KRCEE Second Quarter DOE Report

Contents

1. UK-KWRRI DOE Earmark Administration & Short-Term Project Quarterly Report

July 10, 2004

Project Title

KRCEE Administration & Short Term Projects

Project Goals

- Respond with research, review, and recommendations to DOE short-term project requests
- Coordinate, supervise, and integrate KRCEE-DOE earmark project activities

Project Team / Member Roles / Tasks

Dr. Lindell Ormsbee/Director, KRCEE-UK. Direct KRCEE-DOE earmark activities.

Steve Hampson/Asst. Director/KRCEE-UK . Program and daily activity lead.

Dr. John A. Volpe/KRCEE Contractor. Provide technical and regulatory expertise for KRCEE-DOE earmark projects.

Jim Kipp/Acting Director KWRRI-UK. Provide administrative and technical support for KRCEE-DOE earmark activities.

Edwin Ebrahimi/KRCEE Financial Officer - UK . Provide support for KRCEE-DOE earmark financial activities.

Anna Hoover/KRCEE-UK. Administrative support.

Project Status

Projected Completion Date: September, 2006

Percentage Completion to Date: Contractual arrangements with faculty and staff Project Teams that will conduct long-term projects related to Phase I DOE earmark activities at PGDP are 90% completed. 100% of the short term projects requested by DOE to date have been completed. Because short-term projects are not scoped in advance no percentage completion is applicable.

Project Activity Status Summary

- Participated in quarterly activity meeting with DOE PPO April 2004.
- Completed initial discussions with DOE for scope of work for Holocene Investigation at U-Landfill April 2004.
- Completed scope of work for Phase I Surface Water / Sed Control contract with Dr. Warner.
- Continued reference document and PGDP project document uploads to ftp site.
- Conducted 1 st quarterly meeting with KRCEE-DOE Project Teams
- Completed 1 st quarterly report for distribution
- Obtain revised DOE timelines for projects May 2004
- Obtain access permission to interface with contractors & site personnel April 2004.
- Meeting with GW Project Team at U of L to refince work efforts related to SnT data assessment
- Conducted site tour for SW/TMDL Project Team April 2004
- Continued electronic distribution of documents starting April - June 2004
- Coordinated electronic preparation of Ph I and Ph II Site Investigation documents with Bechtel-Jacobs document center
- Provided KRCEE/UK Gly recommendations for SnT Holocene Investigation to DOE May 2004.
- Reviewed SWOU SI Workplan and submitted comments to DOE June 2004.
- Identified additional tasks for Phase II earmark contracts with faculty and staff April - June 2004.
- Managed WKWMA drill site closure and reinstallation with DOE, UK-KGS, UK-GLY, Ky-EPPC, Naranjo Drilling, and DOE contractors
- Collected, shipped, and obtained analyses for characterization of 99Tc and TCE contamination at WKWMA Drill site April - May 2004.
- Met with Ky-EPPC administrators to obtain concensus on ULF Holocene Displacement investigation proposal April, May, June 2004
- Contacted UK sponsored projects and finance departments to obtain permission for sole source technical and drilling contracts for ULF Holocene investigation June 2004.
- Contacted prospective technical experts and contractors to participate in ULF Holocene investigation May - June 2004.

Project Path Forward

TASK (completion date)

- KRCEE-DOE earmark-wide Project Team meeting (7/04)

- Meeting with DOE to discuss project needs (8/04)
- Finalize QC activity for USEC market-available Nickel analyses (8/04)
- Finalize ULF Holocene Project team, Obtain cost estimate from ITR and Project Team, Drilling, and Field Oversight contractor participants.
- Obtain DOE detailed instructions for ULF Holocene Project.
- Implement activities for Warner Sediment controls Project team.
- Develop additional scope of work for Phase II earmark funding.

2. UK-Paducah Chemical Engineering Uranium Battery Project Quarterly Report

July 2004

Project Title

Development of Depleted Uranium Batteries

Project Goals

- Construct a battery with uranium dioxide as the cathode following characterization of uranium dioxide's electrochemical properties in various organic solvents/lithium salts commonly used in commercial battery industry.
- Manufacture uranium-lithium compounds to mirror the construction of manganese-lithium compounds commonly used in commercial batteries and characterize their electrochemical behavior in common organic solvent/lithium salts.
- Construct a battery consisting of lithium-uranium dioxide.

Project Team / Member Roles / Tasks

Dr. Paul Dunbar/Asst. Professor of Chemical and Materials Engineering-UK Paducah, PI. Perform electrochemical testing on experimental uranium-lithium cells.

