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SYSTEM FOR ENVIRONMENTAL MONITORING
AT HANFORD

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**HEIS: AN INTEGRATED INFORMATION SYSTEM FOR
ENVIRONMENTAL RESTORATION AND MONITORING AT HANFORD**
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INTRODUCTION

The U.S. Department of Energy's Hanford Site has about 1500 waste sites that contain a complex mixture of chemical and radioactive contaminants. After many years of environmental monitoring to assess the impact of Hanford operations to the environment, the Site's mission is shifting to environmental restoration.

Various agencies are involved in the environmental monitoring and restoration. These agencies include the Department of Energy, the Environmental Protection Agency, and Washington State's Department of Ecology. The Hanford Environmental Information System (HEIS) is being developed to provide advanced tools to (1) support environmental restoration and routine site-wide monitoring, and (2) aid the scientists in understanding and conducting the restoration efforts.

This paper describes some of the highlights and distinctive features of HEIS.

THE HEIS

HEIS provides a repository for storing environmental data, spatial data analysis tools, and visual products to depict the monitoring and restoration work at Hanford. Early in the design process it became apparent that no

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single commercial product would satisfy these diverse requirements. Instead, off-the-shelf commercial products were selected and integrated into a common framework. HEIS uses a relational database to provide storage for the large volumes of scientific data, a geographic information system (GIS) to analyze spatial data, and a graphics package for high quality graphs. As user needs and requirements change over time, additional products will be procured and integrated into HEIS.

The combination of diverse software tools and data structures into one package leads to an integrated system that meets the challenge of satisfying the Hanford environmental monitoring and restoration requirements.

THE HEIS DATABASE

The backbone of HEIS is the database. It contains information about environmental samples from the time that samples are scheduled for collection to the end point when analytical laboratory results are verified, validated, stored, and made available to the user.

The database is organized into 11 major subject areas that correspond to areas of environmental interest. These include: atmospheric, biotic, geologic, geophysical, ground-water, and soil gas samples. Over 80 interrelated tables are used to implement these subject areas. Because of the large volumes of data and the need for flexible methods of information access, the system is implemented using the Oracle relational database management system running on a Sequent Unix-based hardware platform. It is anticipated that over 50 gigabytes of raw data will be stored on the system.

HEIS uses a consistent framework for storing contaminants measured by the laboratories across the different subject areas. This is vitally important for comparison of results for different media types by the GIS.

Contaminants are referenced by their Chemical Abstract Society number where available. In addition, HFIS has defined analytical method identifiers that reference each laboratory's unique methods for sample analysis.

Because HEIS is being used in a multi-contractor environment, a key requirement of the system is the ability to support a multi-level access security mechanism within the database itself. HEIS stores each type of data in one physical table, but allows each data owner to restrict access to sample or analysis data until the data is completely verified and validated. Then data can be "released" for public access.

End-users interface with HEIS using a menu and forms-based approach. Easy to understand forms are used for both data input and data viewing. Complex database queries can be generated using simple fill-in-the-blanks procedures.

THE HEIS GEOGRAPHIC INFORMATION SYSTEM

Currently, most commercial database management systems are not designed for sophisticated spatial analysis. Therefore, the HEIS geographic information system (HEISGIS) is being developed as a tool for display and analysis of data in the HEIS database. The close relationship between the data in the HEIS database and the HEISGIS makes a robust interface between them necessary. The GIS system chosen, ARC/INFO, provides the tools needed to support this interface.

It is expected that HEIS will contain a variety of spatial data types including point, line, polygonal, and raster data. All the spatial data will be stored in ARC/INFO and will be cross referenced in the Oracle database. The cross reference index will be updated each time the database or ARC/INFO base map data are updated. The anticipated spatial data storage requirements

will be over 300 megabytes for each copy of the base data. A similar amount of storage would be available to each HEISGIS user for the development of application products. The base data will be updated periodically.

HEISGIS will provide a graphical user interface, 3D displays and profiles, cartography, and spatial analysis capabilities such as data contouring, overlays, and dimensional calculations.

CONCLUSION

The benefits of this multidisciplined, technologically challenging project are already being seen and felt within the Hanford scientific and operations community. It has fostered a greater awareness and appreciation of the scientific disciplines involved and cooperation among those involved in the Hanford cleanup.

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