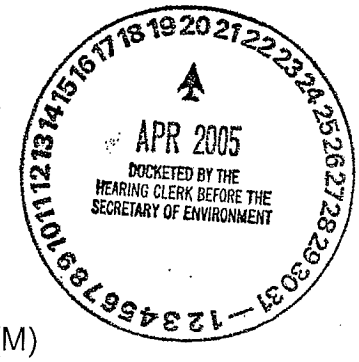

STATE OF NEW MEXICO
BEFORE THE SECRETARY OF ENVIRONMENT

IN THE MATTER OF REQUEST FOR A CLASS 3 PERMIT MODIFICATION FOR CORRECTIVE MEASURES FOR THE MIXED WASTE LANDFILL SANDIA NATIONAL LABORATORIES BERNALILLO COUNTY, NEW MEXICO EPA ID NO. NM5890110518

No. HWB 04-11(M)

HEARING OFFICER'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW

FINDINGS OF FACT

I. Procedural History

1. NMED issued Public Notice No. 04-11 on August 11, 2004, providing notice of a proposed modification to the permit it issued to the United States Department of Energy and Sandia Corporation ("collectively Sandia") for Sandia National Laboratories ("SNL") under the New Mexico Hazardous Waste Act ("HWA"); a draft permit with terms and conditions for a proposed corrective measures or remedy for the SNL Mixed Waste Landfill ("landfill"); and a fact sheet explaining procedures and facts underlying the proposed corrective measures for the landfill. NMED Exhibits 1, 2, 3.

2. The Public Notice announced the availability of the Draft Permit for public review; a 90 period for public comment on the draft; the setting of a public hearing on the Draft Permit beginning December 2, 2004 in Albuquerque, New Mexico; the procedures for public participation, participation as a party and providing technical testimony. NMED Exhibit 1.

3. The Public Notice was published in accordance with the requirements of Sections 20.4.1.901 NMAC and 20.1.4 NMAC. AR 04-081.

4. NMED, DOE and Sandia, Citizen Action, Eric Nuttall and WERC filed Statements of Intent to Present Technical Testimony.

5. NMED held the public hearing December 2, 3, 8, and 9, 2004 at the Radisson Hotel, 2500 Carlisle NE in Albuquerque, NM. TR 1-1406.

6. Jennifer Pruett presided over the hearing, pursuant to a delegation of authority from NMED Secretary Ron Curry dated October 7, 2004. Notice of Docketing and Hearing Officer Assignment.

7. Each of the parties presented their direct cases at the hearing, were allowed to cross-examine witnesses, and were allowed an opportunity for rebuttal. TR 1-1406.

8. The Hearing Officer allowed the public opportunities throughout the hearing to cross-examine witnesses, present comments and submit written statements. Approximately 30 people provided comment at the hearing. The public mailed to the Secretary or Hearing Clerk more than 350 postcards encouraging excavation and clean-up of the landfill (without any statements, technical data or other information supporting the recommendation). TR 1-1406.

9. NMED and others have held several public information meetings concerning the landfill. NMED Exhibit 5, pages 18-22.

II. Regulatory Framework

10. The Resource Conservation and Recovery Act governs the regulation of hazardous waste. 42 USC Section 6901 et seq.

11. On April 16, 1985, pursuant to Section 3006 of RCRA, 42 USC Section 6926, EPA delegated to NMED by delegation numbers 8-31 and 8-32 the authority to enforce the Hazardous Waste Act ("HWA"), NMSA 1978 Section 74-4-1 et seq. and its

implementing regulations, the New Mexico Hazardous Waste Management Regulations ("HWMR"), 20.4.1 NMAC, in lieu of EPA RCRA enforcement. To a large extent, the HWMR incorporate by reference federal regulations found in 40 CRF Parts 260 through 279 promulgated under RCRA. AR 04-076, pp. 1-2; 20.4.1 NMAC.

12. NMED has maintained its delegation from EPA over hazardous waste management in New Mexico and from time to time has amended its state program to conform to statutory or regulatory changes in RCRA.

13. EPA delegated to NMED on January 2, 1996 authority to enforce corrective action requirements under the federal Hazardous and Solid Waste Amendments. 61 Fed. Reg. 2450.

14. Section 74-4-4.2 of the HWA requires all permits issued after April 8, 1987 to require corrective action for all releases of hazardous waste or constituents from any Solid Waste Management Unit ("SWMU") at a facility seeking a permit. A SWMU is any discernible unit at which solid waste has been placed at any time, from which NMED determines there may be a risk of release of hazardous waste or hazardous constituents, regardless of whether the unit was intended for the management of solid or hazardous waste. 40 CFR Part 264, Subpart F (40 CFR Sections 264.90 to 101) (incorporated by 20.4.1.500 NMAC) governs releases from SWMUs. 61 Fed. Reg. 19431, 19442-43 (May 1, 1996); Consent Order, Section III.B (NMED Exhibit 24).

15. The landfill is SWMU 76 at SNL, and regulated under 20 CFR Section 264.101 (incorporated by 20.1.4.500 NMAC) TR 968-69; AR 04-077.

16. 40 CFR Section 264.101(a) requires that corrective action be taken at a SWMU "as necessary to protect human health and the environment for all releases of

hazardous waste or constituents from any [SWMU] at the facility, regardless of the time at which the waste was placed in such unit."

17. The corrective action process at the landfill is now governed in large part by an enforceable Consent Order entered into by NMED, DOE and Sandia dated April 29, 2004. NMED Exhibit 24.

18. While the Consent Order, by its terms, does not apply to radionuclides, Sandia has committed to voluntarily include information on radionuclides in the corrective action process. NMED Exhibit 24.

19. Post-closure care under the HWMR continues for 30 years after closure, although NMED may extend the post-closure period if necessary to protect human health and the environment. 20.4.1.500 NMAC (incorporating 40 CFR Section 264.117(a).

20. 40 CFR Part 264 does not apply to the landfill as it is not included in any Part B permit, and 40 CFR Part 265 does not apply to the landfill as it is not an interim status facility in SNL's Part A permit application. TR 969.

III. Regulatory History of the Landfill

21. NMED issued a hazardous waste permit for storage of hazardous waste at SNL on August 6, 1992. The permit requires Sandia to take corrective action in accordance with applicable requirements. AR 04-076, p. 2.

