Quarterly KRCEE-DOE Project Activity Summary Report

KENTUCKY RESEARCH CONSORTIUM FOR ENERGY AND ENVIRONMENT

April 2005 – June 2005

September 15, 2005

KRCEE-DOE Earmark Quarterly Progress Report
April 2005 – June 2005

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KRCEE-DOE Earmark PHASE I PROJECTS
Quarterly Activity Reports

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

August 4, 2005

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

Projected Completion Date:

September, 2006

Percentage Completion to Date:

Contractual arrangements with faculty and staff Project Teams to conduct long-term projects related to Phase I DOE earmark activities at PGDP are **95%** completed.

100% of the short-term projects requested by DOE through this quarter have been completed. Because short-term projects are not scoped in advance no percentage completion is applicable.

Project Team/Member Roles/Tasks:

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

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

Dr. John A. Volpe/KRCEE Contractor. Provide technical, radioactive material, radiation health, and regulatory expertise for KRCEE-DOE earmark projects.

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

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

Anna Hoover/ Administrative support, UK-KRCEE.

Stephanie Jenkins/ Administrative support, UK-KRCEE.

Project Activity Status:

- No quarterly activity meeting with DOE PPO April - June 2005.
- Follow-up review of UK-Superfund/ACT garden sample radiation data set April 2005.
- Redefined and distributed timelines for Holocene project in April 2005.
- Continued reference document and PGDP project document digitization & uploads to ftp site April – June 2005.
- IT contractor completed development of automated PDF document indexing June 2005.
- Conducted 6th quarterly meeting with KRCEE-DOE Project Teams April 2005.
- Completed preparation of Holocene Displacement PROJECT SPECIFIC MOU and site access/Readiness Review Requirements from comprehensive package of requirements supplied by Bechtel Jacobs in February April 2005.
- Provided Bechtel Jacobs Draft Holocene MOU and site access/Readiness Review April 2005.
- Held meetings/conference calls with KRCEE Holocene Project contractors to discuss MOU and site access/Readiness Review Requirements late February 2005.
- Finalized field oversight contract for Holocene Project fieldwork with SAIC May 2005.
- Completed review of KRCEE Health and Safety plans with UK Safety office April 2005.
- Completed review of Holocene Project MOU site requirement with UK Safety office April 2005.
- Planned and coordinated Holocene Project field reconaissance with Lettis & Associates, UK-Geological Sciences, SAIC, Tricord, DOE Site Office/Navarro Eng., Bechtel Jacobs, Weskem/U-Landfill office, and Ky DWM.
- Conducted Holocene Project field reconnaissance; visited Barnes Creek seismic study site to observe local stratigraphy and seismic features, U-Landfill office to review U-Landfill construction documents, Little Bayou Creek and PGDP environs; SAIC offices to observe Site 3A soil cores April 19 -21, 2005.
- Completed contracts for Holocene Project ITR contractors April 2005.
- Began direct discussion with Bechtel Jacobs regarding Holocene Project Health and Safety Plan May 2005.
- Iteratively reviewed and revised draft final Holocene Project Workplan, Health & Safety, and Waste Management Plans April - June 2005.
- Scoped Ecological Activities Summary Project with Steve Alexander/USFWS and Tim Kreher/WKWMA scoping and making prospective PI April - June 2005.
- Continued background data/information compilation and distribution to Wm. Lettis and Associates April - June 2005.
- Completed 5th quarterly report (for January thru March, 2005) for distribution April 2005

- Conference calls with Argonne National Laboratories and Tricord, Inc. relative to project roles, potential technical subcontractors and implementation of SW "Real-Time" Characterization & Remediation Project April – June 2005.
- Based on PORTS DOE facility Data Warehouse interface presentation from SAIC/ Dublin, Ohio office (March 2005), discussed implementation of PGDP Data Warehouse Project with DOE & DOE contractor Navarro Engineering PGDP, April, 2005.
- Held meetings with SAIC/Dublin office to scope PGDP Data Warehouse Project at UK April 2005.
- Contracted with KGS to provide day-to-day KRCEE project participation and oversight for PGDP Data Warehouse project April 2005.
- Contracted with SAIC/OR (for Dublin, Ohio office) to conduct PGDP Data Warehouse April-May 2005.
- Completed development of well log data conversion macro for use with UK-Civil Engineering and CDM-State College Office. Macro used to convert Rockware lithologic log inputs to format compatible with CTECH EVS 3-D visualization and data evaluation software April – May 2005.
- Completed development of PGDP data assessment program that will provide quantitative and qualitative summary statistics for groundwater monitoring data such as # analyses, # detects, # results validated, # non-detects, # detects > regulatory screening/compliance criteria June 2005.
- Completed review and recommendations for DOE Probablistic Modeling/Risk Assessment utilizing key faculty and staff April-May 2005.

Projected Task Summary for KRCEE 7th Quarter Project Activities:

- Coordinate KRCEE-DOE earmark-wide Project Team meeting (7 - 8/05)
- Plan meeting with DOE to discuss project needs (7 - 8/05)
- Continue revisions and finalize HASP, QAPP, SAP for Holocene Issues Project fieldwork based on initial project team review (7/05)
- Finalize planning for Holocene Project. (7/05)
- Finalize Holocene Issues fieldwork MOU and site access/Readiness Review Requirements with Bechtel Jacobs and DOE (7/05)
- Finalize Holocene Issues fieldwork ITR, Project Team, & Drilling contracts (7/05)
- Finalize Holocene Issues fieldwork Health and Safety planning and document revisions (7 – 8/05)
- Implement activities for PGDP Data Warehouse with KGS & SAIC (7/05)
- Coordinate PGDP Data Warehouse conference calls and meeting(s) with Bechtel-Jacobs/DOE Site Office/Navarro Engineering (7 -8/05)
- (Conduct SW "Real-time" project conference with KRCEE, DOE, Project Team, Tricord, EPPC, Argonne (7 - 8/05)
- Complete SnT Landfill historical data analysis macro with Civil Engineering and UL (7/05)
- Continue SnT Landfill historical data analysis (7 – 9/05)

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

July 15, 2005

Project Title

Development of Depleted Uranium Batteries

Project Goals:

- Characterize uranium dioxide's electrochemical properties in various organic solvents/lithium salts commonly used in commercial battery industry. These experiments will be performed in a glove box where the moisture and oxygen concentration will be controlled. These tests will mainly consist of cyclic voltammetry and impedance spectroscopy experiments. This information will be used to construct a battery with uranium dioxide as the cathode.
- 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.

Projected Completion Date:

September, 2005

Percentage Completion to Date:

80%

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.

Dr. Rick Howard/Battery Materials Consultant. Dr. Howard has guided the methods to construct LixUyOz compounds.

