UOP
A Honeywell Company



Honeywell: Successful Partnerships for Environmental Remediation

Efficient treatment of liquid nuclear wastes

Background

The U.S. Department of Energy (DOE) has been tasked with ensuring America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions. Because of its strong history innovating technologies that address difficult challenges such as energy efficiency, clean energy generation, and environmental remediation, Honeywell is in a unique position to partner with the DOE to help meet its goals. With approximately 132,000 employees worldwide, including more than 22,000 engineers and scientists, Honeywell has the capability to deliver cutting-edge, high-performing technology to meet today's industry challenges.

Fukushima Environmental Remediation

IONSIV™ Selective Media provided by Honeywell's UOP has been used for cesium and strontium removal at the Fukushima Daiichi Nuclear power plant in the SARRY™ System, designed by Toshiba, Shaw, and AVANTech following the 2011 tsunami. More than 200 million gallons of contaminated water have been treated to date. Honeywell's UOP continues to partner with stakeholders to develop new technologies to address ongoing water remediation activities.

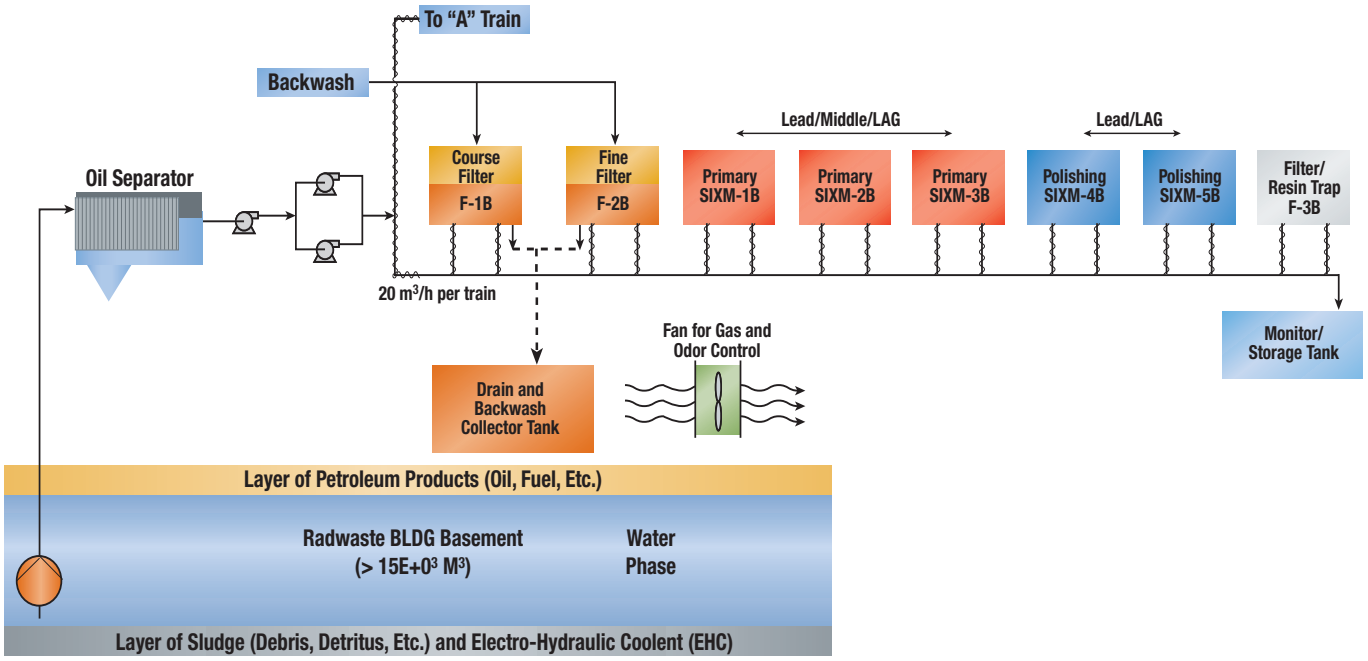
IONSIV Selective Media Key Features

- Proven solution for selective Cs removal from highly saline wastewater streams
- Excellent radiation, mechanical and chemical stability
- High capacity for Cs results in minimized media replacement costs, final waste volumes and downtime for reloads



