DEPARTMENT OF THE ARMY
TOOELE ARMY DEPOT
TOOELE, UTAH 84074-5000

REPLY TO ATTENTION OF

6 March 1997

Safety & Environmental
Management Division

Mr. Chris Whitman
Ground Water Protection & Remediation Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Whitman:

Please find enclosed for your review the Army response to the New Mexico Environment Department, Groundwater Protection and Remediation Bureau (NMED) comments, letter dated 18 July 1996 to Tooele Army Depot, regarding the Revised Draft Final Remedial Investigation and Feasibility Study Report for the Fort Wingate Army Depot, dated 25 March 1995.

To address the NMED concerns relative to site screening and the groundwater pathway, the Army has subjected those sites specifically identified in the NMED, 18 July 1996 correspondence to another level of analysis. The approach taken by the Army was to build upon the site screening process adopted early on in the Fort Wingate cleanup program and to use the most recent developments in site screening techniques to resolve concerns about the groundwater pathway and the need to further investigate sites. To this end, the Army has employed methods described in the U.S. Environmental protection Agency (EPA), Soil Screening Guidance: Technical background Document, May 1996 to develop soil screening levels for the migration to groundwater pathway. A copy of the EPA publication entitled "Soil Screening Guidance: Fact Sheet" is attached for your information.

In response to NMED concerns regarding the former Bomb Washout Plant Lagoons (Washout Lagoons), and in advance of this correspondence, the Army has embarked on a program to fully evaluate historical releases of contaminants associated with the Washout Lagoons, commencing with the installation and sampling of groundwater monitoring wells. Additional efforts are currently being planned, including the placement of supplemental monitoring wells to further evaluate site conditions in the vicinity of the Washout Lagoons. Of course, we will be looking to NMED for involvement during this planning stage, and all workplans for

this undertaking will be forwarded to NMED for review.
We hope that, taken in combination, these efforts satisfactorily resolve the concerns outlined in your letter.

Sincerely,

THOMAS A. TURNER
Acting Director of Industrial
Risk Management

CF:

Phillip Solano
Chuck Hendrickson
Pat Flynt, DAIMBO
William Bradley/Kevin Tiemeier
Timothy Alexander, AEC
Katrina Ajemian, COE Ft. Worth District

Response To State of New Mexico Environment Department - Ground Water Quality Bureau Comments on the Fort Wingate Depot Activity Revised Draft Final Remedial Investigation/Feasibility Study, dated 25 March 1995

The comments summarized below were provided in a correspondence from Mr. Chris Whitman, Geologist, Assessment and Abatement Section, Ground Water Protection and Remediation Bureau, New Mexico Environment Department (NMED) to Mr. Larry Fisher, Tooele Army Depot, Tooele, UT, dated 18 July 1996.

Comment No. 1:

Section 3.1.2.6: Figure 3-1 uses the same symbol to represent wells that intersect ground water and dry wells which have been completed in the vadose zone. Because this important distinction is made in the text it should also be depicted in Figure 3-1.

RESPONSE: The wells presented on Figure 3-1 were installed by ESE in the 1980 to 1981 time frame and were screened in observed moist zones with the objective of monitoring ground water. Several of these wells have not contained measurable quantities of ground water in the past. Figure 3-1 will be revised to show separate symbols to distinguish between monitoring wells where ground water has been historically or recently observed and the remaining dry wells.

Comment No. 2:

Sections 3.1.2.6 and 5.2.1: Both sections state that "13 ground water monitoring wells" were installed by ESE in the 1980 to 1981 time-frame. However, section 2.2.5.6 indicates that only one of the 13 wells encountered ground water during drilling. During Environmental Resources Management's (ERM) assessment of the 13 wells for the RI/FS, three contained sufficient quantities of ground water for sampling. Unsaturated flow in the vadose zone is dominated by capillary forces. Therefore, it is highly unlikely that water will enter a large void, such as a well in the vadose zone. Furthermore, sand packs around wells at FWDA may be coarser grained than the native material, and therefore represent a capillary barrier to fluid flow. It is incorrect and misleading to refer to the dry wells with screens set in unsaturated alluvium as "ground water" monitoring wells. This should be corrected where it occurs in the text.

RESPONSE: The "wells" installed by ESE in the 1980 to 1981 time frame were screened in observed moist zones with the objective of monitoring ground water. Several of these wells have not contained measurable quantities of

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ground water in the past. Text discussion will be revised to distinguish between monitoring wells where ground water has been historically or recently observed and the remaining dry wells.

Comment No. 3:

Section 5.2.1: From the fact that 10 dry wells contain too little water to sample, the conclusion is drawn that "no permanent ground water system is present in the shallow alluvial sediments at FWDA." This conclusion cannot be made from the available data because, as an Army Environmental Center (AEC) representative detailed during the June 4, 1996 meeting at FWDA, characterization of ground water was not an objective of the ESE investigation. Well construction information confirms this assertion. As indicated in Section 2.2.5.6 of the RI/FS, the average depth of the wells drilled during the ESE study is 30 feet. The fact that 10 shallow boreholes did not encounter ground water does not preclude its existence in the alluvium at any well location. To the contrary, the ground water investigation performed by the Army Corps of Engineers to assess the impact of leaking underground storage tanks (UST) near Building #6 demonstrates that a water table exists at a depth of between 45 and 47 feet in that area. Wells drilled to comparable depths in the 1980 ESE study also encountered ground water, counter to the statement that "no permanent ground water system is present." Sweeping generalizations about the nature and extent of alluvial ground water should be removed from the RI/FS.

RESPONSE: Generalizations regarding the nature and extent of alluvial ground water and the reported conclusion that "no permanent ground water system is present in the shallow alluvial sediments at FWDA." will be removed from the RI/FS until such a time as a body of evidence exists to support these statements.

Comment No. 4:

Section 2.2.5.6: Table 2-2 indicates that the background monitoring well, FW-31, was drilled to a total depth of 30 feet. Section 3.1.2.6 text states that FW-31 was drilled to a depth of 50 feet. This is a critical distinction because FW-31 is a well that intersects ground water. Also, text in Section 3.1.2.6 refers to Table 6-63 for well-depth comparisons with time. This information actually appears in Table 7-65.

RESPONSE: Table 2-2 will be corrected to reflect the actual depth of FW-31, which is 50 feet. The table referenced in Section 3.1.2.6 will also be corrected to state that the information appears in Table 7-65.

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RESPONSE: Table 2-2 will be corrected to reflect the actual depth of FW-31, which is 50 feet. The table referenced in Section 3.1.2.6 will also be corrected to state that the information appears in Table 7-65.

Comment No. 5:

Section 5.5: Five contaminant migration pathways are considered. The text concludes the migration pathway to ground water can be "dismissed as a potential transport pathway due to the high evapotranspiration rates and corresponding low precipitation rates and the ephemeral nature of shallow ground water observed during both the current and previous investigation at FWDA." Both reasons are assumptions made without evidence to support them. While evapotranspiration is high and precipitation is low at FWDA relative to other parts of the country, aquifer recharge through the vadose zone has been shown to occur in New Mexico. No studies at FWDA refute this. Refer to Gee, et. al., 1994, "Variations in Water Balance and Recharge Potential at Three Western Desert Sites," Soil Science Society of America Journal, 58:63-72, for detail of studies of potential aquifer recharge. Comments 1-3 above treat the assumption that shallow ground water is "ephemeral" at FWDA. Additionally, contaminants may be carried with liquid wastes artificially recharging ground water. This migration route may be as important as, or more important than, leaching of contaminants driven by precipitation in terms of impact on ground water quality at FWDA. Additional comments below address the migration of liquid wastes to ground water.

RESPONSE: The primary objective of the FWDA site characterization effort was to implement site-specific/source area evaluations of the identified Areas of Concern (AOCs). Ground water was not encountered in any of the soil borings drilled during this investigation, therefore, no additional monitoring wells were installed. Additional AOC-specific evaluation was agreed to at the AOCs which could have potentially discharged significant quantities of wastes in liquid form, thereby providing a potential for contaminant migration (e.g., Acid Waste Holding Pond, TNT Washout Lagoons, Sewage Treatment Plant). To characterize ground water conditions in the area of the TNT Leaching Beds, four (4) additional ground water monitoring wells have been installed and an additional well was installed in the vicinity of the Former Sewage Treatment Plant. It was agreed that the Acid Waste Holding Pond did not require further evaluation, however, it was believed that the additional wells installed at the Former TNT Leaching Beds would potentially provide an assessment of shallow ground water conditions in an area encompassing the Acid Waste Holding Pond. If contaminants are found in the monitoring wells above human health screening levels, then further evaluation will be proposed.