Graduate Student Technician to perform daily repetitive experiments.

Project Activity Status:

- The first tasks were to identify and purchase equipment capable of producing electrochemical experiments of high quality using uranium dioxide (UO_2 and U_3O_8) as cathode materials in an electrochemical cell to mirror experiments performed on manganese dioxide compounds. This involved purchasing hardware including a Vac-Atmosphere glovebox, potentiostat, frequency response analyzer, materials needed to produce the correct cathode thicknesses, state-of-the-art electrochemical cells, software to perform and analyze the data, lithium salts/solvents made by battery manufacturers, lithius metal to be used as reference and counter electrodes. These tasks have been completed.

- Build a prototype battery consisting of uranium dioxide as the cathode and lithium as the anode. This was completed last June (2004) and the battery showed a low current output (as expected), but it surprisingly showed the ability to be recharged.

- Since last fall (October 2004) we began to focus on the construction of lithiated uranium compounds. In theory these compounds show the most promise of producing a high current output as well as the ability to be recharged.

- Dr. Richard Howard was hired to determine the best strategy to construct these compounds. Dr. Howard recommended the purchase of a tube furnace whereby reducing conditions could be created to permit the proper chemical reaction to produce the compound Li_2UO_3.

- Electrochemical properties of uranium dioxide are being measured in four different electrochemical cells. Each cell has a different lithium electrolyte in 1 M solutions used in commercial lithium batteries

- A tube furnace has been used to produce a $Li_xU_zO_y$ compound which may have suitable electrochemical properties. This compound was manufactured July 13, 2005. It will be tested for reversibility and for its valence state the week of July 18th. This compound will also be tested July 25th through July 30th in various lithium electrolytes.

Task Summary:

$Li_xU_zO_y$ compound batteries will be constructed by Walter Tracinski of Applied Power during the week of July 25th 2005.

Initial $Li_xU_zO_y$ compound battery testing will be conducted from July thru September, 2005.

Different forms of uranium and lithium-uranium compounds will be tested for the optimal electrochemical properties suitable for commercial battery development.

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

July 15, 2005

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/ Member Roles/Tasks:

Mike Kemp, Ph.D./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 Activity Status
Task (% Completion) (Projected Completion Date):

Hydrologic Model Development and Calibration (60%) (09/05)

1. Acquire Existing Plant Outfall and Creek Flow Data (100%)

2. Acquire Model Input Existing Data (85%) (5/05)

3. Preliminary Model Development (80%) (5/05)

4. Initial Model Calibration (60%) (6/05)

5. Install Flow Measurement Equipment If Needed (0%) (Task not needed)

6. Calibrate Model Based on Actual Measurements (30%) (6/05)

TMDL Development (25%) (9/05)

1. Acquire Existing Water Quality Data (100%) (6/05)

2. Identify Waste Sources (100%)

3. Input Model Mass Loadings to Model (10%) (7/05)

4. Allocate Mass Loadings (0%) (7/05)

5. Final Model Calibration and Long Term Run (0%) (8/05)

Final Report (15%) (9/05)

Significant Findings:

1. General. Two reports are envisioned, one for Tc-99 and one for the other metals. Skeleton reports including general background information and summaries of existing water quality data have been prepared for both.

2. Hydrologic model.

The focus of the work done on this section of the project during the past quarter was the development of a continuous simulation hydrologic model. The purpose of this model is to enable evaluation of pollutant concentrations on the Bayou Creek and Little Bayou Creek watersheds draining the site.

The model employed in this work is the Hydrologic Simulation Program FORTRAN (HSPF), which is available through the U.S. Environmental Protection Agency (EPA). In addition, input data files were created using the BASINS program available from the same agency.

Input data. Input data required for the HSPF program include watershed characteristics, land use classifications, soils data, weather, and stream gaging data. Watershed and subwatershed characteristics were developed and formatted for HSPF input using the BASINS program described above. Our team used the automated watershed and subwatershed delineation technique available in BASINS. Delineations were based on a 10 meter digital elevation model (DEM) obtained from the Kentucky Office of Geographic Information. Stream channels were defined using the National Hydrologic Dataset (NHD).

Three watersheds to be used in modeling were created using BASINS. These are described by HSPF using their reach number. *Reach 2* includes all the Bayou Creek watershed upstream of gage 03611800 and comprises the Forestdale Creek subwatershed. *Reach 4* includes the Bayou Creek watershed upstream of gage 03611850 and comprises the Forestdale Creek, Ordinance Works Creek, Brushy Creek, and Interbasin subwatersheds. *Reach 3* consists of the subwatershed upstream of gage 03611900 on Little Bayou Creek.

Soils data for BASINS and the HSPF model were generated in–house. The soils sheets from the Soil Survey of Ballard and McCracken Counties, Kentucky (USDA, SCS, 1976) were scanned and then georeferenced to the corresponding Digital Orthophoto Quarter Quad (DOQQ) downloaded from the Kentucky Division of Geographic Information (http://dgi.ky.gov/data/doi.htm). ArcInfo 8.3 (ESRI , 2002) was used to digitize and edit the soil boundaries, and the resulting polygons were assigned the soil symbol and hydrologic group in the attribute table.

Land use/ land cover data for the current HSPF model were acquired using the BASINS Download Data process and were created by the USGS for the GIRAS project (http://www.epa.gov/waterscience/basins/metadata/giras.htm). More detailed land use/land cover data are available from the Kentucky GAP Project (KY Fish & Wildlife, 2003). These data have not yet been incorporated into the model since our initial efforts included keeping the model simple enough to run.

Weather data for use in modeling was obtained from the National Climate Data Center (NCDC). Based on work done previously in this project, weather data (hourly precipitation, daily maximum temperature, and daily minimum temperature) were obtained for the period from October 1, 1996 to August 31, 2003 from the weather station at Barkley Regional Airport. This period was selected to match historic stream gaging data available for the three stream gages on the Bayou and Little Bayou Creek watersheds. Weather data formatting was a particularly time intensive step in the modeling because it was necessary to manually reformat NCDC data in the manner required by the HSPF program. In addition, using maximum and minimum temperature data, the Hamon Method was used to compute potential evapotranspiration for use in modeling.

Stream gaging data was obtained for the two gages (03611800 and 03611850) on Bayou Creek and the sole gage (03611900) on Little Bayou Creek. Historic data for the period from October 1, 1996 to August 31, 2003 was formatted for used in model calibration.

Initial modeling. An initial hydrologic modeling run has been performed in HSPF, and calibration is currently in progress. Preliminary output generated predicted flows for comparison with observed flows. A limited examination of plots of predicted and observed data shows a general correlation ($r \sim 0.75$) with an apparent seasonal trend. Future efforts with the model require tuning of the hydrologic model prior to modeling of pollutant loadings.

