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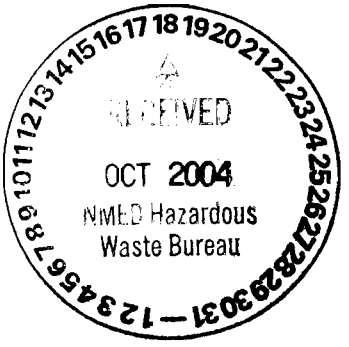
October 15, 2004



Mr. David Cobrain
State of New Mexico Environment Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building One
Santa Fe, New Mexico 87505-6303

Reference: Work Assignment No. 06110.290.0002; State of New Mexico Environment Department, Santa Fe, New Mexico; Human Health and Ecological Risk Assessment Support; Summary of Sandia National Laboratory's Mixed Waste Landfill Risk Assessments, Task 2 Deliverable.

Dear Mr. Cobrain:

Enclosed please find the deliverable for the above-referenced work assignment. The deliverable consists of summaries of risk assessments associated with the Sandia National Laboratory's Mixed Waste Landfill. The risk assessments summarized include the following:

- Mixed Waste Landfill Corrective Measures Study, Final Report, Appendix I (Risk Assessment), dated May 2003;

- Report of the Mixed Waste Landfill Phase 2 RCRA Facility Investigation (RFI), dated September 1996 (a 2002 version of the report was available, however, Mr. William Moats (NMED) indicated that this later version was not the official version and should not be reviewed); and

- Review of the Risk Screening Assessment for the Mixed Waste Landfill, SWMU 76, by Marvin Resnikoff, Radioactive Waste Management Associates, dated July 2001.

The summaries are being provided at the request of Mr. Moats in preparation for the December 2 and 3, 2004 Administrative Hearing, at which Ms. Paige Walton (TechLaw) will be assisting NMED in providing testimony with respect to the risk assessments.

Also at the request of Mr. Moats, comments on the risk assessments were not provided unless it was thought that the issue could potentially impact the overall conclusion of the report. It should be noted that the deliverable consists of summaries only, and does not necessarily represent entire testimony that may be used by Ms. Walton. Other documents (such as response to comments) will be reviewed in preparation for the hearing.

The risk assessment presented in the Mixed Waste Landfill Corrective Measures Study (CMS)

was not well presented and was difficult to follow. Ms. Walton contacted Mr. Moats to discuss several issues. In response, Mr. Moats had the Sandia risk assessor, Mr. Mike Nagy, contact Ms. Walton to discuss her concerns. Mr. Nagy called Ms. Walton on October 12, 2004. Summaries and/or clarifications provided by Mr. Nagy are provided in the summary associated with the CMS report. In addition, Mr. Nagy could not address all her concerns, specifically radiological issues, and was to have Mr. Mark Miller of Sandia contact her to answer remaining questions. At this time, Mr. Miller has not contacted Ms. Walton. Outstanding issues are bolded in the attached summaries.

While a summary was provided of the risk assessment provided in support of the Phase II RFI, there were several information data gaps, which prevented a complete evaluation of the risk assessment. However, as Mr. Moats indicated that this risk assessment had been withdrawn and that the risk assessment associated with the CMS report superceded this assessment, the lack of information did not pose considerable concern. Mr. Moats further indicated that the RFI assessment summary was necessary only in the event that some members of the public may comment on it.

The document is formatted in Word. The deliverable was emailed to you on October 15, 2004 at David_Cobrain@nmenv.state.nm.us. A formalized hard (paper) copy of this deliverable will be sent via mail. If you have any questions, please call me at (303) 763-7188 or Ms. Paige Walton at (801) 451-2978.