Dr. Rhonda Lee/Assistant Professor of Chemical and Materials Engineering-UK Paducah, Co-PI. Perform electrochemical testing on experimental cells and make lithiated uranium compounds.

Dr. Stephen Lipka/Center for Applied Energy Research-UK, materials science consultant for electrochemical cell assemblage and data interpretation.

Walter Tracinski/Applied Power International. Lithium battery expert who will construct prototype batteries.

Graduate Student Technician to perform daily repetitive experiments.

Project Status

Projected Completion Date: September, 2005

Percentage Completion to Date: 40%

Identification of major project tasks

The most important equipment was delivered during June and July of 2004.

- 2000 Model Year Vac Atmospheres Stainless Glove Box
- Vacuum Pump for Glove Box
- Used Solartron 1250 Frequency Response Analyzer
- Hohsen 3-Electrode H S-3E Electrochemical Cell
- Lithium Foil for Counter Electrode and Reference Electrode
- Pure Nickel discs for current collector
- Scribner Electrochemical CorrWare®, ZPlot®, Zview, and CorrView for Windows
- Lithium Salts with Solvents
- Lithium Carbonate and Uranium Dioxide
- Muffle Furnace
- Quartz Crucibles, Gloves, and Tongs
- Vacuum Oven and Vacuum Pump

Three lithium-uranium dioxide prototype batteries were constructed by Applied Power. The batteries were tested in the Glendale, CA laboratory. The anode consisted of lithium foil and the cathode consisted of uranium dioxide, graphite, and Teflon for a binder. The battery produced as much as 3.7 Volts. The batteries showed low theoretical yields, but they did show some rechargeable characteristics which was quite positive. The battery's yield should greatly increase as we find the optimal salt/solvent combination.

However, lithiating the uranium dioxide we most likely produce the most fruitful results. The equipment will allow us to achieve the second project goal as listed.

Project Path Forward

Laboratory work related to the project will continue in July - September 2004

3. Murray State University Surface Water Modeling & TMDL Quarterly Report

July 12, 2004

Project Title

Surface Water Characterization and TMDL Development for the Paducah Gaseous Diffusion Plant and Associated Impaired Creeks

Project Goals

The project has two major goals as follows:

1. Hydrologic characterization of the PGDP area including a water budget analysis of the PGDP facility. Characterization will include the development and calibration of continuous simulation hydrologic models for the Bayou and Little Bayou creek watersheds using the HSPF watershed model or other appropriate tools.

2. Development of Total Maximum Daily Loads (TMDLs) for each creek. Constituents of concern for Bayou Creek are iron, lead, copper, mercury, and Tc-99. Constituents of concern for Little Bayou Creek are iron, lead, copper, and Tc-99.

Project Team

Mike Kemp, Murray State University, Department of Industrial and Engineering Technology, Principle Investigator (PI) - overall project administration, budget and schedule control, coordination with UK project management, primary lead on TMDL development, emphasizing water quality.

Andy Kellie, Murray State University, Department of Industrial and Engineering Technology, Co-PI - primary lead on hydrologic model development and calibration, secondary lead on TMDL development, emphasizing water quantity.

Jane Benson, Murray State University, Center for Reservoir Research and Department of Geosciences - Technical support on geographic information system operations and hydrologic model development and calibration.

John Hart, Murray State University, Department of Industrial and Engineering Technology - Technical support on computer systems hardware

and software, network management, and field monitoring instrumentation and equipment acquisition, installation, and operation.

Matt Philips, Murray State University, Environmental Engineering Technology - student technical support on hydrologic model data entry and water quality data analyses.

Mike Matthews, Murray State University, Environmental Engineering Technology - student technical support on hydrologic model data entry and water quality data analyses.

Tammy Boyd, Murray State University, Department of Geosciences - student technical support on hydrologic model data input.

Project Tasks (% Completion) (Projected Completion Date)

Hydrologic Model Development and Calibration (50%) (10/04)

1. Acquire Existing Plant Outfall and Creek Flow Data (80%) (6/04)
2. Acquire Model Input Existing Data (60%) (6/04)
3. Preliminary Model Development (50%) (7/04)
4. Initial Model Calibration (20%) (8/04)
5. Install Flow Measurement Equipment If Needed (0%) (9/04)
6. Calibrate Model Based on Actual Measurements (10%) (11/04)

TMDL Development (10%) (7/05)

1. Acquire Existing Water Quality Data (45%) (8/04 for bulk of data)
2. Identify Waste Sources (40%) (8/04)
3. Input Model Mass Loadings to Model (0%) (2/05)
4. Allocate Mass Loadings (0%) (4/05)
5. Final Model Calibration and Long Term Run (0%) (7/05)

Final Report (0%) (9/05)

Tasks Undertaken to Date, Including Identification of Significant Findings and Their Implications on Project

1. General. The project operations center described in report of April 23, 2004 has been established. Computer, plotter/printer, and digitizer facilities have been brought on line. Software has been loaded and is running. Kellie and Benson have completed training on WMS Watershed Management software.

