



Idaho Department of Environmental Quality

Cleanup at the Idaho National Laboratory

Demolition of Excess Facilities

Since its inception in 1949, the Idaho National Laboratory (INL) Site has been involved in cutting edge research for the production of nuclear power. During this time, more than 50 nuclear research reactors have been constructed and operated on the site. These reactors were used to test reactor principles and construction materials. This research was needed to develop performance and safety standards for design, construction, and operation of commercial nuclear power plants.

Many of the facilities* that housed these reactors (or supported associated activities) on the INL Site are now decades old. Some of them were determined to have no future use and are considered excess. In 2005, the Department of Energy (DOE) started demolishing these excess facilities because ongoing maintenance and security costs are not justified. The cleanup mission to demolish these facilities is progressing as funding becomes available.

Most excess facilities are located within five major areas on the INL Site. While significant demolition activity will occur at these five areas in the near future, ongoing activities will also continue throughout the INL Site for many years.

For each of the five major areas, this publication provides:

- **pictures of demolition activities completed since 2005 and planned through 2012,**
- **a short history of past activities,**
- **information about ongoing activities, and**
- **a summary of current environmental contamination information.**

* Facilities are buildings or structures. Structures include camera towers, fuel tanks, water tanks, helicopter pads, evaporation ponds, storage pads, and other small facilities.

Stimulus Money Has Increased the Pace of Demolition at the INL Site

Due to the recent economic downturn, the federal government implemented an economic stimulus program under The American Recovery and Reinvestment Act. As part of this stimulus program, the Idaho Cleanup Project is receiving about \$468 million dollars that will be used to accelerate environmental cleanup work at the INL Site. Over half of this money has been directed to the demolition of excess INL facilities, allowing for early demolition of about 50 of the 250 facilities that will have been demolished between 2005 and 2012. Early demolition of INL Site facilities will reduce DOE's long-term security and maintenance costs associated with these facilities.

DEQ-INL Oversight Program Environmental Monitoring of the INL Site

The Idaho Department of Environmental Quality (DEQ) INL Oversight Program regularly performs a variety of environmental monitoring activities on and around the INL Site. This monitoring focuses on environmental pathways (air, water, and soil) through which radionuclides or other contaminants from the INL Site could enter into the environment. The extensive nature of the DEQ-INL Oversight Program's routine environmental monitoring is designed to detect any contaminant release from the INL Site, including potential releases from demolition activities. This monitoring includes:

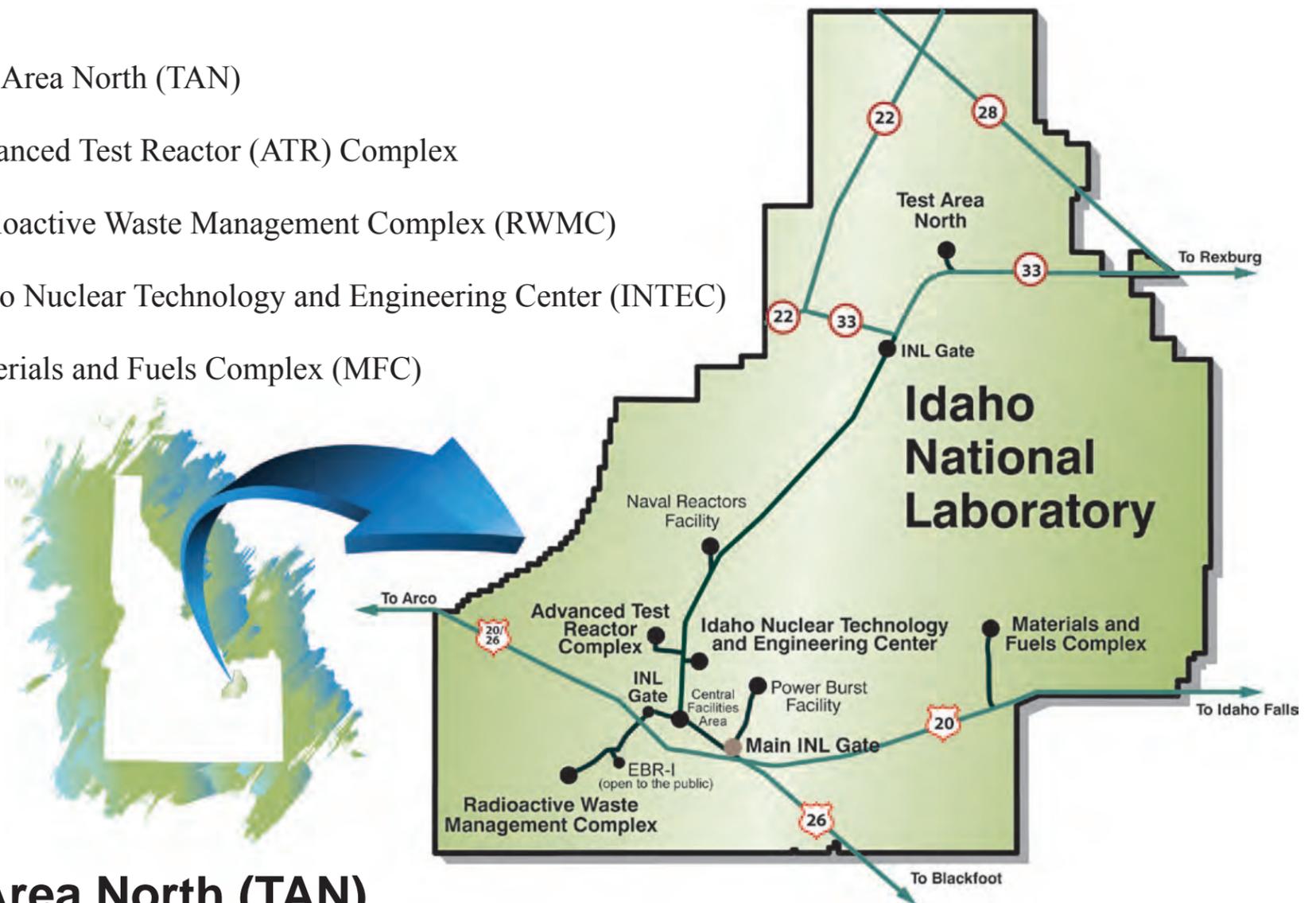
- Air monitoring stations that continuously sample for radioactive particulates, radioactive iodine, and tritium.
- A radiation monitoring network that collects real-time and quarterly radiation measurements.
- Monthly collection of milk samples from local dairies and milk production facilities that are tested for radioactive iodine.
- Annual measurements taken from undisturbed soils to screen for man-made radiation.
- Annual collection of ground water samples to check for radiological and non-radiological contaminants.

This monitoring is performed by DEQ scientists with expertise in ground water hydrology and health physics. For more information on DEQ-INL Oversight's environmental monitoring of the INL Site, see the DEQ-INL Oversight Program publication about Monitoring and Surveillance of the Idaho National Laboratory at: http://www.deq.idaho.gov/inl_oversight/library/newsletter_fall08.pdf.

INL Site Areas with Demolition Activities

These five major areas on the INL Site have demolition activities completed or in progress:

- 1) Test Area North (TAN)
- 2) Advanced Test Reactor (ATR) Complex
- 3) Radioactive Waste Management Complex (RWMC)
- 4) Idaho Nuclear Technology and Engineering Center (INTEC)
- 5) Materials and Fuels Complex (MFC)



Test Area North (TAN)

TAN had 46 facilities scheduled for demolition at the Technical Support Facility (TSF) and at the Loss-of-Fluid Test (LOFT) reactor. Demolition of all 46 of these facilities has been completed (see Figures A and B).



