CH2MHILL

Sustainable Remediation Optimizes Processes and Reduces Costs

Sustainable Solutions

Client
U.S. Air Force Center for Engineering and the Environment (AFCEE)

Location
Cape Cod, Massachusetts, USA

The AFCEE-CH2M HILL team examined the full spectrum of Massachusetts Military Reservation's remediation program and streamlined everything from monitoring and analytical procedures, to pumping strategies and alternative technologies.

At the Massachusetts Military Reservation (MMR), every aspect of the project presented an opportunity to use less energy, generate less waste, emit fewer greenhouse gas emissions, and protect more of the local environment. MMR is one of the U.S. Department of Defense's largest and most complex cleanup sites.

Environmental sustainability is paramount to MMR's remediation program. Located on Upper Cape Cod, the 8,900-hectare (22,000-acre) site is situated over the recharge area for the Sagamore Lens aquifer, the primary source of drinking water for the area's residents.

The AFCEE-CH2M HILL team examined the full spectrum of MMR's remediation program and streamlined everything from monitoring and analytical procedures, to pumping strategies and alternative technologies. An additional benefit is that many of the cost-saving remedial process optimization strategies are also more sustainable and environmentally sound.

Passive, no-purge techniques are used to collect over 90 percent of the long-term monitoring samples, which significantly reduces sampling-related waste; the labor hours needed for sampling, decontamination, and purge-water management; and fuel required for sampling activities (fewer vehicles are needed to transport equipment and no generators are required).

Using an Air Force-owned, direct-push drill rig significantly reduces data collection costs and environmental impacts compared to standard drilling techniques. Fueling the rig with biodiesel and using a soy-based hydraulic fluid enhance the sustainability of this technology. (Other benefits of the direct push rig, as well as the well maintenance rig, include a more timely response and less fuel use since they are already on the site).

An innovative, 111-square-meter (1,200-square foot), zero-valent iron geochemical barrier is used to improve the ecological health of a nearby pond. The barrier passively removes phosphorus from a wastewater plume that discharges into the pond. CH2M HILL monitors the health of the pond and reports results annually.

To date, the optimization and sustainability efforts at MMR have reduced the estimated remediation cost to complete by almost US$200 million. Energy-saving initiatives range from eliminating winter heating (by relying on the geothermal mass of the pumped groundwater flowing through the treatment plants), to installing variable frequency drives, well field optimizations to improve capture efficiency (including turning wells off, packering, pulse pumping, and matching pump/motor sizes to flow rate), to enrolling in a demand response program. Through optimizations, the total reduction in carbon dioxide (CO_2) emissions is estimated at more than 7,500 US tons (6,860 tonnes) Visit www.mmr.org for additional optimization details.

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Summary of Impact Analysis for CS-10 Plume

46 years of pumping that includes RPO versus 80 years of LTM

Negative impacts of pumping alternatives compared to LTM with LUCs:

- Uses 73 million kWh of electricity to operate pump-and-treat systems (equivalent to powering 6,900 homes for a year)
- Releases 56,000 tons of GHG and 2 tons of volatile organic compounds into the atmosphere (equivalent to 15,400 cars on the road in a year)
- Statistics estimate 1.9 injuries and 0.02 deaths from collateral risks

Positive impacts of pumping compared to LTM with LUCs:

- Prevents over 1 billion gallons of new groundwater contamination by containing the spread of the plume
- Reduces potential risks to 1 in a million associated with exposure to surface water

Sustainability Impact Analysis Reveals Benefits of Remediation versus Long-term Monitoring

AFCEE and CH2M HILL also completed a detailed sustainability impact analysis at the CS-10 site. The analysis helped the Air Force quantify the life-cycle impacts of continued groundwater pump-and-treat systems on energy use, GHG emissions, and collateral risks to site workers compared to impacts from long-term monitoring (LTM) with land use controls (LUCs). The summary below shows the overall impacts of remediation compared to LTM. Based in part on the CS-10 work, several leading organizations in the remediation industry are collaborating on how to integrate these types of results into future remediation projects.

Sustainable Components

- Sustainability impact analysis at the CS-10 site helped the Air Force quantify impacts of continued groundwater pump-and-treat systems compared to LTM.
- Optimization and sustainability efforts have reduced the remediation cost to complete by almost US$200 million to date. Reduction in CO_2 emissions is estimated at over 7,500 US tons (6,860 tonnes) per year.
- A 1.5 megawatt wind turbine, constructed and operational in fall 2009, is expected to reduce the AFCEE annual energy use by 25 to 30 percent
- Passive techniques are used to collect over 90 percent of the LTM samples, and a direct-push drill rig significantly reduces costs and environmental impacts compared to standard drilling techniques.
- Geochemical barrier passively removes phosphorus from a wastewater plume that discharges into a nearby pond.

Enrolling in the demand response program offered by the local utility enables AFCEE to voluntarily shut down treatment plants or otherwise reduce electrical demand during periods of high energy demand and be credited for the electricity not used during this time period. In addition, AFCEE receives a fixed dollar value annually for enrolling in this demand response program. Ongoing sustainability initiatives include:

- Evaluation of matrix diffusion effects to determine if contamination has diffused into the low permeability zones creating secondary sources of contamination to an existing plume that may impact remedial system restoration timeframes.
- Evaluation of ozone/peroxide injection into influent to act as a pretreatment technology with the goal to reduce consumption of granular activated carbon (GAC).
- Evaluation of hydrogen injection immediately upstream of the GAC units to drive reductive dechlorination within the GAC units and, thereby, extend the life of the GAC beds.

Other technology evaluations are also scheduled, including microwave and advanced oxidation spent GAC without removing it from the treatment vessel

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