Sincerely,

June K Dreith

June K. Dreith
Program Manager

Enclosure
cc: Mr. John Kieling, NMED
Mr. James Bearzi, NMED
Mr. William Moats, NMED
Ms. Tannis Fox, NMED
Ms. Paige Walton, TechLaw

TASK 2 DELIVERABLE

SUMMARIES OF RISK ASSESSMENTS ASSOCIATED WITH THE SANDIA NATIONAL LABORATORY'S MIXED WASTE LANDFILL

Human Health and Ecological Risk Assessment Support

Submitted by:

TechLaw, Inc.
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Submitted to:

Mr. David Cobrain
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In response to:

Work Assignment No. 06110.290

October 15, 2004

"Mixed Waste Landfill Corrective Measures Study, Final Report, Sandia National Laboratories, New Mexico, May 2003: Appendix I – Risk Assessment for the MWL"

I. Introduction

The Corrective Measure Study (CMS) report outlines four remedial alternatives for the Mixed Waste Landfill (MWL). Part of the review criteria for selecting the most appropriate alternative is that the remedy should be protective of both human health and the environment. As such, a risk assessment evaluating chemical and radiological risks to both human and ecological receptors was conducted for each of the potential remedies. For the human health risk assessments, both an on-site industrial worker and an off-site resident were evaluated. In addition to assessing risk associated with the four potential remedies, a baseline risk assessment was also evaluated. The baseline assessment represents current conditions with no further action (NFA) or institutional controls. The results of the risk assessments were weighed in selecting the preferred remedial alternative for the MWL.

The MWL operated from the year 1959 until December 1988. During this time, low-level radioactive and mixed wastes were disposed of in the landfill. The MWL consisted of two areas: a classified area and an unclassified area. Waste in the classified area was disposed of in unlined vertical pits, while in the unclassified area, waste was either placed in unlined trenches or was placed on the ground surface (ISS area) for temporary storage. Waste placed in the either the pits or the trenches were backfilled with soil and either capped with concrete or more soil. Some waste was containerized in miscellaneous types of containers, while other waste was uncontainerized. Waste contained various metals (inorganics), organics [volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs)], and radionuclides (cobalt-60, strontium-90, plutonium, depleted uranium, thorium, tritium, cesium-137, and radium-226).

Data collected during the Phase I and Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs) were used to identify the nature and extent of contamination in surface soil, subsurface soil, and groundwater. The sampled media were evaluated for metals, VOCs, SVOCs, and radionuclides. Contaminants that were found to be above natural background concentrations were carried forward as constituents of concern (COC) for the risk assessment. While both the Phase I and Phase II RFIs indicated some low-level releases of metals, organics, and radionuclides in soil, the primary COC identified was tritium. Both RFIs concluded that groundwater had not been impacted by contaminants from the MWL.

II. Methodology

The first step in identifying COCs was to compare detected concentrations to natural background levels, where appropriate. Organic chemicals do exist naturally in background and were conservatively carried forward as COCs. NMED-approved background values were applied. For the baseline risk assessment and the future excavation scenario, data collected from all surface and subsurface soil samples were evaluated. For the other remedial alternatives, only soil from zero (0) to five (5) feet below ground surface (ft bgs) were evaluated. For the ecological assessment, soil data from 0 to 5 ft bgs was applied. The exposure depths are consistent with Environmental Protection Agency- (EPA) approved methodologies.

The applicant proposed to further narrow the list of COCs by comparing concentrations to proposed Subpart S action levels. The Subpart S action levels were the precursors to currently applied preliminary remediation goals (PRGs). However, the Subpart S action levels were never

promulgated and are not accepted in industry. As the applicant did not actually include this step in data reduction, no problems were noted. The exclusion of any data reduction in the risk assessment does result in a conservative estimate of COCs and overall risk.

The second step in the risk assessment was to look at the fate and transport of potentially released COCs in soil. This evaluation also provided a qualitative discussion as to the likelihood that detected COCs could migrate to groundwater. The applicant concluded that due to the arid environment, natural chemical degradation and decay, and depth to groundwater (approximately 500 ft bgs), the potential for COCs to migrate to groundwater is negligible. As future groundwater contamination was not anticipated and presently no groundwater contamination had been noted, the groundwater pathway was excluded as an exposure pathway.

