# HANFORD IFRC QUARTERLY REPORT ~ July 2010

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## I. Management Statement

In this July 2010 Quarterly Report for the Hanford IFRC project, we propose to change and streamline our quarterly reporting style to free up more time for scientific advance and project publication. We propose to provide three sections only: i.) a management statement of project status, ii.) bulleted highlights of activities and accomplishments, and iii.) identification of important issues or concerns. We seek feedback from SBR as to whether this new abbreviated format satisfies programmatic needs for quarterly reporting. A more comprehensive annual report including all publications and presentations will be provided as we have done in the past.

The Hanford IFRC had a peer review in late March, and comments were received by the project team in May. Significant efforts have been expended to address these comments. One comment was to develop a modeling plan that articulated a strategy for the use and integration of multiple reactive transport codes and supporting models. This plan was completed and is provided as an attachment to this report (Hanford IFRC Modeling Plan). Another comment was to identify field experimental conditions that would support a successful field injection experiment of U. This comment was addressed by the pre-modeling of ten injection scenarios with results summarized in a SBR quarterly measure report (Hanford IFRC Q3 Pre-modeling) that is also attached. Another important comment was to devise a hydraulic fix to the issue vertical well-bore flows in the IFRC well-field. Considerable field attention has been given to this last comment that will be discussed in the final section of the report.

At this time of reporting 73.8 % of the FY has elapsed and 91% of our IFRC funds have been spent. We are overspent relative to elapsed time because of efforts spent in peer review preparation. We do not expect significant carryover in FY2011, and progress for the remainder of the FY2010 will be limited and focused primarily on vertical flow mitigation and the completion of manuscripts resulting from last year's tracer experiments and characterization activities.

## II. Highlights

- Three new shallow wells were installed in April 2010 to improve monitoring capabilities for the deep vadose zone that becomes seasonally water-saturated in spring. These wells were screened well-above the maximum elevation of the water table. Seven other new planned wells have been deferred to early FY2011 pending our decision (planned for September 2010) on the best approach to mitigate well-bore vertical flows.
- Two pre-modeling campaigns have been completed since April to investigate potential scenarios for U injection experiments in FY 2011. The first campaign

emphasized free-drift experiments and was performed at PNNL using the parallelized version of STOMP. The results of this campaign were reported in the SBR quarterly measure as described above. The second campaign, performed by the Zheng team with MODFLOW based on a design by Haggerty and Kent, targeted potential dipole and dual-dipole experiments using injection and extraction wells. The results of this second campaign are currently being analyzed. A short report on the proposed experimental design for the injection experiment (e.g., free drift or dipole, pulsed or continuous injection) is planned for September 2010.

- A second passive monitoring experiment was initiated in April and it is still ongoing at this time. Hundreds of samples have been collected. The peak in river flow was achieved during the third week in June, and the runoff profile was markedly different from last year. This experiment has some common elements to the one performed last year but it is supported by three new shallow wells that specifically monitor the fluctuating water table region yielding a significantly more robust data set. Additionally, packers were placed in the central low K zone of all fully screened wells to mitigate vertical flows, and periodic EBF measurements were taken in all wells to evaluate packer effectiveness at different river elevations. An elaborate three-salt tracer experiment was performed in the upper high K zone to trace the movement of U released from the vadose zone. Initial results of this year's experiment validate the occurrence of a significant U recharge event during spring high water. Additionally, the results of the multi-solute transport experiment suggest the presence of a low hydraulic conductivity anomaly in the region of high vadose zone recharge of U to groundwater. The full set of results from this experiment will not be available until the end of August.

**III. Issues**

The Hanford IFRC recognized that vertical well-bore flows have were complicating the interpretation of field experimental results from both the passive and injection experiments in November 2009. Since this date, the flows have been quantified in all wells, and relationships established between river stage elevation and the magnitude and direction of flow. Three manuscripts have been written on the cause, magnitude, and modeling of this phenomena. These results were described to the peer review panel in late March 2010, and they recommended that we act to remedy this problem as soon as possible.

Our first attempt at remedy was the installation of either a 19" test-ball or a 30" inflatable packer in all fully screened wells at the initiation of the 2010 passive monitoring experiment in April. The packers were installed in the region of the central, low K zone. The wells were monitored by EBF during April and early May, a time interval that saw significant and powerful oscillations in river stage. While some wells displayed significant reductions in vertical flow, the remedy was not uniformly effective. A second round of testing is now deemed necessary to provide data for a well-field mitigation plan that will be distributed for review in late September or early October depending on the progress of the testing program described below.

Well-bore Mitigation Testing- Round 2

- Finish evaluation of tracer breakthrough curves from recent multiple-salt injections during the passive experiment to identify appropriate location(s) for further testing (completed by mid July). Location selection will be based on the following criteria:
    - Recent EBF surveys indicate significant wellbore flows still occur with packer installed
    - Tracer breakthrough data provide indication of wellbore flow
    - Well is located on the periphery of well-field and not key to the monitoring program
- Collect 2 weeks of comprehensive baseline EBF data on the selected well to establish vertical-flow – river stage relationships (completed August 1).
- Install a dual packer string (two 30" packers in sequence) in the selected well and monitor wellbore flow just above the packer for another 2 week period. If the selected well is currently outfitted with a 19-in test ball packer, first install a single 30-in packer to assess performance before adding the second packer (completed mid to the end of August).
- If the dual packer string shows promise in the abatement of vertical flows, test at additional locations of high vertical flow.
- If the dual packer string does not sufficiently mitigate wellbore flow, deliver (tremie) coated-bentonite pellets into the lower section of the well screen, taking care not to adversely impact the upper screen section in any way. The pellets will extend to 1 ft below the base of the upper higher permeability zone and will be overlain with 1 ft of pea gravel (completed by the end of August).
- Install EBF and monitor wellbore flow at the base of the upper zone for a 2 week period (completed mid September).
- If the bentonite pellet wellbore seal is insufficient, evaluate the effectiveness of bentonite slurry injection to extend the seal into the filter pack over the lower zone. This approach would still use coated bentonite pellets to seal the wellbore over the lower permeability intermediate depth interval.