July 1, 2008—Just Another Day in the Life of Low-Level Radwaste Generators

After July 1, 2008, where will Class B/C LLW go?
This is a question being asked by generators,
by service providers to those generators,
by industry groups,
and by politicians, regulators, and the media.
Studsvik and Waste Control Specialists have an answer.

By Jack Harrison and David Cronshaw

A crisis is looming—the crisis that will occur on June 30, 2008, when the Barnwell, S.C., low-level radioactive waste disposal site closes to commercial generators of LLW in 36 states (those states that are *not* members of either the Atlantic, Northwest, or Rocky Mountain LLW Compact) plus the District of Columbia and Puerto Rico. Class A LLW from those states will have one remaining disposal path: the EnergySolutions facility in Clive, Utah.

Where will Class B/C LLW go?

It is a question being asked by generators, including utilities, hospitals, universities, and other research facilities; by service providers to those generators; by industry groups; and now by politicians, regulators, and the media.

As with any crisis, many answers are being proposed. The U.S. Nuclear Regulatory Commission has held hearings on the issue, and the Nuclear Energy Institute, the Electric Power Research Institute, and others have submitted proposals. Some proposals are radical changes from current practices by the generators, the processors, and the disposal sites. Some proposals call for serious changes to regulations. Some are stopgap measures. Some will invite public criticism and perhaps even strong opposition.

One answer, being proposed by Studsvik Inc. and Waste Control Specialists LLC (WCS), is designed to have no effect on waste generators' current operations. It stays within the bounds of current regulations and has the lowest potential for public concern. Under the Studsvik-WCS plan, July 1, 2008, will be business as usual for LLW generators.

The Plan

Studsvik and WCS plan to take the storage-and-disposal problem away from generators, by creating a new long-term storage facility in Texas. Studsvik not only will accept waste from the generators, but also will take legal responsibility for the waste. This plan puts LLW generators in the same position legally and financially as they hold in the present disposal system. Then Studsvik will use its proprietary THOR (Thermal Organic Reduction) process to volumetrically reduce and stabilize the LLW. As a last step, Studsvik will ship the waste to the WCS facility in Texas. The result is a program that removes the waste from generators and furthermore removes the ongoing compliance concerns that generators will otherwise have if they store B/C waste onsite. And the Studsvik-WCS plan makes use of volumetric reduction and stabilization that are time-honored, environmentally prudent principles of waste management.

Specifically, the THOR process reduces the volume of LLW (particularly resins and filters) by a factor of 5 or more. The THOR process also stabilizes the LLW by removing organics and physically bonding the radioactivity of the remaining material to the reformed residue, an ash-like substance that is the end product of the THOR process. With the organics removed, the common problems of gas formation and combustibility are solved. Likewise, the physical characteristics of the reformed residue inhibit leaching of radioactivity into the biosphere. In the unlikely event of reformed residue migrating outside its high-integrity container (HIC), the radioactivity remains bonded to the reformed residue, resulting in quicker, eas-

The WCS site in Andrews County, Tex.

ier cleanup and no residual fixed contamination of the surfaces that the reformed residue contacts.

The WCS site in Andrews County, Tex., is designed as a state-of-the-art LLW storage facility. Material processed by Studsvik will be stored in belowground concrete vaults. The initial construction will accommodate 30 liners inside a covered facility that meets applicable safety and security requirements for storage. As additional material is sent to WCS, more vault facilities will be constructed. With appropriate license amendments, WCS should be able to safely store sufficient volumes of processed LLW to bridge the gap until a new Class B/C disposal site becomes available.

Commercial Considerations

The commercial aspects of the Studsvik-WCS plan are designed to meet the needs of LLW generators. Upon acceptance by Studsvik of a generator's LLW for processing and storage, Studsvik will take the legal and economic responsibility for disposal. As part of the plan, Studsvik will charge the LLW generator an agreed-upon disposal and vault maintenance/use fee. The usual cost of disposal in today's market (approximately $3146 per cubic foot) will be placed into a secure trust and will be used to cover the cost of permanent disposal of the processed LLW, when that option becomes available. Studsvik will bear the risk of increased cost of disposal and/or movement of the stored LLW in the event it can no longer be stored at WCS.

Again, for LLW generators, this plan puts them in the same position legally and financially as they were in with permanent disposal. This plan also addresses the concerns voiced by the public, environmentalists, regulators, and politicians regarding onsite storage at multiple LLW generator sites. As a result, the Studsvik-WCS plan provides a single storage site, with the experience and systems in place to safely and securely manage the waste.

The THOR Process

Since the summer of 1999, Studsvik's THOR technology housed in its Erwin, Tenn., facility has been successfully providing processing, volume reduction, and disposal services to generators for the disposition of their pumpable water treatment media (resin, powdered media, and/or granular-activated carbon).

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The Erwin facility consists of a heavily shielded process building, an unshielded ancillary building, and an administration building. The process and ancillary buildings are licensed for receipt, handling, processing, and packaging of LLW.

