



EMSL ANALYTICAL, INC.
TESTING LABS • PRODUCTS • TRAINING

STATEMENT OF QUALIFICATIONS

Laboratory Services

Updated February 2026



EMSL CANADA, INC.
LABORATORY • PRODUCTS • TRAINING



ABOUT EMSL ANALYTICAL, INC.

EMSL

As the nation's leading environmental testing firm, **EMSL Analytical, Inc.** has been providing quality analytical services since 1981. We offer a wide array of analytical testing services to support environmental investigations focused on asbestos, microbiology, lead paint, environmental chemistry, indoor air quality, industrial hygiene and food testing. Additionally, we also provide materials testing, characterization, and forensic laboratory services for a wide range of commercial, industrial, regulatory, and law enforcement clients. Our unmatched capacity coupled with a company-wide focus on customer satisfaction makes no project too large or too small. Our corporate research and development capabilities allow us to bring new methodologies on line quickly to meet new industry challenges and client needs. In recruiting and retaining talented and motivated scientists on a national scope, our expertise is marshaled throughout a nationwide network of analytical laboratories. We are committed to providing reliable, defensible data in a standardized and user-friendly format. Rapid turnaround and competitive prices make the dependable results you get that much more valuable.

At EMSL, we're much more than another testing laboratory. We are your project partner!

Overview of EMSL Service Divisions



Asbestos

Asbestos analysis of air, water, bulk, soil and/or dust sample via various methodologies including NIOSH, EPA, OSHA, ASTM, etc., and utilizing PCM, PLM, TEM, SEM, XRD, and STEM.



Radiochemistry

Analysis of various matrices including food, water, soil, vegetation, and other unique sample types for radioactivity. We also possess a liberal radioactive materials license able to handle most environmental radioactive needs when submitting samples for analysis.



Lead and Metals

Testing services include Flame AA, and ICP. We test for lead in paint chips, soil, wipes, drinking water, waste water, and air.



Air Toxics

Testing services for VOCs in air, water and soil, and consumer products. We also provide chamber studies for consumer product off-gassing analyses to understand what products are emitting and comply with regulations.



Microbiology

Testing Services include the analysis of fungi (mold), bacteria (*Legionella*, *E. coli*, *Salmonella*, *Listeria*, etc), mycotoxins, endotoxins, allergens, pollen, and particulates in air, swab, water, soil, bulk, dust, wipe, food, and consumer products.



Consumer Product/Pharmaceutical

Through MPL Laboratories, we offer microbiology testing services for the pharmaceutical, medical device, cosmetic, personal care, and food industries. We are ISO/IEC 17025 accredited by PJLA, FDA and DEA registered, and NJDEP certified.



Industrial Hygiene

Testing Services for air, wipe, and bulk matrices on an extensive list of NIOSH, OSHA, ASTM, and EPA methods.



PCR-DNA

DNA and PCR laboratory services include bacteria, ERMI, fungi, and mold. for scientific, ecological, research, biological, microbiological, environmental, food, and botanical professionals.



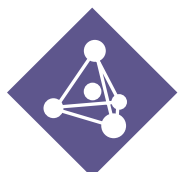
Environmental Chemistry

Instrumental and classical wet chemistry, ICP spectroscopy, microscopy, SEM and EDS analysis, FTIR analysis and more.



Training

EMSL offers an array of training, including on-line educational courses on our various Laboratory services, sampling videos, and in-person training.



Materials Science

Provides materials testing, characterization, and forensic laboratory services to help commercial, industrial, regulatory, and law enforcement clients develop solutions to challenges in manufacturing, quality assurance, and research and development.



Products

EMSL offers environmental products, equipment, and supplies for the field, to support each of our company divisions.



Food

Food laboratory capabilities include: microbiology analysis, nutritional analysis, various food chemistry analysis, allergens, toxins, and adulteration analysis.



Legal Services

EMSL employs highly qualified and experienced chemists, geologists, physicists, mycologists, microbiologists, biologists, materials scientists, and industrial hygienists; available as-needed for Legal support and Expert Witness.