22. On January 23, 2004, Sandia requested a Class 3 modification under 40 CFR Section 270.42. NMED Exhibit 1.

23. NMED proposes to modify Module IV of the permit to: a) incorporate by reference the CMS Report dated May 2003 prepared by Sandia; b) select a vegetative soil cover

with bio-intrusion barrier as the remedy for the landfill; c) requires a Corrective Measures Implementation ("CMI") Plan for the landfill that incorporates the final remedy and provides implementation schedules, that Sandia must submit to NMED within 180 days of final remedy selection; d) requires Sandia to submit progress reports during implementation of the remedy; e) requires Sandia to submit a CMI Report for the landfill to NMED for approval within 180 days after implementation of the remedy is complete; and f) requires that Sandia submit a long-term monitoring and maintenance plan to NMED for approval. NMED Exhibit 3.

IV. Site Description

A. General Site Description and Climate

24. SNL is located within the boundaries of Kirtland Air Force Base ("KAFB"), immediately south of the City of Albuquerque in Bernalillo County. SNL's research and administration facilities occupy 2,842 acres of KAFB, and are divided into 5 Technical Areas ("TA"). AR 03-035.

25. The landfill comprises 2.6 acres in the north-central section of TA-3, with 2 distinct disposal areas. AR 03-035. 2.0 acres comprises the unclassified area, and 0.6 acres makes up the classified area. NMED Exhibit 5, p. 4, TR 905.

26. The climate at the landfill is typical of high-altitude, dry continental areas. The average annual precipitation is about 8.5 inches. Most of the precipitation occurs during heavy thunderstorms in the summer months. TR 904.

27. Vegetation at the landfill is sparse and includes sage, tumbleweed, grasses and several varieties of small cactus. TR 905.

28. The landfill surface topography is relatively flat, with elevations ranging from 5,385 feet above sea level on the east side of the site to 5,375 feet on the west side. No significant drainage features exist on or near the site. TR 905.

B. Operational History of the Landfill

29. The landfill opened in March 1959 as the "TA-3 low-level radioactive waste dump". In an April 1988 environmental survey report prepared by DOE, it was referred to as a "mixed waste site" and has since been referred to as the TA-3 Mixed Waste Landfill. TR 904.

30. From March 1959 to December 1988 the landfill accepted radioactive waste and mixed waste from SNL research facilities and off-site generators including approximately 100,000 cubic feet of radioactive waste containing 6,300 curies ("Ci") of activity at the time of disposal TR 904.

31. Wastes in the classified area were disposed of in a series of unlined, vertical, cylindrical pits. Historical records indicate that early pits were 3 to 5 feet in diameter and 15 feet deep; later pits were 10 feet in diameter and 25 feet deep. Once pits were filled with waste, they were backfilled with soil and capped with concrete. TR 905.

32. Wastes in the unclassified area were disposed of in a series of shallow, unlined, north-south trenches. Records indicate that trenches were 15-25 feet wide, 150-180 feet long, and 15-20 feet deep. Trenches were partially backfilled with soil on a periodic basis and, once completely filled with waste, were capped with soil that had been stockpiled from local sources. TR 905-06.

33. Between 1959 and 1962, chemical wastes were disposed of in Pit 1, which is located in the southeast corner of the classified area. In 1962, SNL established the

Chemical Waste Landfill ("CWL") for disposal of chemical wastes. Because of the existence of the CWL and the disposal records for the landfill that exist, it appears that little hazardous waste was disposed of in the unclassified area of the landfill after 1962. TR 906.

34. In 1967, approximately 204,000 gallons of coolant wastewater from the SNL Engineering Reactor Facility were discharged into Trench D. Prior to 1975, liquid radioactive wastes were disposed in the landfill without solidification or other treatment. In 1975, up to 5,000 gallons of potable water were used to extinguish a fire in Trench B; however the exact quantity of water is unknown. TR 906.

35. From 1989 to 1996, the southern half of unclassified area was used for temporary, aboveground storage of containerized, low-level radioactive and mixed waste; this area was referred to as the Interim Storage Site ("ISS"). TR 79.

36. Waste was commonly contained in tied, double polyethylene bags, sealed metal military containers of various sizes, fiberboard drums, wooden crates. cardboard boxes, 55-gallon drums, and 55-gallon polyethylene drums for disposal. Larger items, such as glove boxes, spent fuel-shipping casks, and contaminated soils, were disposed of in bulk without containment. TR 907-08.

C. Geology and Hydrology

37. SNL is located on the eastern margin of the Albuquerque Basin, which is one of a series of north-south trending basins that developed as a result of the formation of the Rio Grande Rift. The Albuquerque Basin is filled with a thick sequence of unconsolidated sediments, which thin toward the edges of the basin. Alluvial fan deposits overlie fluvial deposits throughout most of the central and eastern portions of

KAFB. There are 4 major faults on the east side of KAFB: the Sandia, West Sandia, Hubbel Springs, and Tijeras Faults. TR 908-09.

38. The Albuquerque metropolitan area utilizes groundwater from the Albuquerque Basin as the principal source of its water supply. The major fresh water aquifers in the Basin are located within the upper Santa Fe Group, and the majority of Albuquerque's wells are also completed in this unit. TR 909.

39. The landfill rests on alluvial fan deposits, which consist chiefly of fine-grained to medium-grained silty sands and occasional lenses of gravel, and contain an upper relatively coarser-grained sequence extending from surface to a depth of approximately 310 feet, and a lower finer-grained sequence. TR 909.

40. Monitoring wells MWL-BW1, MWL-MW1, MWL-MW2, MWL-MW3 and the upper screen in MWL-MW4 are screened in the finer-grained unit. Monitoring well MWL-MW5 and the lower screen in MWL-MW4 are screened across the contact between the finer-grained unit and underlying coarser-grained sediments. Monitoring well MWL-MW6 is screened entirely in coarser-grained sediments. TR 909.

41. Groundwater flow direction at the landfill is toward the west/northwest. TR 93.

42. Depth to groundwater at the site averages about 470 feet, and is dropping at a rate of approximately 1 foot per year, as a result of local pumping. TR 910.

V. Waste Inventory

A. Completeness of Published Inventory

43. Sandia prepared a waste inventory for the landfill, compiled from classified disposal records, unclassified disposal records, interviews with current and retired

employees, solid waste information sheets, nuclear material management records, and photographic records. TR 107, 910.

