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**Streamlined RI/FS Planning for the Groundwater Operable Unit
at the Weldon Spring Site***

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BACKGROUND

The U.S. Department of Energy (DOE) is conducting cleanup activities at the chemical plant area of the Weldon Spring Site located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis and 22 km (14 mi) southwest of the City of St. Charles. The 88-ha (217-acre) chemical plant area is chemically and radioactively contaminated as a result of uranium processing activities conducted by the U.S. Atomic Energy Commission during the 1950s and 1960s. The Army also used the chemical plant area for the production of explosives in the 1940s. The Weldon Spring Site chemical plant area was listed on the National Priorities List (NPL) in 1989. Adjacent to the chemical plant area is another NPL site known as the Weldon Spring Ordnance Works. The ordnance works area is a former explosive production facility that manufactured trinitrotoluene (TNT) and dinitrotoluene (DNT) during World War II. The ordnance works area covers 7,000 ha (17,232 acres); cleanup of this site is managed by the U.S. Army Corps of Engineers (CE).

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the DOE is conducting a remedial investigation/feasibility study (RI/FS) to evaluate site conditions and to develop potential responses that would address groundwater and surface water contamination at the chemical plant area. Groundwater at the chemical plant area is being addressed as a separate operable unit; soil contamination and structural contamination were addressed in a previous investigation. Similar to the approach taken by the DOE at the chemical plant area, the Army is also conducting an RI/FS to address groundwater contamination at the ordnance works area. Although the sources of contamination at the two sites are distinct, the two areas share a common groundwater system. It is therefore essential to incorporate information from both sites in order to obtain a comprehensive evaluation of groundwater conditions in the area. To this end, the EPA has requested that the DOE and the CE either combine efforts in addressing groundwater contamination or share information in order to ensure all pertinent areas are addressed and overlapping efforts are minimized.

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The goals of the planning process for the DOE groundwater operable unit were to maximize the use of available data for characterizing the nature and extent of contamination, support risk assessment and risk management decisions, and provide sufficient baseline information to select a remedial action alternative. Unfilled data requirements were then identified and addressed in the sampling effort supporting the remedial investigation. The following key tasks had to be completed during the planning phase before further data collection could be defined: (1) developing a comprehensive conceptual hydrogeological model incorporating features of both sites (this model was useful in establishing general groundwater flow patterns in the area and identifying the nature and extent of contamination); (2) framing the site exposure model (incorporating current and projected land uses, potential site contaminants, background concentrations of potential contaminants, and probable and plausible exposure pathways); and (3) obtaining adequate information to support selection of alternatives. The resulting data collection efforts for the RI were primarily based on completing or confirming the conceptual hydrogeological model, confirming the conceptual site exposure model, and supporting the rationale for selecting a preferred alternative.

DEVELOPMENT OF THE HYDROGEOLOGICAL MODEL

A conceptual hydrogeologic model depicts the groundwater flow system, portraying its salient features and processes. The model for the Weldon Spring site was developed by assembling and analyzing different types of subsurface data collected in the field, including information on the hydrostratigraphic units and characteristics of the aquifer.

The task of developing a model of this type proved to be complex for two reasons. First, the data from the two sites were obtained from investigations and studies conducted by several consulting organizations, state agencies, and the U.S. Geological Survey (USGS) over different periods of time. As a result, there were inconsistencies in the hydrogeologic interpretations and terminologies. This dilemma was resolved by forming a team composed of support staff from the DOE and the CE. The main focus of this team was to review the geologic data and develop consistent interpretations. Second, the hydrogeologic data used to support the conceptual model were derived from investigations and studies whose individual objectives generally focused on characterizing a certain area or feature of the subsurface environment. For example, data from the Missouri Department of Natural Resources focused on identifying subsurface preferred flow paths through tracer tests, while the USGS focused on providing detailed hydrogeologic information on the related hydrostratigraphy. In assembling and reviewing the data, the investigators found that there was abundant information for some areas (e.g., routine measurements of water levels from numerous wells), while data on the

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aquifer were scarce or nonexistent for other areas. In instances where information was absent or scarce, numerous discussions were held among the parties involved to identify data gaps and to concur on the amount and type of additional data needed (e.g., number and location of wells) to fill the data gaps and complete the conceptual model. This effort resulted in optimized utility of existing information and also identified a minimal further data collection effort.

In summary, the conceptual hydrogeologic model was developed along with the data requirements and reviewed by all parties involved. The cooperative effort established by the DOE and the CE to resolve inconsistencies in the interpretation of subsurface data was beneficial in providing the necessary mechanism for developing a consistent hydrogeologic model that addressed the two sites. Frequent meetings and open discussions regarding outstanding issues ultimately saved time because comments and recommendations from all parties were incorporated during the development stage rather than at the end of the task.

