

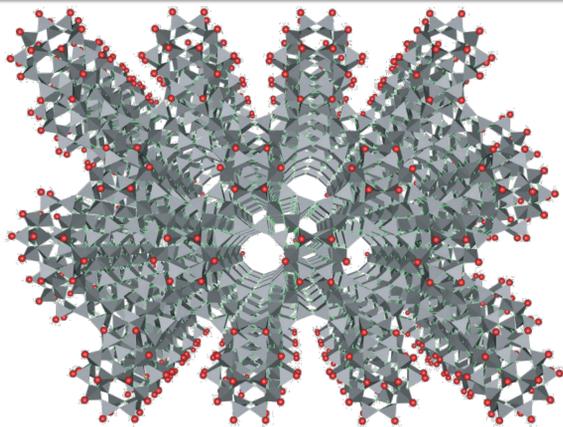
Alternatives to the Existing Strontium-90 Groundwater Treatment System

Earth and Environmental Engineering, Columbia University, New York, NY 10027.

Mentor:

Environmental Protection Division, Brookhaven National Lab, Upton, NY 11973.

Introduction



Radioactive strontium-90 (Sr-90) is removed from groundwater onsite at BNL by pumping the water through a series of tanks containing a type of natural sand media called clinoptilolite zeolite. The structure of clinoptilolite causes the material to bond with radioactive strontium, removing it from water. When the clinoptilolite has become saturated with Sr-90, the tanks, along with the sand media inside, are shipped for disposal as

low-level radioactive waste. This changeout process occurs approximately four times annually, resulting in the disposal of 18 to 24 tanks every year. The objective is to reduce cost and waste while maintaining safe and effective removal of Sr-90 from contaminated groundwater. This study focuses on comparing the current method with alternatives that may provide less costly options for running the system.

Figure 1 (top). Chemical structure of clinoptilolite zeolite. Large octagonal spaces in molecular structure allow clinoptilolite to readily bond with heavy metals such as radioactive strontium-90. Source: <<http://crystaldetox.com.au/wp-content/uploads/2012/09/ZeoliteGrid3.png>> Figure 2 (bottom). Macroscopic photograph of clinoptilolite sand media.

Cost Comparison

Current System

\$191,000/year



Cheaper Tank

\$169,000/year with contractor
\$160,000/year without contractor



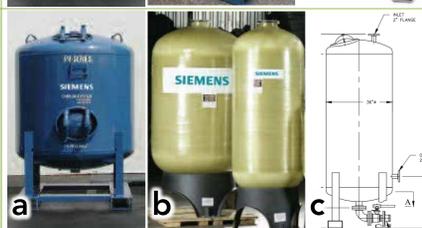
Reuse Tank by Vacuuming

- a) \$172,000 1st year, then \$102,000/year
- b) \$103,000 1st year, then \$100,000/year
- c) \$149,000 1st year, then \$ 98,000/year



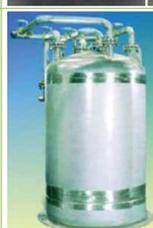
Reuse Tank by Sluicing

- a) \$177,000 1st year, then \$114,000/year
- b) \$174,000 1st year, then \$114,000/year
- c) \$198,000 1st year, then \$110,000/year



Turn-key Contractor

Lease option:
\$305,000 1st year, then \$252,000/year
Purchase option:
\$925,000 1st year, then \$242,000/year



Current System



Figures 3 and 4. Sr-90 groundwater treatment system in building 855. Taken by Laboratory Photographer Michael Herbert.

Recommendations

- ▶ Run vacuuming trial to verify assumptions
- ▶ Remove certified welding requirement on tanks to reduce cost
- ▶ Purchase high-powered vacuum to easily remove sand from tanks
- ▶ Reuse current tanks by vacuuming until unusable
- ▶ Purchase Siemens PV1000 dual-manway tanks

Acknowledgements

I would like to give a special thanks to Diane Rocco for all of her knowledge and guidance on this project. I would also like to thank the rest of the Value Study Team for their help and insight. This project was supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTs) under the Science Undergraduate Laboratory Internships Program (SULI).

Value Study Team Members

NAME	DISCIPLINE
Diane Rocco (TL)	Operations Manager, Waste Management
William Dorsch	Manager, Groundwater Protection Group
George Goode	Assistant Laboratory Director, ESH
Eric Kramer	Groundwater Protection Field Engineer
Terri Kneitel	DOE-BHSD Waste Management Manager
Brian McCaffrey	Facility Complex Engineer
Edmund Pavlak	Waste Management Representative
Ronald Prwivo, Jr	Operations Supervisor, Waste Management
Vincent Racaniello	Environmental Project Manager
Jason Remien	Interim Manager, Environmental Protection Division
Stanley Sakry	Facility Project Manager
Steven Stein	Quality Assurance Specialist
Glen Todzia	Support Services Manager, Waste Management

TL = Team Leader

References

1. Environmental Management Directorate. "Strontium-90 BGRR/ WCF/ PFS Groundwater Treatment System." Brookhaven National Laboratory and J.R. Holzmacher P.E., LLC Consulting Engineers. *Operation And Maintenance Manual U.S. Department Of Energy*.
2. Robinson, S. M. "The Development Of A Zeolite System For Upgrade Of The Process Waste Treatment Plant." Chemical Technology Division, Oak Ridge National Laboratory.
3. Dorsch, W.R. "Groundwater Remediation Program At Brookhaven National Laboratory Upton, New York" Environmental and Waste Management Services Division, Brookhaven National Laboratory. *Fourteenth Conference on the Geology of Long Island and Metropolitan New York: SUNY at Stony Brook*. April 14, 2007.
4. Rocco, D. F. "Standardized Waste Profile Sheet and RCRA Technical Basis Document: Sr-90 Vessel Waste Stream." Waste Management, Brookhaven National Laboratory. January 2011.