EMSL DIAMOND STANDARD

EMSL

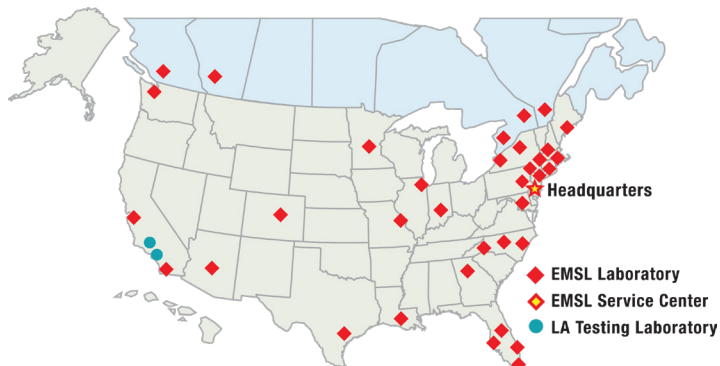
Our diverse staff of approximately 1,000 employees possess a wide range of expertise, educational background, and capabilities. These dedicated employees follow the lead and standard of care demonstrated by the owner and founder of the company, Dr. Peter Frasca, who, as a hands-on owner maintains daily involvement in our laboratory operations, and assures our work is consistent with his *EMSL Diamond Standard*. This “Diamond Standard” includes the following:

- ◆ **Quality Data** – Track, manage, report, and verify that the data from all our accredited testing services are accurate and reliable through quality programs and regulatory requirements.
- ◆ **Customer Dedication** – We strive to create lasting, mutually beneficial relationships with all clients. We solicit feedback from our clients and we are committed to responding quickly to any questions or concerns that may arise before, during, or after an assignment.
- ◆ **Analytical Expertise** – We employ highly qualified and experienced chemists, geologists, physicists, mycologists, microbiologists, biologists, materials scientists, and industrial hygienists to enhance our analytical abilities and expertise.
- ◆ **Integrity and Ethics** – We insist that our employees uphold the highest standard of ethics. We maintain a “no-compromise” policy as it pertains to any ethical issue.
- ◆ **Responsiveness** – We recognize that the timeliness of a report is as important as the quality of the data. We will not however, allow deadlines or the rush needs of a project to adversely impact our quality objectives.
- ◆ **Technology** – We recognize the importance of new technology to better enable us to provide improved services. Online access to your data, customized reports, sample control/processing through our Laboratory Information Management System (LIMS), and analytical instrumentation are continuously upgraded to enable continuous improvement of our services and capabilities.
- ◆ **Value** – We believe that a business relationship with EMSL provides you with an excellent value. We provide you with a complete value package that includes all the components of the *EMSL Diamond Standard*.

LOCALLY FOCUSED, NATIONALLY RECOGNIZED

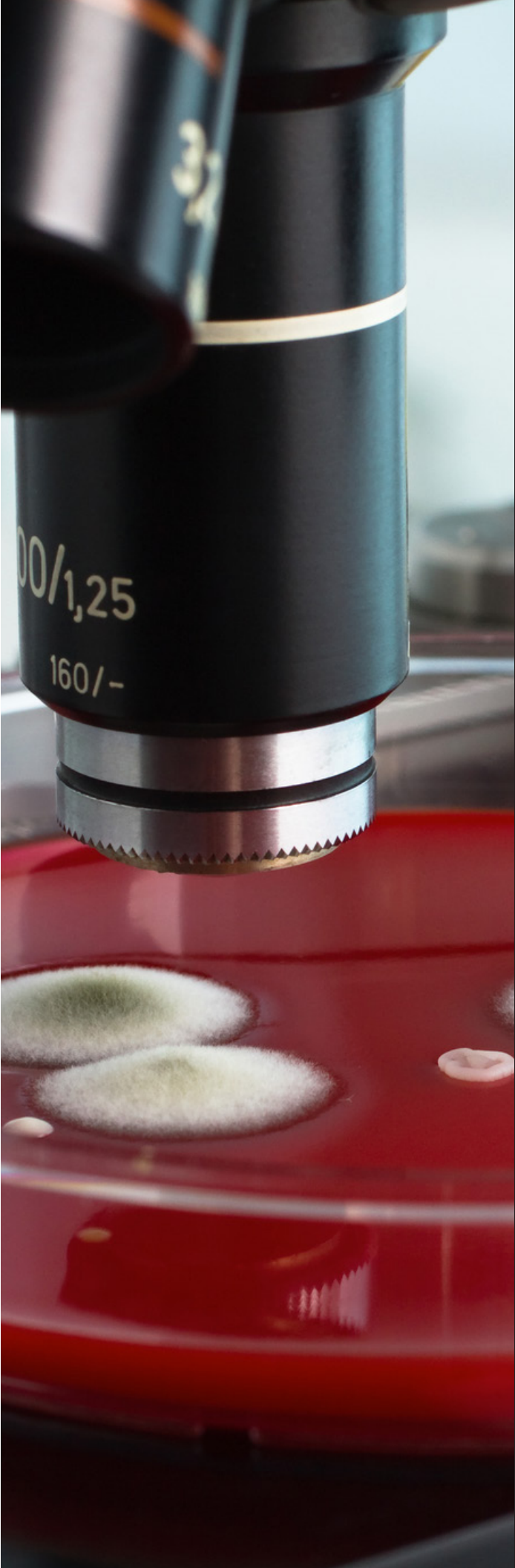
Unmatched capacity from our collective strength of nationwide locations.