FRAMING OF THE SITE EXPOSURE MODEL

A conceptual exposure model developed for the site identified source areas, potential release and transport mechanisms, environmental media of concern, potential human receptors, and routes of exposure. The model reflects the evaluation performed with existing contaminant data and other information. Current and plausible future land uses were identified in order to determine the nature and degree of impact of the potential site contaminants. Current land use is limited to recreational users who may use water from a spring that serves as a discharge point for groundwater; no other use of area groundwater has been identified. Future land use is projected to be similar to current land use, primarily because the site is located near a conservation area and because a large portion of the site will be occupied by a disposal cell that will soon be constructed. The disposal cell is part of the remedy identified for addressing site soil and structural contamination. Although the regulators (the EPA and the Missouri Department of Natural Resources) have agreed that the identified land uses are reasonable, they have requested that calculations for a residential scenario be included in the baseline risk assessment to add to the information base to support decision making. It was acknowledged by the regulators, however, that alternative selection and remedial decisions would be consistent with the reasonable projected land uses.

Data in a sizeable existing database from a monitoring well network that has been maintained for several years at the chemical plant area were utilized in identifying potential site-related contaminants. Evaluation of the contaminant data included determining if the frequency and location

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of the wells within the monitoring network were appropriate for the purpose of the RI/FS. Relevant data were then compiled and evaluated to identify potential site-related contaminants. Maximum site concentrations were compared with federal and state criteria and with conservative health risk criteria calculated on the basis of assumed reasonable worst-case intake levels of groundwater. Further data collection efforts were then focused on only those contaminants that could potentially cause adverse human health effects from exposure to groundwater. Although the above described procedure was deemed reasonable by the regulators, they expressed discomfort in the fact that this type of screening is typically not performed during the scoping or planning phases but primarily during the remedial investigation/baseline risk assessment stages. Negotiations resulted in an agreement to collect additional data for a few parameters to confirm their absence or the insignificance of their contribution to overall human health risk.

Another issue that was highlighted during negotiations in planning meetings was the desirability of determining background concentrations of naturally occurring inorganic constituents. Several metals and anions have been detected in site groundwater. Data on background concentrations of these metals and anions, if available, could be used to determine whether the levels detected are related to activities at the site. However, the logistical constraints and expense involved in establishing background characteristics of each of the hydrostratigraphic units of concern for the site was deemed to be prohibitive by the evaluators. In addition to the necessity of installing nested wells at background locations, several rounds of data would also have been required to ensure statistically valid comparisons with site data.

As an alternative to comparisons with site-specific background levels, the site data for the inorganic constituents were evaluated to identify particular metals or anions that are clearly above regional background levels, or those that could be eliminated as minimal contributors to human health risk based on a conservative screening-level risk estimate. This approach was presented to the regulators in initial drafts of the work plan. Their general opinion was that background information was important and that comparison to any health-related criteria was premature in the work plan stages. However, because of the logistics and expense discussed above, a compromise was reached to utilize an agreed upon number of wells from the existing network to represent background concentrations. The wells that were chosen were those deemed representative of background conditions primarily because they were located away from contaminant source areas.

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SUPPORTING ALTERNATIVE SELECTION

Because of the particular physical conditions of the site and the nature and distribution of the contamination, it became fairly clear early in the investigation that the most feasible alternative to address groundwater contamination at the chemical plant area would be no action combined with institutional controls and monitoring. Under this scenario, contaminant concentrations in groundwater would attenuate slowly with time after the removal of contaminant sources (i.e., soil and structural contaminated material) at the chemical plant area. Although alternatives involving treatment will be evaluated, it is unlikely that any alternative that treats the affected groundwater would be successful because of the widespread, low-level contamination and the adverse characteristics of the affected subsurface environment, including low conductivity, low sustained pumping yields, and superimposed fractures and weathering. These initial evaluations were considered to be reasonable by the regulators during planning meetings. Further data collection effort was identified to confirm and support the initial evaluation.

CONCLUSIONS

A focused and efficient data collection effort for an RI/FS resulted when key elements that determine the adequacy of the data in terms of supporting remedial decisions were identified early on in planning activities and addressed with the participation of the regulators. The resulting data collection effort was effective and focused and simplified the remedial decision process by providing sufficient data to support the decisions to be made at the later phases. Early acceptance by regulators and stakeholders of the data collection approach was obtained through negotiations and/or agreements and led to timely review and approval of planning documents as they were developed. Grappling with key issues during the planning phases also improved cost estimate accuracy and cost performance tracking.

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