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Mr. Ron Kern
New Mexico Environment Department
Hazardous and Radioactive Materials Bureau
525 Camino de Los Marquez
Santa Fe, NM 87502

Dear Mr. Kern:

Subject: Framework for Risk Assessment,
Person Generating Station, NMT360010342

Enclosed please find our most recent revision to the document Framework for Risk Assessment, Person Generating Station, NMT360010342 which incorporates comments received from the Hazardous and Radioactive Materials Bureau (HRMB) in your letter dated July 6, 1994.

If you find the new language acceptable, I would appreciate a short letter response to that effect. At that time we will forward the draft risk assessment report to you for your review. If you have any questions, please contact me at 848-2998.

Sincerely,

Ron Johnson

Ron D. Johnson
Sr. Environmental Scientist

RDJ:rdj
enclosure
cc: Ms. Teri Davis - NMED

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Engineering-Science, Inc. (ES) proposes to quantitatively characterize under both current and reasonable future exposure scenarios the potential carcinogenic and noncarcinogenic risks posed to human health from volatile organic compound (VOC) contamination in soil and shallow groundwater at the Person Generating Station site. Risks to human health will be quantitatively evaluated using a site-specific approach based on the chemical risk assessment principles and procedures outlined in EPA's Risk Assessment Guidance for Superfund (RAGS) manuals.

There are two primary objectives of the proposed risk assessment for the Person Generating Station Site. The first objective is to evaluate and document potential threats posed by existing site contamination if no action were taken at the site (commonly referred to as a baseline risk assessment). The second is to provide a basis for determining the levels of chemicals that can remain onsite and still be adequately protective of public health. This second objective is primarily aimed at defining risk-based target remediation goals for the site. However, since the Public Service of New Mexico (PNM) and the New Mexico Environment Department (NMED) have already agreed to implement a response action at the Person Generating Station site, assessment of potential site risks under future exposure scenarios should also concentrate on the risks associated with the remedial action itself plus any remaining contamination (commonly termed risk evaluation of a remedial alternative).

On February 4, 1994, representatives from NMED, PNM, and ES discussed possible approaches to quantitatively evaluate site risks for the Person Generating Station site. The group collectively agreed that quantitative risk information could be used to assess the continuing need for and effectiveness of the remedial action described in the Corrective Measures Proposal (CMP) for the Person Generating Station site. Given that PNM and NMED have reached a consensus on the initial remedial technologies to be implemented at the site, the group also agreed that a modified risk assessment strategy may be reasonable and adequate to support the decision-making process for the site. PNM and ES believe that coupling elements of the traditional baseline risk assessment and elements of an evaluation of the short- and long-term risks associated with implementing a remedial action at the site will both evaluate the need for action at the site and define the level of action which will be required to ensure that the final remedy is protective of public health. NMED requested that PNM summarize the proposed risk assessment methods to be used to evaluate site risks for review and approval, as appropriate. PNM and NMED recognized the need to cooperatively identify and approve specific data evaluation methods to be used in risk assessment for the site.

Issues that were discussed in the group forum included what types of data will be factored into the risk assessment; how such data will be evaluated to assess potential site risks; and what data will be included in final risk assessment documentation to support quantitative risk characterization. The following discussion summarizes the proposed streamlined risk assessment process to be completed for the Person Generating Station site.

Data collection and evaluation

PNM and ES propose to use existing soil, soil gas, and groundwater data collected at the Person Generating Station site to complete the risk assessment.

Data on the existing nature and extent of soil contamination at the Person Generating Station site are available (Geoscience Consultants, Ltd., 1984). These data demonstrate that the bulk of contaminated soil extends downward approximately 70 feet from the base of the below-grade source waste tank. Data indicate that soil contamination at a depth of 70 feet to the water table, which is located approximately 110 feet below ground surface, is very low. The source waste tank was removed from service in 1983; PNM subsequently installed a closure cap on the 25′ x 35′ source area to minimize downward infiltration and eliminate the surface soil exposure pathway. Without the continual addition of water to the waste tank, no significant mechanism for vertical transport through the vadose zone has existed since 1983.