Comments No. 6:

Section 7.4.1.2: Referring to monitoring well FW-10 at the TNT leaching bed area the text states, "Although several inorganic constituents exceed their respective screening levels in ground water, they were not carried forward to the Baseline Risk Assessment (BRA) primarily because they are suspected of being background concentrations for the area." The ground-water sample analysis from FW-10 detected 32 milligrams per liter nitrate reported as nitrogen. This concentration is more than three times the New Mexico human health standard and the federal maximum contaminant level (MCL). When, as in the case of FWDA, potential land reuse scenarios include transfer of properties to the Department of the Interior and where there is a likelihood that Bureau of Indian Affairs (BIA) may control the land and develop residences, the suspicion that nitrate contamination of ground water adjacent to unlined explosive leaching beds may be due to background conditions does not satisfy corrective action requirements under New Mexico law. Do analytical results from the background well (FW-31) figure in the suspicion that naturally occurring ground water at FWDA contains three times the MCL for nitrate? As stated by NMED in the June 4, 1996 meeting at FWDA, additional ground-water monitoring wells to be drilled in the area of the TNT leaching beds should be located for the purpose of determining whether the ground-water contamination in FW-10 is due to background conditions or to FWDA operations. If it is determined that nitrate contamination is sourced at the TNT washout facility, the extent of contamination will have to be determined and remedial options should be added to the Feasibility Study (Section 10).

RESPONSE: Four (4) additional ground water monitoring wells have been installed at the TNT Leaching Beds; one as an upgradient (background) well and three downgradient wells, to characterize ground water conditions in the area of the TNT Leaching Beds. The assessment of ground water conditions at the TNT Leaching Bed Area will be presented within an RI/ FS Report for a ground water Operable Unit (OU) which will be completed as a separate deliverable.

<u>Comment No. 7:</u>

Section 7.4.1.2: The text also states that "the limited quantities of ground water in the alluvium are insufficient for consumptive use." NMED refutes this assertion in previous comments and adds further that monitoring well FW-10 contained a nearly 20-foot column of water when it was sampled in 1992 as part of the RI/FS. On June 4, 1996, ERM determined that FW-10 contained approximately 12 feet of water. Both measurements indicate that quantities of ground water in the alluvium may be sufficient for consumptive use. Further investigation of ground water in the TNT leaching beds planned for 1996 has the potential to, and should, address this issue.

RESPONSE: The additional ground water investigation being performed within the TNT Leaching Bed Area will provide information regarding the potential for shallow ground water in this area to be used for consumptive purposes. However, the thickness of water column in a well does not necessarily correlate to the quantity of water that may be pumped from that well. This is particularly true when ground water is encountered under confined or semi-confined conditions as appears to be the case for FW10.

Comment No. 8:

Section 6.4.1: Under the heading, "Identification of Potential Exposure Pathways for the Screening Assessment," the text reads: "As discussed in Section 5.0, leaching to ground water and generation of fugitive dusts are not significant migration pathways for areas of concern at the FWDA...." Comments above, especially comments 6 and 7 when referring to well FW-10, express NMED's position that evidence in the RI/FS supports the consideration of ground water as a potential exposure pathway. Furthermore, NMED concurs with EPA comment #4 in Attachment A of the September 12, 1995 letter from David Neleigh. That comment on Section 5 of the RI/FS states that "the report does not present enough information to conclude that a ground-water pathway is absent at FWDA."

The EPA comment further states that "hydrogeologic cross-sections and maps are needed for the Northern Property to show the nature of the alluvial aquifer system, including stratigraphy, control points, depth to the base of the aquifer, and the potentiometric surface." To date, NMED has not seen a response to the comment that would incorporate this necessary hydrogeologic information into the RI/FS. However, Tim Alexander requested in a telephone conversation on June 7, 1996 that NMED identify specific contaminant sources which have the potential to threaten ground water quality. NMED, comments on contaminant sources appear below and it is the position of NMED that a ground water investigation at these areas of concern would, in aggregate, provide sufficient data to enable a response to EPA comment #4. Characterizing the ground water potentially affected by these AOCs is prerequisite to evaluation of the risk to human health through the ground-water exposure pathway because the soil investigations described in the RI/FS are of very limited vertical and horizontal extent and cannot rule out the contamination of ground water.

RESPONSE: The primary objective of the FWDA site characterization effort was to implement site-specific/source area evaluations of the identified AOCs. Ground water was not encountered in any of the soil borings drilled during this investigation, therefore, no additional monitoring wells were installed. To characterize ground water conditions in the area of the TNT Leaching Beds, four (4) additional ground water monitoring wells have been installed at the TNT Leaching Beds; one as an upgradient (background) well and three downgradient wells. These wells indicate that ground water does exist in a shallow unconfined zone in the vicinity of the TNT Leaching Beds. Additional consideration of ground water as a potential exposure pathway will be made in light of the new ground water monitoring wells and an evaluation of potential risks through the ground water exposure pathway will be performed, as appropriate, based on the analytical results of ground water sampling. The assessment of ground water conditions for the TNT Leaching Bed area will be presented within an RI/ FS Report for a ground water OU which will be completed as a separate deliverable.

Comment No. 9:

Section 2 and Section 7: These sections identify 45 areas of concern at FWDA and detail the investigations performed to determine if releases from the AOCs represent a health threat. The approach used in screening the AOCs was a program of soil borings and sampling. This approach advances 3 of the AOCs forward to the Feasibility Study (Section 10) because of concentrations of contaminants in soils. However, the approach cannot detect contamination of ground water. Owing to the fact that several wells demonstrate that ground water exists at FWDA and can become contaminated by discharges at or near the ground surface (for example, the underground storage tank investigation at Building #6 and potentially monitoring well FW-10), monitoring of ground water at AOCs which discharged significant quantities of wastes in liquid form is necessary.

RESPONSE: The primary objective of the FWDA site characterization effort was to implement site-specific/source area evaluations of the 45 identified AOCs. At many of the AOCs, no historical evidence of potential environmental impacts was identified. The objective of the EI Program field activities was therefore to document the absence of environmental impact (e.g., "confirm the negative") and support a finding of No Further Action (NFA) required. Soils in potential source areas were then investigated to depths that generally ranged between 10 and 20 feet. The combined evidence of no observable surface impacts and absence of soil contamination exceeding screening levels provided a high degree of confidence that no environmental impacts had been caused by AOCs where liquid wastes were not identified as a concern.

In addition, previously-completed reports and facility records were reviewed to determine which of the established AOCs may have had liquid wastes associated with them. A subset of the 45 AOCs, those which may have had liquid wastes associated with them during facility operations were researched further. Information regarding the types and volumes of liquid wastes generated was compiled and is presented in AOC-specific responses included in the response to Comment 11. As a result of this research, it was agreed that site-specific ground water evaluations be performed at two AOCs (TNT Leaching Beds and Sewage Treatment Plant). To characterize ground water conditions in the area of the TNT Leaching Beds, four additional ground water monitoring wells have been installed. These wells will potentially provide an assessment of shallow ground water conditions in the area encompassing the Acid Waste Holding Pond. An additional well was installed in the vicinity of the Former Sewage Treatment Plant to evaluate potential impacts to ground water caused by operation of this facility. If contaminants are found in the monitoring wells above human health screening levels, then further evaluation will be proposed.

The remainder of the AOCs identified as having liquid waste associated with them were evaluated further with regard to their potential for residual soil concentrations to pose a threat by leaching to ground water. Leaching Screening Levels (LSLs) were calculated according the methodology developed by USEPA and presented in the Soil Screening Guidance (May 1996). The methodology used and a table of the LSLs calculated for the site-specific constituents of concern are presented in Attachment A. The results of the LSLs comparison is presented in AOC-specific responses included in the Response to Comment 11.

Comment No. 10:

Section 7.4.1.1 and 7.4.1.2: The investigations of the unlined TNT leaching beds demonstrate the impracticality of relating soil sampling results and potential ground-water impact. Until further investigation is completed these beds must be considered to be the likely source of the 32 milligrams per liter nitrate concentration in well FW-10. Although nitrate concentrations in the soils at the pre-1962 leaching bed exceed background, it's impossible to predict the concentration of nitrate in ground water based on the soil data. The negatively charged nitrate ion has little affinity for soil particles and so may leach readily through the vadose zone. Several other physical mechanisms exist to explain why contaminants not detected in soil samples near a particular source occur in ground water. Preferential flow pathways can channel contaminants to restricted conduits that would only be detected by fortuitous sample location. Contaminants can volatilize from the shallow subsurface while the portion escaping the shallow zone migrates downward possibly explaining analytical results of soil sample from fire training ground, Section 7.3.3). Over time, the shallow subsurface can be flushed of contaminants which leach downward. But in all cases prediction of impact to ground water by correlation to surface and near-surface soil sampling is unreliable.

RESPONSE: To characterize ground water conditions in the area of the TNT Leaching Beds, four (4) additional ground water monitoring wells have been installed at the TNT Leaching Beds; one as an upgradient (background) well and three downgradient wells. These wells indicate that ground water does exist in a shallow unconfined zone in the vicinity of the TNT Leaching Beds. Additional consideration of ground water as a potential exposure pathway will be made in light of the new ground water monitoring wells and an evaluation of potential risks through the ground water exposure pathway will be performed, as appropriate, based on the analytical results of ground water sampling.

