HANFORD IFRC QUARTERLY REPORT ~ January 2011

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I. Management Statement

In this January 2011 Quarterly Report for the Hanford IFRC project, we summarize activities performed during the first quarter of FY 2011. A more comprehensive annual report that includes publications and presentations will be provided in February 2011 as we have done in the past. The primary emphasis of first-quarter research has been well-field mitigation; reconfiguration of the geophysics monitoring array and geophysics experiment planning; experimental design of the spring 2011 field experimental campaign with the remediated, reconfigured well-field; developing a smear zone reactive transport model; and publication.

The Hanford IFRC has been actively working with a DOE-RL supported remediation contractor team (Intera) that is tasked with developing a pragmatic, yet scientifically based reactive transport simulator of natural attenuation for the 300 A U(VI) groundwater plume. We have reviewed their modeling plan, provided many BER-supported laboratory data sets on contaminant U behavior for process model calibration, provided extensive field characterization data sets on contaminant U concentrations and distribution for field model development; and remain responsive to their continuing information requests.

At this time of reporting 25.6% of the FY has elapsed and 26% of our total FY 2011 IFRC budget has been spent, including 3rd party commitments (e.g., allocations to university participants). Thus, our spending goes in course with plan. However, 60% of FY 2011 CR funding (e.g., FY 2011 funding received to date) has been spent requiring continued administrative attention. The IFRC project also carried over $350K of FY 2010 funds that are being used for the installation of four new wells for hydrologic modeling control points, and for well-field remediation. These funds are currently being spent.

II. Highlights

- A well field mitigation plan was completed and submitted to BER/SBR for review in early October 2010. Comments were returned to PNNL from the FREC and external reviewers in early November 2010. The Hanford IFRC project team responded to these comments through BER on December 7, 2010.
- The proposed bentonite-sealing approach for well-field mitigation was tested on a second fully-screened well (2-22) experiencing large vertical flows during the month of December. The test was highly successful as shown in Figure 1. We are now fully confident that bentonite injection will yield upper aquifer monitoring wells with minimal interference from vertical flows. The mitigation

of all remaining fully-screened wells will be completed by mid-February, with the exception of a grouping of six wells in the SE corner that will be temporarily sealed with a dual packer string to allow for continued biogeochemical experimentation at the Ringold-Hanford interface and an SBR external investigator mass-transfer geophysical experiment.

- A surface geophysical electrode array was installed in early December 2010 that is being used to augment the existing down-well array for the monitoring of infiltration through the vadose zone during the wet winter months when aquifer recharge from precipitation may occur. This activity was initiated to resolve lingering questions (by the DOE site steward) on the timing and degree of recharge through the U(VI)-contaminated vadose zone.
- A number of oral presentations and posters were given on Hanford IFRC research at the Fall 2010 AGU meeting in San Francisco, CA. The citations for these will be provided in the CY 2010 annual report.
- An extensive set of upper-aquifer injection scenarios have been modeled with eSTOMP on EMSL's Chinook supercomputer in preparation for our anticipated spring experimental campaign with the remediated well-field. Reactive transport parameters for U(VI) were derived from laboratory column experiments with intact IFRC cores. Variables such as injection rate, duration, and sequence have been evaluated in eSTOMP simulations to determine optimal experimental conditions to investigate the in-situ kinetic adsorption/desorption behavior of U and associated mass-transfer behavior. Our past IFRC injection experiments were dominated by flow through the lower, high K zone; and we anticipate very different and slower transport in the upper aquifer zone.
- IFRC passive experimental monitoring campaigns during the spring high water of CY 2010 and CY 2011 have shown that the lower vadose zone, when inundated with spring high water (the smear zone), is an important source of soluble, contaminant U(VI) to the persistent groundwater plume. Accordingly, an integrated effort was initiated between multiple Hanford IFRC and PNNL SFA investigators (PNNL, OSU, USGS, and ORNL) in October 2010 to develop and parameterize a kinetic reactive transport model for smear zone sediments based on laboratory multi-scale experimentation. The experimentation is focused on an IFRC composite smear-zone sediment that was created from subsamples collected from 15 different IFRC wells. A goal is to parameterize the geochemical model by the end of FY 2011.
- A geophysics research plan has been drafted for the Hanford IFRC site by Tim Johnson, Andy Ward, Roelof Versteeg, and Fred Day-Lewis. The plan evaluates the capabilities of the geophysical monitoring system after well field mitigation, describes approaches/strategies for monitoring capabilities replacement, and discusses scientific opportunities accessible with the different candidate electrode arrays. A draft of the research plan is currently under internal review.
- A joint Rifle IFRC-Hanford IFRC team has assembled to write a comparative manuscript on the coupled hydrologic and (bio)geochemical behavior of uranium in these two sites that exist within the dynamic groundwater-surface water interaction zone. This activity was recommended as an outcome of the March

