An analyst works with the gas manifold in a laboratory.

Analytical Research Laboratories

The Analytical Research Laboratories (ARL) at Idaho National Laboratory's Materials and Fuels Complex provide the chemical, radiochemical, physical and analytical data needed for various research and engineering development programs, and for applied research and engineering development activities supporting advanced nuclear fuel design, waste management, environmental and other INL programs.

The laboratories receive samples from across INL, as well as outside entities. These samples include irradiated and unirradiated fuels and materials, and samples needed for testing related to material accountability, radiation monitoring, process monitoring and environmental monitoring. The laboratories also support engineering development activities such as the preparation of samples for irradiation testing.

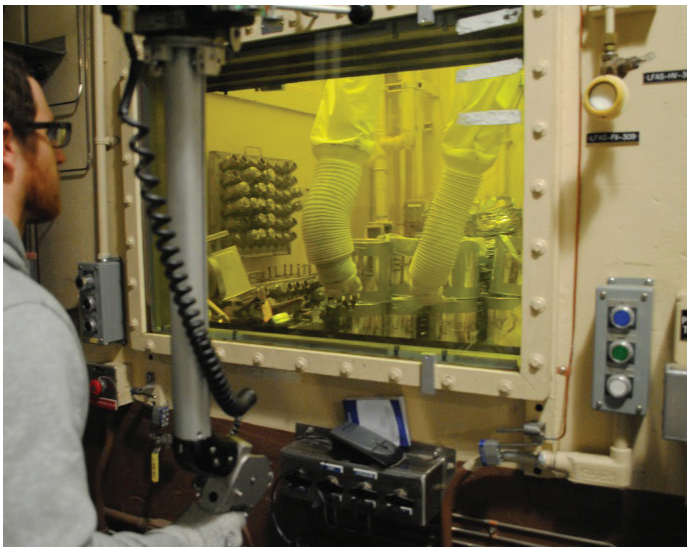
The main features and equipment in the labs' A-wing include six interconnected hot cells, gloveboxes, a chemistry laboratory, a 5-ton overhead bridge crane and other cask handling equipment. The primary features of the B-wing include state-of-the-art analytical instrumentation, general chemistry laboratories, air and inert atmosphere gloveboxes, fume hoods, counting rooms and assay equipment.

The ARL maintain equipment typical of a standard chemistry laboratory, including furnaces, X-ray diffractometers and equipment to test fundamental physical properties. The laboratories also host several unique fuel fabrication capabilities in the Casting Laboratory, including the INL-designed glovebox advanced casting system (GACS) furnace. This furnace casts metallic fuel samples containing transuranic elements with greater efficiency and less waste than previous designs.

BASIC CAPABILITIES:

- Analysis and characterization of as-built and post-irradiated nuclear fuels and reactor components.
- Analysis of hazardous, mixed, or highly radioactive waste, other waste forms, and samples.
- Analytical chemistry support for nuclear forensics.
- Determination of stable and radioisotopic content in a variety of matrices.
- Radioisotope separation.
- Characterization of engineered materials.
- Expertise in characterization of engineered materials and the nuclear fuel life cycle.

Idaho National Laboratory



An analyst receives samples in hot cell 1.

TECHNICAL INFORMATION

The mission of the ARL is to perform chemical, radiochemical and physical measurements, provide nondestructive analysis measurements and conduct applied research and engineering development activities that support advanced reactor design, waste management, environmental and other programs at MFC and INL. Our mission is accomplished through a broad range of analytical chemistry capabilities.

The ARL receive a variety of samples from across INL, as well as from outside entities. Sample types include liquids, solids, gases and irradiated/unirradiated fuels/materials related to research and development activities, material accountability, radiation monitoring, process monitoring and environmental monitoring. The labs also support engineering development and testing activities by creating unique standards and preparing samples for irradiation testing. ARL scientists possess a broad range of expertise as outlined below.

KEY EXPERTISE:

- Analysis and characterization of as-built and post-irradiated nuclear fuels, materials and reactor components
- Analysis of hazardous, mixed, or highly radioactive wastes, other waste forms and samples
- Analytical chemistry support for nuclear forensics.
- Burnup analyses.
- Determination of stable and radioisotopic content in a variety of matrices.
- Elemental/isotopic separation.
- Characterization of engineered materials and the nuclear fuel life cycle.
- Method development/ experimental design.

KEY CAPABILITIES/ INSTRUMENTATION:

- Six interconnected air atmosphere hot cells
- Gloveboxes
  - » Hot cell #1
  - » Shielded ICP-OES at hot cell #6
  - » Special projects
  - » Radiochemistry
  - » Waste form testing
  - » Casting lab
  - » Wet prep
  - » Fresh fuels
  - » CNO (carbon/ nitrogen/oxygen)
- Fume hoods
- Counting laboratories
  - » Gamma
  - » Alpha spec
  - » Gas flow proportional counters
  - » Liquid scintillation
  - » Low background counting laboratory in pre-WWII steel vault using low-background concrete
- Gas chromatograph
- Gas pressurized extraction chromatography (GPEC) (manual and automatic)
- Gas mass spectrometer (portable)
- High resolution multi-collector fission gas mass spectrometer (MC-GMS) (2022)
- Mass spectrometers
  - » Inductively coupled plasma (Quad-ICP-MS)
  - » High-resolution inductively coupled plasma (HR-ICP-MS)
  - » Multi-collector inductively coupled plasma (MC-ICP-MS)
  - » Inductively coupled plasma time of flight (ICP-TOF)
  - » Thermal ionization mass spectrometer (TIMS)
- Elemental analysis
  - » Optical emission (ICP-OES)
  - » Femtosecond laser-induced breakdown spectrometer (fs-LIBS)
- Light element (CSONH) combustion and inert fusion analyzers
- Capillary electrophoresis (CE)
- High performance liquid chromatography (HPLC)
- X-ray fluorescence (XRF)
- Microwave-assisted digestor
- 3D laser scanning confocal microscope
- 4K digital microscope
- Hot cell particle picking microscope
- Hot cell entrained gas collector
- Mass separator (rad and non-rad)
- Non-destructive barrel scanner
- Hot uniaxial press (HUP), muffle, well, and tube furnaces
- Glovebox advanced casting system (GACS) furnace
- Wet chemistry laboratories

FOR MORE INFORMATION

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