Comment No. 11:

Section 7: Several facilities formerly operating at FWDA released quantities of liquid wastes to the environment as part of standard operating procedure. These facilities are concentrated in the northern portion of the FWDA property and are detailed below. In accordance with New Mexico WQCC regulation 1203, it is the recommendation of NMED that a plan be developed to install, maintain, and use monitoring devices for the ground water most likely to be affected by the liquid waste discharges. In so doing, adequate information would be available to generate the hydrogeologic characterization recommended in EPA's comment #4 (referenced in comment 8, above) while also satisfying the state's requirements.

[Comment No. 11a] Section 7.3.1.1: The Building 5 garage discharged liquid wastes to a storm sewer. Solvents, including TCA, were used at the garage. The garage came into use in the 1940's. The RI/FS does not contain information about disposal of solvents throughout FWDA operations. If a disposal site were identified, a soil-vapor survey to define the extent of contamination would be appropriate.

[Comment No. 11b] Section 7.3.1.2: The Building 15 garage was in use beginning in the 1940's and utilized solvents. Disposal sites for liquid wastes from Building 15 are not described in the RI/FS and presumably cannot be determined from FWDA records.

[Comment No. 11c] Section 7.3.1.3: The former locomotive shop (Building 11) was previously reported to have 3 pits, each with drains. The RI/FS confirms only 1 pit and does not indicate where the discharge point of the drain(s) is located.

[Comment No. 11d] Section 7.3.3: Operation at the Fire Training Ground involved dumping fuel, solvents, or oil into unlined pits for fire crew training three times per year. Volatile organic compounds were identified in soil borings below the pits.

[Comment No. 11e] Section 7.3.3.1: The Sewage Treatment Plant was designed to dispose of treated waste water by evaporation and infiltration in unlined lagoons. Well FW-29 was drilled to monitor the facility's impact on ground water, but the well screen is set in the vadose zone.

[Comment No. 11f] Section 7.3.7.2: The former petroleum, oils, and lubricants (POL) area was a site used to dispose of an estimated 200 gallons of these materials by pouring them onto the ground. The RI/FS indicates that well FW-26 in this area was drilled to a depth of 31 feet, apparently above alluvium which may be saturated with ground water.

[Comment No. 11g] Section 7.4.2: Acidic waste pickling solutions from Building 515 were routinely discharged to the unlined Acid Waste Holding Pond for evaporation and infiltration. No volume estimate is given, but the facility operated from the 1940's to the late 1960's. Discharge of solvents, chlordane and other chemicals wastes to the Acid Waste Holding Pond are also reported. The discharges to this facility represent a potential threat to ground-water quality. Two wells adjacent to the Acid Waste Holding Pond were drilled to depths of 49 and 26 (as reported in Table 2-2). Neither well had yielded information on depth to ground water or ground-water quality.

GENERAL RESPONSE:
The primary objective of the FWDA site characterization effort was to implement site-specific/source area evaluations of the identified AOCs. Areas established as requiring environmental evaluations at the FWDA were established in the "Final Work Plans" for the Environmental Investigation (EI) Program, dated November 6, 1992. The Final Work Plans were developed based on the information presented, and included Solid Waste Management Units (SWMUs) and AOCs identified, in the Enhanced Preliminary Assessment Report and the Master Environmental Plan for the FWDA. In addition, information presented in the RCRA Facility Assessment Report and the Final Environmental Impact Statement was considered.

Additional AOC-specific evaluation was agreed to at the AOCs which discharged significant quantities of wastes in liquid form, thereby providing a potential for contaminant migration (e.g., Acid Waste Holding Pond, TNT Washout Lagoons, Sewage Treatment Plant). To characterize ground water conditions in the area of the TNT Leaching Beds, four (4) additional ground water monitoring wells have been installed and an additional well was installed in the vicinity of the Former Sewage Treatment Plant. It was agreed that the Acid Waste Holding Pond did not require further evaluation, however, it was believed that the additional wells installed at the Former TNT Leaching Beds would potentially provide an assessment of shallow ground water conditions in an area encompassing the Acid Waste Holding Pond. If contaminants are found in the monitoring wells above human health screening levels, then further evaluation will be proposed.

<u>Response to Comment Nos. 11a and 11b - Buildings 5 and 15 (Garages)</u>
Previous reports indicate that liquid wastes generated at the FWDA included waste oil (385 gal/yr), waste solvent (55 gal/yr), and waste antifreeze (220 gal/yr). The waste oil was returned to the DRMO, waste antifreeze was disposed of through evaporation, and the used solvent was picked up by the supplier for recycling/recovery. In 1989, the use of 1,1,1-trichloroethane (TCA) was discontinued and replaced with mineral spirits (naphtha).

The Technical Plan (Metcalf & Eddy, Inc., 1992) established that the history of releases from Buildings 5 and 15 consisted of neutralized battery acid that was disposed of down the storm sewer. No specific release incident or potential source pathway was identified. Proposed field investigation activities to investigate Buildings 5 and 15 consisted of: (1) collection of five surface soil samples located around the perimeter of each building; (2) installation and subsurface soil sampling of four soil borings to a depth of 10 feet around the perimeter of each building; and (3) collection of one sediment sample in Building 5, from a sump leading to the storm sewer. The parameters for analysis included target compound list (TCL) volatile organic compounds (VOCs), TCL semi-volatile organic compounds (SVOCs), and pesticides. The objectives of this investigation were to determine if surface and subsurface soils around Buildings 5 and 15 have been impacted by facility operations and to collect sufficient data to support a baseline risk assessment.

The scoped investigation activities were completed with the exception of the sump sediment sample. No sediment was present in the sump, however, a fluid that appeared to be water was observed within the sump. This fluid was sampled and analyzed for the parameters listed above.

The results of the EI Program for Building 5 were that two surface soil samples, three subsurface soil samples collected from the 0 to 1-foot bgs interval and two subsurface soil samples collected from the 3 to 5-foot bgs interval contained at least one pesticide at a concentration that exceeded its health-based screening level. The site was evaluated in the Baseline Risk Assessment and the conclusions were that the risks were above the USEPA's "point of departure" for acceptable risk. Remedial alternatives for the upper one foot of soil at Building 5 were evaluated in the Feasibility Study. Based upon the very small volume of potentially contaminated soils at Building 5, it was proposed that the soils be excavated and transported off-site to an approved, permitted disposal facility.

A subsequent field effort was completed at Building 5 by the U.S. Army Engineer Division, Albuquerque during September 1994. Six soil borings were drilled in a grassy area located on the eastern side of Building 5. These borings were drilled to a depth of 4.5 feet below ground surface (bgs) and subsurface soil samples were collected for analysis of pesticides and PCBs.

The results of the EI Program for Building 15 were that no constituents of concern were detected at concentrations exceeding screening levels in surface or subsurface soils. No further action was recommended for Building 15.

With regard to Buildings 5 and 15, the NMED specifically identified solvents as a concern because of their potential impact on ground water. It should be noted that no TCL VOCs were detected in subsurface soil samples collected from Building 5, or in either surface or subsurface samples collected from Building 11. A Soil Leaching Screening Level evaluation was performed on trace concentrations of toluene that were detected in surface soil samples collected from Building 5. The reported toluene concentrations were below the calculated Leaching Screening Level (see Attachment A). The lack of constituents present above Leaching Screening Levels suggests that residual constituents in soils do not represent a source of ground water contamination in these areas.

Response to Comment No. 11c - Building 11 (Locomotive Shop)
The Technical Plan established that the history of releases from Building 11 consisted of a transformer leaking onto the basement floor for an undetermined period of time. Previously completed documentation indicated that Building 11 has a concrete floor with three maintenance pits, each with a floor drain. It was not known where these drains discharged. However, as documented in the RI/FS, ERM observed three sets of rail lines coming into the building, but only one maintenance pit located under the southern-most set of tracks. Two sumps were observed in the basement of Building 11. There were no drains observed within Building 11.

Proposed field investigation activities to investigate the identified pathways consisted of: (1) collection of four wipe samples from the floor; (2) collection of four chip samples from the floor; and (3) collection of one sediment sample from a floor drain. The parameters for analysis included polychlorinated biphenyls (PCBs). The objectives of this investigation were to determine if PCBs had affected the basement floor or had flowed into the floor drain, and to collect sufficient data to support a baseline risk assessment.

The scoped investigation activities were completed with the exception that seven wipe samples were collected and one composite sediment sample was collected from two sumps located in the basement of Building 11. The results of the EI Program were that PCBs were detected in four of the wipe samples, all of the chip samples, and in the sump sediment sample. However, only four of the chip samples and the sump sediment sample contained concentrations of PCBs that exceeded cleanup levels established by the Toxic Substances Control Act (TSCA). The possibility of exposure to these constituents is thought to be limited, depending on the final disposition of Building 11.

Response to Comment No. 11d - Fire Training Ground
The Fire Training Ground was reportedly in operation from the early seventies to approximately 1990 during which time, training operations occurred there only three times per year .