United States and Canada Locations



EMSL Analytical, Inc. has been fortunate to be able to maintain a solid history of stable growth and viability for over 45 years with a current network consisting of 38 laboratories and 1 service center.

See the laboratory locations listing on page five and six.



*Corporate Headquarters for EMSL
Analytical, Inc. and LA Testing,
Cinnaminson, NJ USA*

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EMSL LOCATIONS

EMSL

Arizona – Phoenix (1,2,6,7,8,11)
Asbestos, Legionella and Mold Testing
 3356 West Catalina Drive, Phoenix, AZ 85017
 Tel: 602-276-4344

California – Huntington Beach (1,2,3,4,7,11)
LA TESTING
Asbestos, Metals, Legionella, Mold, Bacteria, TO-15, and Industrial Hygiene Testing (Silica, Organics, etc.)
 5431 Industrial Drive, Huntington Beach, CA 92649
 Tel: 714-828-4999

California – South Pasadena (1,2,3,6,7,11)
LA TESTING
Asbestos, Mold, Bacteria, Legionella and Materials Testing
 520 Mission Street, South Pasadena, CA 91030
 Tel: 800-303-0047

California – San Diego (1,6,7,11)
Asbestos and Mold Testing
 7725 Convoy Court, San Diego, CA, 92111
 Tel: 858-499-1303

California – San Leandro (1,2,3,7,11)
Asbestos, Lead, Legionella and Mold Testing
 464 McCormick Street, San Leandro, CA 94577
 Tel: 888-455-3675

Colorado – Denver (1,2,8)
Asbestos, Legionella and Mold Testing
 1010 Yuma Street, Denver, CO 80204
 Tel: 303-740-5700

Connecticut – Meriden (1,2,7,8,10)
Asbestos, Mold, Bacteria, Personal Care Products and Legionella Testing
 165 Gracey Ave, Meriden, CT 06451
 Tel: 203-284-5948

Florida – Fort Lauderdale (1,2,8)
Asbestos and Mold Testing
 2700 West Cypress Creek Road, Suite C108
 Fort Lauderdale, FL 33309
 Tel: 954-786-9331

Florida – Miami (1,2,8)
Asbestos and Mold Testing
 Skylake Executive Industrial Park
 19501 NE 10th Avenue, Bay A, N. Miami Beach, FL 33179
 Tel: 305-650-0577

Florida – Orlando (1,2,3,4,6,7,8)
Asbestos, Metals, Legionella, Mold, Bacteria, and Lead Testing
 3303 Parkway Center Court, Orlando, FL 32808
 Tel: 407-599-5887

Florida – Tampa (1,6)
Asbestos, Mold, and Food Testing
 5406 Hoover Blvd, Ste 21, Tampa, FL 33634
 Tel: 813-280-8752

Georgia – Atlanta (1,2,7,8)
Asbestos, Mold, Legionella and Bacteria Testing
 2205 Corp. Plaza Pkwy. SE, Suite 200, Smyrna, GA 30080
 Tel: 770-956-9150

Illinois – Chicago (1,2,3,4,7,8)
Asbestos, Metals, Legionella, and Mold Testing
 4140 Litt Drive, Hillside, IL 60162
 Tel: 773-313-0099

Indiana – Indianapolis (1,2,3,4,6,7,8,10,11)
Asbestos, Metals, Mold, Legionella, Bacteria, Environmental Chemistry, Food Micro and Industrial Hygiene (Organics, Hex Chrom., Silica) Testing
 6340 Castleplace Drive, Indianapolis, IN 46250
 Tel: 317-803-2997

Louisiana – Baton Rouge (1,6,8)
Asbestos, Lead and Mold Testing
 18369 Petroleum Drive, Baton Rouge, LA 70809
 Tel: 225-755-1920

Maine – South Portland (1,6,8)
Asbestos and Mold Testing
 161 John Roberts Road, South Portland, ME 04106
 Tel: 207-517-6921

Maryland – Beltsville (1,2,3,6,7)
Asbestos, Lead, Mold and Bacteria Testing
 10752 Baltimore Avenue, Beltsville, MD 20705
 Tel: 301-937-5700

Massachusetts – Boston (1,2,3)
Asbestos, Lead, Mold and Bacteria Testing
 5 Constitution Way, Unit A, Woburn, MA 01801
 Tel: 781-933-8411