3. TMDL development

Point source loadings for copper, iron, and lead together with flows from the PGDP to Bayou and Little Bayou creeks were formatted for data entry. This process is ongoing as of the time of this report. Mass estimates for the parameters to be modeled have been developed using a range of actual concentrations and actual flows and predicted flows and approximate regulatory limits for comparison with the model results.

4. University of Louisville Groundwater & Burial Ground Project Report

July 20, 2005

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 .** Coordinate 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.** Assist with the coordination of activities for the project.

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

Nick Uhl/CEE Department-UL – Research Assistant. Conduct document review, prepare comments, evaluate adequacy of characterization efforts to date, coordinate activities with KCEE colleagues

Project Tasks:

Task (percent completion) (projected completion date)

1. Landfill waste characterization and source evaluation (50%) (9/30/2005)

a) **Project 1A**: Characterize the wastes in the S&T landfill and in other landfills on the PGDP site.
b) **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.
c) **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 (90%) (9/30/2005)

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

Project Activity Status:

Landfill waste characterization and source evaluation.

A more comprehensive analysis has been completed of the information obtained in the 2004 investigation at the S and T landfills. During the investigation, samples were taken and laboratory tests were done to search for contaminants of concern. For the two primary contaminants of concern, TCE and Tc-99, 122 tests were done for TCE and 78 tests were done for Tc-99. Of the 122 tests for TCE, this contaminant was found at levels above the detection limit for the laboratory procedure used, in 35 samples, from boring locations 10, 11, 12, 13, 20, 21, 22, and 23. The average concentration of the TCE detected in those samples was 16.7 micrograms per liter. Tc-99 was detected at levels above detection limits and in excess of standard errors of measurement in 14 of the 78 samples, from boring locations 10, 14, 15, 6, 7, 8 and 9.

Borings 7, 8, 9, 10, 14 and 15 were located along a north-south line well to the west of the S and T landfills, while boring 6 was located south of the landfills. Borings 20, 21, 22 and 23 were located along a north-south line to the east of the S and T landfills, and borings 11, 12 and 13 were located along a north-south line farther to the east than borings 20 through 23. Borings 4, 5 and 17 were located on a north-south line located approximately through the east-west center of the two landfills. The dominant direction of groundwater flow in the vicinity of the S and T landfills is north-northeast.

In all of the borings where TCE and Tc-99 were detected, contaminant levels were higher at greater depths in the borings, reflecting the migration of TCE and Tc-99 most probably in the lower layers of the Regional Gravel Aquifer. For example, the Tc-99 activity above a 60-foot depth was 46 picoCuries per liter in the one boring where it was detected

in a sample from that depth range, while average activity between depths of 60 feet and 75 feet was about 84 picoCuries per liter and for depths greater than 75 feet was about 159 picoCuries per liter. If both contaminants were being leached out of the S and T landfills, more frequent detection at shallow depths would be expected. The hydraulic gradient in the area of the landfills is downward in the Upper Continental Recharge System, but strongly horizontal toward the Ohio River in the Regional Gravel Aquifer.

Significantly, TCE and Tc-99 were not detected at levels above detection limits or standard errors of measurement in borings 4, 5 and 17. Tc-99 was not detected in any of the borings located north and east from the S and T landfills. Thus, the appearance of Tc-99 in borings south and west of the landfills indicates that the landfills are not the source for that Tc-99. Moreover, the absence of Tc-99 in the samples taken in the remainder of the borings indicates that Tc-99 is not emerging from the landfills. If these contaminants were migrating out of the S and T landfills, Tc-99 should have been detected in borings 11, 12, 13, 17, 20, 21, 22 and 23 but that contaminant was not detected in samples from those borings.

Even though borings 12 and 13 were located farther east and at a greater distance from the S and T landfills than were borings 20 through 23, TCE concentrations were higher in the samples from borings 12 and 13 than in the samples from borings 20 through 23. If TCE were leaching down out of the S and T landfills, TCE should have been detected in boring 17 but it was absent from the samples taken in that boring. Moreover, concentrations of TCE should have been higher closer to the S and T landfills than in more remote locations.

Investigations done as part of the BGOU studies have shown the presence of roofing materials, wood, metal flashing, fragments of plastic and other types of construction and demolition wastes in SWMU 145 under part of the S and T landfill area. Flyash also was found in that area. All types of scrap materials had been deposited in that area from the 1950s into the 1980s. No report of TCE or Tc-99 was included in the data from the investigations on SWMU 145.

Groundwater Management/Remediation Technologies. In the last quarter, personal interviews have been conducted with individuals involved in development of groundwater remediation technologies, including Richard Raymond of Terra Systems, Inc., and Alexander Shulgin, a Russian émigré scientist.

Raymond provided information on both aerobic and anaerobic degradation of TCE including information on problems associated with both methods of remediation. Chemical oxidation is being emphasized in conjunction with bioremediation for chlorinated hydrocarbon contamination of groundwater. Bioremediation appears to be more feasible for dissolved contaminants while chemical oxidation appears to be more effective in treating source areas with high concentrations of contaminants.

In the systems described by Raymond, both active and passive methods of introduction of microbes into the contaminated groundwater systems have been developed. Data on certain parameters are necessary for design of delivery and treatment systems, including information on mass of contaminant, mass of other electron acceptors, groundwater seepage velocity, and overall site geology. In anaerobic dechlorination, provision of a substrate appears to be more important than provisions of nutrients to the microbes. Control of electron acceptors is important, as is groundwater pH.

In the work done by Shulgin, humic acid derivatives have been employed for remediation of contamination in soil, rock, groundwater and surface water systems. Most of the prior work has been directed at remediation of chlorinated hydrocarbons such as PCBs and dioxins, but the similarities in molecular structures among those compounds and TCE and its derivatives indicate that humic acid derivatives could be used to degrade TCE and to function in conjunctions with microbial degradation processes. The humic acid derivatives provide much-needed substrate for the microbes and facilitate microbial metabolic transformations by controlling pH and other environmental parameters.

In the past, humic acid and its derivatives have been used to immobilize heavy metals such as Uranium-238 and other metals that occur as cations. Tc-99 most probably is present in an anionic form in the Regional Gravel Aquifer, so a derivative of humic acid would be necessary to achieve immobilization of that species. However, humic acid derivatives have been used successfully to stabilize anionic forms of arsenic and chromium in work done by Shulgin and others. Discussions with Shulgin are continuing.

The assessment of remediation processes is almost complete, and a report is partially complete. That report will include a draft procedure for site assessment to select the appropriate bioremediation technology or combination of biological and chemical technologies for conditions in the soil and groundwater at the PGDP.

