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Annual Report

Project Number: AL-04 3101

Reporting Period: April 1- September 30, 2004
PI: Malcolm Siegel
Project Title: Arsenic in Water Treatment
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PROJECT STATUS

Project Objective:

Sandia National Laboratories (SNL) is collaborating with the Awwa Research Foundation (AwwaRF) and WERC (A Consortium for Environmental Education and Technology Development) in a program for the development and testing of innovative technologies that have the potential to substantially reduce the costs associated with arsenic removal from drinking water. Sandia National Laboratories will administer contracts placed with AwwaRF and WERC to carry out bench scale studies and economic analyses/outreach activities, respectively. The elements of the AwwaRF program include 1) identification of new technologies, 2) proof-of-concept laboratory studies and, 3) a research program that will meet the other needs of small utilities by providing solutions to small utilities so that they may successfully meet the new arsenic MCL. WERC's activities will include development of an economic analysis tool for Pilot Scale Demonstrations and development of educational training and technical assistance tools. The objective of the Sandia Program is the field demonstration testing of innovative technologies. The primary deliverables of the Sandia program will be engineering analyses of candidate technologies; these will be contained in preliminary reports and final analysis reports. Projected scale-up costs will be generated using a cost model provided by WERC or another suitable model.

Problems, Issues Concerns:

It is anticipated that at least half of the FY04 funds will be carried over into FY05 because of the late start date and the time required to resolve a number of contracting issues with AwwaRF and WERC.

- Initial project funding was received in April 1, 2004; additional funds were received in July and September, 2004.
- Several institutional issues plagued the initial establishment of the Partnership. These resulted in delays that have contributed to the large carryover. Problems in placing a

large contract (approximately $1M) with AwwaRF (a small non-profit organization) has delayed the SNL work schedule and the AwwaRF work schedule; the AwwaRF activities have not started yet. Similar problems also affected the schedule of placing a contract with WERC, a consortia run by New Mexico State University until September 1, 2004 for $588K.

Corrective Actions:

Request FY04 funds carryover level over usual limits for use in FY05.

- Actions to bring uncosted balance down include: legal negotiations between Sandia ada AwwaRF to allow placement of the contract with AwwaRF, acceleration of work at NMSU/WERC and acceleration of work at Sandia through additional on-site subcontracts and hiring of additional staff.
- Balances should have no impact on future budget requests. Sandia projects are operating on schedule and within budget to complete Sandia's portion of the work of the Partnership.

Technical Status:

Activities during the fiscal year (April 1 – September 30, 2004) were focused primarily on project management, including staff hiring and contract placement, and initial activities in site selection and technology evaluation.

1. Project Management (Task 1): Several meetings of the Project Management Committee were held primarily in preparation for the first meeting of the Technical Review Committee. The first meeting of this advisory committee was held at the end of August. The research goals for the AWTP using funds appropriated in FY03 and FY04 were set and RFPs were issued by AwwaRF.

2. Technology Survey and Evaluation (Task 2): Discussions were held with vendors recommended at the 2003 Arsenic Treatment Vendors Forum for the first 2 pilots; companies included MEI, Filtronics, Kinetico, AdEdge and others. Detailed planning was carried out for the 2nd Arsenic Treatment Vendors Forum to be held at 2004 New Mexico Environmental Health Conference. (Note that this Forum will be conducted using funds from a separate Work-for-Others contract with AwwaRF using the budget appropriated in FY03). MS ACCESS Databases for technologies and candidate sites were set up. Experimental plans for improving the design of pilot tests were drawn up. These include 1) the use of Rapid Small-scale Column test procedures to accelerate the testing process and 2) pre-and post-test characterization of adsorptive media both in the lab and in the field to assess the effect of long-term contact with groundwater solutes and conditions on performance. Initial RSSCT experiments were started using adsorptive media that will be tested in the first pilot test at Socorro, NM.

3. Site Survey (Task 3): During the last 6 months, several site visits were made and discussions were held with water utility staff for the purpose of detailed planning of a pilot test at a pump house in Socorro, New Mexico. During April, May and June, a site visit was carried out and meetings were held with staff from the Jemez Pueblo Water Utility Board and US Indian Health service to plan a pilot test on the Pueblo. In July, site visits in the Las Cruces-El Paso areas included meetings and inspection of potential

facilities for pilots at Berino, NM, Desert Sands, NM, Anthony, NM, Santa Teresa, NM and Canontillo, TX. These visits complemented activities carried out in FY2003 to evaluate sites in Central and Northern New Mexico such as Chama and Placitas. Finally, evaluation of sites in Michigan, Wisconsin and New Hampshire began with the assistance of the National Sanitation Foundation, the Interstate Technology Regulatory Council and the US EPA.