2. Hydrologic model. Bayou Creek (BC) and Little Bayou Creek (LBC) watersheds have been subdivided into subwatersheds appropriate for modeling. Basic watershed metrics (length, area, slope, shape factors, channel lengths, main stem lengths, etc) have been acquired for both watersheds and for all LBC subwatersheds.

Preliminary soils and land cover data for both BC and LBC watersheds have been obtained; these are sufficient for preliminary hydrologic modeling. Digitization of precise land cover and soils data is in progress; positional information for these data will be linked to attribute information for use in hydrologic modeling.

Gaging data for both watersheds (gages 03611800, 03611850, and 03611900) have been downloaded as a basis for model calibration. Hyetographs of maximum flows at gage 03611900 (LBC) have been prepared to enable comparison of actual storm data with the type II rainfall distribution assumed in modeling. Base flow and storm flow separation analysis is in progress.

Precipitation data from has been downloaded for rain gages located at Grand Chain, Dixon Springs, Brookport, Gilbertsville, Benton, Bardwell, Paducah Barkley Field, and Bardwell. Station weighting has been calculated and an analysis of the correlation between rainfall at these stations has been completed.

3. TMDL development. Concentrations of copper, iron, mercury, lead, and technicium-99 at all plant outfalls have been downloaded using both the OREIS database and the annual reports from the Paducah Gaseous Diffusion Plant. Preliminary analysis of these data (maximum, minimum, and mean) has been done for LBC. Similar data has been obtained for BC. Data has been structured, but preliminary analysis pends.

4. University of Louisville Groundwater & Burial Ground Project Report

April 16, 2004

Project Title

Evaluation of technology characterization for soils, landfills and groundwater, Part 1 (concentration of S and T landfills)

Project Goals

- Review & evaluate existing groundwater information/documents/data for the PGDP.
- Identify data gaps and provide recommendations for improvements groundwater monitoring
- Provide updated recommendations relative to applicable groundwater technologies
- Evaluate landfill/burial ground information/documents/data for the PGDP.
- Provide summary of releases, release potential
- Provide BEP/BMP monitoring & remediation recommendations for landfills and burial grounds.

Project Team / Member Roles / Tasks

Dr. D. J. Hagerty/CEE Department-UL, Co-PI. C oordinate activities with KRCEE and project team colleagues, conduct document review, prepare comments, evaluate adequacy of characterization efforts to date.

Dr. James C. Watters/ChE Department-UL, Co-PI.

Rebecca Thompson/ChE Department-UL, Research Assistant. Conduct document reviews, prepare comments, evaluate adequacy of characterization efforts to date, coordinate activities with KCEE colleagues.

Project Status

Percentage Completion to Date: Projects and significant project tasks are identified below along with the percentage completion and the projected completion date as follows:

Project Tasks (% Completion)(Projected Project Completion Date)

1. Landfill waste characterization and source evaluation (50%) (9/30/2004)

- Project 1A: Characterize the wastes in the S&T landfill and in other landfills on the PGDP site.
- Project 1B: Evaluate mobility of contaminants in the S&T Landfill and in other PGDP landfills and the likelihood that contaminants from PGDP landfills have entered the groundwater flow system, or the surface water flow system.
- Project 1C: Evaluate the collected data on site conditions and groundwater flow around the PGDP landfills to assess the adequacy of that data in identifying sources of contaminants and portraying concentration zones of those contaminants.

2. Groundwater Management/Remediation (15%) (12/31/2004)

- Project 2A: review and critique the process by which prior decisions were made relevant to groundwater remediation.
- Project 2B: Assess changes in technologies that were evaluated previously, and investigate new remediation technologies and/or new combinations of remediation technologies.

3. Surface Soils and Sediment Evaluation (0%) (9/30/2005)

- Project 3: Perform comprehensive review of collected data, identify zones of contaminated soils and sediments that require management, and recommend appropriate management strategies.

