Statement of Work
FY 2013 – 2017
USGS Interagency Agreement

1. Background

The Eastern Snake River Plain (ESRP) aquifer of Southeastern Idaho, a part of which underlies the Idaho National Laboratory (INL) Site is an important resource to both the State of Idaho and the U.S. Department of Energy (DOE). The entire water supply for the INL (including drinking water) is obtained from the aquifer. At the INL, the aquifer is part of an extensive geohydrologic system that also includes a thick, overlying unsaturated zone, perched groundwater zones, and intermittent streams, playas, and water-diversion areas.

Some parts of the ESRP aquifer, unsaturated zone, and perched groundwater zones contain low-level radioactive- and chemical-aqueous wastes generated by activities at the INL. From 1952 to the present, aqueous wastes were either injected directly into the aquifer through disposal wells, or were discharged to infiltration ponds. Ponded wastewater infiltrates the soil and underlying rock units and eventually percolates downward to the aquifer. Perched groundwater zones have formed in places where the downward movement of wastewater is impeded because of a decrease in vertical hydraulic conductivity. As wastewater reaches the aquifer, it moves downgradient toward the southern boundary of the INL Site.

Because of continuing concern about water pollution and data needs derived from the INL Groundwater Monitoring Plan and the Idaho Completion Project, the U.S. Geological Survey (USGS) has designed and implemented an extensive geohydrologic, hydraulic, chemical, and radiochemical data collection network under previous inter-agency agreements (IAAs) with the Department of Energy, Idaho Operations Office (DOE-ID) . The USGS has been providing support to DOE-ID and its predecessor agencies since the land area now known as the INL Site was first used for nuclear research.

2. Request for Proposal

The USGS has extensive knowledge and capabilities associated with their long-term work at the INL Site. DOE-ID desires to maintain the long standing relationship with USGS and continue to utilize the knowledge and capabilities of the USGS by establishing a five (5) year IAA. Work under the IAA will be negotiated annually for each fiscal year based on DOE-ID technical needs for subsurface characterization related to contaminant transport, facility siting and impact determinations, and natural hazard phenomenon determinations as well as available funding in the following areas:

2.1. Geohydrologic Studies and Monitoring

Horizontal and vertical migration of solutes in the subsurface, and the resultant dispersion, dilution, sorption, and radioactive decay are a result of complex physical and chemical processes that need to be evaluated by continual water quality monitoring. Similarly, stresses on the geohydrologic system must be evaluated and monitored to describe the variation in processes and to estimate the sensitivity of waste migration and water availability to natural conditions.

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Work in this area may include:

- Amount and timing of potential recharge to the aquifer from the infiltration of streamflow
- Geologic framework of the ESRP aquifer
- Hydraulic characteristics of the aquifer
- Geochemical processes

2.1.1. Hydrologic Monitoring

Design and perform hydrolic monitoring that supports DOE-ID environmental surveillance needs and understanding of groundwater contaminant and water level changes. Monitor surface streams to understand potential impacts to INL Site Facilities and groundwater characteristics. Data collected from hydrologic monitoring activities are added to the USGS NWIS database.

2.1.2. Geologic Framework

Refine the UGSG geologic framework understanding of the INL Site to support DOE-ID. The USGS should consider, but not be limited to, the following areas to support DOE-IDs needs:

- Paleomagnetic Characterization of Basalt Stratigraphy
- Petrologic and Geochemical Characterization of Basalt Stratigraphy
- Basalt Radiometric Dating

2.1.3. Subsurface Visualization

Refine the 3-D model of the INL Site hydrogeologic framework by adding new data as it becomes available. Develop presentations or other means that the subsurface visualization can be used to communicate the hydrogeologic conditions related to contaminant transport, facility siting and impact determinations, and natural hazard phenomenon of the INL Site to DOE-ID stakeholders.

2.1.4. Hydrochemistry

Continue sufficient studies and investigations in hydrochemistry as necessary to ensure understanding of impacts to and from the INL Site including early detection of potential for wastes moving past the INL Site boundary.

2.1.4.1. Geochemical Modeling

Investigate the natural geochemistry of the INL Site in order to ensure the understanding of the fate and transport of wastes in the aquifer including the interaction of natural and man-caused processes and their impact on waste migration. This includes the geochemistry and geochemical evolution of source water (recharge) to the aquifer at the INL that includes infiltrating surface water and irrigation return flows, groundwater from tributary valleys and the northeast, industrial waste discharges, and geothermal water.

2.1.4.2. Vertical Water-Quality Sampling

Increase understanding of the vertical distribution of constituents in the ESRP aquifer with multilevel monitoring systems (MLMS) to acquire water-chemistry data. Continue to sample the existing MLMS and determine the benefit of installing additional MLMS systems.