PNM and ES propose to use the existing soil data to develop representative concentrations for each contaminant of concern (COC) for the surficial soil and vadose zone media to evaluate site risks under both current and potential future exposure scenarios, per EPA risk assessment guidance (EPA, 1992a). However, it is important to note that surficial and vadose zone soil data were only collected from 19 sample locations within the former waste oil tank area prior to installation of the closure cap.

Data analysis for these samples focused on 1,1,1-trichloroethane (1,1,1-TCA) and tetrachloroethene (PCE); there are no soil data for 1,1-dichloroethene (1,1-DCE). However, calculated exposure concentration levels based on these 19 samples will be conservative for three reasons. First, these data are representative of only the most contaminated soil material at the site. Use of this data to characterize potential representative soil concentrations to which potential human receptors may be reasonably exposed will overestimate the amount of soil contamination at the site. For example, even if these soil concentrations were representative of onsite conditions, it is highly unlikely that these concentrations reflect existing or potential offsite conditions. No significant lateral or vertical transport mechanism exists to allow soil contamination to migrate beyond this source area. Second, the presence of the 25′ x 35′ closure cap over the former waste oil tank area effectively makes these soils inaccessible to human receptors under most reasonable exposure assumptions. The only way that a current or potential future receptor could come into contact with these soils would be to dig beneath the closure cap. This is not a reasonable exposure assumption. Third, the remedial approach described in the CMP calls for source removal using soil vapor extraction techniques, which will rapidly decrease the concentration of VOCs in the affected soil column. Although PNM and ES propose to include soil contamination when assessing both risks to potential future receptors and potential residual risks 20 years after initiating planned remediation at the site, soil concentration data will not be adjusted to reflect either effects from either natural attenuation or the anticipated 90 percent reduction in contaminant concentrations due to planned soil vapor extraction activities. Thus, estimates of risk due to exposure to deep soil contamination under future exposure scenarios (using both baseline and residual concentrations) will be highly conservative and subject to discussion in the uncertainty analysis section of the risk analysis report. Although this approach is admittedly conservative, in the absence of soil data more representative of actual exposure conditions at the site, these are the only data available. All risk calculations based on this data will provide a "worst case" or bounding estimate of potential risks due to exposure to site soil contamination.

Representative concentrations appropriate for risk assessment are defined by EPA as the 95% upper confidence limit (UCL) on the arithmetic mean of the data; details on deriving this value are discussed later in this section.

A shallow soil gas investigation has also recently been completed at the Person Generating Station site (Tracer Research Corporation, 1990). PNM and ES propose to use representative COC concentrations from soil gas data from 40 onsite and 12 offsite sample locations to evaluate potential risks associated with inhalation of VOCs accumulating in structures in direct contact with soil. Soil gas data is available for 1,1,1-TCA, 1,1-DCE, and PCE. Again, the representative COC concentration appropriate for risk assessment is the 95% UCL of the arithmetic mean. These concentrations will then be incorporated into simple diffusion models (e.g., EPA, 1981, 1992b; Michelson, 1993) to estimate exposure point concentrations under defined exposure scenarios. As with soil contamination estimates, estimates of risk due to exposure to contaminated soil gas under potential future exposure scenarios will be highly conservative and subject to discussion in the uncertainty analysis section of the risk analysis report.

Significant groundwater quality data exists for the Person Generating Station site, which has been incorporated into the remedial design and performance assessment described in the CMP. Measured groundwater data will be used to develop representative COC concentrations to be used to assess current site risks (EPA, 1992a). As for soil and soil gas data, the representative COC concentration in groundwater appropriate for risk assessment is the 95% UCL of the arithmetic mean. However, PNM and ES propose to use the model-derived groundwater concentrations expected following implementation of the remedial action described in the CMP to assess potential future site risks (Engineering-Science, 1994). This strategy is based on EPA guidance regarding evaluation of residual risk following remedial action (EPA, 1991a). This approach will be supplemented with the development of preliminary remediation goals (PRGs) for the groundwater exposure pathway appropriate for hypothetical future exposure scenarios following the methodology outlined in Part B of the RAGS manuals (EPA, 1991b). Thus, both quantitative estimates of risk levels using modeled data and target long-term remediation goals will be developed for future exposure scenarios to provide information as to what level of treatment will be protective of human health.