Figure A. Technical Support Facility at Test Area North (TAN)

All photos courtesy of Department of Energy

TAN History

TAN was established in the 1950s to support the federal government's intent to build and fly a nuclear-powered airplane. Three prototype nuclear-powered aircraft engines were built and ground-tested under this program. The project was cancelled in the 1960s after it was determined that the Soviet Union was not pursuing a similar program. Other projects hosted at TAN have included the LOFT reactor and examination of fuel and core debris from the 1979 Three Mile Island nuclear accident. (Three Mile Island fuel and core debris are currently stored at INTEC awaiting final disposition outside of Idaho).

The LOFT reactor (see Figure B) was a scaled-down version of a commercial pressurized water reactor. It was constructed at TAN (about 2 miles northwest of the TAN facilities shown in Figure A) in 1965 and operated until 1985. The LOFT reactor's design allowed nuclear engineers to create or re-create loss-of-fluid accidents (reactor fuel meltdowns) under very controlled conditions. The Nuclear Regulatory Commission incorporated the data from these tests into commercial reactor operating requirements to help ensure the safety of working commercial reactors. Thirty-eight experiments were conducted with the LOFT reactor, including several small loss-of-coolant experiments designed to simulate the type of accident that occurred at Three Mile Island.

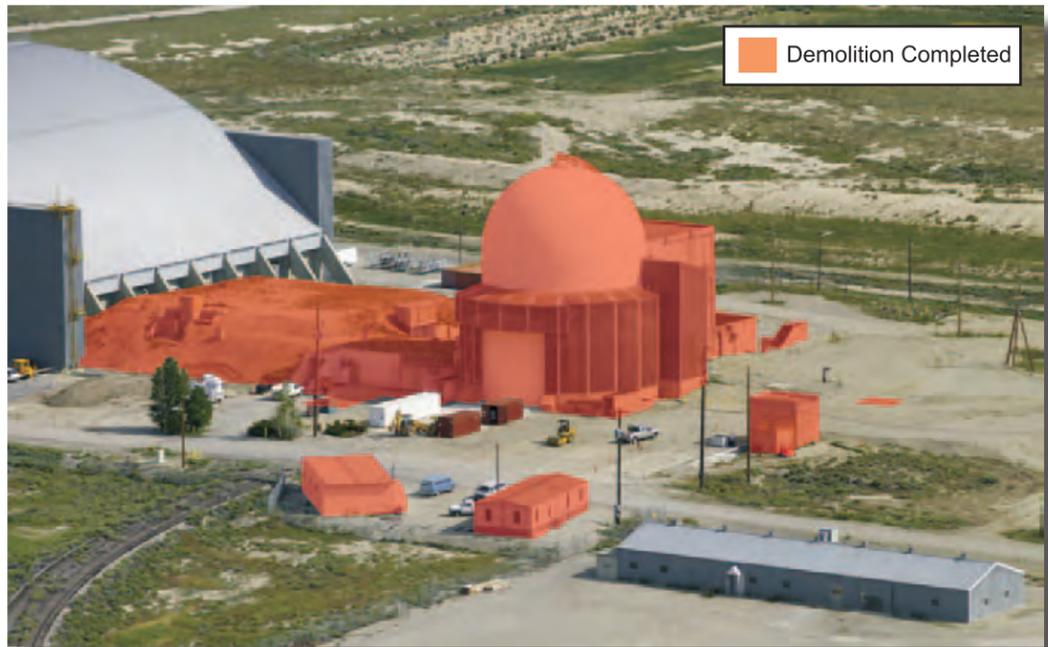


Figure B. Loss-of-Fluid Test Reactor at Test Area North (TAN)

Ongoing TAN Activities

Ongoing activities at TAN include:

- 1) Manufacturing armor for the U.S. Army's M1 Abrams Main Battle Tanks, at the Specific Manufacturing Capability facility.
- 2) Treating ground water to reduce volatile organic compound contamination in the aquifer. This groundwater remediation is performed by using in-situ bioremediation, pump-and-treat methods, and monitored natural attenuation.

