includes Figure E-25 entitled "Trigger Evaluation Process for the Mixed Waste Landfill". The methods by which the analytical data and any trigger level exceedances will be evaluated will be addressed in the revised LTMMP.

Comment 3: In NOD Comment 9, the NMED concluded that the neutron probes will only be able to evaluate soil moisture at depths in the vadose-zone that are considerably deeper than the base of the soil cover. Because it would take substantial time for moisture to move through the vadose zone to the depths of the neutron probe access tubes, and because the current design does not monitor for breakthrough of moisture from the cover to the waste, NMED does not agree that such moisture monitoring offers the best possible design for an early warning system. Thus, NMED will place more emphasis on other types of monitoring in the LTMMP. No response is required by the Permittees for this comment.

Response 3: No response required.

Comment 4: In NOD Comment 14, the Permittees indicate that soil samples from animal burrows and ant hills will be collected every five years. NMED believes that every five years is too long of an interval between sampling events given that the MWL remedy and fate and transport model are to be re-evaluated every five years in accordance with the Final Order. The Permittees' current proposal involves only one round of sampling results to be available for each five year re-evaluation. The Permittees must propose a sampling frequency with a shorter interval between sampling events.

Response 4: DOE/Sandia will revise this sampling frequency to occur annually, if these features are found to exist following the annual inspection and survey, and there is adequate sample volume.

Comment 5: In NOD Comment 15, NMED indicated that soil gas in the vadose zone was to be monitored for tritium, radon, PCE, and total VOCs. The Permittees plan to install a FLUTE™ vadose zone soil-gas monitoring system around the MWL for VOCs, and propose trigger levels of 20 parts per million by volume (ppmv) for trichloroethylene (TCE) and tetrachloroethylene (PCE), and 25 ppmv for total VOCs to ensure protection of groundwater. However, the Permittees did not agree to monitor for tritium or radon in the soil gas on the basis that the data would be of limited value, and that the NMED did not have the authority to require monitoring of these radioactive constituents. Note that the U.S. Environmental Protection Agency (EPA) and NMED regulates gross beta in groundwater through drinking water standards. Tritium and some isotopes of radon are beta emitters. Furthermore, NMED disagrees that the data would be of limited value, as NMED believes that concentration trends are useful indicators of contamination migration. Thus, NMED expects the Permittees to monitor for tritium and radon in soil gas in the vadose zone. The Permittees must specify trigger levels for radon and tritium for soil gas in the vadose zone.

Response 5: On November 13, 2008, the NMED clarified in a personal communication (Griffith, 2008) that DOE/Sandia will not be required to sample for radon and tritium in subsurface soil-vapor samples nor specify trigger levels for radon and tritium in soil vapor in the vadose zone. Thus, no response is required.

Comment 6: In NOD Comment 19, NMED asked that the Permittees propose additional monitoring points at locations (surface and subsurface) within the landfill where contaminants were detected at their highest levels during the RCRA Facility Investigation of the MWL. No additional sampling was proposed by the Permittees, chiefly on the basis that intrusive monitoring techniques could possibly compromise cover integrity. However, NMED believes that additional monitoring points can be located within the landfill, and that such monitoring can be conducted without necessarily driving heavy vehicles over the landfill surface. The Permittees shall propose additional monitoring points at locations within the landfill where radon, tritium, and VOCs were detected at their highest levels during the RCRA Facility Investigation. These monitoring locations should consider air, surface soil, and subsurface soil as media to be monitored.

Response 6: On November 5, 2008, the NMED clarified in a personal communication (Griffith, 2008) that the subsurface samples refer to soil-vapor samples collected in the subsurface. DOE/Sandia proposes to install two permanent soil-vapor sampling points within the landfill boundary. The LTMMP will be revised to include sample collection points within the landfill boundary (on the cover) for air, surface soil, and soil vapor.

Soil-vapor samples will not be analyzed for radon and tritium (see Response 5).

Trigger levels for constituents in soil vapor will apply only to samples collected from the deepest sample points (i.e. from the 400-foot sample ports of the FLUTE™ vadose zone soil-vapor monitoring system installed around the perimeter of the cover).

Comment 7: In NOD Comment 18, and in Table 2 of the Permittees' January 19, 2007, responses to the NOD for Comment 20, Permittees did not agree to lower the trigger levels for the VOCs 1,1,1-TCA, ethylbenzene, styrene, toluene, and total xylenes (in groundwater). The Permittees continue to propose trigger levels based on one-half of the value of EPA Primary Drinking Water Standards, and state that there are no regulatory or technical reasons for further reducing the trigger levels for these VOCs. The Permittees also argue that there are analytical difficulties with measuring low concentrations of VOCs in groundwater which could lead to false detections of contaminants.