The Technical Plan established that the history of releases from the Fire Training Ground consisted of oil stains and fuel odors which were observed during site visits. Proposed field investigation activities to investigate the identified pathways consisted of: (1) collection of surface soil samples (two samples located at each of two fire training pits and near a rail car); and (2) installation and subsurface soil sampling of six soil borings to a depth of 10 feet (two in each fire training pit and near the rail car). The parameters for analysis included TCL VOCs, TCL SVOCs, and target analyte list (TAL) metals. The objectives of this investigation were to determine if surface and subsurface soils around the training pits and rail car had been impacted by facility operations and to collect sufficient data to support a baseline risk assessment.

The scoped investigation activities were completed with the exception that one of the soil borings was drilled to a depth of 20 feet and subsurface soil samples were collected at five-foot intervals throughout the length of this boring. The results of the EI Program were that no constituents of concern were detected at concentrations exceeding screening levels used in the RI/FS in the surface soil or subsurface soil samples. No further action was recommended for the Fire Training Ground.

Regarding the Leaching Screening Level evaluation of detected soils concentrations representing a source of potential ground water contamination, it should be noted that no target VOCs or SVOCs were detected in soil samples collected from the Fire Training Ground. Isolated detections of two nontarget VOCs (i.e., 1-ethyl-3-methylbenzene in one sample, and methylene chloride in three samples) and four nontarget SVOCs (2,6,10,14-tetramethylpentadecane, in two samples; and 1,5-dimethylnaphthalene, 2,6,10,14-tetramethylheptadecane, and docosane, each in one sample) were reported. [Note - Methylene chloride, the most frequently reported nontarget compound, is a common laboratory contaminant, and its presence may reflect cross contamination during sampling and/or analysis]. The isolated detections of these nontarget constituents, coupled with the absence of target VOCs and SVOCs, suggest that any residual constituents that may be present in soils in this area do not represent a source of ground water contamination.

Response to Comment No. 11e - Sewage Treatment Plant

The Technical Plan established that no specific release incident or potential source pathway was identified, and no previous investigation had been performed. Proposed field investigation activities to investigate the identified pathways consisted of: (1) installation and subsurface soil sampling of eight soil borings to a depth of 10 feet in the aeration and evaporation lagoons; (2) installation and subsurface soil sampling of three soil borings to a depth of 10 feet in the sludge beds; and (3) collection of four surface water samples from the aeration and evaporation lagoons. The parameters for analysis included TCL VOCs, TCL SVOCs, and TAL metals. The objectives of this investigation were to determine if subsurface soils below the evaporation lagoons had been impacted by operation of the Sewage Treatment Plant and to collect sufficient data to support a baseline risk assessment.

The results of the EI Program were that no constituents of concern were detected at concentrations exceeding RI/FS screening levels in the surface soil, subsurface soil, or surface water samples. No further action was recommended for the Sewage Treatment Plant.

Additional AOC-specific evaluation was agreed to at the AOCs which discharged significant quantities of wastes in liquid form, thereby providing a potential for contaminant migration (e.g., Acid Waste Holding Pond, TNT Washout Lagoons, Sewage Treatment Plant). To characterize ground water conditions near the Sewage Treatment Plant, an additional well was installed in this vicinity. If contaminants are found in this monitoring well above human health screening levels, then further evaluation will be proposed.

Response to Comment No. 11f - Former POL Area

The Technical Plan reported that soil in the Former POL (Petroleum, Oil, and Lubricant) Area was reported to be saturated with POLs, however, the area was reportedly covered with clean soils in 1975 and the precise location of the Former POL Area was not known. The former POL area was reportedly used as a dump site for waste oils and possibly solvents from an unknown time until 1975, when it was covered with earth. It is estimated that approximately 200 gallons per year of waste from vehicle maintenance operations was disposed of here (*Master Environmental Plan*, ANL, December 1990).

Proposed field investigation activities to investigate the identified pathways consisted of: (1) installation and subsurface soil sampling of five soil borings to a depth of 10 feet; and (2) sampling of ground water monitoring well FW26 located adjacent to the Former POL Area. No surface soil samples were collected because no areas of stained soil were observed. The parameters for analysis included TCL VOCs, TCL SVOCs, TAL metals, and PCBs. The objectives of this investigation were to: more precisely locate the Former POL Area, determine if surface and subsurface soils had been impacted by the reported disposal of waste oils and solvents, and to collect sufficient data to support a baseline risk assessment.

The scoped investigation activities were completed with the exception that no ground water was present in well FW26; consequently no ground water sample was collected. The results of the EI Program were that no constituents of concern were detected at concentrations exceeding the screening levels used in the RI/FS in the subsurface soil samples. No further action was recommended for the Former POL Area.

The NMED comment specifically references the disposal of petroleum, oils, and lubricants at the former POL area. It should be noted no TCL VOCs or SVOCs were detected, and that the reported concentrations of inorganics were consistent with background levels. Thus, soils in this area do not appear to represent a source of ground water contamination.

Response to Comment No. 11g - Acid Waste Holding Pond

The Technical Plan reported that previous investigations of the Acid Waste Holding Pond had detected the presence of hazardous organic compounds in the soil. Proposed field investigation activities to investigate the identified pathways consisted of: (1) collection of three surface soil samples within the Acid Waste Holding Pond; (2) installation and subsurface soil sampling of three soil borings to a depth of 20 feet (one upgradient, one downgradient, and one within the Acid Waste Holding Pond); and (3) installation and subsurface soil sampling of one soil boring to a depth of 10 feet within the area of the septic system drain field associated with the building. The parameters for analysis included TCL VOCs, TAL metals, PCBs, pesticides, explosives, nitrate/nitrite, and total phosphorus. The objectives of this investigation were to: determine if surface and subsurface soils in and around this area had been impacted by facility operations, and to collect sufficient data to support a baseline risk assessment.

The results of the EI Program were that no constituents of concern were detected at concentrations exceeding RI/FS screening levels in the surface soil or subsurface soil samples. No further action was recommended for the Acid Waste Holding Pond.

Additional AOC-specific evaluation was agreed to at the AOCs which discharged significant quantities of wastes in liquid form, thereby providing a potential for contaminant migration (e.g., Acid Waste Holding Pond, TNT Washout Lagoons, Sewage Treatment Plant). Four additional wells to be installed at the TNT leaching beds will potentially provide an assessment of shallow ground water conditions in the area encompassing the Acid Waste Holding Pond. If contaminants are found in these monitoring wells above human health screening levels, then further evaluation will be proposed.

Comment No. 12:

The leaking underground storage tank investigation at Building #6 demonstrates both that ground water is present at approximately 47 feet below the FWDA Administration Area, and that contaminant releases to the shallow subsurface have the potential to contaminate this shallow alluvial aquifer. Relevant hydrogeologic information generated in the UST investigation will be incorporated into the RI/FS.

RESPONSE: Relevant hydrogeologic information generated in the UST investigation at Building No. 6 will be incorporated into the RI/FS.

Comment No. 13:

An initial phase of the Western Landfill investigation has been completed. The investigation has so far taken place outside of the RI/FS format. If the investigation determines that contaminant releases at the Western Landfill have occurred in such quantity as may with reasonable probability injure or be detrimental to human health, animal or plant life, or property, or unreasonably interfere with the public welfare or the use of property, the site should be assessed, monitored, and remediated in conjunction with the base-wide assessment and remediation plan in the RI/FS.

RESPONSE: A separate report will be provided which describes the investigation of the Debris Piles and Burial sites. Resolution of these areas will be incorporated into the base-wide restoration effort.

General Comment:

The thirteen comments above specifically address the assertion in the RI/FS that ground water is not an exposure pathway because the first usable aquifer is the San Andres Formation. NMED believes that such a conclusion is unwarranted as is it contradicted by evidence found within the RI/FS and other sources. Therefore, the RI/FS should assess the potential risk to human health (including stock watering) through the ground-water exposure pathway. It is not the NMED position that each of the facilities needs to be designated for one or more monitoring wells, but rather that a comprehensive ground-water monitoring approach can be designed to address both NMED and EPA comments with fewer ground-water monitoring wells. Please feel free to contact me with any questions in concerns regarding these comments.

RESPONSE: Based on discussions with NMED and USEPA, ground water monitoring wells have been installed in areas where liquids were potentially discharged to the ground in large quantities (i.e., TNT Leaching Beds, Former Sewage Treatment Plant). The assessment of ground water conditions will be presented within an RI/ FS Report for a ground water OU which will be completed as a separate deliverable.

The recommendation that stock watering be considered is no longer appropriate because the stock watering system is no longer fed by onsite ground water. Water is now provided for stock watering by a tanker truck whose water source is the drinking water supply for the FWDA.

INTRODUCTION

As noted in the Response to Comment 11, leaching screening levels (LSLs) were developed in order to assess the potential for residual soil constituents to leach to ground water. These screening levels were calculated following the methods proposed by USEPA in *Soil Screening Guidance: Technical Background Document* (May 1996). The following text outlines the specific equations and assumptions used to derive LSLs. Calculated LSLs are presented on Table A-1.