4. Lab/facility Modification (Task 5): A laboratory for the conduct of Rapid Small Scale Column Tests was set up and plans for a second laboratory for large-scale column studies were drawn up. Laboratory supplies and several pieces of equipments were purchased.

5. Pilot Test #A: Draft documents describing procedures controlling Intellectual Property are being prepared by Sandia Legal. Documents describing the protocols for sampling and testing procedures were completed and are currently being reviewed by the National Sanitation Foundation. Engineering drawings for the Socorro pilot were prepared and necessary equipment has been ordered. The pilot is scheduled to begin between November 19 and December 1, 2004.

FUNDING, COSTS, AND SCHEDULE VARIANCES

FY04 Funding: $2.982M
Total Available Funding: $2.982M
Costs to date: $536,422 spent + $1,091,033 commitments
Estimated YTD Percent Complete: 18%

MILESTONES

Task	Deliverables	Completion Date	Status
1	Quarterly and annual progress reports.	September 30, 2005	In progress, first report was quart
2	Summary reports describing bench-scale and local pilot evaluation of technologies proposed for pilot demonstrations. Local pilot studies	May 31, 2005	Draft report for Kirtland AFB Pil
3	Summary reports describing analyses of potential pilot sites 1. Pilot 1 site selection 2. Pilot 2 and 3 site selection	August 7, 2004 October 1, 2004	Draft complete – expect final by 1 Delayed due to construction sche contract delays
4	Summary report describing technologies selected for pilot demonstrations 1. Site 1 2. Site 2 3. Site 3	July 15, 2004 October 30, 2004 July 1, 2005	Draft complete – expect final by 1 Delayed due to construction sche contract delays
5	Completion of laboratory modifications.	September 30, 2005	In progress
6	Completion of capital equipment purchases	September 30, 2005	
7	Pilot Test A 1. Test Design Report Pilot A 2. Pilot Test A Final report	October 7, 2004 August 23, 2005	Drafts completed; in review at NS
8	Pilot Test B 1. Test Design Report Pilot B 2. Progress report on Pilot Test B .	December 17, 2004 September 15, 2005	Delayed due to construction sche contract delays
9	Test Design Report Pilot C	September 15, 2005	

Task	Deliverables	Completion Date	Status
10	AwwaRF bench scale research program Report on RFP selection Status report on AwwaRF research	 5 months after contract initiation September 15, 2005	Contract **not** placed as of Oct. 1,
11	WERC educational projects 1. WERC design contest report 2. Website complete 3. Cost web tool complete	 June 30, 2005 September 15, 2005 September 15, 2005	Contract placed Sept 1, 2004

Monthly Status Report
October 2004

Monthly Status Report

Project Number: AL-04 3101

Reporting Period: October 1- October 31, 2004
PI: Malcolm Siegel
Project Title: Arsenic in Water Treatment
Phone: 505-844-5426
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PROJECT STATUS

Project Objective:

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Problems, Issues Concerns:

It is anticipated that at least half of the FY04 funds will be carried over into FY05 because of the late start date and the time required to resolve a number of contracting issues with AwwaRF and WERC.

- Initial project funding was received in April 1, 2004; additional funds were received in July and September, 2004.
- Several institutional issues plagued the initial establishment of the Partnership. These resulted in delays that have contributed to the large carryover. Problems in placing a large contract (approximately $900K) with AwwaRF (a small non-profit organization) has delayed the SNL work schedule and the AwwaRF work schedule; the AwwaRF activities have not started yet. Similar problems also affected the

schedule of placing a contract with WERC, a consortia run by New Mexico State University until September 1, 2004 for $525K.

Corrective Actions:

Sandia has requested a FY04 funds carryover level that is over the usual limits for use in FY05.

- Actions to bring uncosted balance down include: legal negotiations between Sandia and AwwaRF to allow placement of the contract with AwwaRF, acceleration of work at NMSU/WERC and acceleration of work at Sandia through additional on-site subcontracts and hiring of additional staff.
- Balances should have no impact on future budget requests. Sandia projects are operating on schedule and within budget to complete Sandia's portion of the work of the Partnership.

Technical Status:

Activities during the report period year were focused primarily on project management, , site selection, technology evaluation, and design of the first pilot study.

1. Project Management (Task 1): Malcolm Siegel participated in telecons for Project Management Committee in order to review results of the Technical Review Committee meeting held at the end of August. Siegel also participated in the annual meeting of the Interstate Technology Regulatory Council (ITRC) held in Albuquerque on September 26 – 28. He gave a presentation on the AWTP at the meeting of the Arsenic in Groundwater Team and one at the General Plenary Session. The goal of participation in the ITRC is to use the state agency resources to identify pilot sites and disseminate program results to state and county agencies. The ITRC has requested support from the AWTP for the 2005 calendar year.