Environmental Contamination at TAN

Liquid wastes from operations at TAN-TSF were discharged into ground water through an injection well from 1953 to 1972. These liquid wastes included chlorinated organic solvents that contained dissolved strontium-90, cesium-137, tritium, and uranium. Since 1999, DOE has been using several *ground water remediation techniques* to treat ground water at TAN.

Currently, concentrations of chlorinated organic solvents (primarily trichloroethylene and tetrachloroethylene) and strontium-90 exceed Idaho Ground Water Quality standards*. In-situ bioremediation and pump-and-treat remediation activities have been used at TAN-TSF to reduce these contaminants. Monitored natural attenuation is being used to determine if long-term cleanup goals can be met without restarting in-situ bioremediation or pump-and-treat activities.

The Idaho Department of Environmental Quality (DEQ) collects and analyzes samples from 12 aquifer wells in and around TAN to monitor contaminant concentrations and trends.

* Idaho Ground Water Quality standards are derived from Environmental Protection Agency drinking water Maximum Contaminant Levels (MCLs).

Ground Water Remediation Techniques

in-situ bioremediation – Microbes that are naturally in the groundwater are provided nutrients to increase their growth, which increases their ability to breakdown organic solvents in ground water.

pump-and-treat – Contaminated ground water is pumped from the area with the highest concentration of contaminants, treated to remove these contaminants, and pumped back into the ground at another location.

monitored natural attenuation – Ground water is monitored to determine if naturally occurring microbes in the soil—without additional nutrients provided to increase the microbial growth—are adequately breaking down organic solvents to meet long-term cleanup goals.

Advanced Test Reactor (ATR) Complex

The DOE has completed demolition of 20 facilities at the ATR Complex. An additional 12 facilities are scheduled for demolition (see Figure D).



Figure D. Advanced Test Reactor (ATR) Complex

The ATR Complex History

The ATR Complex, formerly known as the Reactor Technology Complex and Test Reactor Area, has served as a focal point in the INL's energy research mission for over 50 years. Three major test reactors have operated at the ATR Complex: the Materials Test Reactor (MTR) (1952-1970), the Engineering Test Reactor (ETR) (1957-1982), and the Advanced Test Reactor (ATR) (1967-present).

The MTR was the second reactor operated at the INL Site*. The MTR was used to test metals and components for use in reactors. Prior to the operation of the MTR, little was known about how high levels of radiation would affect metals and components in an operating reactor. The MTR is currently being demolished.

The ETR provided more testing space and more flexibility than the MTR. When it started up, the ETR was the largest and most advanced materials test reactor in the world. The reactor was used to evaluate characteristics of fuels, coolants, and moderators in environments similar to those in many types of nuclear power reactors. Demolition of the ETR has been completed.

*The Experimental Breeder Reactor No. 1 (EBR-I), now a Registered National Historic Landmark, was the first reactor operated at the INL site.

Ongoing ATR Complex Activities

In support of the INL's nuclear energy research mission, operating the Advanced Test Reactor is the main activity at the ATR Complex. This reactor is used to study the effects of radiation on fuels and materials used in nuclear reactors. To determine how fuels and materials react when bombarded by streams of neutrons and gamma rays under a variety of pressure and temperature conditions, the ATR creates a wide range of reactor environments in which to run experiments and tests. Years would be required to gather this information from normal reactor operations, but it can be obtained in a matter of weeks or months using the ATR. The ATR also produces nuclear isotopes for medical and industrial uses.

Environmental Contamination at the ATR Complex

Historic operations at the ATR Complex included waste disposal to unlined ponds and an injection well. This resulted in contaminated soils and ground water beneath the ATR Complex. Use of unlined ponds and the injection well have been discontinued. Currently, there are no contaminants detected at levels that exceed Idaho Ground Water Quality standards in the ground water beneath the ATR Complex.

DEQ collects and analyzes samples from four aquifer wells in and around the ATR Complex to monitor contaminant concentrations and trends.