Minnesota – Minneapolis (1,2,3,4,7,8)
Asbestos, Bacteria, Metals, Legionella, Mold, IH and Food Testing
 3410 Winnetka Avenue North, New Hope, MN 55427
 Tel: 763-449-4922

Missouri – St. Louis (1,3,4,6,11)
Asbestos, Metals, Mold, Food Micro and Bacteria Testing
 100 Green Park Industrial Court, St. Louis, MO 63123
 Tel: 314-577-0150

New Jersey – Cinnaminson (1,2,3,4,5,6,7,8,10,11)
Corporate Headquarters
Asbestos, Lead & Metals, Mold, Bacteria, Legionella, Radiochemistry, Environmental Chemistry, PCR, Food Micro, Industrial Hygiene (Organics, Metals, Hex Chrom., Silica, etc.), Food Chemistry, Materials Testing, Pharmaceutical and TO-15 Testing
 200 Route 130 North, Cinnaminson, NJ 08077
 Tel: 800-220-3675

New Jersey – Piscataway (1,2,7,8,10)
Asbestos and Mold Testing
 1056 Stelton Road, Suite 5, Piscataway, NJ 08854
 Tel: 732-981-0550

New Jersey – Sparta
cGMP, Pharma and Personal Care Products Testing
 12 Wilson Drive, Sparta, NJ 07871
 Tel: 973-300-9715



New York – Buffalo (1,2,7,8,10)
Asbestos, Legionella, Bacteria and Mold Testing
 490 Rowley Road, Depew, NY 14043
 Tel: 716-651-0030

EMSL LOCATIONS

The EMSL logo is a red diamond shape with the letters "EMSL" in white, bold, sans-serif font inside it.

New York – Carle Place (1,2,3,4,7,8,10,11)
Asbestos, Legionella, Lead and Mold Testing
528 Mineola Avenue, Carle Place, NY 11514
Tel: 516-997-7251

New York – New York City/Queens (1,2,3,4,7,8,10)
Asbestos, Mold, Legionella and Bacteria Testing
10-39 45th Road, Long Island City, NY 11101
Tel: 212-290-0051

New York – Manhattan
Service Center
325 West 38th Street, Suite 202, New York, NY 10018
Tel: 646-755-3456

New York – Rochester (1,2,8,10)
Asbestos Testing
2975 Brighton Henrietta Town Line Rd, Building 100, Suite 130
Rochester, NY, 14623
Tel: 585-957-9436

North Carolina – Charlotte (1,2,3,4,8)
Asbestos, Lead & Metals, Bacteria,
Environmental Chemistry, Industrial Hygiene
(Organics, Metals) and Mold Testing
10801 Southern Loop Blvd., Pineville, NC 28134
Tel: 704-525-2205

North Carolina – Kernersville (1,2,4,8)
Asbestos, Lead and Mold Testing
706 Gralin Street, Kernersville, NC 27284
Tel: 336-992-1025

North Carolina – Raleigh (1,2,6,7)
Asbestos, Food Micro, Legionella, Bacteria and Mold Testing
2500 Gateway Centre Blvd., Suite. 600, Morrisville, NC 27560
Tel: 919-465-3900

Pennsylvania – Plymouth Meeting (1,2,3)
Asbestos and Mold Testing
5221 Militia Hill Road, Plymouth Meeting, PA 19462
Tel: 610-828-3102

Texas – Houston (1,2,4,6,7,8)
Asbestos, Food Micro, Mold, Lead, Legionella and Bacteria Testing
5950 Fairbanks North Houston Road, Houston, TX 77040
Tel: 866-318-3920

Washington – Seattle (1,2)
Asbestos and Mold Testing
5900 4th Ave. S., Suite 100, Seattle, WA 98108
Tel: 206-269-6310

CANADA LABORATORIES



EMSL CANADA, INC. - Toronto, Ontario (1,2,3,4,7,8)
Asbestos, Industrial Hygiene (Organics, Metals,
Silica), Lead & Metals, Radon and Mould Testing
2756 Slough Street, Mississauga, ON, L4T 1G3
Tel: 289-997-4602

EMSL CANADA, INC. - Calgary, Alberta (1,8,9)
Asbestos, Lead, and Mould Testing
416 Meridian Road Southeast, Building C, Calgary, AB T2A 1X2
Tel: 403-879-1149

EMSL CANADA, INC. - Ottawa, Ontario (1,8,9)
Asbestos and Mould Testing
22 Antares Drive, Unit C, Ottawa, ON, K2E 7Z6
Tel: 343-882-6076

EMSL CANADA, INC. - Montreal, Quebec (1,8)
Asbestos and Mould Testing
4210 rue Seré, Ville Saint-Laurent, QC, H4T 1A6
Tel: 438-338-9142