44. NMED conducted a review of a small randomly-selected group of disposal records from various years to assess the accuracy of the inventory and determine whether the specific waste items and quantities in the classified inventory could be traced to the Sandia published waste inventory. For each of the 36 records reviewed, NMED was able to trace the specific classified waste item to a waste item listed in the Sandia published waste inventory. TR 911-12; NMED Exhibit 15.

45. The waste inventory is unlikely to be complete or completely accurate. However, it is reasonably complete and accurate considering the age of the records, length of time the landfill operated, and the types of wastes routinely disposed of in the landfill. Most older landfills operating during the same time period have no disposal records or incomplete disposal records. TR 910-11.

B. Nuclear Fuel Canisters

46. NMED received citizen requests to determine whether high-level radioactive wastes in the form of mixed oxide nuclear fuels are in the landfill, citing 1997 Sandia memoranda on disposal of stainless steel canisters in the landfill. TR 433-35, 912, AR 97-001, AR 97-004.

47. NMED investigated the nature of the experiments that involved mixed oxide nuclear fuels. TR 913-916, NMED Exhibit 17.

48. NMED's investigation concluded that SNL received spent nuclear fuel from the EBR-II Reactor at the Idaho National Environmental Engineering Laboratory ("INEEL")

and the BR3 Reactor in Mol, Belgium, and part of one fuel pin from the KNK-II Reactor in Karlsruhe, Germany. TR 913-916; NMED Exhibit 17.

49. NMED's investigation verified that the fuels that were used in experiments were stabilized in epoxy and then removed from the canisters, and that all experimental packages containing spent fuel are accounted for in storage at SNL, and are not buried in the landfill. TR 913-16, NMED Exhibit 17.

50. Dr. Nutall also suggested that nuclear fuel and canisters from STAR experiments were disposed of in the landfill. NMED's investigation, however, confirmed that the STAR canisters were not opened after the experiments. NMED verified the location of these specific canisters and confirmed they were not disposed of in the landfill. TR 433-35, 916-18.

VI. Characterization of the Landfill

51. Sandia has performed the following characterization activities at the landfill: (a) decennial environmental monitoring (1969, 1979); (b) annual environmental monitoring (1980 to present); (c) additional borehole drilling (1981, 1982); (d) Phase 1 RCRA Facility Investigation ("RFI") (1989-1990); (e) Phase 2 RFI (1992-1996); (f) groundwater monitoring (1990-present); (g) air monitoring (1992-1998); (h) tritium flux monitoring (1992, 1993, 2003); (i) ecological study (1997); and (j) interim storage site sampling (2001). Sandia Exhibit 1.

A. Phase 1 RFI

52. Sandia conducted a Phase 1 RFI in 1989 and 1990 to determine the nature and extent of contamination, the source of contamination, the release and transport mechanisms, and the pathways of contamination. TR 948.

53. Sandia collected and analyzed air, surface soil, and subsurface soil samples to determine whether hazardous or radioactive contaminants had been released to the environment. TR 948-50; AR 03-035.

54. Elevated tritium levels were detected in the classified area surface soil (0-0.5 feet) and near-surface soil (0.5 to 30 feet), with tritium activity greatest within the upper 30 feet of soil. TR 951, AR 03-035.

55. Results of the Phase 1 RFI indicated that tritium was the primary contaminant of concern and that it had migrated from the landfill disposal cells into surrounding soil. AR 03-035, TR 950-51.

56. The Phase 1 RFI did not provide sufficient data to determine whether contamination from the landfill had reached groundwater, and concluded that Sandia would need additional investigation to fully characterize the landfill, determine potential for future releases, and to determine whether groundwater had been contaminated. TR 951.

B. Phase 2 RFI

57. Sandia conducted a Phase 2 RFI from 1992 to 1995 to more thoroughly characterize the site, evaluate potential risks and determine what remedial action was needed. Investigation activities included examination of landfill records, radiological surveys, soil sampling, active and passive soil-gas surveys, surface soil sampling, borehole sampling, vadose zone tests, aquifer pumping tests, and a risk assessment. TR 952, AR 96-009.

58. A walkover radiation survey of the landfill detected 3 areas of elevated surface-contact radiation in the classified area (Pit SP-4, Pit 36, and Pit 35). After backfilling these pits with soil, radiation levels were measured at background levels. TR 953.

59. Air samples taken in 1992 indicated that beryllium, uranium and plutonium were not detected above background levels, but plutonium-238 at the west side, next to the landfill was an order of magnitude higher than detected at the upwind location. TR 953.

60. The highest tritium flux (flow of tritiated water off surface soils into the atmosphere) occurred at the east boundary of the classified area. TR 55-56, 953. Sandia estimated total tritium activity released from the landfill during 1993 to be 0.294 curies (which decreased to 0.09 curies per year in 2003). TR 954.

61. Sandia's Phase 2 RFI investigations concluded that reports of burial of waste outside the landfill were unsubstantiated. TR 954-55.

62. Sandia's 1992 and 1993 surface soil samples indicated that the highest tritium activities were at Pit 33, where records show that almost half of the curies of tritium disposed of at the landfill were placed. Between 1982 and 1993 Pit 33's tritium activity decreased from 10,400 pCi/g to 1,103 pCi/g. TR 955.

63. Sandia conducted its first round of passive soil-gas surveys in July-August 1993, and found 12 volatile organic compounds ("VOCs") detected around trenches in the unclassified area and in the southern part of the classified area. TR 955-56.

64. Sandia's second round of passive soil-gas surveys, in September 1993, had results consistent with the first round of sampling. TR 956.

65. Sandia conducted active soil-gas sampling in June, August and October of 1994, which detected 8 VOCs which generally increased with depth. TR 956.

66. Sandia drilled 15 boreholes at the landfill during the Phase 2 RFI and analyzed them for VOCs, semi-volatile organic compounds ("SVOCs"), metals, tritium, and other radionuclides. Most boreholes detected VOCs and all found tritium. TR 957-78.

67. The maximum depth at which Sandia's boreholes encountered tritium above background was 120 feet. For the most part, the highest tritium activities were in the upper 9 feet of soil. TR 958.

68. Sandia's Phase 2 RFI concluded that tritium was the primary contaminant released from the landfill, and that no further action was needed. TR 958.