NMED finds that some of the proposed trigger levels are unacceptable because they fall within three general categories: a) they fail to take into account Consent Order (April 29, 2004) requirements for groundwater cleanup levels; b) they are erroneous; or c) they do not address all constituents of concern for the MWL. These deficiencies are discussed more specifically below. NMED also proposes alternative trigger levels for those considered to be unacceptable in the tables provided below.

A. Consent Order Requirements for Cleanup Levels

The Permittees assert that regulations do not require the cleanup of groundwater to concentrations that are below water quality standards; hence, setting trigger levels at one-half the water quality standard is adequate to protect groundwater. However, NMED may require corrective action at any solid waste management unit (SWMU) as necessary to protect human health and the environment from releases (20.4.1.500 NMAC incorporating 40 CFR 264.101). This is true even in cases where groundwater is known to be contaminated at levels below water quality standards. Additionally detection and prevention of the contamination of groundwater at any concentration should be the main goal of long-term monitoring at the MWL.

Any given trigger level applicable to groundwater beneath the MWL should be based on the appropriate water quality standard, which in general will be the most stringent of a state or federal standard for the constituent of interest. Section VI.K.1.a of the Consent Order states that “[g]roundwater cleanup levels are based on the WQCC standards and EPA MCLs for drinking water Contaminants. If both a WQCC standard and a MCL have been established for an individual substance, then the most stringent of the two levels shall be considered the cleanup level for that substance...If a WQCC standard or MCL has not been established for a specific substance, the EPA Region VI Human Health Medium Specific Screening Level for tap water shall be used as the screening level.

The purpose of establishing trigger levels is to provide for early warning of any unexpected releases so that action can be taken to prevent groundwater contamination, and especially to prevent contamination from exceeding a water quality standard. Groundwater investigations can take considerable time to complete; often such investigations may take many years. Thus, to be useful as part of an early warning system, trigger levels are generally set much lower than their corresponding standards, and especially in cases where standards are much higher than laboratory analytical detection limits.

For these reasons, NMED believes one-half of a water quality standard is too high for a trigger level for a give groundwater constituent where the standard is greater than about 0.040 mg/L. In cases where the standard is greater than 0.040 mg/L, NMED proposes that the trigger level for a groundwater constituent should be set at one-quarter (25%) of the standard, which should be sufficiently higher than most detection limits such that false positives should be uncommon. However, in the case of naturally occurring constituents, it may be necessary to set the trigger level to corresponding background levels whenever 25% of the standard falls below the approved maximum background concentration for the area.

The trigger levels for 1,1,1-TCA; 1,1-dichloroethene, toluene, vinyl chloride, total xylenes, chlorobenzene, ethylbenzene, styrene; cis 1,2-dichloroethene; trans 1,2-dichloroethene, and method 8260 VOCs in groundwater are not acceptable as they are not based on the lowest concentration of the applicable EPA MCL, WQCC standard, or if an applicable MCL or WQCC standard does not exist, the applicable EPA Region 6 Human Health Medium Specific Screening Level for tap (residential) water. NMED proposes alternate trigger levels for these constituents in the table below. The NMED's proposed alternate trigger levels should be incorporated into Table E-6 of Appendix E of the CMI Plan.

Environmental Medium	Parameter	NMED proposed trigger level	Comments
Groundwater	1,1,1-TCA	0.015 mg/L	25% of WQCC standard (0.060 mg/L)
Groundwater	1,1-dichloroethene	0.0025 mg/L	50% of WQCC standard (0.005 mg/L)
Groundwater	toluene	0.1875 mg/L	25% of WQCC standard (0.750 mg/L)
Groundwater	vinyl chloride	0.0005 mg/L	50% of WQCC standard (0.001 mg/L)
Groundwater	total xylenes	0.155 mg/L	25% of WQCC standard (0.620 mg/L)
Groundwater	chlorobenzene	0.025 mg/L	25% of EPA MCL
Groundwater	ethylbenzene	0.175 mg/L	25% of EPA MCL
Groundwater	styrene	0.025 mg/L	25% of EPA MCL
Groundwater	cis 1,2-dichloroethene	0.0175 mg/L	25% of EPA MCL
Groundwater	trans 1,2-dichloroethene	0.025 mg/L	25% of EPA MCL
Groundwater	method 8260 VOCs	50% of the most stringent of EPA MCL, WQCC	As explained in the column to the left.

		standard, or EPA Region 6 Human Health Medium Specific Screening Level for tap water, as applicable. Trigger level to be set at 25% of the standard if the standard is greater than 0.040 mg/L.	
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B. Erroneous Trigger Levels

The trigger levels for cadmium and mercury in surface soil are not acceptable for the reasons indicated in the column for “Comments” in the following table. NMED also proposes alternate trigger levels for these constituents in the following table. The alternate trigger levels are based on NMED industrial/occupational soil screening levels. The NMED’s proposed alternate trigger levels should be incorporated into Table E-6 of Appendix E of the CMI Plan.