EMSL CANADA, INC. - Vancouver, British Columbia (1,8,9)
Asbestos and Mould Testing
7964 Winston Street, Suite 200, Burnaby, BC, V5A 2H5
Tel: 604-757-3158

(1) NVLAP Accredited*
(3) AIHA IHLAP Accredited*
(5) NELAC Accredited*
(7) CDC ELITE - Legionella*
(9) CALA Accredited*
(11) CA ELAP Accredited*

(2) AIHA EMLAP Accredited*
(4) AIHA ELLAP Accredited*
(6) A2LA Accredited*
(8) IRSST Recognition*
(10) NY DOH/ELAP Accredited*

*Certifications/Accreditations summary may not be for a specific test or method requested and may be more broadly defined as a Field of Testing and/or Lab Division; Customer is responsible to verify specific accreditation parameters and up-to-date status of the referenced certification/accreditation. Current as of January 10, 2023.



COMMITMENT TO QUALITY

EMSL Analytical, Inc.'s laboratory services are governed by our Quality Assurance Program (QAP) of Policies and Procedures which is described in our Quality Management System (QMS) Manual. Where applicable, this program follows the quality guidelines as documented in ISO/IEC 17025:2017 as well as program requirements of the American Industrial Hygiene Association (AIHA), the National Voluntary Laboratory Approval Program (NVLAP), The NELAC Institute (TNI), and other applicable state and federal regulatory requirements associated with laboratory accreditations/certifications.

Our QMS has been designed to ensure that quality professional services and technical excellence is provided to our customers. It is a real and living program in that the QMS Policies and Procedures are integrated into our daily work and are continually reviewed and updated by the Management Team. It is formally reviewed at least annually by the National Director of Quality Assurance as well as formal reviews performed any time a problem arises that indicates a possible program flaw. In such instances, the National Director of Quality Assurance involves the Corporate Officers as well as National Directors, Regional Managers, Laboratory Directors, and Quality Assurance Department Personnel and Senior Analysts/Chemists to ensure that all necessary feedback is solicited and changes are made when necessary.

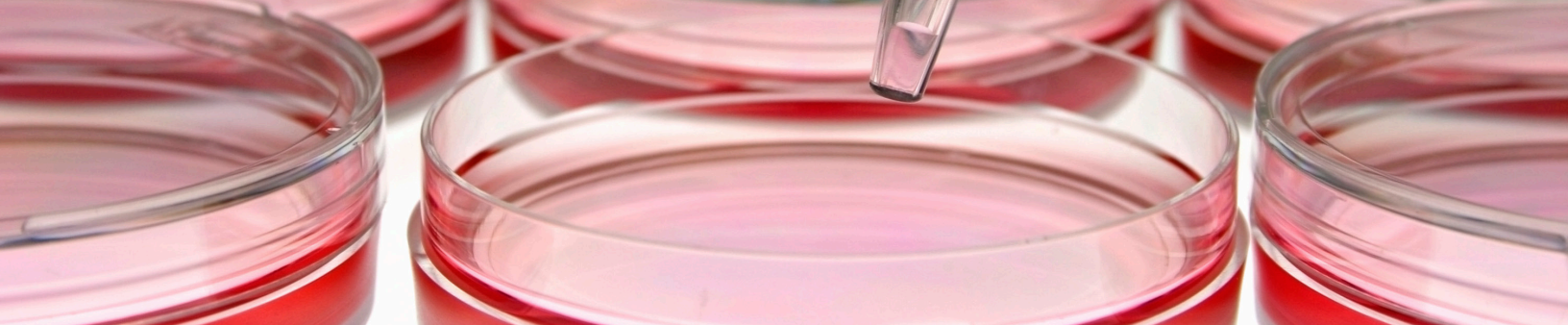
Organizational Responsibility and Commitment

The corporate headquarters of EMSL Analytical, Inc. operates out of the Cinnaminson, New Jersey laboratory location. The corporate headquarters oversees the laboratory operation at the Cinnaminson laboratory location as well as all of the 46 branch laboratories within the U.S. and Canada. The Corporate Management Team recognizes the importance of our Quality Assurance Program and understands that company success comes from its commitment to quality. Management's policy for the laboratory is to perform all work in a responsive and efficient manner without compromising quality. To accomplish this, the Corporate Management Team makes the necessary financial resources available for the necessary equipment and staffing to ensure the following Quality Assurance Program goals are achieved for tests covered under accreditation:

- Delivery of the highest quality of professional services and technical excellence to our customers.
- Provide legally defensible data of high quality in a responsive manner.
- Conformance with all approved analytical methodologies and Standard Operating Procedures (SOPs).
- Fulfillment of the requirements of the American Industrial Hygiene Association (AIHA), the National Voluntary Laboratory Approval Program (NVLAP), and/or The NELAC Institute (TNI).
- Conformance with corporate mandated Quality Assurances and Quality Control (QA/QC) requirements.
- Ensuring the standards documented in ISO 17025:2017 are upheld in all associated company business activities.