69. Sandia sampled its 5 groundwater monitoring wells for the Phase 2 RFI, and found no evidence of groundwater contamination. TR 958.

70. NMED concluded that the data collected during the RFI were of acceptable quality. TR 979.

71. Using NMED's air sampling studies and the Phase 2 RFI results, NMED concluded that the landfill does not present unacceptable risks to ambient air. AR 96-009; AR 03-035, TR 985.

72. The Phase 2 RFI risk assessment results indicated that VOC vapor levels at the landfill pose insignificant risk to human health and the environment under an industrial land use scenario. TR 985.

73. The Phase 2 RFI similarly concluded that the landfill presents little risk of groundwater contamination, and that there was no evidence of groundwater contamination from the landfill. TR 985-86.

C. Groundwater Monitoring

74. Currently, the landfill's groundwater monitoring well network consists of 7 wells, and includes 1 background well. TR 918.

75. Sandia has monitored groundwater at the landfill since 1990, and has conducted more than 30 sampling events. TR 94, 918.

76. Sandia has analyzed groundwater samples for a variety of parameters including radionuclides, metals, VOCs, SVOCs, perchlorate, major ions, and general water chemistry. NMED has periodically collected split samples with Sandia. TR 95, 920.

77. Groundwater monitoring data as a whole show that there has been no contamination of groundwater beneath and surrounding the landfill. In general, radionuclides and hazardous constituents of concern have been undetectable or consistent with background conditions. TR 100, 920, NMED Exhibit 18.

78. There have been sporadic detections of radionuclides and hazardous constituents above background levels or detection limits, and a very few detections of hazardous constituents above applicable water quality standards. NMED does not believe the detections represent actual groundwater contamination caused by releases from the landfill, but rather are due to laboratory error or other factors. TR 97-98, 921.

79. NMED's conclusions that detection of contaminants is not the result of releases from the landfill is based on the abundance of data showing no contamination in groundwater and the lack of any related contamination in the vadose zone. TR 922.

80. There have been occasional detections of toluene at the landfill. However, NMED attributes this to laboratory error, except in MWL-MW4. In MWL-MW4, toluene leaked from a damaged pneumatic packer fabricated with toluene. TR 97-99, 922-24.

81. Elevated levels of nickel and chromium have been detected since 1992 in MWL-MW1, MWL-MW2, MWL-MW3 and MWL-BW1, which wells are all constructed with stainless steel well screen. NMED attributes these elevated levels to corrosion of the stainless steel well screens. TR 99, 924-26.

82. Low levels of cadmium have been detected in approximately one third of all landfill groundwater samples collected since 1990, some above the EPA Maximum Contaminant Limit ("MCL"). NMED and Sandia attributed these elevated levels to laboratory error, due to evidence of quality control issues and subsequent sampling at lower levels. TR 926-27.

D. Interim Storage Site ("ISS") Soil Sampling

83. In 2000, Sandia collected 25 soil surface samples at the ISS and tested for RCRA metals, beryllium, VOCs, SVOCs, gamma spectroscopy, gross alpha/beta, uranium, tritium, and isotopic plutonium. TR 79-82.

84. At the ISS tritium was detected above background levels. Uranium-238 was also detected slightly above background levels, and low-level plutonium was detected at 5 sample locations. TR 79-82.

85. Sandia concluded that the plutonium may have originated from residual contamination on one of the drums stored at the ISS or a spill. TR 79-82.

86. Sandia subsequently closed the ISS and moved the drums off-site. As part of the closure process, Sandia analyzed risk presented by the ISS, which predicted risk significantly below background levels in Albuquerque. TR 82-83.

87. Soil sampling performed by Sandia after closure of the ISS, did not find plutonium in subsurface soils, which confirmed Sandia's conclusion that the initial detections at the ISS most likely originated from activities at the ISS. TR 83-85.

E. Ecological Study

88. As tritium moves with water, it is incorporated into vegetation as the vegetation uses water from its environment. TR 102-04.

89. Sandia has sampled vegetation along the perimeter of the landfill annually since 1980. Tritium activities in the vegetation are above background levels. The highest tritium activities are found in the northeast corner of the landfill, averaging 9.1 picocuries per millimeter (pCi/ml) from 1991-2000. During this period, the maximum tritium activity measured in vegetation was 26 pCi/ml. TR 102-04.

90. Based on the maximum value, one would have to ingest 260 pounds of vegetation to receive a radiation dose of 1 millirem, which is 1/360th of background levels in Albuquerque. TR 104.

91. Sandia conducted an ecological study at the landfill in 1997. For the study, Sandia collected small mammals from the landfill and from a control site, and compared tissue results. The mammals included Merriam's kangaroo rat and several varieties of mice. TR 102-04.

92. Sandia tested the mammals' tissue samples for tritium, total uranium, gamma spectroscopy, metals and strontium-90. Tritium levels were elevated in the mice from the landfill, but other contaminants were not detected. TR 104.

VII. Corrective Measures Study

93. In October 2001, NMED directed Sandia to conduct a Corrective Measures Study ("CMS") to evaluate potential remedial alternatives for the landfill. TR 1008-09.

94. Sandia implemented a streamlined approach to the CMS. TR 1009.

95. Sandia submitted the CMS Report to NMED May 21, 2003 and NMED deemed it complete January 5, 2004.

96. The objectives of the CMS were to:

(a) minimize exposure to site workers, the public and wildlife;

(b) limit migration of contaminants to groundwater such that regulatory limits are not exceeded;

(c) minimize biological intrusion into buried waste and any resulting release and redistribution of contaminants to potential receptors; and

(d) prevent or limit human intrusion into buried waste over the long term.

TR 1009; AR 03-035.

A. Screening of Potential Technologies

97. Sandia used 3 criteria to initially screen 16 potential technologies:

(a) responsiveness to the corrective action objectives;

(b) implementability; and

(c) performance.

TR 1010, NMED Exhibit 9.

98. After the initial screening, Sandia selected 9 technologies for further and more detailed screening. After additional screening, 4 candidate corrective measures alternatives remained:

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(a) no further action with institutional controls (Alternative 1.a);

(b) vegetative soil cover (Alternative III.b);

(c) vegetative soil cover with bio-intrusion barrier (Alternative III.c); and

(d) future excavation (Alternative V.e).

TR 1011-12.

