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Hanford Environmental Information System Requirements Document for RI/FS Activities

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1.0 Introduction

This document identifies the requirements of a computer-based technical database and information management system needed to support the RI/FS (Remedial Investigation/Feasibility Studies) program currently being implemented by the Westinghouse Hanford Company (WHC). The Hanford Environmental Information System (HEIS), a system being developed by Pacific Northwest Laboratory (PNL) for management of Hanford environmental data, will be utilized for this purpose.

1.1 Background and Current Status

Information related to Hanford environmental issues is currently maintained in several forms including automated databases on VAX's and PC's, automated and manual file systems, and in numerous documents and reports. Even when data is maintained in an automated database, accessing that data is generally difficult without an indepth understanding of the database structure and content. Integration of data from multiple systems is currently performed manually and is limited to an individual's knowledge of the various information resources that are available.

The HEIS project was initiated by PNL as a means of responding to the critical need for a centralized repository of environmental information that could be accessed by a varied group of people in a more user ready fashion. This system will provide a more global database that will simplify the task of establishing relationships between sets of technologically distinct data and will provide greater assurrance that all relevant information is being considered. Achieving this goal is imperative in the RI/FS program, where it is necessary to be able to integrate site and facility information before decisions can be made regarding selection of the most effective and reasonable remedial alternatives.

PNL presently has a Geographic Information System (GIS), which will be utilized to present information about the Hanford site in a map and overlay format. Also recently acquired is a Sequent multi-processor computer, which will function as the database machine. The PNL Sigma Vax cluster will provide the interface between the Sequent and the GIS and will contain much of the supporting software. It is anticipated that software will also be acquired that will increase the display capabilities of the GIS and will provide the capacity to generate graphical displays of technical information in the form of charts, diagrams, or profiles.

1.2 Scope of Requirements Document

The scope of this document includes a discussion of the general requirements necessary for the development of HEIS (Section 2). Aspects of this discussion include:

- o database requirements
- o GIS and graphics development
- o communications
- o procedures

A summary of technical capabilities expected of HEIS during FY89 is presented in Section 3. This includes implementation of data areas for geophysics, vadose zone soil, and groundwater monitoring in the HEIS database and preparation of GIS basemaps and data overlays. Also included is development of an upgraded GIS basemap of the 1100-EM-1 operable unit and associated waste sites.

A final section of this document presents some aspects of HEIS that need to be developed during FY90 and beyond (Section 4).

The information presented in this document is intended to provide general guidance for the development of HEIS in the support of WHC RI/FS activities. It is also intended to provide the basis for the generation of an Outyear Plan by PNL. The Outyear Plan will provide a proposed schedule for developing the capabilities identified in the Requirements Document and an estimate of costs associated with meeting this schedule.

2.0 General Requirements for HEIS Development

General requirements of HEIS include the development of a computer-based system for the storage, retrieval, integration, and display of technical data acquired in support of site characterization and remedial activities associated with the RI/FS process. The system shall also function as a comprehensive directory of records available for waste sites and operable units and identify the location of all such materials. In addition, the Geographic Information System shall be utilized to generate base maps of the waste sites and units with the capability of adding overlays illustrating features such as roads, boundaries, and buildings, or data of technical importance. It is necessary to design HEIS in such a manner that the system may be easily accessed by the technical staff. At the same time, however, it is important to have procedural controls in place that will insure the integrity and security of the system and the database.

2.1 Database Requirements

Information to be stored in the HEIS database machine will include designated categories of raw data plus a comprehensive directory of all technical records available. The specific types of raw data that will be directly stored in the HEIS database must be determined on a case-by-case basis. Factors to be considered in making this decision include identification of information needs required by the RI/FS process, the nature of data processing required by a specific technical activity, and the

data storage requirements associated with a category of raw data. A decision of this type has to be based on the technical judgement of the personnel directly involved with acquiring and interpreting the data.

Data obtained in the course of conducting geophysical surveys may be presented as an example of a technical area which will involve data of various types. Much geophysical raw data, such as seismic information, will probably not be directly stored in HEIS because of the extremely large storage requirements that would be needed. It is generally more feasible to archive the final seismic profile as a hard copy record; this profile represents the final product of all processing procedures performed by the geophysical personnel responsible for obtaining the information. In addition, however, it is possible to digitize a map illustrating a technical interpretation of the seismic data (an "interpreted map") for use as an overlay in the GIS.

Raw data associated with magnetic surveys, on the other hand, is an example of geophysical raw data which requires less storage resources; thus it may be feasible and useful to electronically store this data in the HEIS database. Furthermore, storage of this information is desirable since magnetic data may be utilized in models that provide a physical interpretation of the raw data.