2.1.5. Hydraulic Properties

2.1.5.1. Unsaturated Zone

Quantify subsurface water flow and contaminant transport in the unsaturated zone at the INL Site. Continued development of large-scale simulations of water and contaminant transport and correlations between perched well water levels, weather, and fluctuating inputs at the land surface to assess their sensitivity to preferential-flow behaviors. Consider further development of the source-responsive model that demonstrates that a simple approach can be applied to quantify the effects of preferential flow at the INTEC.

2.1.5.2. Saturated Zone

Better define the geologic layers and hydraulic properties used to validate the groundwater-flow models by increasing understanding of the vertical movement of water and contaminants in the aquifer using the data collected from MLMS.

2.1.6. Groundwater Flow and Contaminant Transport Models

Work is needed to continue the comprehensive long-range study to improve the groundwater flow and advective transport model published in 2010 (available at: *http://pubs.usgs.gov/sir/2010/5123/*) and the solute-transport model that was constructed in the early 1970s (see bibliography: *http://id.water.usgs.gov/projects/INL/INL_Bibliography.pdf*).

A 50-plus year history of waste disposal associated with nuclear-reactor research and nuclear-fuel processing at the INL has left measurable concentrations of radioactive and chemical contaminants in the ESRP aquifer. A thorough understanding of the movement and fate of these contaminants in the subsurface is needed by the DOE and the State of Idaho to minimize health and safety risks and to plan effectively for remediation should this become necessary. To achieve this goal, the groundwater flow and contaminant transport models are being used to determine the long-term risks associated with contaminants that are present in the aquifer today or might be present in the future from additional, slow releases of residual contamination present in the unsaturated zone. The models will also be used to determine the risks to the aquifer associated with the selection of sites and operation of future nuclear research facilities.

2.1.6.1. Present Groundwater Flow And Contaminant Transport Models

Continue validation of the conceptual model that identifies the important features, processes, and events controlling fluid flow and contaminant movement in the aquifer. The model should also consider water availability predictions at the INL Site and potential for use in natural phenomena determinations as well as providing qualitative description of how water and contaminants move through the aquifer.

2.2. Site Support Services

The USGS provides on-call video- and geophysical-logging services to DOE contractors and core-sampling and analysis support to contractor personnel and local and national researchers.

2.2.1. Borehole Logging

Provides on-call video and geophysical logging services to support borehole construction, borehole instrumentation, well-maintenance, unsaturated- and saturated-zone monitoring, and interpretative studies to characterize the geologic and hydrologic controls on water movement in the unsaturated-zone and the ESRP aquifer beneath the INL Site. During drilling operations at the INL Site, these services are available on a 24- hour, 7-day-per-week basis. Maintain an inventory of about four borehole video cameras, 12 geophysical logging tools, and two logging vans.

2.2.2. Core Storage Library

Operate the INL Lithologic Core Storage Library and Core Library Annex to provide a centralized area to store, examine, and sample drill core. The Core Storage Library also provides a laboratory with standard rock and sediment processing equipment for use by USGS, DOE, and contractor personnel.

Develop and maintain documentation for each core; the documentation should be appropriate for the purpose for which it was drilled. The following basic information should be documented for every core:

- Location and unique identifier for the well or borehole from which the core was obtained
- Altitude of the land surface at the well or borehole
- Interval cored
- General rock types included in the core
- Parts of a core that have been destructively analyzed
- Record of the types of analyses that have been performed on selected sections of the core
- References to the publication in which analyses are contained when identified.

Continue to enter new core, and consider existing core, using the USGS INL Project Office standardized procedure to digitally catalog core data, to produce lithologic, geophysical, and geochemical logs, and to produce high-resolution core photographs.

2.3. Databases

Maintain the following databases, both locally and nationally, to ensure the integrity and availability of the geophysical-log, water-level, and water-quality data the USGS collects.

2.4. Publications

Prepare hydrogeologic-data and interpretive reports that provide documentation of field conditions at the INL and include groundwater-level measurements, water-quality analyses, streamflow measurements, and other site information needed to document hydrologic conditions. Prepare interpretive reports to describe the geohydrologic conditions at the INL and how those

conditions relate to DOE-ID operations and concerns. Reports should be published by the USGS and provided to the DOE and its contractors; other Federal, State, and local agencies; and the general public. The data and interpretive reports should provide information that is critical to the long-term management and use of the ESRP aquifer by the INL and the State of Idaho.

2.5. Technical Support and Outreach

As part of the general scope of the Interagency Agreement in support of characterization studies at the INL, the USGS INL Project Office staff should provide technical support to DOE and its contractors and provide outreach to the scientific community and the general public.

2.6. Budget

DOE-ID expects to have $1.375M to fund the work performed by the USGS through the INL Project Office for FY 2013. Funding for FY 2014 is expected to be at approximately the same level. Funding for FY 2015 – FY 2018 is expected to be no less than $1.375M. However, the funding for each fiscal year will be based on the negotiated scope of work and the availability of funds.