After the COCs had been identified, the human health and ecological risk assessments were conducted. The assessments were conducted using standard EPA-and NMED-approved methodologies and algorithms. While some of the exposure parameters and toxicological data may not represent current input values, the data is consistent with EPA- and NMED-approved exposure parameters at the time of the drafting of the CMS. Revising the assessment to reflect the most current input data would not likely affect the overall conclusions of the risk assessments. Radiological COCs were evaluated using the RESRAD code, which is also standard practice.

III. Human Health Risk Results

The results of the risk assessment for the baseline scenario indicate that for the chemical COCs, both noncancer (hazard index of one) and cancer (1E-06) target levels were exceeded for the residential scenario. However, for the industrial scenario, the risks were within acceptable levels (hazard index of one and cancer risk of 1E-04). For radiological exposure, the Department of Energy (DOE) and the Nuclear Regulatory Commission (NRC) generally enforce a total exposure dose equivalent (TEDE) limit of 25 millirem per year (mrem/yr). However, the EPA applies a more conservative value of 15 mrem/yr. Both the industrial scenario and the residential TEDEs were below the EPA limit of 15 mrem/yr. Cancer risks due to exposure to radionuclides were acceptable for the industrial scenario but exceeded the target level of 1E-06 for the residential scenario.

Radiological and chemical risks to the industrial worker and off-site resident for Alternatives I.a (no further action with institutional controls), III.b (vegetative soil cover), and III.c (vegetative soil cover with bio-intrusion barrier) were within acceptable levels. For the future excavation scenario (Alternative V.e), the TEDE was exceeded.

IV. Ecological Risk Results

The ecological risk assessment evaluated the plant community, a deer mouse, and a burrowing owl from exposure to both radiological and chemical COCs. The risks due to chemical COCs were slightly elevated above the target hazard index of one for all but the herbivorous deer mouse. However, none of the risks exceeded a value of 2. The assessment was a screening analysis and several conservative assumptions were built into the ecological assessment, including the use of no-observed-adverse-effect-levels (NOAELs). The applicant concludes that unacceptable risks to ecological receptors would not be anticipated. Based upon the conservativeness of the screening assessment, it is agreed that ecological risk is acceptable.

V. Acute Risk

Risks that could occur while implementing the remedial action alternatives were also quantified in the assessment. The risks included transportation-related injury and fatalities. The applicant concluded that the risks due to transportation accidents far outweighed the risks associated with chemical and/or radiological exposure.

VI. Comments

One of the corrective action objectives as outlined in Section 2.2 of the CMS report was to ensure radon emissions to ambient air do not exceed 20 pCi/square meter/second (limit set forth in 10 CFR §834). However, the report does not appear to provide estimations of radon flux. This appears to be a major omission of the report results in an incomplete risk assessment and evaluation of the corrective action alternatives. In addition, the residential scenario did not include inhalation of radon gas. While it is noted that radon may not have been detected in soil and thus excluded from the assessment, radon emissions should have been estimated and included in the assessment. **Note: This issue was discussed with Mr. William Moats (NMED). According to Mr. Moats, the issue of radon flux was addressed in a separate document. Mr. Moats faxed a report entitled "Radon Flux Testing at the Mixed Waste and the Adjacent Classified Waste Landfills, Technical Area III, SNL/NM" (January 18, 1998). Upon review of this report, radon flux measurements were taken. The testing was conducted using 4-inchdiameter activated charcoal canisters, which were sent to Thermo NuTech for analysis by gamma spectroscopy. The results of the sampling indicate that the criterion of 20 pCi/square meter/second has been met. The CMS should have referenced this report.**