2010 IFRC reviews. An abstract and outline has been completed and writing on the body of the paper is underway.

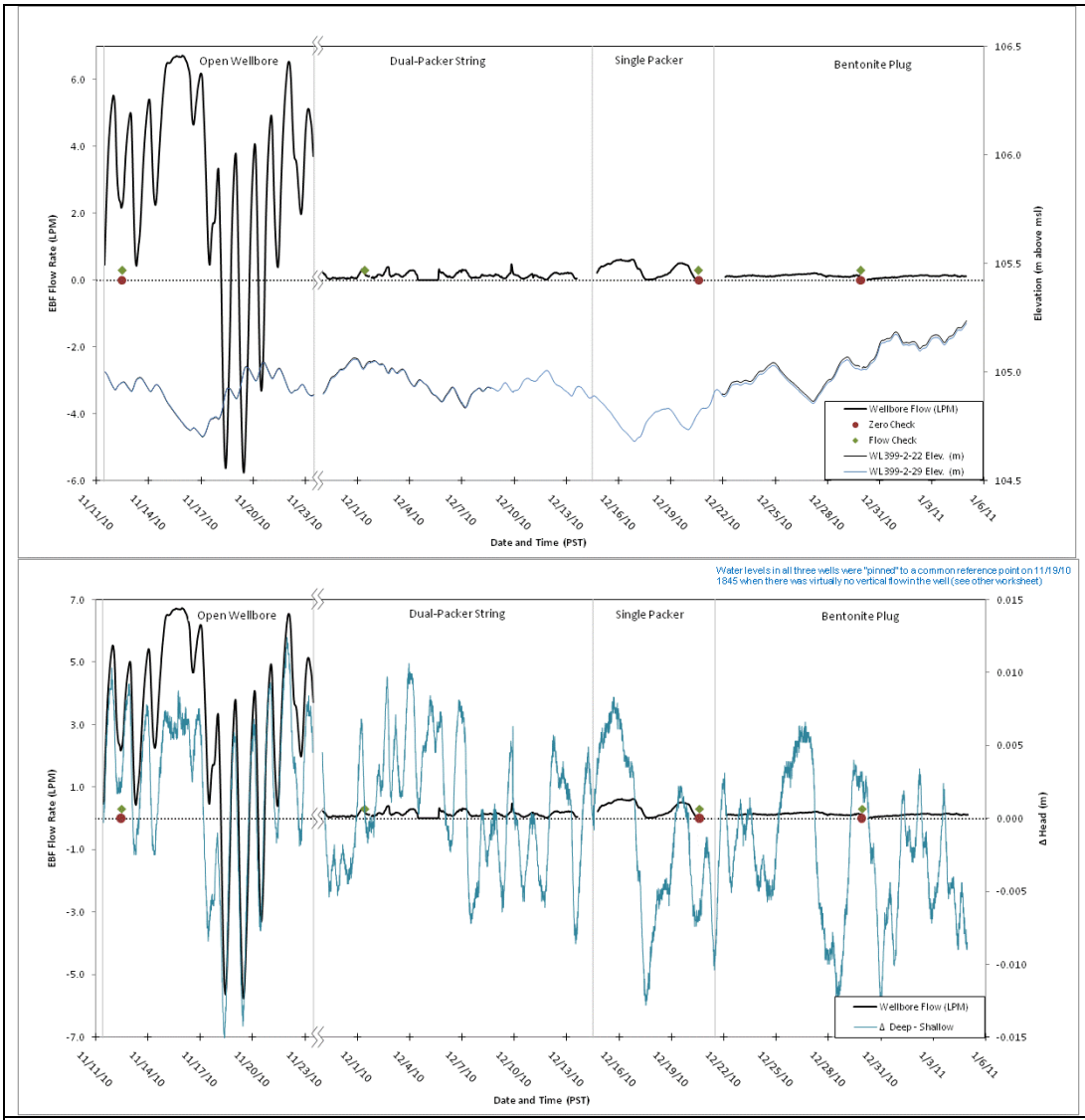

Figure 1. EBF monitoring of new IFRC mitigation test well 2-22, and responses to placement of a dual packer string, a single packer, and a bentonite plug in the lower 2/3 of the well. The figures display EBF flow-rate in liters per minute (LPM) in either upward (+) or downward (-) directions. The right vertical axes display river elevation in meters above sea-level (top) or head (bottom). The bentonite plug mitigates vertical flow with readings near zero.

III. Issues

An issue has been developing with geophysical research at the IFRC site. At this point, the IFRC project does not have a petro-physical model(s) that can enable the integration of geophysical logging information or the 3-D ERT electrical conductivity

measurements into the IFRC site hydrophysical model. This situation is not for lack of attention, as significant resources have been invested in this task over a three year period. A viable petro-physical model is a critical project need for the: establishment of a robust site hydraulic conductivity field, interpretation of past tracer experiments, planning of credible future experiments, and robust publication of research results accrued to date. A change in staffing and research approach is underway to rectify this important situation.