Key Components of EMSL's Quality Management System (QMS)

- 1. Use of Qualified and Properly Trained Staff**
 - Establishment of minimum qualifications for education and experience
 - Job descriptions of each position clearly delineating responsibilities
 - Establishment of formal training requirements
 - Ethics and integrity awareness training
- 2. Adherence to Standard Operating Procedures (SOPs)**
 - Good laboratory techniques that ensure a contamination-free environment
 - Assurance that national coherency is maintained
 - Proper documentation, document control, and record retention
 - Conformance with all approved analytical methodologies
 - Use of appropriate analytical technology including review of current literature to capture the latest applicable developments
 - Respect for customer confidentiality
 - A work atmosphere away from unreasonable productivity pressures
- 3. Extensive Quality Controls**
 - Constant oversight of laboratory quality performance
 - Internal and external quality audit programs
 - Proper documentation and quality review of analytical data
 - Participation in Round Robin and/or Proficiency Testing (PT) Programs
 - Method required calibration checks, use of reference standards, control blanks, replicate/duplicate sample analyses, etc.
 - Control of records and documents
 - Maintenance of accreditation and certification programs



TECHNICAL EXPERTISE

Analysis of environmental samples requires special skills that come from a combination of industry experience and academic credentials, coupled with formal training. The individual training requirements for each person is based on the complexity of the test(s) that will be performed by the individual. EMSL will only allow a scientist to independently analyze and report results after they have met the requirements of the training program. Our programs address both the technical scientific aspects of the analytical process as well as Ethics and Data Integrity Training as it pertains to the process of providing data and results to our customers.

Education and Experience

Minimum education and/or experience requirements are listed for each position within the company. Additionally, all technical staff (analysts, chemists, technicians, etc.) must successfully complete an EMSL training program prior to performing analysis independently.

Training Programs

Laboratory Managers are responsible for ensuring that appropriate training is provided to the technical staff and that they are qualified to perform the test method. At a minimum, training consists of formal instruction and hands-on training with the instruments as well as systems related to the analytical process and methods. Additionally, the training includes formal tracking and documentation of a person's "Demonstration of Capability" (DOC) which is required before they can independently process samples. Annually, ongoing training and review of ongoing demonstration of capability is performed.

Ongoing training is provided to all employees on a consistent basis which may include, but not be limited to, the following:

- **Laboratory Staff Meetings** – Typically includes a variety of topics, but often addresses technical updates on analytical methods, customer service training issues, health and safety incidents and training, etc.
- **Laboratory Audit Review** – Staff are encouraged to consult with internal and external auditors for advice on various topics related to the audit findings and recommendations and/or deficiencies.
- Workshops provided by professional organizations, agencies, and/or by instrument/equipment vendors.

Health and Safety Training

Health and Safety training is provided to all EMSL employees as described in our written Chemical Hygiene and Safety Plan. The Chemical Hygiene and Safety Plan defines work practices and procedures that ensure the employees of EMSL are protected from health risks associated with the potential exposure to hazardous chemicals and is compliant with the standard promulgated by OSHA entitled "Hazardous Work in Laboratories", 29CFR 1910.1450.

Code of Ethics Training

One of the objectives of the QMS is to ensure that staff of EMSL are provided information with regard to ethics as they pertain to laboratory operations. The goal of the EMSL ethics training and policy is for each staff member to understand their responsibility to provide true and accurate information and the consequences of unethical conduct. The QMS addresses the Code of Ethics by including the following:

- Specific guidelines and interpretations which define "Right and Wrong" as it relates to job related situations.
- Reinforcement of the consequences of unethical decisions and the understanding of the impact of our actions.
- Direction to employees to report or inquire about situations that may be ethically questionable.
- Procedures which ensure that all employees are free of undue pressure and stress.



STANDARD OPERATING PROCEDURE & QUALITY CONTROL

Instructions and procedures for the activities related to the analytical process are developed by the Management Team and are clearly defined and documented in our Standard Operating Procedures (SOPs). These technically specific SOPs are available at each laboratory facility and include the step-by-step procedures for each analytical test method performed inclusive of the initial acceptance and handling of samples, sample control throughout the process, sample preparation, analysis, and reporting of the data. EMSL utilizes company-wide standard procedures incorporated in each specific SOP which comply with our QMS and adhere to the following protocols:

Acceptance of Work

Our services are generally offered as unit cost tests which reference documented methodologies. Laboratory services are typically requested by the customer as “open order” requests meaning that samples may be delivered to the laboratory at any given time, without a firm documented arrangement (contract). EMSL accepts the customer Chain-of-Custody (COC) as the open-order authorization which specifies the analytical test, turnaround time (TAT), and quantity of tests to be completed. In the absence of a formal contract agreement, work-order, and/or purchase order, EMSL’s Terms and Conditions will apply. Modifications to the standard Terms and Conditions must be documented and agreed upon by both EMSL and the customer.