Project Activity Status Summary (Date of Activity)

The UL GW team held a preliminary meeting in May 2004 to clarify data sources and refine scope of work for the SnT landfill

The following information has been reviewed this quarter relative to Projects 1A and 1B:

- S and T LANDFILL Scoping Document Ground Water Data
- Report of April 2001 on TCE and Tc-99 Groundwater Contamination in the RGA
- Historical Plume Maps with particular emphasis on areas near S, T and U Landfills
- Monitoring well data with particular emphasis on wells in areas near S, T and U Landfills
- The following information has been reviewed this quarter relative to Projects 2A and 2B:

- A student assistant has been hired to begin the assessment of remediation processes as described in Project 2A for review and critique of the process by which prior decisions were made relevant to groundwater remediation.
- Student will work with the project Principal Investigators to complete Project 2B, to assess changes in technologies that were evaluated previously, and
- Student will investigate new remediation technologies and/or new combinations of remediation technologies.

Project Path Forward (Date of Activity)

- Query OREIS data base to obtain the most up to date monitoring information for the SnT and U Landfills (Task 1A & B).
- Develop cross-sections depicting physical conditions underlying the SnT and U landfills reflecting the relationships of well screens to lithology, each other, and NSDD (Task 1A & B).
- Develop isoconcentration maps for select contaminants at SnT (Task 1A & B).
- Develop temporal contaminant trends for each well at SnT (Task 1A & B).
- Develop iscocncentration trend maps at SnT (Task 1A & B).
- Review ITRD report (Task 2A & B).
- Begin literature review of applicable technologies (Task 2A & B).

Significant Findings to Date

1. Electronic versions of the data were obtained from existing files for the SnT Landfill TCE and 99 Tc, as well as a host of other contaminants ranging from Uranium to other organics.
2. Initial review of the data showed anomalies relative to data quality. Many points had no detection limits quoted, while others reported concentrations less than the specified detection limits. A separate Excel program was written to sort these data based on level of meaningfulness. Useable data had detection limits associated with them and reported values were greater than these detection limits. Questionable data had no associated detection limits, but values quoted were in a range comparable with usable data. Questionable data also included data of unknown provenance. Invalid data had no detection limits and reported values were less than the range of usable data, or negative. At this time we have sorted more than 50 sheets of data, each containing up to 2000 point values for more than 50 contaminants, collected over the period 1997 to 2001.

3. The plume maps in the April 2001 document show a divergence in the northwest plume for TCE at the location of the two sludge lagoons. A lobe of the plume has been shown extending around the east end of the lagoons and north along the west side of the S and T landfill sites. No indication of TCE contamination is shown immediately north of the two lagoons. In contrast, the Tc-99 plume has a dominant lobe extending north of the two lagoons. The divergence in the TCE plume is attributed to leakage from the lagoons, which "is causing a mound of higher hydraulic potential beneath the lagoons." The reason for the divergence of the TCE plume while the Tc-99 plume is not diverging is not clear and appears questionable.
4. The comment is made, on page 10, that "The extent of the off-site 99 Tc plume, as defined by an activity of 25 pCi/L, is primarily limited to the area south of the C-746-S&T Landfill." The meaning of this statement is unclear, since two very long plumes of Tc-99 are shown on plume maps extending far to the north of the S and T landfills, in the northwest plume. Even the short lobe of the plume that extends north along the east end of the two sludge lagoons reaches to the edge of the S and T landfill sites.
5. Statements are made that "contaminants may be derived from the Northwest Plume." The context for the statement is that the Northwest Plume may be the source of the high levels of TCE and Tc-99 found in the C-746-C area. Apparently, this interpretation of the sample quality data is based on a migration of contaminants to the north and east from a DNAPL zone near the source of the Northwest Plume. Why should this flow occur at this time? The principal change in conditions near the Northwest Plume has been the beginning and continuation in pumping from the south and north well fields in that plume. Why would contaminants flow along the plume paths for a long time, and then begin to diverge? Why would they have diverged at any time?
6. On page 9, the decline in TCE concentrations in groundwater samples withdrawn from the RGA between 1995 and 2000 was taken to suggest "that dissolution may be rapidly depleting the DNAPL source zones to the Northwest Plume." Additionally, declines in TCE levels in the main core of the Northeast Plume outside the plant boundaries were cited as evidence that "the pump-and-treat system is being effective at containing the core of the off-site plume." The latter statement may be justified. The decline in TCE levels in the Northeast Plume may be good evidence that pump-and-treat has prevented the spread of TCE.
7. The decline in observed concentrations of TCE noted in connection with the Northwest Plume may be caused by a difference between the rate at which TCE desorbs from the solid media, and the rate at which the groundwater is being removed by the pump-and-treat system.