PNM and ES will compute representative COC concentrations by media using the methods outlined in Supplemental Guidance to RAGS: Calculating the Concentration Term (EPA, 1992a) and the RAGS manuals. Conventional distribution tests (i.e., the Chi-Square Distribution Test and the Kolmogorov-Smirnov Test) will be used to test uncensored data sets for normality or lognormality. If the data can be described by a normal distribution, the 95% UCL of the arithmetic mean will be computed using the normal statistical approximation, per EPA guidance (1992a). If the data can be described by a lognormal distribution, the data will be transformed using the natural logarithm function (to achieve a more normal distribution). The transformed data set will then be used to compute the 95% UCL of the arithmetic mean using the lognormal statistical approximation (EPA, 1992a). This approach is consistent with EPA guidance on how to establish the exposure concentration for risk assessments.

Nondetected results for the COCs will not be omitted from the risk assessment. One-half the value of the reported result for all nondetect values will be used as a proxy concentration when determining a single concentration most representative of potential exposures at the site. Both detected and proxy values will then be used to compute the 95% UCL of the arithmetic mean using the appropriate statistical approximations. Uncertainties inherent in such statistical approximations will be fully described in the risk analysis report.

<u>Contaminants of concern</u>

PNM and ES propose to limit risk calculations to the three contaminants that have been consistently reported above detection limits in soil and groundwater: 1,1,1-TCA, 1,1-DCE, and PCE. Although several other VOCs have been occasionally measured in environmental samples from Person Generating Station site (e.g., chloroform, 1,1-DCA, 1,2-DCA, TCE, and bromochloromethane), these VOCs have been detected in less than 5 percent of the total samples (i.e., frequency of detection is < 5%). These contaminants are usually omitted from the risk assessment process as they do not illustrate potential representative exposures for the site.

Exposure assessment

Decisions regarding land use are at the heart of identifying potential receptors, potential exposure pathways, and reasonable exposure scenarios. EPA advises that the potential land use associated with the highest level of exposure and risk that can reasonably be expected to occur should be addressed in the risk assessment (EPA, 1991c). Although the exposure scenarios based on potential future residential land use provide the most conservative risk estimates and are important considerations in deciding whether to take action at a site, EPA risk assessment guidance materials state that this conservative approach may not be justifiable if the site is surrounded by operating industrial facilities that can be reasonably assumed to remain as industrial areas. In these cases, EPA recommends using other exposure scenarios, such as agricultural or recreational, and include a qualitative assessment of the likelihood that the assumed reasonable future land use will occur (55 FR 710). PNM and ES believe that the characteristics of the Person Generating Station site may prohibit future unrestricted residential development. However, NMED informed PNM and ES that the residential land use assumption should be applied to obtain the most conservative risk estimates. PNM and ES will follow NMED's technical direction but will discuss how the resulting risk estimates may be affected by more realistic land use considerations in the risk analysis report.

Thus, PNM and ES propose to assess potential risks under six different exposure scenarios:

1. Current risks to both onsite and nearby offsite light industrial/commercial workers;
2. Current risks to onsite construction/remediation workers;
3. Future risks to both onsite and nearby offsite light industrial/commercial workers;
4. Future risks to onsite construction workers;
5. Future risks to both onsite and nearby offsite residents 20 years after initiating planned remediation at the site; and
6. Future risks to both onsite and nearby offsite residents if no action were taken at the site.