99. At the request of the public and WERC, and at NMED's direction, Sandia included a 5th alternative, complete excavation with off-site disposal, even though it had failed prior screening. TR 1018.

100. NMED and EPA specified 5 criteria for evaluating the candidate corrective measures:

(a) long-term reliability and effectiveness;

(b) reduction of toxicity, mobility or volume of wastes;

(c) short-term effectiveness;

(d) implementability; and

(e) cost.

TR 1013-15.

101. Any remedy that is protective of human health and the environment may be selected; Sandia is not required to select the most protective remedy. TR 1012.

B. Analysis and Recommended Remedies

102. Under no further action with institutional controls (Alternative 1.a), the operational cover would be maintained and current institutional controls and groundwater monitoring would continue. There would be no intrusive activities and no exposure to waste. This alternative poses minimal risk to site workers implementing institutional

controls. Sandia estimated that capital and operation and maintenance costs for Alternative 1.a are $1,772,882. TR 139-40; 1015-17. Sandia Exhibit 1.

103. Under vegetative soil cover (Alternative III.b), a vegetative soil cover comprised of multiple lifts of compacted soil would be placed on the existing landfill surface to isolate buried waste from the surface environment and to further minimize infiltration of precipitation. A topsoil layer would be vegetated with native plants to promote transpiration and to mitigate wind and water erosion. Based on modeling, a cover constructed of natural soil is expected to perform well with minimal maintenance. This alternative involves minimal intrusive activities and minimal exposure to waste, and poses minimal risk to site workers implementing institutional controls. Sandia estimated that capital and maintenance costs for Alternative III.b are $4,335,274. TR 139, 1015-17; Sandia Exhibit 1.

104. Under the vegetative soil cover with bio-intrusion barrier (Alternative III.c), a bio-intrusion barrier consisting of a layer of crushed rock would be constructed on the existing landfill surface before construction of a vegetative soil cover. The vegetative soil cover would be comprised of multiple lifts of compacted soil to isolate buried waste from the surface environment and to further minimize infiltration of precipitation. A topsoil layer would be vegetated with native plants to promote transpiration and to mitigate wind and water erosion. Based on modeling, a cover constructed of natural soil is expected to perform well with minimal maintenance. This alternative involves minimal intrusive activities and minimal exposure to waste, and poses minimal risk to site workers implementing institutional controls. Sandia estimated that capital and

maintenance costs for Alternative III.c are $7,096,859. TR 139-40, 1015-17; Sandia Exhibit 1.

105. Under future excavation (Alternative V.e), the landfill would be completely excavated at some future date. Future excavation would entail either aboveground retrievable storage of waste and/or shipment of waste to an off-site facility for disposal. Warehouses for processing and storage of classified and unclassified waste would be built on site, adjacent to the landfill to minimize handling and transportation logistics and costs. Sandia projected that capital costs for future excavation are $325,704,159, with no operations and maintenance costs. This alternative presented the highest risk to on-site workers. TR 139-40, 1015-17, Sandia Exhibit 1.

106. Sandia also evaluated complete excavation with off-site disposal (Alternative V.b) at NMED's direction. Under this alternative, the landfill would be excavated and waste debris separated from soil. Wastes and any highly contaminated soils would be shipped off-site for disposal. Excavation and waste management would take place under temporary structures to mitigate risk of exposure to the public, surrounding facilities, and the environment. Sandia estimated that total direct and indirect costs would be $618,000,000. NMED Exhibit 9.

107. Sandia recommended a vegetative soil cover as the preferred alternative because it offers additional protection against contact with waste in landfill disposal cells, minimizes infiltration of water and limits surface erosion, mitigates biological and human intrusion without significant cost in construction and long-term monitoring, surveillance and maintenance, and it is consistent with EPA's directives regarding

presumptive remedies for municipal and hazardous waste landfills. TR 140; Sandia Exhibit 1.

108. NMED proposes in the permit modification selection of a vegetative soil cover with bio-intrusion barrier. Modeling studies of the performance of evapotranspiration covers subject to similar conditions as the landfill predict that infiltration and subsequent percolation of water through the cover should be below a few millimeters per year. Moreover, the bio-intrusion barrier is intended to prevent wastes and contaminated soil in the landfill from being transported by burrowing animals. TR 1969-1074.

C. Risk Assessment

109. Sandia conducted a baseline human health and ecological risk assessment as part of the CMS, as well as a human health and ecological risk assessment for each of the remedial alternatives considered. TR 1027-28.

110. The primary purpose of the CMS risk assessment was to calculate the relative risk of the various alternatives for the purposes of screening potential remedies. Risk assessments associated with remedial alternatives assess the effectiveness of the remedy in preventing risk to both human and ecological receptors. TR 126, 1028.

111. Sandia based its risk assessment on NMED and EPA guidance, and calculated the risk for both human health and ecological receptors. TR 126, Sandia Exhibit 1.

112. The baseline human health risk assessment evaluates total risk under current conditions, assuming no remedial or correction action, with no institutional controls. For the residential scenario, Sandia assumed a resident living off-site of the landfill. For the industrial scenario, Sandia assumed a non-intrusive industrial worker at the landfill. For

both residential and industrial scenarios, the risks for chemical and radiological constituents were evaluated separately. TR 1031-32.

113. For the residential scenario, the hazard index and cancer risks exceed target levels while the total exposure dose equivalent does not, assuming no remedial action. TR 1028-29, 1032.

114. For the non-intrusive industrial worker, the hazard index, the cancer risks, and the total effective dose equivalent do not exceed target levels, again assuming no remedial action. TR 1028-29, 1032.

115. Sandia's baseline ecological risk assessment evaluated the herbivorous, omnivorous and insectivorous deer mouse, a burrowing owl, and plants, and assumed current conditions with no institutional controls. TR 1033.

116. Individual hazard quotients for the animals and plants were less than one for all constituents of concern with one exception. The overall hazard indices for the omnivorous and insectivorous deer mouse, the owl, and plants slightly exceeded the target limit of one, with a maximum hazard index of 2.9. Total radiation dose to the deer mouse and burrowing owl are each estimated to be less than EPA's acceptable benchmark. TR 1033.

117. The CMS Report evaluates the 4 remedial alternatives for chemical and radiological risks to both human and ecological receptors. For human health risk assessments, Sandia evaluated an on-site industrial worker, consistent with EPA guidelines. TR 1033-34.