8. Review of historical plume maps from the period 1990 to present leads to doubt about the usefulness of these maps to predict contamination from the landfills.
9. The plumes have been drawn to represent the MAXIMUM concentration of contaminant (TCE or 99 Tc) ever recorded at a specific well site. As time progresses and a contaminant spreads out from the source into the groundwater, these maps show a contaminant plume growing with time, assuming a constant source producing the contaminant.
10. To characterize the S & T landfill contributions (if any) to the growing plume we plan to develop "snapshot" maps of the area near these landfills at several points in time. We anticipate that both inflow and outflow concentrations of TCE and 99 Tc to the S & T Landfill area will not change at fixed points in time if the S & T landfills do not contribute substantial additional amounts of contamination.
11. The PIs initiated a meeting with Steve Hampson at UofL on May 21. The purpose of the meeting was to clarify future directions for the UofL contribution to the project, to identify needed information, and to characterize the quality of concentration data previously provided. This meeting greatly clarified the situation with regard to data quality. According to p. 5 of the S & T landfill scoping document, no materials with detectable technicium-99 were deposited in the S landfill, and only concrete, wood, rock and steam plant fly ash were deposited in the T landfill. If these statements are reliable, then the sources for that contaminant must be outside those landfills. Our "snapshot" maps should prove or disprove this assertion.
12. Well data and plume maps described above are frequently available for different levels within the RGA (upper, middle and lower). These data will also be analyzed to determine if they can provide insight into the vertical movement of the contaminants within the RGA, including an estimation of the actual hydraulic conductivity. It is increasingly obvious from these data that the RGA cannot be modeled as a single phase, but may contain several hydraulically distinct strata.
13. Preliminary investigation has yielded information on potential daughter products of TCE decay. Comparison of these decay products with organics identified in the well data may allow estimates of the mobility of TCE north from the plant relative to its tendency to decay.

5. UK/CE Groundwater Modeling Project Quarterly Report

July 20, 2004

Project Title

Groundwater Modeling

Project Goals

- Evaluate the adequacy of existing groundwater models at the site.
- Recommend necessary improvements to the models.
- Evaluate the potential use of natural attenuation for addressing off-site dissolved phase groundwater contaminants.
- Use the models to evaluate the efficiency of proposed groundwater remediation plans.

Project Team/Member Roles/Tasks

Srinivasa Lingireddy, Ph.D./Associate Professor of Civil Engineering/UK- PI. Coordinate the team activities, recruit and direct graduate students and post-doctoral scholars to help with the modeling efforts, prepare quarterly reports.

Steve Hampson, Assistant Director/KRCEE - Project Manager

Dr. Lindell Ormsbee/Director, KRCEE-UK. . Technical Advisor

Dr. Joe Hagerty, Professor of Civil Engineering, UL. Provide technical consultations and expert opinion on modeling activities

Prasad Manthena, Graduate Student, Department of Civil Engineering, Univ. of Kentucky.

Jim Kipp, Director/KWRRI, Provide technical and administrative support

Project Status

Projected Completion Date: September, 2005

Percentage Completion to Date: Approximately 20%

Project Activity Status Summary

Activity(% Completion)(Projected Project Completion Date)

- Finalize reviews, evaluations, and recommendations from ongoing UK groundwater modeling activities for the PGDP site. (70%)(08-31-2004)
- Provide modeling assessment for a range of groundwater remedial approaches including natural attenuation, hydraulic containment, pump & treat, and source/dissolved phase removal/treatment. (30%) (06-30-2005)
- Provide modeling assessment for the efficiency and expected performance of proposed groundwater remediation plans. (30%) (12-31-2004)
- Provide an assessment of the adequacy of the USACOE web-based groundwater model for the PGDP. (0%) (06-30-2005)
- KRCEE met with USACOE engineers responsible for USACOE FEFLOW model
- Meeting with USACOE for overview of the FEFLOW model will be scheduled for Sept - Nov. 2004.

