Analytical Support for Waste Characterization

John M. Keller

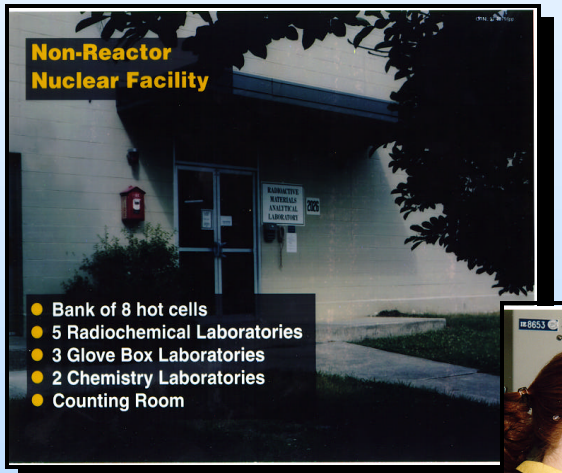
Radioactive Materials Analytical Laboratory (RMAL), Building 2026
Chemical & Analytical Sciences Division (CASD)
Oak Ridge National Laboratory (ORNL)

For questions or more information

phone:	**(423) 574-4885**
fax:	**(423) 574-7404**
e-mail:	**juk@ornl.gov**
web:	**http://www.ornl.gov/rmal/rmalhome.htm**

Analytical Support for Waste Characterization

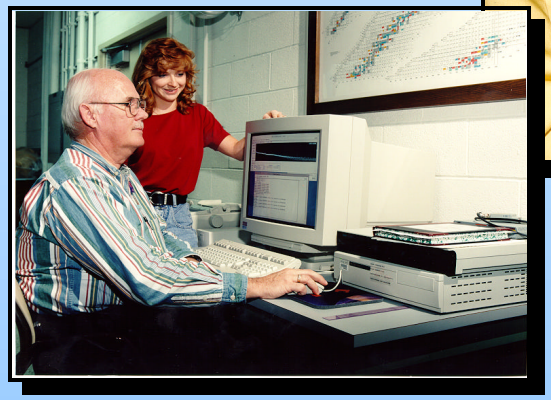
Typical Operations available to support Analytical Chemistry needs for Environmental Restoration and Waste Management



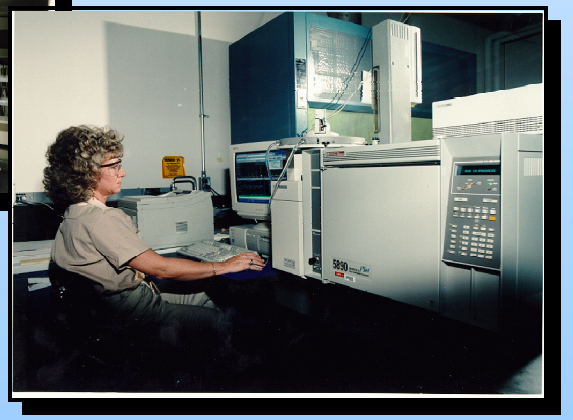
RMAL, Building 2026

ICP & GFAA Lab

ICP-MS Lab



Counting Lab



GC-MS Lab

Analytical Support for Waste Characterization

Radioactive Materials Analytical Laboratory Mission

I. Applied R&D in selected areas of Analytical Chemistry involving radioactive materials.

- Radiochemistry (alpha, beta, gamma, neutron, etc.)
- Inorganic Chemistry (metals, anions, isotopic ratios, etc.)
- Organic Chemistry (VOA, SVOA, NH-VOA, PCB)
- Physical Measurements (TDS, TSS, density, etc.)
- Rheometry (viscosity, shear strength, flow properties, etc.)

Analytical Support for Waste Characterization

Radioactive Materials Analytical Laboratory Mission

II. ORNL R&D, Environmental Restoration, and Waste Management support for the characterization of radioactive materials.

- Waste treatment options
- Regulatory requirements (SW-846, RCRA, TCLP,etc.)
- Waste classification (TRU, RCRA, TSCA, etc.)
- Criticality ("denature ratios", ^{235}U or ^{239}Pu equivalent)
- Special experiments/projects

Analytical Support for Waste Characterization

Quality Assurance (QA)

- ✔ **Group & Facility Quality Assurance Plans (QAP)**
  Staff experienced with high rigor, graded approach, DQOs, N&S process, and WSS.

- ✔ **Calibrations & Certifications addressed in QAP and procedures.**

- ✔ **Training addressed in QAP and Nuclear Facility Training Plan.**

(Note: Documents above available on request.)