Further review of documents.

Documents describing conditions in the burial ground operable unit sources and the migration of contaminants from those sources has been initiated, as directed by Director Hampson in May 2005. Reports on SWMUs 2,3,4,5,6,7, 30 and 145 (under the S and T landfills) have been reviewed. SWMU 4, the C-747 Contaminated Burial Yard is an area of high concern, with uranium, Tc-99, metals and TCE in the pits and in the subsurface. TCE is present in relatively high concentrations. Much lower degrees of risk are apparent at SWMUs 3, 5 and 6, in terms of contamination of the RGA.

In SWMU 2, excavation for burial pits disrupted the fragipan at that site, allowing possible migration of contaminants through leaching and downward movement of infiltrating waters. This site appears to pose low risk to the RGA, and it is likely that TCE and Tc-99 in nearby monitoring wells originated at other sources. At SWMU 7, uranium and other metals were detected around and under the five burial pits at the site, but the source of the TCE in the groundwater is more likely to be the northwest plume

than the burial pits. TCE was present in relatively high concentrations in the RGA, but at low levels in the UCRS. The site of a former incinerator at SWMU 30 is contaminated with PCBs, PAHs, and TCE at high levels below the surface soils, but the TCE appears to be separate from the burial pits and may be present because of the northwest plume.

In the Scoping Document for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study released in November 2004, in regard to SWMU 145,the authors stated on page 45 "Consistent with the DOE strategy, DNAPL is considered a potential source beneath the buried waste. However, DNAPL has not been positively identified beneath any BGOU SWMUs."

Projected Task Summary for 7th Quarter:

1. Continue assessment of historical data, new data, and conditions at SnT and U Landfills (Task 1A & B)(12/30/2005).
2. 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) (12/30/2005).
3. Finish D1 updated technology review relative to technology in ITRD report (Task 2A & B) (9/30/2005).

5. UK/CE Groundwater Modeling Project Quarterly Report

July 15, 2005

Project Title:

Groundwater Modeling

Project Goals:

- Evaluate the adequacy of existing groundwater models at the site
- Recommend necessary improvements to the models
- Conduct Sensitivity analyses for CAB/PGDP GW modeling team Water Budget Items
- 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

Projected Completion Date:

September, 2005 for existing tasks, additional time and tasks are expected as part of Phase I activities

Percentage Completion to Date:

Identified with project tasks below.

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, UK-KRCEE – Project Manager

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

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

Dr. Chandramouli Viswanathan/Visiting Faculty, UK Civil Engineering. Provide technical modeling experience to PGDP groundwater and Murray State University TMDL Project HSPF models.

Jim Kipp/Associate Director, UK-KWRRI, Provide technical and administrative support

Project Activity Status
(per cent completion)(expected date of completion):

1. Finalize reviews, evaluations, and recommendations from previous and ongoing UK groundwater modeling activities for the PGDP site. **(85%)(12/2005)**

2. Provide modeling assessment for a range of groundwater remedial approaches including natural attenuation, hydraulic containment, pump & treat, and source/dissolved phase removal/treatment. **(50%) (12/2005)**

3. Provide modeling assessment for the efficiency and expected performance of proposed groundwater remediation plans. **(30%) (12/2005)**

4. Conduct "Water Budget" sensitivity analyses with DOE contractors Navarro, Bechtel Jacobs, and SAIC **(75%) (12/2005)**

    (a) **Sensitivity analysis on hydraulic conductivity in layer 3 (RGA aquifer) (100%)(6/03)**
    (b) **Sensitivity analysis on Big Bayou and Little Bayou creek stages their influence on contaminant distribution and system potentiomentric surface (100%)(6/03)**
    (c) **Evaluation of water inputs to model and water outputs from as percentage of total model water inputs/outputs including storage, constant head, recharge, river leakage, head dependent boundary (100%)(6/03)**

5. Develop MS EXCEL macro for conversion of Rockware geologic software lithologic/stratigraphic input of PGDP data to format suitable for input with C-Tech EVS 3-D software **(100%)(6/05)**

6. Develop MS EXCEL macro for PGDP data evaluation relative to #analyses, # detects, # analyses exceeding health/regulatory/background thresholds. **(90%) (7/2005)**

7. Completed evaluation of initial of baseline model provided to UK by DOE contractors **(100%)(6/05)**

Projected Tasks Summary for UK-CE KRCEE 7th Quarter:

- Add Risk Targets columns to MS EXCEL data macro that will be applied as qualitative and quantitative evaluation of data from gw, sw, soil, sediment sampling locations (8/05 - 12/05)

- Continue GW Modeling (PGDP) Team sensitivity analyses (7/05 - 12/05)
- Continue modeling natural attenuation simulations (7/05 - 12/05)
- Obtain and verify groundwater withdrawals from TVA & vicinity (7/05 - 10/05)
- Evaluate boundary condition effects on current vicinity & SWMU scale models (7/05 – 8/05)
- Complete simulations and documentation of groundwater conditions when plant activities cease under a number of possible remedial scenarios with consideration of parameter sensitivity analyses (7/05 - 10/05)
- Evaluate predicted changes in observation wells for Olmstead Dam pool increase (7/05 – 12/05)
- Evaluate calibration of transport model (7/05 – 12/05)
- Evaluate Kd Sensitivity Analysis document (circa June 2002) (7/05 – 12/05)

Significant Findings to date:

1. Existing groundwater flow model calibrated well to two significant field water level measuring events
2. Reduction of Hydraulic Conductivity (K) at the end of the first stress period indicates that the reduction of K increases the head values at observation wells.
3. Reduction in K with resulting increase in head leads to deviation of model results from the calibration.
4. Can conclude that assignments of K in zones as presently understood and applied is representative of physical system.
5. Existing groundwater flow model accounts for Ohio River stage change from Olmstead Dam with 306’ msl pool in Stress Period 2.
6. Transport model calibration not well understood or widely distributed
7. Existing sensitivity analyses conducted for transfer of model to new contractors not intensely reviewed or widely distributed
8. Stage changes in LBC have greater influence on head distribution and plume configuration than stage changes in BBC
9. Stage of LBC influences contaminant distribution in NE Plume & NW Plume

6. UK-Paducah Chemical Engineering Nickel Project Quarterly Report

April 29, 2005 – FINAL QUARTERLY ACTIVITY REPORT

Project Title:

Purification and Recovery of Radiologically-Contaminated Metals.