Based upon review of the CMS report, it was not clear what the excavation scenario represented and it is clear why there is confusion by the public over this scenario. Mr. Mike Nagy of Sandia National Laboratories was contacted for further clarification (October 12, 2004). According to Mr. Nagy, the excavation scenario (Alternative V.e) is based upon both the actual removal of the waste and an evaluation of residual risks, post-remediation. For the evaluation of post-remediation risks, an industrial worker was assumed to be exposed to soil potentially contaminated with residual waste. The CMS presented a chemical risk assessment, which assumed residual concentrations of COCs in soil after removal of the landfill contents would be similar to the existing concentrations detected in soils that are the result of releases. The CMS does not provide a summary of radiological risk associated with this scenario, but rather Mr. Nagy indicated that the radiological risks associated with the post-excavation industrial worker would be the same as the risks associated with the Baseline risk assessment. During the excavation process, the entire waste inventory will be exposed to the environment. Equipment may cause damage to the integrity of containers and there is a higher potential for contaminants (both chemical and radiological) other than those currently detected in soil to remain post-excavation. Based upon this assumption, the risks to the post-excavation worker are most likely underestimated. Typically a risk assessment of this nature can only be completed using conformation samples obtained after remediation is complete. There is not adequate justification presented in the report to assume that the risks to the post-excavation worker will be within acceptable limits. In addition, there is disagreement with the discussion of the excavation scenario (Attachment I, Section VI.6.2.5) that indicates that the assessment is a reasonable worst-case scenario.

The second part of the future excavation scenario actually estimated the risks due to exposure to radiological contaminants to the worker removing the waste. According to Mr. Nagy, a weighted-average of the landfill inventory was used to estimate the dose to the worker. Chemical

risks to the worker were not quantified, due to uncertainties associated with the chemical waste inventory in the landfill. Sandia assumes that the risk to the excavation worker due to exposure to chemicals will exceed acceptable levels. **The CMS does not address any of this, nor does the report provide the weighted-average or methodology used to obtain the weighted average. Mr. Nagy has contacted Mr. Mark Miller of Sandia, who is to contact Mr. Walton to discuss this issue as well as provide associated documentation. At this time, no discussion with Mr. Miller has occurred.**

If risk to the excavator were based upon the entire landfill waste contents (including exposure to organics and metals), the resulting risk would have been considerable higher than the risk quantified in the report. The TEDE (3,230 mrem/yr or 3.2 rem/yr) is well over acceptable limits and also does not comply with the corrective action objective of ensuring the dose to site workers is less than 2 rem/yr TEDE for all pathways. Even though the future excavation scenario would occur at some time in the future, and many of the dominant radionuclides are relatively short-lived (i.e., Co-60, Sr-90, Cs-137, H-3, and Pu-238), which would reduce the overall dose, depleted uranium and its decay products (Th-230 and Ra-226) are long-lived and would need to be evaluated. Based upon the above discussion, it appears that the risks to a future excavator would be significantly above acceptable levels. **Note: There is some concern over conflicting comparisons to the TEDE for the industrial worker (5 rem/yr versus 2 rem/yr). This issue will be discussed with Mr. Miller.**

Additional comments to be retained for rebuttal

The chemical risk assessment does not address the toxicity of radionuclides as metals. For example, uranium is a metal and as such has toxicity associated with it that can be incorporated into a chemical risk assessment. The only area where this is a concern is the surface soil around the ISS, where plutonium and uranium were detected. While the exclusion of the uranium is an error, the overall impact on the assessment is most likely negligible.

The applicant did not include a comparison of detected concentrations to soil screening limits (SSLs.). SSLs are developed to provide an estimate of the potential for a contaminant to migrate to groundwater. Tritium was identified as the primary COCs. The default decay-corrected SSL for tritium from EPA's " Soil Screening Guidance for Radionuclides: Technical Background Document," is 160 pico Curries per gram (pCi/g). This value is based upon a dilution attenuation factor (DAF) of 20, a risk level of 1E-06, and standard EPA default parameters. The application of the default parameters would result in an overly conservative estimate of the SSL. The maximum detected concentration for tritium in surface (1,100 pCi/g) and subsurface soil (267 pCi/g) exceed the SSL. A more-refined source-based SSL should be estimated and compared to the average concentration of tritium. If input data for the MWL and environmental data representative of the conditions at the site and a source area- based DAF were applied to estimate a refined SSL, it is anticipated that the result would indicate little potential for tritium to migrate to groundwater.