Environmental Medium	Parameter	NMED proposed trigger level	Comments
Surface soil	cadmium	564 mg/kg	Screening value was listed incorrectly in Table 2.
Surface soil	mercury	6.84 mg/kg	Screening value for methyl mercury is more conservative. Use of elemental mercury not supported by waste inventory.

C. Additional Metals of Concern at the MWL

For each given medium listed in the left-most column of the table below, add the following additional constituents and their corresponding trigger levels to Table E-6 of Appendix E of the CMI Plan. The trigger levels for soil are based on NMED industrial/occupational soil screening levels. The NMED’s proposed additional trigger levels should be incorporated into Table E-6 of Appendix E of the CMI Plan.

Environmental Medium	Parameter	NMED proposed trigger level
Surface soil	Copper	45,400 mg/kg
Surface soil	Nickel	22,700 mg/kg
Surface soil	Vanadium	1,140 mg/kg

Surface soil	Zinc	100,000 mg/kg
Surface soil	Cobalt	20,500 mg/kg
Surface soil	Beryllium	2,250 mg/kg
Groundwater	Chromium (total)	0.043 mg/L (background)
Groundwater	Cadmium	0.0025 mg/L (50% of EPA MCL)
Groundwater	Nickel	0.050 mg/L (25% of WQCC standard of 0.2 mg/L)
Groundwater	Dichlorodifluoromethane	0.0975 mg/L (25% EPA Region 6 screening level for compound)
Groundwater	tritium	4 mrem/year (EPA MCL)
Groundwater	radon	300 pCi/L (proposed EPA MCL)

Response 7: DOE/Sandia applied the formula proposed by the NMED to determine the trigger levels for method 8260 VOCs in groundwater. The following table details the NMED proposed trigger levels for method 8260 VOCs in groundwater with an additional third column representing the DOE/Sandia agreement to apply those without a cited trigger value and includes a DOE/Sandia counterproposal for the following four (4) VOC trigger levels: bromodichloromethane, dibromochloromethane, cis-1,3-dichloropropene, and trans-1,3-dichloropropene.

Table 1. Proposed Trigger Levels for VOCs in Groundwater

Analyte	NMED Proposed Trigger Level (µg/L)	DOE/Sandia Counterproposal Trigger Level (µg/L)
1,1,1-Trichloroethane (1,1,1-TCA)	15	
1,1,2,2-Tetrachloroethane	5	
1,1,2-Trichloroethane	1	
1,1-Dichloroethane	12.5	
1,1-Dichloroethene	2.5	
1,2-Dichloroethane	2.5	
1,2-Dichloropropane	2.5	
2-Butanone (methyl ethyl ketone)	1775	
2-Hexanone	none	
4-methyl-, 2-Pentanone (Methyl isobutyl ketone)	500	
Acetone	1375	
Benzene	2.5	
Bromodichloromethane	0.09	0.9
Bromoform	4.25	
Bromomethane	4.25	
Carbon disulfide	250	
Carbon tetrachloride	2.5	
Chlorobenzene	25	
Chloroethane (ethyl chloride)	1.95	
Chloroform	25	
Chloromethane	48	
Dibromochloromethane	0.065	0.65
Ethyl benzene	175	
Methylene chloride	2.5	
Styrene	25	
Tetrachloroethene (PCE)	2.5	
Toluene	187.5	
Trichloroethene (TCE)	2.5	
Vinyl acetate	103	
Vinyl chloride	0.5	
Xylene	155	
cis-1,2-Dichloroethene	17.5	
cis-1,3-Dichloropropene (1,3-Dichloropropene)	0.2	2.0
trans-1,2-Dichloroethene	25	
trans-1,3-Dichloropropene	0.2	2.0

The proposed trigger levels for bromodichloromethane, dibromochloromethane, cis-1,3-dichloropropene, and trans-1,3-dichloropropene are less than the method detection limit of the contract analytical laboratory. Accordingly, the DOE/Sandia offer a counterproposal for these constituents based on the following considerations:

- The NMED triggers levels for these carcinogens were selected using the EPA Region 6 Human Health Medium Specific Screening Level for tap (residential) water per NMED Comment 7 criteria, which uses a target cancer risk of 1.0E-06.
- DOE/Sandia propose to adjust these triggers to use the target cancer risk of 1.0E-05 as presented in the NMED Soil Screening Levels (June 2006).

The revised triggers levels increase by an order of magnitude, as a result of using the higher target cancer risk.

In reference to the surface soil trigger levels listed in Comment 7, Table B, Erroneous Triggers Levels, the DOE/Sandia will apply the cadmium trigger level of 564 mg/kg in surface soil samples.

The trigger level value for methyl mercury as it appears in Comment 7 is assumed to be incorrect. DOE/Sandia will use a corrected value of 68.4 mg/kg for industrial/occupation soil (NMED Soil Screening Levels, June 2006).

The DOE/Sandia agree to apply the proposed trigger levels listed in Comment 7, Table C, Additional Metals of Concern at the MWL.