SARRY System Installation at Fukushima

Figure 1 – Simplified Active Water Retrieve and Recovery (SARRY) System



Application of this media has resulted in near-complete removal of cesium from seawater and achieved the following outcomes:

- Reduced Cs levels by factors over 1,000,000 to non-detectable levels
- Improved efficiency of downstream systems
- Minimized media replacement costs and downtime for reloads
- Decreased waste volumes by more than 90% compared to alternative treatment systems incorporated into overall clean-up activities

This same technology can be applied to wastewater treatment systems at DOE facilities to support DOE's Office of Environmental Management in completing the safe cleanup of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research.

Domestic Environmental Remediation

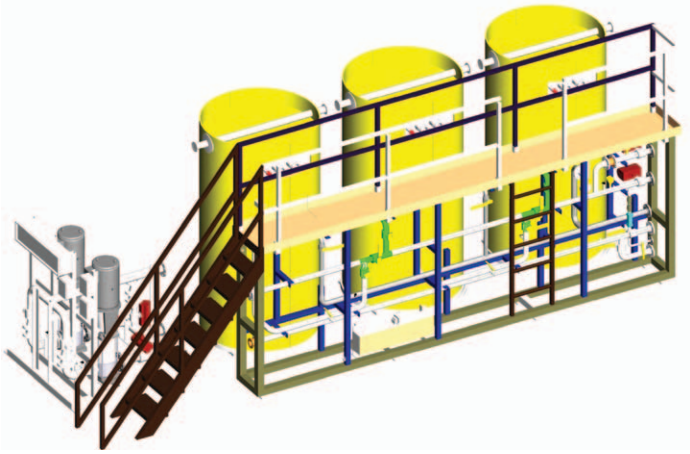
Honeywell has decades of experience in solving domestic water remediation challenges at DOE sites, including:

- **Savannah River Site[1]:** IONSIV media for Cs removal has been validated through technology readiness level six for treating salt wastes. Literature reviews also have shown that projected final waste volumes can be reduced by seven times and that overall project costs for salt waste processing can be reduced by more than 70% compared to the baseline alternative.
- **Oak Ridge National Laboratories[2]:** IONSIV was used to remove Cs and Sr from a simulated waste and exhibited decontamination factors that were 100 times greater than those achieved using natural chabazite.
- **Three Mile Island[3]:** IONSIV was used to remove Cs from contaminated water using a submerged demineralizer system that reduced total waste volumes.

Organizational Capabilities

Honeywell has strong capabilities to help DOE address its most critical priorities. As a recognized leader in process technology, with a history of reliability and excellence, Honeywell is the technology provider of choice for many industries due to its:

- Strong portfolio of technologies
- Deep focus on customer relationships
- Continuous research and development activities to improve process technology and product offerings



IONSIV Selective Media Equipment Installation

[1] A Comparative Evaluation of IONSIV IE-911 and Chabazite Zeolite for the Removal of Radiostrontium and Cesium from Wastewater.
[2] Small-Column Ion-Exchange Alternative to Remove ^{137}Cs From Low-Curie Salt Waste: Summary of Phase 1; J.F. Walker, Jr. et al; May 2004. 3
[3] "Three Mile Island Cleanup: Experiences, Waste Disposal, and Environmental Impact." King,L and Opelka, J. AIChE Journal Volume 78, 1982.

UOP LLC, A Honeywell Company
25 East Algonquin Road
Des Plaines, IL 60017-5017, U.S.A.
Tel: +1-847-391-2000
www.uop.com

RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

© 2013 UOP LLC. All rights reserved.
This information is not to be taken as a warranty or representation for which UOP assumes legal responsibility nor as permission or recommendation to practice any patented invention without a license. It is offered solely for your consideration.
UOP6234 December, 2013

UOP
A Honeywell Company