Even though all raw data will probably not be directly stored in the HEIS database, HEIS must be able to function as a directory or catalog that can identify all available technical information relevant to RI/FS activities. Key identifiers include waste site or operable unit designations, technical subject area, or specific data type. This directory should indicate the present room location of the information, specific storage file identification (i.e., cabinet/drawer number), and the name and phone number of the individual responsible for maintaining the information. The information may consist of the original raw data, samples, maps, cross-sections, final reports, or related documents. Also of importance is the identification of pertinent characteristics of the data. This includes information regarding data collection or processing procedures, the location (coordinates and depth) of the sampling point, and technical comments necessary for assessing the general quality or limitations of the information.

Other aspects of data management include those related to quality assurance. This arises from the regulatory requirements associated with the development of RI/FS documentation. Data and information storage requirements related to this include:

- o all data and information to be incorporated in HEIS must be sufficiently accurate and reliable to support decisions related to site remedial activities
- o all activities supporting site cleanup must be performed in accordance with approved plans and documented procedures
- o traceability (chain of custody) must be established in order to

document the nature and validity of all processes involved in formulating remedial decisions derived from the original measurements or observations.

Data assessment and evaluation involves the process of estimating the precision, accuracy, representativeness, completeness, and comparability of data measurements. This activity is the responsibility of the scientific and engineering technical staff associated with the data collection and interpretation activities. The outcome of this process will determine whether or not the data is of sufficient quality and reliability to be incorporated within the database. In some circumstances, it may not be possible to completely evaluate and qualify a large amount of data before entering it into HEIS. All such information shall be appropriately identified (flagged) so that the user will be aware that the information may not necessarily meet EPA, DOE, or other regulatory or WHC guidelines.

The accuracy and precision required for a particular measurement depends on the intended use of the data. The confidence associated with a specific measurement or body of information may be expressed in terms of analytical or impact quality levels. In general, most field measurements are designated as EPA analytical level I or II while laboratory measurements are level III, IV, or V. These levels are commonly associated with the intended end use of the data and have designated procedural requirements for acquiring the specific data type. Where practical and appropriate, data entered into HEIS will have an analytical level assignment and be associated with documentation providing justification for this assignment. Technical comments related to the relative validity or intended use of the data should also be included. Also of importance is the inclusion of measures related to the precision of the data (e.g., standard deviation about the mean) and the degree of sensitivity associated with a specific technical method (e.g., detection limit). In most instances, information of this nature will be provided in reports submitted by the personnel generating the data and will be related to the specific equipment and procedures utilized. It is also appropriate to provide information related to evaluation of analytical accuracy. In the case of chemical data obtained from laboratory measurements, this information may be obtained by using interlaboratory splits or blind standards.

2.2 GIS and Graphics Development

The GIS facility is an integral component of HEIS in that it will provide an accurate and detailed basemap of the RI/FS operable units and waste sites, and has the capability of providing overlays that portray technical information in a geographical context. The GIS system to be developed in support of HEIS must have, as a minimum, the software necessary to plot gridded data on a basemap and to construct a contoured map based on this data. To perform this task, it is also necessary to establish an interface between the GIS and the HEIS database machine, where the data set will reside. It is anticipated that sophisticated software packages (e.g., CPS1) will be added to the system that will substantially increase the graphic capabilities of the GIS.

The development of additional graphical capabilities for use with workstations that utilize the HEIS database machine must also be undertaken. This includes the ability to construct

- o simple geophysical profiles from raw data (e.g., magnetic surveys)
- o geological logs and cross-sections
- o vertical trends in soil chemistry and associated lithology
- o changes in groundwater chemistry with time.

2.3 Communications

In order to make the HEIS database readily accessible to technical personnel, a telecommunications system needs to be provided. It is anticipated that this will be achieved with the present Local Area Network (LAN). This will allow, for example, data retrieval by technical staff that have personal computers or terminals on the LAN with access privileges to HEIS. This arrangement will also facilitate data entry by qualified operators. It is also anticipated that an additional GIS facility will be established within WHC that will be connected to the HEIS database machine via a direct communications line.

2.4 Procedures

An important aspect of HEIS development is the identification and preparation of administrative and technical procedures. This includes, as a minimum, procedures for

- o system security and access
- o data backup
- o data transfer verification
- o retrieval of information from technical subject areas (user's manual)
- o data entry and change (operator's manual)

Preparation of these procedures will be a responsibility of PNL. Draft copies will be submitted to WHC for review and approval.

3.0 HEIS Development in FY89

HEIS is currently undergoing development as defined in a FY89 Statement of Work (SOW). The following information provides some additional information concerning aspects of this work. Specific requirements for the individual technical subject areas will be presented in Acceptance Criteria (Specification) Documents as described in the FY89 SOW.