2. Technology Survey and Evaluation (Task 2): Discussions were held with vendors recommended at the 2004 Arsenic Treatment Vendors Forum for the first 4 pilots; companies included Dow, Purolite, ResinTech, and EaglePicher. (The Vendors Forum was held at 2004 New Mexico Environmental Health Conference using funds from a separate Work-for-Others contract with AwwaRF using the budget appropriated in FY03). MS ACCESS Databases for technologies and candidate sites were populated with new data. Experiments using Rapid Small-scale Column Test procedures designed to accelerate the testing process and preliminary pre-and post-test characterization of adsorptive media were initiated. An abstract (Attachment 1) describing the RSSCT experiments was accepted for a poster session at the 2004 Fall meeting of the American Geophysical Union (December 14, 2004, San Francisco, CA.)

3. Site Survey (Task 3): As a result of the ITRC meeting, discussions with the Phoenix Area Office of the Indian Health Service and state agencies in California, Nebraska, New Jersey, Oklahoma, and North Carolina have been started to identify promising sites.

4. Lab/facility Modification (Task 5): The laboratory for the conduct of Rapid Small Scale Column Tests was set up and facility modifications for a second laboratory

for large-scale column studies were planned. Laboratory supplies and several pieces of equipment were purchased.

5. Pilot Test #A: Revisions to the test plan for Socorro pilot were made in light of information obtained at the Vendors Forum. The necessary equipment has been ordered and construction of the pilot plant will begin in early November. The pilot is scheduled to begin between November 19 and December 1, 2004.

6. Task 11. WERC: Evaluation of available cost models for arsenic treatment continued. Planning for the 2005 WERC design contest continued; the problem definition for the arsenic task was revised. Development of the homepage for the AWTP continued.

FUNDING, COSTS, AND SCHEDULE VARIANCES

FY04 Funding: $2.982M
Total Available Funding: $2.982M
Costs to date: $996,422 spent + $1,170,0 commitments
Estimated YTD Percent Complete: 33%

MILESTONES

Task	Deliverables	Completion Date	Status
1	Quarterly and annual progress reports.	September 30, 2005	In progress, first report was quarterly report
2	Summary reports describing bench-scale and local pilot evaluation of technologies proposed for pilot demonstrations. Local pilot studies	 May 31, 2005	Draft report for Kirtland AFB Pilot completed
3	Summary reports describing analyses of potential pilot sites 3. Pilot 1 site selection 4. Pilot 2 and 3 site selection	 August 7, 2004 October 1, 2004	 Draft complete – expect final by 11/20 Delayed due to construction schedule and contract delays
4	Summary report describing technologies selected for pilot demonstrations 4. Site 1 5. Site 2 6. Site 3	 July 15, 2004 October 30, 2004 July 1, 2005	 Draft complete – expect final by 11/25 Delayed due to construction schedule and contract delays
5	Completion of laboratory modifications.	September 30, 2005	In progress
6	Completion of capital equipment purchases	September 30, 2005	In progress
7	Pilot Test A 3. Test Design Report Pilot A 4. Pilot Test A Final report	 October 7, 2004 August 23, 2005	 Drafts completed; in review at NSF
8	Pilot Test B 3. Test Design Report Pilot B 4. Progress report on Pilot Test B .	 December 17, 2004 September 15, 2005	 Delayed due to construction schedule and contract delays
9	Test Design Report Pilot C	September 15, 2005	

Task	Deliverables	Completion Date	Status
10	AwwaRF bench scale research program Report on RFP selection Status report on AwwaRF research	 5 months after contract initiation September 15, 2005	Contract **not** placed as of Oct. 31, 2004
11	WERC educational projects 4. WERC design contest report 5. Website complete 6. Cost web tool complete	 June 30, 2005 September 15, 2005 September 15, 2005	Contract placed Sept 1, 2004

ATTACHMENT 1

Determining the Influence of Groundwater Composition on the Performance of Arsenic Adsorption Columns Using Rapid Small-Scale Column Tests.

Alicia Aragon, Malcolm Siegel, MS0750, Sandia National Laboratories, Albuquerque, NM 87185

The USEPA has established a more stringent drinking water standard for arsenic, reducing the MCL from 50 μg/L to 10 μg/L. This will affect many small communities in the US that lack the appropriate treatment infrastructure and funding to reduce arsenic to such levels. For such communities, adsorption systems are the preferred technology based on ease of operation and relatively lower costs.