CALCULATIONS

Consistent with USEPA guidance (May 1996), the following equation was used in the calculation of LSLs for organic constituents:

$$C_t = C_w x \left[(k_{oc} x f_{oc}) + \left(\frac{\phi_w + \phi_a x H'}{D_b} \right) \right]$$

where

C_t	target concentration in soil or LSL	(mg/kg)
C_w	target concentration in water	(mg/l)
K_{oc}	soil organic carbon/water partition coefficient	(l/mg)
f_{oc}	organic carbon content of soil	(kg/kg)
$ø_w$	water-filled soil porosity	(dimensionless)
$ø_a$	air-filled soil porosity	(dimensionless)
D_b	dry soil bulk density	(kg/l)
H'	Henry's Law Constant	(dimensionless form)

Consistent with USEPA guidance (May 1996), target concentrations in water (C_w) were based on Maximum Contaminant Levels (MCLs) where available; for constituents without MCLs, health-based levels (HBLs) were

Table A-1
Summary of Leaching Screening Levels
Fort Wingate Depot Activity
Gallup, New Mexico

Area of Concern	Soil Constituent	MCL/HBL (mg/l)	Type	Koc (l/kg)	Source	H (atm-m^3/mol)	Source	H' (dim'less)	Leaching Screening Level (mg/kg)		Maximum Detected Concentration (mg/kg)
Building 5	Toluene	1.00E+00	MCL	1.40E+02	Note 2	6.64E-03	Note 2	2.72E-01	1.0E+01	Note 3	3.30E-01
Building 15	(No VOCs detected)										
Fire Traing Ground	Methylene chloride	(Note 4)									
	1-Ethyl-3-Methylbenzene	(Note 4)									
	2,6,10,14-TMPD	(Note 4)									
	1,5-Dimethylnaphthalene	(Note 4)									
	2,6,10,14-TMHD	(Note 4)									
	Docosane	(Note 4)									
Former POL Area	(No VOCs or SVOCs detected)										

Notes:
1. VOCs - volatile organic constituents
SVOCs - semi-volatile constituents
MCL - Maximum Contaminant Level (promulgated under the Safe Drinking Water Act)
HBL - health-based level
TMPD - tetramethylpentadecane
TMHD - tetramethylheptadecane
POL - petroleum, oil and lubricants
2. Source of chemical fate information: USEPA, 1996, Soil Screening Guidance: Technical Background Document.
3. Leaching Screening Levels (LSLs) were calculated according to the methodology outlined in the text of Attachment A.
4. Consistent with the RI/FS, isolated detections of non-target compounds were not evaluated in the screening.

used. Cw values were calculated as the product of the appropriate MCL (or HBL) and a dilution/attenuation factor (DAF) of 20. USEPA has chosen 20 as the default DAF, recognizing that "[A]t most sites, this adjustment will more accurately reflect a contaminant's threat to ground water resources than assuming a DAF of 1 (i.e., no dilution or attenuation)" [USEPA, 1996, page 46].

Koc and H' values are chemical specific; appropriate values were identified from the literature, as noted on Table A-1. The dimensionless form (H') of each Henry's Law Constant (H) was calculated as follows:

$$H' = \frac{H}{R \times T}$$

where

H	Henry's Law Constant	(atm-m^3/mol)
R	Universal Gas Constant	(8.2 x 10^{-5} atm-m^3/mol-degree K)
T	temperature	(298 degrees K)

This reduces to the following:

$$H' = H \times 41$$

Default values from USEPA guidance (May 1996) were used for the remaining parameters. These are summarized below:

f_{oc} 0.002 (0.2%)

$\varnothing_w$ 0.3 (30%)

$\varnothing_a$ 0.13 (13%)

D_b - 1.5 kg/l

As described in the USEPA guidance (May 1996), a number of conservative assumptions are implicit in the development of LSLs. Among these are the following:

- The source of contamination is considered to be infinite; that is, there are no losses due to volatilization or degradation of the constituent, and no consideration is made as to whether the total mass of the constituent is sufficient to adversely degrade ground water.

- The soil and pore water concentrations are in equilibrium.
- Adsorption processes are reversible.

In addition, USEPA's LSL methodology assumes that adsorption is linear with respect to concentration. Although departures from a linear relationship may characterize the adsorption of certain constituents, such departures are expected to be most significant only at very high soil concentrations. In the range of concentrations defined by the LSLs, such departures are not believed to be significant (USEPA, 1996), and, hence, are not expected to reduce the conservatism of the LSLs.

PB96-963501

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EPA

Soil Screening Guidance: Fact Sheet

Office of Emergency and Remedial Response | Quick Reference Fact Sheet

This fact sheet summarizes key aspects of the U.S. Environmental Protection Agency's (EPA) Soil Screening Guidance. The Soil Screening Guidance is a tool developed by EPA to help standardize and accelerate the evaluation and cleanup of contaminated soils at sites on the National Priorities List (NPL) where future residential land use is anticipated. The User's Guide provides a simple step-by-step methodology for environmental science/engineering professionals to calculate risk-based, site-specific soil screening levels (SSLs) for contaminants in soil that may be used to identify areas needing further investigation at NPL sites. The Technical Background Document presents the analysis and modeling upon which this approach is based, as well as generic SSLs calculated using conservative default values, and guidance for conducting more detailed analysis of complex site conditions, where needed.

SSLs are not national cleanup standards. SSLs alone do not trigger the need for response actions or define "unacceptable" levels of contaminants in soil. In this guidance, "screening" refers to the process of identifying and defining areas, contaminants, and conditions, at a particular site that do not require further Federal attention. Generally, at sites where contaminant concentrations fall below SSLs, no further action or study is warranted under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), commonly known as "Superfund." (Some States have developed screening numbers that are more stringent than the generic SSLs presented here; therefore, further study may be warranted under State programs.) Where contaminant concentrations equal or exceed SSLs, further study or investigation, but not necessarily cleanup, is warranted.

The decision to use the Soil Screening Guidance at a site will be driven by the potential benefits of eliminating areas, exposure pathways, or contaminants from further investigation. By identifying areas where concentrations of contaminated soil are below levels of concern under CERCLA, the guidance provides a means to focus resources on exposure areas, contaminants and exposure pathways of concern.

SSLs are risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. Three options for developing screening levels are included in the guidance, depending on how the numbers will be used to screen at a site, and the amount of site-specific information that will be collected or is available. Details of these approaches are presented in the User's Guide (EPA, 1996a) and the Technical Background Document (TBD) (EPA, 1996b). The three options for using SSLs are:

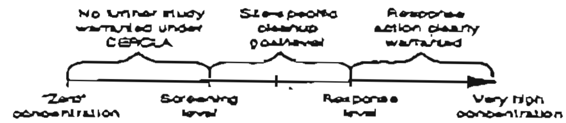
- Applying generic SSLs
- Developing simple, site-specific SSLs
- Developing site-specific SSLs based on more detailed modeling

The progression from generic to simple site-specific and more detailed site-specific SSLs usually involves an increase in investigation costs and, generally a decrease in the stringency of the screening levels because conservative assumptions can be replaced with less conservative site-specific information. Generally, the decision of which method to use involves balancing the increased investigation costs with the potential savings associated with higher (but protective) SSLs. The User's Guide focuses on the application of a simple site-specific approach by providing a step-by-step methodology to calculate site-specific SSLs. The TBD provides more information about the other approaches.

Generic SSLs for the most common contaminants found at NPL sites are included in the TBD. Generic SSLs are calculated from the same equations presented in the User's Guide, but are based on a number of default assumptions chosen to be protective of human health for most site conditions. Generic SSLs can be used in place of site-specific screening levels; however, in general, they are expected to be more stringent than site-specific levels. The site manager should weigh the cost of collecting the data necessary to develop site-specific SSLs with the potential for deriving a higher SSL that provides an appropriate level of protection.

The TBD also includes more detailed modeling approaches for developing screening levels that take into account more complex site conditions than the simple site-specific methodology emphasized in the User's Guide. More detailed approaches may be appropriate when site conditions (e.g., a thick vadose zone) are different from those assumed in the simple site-specific methodology presented here. The technical details supporting the methodology used in the User's Guide are provided in the TBD. SSLs developed in accordance with the User's Guide are based on future residential land use assumptions and related exposure scenarios. Using this guidance for sites where residential land use assumptions do not apply could result in overly conservative screening levels; however, EPA recognizes that some parties responsible for sites with non-residential land use might still find benefit in using the SSLs as a tool to conduct a conservative initial screening.

SSLs developed in accordance with this guidance could also be used for Resource Conservation and Recovery Act (RCRA) corrective action sites as "action levels," since the RCRA corrective action program currently views the role of action levels as generally fulfilling the same purpose as soil screening levels.[1] In addition, States may use this guidance in their voluntary cleanup programs, to the extent they deem appropriate. When applying SSLs to RCRA corrective action sites or for sites under State voluntary cleanup programs, users of this guidance should recognize, as stated above, that SSLs are based on residential land use assumptions. Where these assumptions do not apply, other approaches for determining the need for further study might be more appropriate.