Risks to light industrial/commercial workers and construction/remediation will incorporate carcinogenic and noncarcinogenic effects due to exposure to soil and soil gas contamination. No groundwater component will be included in these exposure scenarios as risk-based concentrations for groundwater affected by activities at the Person Generating Station site will be based on residential exposures. Differences in risk estimates for light industrial/commercial workers and construction/remediation workers will be attributable to possible differences in the soil exposure point concentration. Specifically, risks to light industrial/commercial workers will be due to exposure to contaminated surficial soil and accumulating soil gases. Routes of exposure to light industrial/commercial workers will include incidental ingestion and dermal contact with contaminated surficial soils and inhalation of VOCs within the outdoor breathing zone due to upward diffusion through the contaminated soils into the atmosphere. Measured soil gas concentrations can not be directly used to evaluate potential risks due to inhalation of VOCs diffusing upward through the vadose zone into the atmosphere. Because this exposure pathway may represent a source of risk for these receptors, several diffusion and dispersion models recommended by the EPA (EPA, 1992b) will be used to determine risk assessment concentration levels for volatilizing COCs in the atmosphere. A simple flux model coupled with a distance-related attenuation/dispersion equation will be used to estimate the concentration in the air a receptor may reasonably be expected to inhale. The outdoor concentration of each COC that a light industrial/commercial receptor could be reasonably expected to be exposed was based on a constant emission rate calculation. This estimated flux rate will then be incorporated into a simple virtual upwind point source dispersion equation recommended by the EPA to characterize air quality impacts (EPA 1981, 1992b). The outdoor concentration will be based on a receptor located in the middle of the Person Generating Station site, downwind of the constant emission source (i.e., the former waste oil tank area). As discussed previously, soil gas measurements used in these models will not be adjusted to reflect effects due to natural attenuation or the 90 percent reduction in contaminant concentrations due to planned soil vapor extraction activities. Essentially, all inhalation risks will be based on baseline conditions.

Risks to construction/remediation workers will be due to exposure to deeper soils and soil gas. Routes of exposure to this receptor will include incidental ingestion of and dermal contact with contaminated vadose zone soils and inhalation of VOCs within the outdoor breathing zone due to upward diffusion through the contaminated soils into the atmosphere. As before, the outdoor concentration of VOCs will be estimated using a simple flux model, although a more conservative model appropriate for potentially acute exposure scenarios will be employed. This model, also recommended by the EPA (1992b), is driven by pressure changes that can increase the concentration of VOCs "forced" from the soils (i.e., soil gas expressed because of pressure difference). Because the proposed vapor extraction system will be connected to activated carbon canisters designed to remove 99 percent of vapor contamination before the treated effluent is discharged into the environment (Engineering-Science, Inc., 1994), workers would not be exposed to this acute contamination source. However, these receptors may be working in close proximity to the former waste oil tank area. The pressure-driven flux model will provide a method to conservatively estimate the concentration of soil gas to which construction/remediation workers could potentially be exposed. The same simple virtual upwind point source dispersion equation used for light industrial/commercial workers will be used to estimate the outdoor concentration of soil gas in the workers' breathing zone. Again, soil gas measurements used in these models will not be adjusted to reflect effects due to natural attenuation or the 90 percent reduction in contaminant concentrations due to planned soil vapor extraction activities. Essentially, all inhalation risks will be based on baseline conditions.

Risks to potential future residents will reflect both carcinogenic and noncarcinogenic effects due to exposure to contaminated soil, soil gas, and groundwater. Risks from ingestion of contaminated groundwater will be factored into the total risk calculation under the residential exposure scenario. Representative chemical concentrations in water used in these equations will be based on (1) baseline concentrations to assess the risks associated with taking no action at the site and (2) baseline soil and soil gas data and the modeled groundwater quality data used to evaluate the effectiveness of the proposed remedial action. However, the vertical extent of the shallow groundwater contamination under the Person Generating Station site is currently about 20 feet below the water table. Although it is extremely unlikely that potential future residents would use even the treated upper flow zone as a source of potable water, PNM and ES will use these concentration values as an upper bounding risk calculation for both exposure scenarios 5 (residential, residual) and 6 (residential, baseline). Uncertainties inherent in this approach will be discussed in the risk analysis report. Note that ingestion of fruits and vegetables will not be considered a significant exposure pathway, even under the most conservative residential exposure scenario.

Risk calculations under the six exposure scenarios will be based on the appropriate intake equations and default parameters defined in the RAGS manuals and related EPA risk assessment guidance material.

Toxicity Assessment

Toxicity information used in the estimate of risk and the calculation of risk-based PRGs will include the reference dose (RfD) and the reference concentration (RfC) for noncarcinogenic effects and the slope factor (CSF) for carcinogenic effects. Values will be obtained from the Integrated Risk Information System (IRIS) (Micromedix, Inc., 1994). If values are not available from IRIS, the Health Effects Assessment Summary Table (HEAST) will be consulted (EPA, 1993). In addition to toxicity values, information on toxic endpoints, i.e., critical effects on target organs, will be identified for the three COCs for Person Generating Station site. This information will be incorporated into the risk calculations and development of PRGs to ensure that cumulative risk estimates account for the presence of multiple contaminants.