118. NMED approved Sandia's risk assessment methodology (including use of the RESRAD code) as acceptable and reasonable, and consistent with those accepted by industry and regulators. TR 1036-40.

119. Radiological and chemical risks to an industrial worker for no further action with institutional controls (Alternative 1.a), vegetative soil cover (Alternative III.b), and vegetative soil cover with bio-intrusion barrier (Alternative III.c) were within acceptable levels. TR 1041.

120. For the future excavation scenario (Alternative V.e, 39 years in the future), the total dose equivalent was exceed for a worker excavating the landfill. In NMED's opinion, although the risk assessment could have used more realistic assumptions, it is clear that excavation of the landfill in the near-term could pose substantial risk to excavation workers. TR 1041-43.

121. Sandia hired a contractor, URS, to conduct the risk assessment for complete excavation of the landfill at the current or near current time (Alternative V.b), approximately 5 years in the future. Radiological risks were estimated using worst-case, decay-corrected activity, with no shielding (i.e. assuming a current excavation worker would be exposed to all the contents of the landfill during the entire excavation process). The resulting radiological risk indicated that the worker could be exposed to an unacceptable risk, and that significant engineering and administrative controls would be necessary to ensure worker protection. Chemical risks were not estimated because it was assumed that personal protective equipment would mitigate chemical risks to the workers. Off-site risks were assumed to be mitigated by engineering controls (i.e. conducting excavation in a closed, tented environment). TR 1043-45.

122. The ecological risk assessment concluded that risks for the baseline and Alternative 1.a (no further action with institutional controls) were the same.

123. Risks for vegetative soil cover (Alternative III.b) and vegetative soil cover with bio-intrusion barrier (Alternative III.c) were not evaluated because exposure would be prevented by 5 feet of cover material. In NMED's opinion, the ecological risk from these two alternatives would be less than or equal to the ecological risks for the baseline scenario. TR 1045-46.

124. For future excavation (Alternative V.e), ecological risks during excavation were assumed to be mitigated through site controls, and any exposure would be to soil outside the work area. These risks were assumed to be identical to the baseline risk assessment. TR 1046.

125. Sandia concluded that unacceptable risks to ecological receptors would not be anticipated for any of the 4 alternatives. NMED found Sandia's conclusion acceptable. TR 1046-47.

126. Sandia concluded that acute risks from transportation-related injury and fatalities far outweighed risks associated with chemical and/or radiological exposure, which NMED found acceptable. TR 1047-48.

127. NMED concluded that Sandia's risk assessment in the CMS Report is adequate, based on currently accepted methodologies, including EPA guidance. TR 1049.

VIII. Issues Raised by the Parties and the Public

A. Need for Fate and Transport Model

128. Dr. Eric Nuttall testified that Sandia should have used a comprehensive mathematical fate and transport model to predict future behavior and potential risk of the landfill and its potential to contaminate groundwater. TR 147-53.

129. DOE commissioned WERC to perform independent peer review of Sandia's draft CMS. The WERC panel of experts produced a report dated November 2002, in which the panel "strongly" recommended the development of an integral numerical fate and transport model, and found it "regrettable" that such a model had not yet been developed. WERC's panel suggested that the model be calibrated with existing data from the landfill and "fine-tuned" with future monitoring results. WERC Notice of Intent.

130. Sandia used 3 numeric codes to model the landfill: the HELP Code, the VS2DT code, and UNSAT-H. Sandia did not construct a comprehensive fate and transport model, as it was concerned about its acceptance by regulators and the public, and felt its risk assessment in the CMS Report addressed similar issues and would be more widely accepted. TR 412, 1006-08.

131. NMED did not require Sandia to perform a fate and transport model, and provided testimony that the uncertainty associated with the waste inventory of the landfill made it questionable whether a reliable fate and transport model could be produced. TR 1006-08.

132. NMED asserted in testimony that a mathematical fate and transport model is not necessary because there is no present groundwater contamination and future

contamination is not expected. Nor was it NMED's opinion that such a model was necessary for selection of an appropriate remedy. TR 1006-08.

133. Dr. Nuttall agreed during cross-examination that a fate and transport model could be developed after the remedy for the landfill is selected. He noted that such a model could be useful at any stage of work on the landfill, and could assist in identifying future action levels or triggers. TR 156-57.

B. Groundwater Contamination at the Landfill

134. Dr. Resnikoff alleged that groundwater contamination has been found at the landfill, relying on an analysis performed by Dr. Mark Basham who found higher uranium with isotopic proportions in groundwater under the landfill than in background groundwater. TR 679-80.

135. Dr. Resnikoff was unaware of later monitoring data that showed isotopic uranium in groundwater under the landfill consistent with background conditions, and on cross-examination admitted he was not sure whether there was groundwater contamination at the landfill. TR 680, 693-94.

136. The first WERC report agreed that later analytical testing suggests that uranium isotopic activity ratios in groundwater at the landfill are representative of natural levels of uranium. WERC Notice of Intent.

137. Dr. Resnikoff further suggested that the landfill presented a threat to groundwater contamination, based on contamination at other sites owned or operated by Sandia or DOE (including the chemical waste landfill, Tijeras Arroyo Groundwater Area, and Lurance Canyon Burn site), and another site in Beatty, Nevada. However, on cross-examination, he could not specify data to support these allegations, and NMED

presented credible testimony refuting these charges, showing that the sources of contamination were different, the quantities of liquids were different, or other variables. TR 679-94; 987-994.

138. Dr. Resnikoff also alleged that discharges from Sandia's liquid waste disposal system could encourage groundwater contamination at the landfill. NMED also effectively met these allegations by detailing the distance between the 2 sites, and showing Resnikoff's lack of data. TR 988-90, NMED Exhibit 9, p. 39-40.

139. Dr. Nuttall testified that in his opinion, and the 1st WERC panel found, there is no groundwater contamination at the landfill. TR 155-56.

140. Erik Ringelberg asserted there is toluene contamination at the landfill. However, he was not aware of follow-up sampling and testing done by Sandia that demonstrated that toluene detections were the result of laboratory error and a damaged packer. TR 687-91, 1000-01, Findings of Fact #80-81.

141. Paul Robinson testified that canisters and other containers in the landfill will break down over time, releasing contaminants which could threaten groundwater in the future. TR 995.