Projected Completion Date:

May 25, 2005

Percentage Completion to Date:
NA

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 laboratory-scale reactor
- Evaluate industrial-scale reactor for recovery of existing stockpiles of nickel waste

Project Team/Member Roles/Tasks:

FUTURE PROJECT TEAM TBD

Project Activity Status:

Activity (% completion)(Completion Date/Projected Completion Date)

- Attend PACROE meetings about salvage of volumetrically contaminated Ni ingots at PGDP (80%) (TBD)
- 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 (100%)(9/03)
- Raw material samples distributed to UK-Chem & Materials Engineering for standard laboratory preparation (100%)(10/03 - 11/03)

- Prepared laboratory samples obtained from UK-Chem & Materials Engineering (100%)(10/03 - 11/03)
- Track sample analyses (100%)(12/03 - 9/04)
- Complete review of validated CHS-REMS radiation lab and USEC virgin nickel radioisotope analyses (100%) (9-10/04)
- Identified graduate student and external consultant to become project participants (7-9/04)(100%)
- Process flow diagram for laboratory CVD reactor system complete (100% complete)(8/04).
- Literature and patent searches regarding background of previous or existing CVD operations is complete (7/04)(100%)
- Finalize analytical plans (3/05)(100%)
- Finalize process flow diagram (3/05)(100%)
- Finalize laboratory Health and Safety plan that address handling/use/production of Ni Carbonyl (3/05)(25%)
- PROJECT SUSPENDED

Task Summary:

(a) Order and setup laboratory CVD reactor system.
(b) Operate reactor system with nickel powder and optimize operating conditions. Get comfortable using ICP analytical test method to monitor purity of nickel product.
(c) Dose virgin nickel powder feedstock with appropriate surrogate contaminant to simulate recovery conditions
(d) Attend CVD bench-scale demonstration in Va./W. Va. (VENDOR DECLINED TO ALLOW UK PARTICIPATION. KRCEE WILL NEED THE ASSISTANCE OF DOE AND PACRO IN ORDER TO OBTAIN PERMISSION FOR KRCEE OVERSIGHT PARTICIPATION IN THE CVDR PILOT TEST)
(e) Evaluate CVD Bench Scale Results from Vendor (TBD)
(f) Bring UK CVD reactor on-line (TBD)
(g) Conduct Bench scale studies at UK using basic CVD technology application (6/05+)

Implications/conditions that affect project:

1. NEED TO OBTAIN SUPPORT OF DOE AND PACRO TO INFLUENCE CVDR CORPORATION TO ALLOW KRCEE PARTICIPATION IN THE OVERSIGHT OF THE PILOT CVD DEMONSTRATION BEING CONDUCTED BY THE DEPARTMENT OF THE NAVY ON PGDP NICKEL INGOTS.
2. KRCEE is concerned about the legalities relevant to development and deployment of CVD or CVD-like technology to the PGDP from the University of Kentucky and/or other entities that are not patent holders for the process

PROJECT SUSPENDED BASED ON IMPLICATIONS 1 and 2 ABOVE. MAY BE RESUMED PENDING FURTHER DISCUSSION WITH DOE – PPPO

7. UK Chemical Engineering Nickel Project Quarterly Report

July 15, 2005

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:

100%

Project Goals:

- Provide standard preparation of market available Ni for distribution to laboratories conducting analyses
- Investigate the chemical/physical 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 ^{99}Tc 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, UK-KRCEE. 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:
Activity (% completion)(Completion Date/Projected 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 (100%) (10/03, 11/03, 2/04, 6/04, 8/04, 9/04, 10/04)
- Conduct research into documented removal technologies (100%) (6/04)
- Identify promising technologies for removal (100%) (6/04)
- **FINAL PROJECT REPORT DISTRIBUTED JANUARY 2005.**

Task Summary:

- Distributed final report (1/05)

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 beginning in early CY 2005.

BASED ON THE FINDINGS FROM THIS PROJECT TEAMS COMPLETION OF WORK, A RESEARCH AND DEVELOPMENT PROJECT FOR THE DEVELOPMENT OF 99Tc/Ni DISTILLATION-SEPARATION PROCESS WAS INITIATED IN AUGUST 2005 AS PART OF KRCEE PHASE II ACTIVITIES.

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

July 25, 2005

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:

September 2005

Percentage Completion to Date:

90%

Project Goals:

- To better monitor and locate earthquakes in the area
- To provide an independent and peer reviewed probabilistic 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, UK-Kentucky Geological Survey, **Co-PI**

Dr. Edward W. Woolery/Assistant Professor, UK-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, UK-KRCEE. Project Team member.

Steve Hampson/UK-KRCEE. General project management.

Project Activity Status:

1. **Seismic Monitoring**

Task 1. Installation of seismic stations in Jackson Purchase to enhance the existing seismic system network allows for monitoring of area micro-seismicity and the collection of seismic data directly related to and needed for ongoing and future DOE-PGDP activities. Data collected at this and other stations will provide information that will assist in the development of a database to characterize the amplification effect of near-surface soils on strong ground motion in the New Madrid Seismic Zone.

Task (Percent Complete)(Projected completion)

- Identify new seismic station locations in the area (100%)(04/04)
- Contract driller for PGDP seismic station installation in WKWMA (100%) (3/04)
- Install WKWMA boreholes (100%) (4/04-8/04)
- Order PGDP seismic instruments (100%) (1/04)
- Completed installation seismic station at Paducah Airport (100%)(8/04)
- Completed installation seismic station in Lovelaceville (100%) (8/04)
- Implemented new Health and Safety and Notification procedures for PGDP work (1/05-3/05)
- Installed fence and electric for WKWMA seismic installation (100%)(1/05-3/05)
- Prepare seismic instruments for the station at WKWMA (100%) (1/05-3/05)
- Conducted in-situ velocity testing (100%)(3/2005)
- Completed installation of seismic station monitoring instruments at WKWMA (100%) (4/05)
- Begin data collection from WKWMA seismic monitoring station (TBD)(TBD)

2. Seismic Hazard Assessment

Task (Percent Complete)(Projected completion)

Task 1: 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 (i.e., source zonation and attenuation) and methodology for PGDP seismic related activities (90%)(9/30/05).

Task 2: Seismic source Characterization: Based on the information derived from Task 1, the seismic sources and attenuation relationship in and around PGDP will be defined (90%)(9/30/05).

Task 3: Probabilistic seismic hazard analysis (PSHA): PSHA will be performed based on the data from Task 2 (90%)(9/30/05).

Task 4: Deterministic seismic hazard analysis (DSHA): DSHA will be performed based on the data from Task 2 (60%)(9/30/05).

Task 5: Develop Preliminary report (90%)(9/30/05).

Task 6: Panel review: A 5-member review panel consisting of national and international experts will be formed to review the preliminary report (25%)(10/31/05).