A second corrective action objective (Section 2.2 of the CMS) is to ensure that the dose to representative members of the public via the air pathways is less than 10 mrem/yr. While the report does not directly address this issue, it can be inferred that since the TEDEs for the resident for each scenario are less than 10 mrem/yr, that the criterion for the inhalation pathway has been met. **This issue will be discussed with Mr. Miller of Sandia.**

None of the input/output files for the RESRAD analyses were provided with the report; therefore, a review of the final estimated doses could be conducted. **This issue will be discussed with Mr. Miller of Sandia.**

Concern over the use of the Subpart S action levels was expressed to Mr. Nagy. He indicated that the inclusion of these levels was an artifact of previous agreements approved by the State of New Mexico, approximately 9 to 10 years ago. Sandia no longer uses these levels and that the protocol followed in the CMS was based upon this past risk assessment methodology.

It is noted that some of the exposure parameter data and toxicological data may not be the most current, however, it was most likely current at the time of the drafting of the CMS and updating these values will most likely not impact the overall conclusions and/or risks.

"Report of the Mixed Waste Landfill Phase II RCRA Facility Investigation, dated September 1996," Chapter 7: Risk Assessment and Appendix N: MWL Risk Assessment

1. Chapter 7 – Risk Assessment

The identified land use for the Mixed Waste Landfill (MWL) is industrial and the most exposure receptor as discussed in the report is a future industrial worker. Institutional controls were assumed that would prevent intrusion into the waste materials. Therefore, the only identified transport pathways for potential contaminants of concern (COCs) are via migration to groundwater, volatilization from soil to ambient air, and direct contact with soil. Based on these transport pathways, the exposure routes for the industrial worker for chemicals and radionuclides were: ingestion of drinking water, ingestion of soil, and inhalation of vapors and particulates. For radionuclides, external radiation was also evaluated.

COCs to be carried forward in the risk assessment were those chemicals that were detected above natural background. Note that the report indicates that the New Mexico Environment Department (NMED) had not approve the background values. For conservatism, the maximum detected concentration was applied. Typically the 95% upper confidence limit (UCL) is used as the exposure point concentration (EPC); however, the approach applied is conservative, as stated. A second step in data reduction was applied where those COCs that exceeded background were compared to the Subpart S action levels. These action levels were never promulgated and are an artifact of previous draft regulations. The use of the Subpart S action levels is not an EPA- or NMED-approved methodology. However, the results of the Subpart S screening process "failed" and therefore no COCs were screened out based on this comparison.

Either methodologies outlined in Environmental Protection Agency (EPA) risk assessment guidance or the code RESRAD were used to estimate concentrations of respirable particles and for vapors, data collected during the passive soil gas surveys were used.

While the report indicates that groundwater sampling has not resulted in positive detects, transport modeling was applied to organics to estimate potential concentrations in groundwater. The applicant indicates that this is another level of conservatism built into the assessment.

The results of the risk assessment indicate that exposure to site contaminants (as detected in soil) by the future industrial worker will not result in unacceptable risk or dose.

2. Appendix N – MWL Risk Assessment

Appendix N contains the algorithms and exposure parameters applied in the MWL risk assessment for industrial land use. The exposure pathways identified as the primary pathways of concern are the ingestion of drinking water, soil, inhalation of vapors and particulates, dermal contact with water and soil, and external exposure to radiation. The algorithms and input parameters are consistent with approved EPA methods of the time.

Comments to be retained for rebuttal

Several pieces of information are missing to provide a complete assessment of the risk assessment. For example, the tables outlining the comparison to background were not provided, nor were tables or data showing what chemicals/radionuclides were detected in soil and at what depths. Therefore, the list of COCs could not be verified. In addition, information as to how cancer risk from radionuclides was converted into an exposure dose is not clearly presented. It is

assumed that the code RESRAD was applied to determine dose, but input and output files associated with the modeling were not provided. Much of the methodology, exposure parameters, and toxicological information are out of date.