Sample Acceptance Criteria

The acceptance of custody of the samples at time of delivery does not imply that samples are acceptable for analysis. Samples are inspected and evaluated upon receipt to determine if they conform to laboratory’s sample acceptance criteria. Samples may be rejected if their condition upon delivery to the laboratory is unacceptable. Such conditions may include, but not limited to, improper packaging, broken or leaking container, insufficient or compromised labels, received past analytical holding time, improper sample preservation, insufficient sample volume, insufficient sampling information, etc. Rejections of samples will be followed up by notification to the customer for further direction.

Sample Tracking and Control

Chain-of-Custody

In order to ensure the integrity of any sample, records of its custody must be maintained from sample collection in the field until relinquishment of the samples and acceptance by the laboratory. When the customer collects the sample, EMSL does not accept responsibility for the validity of the sample collection and delivery protocols, nor the sample information reported by the customer. As needed and/or requested, we can recommend

sampling media, volumes, sample size, and other items which we have found to have an effect on the quality of the analytical results due to the sample condition.

Once the sample is accepted for analysis by the laboratory, the EMSL “Internal Chain of Custody” may be used to document the handling of the samples throughout the analytical process. In instances when samples are internally transferred to a different EMSL laboratory in the network, the samples are accompanied with a completed “Sample Relinquish Form” which includes internal custody transfer sign-off and customer/project information for tracking purposes. A copy of the completed form is also maintained in a tracking manual at the initial laboratory that received the samples. Whenever samples are transferred to another laboratory, EMSL will request customer approval for the transfer unless a standing agreement is in place.

Sample Log-In

EMSL’s sample tracking and control starts from the time the samples arrive at the laboratory at “sample receiving/log-in”. Log-in of samples is normally done by the log-in department and/or the administrative coordinator but may also be done by other employees trained and familiar with the process. Information is entered for the samples received by the laboratory into the Laboratory Information Management System (LIMS). LIMS is a computer-based management system which serves to track all samples from receipt through prep, analysis, reporting, and billing. If requested, the LIMS will send an email notification automatically to the customer when the samples are received by EMSL. The email notification includes when the samples were received, sample log-in information (tests, sample numbers, etc.), and the scheduled due date for results.



STANDARD OPERATING PROCEDURE & QUALITY CONTROL

Archival and Disposal of Samples

Samples that are not completely consumed in analysis are retained as detailed in the area-specific quality assurance modules which specify sample retention schedules. In accordance with this schedule, samples are then disposed of by a licensed contractor, where required, and a copy of the waste manifest is obtained and kept on file.

If requested, samples will be returned to the customer. If a customer has specific requirements for sample storage or retention times beyond standard EMSL policy, this should be discussed at the time of sample delivery, documented, and approved by EMSL and the customer. Secured long-term sample archival is available at EMSL's Cinnaminson laboratory for a monthly fee.

Subcontracting

Other than utilizing our internal network of laboratories, EMSL generally does not subcontract much analytical work to outside laboratories. However, in the event such services are required, the laboratory manager will ensure all procedures are performed by laboratories that comply with the quality management system as addressed in the EMSL QMS Manual and the policies of the accreditation program(s) currently held by the original laboratory. EMSL will request customer approval prior to subcontracting. Laboratories must subcontract to outside laboratories that maintain accreditations appropriate for that analysis unless otherwise directed by the customer.

Sample Processing and Procedures

Quality of Materials

The high quality of materials used in the laboratories is ensured through specific purchasing and verification procedures and proper handling techniques. Selection of the appropriate grade of reagent(s) is designated in the reagent section of each analytical SOP and in addition may be specified by the laboratory manager in unusual circumstances. As a general practice, reagents will be of at least ACS grade quality.

Reagents and standards are purchased in accordance with the analytical needs of the laboratories as determined by the laboratory manager. When received by the laboratory, these items' labels are dated and initialed with the date received and expiration dates provided by the manufacturer, or as assigned by the laboratory. Labels are also dated and initialed when opened

and/or when reagent mixtures are prepared.

Verification of reagents will consist of confirming that the purity grade recorded on the reagent label conforms to the requirements of the SOP.