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

July 25, 2005

Project Title:

Development of Conceptual Stratigraphic Model for the PGDP.

Projected Completion Date:

September 30, 2005

Percentage Completion to Date:
55%

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.

Josh Sexton/UK-Graduate Student. Perform daily tasks, organization of data, execution of field work relative to project goals.

Project Activity Status:

This project officially started July 1, 2005.

- Participate in PGDP GW Modeling Team quarterly meeting (NA)(3/04 & 7/04)
- Identify and recruit graduate student (100%)(4/04)
- Identify existing information (95%)(09/05)
- Develop database of lithologic logs (85%)(9/05).
- Map exposures along Little Bayou and Bayou creeks and their tributaries (85%)(12/05).
- Correlate sedimentary facies in areal and cross-sectional views using Arcview, Surfer, and RockWorks 2002 (50%)(01/06)

Significant Findings:

Field Mapping

Fieldwork was conducted on June 7-10th by Josh Sexton. Steve Meiners (Tricord) and Steve Hampson (KRCEE) provided logistic and plant coordination assistance. During this field event, the effectiveness of carbon 14 dating of strata was evaluated along outcrop exposures along Bayou and Little Bayou Creek. At this time it appears that modern rooting has impacted the HU-1, HU-2, and HU-3 stratigraphic horizons and would likely not prove to be an adequate dating method. The implementation of other dating methods is currently being investigated at this time. The surficial geology along Bayou Creek from Ogden Landing Road to Acid Road was also examined, and this data should help correlate the Terrace Gravel and HU-2 transition zone.

Conceptual Model Development:

Steve Hampson, Lindell Ormsbee, Alan Fryar, and Josh Sexton met to discuss project status and deliverables during the quarter. Josh Sexton also met with Steve Cordiviola to provide a sample of final database deliverables and discuss formatting of the database. Steve Greb met with Josh Sexton during the quarter to begin the creation of preliminary stratigraphic cross-sections, review previous work, and offer input and guidance on clast-orientation data collected in outcrop exposures.

Lithologic database information in conjunction with surficial data at this time is believed to be sufficient to begin constructing a stratigraphic framework. Additional lithologic data will be entered at the request of KRCEE. Further data input will be added if United States Geological Survey (USGS) logs can be acquired for the Joppa Geologic Quadrangle (GQ). All wells/borings in the lithologic database are now spatially referenced in both plant coordinates and the Universal Transverse Mercator (UTM) coordinate system. Stratigraphic contacts are currently being identified to construct the geologic model and preliminary geologic cross-sections are being evaluated.

10. UK Agricultural Engineering Sediment/Contaminant Release Control Project

(Project Activities on hold during portion of quarter pending completion of contractual arrangements)

July 15, 2005

Project Title:

Development and Design of Cost-effective, Real-Time Implementable Sediment and Contaminant Release Controls

Projected Completion Date:

December 30, 2005.

Percentage Completion to Date:

45%

Project Goals:

- Provide soil/surface water/sediment transport model that will accurately predict soil/sediment and associated contaminant trends.
- Evaluate, design, assess and provide recommendations for surface water/sediment/contaminant control remedial options that will be cost effective and will be able to be implemented in real time.

Project Team/Member Roles/Tasks:

Dr. Richard Warner/UK-Agricultural Engineering, Surface Mining Institute, LLC, **PI**. Lead project efforts.

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

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

Dr. Mike Kemp/Murray State University. Technical Advisor

Steve Hampson/UK, KRCEE. General project support.

Project Activity Status:

Task (% Completion) (Projected Project Completion Date)

- Obtain and review site maps for relevant environmental and engineering features (50%) (3/05)
- Obtain and review rainfall records for PDGP site and vicinity (90%) (3/05)
- Obtain and review soil, storm water, and sediment data for outfalls (30%) (3/05)
- Conduct review efforts to identify applicable readily-implementable, cost-effective storm wate/sediment/contaminant control technologies (75%) (3/05)
- Prediction of hydrologic response (rainfall-runoff) for current conditions (20%) (6/05)
- Develop conceptual designs of alternative control systems (65%) (6/05)
- Provide report and design recommendations for outfalls (0%) (9/05)
-

Project Task Summary:

- Identified alternative controls including weep berms, flocculation, and sand filters.
- Evaluated the potential performance of each of the above controls.
- Conducted preliminary hydrologic modeling of the 20 mm and the 2 yr 24 hr design storm.

Significant Findings:

- Need detailed description and dimensions of current surface water and sediment control facilities.
- The apparent lack of a digital terrain model or a contour map with 2-ft contours will require an approximate delineation of watershed and subwatershed boundaries.
- There is concern that there will not be sufficient space to locate a passive control system. Field reconnaissance is being scheduled to assess space limitations.
- Tradeoffs between surface water treatment and sub-surface water contamination are a design consideration.

ACTIVE KRCEE-DOE Earmark PHASE II PROJECTS
Quarterly Activity Reports

11. UK Geological Sciences & KGS Field Determination of S & P Wave Velocities

July 15, 2005

Project Title:

Field Determination of S & P Wave Velocities for Ground Motion Model Input at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky Field Determination of S & P Wave Velocities for Ground Motion Model Input at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Project Goals:

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- To obtain site-specific S- and P-wave velocity field measurements at the PGDP.
- To obtain field measurements of site specific soil damping properties at the PGDP.
- To provide measured P- and S-wave velocity models at each of the PGDP seismic monitoring sites.
- To provide accurate seismic models that reflect measured site specific S- and P-wave velocities and measured soil damping properties for the PGDP.
- Preliminary report and summary report summarizing the site specific P- and S-wave velocity models
- Preliminary report and summary report summarizing the measured damping properties of PGDP soils.
- Inclusion of site specific P- and S-wave velocity models and soil damping

Projected Completion Date*:

November 2005

*Field activities relative to this project were completed in March and April 2005. BASED ON QUALITY OF INITIAL FIELD DATA ACQUISITION, ADDITIONAL FIELD MEASUREMENTS WILL BE NECESSARY. ADDITIONAL FIELD MEASUREMENTS WILL BE OBTAINED IN OCTOBER AND NOVEMBER 2005.

Percentage Completion to Date:

75%

Project Team/Member Roles/Tasks:

Dr. Zhenming Wang/Seismologist and Section Head/Geological Hazards
UK-Kentucky Geological Survey, **Co-PI.**

Dr. Edward W. Woolery/Assistant Professor, UK-Department of Geological Sciences, **Co-PI**.

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

Jim Kipp/UK-KWRRI. Project Team member.

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

Steve Hampson/UK-KRCEE. General project management.

