Federal Contaminated Sites Action Plan (FCSAP)

Wind-Powered Groundwater Sparging at Farnworth Lake

In an isolated, off-grid location, wind energy became the key to remediating contaminated groundwater.

Background

The Farnworth Lake Floatplane Base is located in an isolated area about 10 km southwest of Churchill, Manitoba. Over the years, the aviation storage and fuelling, along with caching of fuels, have led to subsurface contamination at the base location. As the site's custodian, Public Works and Government Services Canada (PWGSC) was responsible for its remediation.

The Challenge

PWGSC's environmental assessment indicated subsurface contamination near the fuel storage facilities and at the fuelling area at the main dock. The contaminants included petroleum hydrocarbons such as benzene, toluene, ethylbenzene and xylene. The assessment also identified potential effects on a nearby lake, as the contaminant levels exceeded the Canadian guidelines for freshwater aquatic life in the groundwater that flowed toward the lake.

Any remediation plan for the site would have to contend with a number of limitations. Since the site was isolated, any equipment that could not be brought from nearby Churchill would be very expensive to transport. Because the base was off the electrical grid, any remediation equipment would also have to be powered on site. Finally, the harsh subarctic weather conditions would limit what kinds of remediation strategies could be performed, especially as sparging techniques—that is, removal of contaminants in groundwater by injecting air—depend on some permeability of the soil, and are near-impossible in freezing conditions.

PWGSC issued a public tender for the design of a groundwater remedial system that would take these factors into account, and selected AMEC, an engineering consultant firm. After exploring alternative energy options, AMEC advanced a design that would use windmill-driven turbines to power a compressor to supply air for the sparging system. This system would remediate the petroleum hydrocarbons in the groundwater.

The active site in 2010

This project was made possible with support from the Federal Contaminated Sites Action Plan (FCSAP), a program aimed at reducing the environmental and human health risk, and associated federal financial liabilities, from known federal contaminated sites. More information about FCSAP is available at www.federalcontaminatedsites.gc.ca.

The Solution

In AMEC's design, four wind-powered turbines would be used to motorize the compressor to supply air to the sparging system. The windmills selected for the site were typically used to aerate fish ponds or for livestock watering sloughs; sparging would be a taller order, but AMEC determined that the windmill system could easily be adapted to supply injected air into the site's permeable soils.

The air itself was delivered through two lines (or "header cells") that ran through the contaminated groundwater plumes. As with conventional sparging techniques, the windmill-driven air would increase pressure on the groundwater, driving the more volatile contaminants out.

Because the windmills would be susceptible to damage from freezing rain, sleet or snow—and the area's occasional gale-force winds—the design provided for seasonal decommissioning and storing of the turbine units over the winter months.

Outcomes and Benefits

The design was put into effect in 2010 and has since proven its effectiveness:

- Using a renewable energy source eliminates the emissions, spillage and other hazards associated with diesel generators.
- The in situ remedial approach made removal and offsite treatment of media unnecessary, further reducing costs.
- The windmills require minimal mobilization and maintenance, and the equipment is reusable.
- Compared with conventional sparging systems, the use of a renewal energy source with low operation and maintenance costs translated into savings of $100,000 to $300,000.

These benefits could easily be duplicated in remediation efforts at other remote and northern locations where mobilization costs are prohibitive.

Covering header in trench

Headers before being buried

Risers that connect to windmills

Seasonal shutdown in 2010

Public Works and Government Services Canada is mandated by FCSAP to promote the use of innovative technologies, approaches and best practices in the remediation of federal contaminated sites. This is one of a series of profiles featuring innovative, sustainable and green remediation technologies, approaches, and best practices in Canada.

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