3.1 Geographic Information System

GIS development activities planned in FY89 include general enhancement of a Hanford base map and completion of an interface between the GIS and a new HEIS database machine. Specifically, the base map of the 1100 Area shall be upgraded in support of RI/FS activities currently underway for the 1100-EM-1 Operable Unit and overlays of technical information will be prepared (see below).

3.2 Development of Geophysical and Soil Gas Data Subject Areas

Geophysical data to be incorporated into HEIS will be acquired using various techniques. The raw data associated with these techniques may or may not be directly entered into the HEIS database, depending on technical needs and data storage requirements. Seismic or ground penetrating radar data, for example, will probably not be directly stored in HEIS because of the immense storage requirements that would be needed. Raw data from magnetic surveys, on the other hand, could be feasibly stored because of the lower quantity of information involved.

All geophysical surveys will be identified in a catalog or directory. This catalog should be indexed by operable unit, waste site, and type of survey and should contain, as a minimum, the following information:

- o complete listing of geophysical surveys
- o coordinates of line-ends and/or each data point (GIS)
- o instrumentation/survey specifications
- o identification of processing steps
- o location of hardcopies plus magnetic tapes, reports, etc.
- o impact or analytical levels

Specific geophysical data types to be considered during FY89 include

- o ground-penetrating radar (catalog)
- o electro-magnetic (raw data and catalog)
- o magnetic (raw data and catalog)
- o metal detector (raw data and catalog).

In general, ground-penetrating radar data will not be directly stored in HEIS and, thus, cannot be utilized to generate graphical displays. Location of survey lines and associated end-points, however, should be provided on GIS base map overlays, as requested. In addition, a digitizer

should be available to generate overlays of maps resulting from interpretations of raw data (including ground-penetrating radar) as provided by technical personnel.

Raw data that is amenable to direct permanent storage within the HEIS database will, as a rule, consist of a limited number of discrete data values per survey. Each of these values will also generally be associated with a specific surface sample location, in a one-to-one relationship. As such, this data may readily be gridded and contoured on a GIS base map overlay. It is also anticipated that profiles will need to be generated using data of this type. Magnetic data along a survey line, for example, can be displayed in a graph portraying magnetic intensity versus location along the line. This type of presentation is a useful source of information for conducting certain basic modeling activities.

Data to be utilized in developing the geophysical data subject area during FY89 will consist primarily of that information acquired in connection with field activities in the 1100-EM-1 Operable Unit. Other Hanford geophysical data may be substituted for this, however, if data from the 1100 Area is not available in time for incorporation into HEIS or is insufficient to meet all database development requirments.

Also being undertaken at this time is the initial work involved with the development of a soil gas data subject area for HEIS. This activity is being conducted concurrently with geophysical database design activities since soil gas sampling and geophysical surveys are being conducted at approximately the same time in the 1100-EM-1 Operable Unit. It is anticipated that all raw data associated with the soil gas investigations will be entered into the HEIS database. This information will be utilized to construct GIS overlays illustrating the extent of potential contamination associated with specific chemical components. In addition, a catalog will be developed for the purpose of identifing all soil gas surveys conducted in the 1100-EM-1 Operable Unit and the current location of this information.

The milestone date for identification of acceptance criteria for the geophysical subject area, per the FY89 SOW, is 2/28/89. A demonstration of HEIS and GIS capabilities in the geophysical subject area is scheduled for 3/31/89; draft copies of associated procedures will also be submitted at that time.

3.3 Development of Vadose Zone Soil Data Subject Area

Information to be included in this subject area includes physical properties and chemical analyses of soil samples obtained from vadose zone boreholes. Additional geological information will include geologic logs comprised of soil and rock descriptions and elevations of important stratigraphic contacts.

Analytical data incorporated within this data subject area should be accompanied by measures of accuracy and precision and technical comments pertaining to the validity or limitations of the data. Technical procedures utilized in data acquisition should be clearly identified. This information

will generally be provided by the technical personnel responsible for acquiring the data.

A catalog will also be initiated in FY89 for the purpose of identifing all data or information sources that pertain to the vadose zone soil subject area and the current location of this information. This catalog will also indicate the archival status of any soil samples.

The GIS will be utilized to illustrate the location of vadose zone boreholes with respect to waste sites. In addition, contoured GIS overlays will be generated to illustrate the distribution of specific chemical components based on the analytical data in HEIS. Graphical displays will also be utilized to illustrate vertical trends in soil chemistry and lithology for individual boreholes.

Data to be utilized in developing the vadose zone soil subject area during FY89 will consist of that information acquired in conjunction with field activities in the 1100-EM-1 Operable Unit. Other Hanford data may be substituted for this, however, if data from the 1100 Area is not available in time for this purpose.