Project Activity Status:

Task (% Completion) (Projected Project Completion Date)

- Procure equipment (100%) (8/04)
- Conduct field measurements I (100%) (04/05)
- Data Reduction and assessment I (100%) (4/05)
- Conduct field measurements II (0%) (10/05 – 11/05)
- Data Reduction and assessment II (0%) (10/05 – 11/05)
- Preliminary report and summary report summarizing the site specific P- and S-wave velocity models (0%) (11/05)
- Preliminary report and summary report summarizing the measured damping properties of PGDP soils. (0%) (11/05)

12. UK-KRCEE Adaptive Sampling and Analysis Real-Time Remediation Project ("Real-Time Remediation" or "NDA" Project)

July 5, 2005

Project Title:

Field Demonstration Project for the Application of real-time survey and analytical methods (Non Destructive Analyses) for Cost Effective, Real-time Remediation of Surface Water, Sediment, and Soil at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Projected Completion Date:

October, 2005 – July, 2006.

Percentage Completion to Date:

25%

Project Goals:

1. To demonstrate the effectiveness of real-time survey and analytical methods to:

   - Identify sediment and soil requiring remediation in a section of Outfall 011 at the PGDP
   - Verify achievement of cleanup goals following remediation of a section of Outfall 011 at the PGDP
   - Provide WAC characterization that is both time and cost-effective relative to presently deployed methods at the PGDP

2. Provide a general cost & time comparison for the deployment of real-time survey and analytical methods and remediation completion versus historical methods previously and presently utilized for site characterization and for conducting remedial actions at the PGDP

3. Present concept and proposed plans to CAB, regulatory decision makers, and DOE/contractors

4. Present results and recommendations for future utilization of process for soil and sediment remediation at the PGDP

5. Involve the developers of EPA TRIAD and Argonne National Laboratory ASAP

Project Team/Member Roles/Tasks:

Steve Hampson/Assistant Director, UK-KRCEE. Review of documents, methods, and contractors chosen for implementation of real-time characterization and cleanup demonstration.

Dr. John A Volpe/Technical Consultant, KRCEE. Conduct evaluation of methods for real-time site characterization and cleanup.

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

Dr. D. Joseph Hagert/ Professor, UL- College of Engineering. Technical Advisor.

Dr. Mike Kemp/Professor, Murray State University. Technical Advisor

Dr. Richard Warner/UK-Agricultural Engineering. Technical Support.

Mr. David Williams/PGDP-RPM, Region IV EPA. Advisor.

Mr. John Richards/Region IV EPA. Mr. Richards will bring subject matter experience on related projects in Region IV and experience related to his role in the development of the multi-agency MARSSIM guidance.

Mr. Tony Hatton/EPPC, Assistant Director Division of Waste Management. Mr. Hatton will provide remedial and regulatory expertise as a member of the project team.

Project Activity Status:

1. KRCEE will develop a demonstration project utilizing real-time sampling, real-time analysis, and real-time cleanup of a section Outfall 011. A final status survey will employ statistical sampling of the remediated area to demonstrate utility of real-time methods and to confirm the attainment of cleanup goals.

2. KRCEE will develop sampling and analysis plans and quality assurance project plans to ensure the production of the quality data to support Data Quality Objectives.

3. KRCEE will utilize approaches developed by USEPA, DOE and DOE national laboratories to demonstrate the effectiveness of real-time assessment and cleanup of outfalls, ditches, and soils at the Paducah Gaseous Diffusion (PGDP).

4. The project will demonstrate utilization of appropriate radiation survey instruments, *in situ* gamma spectroscopy for radionuclides, head space measurement/in-field electron capture gas chromatography for volatile organics, and XRF technology for metals.

Task Summary:

Task (% Completion) (Projected Project Completion Date)

1. Internet and document search and reviews to evaluate the availability and applicability of adaptive sampling and analysis approach characterization, remediation, cleanup verification, and waste characterization methods applicable to soil and sediment remedial needs at the PGDP (100%)(01/05)
2. Internet search to find companies that have the capability to implement real-time survey mapping, and analysis procedures. A number of companies have the capability of conducting a radiation walkover survey utilizing coupled radiological survey and data positioning. Real-time methods utilized by various companies employ a GPS systems coupled to a survey meter that permits measurement, recording, and mapping of impact areas. In comparison to other technologies real-time survey and mapping technologies allow for greater areal coverage and complete site characterization versus traditional multiple phases of random location sampling and laboratory analyses.(75%)(07/05)
3. Requested a quotes from Canberra for in-situ gamma spectroscopy (50%)(07/05).
4. Review of DRAFT DOE G 441.1-XX, "CONTROL AND RELEASE OF PROPERTY WITH RESIDUAL RADIOACTIVE MATERIAL for use with DOE 5400.5, *Radiation Protection of the Public and the Environment", April 2002* and applicable portioins of MARLAP multi-agency guidance document (100%)(10/04).
5. Reviewed EPA Triad methodology and decision making documents and Argonne National Laboratory Adaptive Sampling and Analysis Program (ASAP) documents (100%)(10/04).
6. Reviewed Triad and ASAP remedial projects conducted at other sites and documented on the internet (75%)(09/04 – 07/05).
7. Contacted Argonne National Laboratories and began project discussions and contracting process (50%)(11/04 – 08/05).
8. Met with EPPC and EPA to provide information, discuss, gain acceptance and Project Team participation for concept and project (100%) (11/04 – 02/05)
9. Developed SW "Real-Time" Project Team Flowchart (100%)(02/05).
10. Presented SW "Real-Time" Project to PGDP CAB (100%)(03/05).
11. Developed project specific templates for HASP, WP, Waste Mgmt Plan, QAPP (60%)(01/06).
12. Development of a final confirmation sampling approach utilizing Visual Sampling Program (50%)(01/06).

13. UK Chemical Engineering Nickel Distillation Project Quarterly Report

July 19, 2005

Project Title:

Engineering Research and Development for Cost-effective Distillation Technology to Accomplish the Separation of 99Tc/Ni and Decontamination of PGDP Nickel Ingots.

Projected Completion Date:

December 2006.

Percentage Completion to Date:

35%

Project Goals:

- Design and Construct Knudsen Cell Mass Spectrometer to generate physical and chemical property data for Rhenium- Nickel prior to generating data for ^{99}Tc-Nickel system
- Investigate and document the chemical/physical characteristics of ^{99}Tc
- Investigate and document the chemical/physical characteristics Nickel
- Apply research findings to develop bench-scale distillation unit for the separation of 99Tc from nickel ingots
- Conduct bench scale experiments
- Apply research and bench scale experiment findings to the design of full-scale process

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. Tony Zhai/UK-Chemical & Materials Engineering, Metallurgy Technical Advisor

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

Mr. Bert Lynn/UK-Chemical & Materials Engineering, Mass Spectrometer Expert. Will advise project team on MS design, procurement of materials, and will construct the specialized MS equipment.