It is not clear whether any radiological surveys of the MWL surface have been conducted to provide a better estimate of external exposure. While radionuclides may not have been detected in surface soil samples, activity from radionuclides, especially high concentrations of gamma emitters, could penetrate soil and pose an unacceptable threat to the worker.

"Review of the Risk Screening Assessment for the Mixed Waste Landfill, SWMU 76, by Marvin Resnikoff, Radioactive Waste Management Associates, dated July 2001."

I. Introduction

Mr. Marvin Resnikoff, Ph.D., was asked by Citizen Action to review the risk assessment associated with the Mixed Waste Landfill Phase II RCRA [Resource Conservation and Recovery Act] Facility Investigation (RFI), dated September 1996 and assess whether the objectives of the report had been met and if additional analyses were warranted. The Resnikoff paper identified the Phase II RFI objectives as being to "determine thoroughly the contaminant source, define the nature and extent of contamination, identify potential contaminant transport pathways, evaluate potential risks posed by the levels of contamination identified, and recommend remedial action if warranted." His general conclusion was that the contaminant source had not been identified and that potential risks posed by the landfill had not been fully evaluated.

The Resnikoff paper indicates that the Phase II RFI concluded that contaminants potentially released from the mixed waste landfill (MWL) will not pose significant threat to human receptors via the groundwater or inhalation pathways and that no significant health risks will be present for an industrial worker. Based upon his review of the Phase II RFI, tritium was identified as the primary constituent of concern (COC).

II. Background

In the Background section of the paper, Dr. Resnikoff provides and overall summary of the risk assessment provided in the Phase II RFI. In addition, he iterates that the Phase II RFI indicates that for subsurface soil, the dominant exposure pathway for humans is ingestion of groundwater contaminated by COCs percolating through the landfill and soil. Dr. Resnikoff differs in his evaluation of the exposure pathways and indicates that the primary exposure pathway is inhalation and ingestion of COCs transported off-site via wind erosion.

Dr. Resnikoff also provides contrasting information to the conclusion drawn by Sandia in the Phase II RFI that groundwater has not been impacted. He indicates that low-levels of contaminants have been detected in groundwater and suspects that they may be the result of reactor cooling water that was disposed of in Trench D and/or the result of non-solidified liquids being placed in the landfill prior to 1975.

III. Baseline Risk Assessment

Dr. Resnikoff categorizes his comments on the Phase II RFI baseline risk assessment into three categories: comments related to data collection and evaluation, exposure assessment, and risk characterization.

Data Collection and Evaluation

Dr. Resnikoff concludes that the contaminant source has not been fully characterized. He also cites a letter from the NMED, which he indicates agrees with this conclusion. Without understanding what constituents are present in the landfill, adequate risk/dose cannot be estimated and container failure cannot be estimated. He indicates that the entire inventory (classified and unclassified) should be provided. Dr. Resnikoff provides an example highlighting the importance and effect of the lack of the full waste inventory. Even without the waste inventory, Dr.

Resnikoff concludes that the presence of activation products and actinides could render the landfill hazardous "essentially forever."

Dr. Resnikoff also outlines three concerns associated with Sandia's quality assurance/quality control (QA/QC) procedures:

1. Use of filtered versus unfiltered water samples. While Dr. Resnikoff notes that Sandia collected unfiltered samples, he is unclear whether the laboratory may have filtered the samples. This would result in potential underestimation of metals and radionuclides.
2. Samples with high concentrations were in some cases considered suspect and rejected, but no samples with unusually low concentrations were rejected. While the results from one laboratory were questioned, it appeared that the laboratory QA/QC procedures were correct, but the sample was still rejected. Overall the data set may be biased low.
3. Conflicting soil measurements for plutonium were obtained from three different laboratories, but without the core sample, the sample cannot be re-analyzed.

