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## **Safely Plugging and Abandoning High-Risk Wells on the Oak Ridge Reservation, Oak Ridge, Tennessee**

Hydrofracturing of a low-permeability, thick shale (Pumpkin Valley Shale Formation) followed by emplacement of low-level radioactive waste grout slurry was a common waste disposal practice used on the Oak Ridge Reservation until 1985. This disposal method was voluntarily halted because of more stringent permitting standards and injection well specifications required under Underground Injection Control Regulations.

Four injection wells and over one hundred additional wells used to monitor hydrofracture operations remain open and unused on the Oak Ridge Reservation. These open wells pose a risk to health, safety, and the environment because of their deteriorating condition.

A program was started in 2000 to safely and effectively plug and abandon these wells to protect the shallow freshwater zone and the underlying high saline zone (Rome Formation), to isolate the injection horizon, and to minimize exposure risks. Program goals are being achieved by using several pieces of custom fabricated or modified oilfield equipment. The key system components include:

- a workstring wash unit,
- real-time feedback of washer effectiveness,
- equipment designed to deal with contaminated wells/groundwater,
- spill containment techniques and equipment,
- downhole fluids isolation during well-opening activities,
- secondary spill and isolation techniques and practices,
- updated as-low-as-reasonably-achievable (ALARA) practices, and
- equipment improvements for splash and spill protection.

More than forty hydrofracture wells have been plugged to date. Performance has exceeded expectations and has set new standards for all downhole projects that involve contaminated solids and fluids.