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

Steve Hampson/UK-KRCEE. General project support.

Project Activity Status:

(% Completion) (Projected Project Completion Date)

- Conduct research to construct specialized mass spectrometer.(100%) (11/03)
- Meetings with MS specialist to identify design parameters and suppliers (100%)(7/04 – 12/04)
- Submit equipment cost estimates (100%) (8/04)
- Begin procurement from suppliers (90%) (9/04 – 4/05)
- Visited NASA research facility in Ohio to observe Knudsen cell mass spectrometer installation (100%)(12/04)
- Assembly of Knudsen Cell Mass Spectrometer or KCMS (50%)(10/05)
- Calibration of KCMS (0%)(12/05)
- Begin analytical tests (0%)(7/05 - 12/05)

Significant Findings:

TBD

14. UK–KRCEE, UK Geological Sciences & KGS Holocene Issues Project Team

Aug 4, 2005

Project Title:

Field Study and Peer Review for Determination of Holocene Displacement at the C-746-U Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Projected Completion Date:

Fieldwork - September, 2005
C-14 and TLS Sampling – October – November, 2005.
Report to Stakeholders – November, 2005
Report for Publication - Nov

Percentage Completion to Date:

30%

Project Goals:

- To determine whether Holocene displacement has occurred along target zones associated with faults identifed at the C-746-U landfill
- To provide an independent and peer reviewed report summarizing the results of the field investigation

Project Team/Member Roles/Tasks:

Dr. Zhenming Wang/ Seismologist and Section Head/Geological Hazards, UK-Kentucky Geological Survey, **Co-PI**

Dr. Edward W. Woolery,/Assistant Professor, UK-Department of Geological Sciences, **Co-PI**.

Dr. Martitia Tuttle/Tuttle and Associates. (formerly Univ. of Maryland). Project Team member-Independent Technical Review.

Dr. Roy Van Arsdale/University of Memphis. Project Team Member-Independent Technical Review.

Mr. John Nelson/ Illinois Geological Survey. Project Team.

Mr. John Nelson/ Illinois Geological Survey. Project Team.

Dr. Bill Lettis, Dr. John Baldwin, Dr. Keith Kelsen Lettis & Assoc. / Walnut Grove, Ca Project Team Members, Field Oversight Contractors

Dr. Dave Amick /SAIC-Augusta. Project Team.

Mr. Marshall Davenport/Jacobs Engineering, Oak Ridge. Project Team

Steve Hampson/UK, KRCEE. General project management.

Project Activity Status:

Activity(% Completion) (Projected Project Completion Date)

Task 1. Recruit project and Independent Technical Review (ITR) teams comprised of experienced national and international experts (100%)(03/05)

Complete ITR Contracts (90%) (3/05 – 7/05)

Task 2. Hire experienced and qualified contractor to obtain DPT cores

Complete Project Team Contracts (50%) (7/05)

Task 3. Hire experienced field management team to oversee all aspects of fieldwork

Completed William Lettis and Associates contract for workplan development, background research, and field oversight (100%) (November 2005)

WLA Project Team background research conducted during November-March 2005 (50%) (3/05)

Began contracting process with SAIC-Paducah to provide field oversight manager to coordinate activities on-site (50%)(04/05 - 06/05)

Task 4. Complete review and submission of Readiness Review items

Readiness Review Requirements information package for UK-KRCEE was substantially completed by Bechtel Jacobs (100%)(2/05)

KRCEE/UK MOU review and project specific revisions (100%)(2/05 – 7/05)

Submit Readiness Review as complete package (80%)(3/05 – 07/05))

Task 5. Complete project scoping.

Discussions are ongoing with Project Team members and with WLA

Write workplan, Health and Safety plan and submittals (90%)(07/05)
Compile and distribute background information to technical contractors (80%)(07/05)
Plan and conduct field recon (100%)(04/05)

Task 6. Conduct field activities (Expected 9/05)

Task 7. Convene project team to write preliminary project report (Expected 10 - 11/05)

Task 8. Submit and revise project report based on ITR review (Expected 04/05 - 09/05)

Task 9. Preliminary reporting for stakeholders (Expected 11/05 - 12/05)

Task 10.Final report for distribution and journal publication (Expected 12/05 - 03/06

Significant Findings:

TBD

14. UK–KRCEE, PGDP Data Warehouse Development

August 4, 2005

Project Title:

PGDP Data Warehouse Development

Projected Completion Date:

December, 2005

Percentage Completion to Date:

20%

Project Goals:

Develop a secure internet accessible website to provide managers and scientists access to the PGDP geospatial, geotechnical, environmental and related data to support environmental projects such as site characterization, groundwater modeling, regulatory compliance, remedial design, and risk assessment. The Data Warehouse Project will implement and complet activites related to the following categories:

1. Website Modification and Development
2. Geospatial Data Warehouse Development
3. Training

Project Team/Member Roles/Tasks:

Steve Hampson/UK, KRCEE. General project management.

Steve Cordiviola/UK-Kentucky Geological Survey (KGS). Daily Technical Management

Jeff Wilson/SAIC-Dublin, Ohio. SAIC Contract Management

Dave Korns/SAIC-Dublin, Ohio. SAIC Technical Lead

Dr. John A Volpe/Technical Consultant, KRCEE. General project support.

Project Activity Status:

Task(% Completion) (Projected Completion Date)

Task 1. Develop Scope of Work (100%)(04/05)

Task 2. Hire experienced DOE contractor to apply previous project expertise to development of Data Warehouse

Complete SAIC Contract (100%) (4/05)

Task 3. Hire experienced UK staff to participate in daily project activities

Complete full-time 4-month contract for KGS IT manager (100%)(04/05)

Task 4. Website Modification and Development

1. Assembly of PGDP-specific website (50%)(9/05)
2. Interface/meetings with Bechtel Jacobs project and IT personnel to identify site project participants, data/information not presently in OREIS, and short/long-term data use needs for site activities (25%)(08/05)

Task 5. Geospatial Data Warehouse Development

1. Obtain, input, and format OREIS database (25%)(07/05)
2. Obtain, input, and format geospatial information from existing data, internal sources, and external sources (50%)(08/05)

Task 6. Training

1. Obtain software and application-specific training for KGS-IT manager (50%)(07/05)
2. Provide training to Project Team for prototype database (0%)(09/05)
3. Provide user training (0%)(09/05)

Significant Findings

1. Additional project time will be required for basic activity of including site participants in project through the PGDP prime contractor.
2. Additional project time will be required for obtaining OREIS database.