Project Path Forward

Activity (Date)

- Complete write up of UK baseline modeling efforts (4/04-7/04)
- Begin runs for GW Modeling (PGDP) Team sensitivity analysis (6/04 - 9/04)
- Continue model natural attenuation simulations (6/04 - 12/04)
- Obtain and verify groundwater withdrawals from TVA & vicinity (9/04)
- Evaluate boundary condition effects on current vicinity & SWMU scale models (9/04 - 12/04)
- Begin simulations and documentation of groundwater conditions when plant activities cease under a number of possible remedial scenarios (being conducted under sensitivity analysis runs (7/04 - 12/04)

Significant Findings

Precise estimation of inflows and outflows (water balance) to the groundwater model is essential for accurate prediction of contaminant transport. There are several diverse inflows and outflows to the model and precise estimation of these quantities is often difficult and expensive. In this context, use of sensitivity analysis was employed to help pinpoint the data

that influences contaminant transport significantly in model output. The project team has identified the following tasks towards water balance related sensitivity analysis.

- Pumping at TVA Shawnee Plant
- River stage changes
- Recharge rates
- Plant recharges (lagoons)
- Rain recharges
- Leakage along the pipeline
- Plant shut down scenario
- No outflow to Little Bayou Creek
- Reduced outflow to Big Bayou Creek
- Several other tasks as identified at the water budget analysis meeting
- Appendix A presents results from some of the tasks completed. The results from the sensitivity analysis were compared to the results from a baseline TCE transport model acquired by the PIs. Some of the important characteristics of the baseline model are listed in the following.
- Calibrated model based on 1998 data
- 1st stress period - 10years
- 2nd stress period - 20years
- Normal rainfall and plant recharge
- Pumping rates at TVA Shawnee plant not included
- Ohio river stage changes from 300ft in 1st stress period to 306ft in 2nd stress period

Based on the results presented in the Appendix, it is clear that none of the parameters tested (Shawnee plant pumping rates, Ohio River stage, rainfall recharge, and plant recharge) seem to influence the TCE transport significantly.

6. UK-Paducah Chemical Engineering Nickel Project Quarterly Report

April 9, 2004

Project Title

Purification and Recovery of Radiologically-Contaminated Metals.

Projected Completion Date

October, 2004

Percentage Completion to Date: 90%

Project Goals

- Investigate the radiological characteristics of market available Nickel
- Investigate the application of chemical vapor deposition (CVD) technology for the removal of radionuclides from radioactively-contaminated metal waste.
- If CVD is a viable method of purification, design and test a laboratory-scale reactor or evaluate demonstration of industrial scale reactor.
- Evaluate industrial-scale reactor for recovery of existing stockpiles of nickel waste.
- If CVD technology does not prove to be a suitable method for purification of radioactively-contaminated metal waste, explore use of electro-refining (ER) technology as a method of purification.
- If ER technology proves to be a viable method of purification, design and test an laboratory-scale reactor
- Evaluate industrial-scale reactor for recovery of existing stockpiles of nickel waste.

Project Team / Member Roles / Tasks

Dr. Jim Smart/UK-Paducah Engineering, PI. Conduct background research, prepare experimental plan, interpret experimental results, prepare project reports, and coordinate budget.

Dr. Fuqian Yang/UK-College of Chemical & Materials Engineering, co-PI. Consult with PI to plan/interpret experimental plan. Assist in preparation of documents.

TBA - Post-Doctoral Fellow, to be hired. Retrofit existing CVD equipment. Run experiments and assist in preparation of documents.

Project Activity Status

Project Task (% Completion) (Projected Project Completion Date)

- Attend PACROE meetings about salvage of volumetrically contaminated Ni ingots at PGDP (80%) (8/03-3/04)
- Identify Nickel refiners and suppliers (100%)(9/03 - 10/03)
- Nickel powder and barstock obtained from three different U.S. Ni suppliers (100%)(10/03)
- Participate in meetings to develop laboratory analytical methods (100%)(9/03 - 10/04)
- Obtain & review CVD technology information (80%)(9/03)
- Review ER pilot demonstration data (100%)(9/03)
- Samples prepared and distributed to laboratories (100%)(10/03 - 11/03)
- Participated in meetings at UK CVD lab (100%)(12/03)
- Track sample analysis (100%)(12/03 - 3/04)

Project Path Forward

- Complete independent QC of laboratory analytical data (9/04)
- Compile & Evaluate Data & Write report summarizing laboratory findings (9/04 - 10/04)
- Attend CVD bench-scale demonstration in W. Va. (VENDOR DECLINED TO ALLOW PARTICIPATION)
- Evaluate CVD Bench Scale Results from Vendor (8/04 - 12/04)
- Bring UK CVD reactor on-line (7/04 - 12/04)
- Conduct Bench scale studies at UK using basic CVD technology application (12/04 - 6/05)

Significant Findings

MCL's or release criteria have not been developed for release of nickel or other volumetrically contaminated metals. Therefore, participating laboratories analyzed the market available Ni samples so that isotopic activities below background levels could be detected.