Exposure Assessment

In general, Dr. Resnikoff disagrees with Sandia's conclusion that the MWL is eligible for unrestricted release for four reasons: future risk under realistic scenarios was not considered; a full waste inventory has not been provided; there are high gamma exposure rates over some of the pits that have not been addressed; and the direct gamma rates are greater than 15 millirem per year (mrem/yr). In response to the above concerns, Dr. Resnikoff would like Sandia to conduct a residential risk assessment at year 100, with a hypothetical resident and/or farmer residing on the MWL. The assessment should assume a complete lack of institutional controls, and include an assumption that crops could be grown and cattle raised on the MWL. In addition, a scenario in which a well is drilled through the contents of the MWL be considered.

Dr. Resnikoff acknowledges that Sandia proposes to use a vegetative cap as the preferred remedy. He discusses some of the drawbacks to this remedy, including providing for cap maintenance and prevention of burrowing animals. If the vegetative cap is the final remedy, Dr. Resnikoff believes a maintenance and monitoring dedicated trust fund should be established.

Risk Characterization

Dr. Resnikoff expressed some concern over the use of older dose conversion factors. The use of the older conversion factors does not allow for the estimation of dose to a child or fetus. The result is potentially an underestimation of dose. His other primary concern is that the cancer risks from chemical and radiological exposure were not considered as cumulative risk. This too provides an underestimation of overall risk.

IV. Conclusions

In conclusion, Dr. Resnikoff indicates that while some low levels of contaminants may have been detected in groundwater, the overall expectation for migration of COCs to groundwater is minimal. His recommendations for Sandia are:

1. Provide the entire waste inventory;

2. Conduct a risk assessment on future scenarios based at 100 years and with no institutional controls; and
3. A dedicated maintenance and monitoring plan be in place if waste is to remain in place.

Comments – to be retained for rebuttal

The actual waste inventory was not applied in the risk assessments, but rather the risk assessments are based upon what the identified receptors could be potentially exposed. As such, only contamination identified in surface soil, subsurface soil, and groundwater was used in the risk assessments. The applicant has indicted that the MWL site would pose unacceptable risk to an on-site resident and therefore has limited the site to an industrial scenario and an off-site resident. However, Dr. Resnikoff's concern over the potential for an underestimation of risk and dose may be valid for the excavation scenario. If waste materials are to be excavated, the risk assessment should consider all potential exposure. **Note: In discussion with Mr. Mike Nagy of Sandia National Laboratory concerning the risk assessment associated with the CMS report, Mr. Nagy indicated that the waste inventory with respect to metals and organics was not known. For the CMS risk assessment for the future excavation scenario, a weighted average of the total radiological waste disposed of the MWL was used to estimated the TEDE to the worker.**

It is unclear what level of data validation was applied to data. Therefore, some of the concerns on the QA/QC procedures expressed by Dr. Resnikoff cannot be fully ascertained. With respect to the plutonium data, it is not clear whether different test methods were applied, which could explain the difference in results.

A primary concern is the evaluation of a resident at the end of the 100-year post-closure period. It appears that all parties agree that direct exposure to contents within the MWL to a resident would result in undue risk. Therefore the MWL is to be closed under an industrial scenario. As a government entity, Sandia cannot place a deed restriction on the MWL; however, Sandia would be required to maintain in their Site Management Plan the restriction if the site to industrial use as outlined in the risk assessment. This restriction would be enforced as long as Sandia were the owner of the property. In the event that at some time in the future Sandia transfers the property to another owner, the industrial restrictions would be transferred; if the buyer were a non-government entity, this would occur as deed restrictions. Thus, the potential that a resident will reside directly over the MWL or a farmer will grow crops or raise cattle is highly unlikely.

Since the results of the Phase I and Phase II RFIs indicated that groundwater had not been impacted, the applicants did not include groundwater as an exposure pathway in the risk assessment. If at any time in the future contaminants were detected in groundwater, the facility would be required to evaluate the potential impact to human health and the environment. At that time, the facility may need to address interim actions and/or corrective action, and a risk assessment including groundwater as a medium of concern may be required.