Power Burst Facility (PBF)

The PBF supported a reactor located outside the five major INL Site areas noted in this publication (see INL site map for location). Built in 1972, the PBF supported studies of reactor fuel during normal and off-normal operating conditions. At the PBF, fuel samples could be subjected to extraordinary power surges, in just milliseconds, causing the fuel to fail so it could be studied. This information was used to develop safe operating limits for the commercial nuclear industry. In 1998, the PBF was placed in shutdown status and defueled.

Demolition of the two facilities associated with PBF was completed in 2008 (see Figure E). There are no contaminants detected in the ground water beneath PBF that exceed Idaho Ground Water Quality standards.



Figure E. Power Burst Facility (PBF)

Radioactive Waste Management Complex (RWMC)

The DOE has completed demolition of 19 facilities at the RWMC. An additional 7 facilities are scheduled for demolition (see Figure F).



Figure F. Radioactive Waste Management Complex (RWMC)

RWMC History

The RWMC was established in 1952 as a burial location for radioactive waste generated on the INL Site. From 1954 to 1970, transuranic waste from the DOE Rocky Flats Site in Colorado was also buried at the RWMC. Transuranic waste received from Rocky Flats after 1970 was retrievably stored at the RWMC for future transfer out of Idaho.

Ongoing RWMC Activities

RWMC has multiple ongoing activities including:

- 1) Disposal of remote-handled low-level waste generated by the INL Site.
- 2) Packaging, certification, and shipment of retrievably stored transuranic waste to the Waste Isolation Pilot Plant (WIPP) in New Mexico.
- 3) Excavation, treatment, and disposal of targeted waste from pre-1970 waste burial pits.
- 4) Extraction and treatment of chlorinated organic solvent vapors from soil above the aquifer using a vapor extraction process.
- 5) Implementation of the final remedial action for the RWMC burial grounds, including the future placement of an evapotranspiration surface barrier (see side bar on next page) over the burial grounds.

Environmental Contamination at the RWMC

Historical waste disposal practices resulted in the release of contaminants to soil and ground water below the RWMC. Ground water beneath the RWMC contains concentrations of carbon tetrachloride (a chlorinated organic solvent) that are above Idaho Ground Water Quality standards. The DOE expects that continuing current remedial actions, along with implementing the planned final remedial actions, will bring these contaminant levels to below Idaho Ground Water Quality standards.

DEQ samples five aquifer wells in and around the RWMC to monitor contaminant concentrations and trends.

Idaho Nuclear Technology and Engineering Center (INTEC)

The DOE has completed demolition of 57 facilities at INTEC. An additional 82 facilities are scheduled for demolition (see Figure C).



Figure C. Idaho Nuclear Technology and Engineering Center (INTEC)

INTEC History

The INTEC was established in the 1950s to recover (reprocess) uranium from spent nuclear fuel. Reprocessing continued until 1992 and recovered more than a billion dollars worth of highly enriched uranium. Reprocessing also generated more than 8 million gallons of highly radioactive liquid waste. Of this, 7 million gallons were converted to a solid granular high-level (highly radioactive) waste material called calcine, which is stored at the INTEC awaiting final disposition outside of Idaho. The remaining liquid waste, which is less radioactive and is referred to as sodium-bearing waste, is stored at INTEC awaiting treatment by solidification.

The DOE recently cleaned and grouted 11 storage tanks that formerly held highly radioactive liquid waste at the INTEC Tank Farm. Grouting reduces the mobility of residual contaminants so they are significantly less likely to get into the environment.

Ongoing and Future INTEC Activities

In addition to demolition of facilities, ongoing activities at INTEC include:

- 1) Moving spent nuclear fuel from water basins to dry storage to await final disposition outside of Idaho.
- 2) Constructing the Integrated Waste Treatment Unit (IWTU) to treat sodium-bearing liquid waste.
- 3) Packaging remote-handled transuranic waste for shipment to the Waste Isolation Pilot Plant in New Mexico.
- 4) Conducting remedial activities to control soil contamination, including the future placement of an evapotranspiration surface barrier over the INTEC Tank Farm and adjacent areas.