142. NMED testified that while canisters and containers in the landfill will deteriorate over time, most landfill contaminants will remain in place as they only mobilize with water, which will be prevented from entering the landfill by the vegetative cover. If the cover is not effective in this manner, vadose zone monitoring will indicate contaminant releases long before they threaten groundwater. TR 995-96.

C. Applicable Regulatory Framework and Requirements

143. While Dr. Resnikoff's testimony and resume indicated expertise in matters involving radioactive materials, it did not indicate expertise in matters involving hazardous waste or RCRA. Citizen Action Statement of Intent.

144. Likewise, Mr. Robinson admitted that he is not an expert on RCRA. TR 867-68.

145. Dr. Resnikoff testified that NMED can and should regulate the landfill under 40 CFR Parts 264 and 265, although he appeared somewhat confused at to whether these regulations applied to the draft permit being considered and on occasion fell back on applying these regulations because it was the "right" thing to do. TR 662-63, 691-93.

146. Mr. Robinson testified that he believed the landfill is a RCRA-permitted facility, and that it is an interim-status facility. TR 869-70.

147. Will Moats, the Albuquerque Group Manager for the Permits Management Program of NMED's Hazardous Waste Bureau, has extensive and long-term experience and expertise in RCRA matters; he asserted that the landfill is regulated as a solid waste management unit ("SWMU") under 40 CFR 264.101, but neither as a permitted facility under 40 CFR 264 nor as an interim status facility under 40 CFR 265. NMED Exhibit 9, pp. 1-6; TR 968-69.

148. NMED cannot exceed its regulatory authority, and cannot demand compliance with regulations it has no authority to enforce. NMED, however, demonstrated that the requirements it demanded for the landfill remedy were technically equivalent to those Dr. Resnikoff and Mr. Robinson urged it to enforce. TR 969-70.

D. Additional Liquid Waste Disposal at the Landfill

149. Mr. Robinson, for Citizen Action, testified that Sandia's inventory was incomplete because it did not take into account 19 million gallons of reactor coolant water disposed of in 2 drain fields near the landfill during between 1963 and 1971. TR 795-98.

150. Dr. Marvin Resnikoff, for Citizen Action echoed this concern, detailed in the paper he authored with Amanda Schneider, dated March 2004, "Independent Evaluation of the Corrective Measures Study, Mixed Waste Landfill, Sandia National Laboratories." This paper alleged that over 19 million gallons of tritiated water discharged into the Liquid Waste Disposal System ("LWDS") at or near the landfill had not been considered in Sandia's and NMED's conclusion that groundwater contamination from the landfill is not likely. AR 04-029, pp. 20-22.

151. NMED effectively refuted any concern about the 19 million gallons of reactor water by pointing out that the LWDS is 0.8 miles northeast of the landfill, and groundwater flow is towards the west-northwest (not towards the landfill). This combination of facts supports NMED's conclusion that disposal of wastewater at the LWDS has not and will not affect groundwater quality at the landfill. NMED Exhibit 9, p. 71, TR 988-990.

E. Miscellaneous Issues

152. Dr. Resnikoff frequently referred to high gamma readings and measurements at the site, apparently based on results in the RFI. However, later measurements (after backfilling three pits with soil) did not indicate levels above background. TR 997-98.

153. Dr. Resnikoff asserted that NMED should not have allowed Sandia to use a streamlined CMS for the landfill, because it is not a low risk facility, and the proposed remedy is neither high quality nor straightforward. TR 1018-19.

154. NMED refuted Dr. Resnikoff's assertions on these 3 points, and testified convincingly about why the streamlined CMS was appropriate. TR 1019-20.

155. Dr. Resnikoff and Mr. Ringelberg charged that Sandia should have based the risk assessment on the entire waste inventory of the landfill, regardless of whether there has been a release to the environment. TR 671-72, 1029.

156. NMED also refuted this charge, testifying that Sandia's risk assessment methodology was consistent with specific EPA policy and directive, and why it was not necessary to consider the entire waste inventory in the risk assessment. Dr. Resnikoff did not appear to be familiar with these specific guidance documents and could not answer questions about them. TR 672-75.

157. Although Dr. Resnikoff also asserted that Sandia's risk assessment should have considered a residential scenario on the landfill, he conceded on cross-examination that this directive, a Nuclear Regulatory Commission regulation, does not apply to the current matter and does not address risk or risk assessment. TR 675-77.

158. Dr. Resnikoff urged NMED to follow the landfill for up to 100 or 1000 years or longer, asserting that inevitably institutional controls will fail and groundwater will become contaminated. TR 974.

159. NMED testified that RCRA post-closure care continues for 30 years, but this period may be extended if necessary to protect human health and the environment.

NMED further stated that the appropriate time period for post-closure care is not part of the remedy selection process being considered in the hearing. TR 973-74.

160. The use of institutional controls conforms to EPA policy and directive, and has been extensively negotiated by NMED and Sandia, resulting in numerous enforceable provisions of the Consent Order they have both signed, dated April 29, 2003. TR 974, NMAD Exhibit 24.

161. Erik Ringelberg criticized Sandia's sampling methodology as non-statistical and as not consistent with guidance from EPA, DOE and NRC (use of the MARSSIM program). TR 998-99.

162. NMED effectively refuted Mr. Ringelberg's charges, demonstrating that the sampling methodology used at the landfill was appropriate, effective and followed EPA-approved approaches. TR 999.

163. The WERC panel's second report (dated January 31, 2003) recommended the use of monitoring triggers, or predetermined target levels for contaminants that trigger a need for a response, noting that vadose zone monitoring is essential to establish appropriate trigger levels. WERC Notice of Intent.

164. WERC's second report also recommended that Sandia continue to maintain a positive and aggressive good-neighbor policy, and that the public continue to be involved in future decisions involving the landfill. WERC Notice of Intent.

165. Mr. Robinson in testimony and in his 2002 report titled, "Is 'Trust Us, We're the Government' Really a Guarantee?" strongly encouraged the Secretary to require some sort of financial assurance from DOE or its contractor, Sandia, to guarantee future activities at the landfill. He also noted several DOE sites where trusts funds and other

mechanisms were used to guarantee monitoring, maintenance and other activities, including: Oak Ridge, Tennessee; the Umatilla Chemical Waste Deport in Oregon; and the Waste Isolation Pilot Plant in New Mexico. TR 816-24, Robinson Exhibits.