The milestone date for identification of acceptance criteria for the vadose zone soil subject area, per the FY89 SOW, is 4/17/89. A demonstration of HEIS and GIS capabilities in the vadose zone soil subject area is scheduled for 5/31/89; draft copies of associated procedures will also be submitted at that time.

3.4 Development of Groundwater Monitoring Subject Area

Selected data shall be extracted from the existing PNL groundwater monitoring database and incorporated into HEIS. Specific data to be transferred includes groundwater (unconfined aquifer) chemistry, hydrological information (hydraulic head and hydrostratigraphic description), and well location. Additional information may be supplied by WHC technical staff for hydrological properties such as hydraulic conductivity, moisture content, and porosity.

Analytical data incorporated within this data subject area should be accompanied by information related to measures of accuracy and precision and technical comments pertaining to the validity or limitations of the data. Technical procedures utilized in data acquisition should be clearly identified. Any information incorporated into the groundwater monitoring subject area that is not qualified in this manner should be clearly flagged.

A catalog will also be initiated in FY89 for the purpose of identifing all data or information sources that pertain to the groundwater monitoring subject area and the current location of this information. This catalog should have the ability to sort these sources by key word, operable unit, or waste site.

The GIS will be utilized to illustrate the location of groundwater monitoring wells with respect to waste sites. In addition, contoured GIS

overlays will be generated to illustrate features such as the distribution of specific chemical components or regional trends in groundwater elevation. Graphical display capabilities to illustrate changes in groundwater chemistry with time shall also be developed.

Data to be utilized in developing the groundwater monitoring subject area during FY89 will include information acquired in conjunction with field activities in the 1100-EM-1 Operable Unit, if available during FY89. Data presently available in the PNL groundwater monitoring database will also be utilized for this purpose.

The milestone date for identification of acceptance criteria for the groundwater monitoring subject area, per the FY89 SOW, is 6/15/89. A demonstration of HEIS and GIS capabilities in the groundwater monitoring subject area is scheduled for 9/29/89; draft copies of associated procedures will also be submitted at that time.

3.5 HEIS Procedures Manuals, Consultation, and User Training

PNL shall develop HEIS procedures manuals for both operators and users. Minimum FY89 requirements, as identified in the FY89 SOW, include detailed outlines for these manuals and the preparation of several procedures related to the management and utilization of the specific subject area capabilities identified above. PNL shall also provide support, training, and consultation services for the operators and users of HEIS and GIS.

4.0 HEIS Development in FY90 and Outyears

An important aspect of outyear development of HEIS will include general enhancements of the three technical areas discussed above, as needs are identified. Some additional system enhancements and requirements are identified below.

4.1 Additional Technical Data Subject Areas

Additional technical data subject areas to be included in HEIS during the outyears includes biotic, surface soil, and air monitoring sampling data. Development of these areas will include definition of specific data sets and GIS and graphics capabilities.

4.2 GIS and Graphics Development

It is anticipated that an additional GIS workstation will be acquired by WHC during FY90. This facility will be linked to the PNL HEIS database machine through a direct communications line.

Acquisition of specialized GIS software packages (e.g., CPS1) should be considered, as these will greatly enhance the display capabilities of HEIS. This includes, for example, the ability to create displays that portray information in three dimensions and the generation of simulated scenarios.

Enhanced graphics capabilities should also be considered. This includes, for example, the ability to construct geologic cross-sections from well log information.

4.3 Communications

Development of a telecommunications system for access of the HEIS database should be a major goal of FY90 activities. It is anticipated that the LAN will be utilized for this purpose. The LAN will allow technical personnel to obtain information through their personal computers and will facilitate data entry and change by operators.

4.4 Expansion of System Hardware

An important aspect of outyear planning includes an assessment of data storage needs and associated hardware requirements. Projected hardware upgrade needs will be presented by PNL in the Outyear Plan.

4.5 HEIS Procedures Manuals

Administrative procedures should be largely completed by the end of FY90. Most technical procedures should also be completed or in draft form at that time. Preparation of these procedures is the responsibility of PNL. Draft copies will be submitted to WHC for review and approval.

4.6 Projected Staffing Requirements

PNL should provide an estimate of staffing requirements in their Outyear Plan. This includes management and technical staff for system operations, design, and development. Staffing needs should also be included for consultation and user training. Staffing requirements for this activity should be moderate, however, since WHC will eventually assume a large portion of this responsibility. It is anticipated that PNL staffing requirements for data entry will also be minimal, since WHC staff will largely assume this responsibility after database design and development activities are complete.

DOCUMENT CLEARANCE REQUEST

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SECTION 1 — Clearance Information

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11. WHC Program: Environmental

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12A. When was the information generated?

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20. Sponsoring Agency (if not U.S. Department of Energy):

21. DOE/HQ Assistant Secretary For: Environment, Health and Safety

22. Remarks

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