Highlight 1. Conceptual Risk Management Spectrum for Contaminated Soil

1.2 Role of Soil Screening Levels

In identifying and managing risks at contaminated sites, EPA considers a spectrum of contaminant concentrations. The level of concern associated with those concentrations depends on the likelihood of exposure to soil contamination at levels of potential concern to human health or to ecological receptors.

Highlight 1 illustrates the spectrum of soil contamination encountered at Superfund sites and the conceptual range of risk management responses. At one end are levels of contamination that clearly warrant a response action; at the other end are levels that are below regulatory concern. Screening levels identify the lower bound of the spectrum—levels below

1 Further information on the role of action levels in the RCRA corrective action program is available in an Advance Notice of Proposed Rulemaking (signed April 12, 1996).

which there is generally no concern under CERCLA, provided conditions associated with the SSLs are met. Appropriate cleanup goals for a particular site may fall anywhere within this range depending on site-specific conditions.

EPA anticipates the use of SSLs as a tool to facilitate prompt identification of contaminants and exposure areas of concern during both remedial actions and some removal actions under CERCLA. However, the application of this or any screening methodology is not mandatory at sites being addressed under CERCLA or RCRA. The framework leaves discretion to the site manager and technical experts (e.g., risk assessors, hydrogeologists) to determine whether a screening approach is appropriate for the site and, if screening is to be used, the proper method of implementation. The decision to use a screening approach should be made early in the process of investigation at the site.

EPA developed the Soil Screening Guidance to be consistent with and to enhance the current Superfund investigation process and anticipates its primary use during the early stages of a remedial investigation (RI) at NPL sites. It does not replace the Remedial Investigation/ Feasibility Study (RI/FS), including the risk assessment portion of the RI, but the use of screening levels can focus sampling and risk assessment on aspects of the site that are likely to be a concern under CERCLA. By screening out areas of sites, potential chemicals of concern, or exposure pathways from further investigation; site managers and technical experts can limit the scope of the field investigation or risk assessment.

SSLs can save resources by helping to determine which areas do not require additional Federal attention early in the process. Furthermore, data gathered during the soil screening process can be used in later Superfund phases, such as the baseline risk assessment, feasibility study, treatability study, and remedial design. This guidance may also be appropriate for use by the removal program when demarcation of soils above residential risk-based numbers coincides with the purpose and scope of the removal action.

The simple, site-specific soil screening levels are likely to be most useful where it is difficult to determine whether areas of soil are contaminated to an extent that warrants further investigation or response (e.g., whether areas of soil at an NPL site require further investigation under CERCLA through an RI/FS). As noted above, the screening levels have been developed assuming residential land use. Although some of the models and methods presented in this guidance could be modified to address exposures under other land uses, EPA has not yet standardized assumptions for exposure scenarios related to those other uses.

This guidance provides the information needed to calculate SSLs for 110 chemicals. Sufficient information may not be available to develop soil screening levels for additional chemicals. These chemicals should not be screened out, but should be addressed in the baseline risk assessment for the site. The *Risk Assessment Guidance for Superfund* (RAGS), *Volume 1: Human Health Evaluation Manual* (HHEM), *Part A, Interim Final* (U.S. EPA, 1989a) provides guidance on conducting baseline risk assessments for NPL sites. In addition, the baseline risk assessment should address the chemicals, exposure pathways, and areas at the site that are not screened out.

Although SSLs are "risk-based," they do not eliminate the need to conduct a site-specific risk assessment for those areas identified as needing further investigation. SSLs are concentrations of contaminants in soil that are designed to be protective of exposures in a residential setting. A site-specific risk assessment is an evaluation of the risk posed by exposure to site contaminants in various media. To calculate SSLs, the exposure equations and pathway models are run in reverse to backcalculate an "acceptable level" of a contaminant in soil. For the ingestion, dermal, and inhalation pathways, toxicity criteria are used to define an acceptable level of contamination in soil, based on a one-in-a-million (10^{-6}) individual excess cancer risk for carcinogens and a hazard quotient (HQ) of 1 for non-carcinogens. SSLs are backcalculated for migration to ground water pathways using ground water concentration limits [nonzero maximum contaminant level goals (MCLGs), maximum contaminant levels (MCLs), or health-based limits (HBLs) (10^{-6} cancer risk or a HQ of 1) where MCLs are not available].

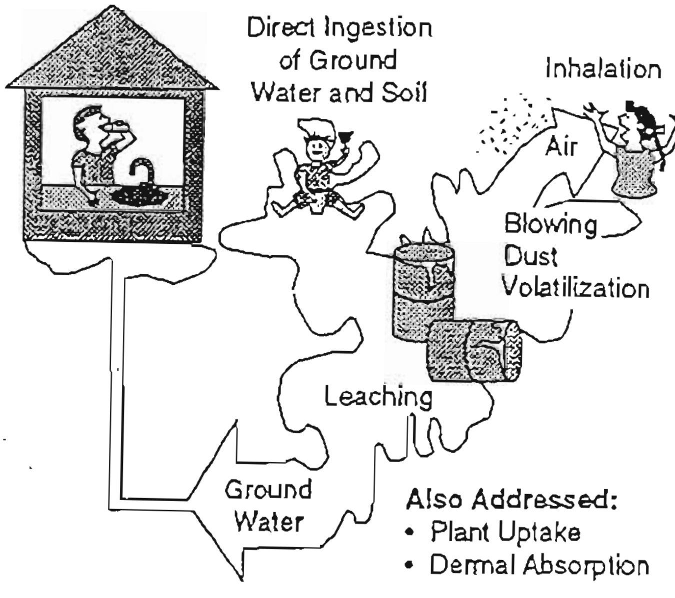
SSLs can be used as Preliminary Remediation Goals (PRGs) provided appropriate conditions are met (i.e., conditions found at a specific site are similar to conditions assumed in developing the SSLs). The concept of calculating risk-based contaminant levels in soils for use as PRGs (or "draft" cleanup levels) was introduced in the RAGS HHEM, *Part B, Development of Risk-Based Preliminary Remediation Goals.* (U.S. EPA, 1991b).

PRGs may then be used as the basis for developing final cleanup levels based on the nine-criteria analysis described in the National Contingency Plan [Section 300.430 (3)(2)(I)(A)]. The directive entitled *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (U.S. EPA, 1991c) discusses the modification of PRGs to generate cleanup levels. The SSLs should only be used as cleanup levels when a site-specific nine-criteria evaluation of the SSLs as PRGs for soils indicates that a selected remedy achieving the SSLs is protective, complies with Applicable or Relevant and Appropriate Requirements (ARARs), and appropriately balances tradeoffs between cleanup options with respect to the other criteria, including cost.

1.3 Scope of Soil Screening Guidance

In a residential setting, potential pathways of exposure to contaminants in soil are as follows (see Highlight 2):

- Direct ingestion
- Inhalation of volatiles and fugitive dusts
- Ingestion of contaminated ground water caused by migration of chemicals through soil to an underlying potable aquifer
- Dermal absorption
- Ingestion of homegrown produce that has been contaminated via plant uptake
- Migration of volatiles into basements.



Highlight 2. Exposure Pathways Addressed by SSLs.

The Soil Screening Guidance addresses each of these pathways to the greatest extent practical. The first three pathways -- direct ingestion, inhalation of volatiles and fugitive dusts, and ingestion of potable ground water -- are the most common routes of human exposure to contaminants in the residential setting. These pathways have generally accepted methods, models, and assumptions that lend themselves to a standardized approach. The additional pathways of exposure to soil contaminants, dermal absorption, plant uptake, and migration of volatiles into basements, may also contribute to the risk to human health from exposure to specific contaminants in a residential setting. The guidance addresses these pathways to a limited extent based on available empirical data. (See Step 5 and the TBD for further discussion).

The Soil Screening Guidance addresses the human exposure pathways listed previously and will be appropriate for most residential settings. The presence of additional pathways or unusual site conditions does not preclude the use of SSLs in areas of the site that are currently residential or likely to be residential in the future. However, the risks associated with additional pathways or conditions (e.g., fish consumption, raising of livestock, heavy truck traffic on unpaved roads) should be considered in the RI/FS to determine whether SSLs are adequately protective.

An ecological assessment should also be performed as part of the RI/FS to evaluate potential risks to ecological receptors.

The Soil Screening Guidance should not be used for areas with radioactive contaminants.

Highlight 3 provides key attributes of the Soil Screening Guidance: User's Guide.

Highlight 3: Key Attributes of the User's Guide

- Standardized equations are presented to address human exposure pathways in a residential setting consistent with Superfund's concept of "Reasonable Maximum Exposure" (RME).
- Source size (area and depth) can be considered on a site-specific basis using mass-limit models.
- Parameters are identified for which site-specific information is needed to develop SSLs.
- Default values are provided to calculate generic SSLs when site-specific information is not available.
- SSLs are based on a 10^{-6} excess risk for carcinogens or a hazard quotient of 1 for noncarcinogens. SSLs for migration to ground water are based on (in order of preference): nonzero maximum contaminant level goals (MCLGs), maximum contaminant levels (MCLs), or the aforementioned risk-based targets.