Internal duplicates and spike were performed at a rate of one per ten samples.

Because of current government and DOE release policies, any technology potentially applicable for the removal of radioactive material from volumetrically contaminated stock must be judged upon it's ability to remove radionuclides to activities at or below background levels and/or activities below laboratory detection limits.

1. Samples of nickel were received from the following vendor sources:

- Alfa Aesar Nickel Rod 99.5% Purity
- Ward Hill, MA Powder 99.8% Purity -325 Mesh
- Belmont Metals Nickel Cathodes 99.9% Purity
- Brooklyn, NY Powder 99.9% Purity 100-325 Mesh
- Atlantic Equipment Engr Metal Squares 99.99+% Purity
- Bergenfield, NJ Powder 99.9% Purity-325 Mesh

To ensure comparable analytical results, USEC and KY Dept of Public Health laboratories agreed on the following analytical methods: (a) gamma Spectroscopy on solid or dissolved nickel will be used to quantify K-40, Co-60, Cs- 137, U-238, Np-237 and Am-241, (b) alpha Spectroscopy will be used to quantify U-238, U-235, U-234, Th-228, Th-230, Th-232, Pu-238, Pu-239/240, Am-241 and Np-237, and (c) liquid scintillation will be used to quantify Tc-99.

Since no MCL's have been assigned to nickel, both labs analyzed for low limits as specified in the respective method (approaching or being below background levels). Analytical results are reported in Bq/g. Internal duplicates and spike were performed at a rate of one per ten samples.

In early April, analytical laboratory results were complete. Data validation and verification are in progress before a final report is released. Tentative results show no contaminants above background levels.

2. Graduate student is working 20 hrs/week to get familiar with CVD technology in preparation for retrofitting CVD equipment.

Implications: Need to identify what surrogate material will be used in initial recovery of CVD operation. Also may need to evaluate what radionuclide content of recycled Ni stock typically contains as previous analyses were conducted on virgin Ni stock.

7. UK Chemical Engineering Nickel Project Quarterly Report

April 23, 2004

Project Title

Background research & chemical engineering evaluation of technologies for the removal of 99Tc from volumetrically contaminated metals.

Projected Completion Date

June 30, 2004

Percentage Completion to Date: 50%

Project Goals

- Provide standard preparation of market available Ni for distribution to laboratories conducting analyses.
- Investigate the chemical characteristics 99 Tc
- Evaluate market uses of Nickel
- Identify market uses where slightly volumetrically contaminated Ni might be utilized
- Conduct a thorough research & review effort to identify documented removal methods for 99Tc from volumetrically contaminated material.
- Provide recommendations for bench scale study to evaluate removal of 99 Tc if processes other than commercially available CVD or electrochemical refining are promising.

Project Team / Member Roles / Tasks

Dr. Eric Grulke/UK-Chemical & Materials Engineering, PI. Lead project efforts.

Louie El Asami/UK-Chemical & Materials Engineering, Graduate Research Assistant. Conduct daily research & investigative efforts.

Dr. Lindell Ormsbee/Director, KRCEE-UK. . Technical Advisor.

Dr. John A. Volpe/KRCEE Contractor. Provide technical and regulatory expertise for radioactive material issues.

Steve Hampson/KRCEE. General project support.

Project Activity Status

Project Task (% Completion) (Projected Project Completion Date)

- Provide standard preparation of market available Ni for distribution to laboratories conducting analyses.(100%) (11/03)
- Meetings with project team to discuss chemistry, removal, and release issues (% NA) (10/03, 11/03, 2/04)
- Conduct research into documented removal technologies (60%) (6/04)
- Identify promising technologies for removal (60%) (6/04)

Project Path Forward

Activity (completion date)

- Complete all tasks above (6/04)
- Provide summary report for market use and removal technologies (6/04)
- Provide recommendation for bench scale technology evaluation (6/04)

Significant Findings

Chemical properties of 99 Tc and it's properties associated with other materials are poorly distributed and not readily available if documented.

Russian research and obscure DOE-complex research have indicated that some simple chemical-physical processes that are less complex than CVD are likely to be successful for the removal of 99 Tc from volumetrically contaminated metal.

Bench-scale testing to verify 99 Tc properties and removal from metal matrices are being developed and preliminary testing should be conducted by 9/04.

