FIU | Applied Research Center
FLORIDA INTERNATIONAL UNIVERSITY

U.S. DEPARTMENT OF ENERGY

ENVIRONMENTAL REMEDIATION

PROJECT: Environmental Remediation Technologies: *Sustainability Plan for the A/M Area Groundwater Remediation System*

CLIENT: U.S. Department of Energy
PRINCIPAL INVESTIGATOR: Dr. Leonel Lagos
LOCATION: Savannah River Site, Aiken, SC

Description:

This task supports US DOE EM-13 in developing plans for improving active remediation systems to improve performance while lowering resources (money, GHSs, energy) used. The initial effort identified specific improvements to the SRS A/M Area groundwater remediation system with expectation that it would apply to many "pump and treat" systems across DOE.

Under "Sustainable Remediation" sustainability metrics are identified and included into environmental management decisions.

The analyses applied to subsurface and surface contamination and supplement traditional risk paradigms which help to develop interim and final remediation end-states and improvements from upgrades to aging components and optimization of operations.

Fig. 1: M-1 Air Stripper System at SRS A/M Area

Benefits:

- Provides state of the practice tools (developed for DOD sites) for analysis of sustainable and green remediation alternatives, which are needed to address long-term sustainability in terms of reduced environmental and energy footprints of remedial actions and operating systems.
- Greatly lowers costs and improves effectiveness of remediation strategies applicable to soil, groundwater, radioactive waste, and facility D&D.
- Helps identify alternatives for remediation, monitoring, waste handling, and D&D design that save money and support sustainable, compliant decision-making.
- Identifies sustainability factors for the investigation, construction, operation, and long-term monitoring phases to estimate footprint of alternatives.
- Provides a decision matrix for remedy selection, design, or implementation and allows for remedy optimization.

US EPA identifies **6 core elements** of Green Remediation in its primer that are considered when designing and implementing cleanup measures:

- *Material & Waste:* Reduce material use; source unrefined materials locally and/or from recycled sources; minimize hazardous and non-hazardous waste generated onsite; and recycle waste generated on site.
- *Land & Ecosystem*: Protection of valuable "ecosystem services" at sites during cleanup (soil erosion control, nutrient uptake and water quality protection, wildlife habitat, etc.).
- *Water:* Seek beneficial use of extracted/treated water; optimize capture zones of pump and treat (P&T) systems; divert clean water around impacted area; infiltrate diverted storm water for aquifer storage; use less-refined water resources when possible; and manage stormwater runoff.
- *Energy:* High-efficiency equipment, low-emission vehicles, carpools, local materials and services, DC motors, cogeneration, on-site renewable energy, etc.
- *Air:* Reduce particulate matter, sulfur oxides, nitrous oxides, and greenhouse gases (GHGs).
- *Stewardship:* Reduce emissions of greenhouse gases; install renewable energy systems; use passive sampling; solicit community involvement.

ABOUT

Since 1995, the Applied Research Center at Florida International University has provided critical support to the Department of Energy's Office of Environmental Management mission of accelerated risk reduction and cleanup of the environmental legacy of the nation's nuclear weapons program. ARC's research performed under the DOE-FIU Cooperative Agreement (Contract # DE-EM0000598) can be classified as fundamental/basic, proof of principle, prototyping and laboratory experimentation.

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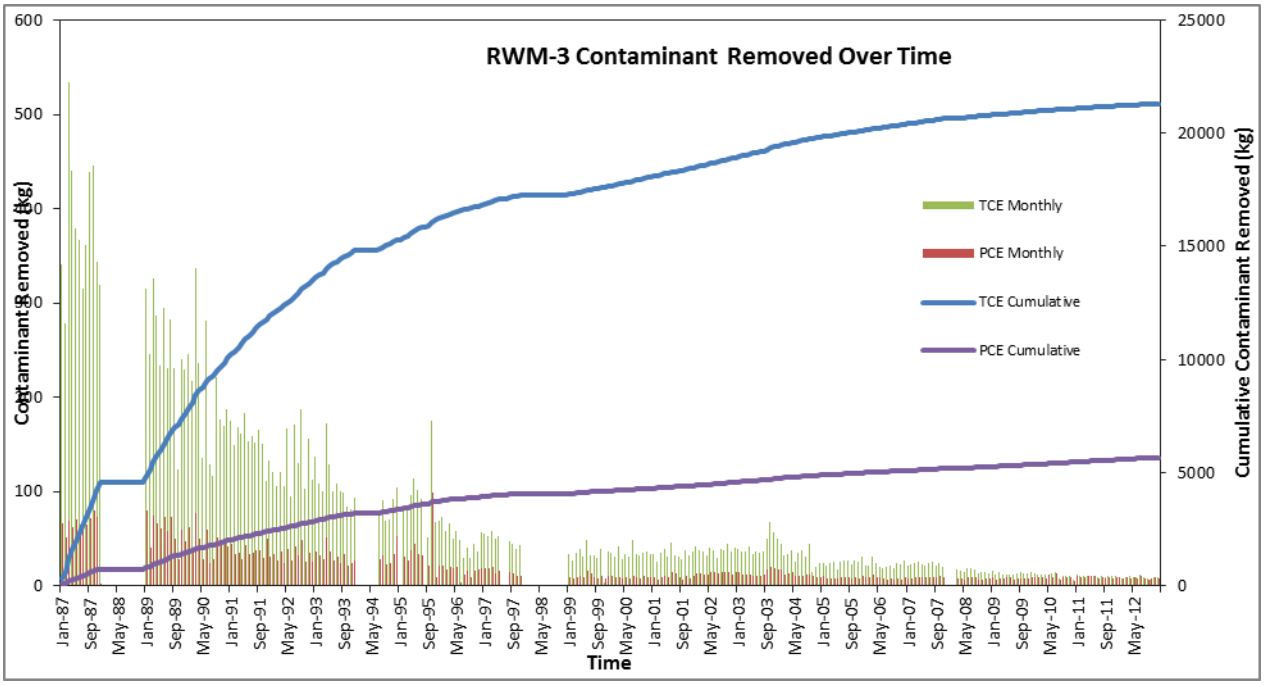

Fig. 2. Recovery of TCE and PCE from 1987 to 2012 from Recovery Well #3 as indicator for the need to optimize pumping from every well.

Accomplishments:

- Completed five Sustainable Remediation papers:

1. *Green and Sustainable Remediation Practices, Tools and their Application at DOE Office of Environmental Management Sites*
2. *Baseline Summary Report for Sustainable Remediation Options for M1 Air Stripper at DOE SRS*
3. *Sustainability Analysis for the M1 Air Stripper and Pumps of the M Area Groundwater Remediation System at DOE SRS*
4. *Green and Sustainable Remediation Options for the M Area Groundwater Remediation System at SRS*
5. *A preliminary Green and Sustainable Remediation Analysis of the M1 Air Stripper at DOE's Savannah River Site, Waste Management, Mar. 2016.*

Sustainability analyses resulted in these 4 primary recommendations:

1. Utilization of a solar photovoltaic system for powering the A/M Area groundwater remediation system.
2. Further analysis to determine an optimal speed for the blower motor that is sufficient to run the countercurrent stripper and removes the volatile organic contaminants to below the 1 ppb required.
3. Groundwater modeling analysis to optimize the pumping rate for each recovery well and for the entire system that provides hydrologic containment and maximizes the concentration of contaminants pumped to the stripper with lower total groundwater and air flow rates.
4. Replacement of groundwater pumps when they fail with lower power pumps that match the required pump rate of the recovery well (e.g., additional lower powered 1-5 HP pumps).