The primary purpose of this facility is to receive radioactively contaminated organic waste (e.g., ion exchange resins, powder filter media, and activated carbon), mass and volume reduce this material utilizing the THOR process, and package the volume/weight-reduced waste residue. The Erwin facility has safely processed more than 300 000 ft^3 (approximately 15.5 million pounds) of LLW since its startup in 1999.

The patented THOR technology is used to disassociate the organic material contained in the LLW through pyrolysis and steam reforming. This can be defined as the destruction of organic material using heat in the absence of a stoichiometric amount of oxygen. Pyrolysis significantly reduces the final weight and volume of organic LLW. When the THOR process is applied to organic LLW, such as ion exchange resins, the long-chain polymer material is disassociated, and a nonreactive carbon-rich process residue and pyrolysis gases are formed.

Process residue is a solid residue (comprising principally carbon and metal oxides) that contains the majority (around 99.98 percent) of the radioactive metals that have been captured by the resins. This residue is retained in the pyrolysis system and further reduced by steam reforming. It is then packaged for shipment from the facility.

Pyrolysis gas forms when the organics that make up the majority of the original waste volume are converted to a syngas that is carried from the pyrolysis vessel and utilized to provide energy to evaporate the water content of the input resin. This syngas is composed of the following major elements and compounds:

- Carbon dioxide.
- Carbon monoxide.
- Water.
- Hydrogen and hydrocarbon gases.
- Nitrogen.

The THOR technology is a low-temperature (800°F) thermal process (compared to vitrification) that operates below the volatility point of cesium (one of the two heavy gamma emitters, the other being cobalt, which has a very high volatility point). The relatively low temperature prevents the radioactive metals from volatizing and retains the radioactive metals in the final metal oxide residue. The filtered pyrolysis gases are then converted at higher temperatures to carbon dioxide and water without the concern of volatile radioactive metals. Trace impurities in the carbon dioxide and water are removed in the off-gas system.

The pyrolysis system includes equipment that provides for reforming of the carbon residue. This commonly utilized technique applies superheated steam and other gases to the carbon material to convert the carbon to carbon dioxide and water and thus further reduce the mass and volume of the residual material.

In practice, waste from the facility input storage tanks is pumped into the THOR processing system. The waste is distilled with the light aromatic gases being prefiltered, converted to CO_2 and water, high-efficiency particulate air filtered, monitored, and discharged out the stack. The remaining fixed carbon and metal oxides go to the second stage of the system for steam reforming of the carbon, resulting in a significant mass re-

Monitoring the off-gas processes at Studsvik's Erwin, Tenn., facility.

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The resin sluice platform at the Studsvik facility.

Unloading an LLW transportation cask at the WCS site.

duction. The final waste residue (containing the metal oxides, radioactivity, and inorganic impurities) is then cooled and packaged in an applicable waste container—generally a polyethylene HIC.

The waste residue HIC will be loaded into an appropriate transportation cask and shipped for storage at WCS. Typically, all process residue and secondary waste will be disposed of or stored for ultimate disposal.

The WCS Facility

Waste Control Specialists LLC, a subsidiary of Valhi Inc., has more than 10 years of hazardous and radioactive waste management experience on its 1340-acre permitted site located on more than 14 000 acres in Andrews County, Tex., and Lea County, N.M.

Since 1997 WCS has continuously strived to expand its capabilities to serve its customers in the environmental and nuclear markets. In February 1997 WCS began receiving hazardous waste for disposal in its Resource Conservation and Recovery Act (RCRA), Subtitle C, landfill—the first permitted after the Land Disposal Restrictions were put into law. Soon afterward WCS applied for a low-level radioactive waste possession license. That license was received in November 1997, and WCS began taking LLW for treatment and storage in February 1998.

In June 2003, WCS was able to

change the law in Texas to allow a private company to dispose of LLW. WCS then filed a license application to dispose of 11e2 by-product material from uranium mining in June 2004 and an LLRW disposal license application in August. The draft license for by-product disposal was received in December 2007. The by-product license will allow WCS to dispose of the Fernald Silo 1 and 2 canisters, which have been in storage at the WCS facility since 2005. WCS received a draft LLRW disposal license on March 31, 2008.

WCS is well positioned to meet the industry's waste management needs now and after the closure of the Barnwell disposal facility. With a 20 000 ft^2 negative pressure mixed waste treatment facility, 5.4 million cubic yards of RCRA/TSCA disposal capacity, more than 1 800 000 ft^3 of radioactive waste storage capacity, and a robust license that is unique in the industry, WCS has provided solutions for many problem waste streams. WCS was instrumental in the closure of the Rocky Flats and Fernald DOE sites and looks forward to meeting the nation's needs for cost-effective waste management services.

Tomorrow and Tomorrow and Tomorrow . . .

Studsvik and WCS are committed to nuclear energy and to presenting innovative, value-driven waste management services to LLW generators. Studsvik and WCS have created a plan that allows generators to maintain current operations and to disposition LLW with financial and liability aspects identical to permanent disposal even though the disposal path for B/C LLW is uncertain. For LLW generators—from operations to the balance sheet—July 1, 2008, will be just another day. ■

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