8. UK - KGS & Geological Sciences Seismic Monitoring and Seismic Hazard Assessment Quarterly Report.

April 23, 2004

Project Title

Enhancing Earthquake Monitoring and Assessing Seismic Hazard for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*

**In budget information, earthquake monitoring and assessing seismic hazards are distinguished as separate projects. However, the co-PI's are the same individuals and the funding for these seismic-related projects was split between the co-PI's respective institutions - the UK-Kentucky Geological Survey and the UK-Department of Geological Sciences.*

Projected Completion Date

October, 2005

Percentage Completion to Date: 25%

Project Goals

- To better monitor and locate earthquakes in the area
- To provide an independent and peer reviewed ground motion hazard assessment for the Paducah Gaseous Diffusion Plant (PGDP).

Project Team / Member Roles / Tasks

Dr. Zhenming Wang, Seismologist and Section Head (Geological Hazards)

Kentucky Geological Survey, University of Kentucky, Co-PI

Dr. Edward W. Woolery, Assistant Professor, Department of Geological Sciences

University of Kentucky, Co-PI.

Dr. John Kiefer, UK/KGS. Project Team member.

Jim Kipp, UK/KWRRI. Project Team member.

Dr. Lindell Ormsbee/Director, KRCEE-UK. **.** Project Team member.

Steve Hampson, UK/KRCEE. General project management.

Project Activity Status

Project Task (% Completion) (Projected Project Completion Date)

Task 1. Installation of seismic stations in Jackson Purchase to enhance the existing seismic system network allow for monitoring of area micro-seismicity and the collection of seismic data directly related to and needed for ongoing and future DOE-PGDP activities.

- Contract driller for PGDP seismic station installation in WKWMA (100%) (3/04)
- Install WKWMA boreholes (0%) (4/04-5/04)
- Order PGDP seismic instruments (100%) (1/04)
- Paducah seismic station installation (0%)(08/04)
- Identify new seismic station locations in the area (100%)(03/04)

Task 2. Thorough literature review: There are many new developments and data in seismic hazard assessment methodology, geology, and seismology locally, regionally, and nationally. The focus will be on the new geological and geophysical investigations in the area. The literature review will ensure the use of the best data and methodology for PGDP seismic related activities.

Task 3. Seismic source Characterization: Based on the information derived from Task 1 and 2, the seismic sources in and around PGDP and their characteristics will be defined (75%)(8/04).

Task 4. Probabilistic seismic hazard analysis (PSHA): PSHA will be performed based on the seismic source data from Task 3 (25%)(09/04).

Task 5. Deterministic seismic hazard analysis (DSHA): DSHA will be performed based on the seismic source data from Task 3 (25%)(10/04).

Task 6. Develop Preliminary report (10%)(12/04).

Task 7. Panel review. A 5-member review panel consisting of national and international experts will be formed to review the preliminary report (25%)(12/04).

9. UK-Geological Sciences PGDP Stratigraphic Model Project Quarterly Report

April 9, 2004

Project Title

Development of Conceptual Stratigraphic Model for the PGDP.

Projected Completion Date

October, 2005

Percentage Completion to Date: 10% -

Project Goals

To develop a detailed, conceptual model of the stratigraphic framework at the PGDP

Project Team / Member Roles / Tasks

Dr. Alan Fryar/UK-Department of Geological Sciences, PI. Conduct background research, oversee collection of existing and field data, integrate data into compatible electronic model, prepare project reports, and coordinate budget.

Dr. Steve Greb/UK-Kentucky Geological Survey, co-PI. Consult with PI to plan/interpret experimental plan. Assist with field work.

TBA - Graduate Student. Perform daily tasks, organization of data, execution of field work relative to project goals.

Project Activity Status

Project Task (% Completion) (Completion Date)

This project will officially start July 1, 2004.

- Participate in PGDP GW Modeling Team quarterly meeting (NA)(3/04)
- Identify existing information (50%)(1/04 - 3/04)
- Identify and recruit graduate student (100%)(4/04)
- Compile lithologic logs from site investigations in a geographic information system (GIS) using ArcView (0%)(6/05).

- Map exposures along Little Bayou and Bayou creeks and their tributaries (0%)(6/05).
- Correlate sedimentary facies in areal and cross-sectional views using ArcView, Surfer, and RockWorks 2002 (0%)(10/05)

Project Path Forward

- Obtain existing boring logs (7/04)
- Compile & Evaluate existing logs (7/04 - 10/04)
- Conduct field work (7/04 - 6/05)

Significant Findings

NA