166. On cross-examination, Robinson acknowledged that RCRA contains an exemption from financial assurance requirements for the federal government, in 40 CFR 264.140(c), and that the Oak Ridge site was regulated under the Comprehensive Environmental Response, Compensation, and Liability Act, 42 USC Section 9601 *et seq.*, rather than RCRA. He also admitted that NMED may already be receiving fund to oversee compliance at DOE facilities. TR 816-24, 855-58, 876-77.

IX. Remedy Selection

167. The remedy of a vegetative soil cover with bio-intrusion barrier (Alternative III.c) with long-term monitoring and maintenance and a contingency plan, is adequate to protect human health and the environment. TR 1069.

168. A vegetative soil cover provides protection against exposure to waste in the landfill, minimizes infiltration of precipitation, and limits bio-intrusion and human intrusion into buried waste. Modeling studies of the performance of evapotranspiration covers subject to conditions similar to those at the landfill predict that infiltration and subsequent percolation of water through the covers should be well below a few millimeters per year. The cover would help to eliminate further migration of plutonium and uranium in surface soil released from the ISS. There would be minimal intrusive activities at the site and therefore there would be little potential for exposure to waste of workers, the public and the environment. A vegetative soil cover poses minimal risk to site workers implementing institutional controls in the present and future. TR 1069.

169. A bio-intrusion barrier will discourage small animal (such as mice, prairie dogs, burrowing owls) from burrowing through the cover and coming into contact with waste and contaminated soil, and from transporting wastes and contaminated soil in the landfill to the surface. A bio-barrier will not stop insects (such as ants) from burrowing into the ground, and will not prevent deep-rooted plants from penetrating the cover. Any animals or plants living on the landfill will be exposed to low levels of tritium and radon, which will penetrate a bio-barrier. TR 1070.

170. As part of the remedy, NMED will consider long-term monitoring and maintenance activities, including maintenance, monitoring, reporting, institution and physical controls, contingency and triggers, and re-evaluation of the cover. TR 1072-74.

171. As several components of the selected remedy remain to be developed (see Finding of Fact 170), it is important that the public continue to have access to information and to participate in future decisions regarding the landfill. Many members of the public who commented at the hearing encouraged NMED to require that Sandia provide convenient public access to monitoring data, major documents, and other significant information.

CONCLUSIONS OF LAW

A. The federal Resource Conservation and Recovery Act ("RCRA"), as amended by the Hazardous and Solid Waste Amendments ("HSWA"), governs the disposal of hazardous waste. 42 USC Sections 6901-6992.

B. Congress waived immunity for federal facilities for actions brought under state hazardous and solid waste laws as well as under RCRA. 42 USC Section 6961.

C. Pursuant to RCRA, EPA authorized NMED to enforce the New Mexico Hazardous Waste Act ("HWA"), NMSA 1978 Sections 74-4-1 to 74-4-14, and its implementing regulations the Hazardous Waste Management Regulations ("HWMR"), now codified at 20.4.1 NMAC, on April 16, 1985 by delegation numbers 8-31 and 8-32.

D. NMED regulates Sandia's management of hazardous wastes under the HWA, HWMR, and Sandia's and DOE's RCRA permit.

E. The HWA requires all permits issued after April 8, 1987 to require corrective action for all releases of hazardous waste or constituents from any SWMU at a facility seeking a permit. NMSA 1978 Section 74-4-4.2.

F. Sandia's and DOE's RCRA permit requires Sandia to take corrective action in accordance with applicable corrective action requirements.

G. 40 CFR Part 264, Subpart F (40 CFR Sections 264.90 to 101) (incorporated by 20.4.1.500 NMAC) governs releases from SWMUs.

H. Facilities such as SNL, seeking a permit for the treatment, storage or disposal of hazardous waste must "institute corrective action as necessary to protect human health and the environment for all releases of hazardous waste or constituents from any [SWMU] at the facility, regardless of the time at which the waste was placed in such unit." 40 CFR Section 264.101(a).

I. The Sandia mixed waste landfill is regulated as a SWMU under 40 CFR Section 264.101 (incorporated by 20.1.4.500 NMAC) for which corrective action is required.

J. The corrective action process at SNL is now governed in large part by the Consent Order dated April 29, 2004 entered into by NMED, DOE and Sandia Corporation. Consent Order, Section IV.D.

K. The requirements of the Consent Order apply to hazardous waste and the hazardous waste component of mixed waste. Consent Order, section 1.

L. The Consent Order does not apply to radionuclides, including but not limited to source, special nuclear, or byproduct material as defined in the Atomic Energy Act of 1954, or the radioactive portion of mixed waste. Consent Order, section 1, III.B.

M. The remedy of a vegetative soil cover with a bio-intrusion barrier, together with long-term monitoring and maintenance and a contingency plan, protects human health and the environment for all releases of hazardous waste or constituents from the landfill, as required by 40 CFR Section 264.101(a) (incorporated by 20.4.1.500 NMAC).

N. Under the HWMR, post-closure care continues for 30 years after closure, although NMED may extend the post-closure care period if necessary to protect human health and the environment. 20.4.1.500 NMAC (incorporating 40 CFR Section 264.101(a).

O. The landfill is not regulated as a permitted facility under 40 CFR Part 264 because Sandia never applied for or was issued a Part B permit for the landfill. The landfill is not regulated as an interim status facility under 40 CFR Part 265 as Sandia did not include the landfill in its Part A application for the facility.

P. DOE and Sandia are exempt from financial assurance requirements for closure activities at the landfill. 20.4.1.500 NMAC (incorporating 40 CFR Section 264.140(c)).

Q. As the State agency entrusted with implementation and administration of the HWA, NMED is entitled to deference to its interpretation and regulatory approach under the HWA and HWMR.

R. Applicable regulations require that notice be given prior to a hearing on a permit modification. 20.1.4.200.C(2) NMAC; 20.4.1.C NMAC.

S. The public notice for the hearing on Sandia's proposed permit modification properly alerted the public and Sandia to the proposed permit modification.

T. The streamlined CMS for the landfill was appropriate and met applicable criteria.

U. Sandia should develop and comprehensive fate and transport model for the landfill, to be used in evaluating future options, triggers, monitoring and contingencies.

Respectfully submitted,

Jennifer J. Pruett, Hearing Officer

April 20 2005

Dated

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