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Mr. Carl Will
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. Y513, 06110.040; State of New Mexico Environment Department, Santa Fe, New Mexico; LANL Permitting Support; Discussion and Review of Risk-Based Analyses Performed in Support of Permitting the TA-16 Burning Ground; Task 7 Deliverable.

Dear Mr. Will:

This letter describes screening level risk analyses performed by TechLaw, Inc. (TechLaw) in support of the permitting of the open burning operations at the Technical Area 16 (TA-16) Burning Ground of the Department of Energy's Los Alamos National Laboratory, Los Alamos, New Mexico (LANL). These analyses were undertaken to ensure that the open burning operations at TA-16 are protective of human health and the environment. Two types of risk-based calculations were performed:

- TechLaw repeated the screening analysis of on-site dry deposition that was performed and submitted by LANL as part of the first facility response to NMED comments (*Response to Notice of Deficiency; TA-16 Part B Application Revision 3.0, January 31, 2000*). TechLaw used a more conservative approach than LANL to establish upper bound estimates of soil concentrations for comparison to New Mexico Environmental Department (NMED) residential soil screening levels and NMED-approved/LANL-derived ecological screening levels (ESLs); and

- TechLaw calculated potential carcinogenic and noncarcinogenic risks via the inhalation pathway for a hypothetical adult resident located on the LANL boundary just over a mile south of the TA-16 Burning Ground. LANL had not performed an analysis of the inhalation pathway as part of its permit application for the TA-16 Burning Ground.

A summary of each analysis performed by TechLaw appears below.

Estimate of On-site Soil Concentrations and Comparisons to NMED-approved Screening Levels

In reviewing LANL's responses to the first NMED TA-16 NOD, TechLaw noted that LANL configured the CALPUFF model to estimate dry deposition from the open burn operation as a point source (i.e., as a stack). LANL was asked to justify this approach by showing that it adequately and conservatively represented the actual open burning process at TA-16 compared to the use of the area source algorithm in CALPUFF or other air dispersion models suitable for modeling open burning operations.[1] In the second facility response to NMED comments, LANL did not furnish such a demonstration but provided some information on why the point source algorithm was used. Because questions remained about the technical basis of the air modeling methodology, TechLaw repeated the deposition analysis using the maximum one-hour air concentration generated by LANL's CALPUFF modeling as the basis for estimating dry deposition flux and, thus, soil concentrations. Other assumptions were made that were more conservative in nature than those employed in LANL's analysis. TechLaw's analysis showed that the soil concentration of none of the constituents included in the analysis exceeded its NMED soil screening level or ESL. A summary of the conservative assumptions used in TechLaw's analysis is presented below.

- The maximum one-hour air concentration obtained from LANL's CALPUFF modeling was used as the basis for estimating dry deposition and, ultimately, soil concentration. While confidence in the accuracy of LANL's air modeling results was low, use of the maximum one-hour air concentration introduced additional conservatism into the analysis as an annual average value would normally be used. The value of 4.63×10^{-8} g/m^3 per g/sec was converted to a deposition flux by multiplying by a generic deposition velocity of 0.3 meters per second. This technique introduces conservatism as well, and results in an overestimate of deposition flux, especially compared to using deposition fluxes that are obtained as output from an air dispersion model. Ultimately, a value of 6.25×10^{-8} mg/kg per gram emitted (in a year) was calculated (using the same methodology employed in LANL's analysis) for use in estimating soil concentrations.

- TechLaw used the same approach as LANL in calculating constituent-specific soil concentrations. As LANL had done, TechLaw multiplied the annual constituent-specific soil concentrations by 10 to estimate soil concentrations at the end of the ten year life of the permit.

- Because questions remained about LANL's choice of emission factors for D003-contaminated trash, TechLaw addressed two separate sets of emission factors for

[1] It is TechLaw's opinion that LANL should have used the area source algorithm available in CALPUFF to more accurately model the source characteristics of the open burning operation at TA-16. Several inquiries have been sent to Earth Tech, the developers of CALPUFF, to determine if the area source algorithm should be used when modeling open burn operations. A response has not yet been received from Earth Tech although receipt of the initial request was acknowledged.

this waste stream. First, the emission factors used by LANL were considered. Then, a second set of emission factors for the burning of dunnage with diesel fuel was extracted from EPA's validated Open Burn/open Detonation (OB/OD) emission factor data base [*Emission Factors for the Disposal of Energetic Materials by Open Burning and Open Detonation (OB/OD)*, EPA/600/R-98/103] and the analysis was repeated.

- To introduce another level of conservatism, TechLaw used the NMED residential soil screening levels rather than the industrial levels employed in LANL's analysis for comparison to the estimated constituent-specific soil concentrations.