Environmental Contamination at INTEC

In the past, liquid wastes were disposed through an injection well and unlined ponds, which resulted in contamination of soil and ground water beneath the INTEC. Waste spills at the INTEC Tank Farm added to these contamination problems. Additionally, service water piping leaks, grass watering, and rain provided water to transport contaminants through soil into the aquifer. DOE has significantly reduced the sources of contamination and water to transport the contamination, resulting in an improvement of ground water quality. However, levels of strontium-90, technetium-99, and nitrates still exceed Idaho Ground Water Quality standards. DOE expects that continuation of current remedial actions and implementation of future remedial action will bring these contaminant levels below Idaho Ground Water Quality standards by 2095.

An *evapotranspiration surface barrier* is designed to direct moisture away from the buried contamination, and to store excess moisture until it evaporates or is absorbed by plants. This reduces the amount of water available to pass through the waste and mobilize contamination.

DEQ samples eight aquifer wells in and around the INTEC to monitor the contaminant concentrations and trends.

Materials and Fuels Complex (MFC)

Demolition work at the MFC will be accelerated due to money received under the American Recovery and Reinvestment Act. Demolition of eight facilities is planned at the MFC (see Figure G).



Figure G. Materials and Fuels Complex (MFC)

MFC History

The MFC, formerly known as Argonne National Laboratory-West, was established in 1949 with construction of the Experimental Breeder Reactor II (EBR-II) and associated facilities. The MFC has since evolved into a national research center for advanced technologies associated with nuclear power systems. As well as the EBR-II, the MFC hosted other reactor facilities including the Transient Reactor Test facility (TREAT) and the Zero Power Physics Reactor (ZPPR).

The EBR-II operated for 30 years, providing power and serving as a point of research for reactor development and testing. The EBR-II is one of the facilities scheduled for demolition.

The TREAT is a graphite-moderated, pulse-type test reactor that was used for transient testing of fuels and materials. The TREAT was used for testing the performance of materials in a nuclear reactor, especially during power excursions. The TREAT is currently in standby status.

The ZPPR facility was used to test reactor design features for different fuel materials and configurations. The ZPPR had a unique design which allowed it to open into two halves. Experimental materials were placed into each half and brought into proximity with each other when the reactor was closed. The ZPPR is being decommissioned and the building that housed it will be used for other activities.

Ongoing MFC Activities

The DOE maintains and operates nuclear facilities at the MFC crucial for the advancement of nuclear energy technology research and development. Major activities at the MFC include:

- 1) Research and development associated with nuclear reactor fuels.
- 2) Constructing and evaluating prototypes of new nuclear reactor fuels.
- 3) Reprocessing sodium-bonded spent nuclear fuel using electrometallurgical treatment.
- 4) Examining nuclear materials to determine how well they have withstood introduction into nuclear reactors.
- 5) Characterization, packaging, and disposal of radiological waste from current and past research activities.
- 6) Producing radioisotope power systems (space batteries) for use in NASA space programs.

Environmental Contamination at the MFC

Historic operations at the MFC used several waste water infiltration ponds for disposal of liquid wastes. These infiltration ponds are no longer in use. Currently, there are no contaminants being detected at levels that exceed Idaho Ground Water Quality standards in the ground water beneath the MFC.

The DEQ collects and analyzes samples from two wells and two effluent sites at the MFC to monitor contaminant concentrations and trends.

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Cleanup at the Idaho National Laboratory Demolition of Excess Facilities



Many buildings previously used for nuclear research at the Idaho National Laboratory are decades old and no longer in use. DOE is in the process of demolishing about 250 of these excess facilities.

Demolition of excess facilities at Test Area North on the Idaho National Laboratory Site

Additional information about the DEQ INL Oversight Program can be obtained at www.deq.idaho.gov/inl_oversight/index.cfm or by calling 1-800-232-4635. This publication and previous DEQ-INL Oversight Program publications are also available at the same Web site. If you would like to be on the mailing list for future issues of the DEQ-INL Oversight Program publications, please email us at INLoversight@cableone.net.