Only oral and inhalation values are available from IRIS or HEAST; EPA has not developed toxicity values for dermal exposure (which may be a significant route of exposure for the Person Generating Station site) due to lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for most pollutants. In the absence of dermal reference toxicity values, EPA has suggested that it may be appropriate to modify an oral RfD so that it can be used to estimate the hazard incurred by dermal exposure (EPA, 1989). This modification requires that the toxic endpoints observed are the same for both oral and dermal exposure, and that a quantitative estimate of both dermal and oral absorption of the chemical be developed. Although this type of detailed information is rarely available, most risk assessments prepared using EPA guidance often rely on oral toxicity values to quantify risk associated with dermal exposure. PNM and ES will incorporate risks due to dermal exposure. Conservative estimates for oral absorption factors for the three COCs to be considered in this risk analysis will be taken from the Agency for Toxic Substance and Disease Registry (ATSDR) Profiles. If such chemical-specific information is unavailable, a conservative absorption factor of 0.90 will be used (commonly used for volatile organic compounds).

Development of target remediation goals

In order to satisfy the second objective of the proposed risk assessment for the Person Generating Station site and in keeping with EPA guidance on risk evaluation of remedial alternatives, PNM and ES propose to calculate target remediation goals or PRGs that are protective of human health at a defined target risk level. Three of the exposure scenarios presented earlier (i.e., future onsite light commercial/industrial worker, future onsite construction/remediation worker, and future onsite resident) will be used to identify chemical-specific concentrations that can be left inplace in each affected media (i.e., soil and groundwater) so that cumulative carcinogenic risks from exposure to multiple chemicals does not exceed a target risk level of 1×10^{-5}. This target risk level has been defined in the New Mexico Water Quality Control Commission (WQCC) guidelines which state that "any water contaminant or combination of the water contaminants in the list below [which includes the three COCs for the Person Generating Station site] creating a lifetime risk of more than one cancer per 100,000 exposed persons is a toxic pollutant." Cumulative risks will be developed by dividing the target risk by the number of carcinogens affecting the same target organ. Similarly, PNM and ES will develop noncarcinogenic target remediation goals by adjusting the target hazard index based on the critical effect of the chemical. If a chemical has both carcinogenic and noncarcinogenic effects, the most stringent of the two calculated PRGs will be identified as the risk-based target remediation goal.

Once these target remediation goals have been developed for each exposure scenario, PNM and ES will compare these values to both the Human Health Standards for Groundwater defined by the New Mexico WQCC and the projected removal efficiencies of the proposed remedial action. The risk analysis report will present this comparison and make recommendations on: (1) which target clean up level should be applied to the Person Generating Station site, and (2) whether the proposed remedial action to be implemented is expected to attain these levels. All uncertainties associated with this evaluation--including, for example, PRG calculations, reliability of modeled results, confidence in technology effectiveness estimates--will be fully discussed in the uncertainty section of the risk analysis report.

Risk characterization

The final step in the traditional risk assessment process is to quantitatively and qualitatively define the cumulative risks associated with exposure to site contamination under both current and future exposure scenarios. PNM and ES will evaluate both the carcinogenic and noncarcinogenic risks for each COC for each (which includes all completed exposure pathways), and sum the risks to define the total risk associated with the exposure potential at the Person Generating Station site. Thus, a cumulative cancer risk level and a cumulative hazard index will be developed for each of the six exposure scenarios considered in the risk assessment. PNM and ES will summarize these findings and explain in clear and plain language what such risk calculations mean. PNM and ES will also qualitatively discuss the differences between the most conservative risk estimates (e.g., future resident) and most reasonable risk estimates (e.g., future onsite light industrial/commercial worker) to provide summary information to support the decision-making process. Information on pathway completion, chemical parameters, and other site characteristics that may be factored in the final decision will also be presented. This section of the risk analysis report will also summarize the comparison between risk-based target remediation goals, regulatory-defined groundwater standards, and expected remedial clean up efficiencies (as discussed above). The risk analysis report will provide the necessary data in accessible format to determine what potential threats are posed by existing site contamination if no action were taken at the site and what level of chemicals can remain onsite and still be adequately protective of public health.

References

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