Analytical Support for Waste Characterization

RMAL has generated almost all of the inorganic, organic, radiochemical, and physical data available for the LLLW storage tanks located throughout the ORNL site. RMAL staff has either prepared technical reports on the characterization of these waste tanks or worked closely with other ORNL staff and subcontractors to prepare data reports for these systems. The major tank groupings characterized to date include the following:

Gunite and Associated Tanks (GAAT):	North tank farm (W1, W2, W3, W4) South tank farm (W5, W6, W7, W8, W9, W10, W11) Tank TH4 which is east of south tank farm
Melton Valley Storage Tanks (MVST):	W24 through W31
Bethel Valley Evaporator Service Tanks (BVEST):	C1, C2, W21, W22, and W23
Old Hydrofracture Tanks (OHF):	T1, T2, T3, T4, and T9
Federal Facility Agreement (FFA) tanks:	WC-2, WC-4, WC-5, WC-6, WC-8, WC-10 through WC-14, WC-16, WC-20, W16, W17, W18, W19, W20, TH1, Th2, Th3, 2026A, 3003A, F-201, HFIR, T-1, T-2, etc.

(Reports on many of these tanks systems are available on the RMAL Home Page)

Analytical Support for Waste Characterization

In addition to the analytical chemistry support, RMAL also provides video, photographic, and digital image documentation of samples taken from the ORNL waste tanks. Visual documentation has been very useful for waste tank characterization because so many of the sludge samples are unique or have unusual physical properties. Engineers have used our video clips to better understand the sludge flow properties. Some sludge and supernatant examples are provided below:

Analytical Support for Waste Characterization

Important points to consider...

- **The RMAL staff not only provides analytical data, but they also have the in-house expertise and experience to evaluate the results and ensure that the data is useful and appropriate for the project requesting the work.**

- **There are many options available to the customer ranging from compliance/regulatory measurements to detailed characterization for engineering support, criticality control, waste classification, and waste certification.**

- **The analytical data and quality needs vary widely for these different applications. For example, the data quality objectives for waste storage verses waste certification are significantly different in both the level of quality required and the corresponding analytical cost.**

Analytical Support for Waste Characterization

More points to consider...

- The RMAL staff has many years experience selecting the best analytical method to provide the data needed by a project.

- The RMAL staff has been involved with both DOE and EPA on the national level for over ten years to develop analytical methodology for the characterization of radioactive waste. The RMAL staff has made significant contributions to the DOE Methods Compendium, EPA SW-846 Updates, DOE/CAO QAPP, and many national policies dealing with radioactive waste.

- Many of the standard analytical methods expected by the regulatory world DO NOT WORK on the typical high pH and high nitrate waste generated by DOE nuclear processes. The RMAL staff knows what will and will not work and has developed the necessary modifications and clean-up methods to satisfy regulatory requirements and meet the needs for engineering staff developing waste processing options such as grouting and vitrification.

Analytical Support for Waste Characterization

More points to consider...

- **The cost and risk associated with collecting highly radioactive samples demands that the analytical work be right the first time.**

- **The radiochemical hazards associated with DOE waste require specialized facilities and experienced personnel to ensure the safety of chemists and technicians performing the analytical measurements. The RMAL is equipped to handle the full range of containment from hot cells to glove boxes to radiochemical hoods, depending upon the activity level in the samples.**

- **The RMAL staff have demonstrated an excellent safety record for laboratory operations during the past several years. During this period almost every radioactive waste tank located at ORNL has been safely sampled and characterized by the RMAL.**

Analytical Support for Waste Characterization

SUMMARY...

- Analytical facilities and laboratories available and in operation. On-site, quick turn-around analysis when needed. Expert advice available on most chemical, radiochemical, and waste related problems.

- Staff experienced with full range of radioactivity; from environmental to high level gamma, beta, alpha or neutron. State-of-the-art counting facilities with gamma/alpha spectrometry, low-level alpha/beta counting, and liquid scintillation counting.

- Expensive capital equipment is available and in operation for radioactive samples. (ICP-AES, ICP-MS, GC-MS, TIMS, NAA, hot cells, analytical glove boxes, etc.)

Analytical Support for Waste Characterization

SUMMARY...

- The inventory of radionuclides handled by the RMAL for the purpose of waste characterization requires the facility to be operated as a DOE Category 3 Hazard - Non-Reactor Nuclear Facility. This type of hazard classification results in "high-rigor" requirements for safety, QA, oversight, and facility operations. This added level of rigor translates into higher analytical costs and liability (PAAA), especially when compared to the corresponding cost/risk for an environmental level laboratory operation.

- Radioactive Liquid & Solid waste disposal systems in-place and fully operational (no return of analytical samples).

- Analytical staff experienced with "high-rigor" QA if needed. Staff understands high costs associated with QA. Staff works with the customer to develop right level of rigor to avoid unnecessary cost.

Analytical Support for Waste Characterization

- For more information on the RMAL capabilities and other reference material on the characterization of ORNL radioactive waste refer to our home page on the web at the following address:

http://www.ornl.gov/rmal/rmalhome.htm

or

contact any of the following for more help

John Keller <juk@ornl.gov>
Joe Giaquinto <g35@ornl.gov>
Jim Stokely <xjs@ornl.gov>
Norman Teasley <ntj@ornl.gov>