As stated above, all comparisons performed by TechLaw showed that no constituent-specific soil concentrations exceeded their NMED soil screening level or ESL. In agreement with LANL's reported results, TechLaw's soil concentrations were orders of magnitude lower that the soil screening levels and ESLs for the vast majority of constituents.

It must be noted that soil screening levels and ESLs are not available for all constituents for which a soil concentration was estimated. LANL is preparing an updated list of ESLs at this time. When the new list is made available to NMED and TechLaw, the comparisons will be updated and finalized.

Estimate of Risk and Hazard to an Off-site Adult Resident via the Inhalation Pathway

To estimate carcinogenic risks and hazard quotients for emitted constituents via the inhalation pathway, TechLaw used the equations and parameter values presented in Tables C-2-1 and C-2-2 of EPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, EPA530-D-98-001B. LANL's CALPUFF air dispersion modeling results were reviewed to identify the maximum one-hour air concentration obtained along the southern edge of the 3 kilometer by 3 kilometer grid addressed in the CALPUFF modeling (for the purposes of TechLaw's analysis, it was assumed that the southern edge of the modeling grid fell along the LANL facility boundary). The maximum modeled value along the southern edge was found to be 685 x 10^{-11} g/m^3 per g/second. Converting the units to μg/m^3 per gram emitted (in a year) resulted in a value of 7 x 10^{-3} that was used as the annual average air concentration in the analysis. A summary of the conservative assumptions used in TechLaw's analysis is presented below.

- The maximum one-hour air concentration generated along the southern edge of the modeling grid used in LANL's CALPUFF air modeling analysis was chosen to represent the unitized annual average air concentration in the analysis. While confidence in the accuracy of LANL's air modeling results was low, use of the one-hour air concentration introduced additional conservatism into the analysis as a modeled annual average value would normally be used.

- As in the deposition analysis described above, TechLaw addressed two separate sets of emission factors for the open burning of D003-contaminated trash. First, the emission factors used by LANL were considered. Then, a second set of emission factors for the burning of dunnage with diesel fuel was extracted from EPA's validated OB/OD emission factor data base [*Emission Factors for the Disposal of Energetic Materials by Open Burning and Open Detonation (OB/OD)*, EPA/600/R-98/103] and the inhalation pathway analysis was repeated.

- Total annual quantities of solvents, D003-contaminated trash, and bulk explosives treated were used to estimate the mass of individual constituents emitted during a year. This introduced a level of conservatism in the analysis as not all identified constituents were expected to be present in all wastes that comprised the three waste streams. For example, the amount of total bulk explosives treated was used to estimate the annual emission rate for barium. However, LANL stated that barium was only present in the Baritol treated during the year. Thus, use of the total amount of bulk explosives treated during the year resulted in an overestimate of the barium emitted.

- Toxicity factors were taken from the IRIS, HEAST and NCEA databases.

Currently, TechLaw's analysis shows cancer risks in excess of 1×10^{-6} for the open burning of solvents (driven by 1,2-dichloroethane) and the open burning of D003-contaminated trash (driven by benzene only when the emission factors from EPA's validated OB/OD emission factor data base were considered). A hazard quotient in excess of 1.0 was obtained for barium when the open burning of bulk explosives was analyzed. However, these estimates must be viewed with skepticism.

While the current version of the inhalation pathway analysis resulted in carcinogenic risks and hazard quotients in excess of target levels for individual constituents, the results can be attributed to the use of inaccurate annual treatment quantities for the treated waste streams and the use of a one-hour average air concentration rather than an annual average air concentration. LANL has supplied new and additional data on annual treatment quantities. It is envisioned that use of these new data will result in lower estimates of risk and hazard. It is hoped, however, that the one-hour average air concentration can be retained in the analysis for the level of conservatism that its use affords. In finalizing the analysis of impacts via inhalation, TechLaw will incorporate the new information on treatment quantities and check for cumulative impacts as appropriate. This will be done at the same time that the new ESL values are incorporated into the deposition analysis.

Cadmium was not included in either analysis. While LANL showed that cadmium was present in ash at levels above accepted background, they could not identify its source and, thus, could not provide information that could be used in estimating the amount of cadmium potentially emitted during a year. Potential sources of cadmium might include the soil and the plastics that were burned during the year. If NMED desires, TechLaw can attempt to include cadmium in the analyses. Cadmium is considered a carcinogen by the inhalation route.

If you have any questions, please feel free to contact Ms. Paige Walton at (801) 451-2978 and Mr. Michael S. Smith at (770) 752-7585, extension 103.

Sincerely,

June K. Dreith (p. Walton)

June K. Dreith
Project Manager

Enclosure
cc: Ms. Lee Winn, NMED
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