2.0 SOIL SCREENING PROCESS

Applying site-specific screening levels involves developing a conceptual site model (CSM), collecting a few easily obtained site-specific soil parameters (such as the dry bulk density and percent moisture), and sampling to measure contaminant concentrations in surface and subsurface soils. Often, much of the information needed to develop the CSM can be derived from previous site investigations [e.g., the Preliminary Assessment/Site Inspection (PA/SI)] and, if properly planned, SSL sampling can be accomplished in one mobilization. This fact sheet provides a brief overview of the steps in the process. A full discussion of the steps and their implementation is available in the User's Guide.

The soil screening process (outlined in Highlight 4) is a step-by-step approach that involves:

- Developing a conceptual site model (CSM)
- Comparing the CSM to the SSL scenario
- Defining data collection needs
- Sampling and analyzing soils at site
- Deriving site-specific SSLs, as appropriate
- Comparing site soil contaminant concentrations to SSLs
- Determining which areas of the site require further study.

The overall outline is fundamentally the same, whether you are using the simple site-specific approach, the generic levels, or a more detailed approach. However, the details of any specific application will be different. In particular, developing the simple site specific SSLs is obviously more involved than using the generic screening levels available in the TBD.

Highlight 4

Soil Screening Process

Step One: Develop Conceptual Site Model

- Collect existing site data (historical records, aerial photographs, maps, PA/SI data, available background information, State soil surveys, etc.)
- Organize and analyze existing site data
  - Identify known sources of contamination
  - Identify affected media
  - Identify potential migration routes, exposure pathways, and receptors
- Construct a preliminary diagram of the CSM
- Perform site reconnaissance
  - Confirm and/or modify CSM
  - Identify remaining data gaps

Step Two: Compare Soil Component of CSM to Soil Screening Scenario

- Confirm that future residential land use is a reasonable assumption for the site
- Identify pathways present at the site that are addressed by the guidance
- Identify additional pathways present at the site not addressed by the guidance
- Compare pathway-specific generic SSLs with available concentration data
- Estimate whether background levels exceed generic SSLs

Step Three: Define Data Collection Needs for Soils to Determine Which Site Areas Exceed SSLs

- Develop hypothesis about distribution of soil contamination (i.e., which areas of the site have soil contamination that exceed appropriate SSLs?)
- Develop sampling and analysis plan for determining soil contaminant concentrations
  - Sampling strategy for surface soils (includes defining study boundaries, developing a decision rule, specifying limits on decision errors, and optimizing the design)
  - Sampling strategy for subsurface soils (includes defining study boundaries, developing a decision rule, specifying limits on decision errors, and optimizing the design)
  - Sampling to measure soil characteristics (bulk density, moisture content, organic carbon content, porosity, pH)
- Determine appropriate field methods and establish QA/QC protocols

Step Four: Sample and Analyze Soils at Site

- Identify contaminants
- Delineate area and depth of sources
- Determine soil characteristics
- Revise CSM, as appropriate

Step Five: Derive Site-specific SSLs, if needed

- Identify SSL equations for relevant pathways
- Identify chemical of concern for dermal exposure and plant uptake
- Obtain site-specific input parameters from CSM summary
- Replace variables in SSL equations with site-specific data gathered in Step 4 .
- Calculate SSLs
  - Account for exposure to multiple contaminants

Step Six: Compare Site Soil Contaminant Concentrations to Calculated SSLs

- For surface soils, screen out exposure areas where all composite samples do not exceed SSLs by a factor of 2
- For subsurface soils, screen out source areas where the highest average soil core concentration does not exceed the SSLs
- Evaluate whether background levels exceed SSLs

Step Seven: Decide How to Address Areas Identified for Further Study

- Consider likelihood that additional areas can be screened out with more data
- Integrate soil data with other media in the baseline risk assessment to estimate cumulative risk at the site
- Determine the need for action
- Use SSLs as PRGs

However, developing site specific levels may be worthwhile given the less stringent but equally protective levels that will generally result.

An important part of this guidance is a recommended sampling approach that balances the need for more data to reduce uncertainty with the need to limit data collection costs. Where data are limited such that use of the "maximum test" (Max test) presented in the User's Guide is not appropriate, the guidance also provides direction on the use of other conservative estimates of contaminant concentrations for comparison with the SSLs.

2.1 Step 1: Developing a Conceptual Site Model

The conceptual site model (CSM) is a three-dimensional "picture" of site conditions that illustrates contaminant distributions, release mechanisms, exposure pathways and migration routes, and potential receptors. The CSM documents current site conditions and is supported by maps, cross sections, and site diagrams that illustrate human and environmental exposure through contaminant release and migration to potential receptors. Developing an accurate CSM is critical to proper implementation of the Soil Screening Guidance.

As a key component of the RI/FS and EPA's Data Quality Objectives (DQO) process, the CSM should be updated and revised as investigations produce new information about a site. *Data Quality Objectives for Superfund: Interim Final Guidance* (U.S. EPA, 1993a) and *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (U.S. EPA, 1989c) provide a general discussion about the development and use of the CSM during RIs.

2.2 Step 2: Comparing the CSM to SSL Scenario

In this step, the conceptual site model for a particular site is compared to the conceptual site model assumed for the development of the Soil Screening Guidance. This comparison should determine whether the SSL scenario is sufficiently similar to the CSM so that use of the guidance is appropriate. The Soil Screening Guidance was developed assuming residential land use. The primary exposure pathways associated with residential land use (given in section 1.3) are (1) direct ingestion, (2) inhalation of volatile and fugitive dusts, and (3) ingestion of contaminated ground water caused by migration of chemicals through soil to an underlying potable aquifer. The residential exposure assumptions associated with these pathways are given in Highlight 5.

Highlight 5
Residential Exposure Assumptions

Exposure frequency .... 350 days/year
Exposure duration .... 30 years

For Noncarcinogens

Body weight .... 15 kg
Ingestion rate .... 200 mg/day

For Carcinogens

Body weight .. age adjusted from 15 - 70 kg
Ingestion rate .... age adjusted from .... 200 - 100 mg/day
Drinking water ingestion rate ...... 2 L/day
Inhalation rate .... 20 m^3/day

The CSM may include other sources and exposure pathways that are not covered by this guidance. Compare the CSM with the assumptions and limitations inherent in the SSLs to determine whether additional or more detailed assessments are needed for any exposure pathways or chemicals. The Soil Screening Guidance can be used to screen those sources and exposures pathways that are covered by the guidance. Early identification of areas or conditions where SSLs are not applicable is important so that other characterization and response efforts can be considered when planning the sampling strategy.

Where the following conditions exist, a more detailed site-specific investigation will be needed:

- site adjacent to surface water,
- potential terrestrial or aquatic ecological concerns
- other human exposure pathways likely (e.g. local fish consumption, homegrown dairy, livestock or other agricultural use, or
- unusual site conditions (e.g., presence of non-aqueous phase liquids, unusually high fugitive dust levels from site activities.)

A consideration of background concentrations should be made to determine whether SSLs are likely to be useful, since the SSLs have much less utility where background concentrations exceed the SSLs. Background concentrations exceeding generic SSLs do not necessarily indicate that a health threat exists, but may suggest that additional analysis is appropriate. For example, it may be important to determine whether the high background concentrations are anthropogenic or naturally occuring. Generally, EPA does not clean up below natural background; however, where anthropogenic background levels exceed SSLs, EPA may determine that some type of comprehensive response is necessary and feasible.

2.3 Step 3: Defining Data Collection Needs for Soils

Once the CSM has been developed and the site manager has determined that the Soil Screening Guidance is appropriate to use at a site, a Sampling and Analysis Plan (SAP) should be developed. Highlight 4 outlines the general strategy for developing sampling plans likely to be needed to apply the Soil Screening Guidance. A different sampling approach is used for the surface and subsurface because different exposure pathways are being addressed. Sampling should also provide site characteristics data necessary to develop site-specific SSLs. The User's Guide provides information on the development of SAPs for these three types of information.

To develop sampling strategies that will properly assess site contamination, EPA recommends that site managers consult with the technical experts in their Region, including risk assessors, toxicologists, chemists and hydrogeologists, who can assist the site manager to use the DQO process to satisfy Superfund program objectives. The DQO process is a systematic planning process developed by EPA to ensure that sufficient data are collected to support EPA decision making. A full discussion of the DQO process is provided in *Data Quality Objectives for Superfund: Interim Final Guidance* (U.S. EPA, 1993a) and the *Guidance for the Data Quality Objectives Process* (U.S. EPA, 1994a). Many of the key elements have been incorporated as part of the guidance.