The performance of adsorption media for the removal of arsenic from drinking water is dependent on site-specific water quality. At certain concentrations, co-occurring solutes will compete effectively with arsenic for sorption sites, potentially reducing the sorption capacity of the media. Due to the site-specific nature of water quality and variations in media properties, pilot scale studies are typically carried out to ensure that a proposed treatment technique is cost effective before installation of a full-scale system. Sandia National Laboratories is currently developing an approach to utilize rapid small-scale columns in lieu of pilot columns to test innovative technologies that could significantly reduce the cost of treatment in small communities.

Rapid small-scale column tests (RSSCTs) were developed to predict full-scale treatment of organic contaminants by adsorption onto granular activated carbon (GAC). This process greatly reduced the time and costs required to verify performance of GAC adsorption columns. In this study, the RSSCT methodology is used to predict the removal of inorganic arsenic using mixed metal oxyhydroxide adsorption media. The media are engineered and synthesized from materials that control arsenic behavior in natural and disturbed systems.

We describe the underlying theory and application of RSSCTs for the performance evaluation of novel media in several groundwater compositions. Results of small-scale laboratory columns are being used to predict the performance of pilot-scale systems and ultimately to design full-scale systems. RSSCTs will be performed on a suite of water compositions representing the variety of water supplies in the United States that are affected by the new drinking water standard. Ultimately, this approach will be used to carry out inexpensive short-term pilot studies at a large number of sites where large-scale pilots are not economically feasible.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

ATTACHMENT 2
PRESS RELEASE-NOVEMBER 2004

SANDIA NATIONAL LABORATORIES TO BEGIN PILOT STUDY OF ARSENIC REMOVAL TECHNOLOGIES IN SOCORRO, NM

Sandia National Laboratories will soon begin a pilot test of innovative water treatment technologies designed to reduce the costs of meeting the new arsenic drinking water standard issued by the U.S. Environmental Protection Agency. The tests will be carried out at a geothermal spring used to supply drinking water to Socorro, New Mexico, a town of about 9000 residents located 80 miles south of Albuquerque. Installation of test equipment will be completed by early December and regular operations will begin before Christmas following a preliminary 'shakedown' period.

The pilot is sponsored the Arsenic Water Technology Partnership, a multiyear-program program funded by a Congressional appropriation through the Department of Energy. The goals of the program are to develop, demonstrate and disseminate information about cost-effective water treatment technologies in order to help small communities in the Southwest and other parts of the country comply with the new EPA standard. The AWTP members include Sandia National Laboratories, the American Water Works Association (Awwa) Research Foundation and WERC, (A Consortium for Environmental Education and Technology Development). The Awwa Research Foundation is managing bench-scale research programs; Sandia National Laboratories is conducting the demonstration program and WERC will evaluate the economic feasibility of the technologies investigated and conduct technology transfer activities.

Congressional support and design of the Arsenic Water Partnership was developed under the leadership of Senator Pete Domenici (R-New Mexico) to help small communities comply with the new USEPA drinking water standard for arsenic. The new regulation, which will go into effect in January 2006, reduces the Maximum Contaminant Level (MCL) from 50 μg/L to 10 μg/L and is designed to reduce the incidence of bladder and lung cancers. Levels of naturally-occurring arsenic in the Southwest United States often exceed the new MCL; the new compliance requirements will impact small communities in the US that lack the appropriate treatment infrastructure and funding to reduce arsenic to such levels.

The pilot test in Socorro will compare five innovative technologies developed by universities, small businesses and large well-established water treatment companies and should last approximately 9 months. These treatment processes were chosen from over twenty candidate technologies that were reviewed by teams of technical experts at Arsenic Treatment Technology Vendor Forums organized by Sandia National Laboratories and held at the 2003 and 2004 New Mexico Environmental Health Conferences.

Sandia National Laboratories is developing plans for future tests in New Mexico and other parts of the country. These additional sites will be chosen through consultation with the NMED, US EPA, the Interstate Technology Regulatory Council and by a website application process whereby interested communities can request to be considered for a pilot. These demonstrations will involve additional technologies reviewed at the Vendor Forums and others developed from the laboratory studies managed by AwwaRF. Educational forums will be organized by WERC at the start of a pilot demonstration, to introduce community members to the program, and after the test is completed to describe the test results. The first forum will be held on December 15 as part of the meeting of the New Mexico Rural Water Association at the Holiday Inn Express in Socorro, NM.

For more information, please contact: Malcolm Siegel, Arsenic Treatment Technology Demonstration Project Manager, MS-0750 Sandia National Laboratories, Albuquerque, NM 87185, 505-844-5426; msiegel@sandia.gov or and visit http://www.sandia.gov/water/arsenic.htm.