One of the critical decisions to make before developing the SAP is to define the specific area to which the Soil Screening Guidance will be applied. Existing data (e.g., preliminary assessment, other site investigation data, historical documents discussing site activities) can be used to determine what level and type of investigation may be appropriate. Areas known to be important sources of ground water contamination should be sampled for subsurface contamination, but it often will not be necessary to develop screening levels based on surface contamination for these areas. Sampling in known source areas will focus on developing remedial alternatives with some sampling to confirm expected problems, as necessary. Other areas may have good historical information to indicate that no waste handling activities occurred there and it is expected that these areas are unlikely to be contaminated. A few samples may be taken to confirm this hypothesis. Much of the sampling effort for soil screening is likely to focus on areas of uncertain contamination levels and history. The User's Guide provides more information about the use of historical information, the statistical basis for the sampling strategy, and the soil characteristics that are needed to develop site-specific screening levels.

2.4 Step 4: Sampling and Analyzing Site Soils

Once the sampling strategies have been developed and implemented, the samples should be analyzed according to the analytical laboratory and field methods specified in the SAP. An important outcome of these analyses is the estimation of the concentrations of potential contaminants of concern which will be compared to the SSLs. At this point, the generic SSLs may be useful for comparison purposes. Where estimated concentrations are above the generic SSLs, site-specific SSLs can be calculated to provide another, less stringent but still conservative comparison.

Because these analyses reveal new information about the site, update the CSM accordingly.

2.5 Step 5: Calculating Site-specific SSLs

With the soil properties data collected in Step 4 of the screening process, site-specific soil screening levels can now be calculated using the equations presented in the User's Guide. The Soil Screening Guidance provides the equations necessary to develop a simple site-specific soil screening levels. For a description of how these equations were developed, as well as background on their assumptions and limitations, consult the TBD. When generic SSLs are being used as for comparison to site concentration, this step may be omitted.

All SSL equations were developed to be consistent with reasonable maximum exposure (RME) for the residential setting. The Superfund program estimates the RME for chronic exposures on a site-specific basis by combining an average exposure-point concentration with reasonably conservative values for intake and duration (U.S. EPA, 1989a; RAGS HHEM, *Supplemental Guidance: Standard Default Exposure Factors*, U.S. EPA, 1991a). Thus, all site-specific parameters (soil, aquifer, and meteorologic parameters) used to calculate SSLs should reflect average or typical site conditions in order to calculate average exposure concentrations at the site.

Exposure pathways addressed in the process for screening surface soils include direct ingestion, dermal contact, and inhalation of fugitive dusts. While the guidance provides all the relevant toxicity from EPA sources necessary to calculate site-specific SSLs, Integrated Risk Information System (IRIS) (U.S. EPA, 1995a) or Health Effects Assessment Summary Tables (HEAST) (U.S. EPA, 1995b) should be checked for current values. Only the most current values should be used to calculate SSLs.

The Soil Screening Guidance addresses two exposure pathways for subsurface soils: inhalation of volatiles and ingestion of ground water contaminated by the migration of contaminants through soil to an underlying potable aquifer. Because the equations developed to calculate SSLs for these pathways assume an infinite source, they can violate mass-balance considerations, especially for small sources. To address this concern, the guidance also includes equations for calculating mass-limit SSLs for each of these pathways when the size (i.e., area and depth) of the contaminated soil source is known or can be estimated with confidence.

The Soil Screening Guidance uses a simple linear equilibrium soil/water partition equation or a leach test to estimate contaminant release in soil leachate. It also uses a simple water-balance equation to calculate a dilution factor to account for reduction of soil leachate concentration from mixing in an aquifer.

The methodology for developing SSLs for the migration to ground water pathway was designed for use during the early stages of a site evaluation when information about subsurface conditions may be limited. Hence, the methodology is based on rather conservative, simplified assumptions about the release and transport of contaminants in the subsurface (Highlight 6). These assumptions are inherent in the SSL equations and should be reviewed for consistency with the conceptual site model (see

Step 2) to determine the applicability of SSLs to the migration to ground water pathway.

> **Highlight 6: Simplifying Assumptions for the SSL Migration to Ground Water Pathway**
>
> - Infinite source (i.e., steady-state concentrations are maintained over the exposure period)
> - Uniformly distributed contamination from the surface to the top of the aquifer
> - No contaminant attenuation (i.e., adsorption, biodegradation, chemical degradation) in soil
> - Instantaneous and linear equilibrium soil/water partitioning
> - Unconfined, unconsolidated aquifer with homogeneous and isotropic hydrologic properties
> - Receptor well at the downgradient edge of the source and screened within the plume
> - No contaminant attenuation in the aquifer
> - No NAPLs present (if NAPLs are present, the SSLs do not apply).

Address Exposure to Multiple Chemicals. The SSLs generally correspond to a 10^{-6} excess risk level for carcinogens and a hazard quotient of 1 for noncarcinogens. This "target" hazard quotient is used to calculate a soil concentration below which it is unlikely that sensitive populations will experience adverse health effects. The potential for additive effects has not been "built in" to the SSLs through apportionment. For carcinogens, EPA believes that setting a 10^{-6} excess risk level for individual chemicals and pathways generally will lead to cumulative site risks within the 10^{-4} to 10^{-6} risk range for the combinations of chemicals typically found at NPL sites.

For noncarcinogens, there is no widely accepted risk range, and EPA recognizes that cumulative risks from noncarcinogenic contaminants at a site could exceed the target hazard quotient. However, EPA also recognizes that noncancer risks should be added only for those chemicals with the same toxic endpoint or mechanism of action.

If more than one chemical detected at a site affects the same target organ (i.e., has the same critical effect as defined by the RfD methodology), an overall hazard index (HI) for the source (or exposure area) can be calculated. If this HI exceeds 1, further investigation is needed. The guidance provides a list of target organs for all chemicals with SSLs based on noncarcinogenic effect.

2.6 Step 6: Comparing Site Soil Contaminant Concentrations to Calculated SSLs

Now that the site-specific SSLs have been calculated for the potential contaminants of concern, compare them with the site contaminant concentrations. At this point, it is reasonable to review the CSM with the actual site data to confirm its accuracy and the overall applicability of the Soil Screening Guidance.

Thus, for surface soils, the contaminant concentrations in each composite sample from an exposure area are compared to 2 times the SSL. (When SSL DQOs were developed, 2 times the SSL was determined to a reasonable upper limit for comparison that would still be protective of human health. Use of this decision rule is appropriate only when the quantity and quality of data are comparable to the levels discussed in the User's Guide. For a complete discussion for the SSL DQOs, see the TBD.) If any composite has concentrations that equal or exceed 2 times the SSL, the area cannot be screened out, and further study is needed.

However, if all composite samples are below 2 times the SSLs, no further study is needed.

For data sets of lesser quality, the 95% upper confidence level on the arithmetic mean of contaminant soil concentration can be compared directly to the SSLs. The TBD discusses strengths and weaknesses of different calculations of the mean and when they are appropriate for making screening decisions.

Since subsurface soils are not characterized to the same extent as surface soils, there is less confidence that the concentrations measured are representative of the entire source. Thus, a more conservative approach to screening is warranted. Because it may not be protective to allow for comparison to values above the SSL, mean contaminant concentrations from each soil boring taken in a source area are compared with the calculated SSLs. Source areas with any mean soil boring contaminant concentration greater than the SSLs generally warrant further consideration. On the other hand, where the mean soil boring contaminant concentrations within a source are all less than the SSLs, that source area is generally screened out.

2.7 Step 7: Addressing Areas Identified for Further Study

Areas that have been identified for further study become a subject of the RI/FS (U.S. EPA, 1989c). The results of the baseline risk assessment conducted as part of the RI/FS will establish the basis for taking remedial action. The threshold for taking action differs from the criteria used for screening. As outlined in *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (U.S. EPA, 1991c), remedial action at NPL sites is generally warranted where cumulative risks for current or future land use exceed $1x10^{-4}$ for carcinogens or an HI of 1 for noncarcinogens. The data collected for soil screening are useful in the RI and baseline risk assessment. However, additional data will probably need to be collected during future site investigations. This additional data will better define the risks and threats at the site and could conceivably indicate that no action is required.

Once the decision has been made that remedial action may be appropriate, the SSLs can then serve as PRGs. This process is referenced in Section 1.2 of this document.

FOR FURTHER INFORMATION

The technical details (e.g, equations and assumptions necessary to implement the soil screening guidance are available in the Soil Screening Guidance: User's Guide (U.S. EPA, 1996a). More detailed discussions of the technical background and assumptions supporting the development of the Soil Screening Guidance are presented in the *Soil Screening Guidance: Technical Background Document* (U.S. EPA, 1996b). The final portion of the guidance package is the *Soil Screening Guidance: Response to Comments*, (U.S. EPA, 1996c) which describes changes made to the guidance following peer review and public comment. For additional copies of this fact sheet, the User's Guide, the Technical Background Document, Response to Comments, or other EPA documents, call the National Technical Information Service (NTIS) at (703) 487-4650 or 1-800-553-NTIS (6847).

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