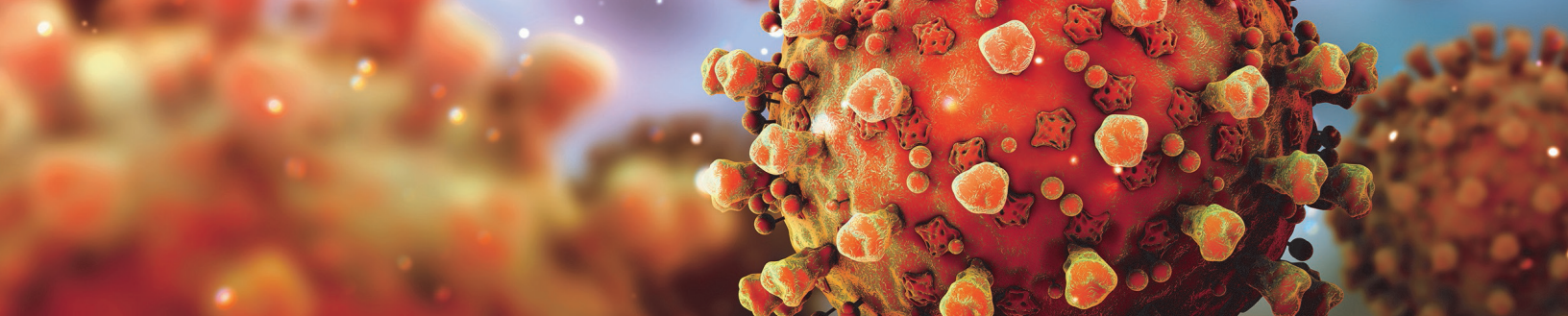
Equipment/Instrument Calibration and Maintenance

The quality and maintenance of equipment plays a critical role in providing quality analytical services. Analytical instruments and equipment are calibrated as required by instrument/equipment manufacturer, and also meeting SOP and regulatory requirements. Instruments and equipment that do not meet requirements are removed from use, and are properly labeled identifying their status. Instruments and equipment that do not meet criteria will be repaired prior to use. The laboratory manager determines whether each instrument is maintained and repaired in-house or by an outside source following EMSL administrative procedures. Additionally, servicing will be performed when a need has been identified by calibration or other QC checks. Where regular maintenance schedules are necessary, the schedules are documented in the analytical SOPs and tracked by the laboratory manager to ensure that all maintenance schedules are met. A maintenance repair/service file is maintained for all equipment which includes documentation of the scheduled and unscheduled maintenance and repair activities.

Contamination Management

Proper observance of laboratory procedures is necessary to guarantee accuracy of results and the safety of laboratory staff members. Contamination of samples, the environment, and reagents used in analysis must be avoided to provide the highest quality, legally defensible data to our customers. In order to achieve this goal, laboratory staff must adhere to various preventative measures and use defined testing procedures for contamination detection as established by the QA manager.

Contamination is prevented through a combination of good laboratory practice and housekeeping, as well as analysis of blank samples and ambient air and surface wipe samples taken from the laboratory. If contamination is detected in any situation, the source of contamination must be traced and the problem resolved to prevent recurrence. All actions taken to resolve a contamination circumstance will be documented properly and completely in the laboratory files.



STANDARD OPERATING PROCEDURE & QUALITY CONTROL

Reporting Results

The customer report is, ultimately, our “final product”. The quality of our report reflects on our standard of quality. Final customer reports are released only after data has been approved by the laboratory manager or designated qualified reviewers. This review includes evaluation of quality control results, calibration measurements, and other controls specified by the method, SOP, and our QMS Manual.

Electronic Data Deliverables (Exported Data)

EMSL delivers laboratory data in several different electronic data formats to many different customers in custom and industry standard formats, including SEDD, custom CSV formats, Excel, PDF, Word, and RTF formats. The electronically delivered data is not intended to replace hard-copy results. Final, signed customer reports are delivered via mail in addition to delivery by email. In this way, exported data can be verified. Electronically transmitted results must meet the requirements of the QA policies with the export formats implemented and controlled by the corporate IT staff which has the flexibility to implement new export formats as required.

Results Online via LABConnect™

Lab Reports, Chain-of-Custody (COC), and Invoices are available 24/7 via the internet on a secure customer website portal. Documents are posted “real-time” which allows remote customers to see their COC as soon as EMSL processes the samples at log-in. Once the report is reviewed and approved by an authorized signatory, the report with electronic signature is posted to the site as well. These PDF documents can be printed by the customer and/or inserted in the customer’s reports or on the customer’s common share sites, if necessary. The customer can do a search query for a result by the customer project number or project name, sample submittal date, or the type of analysis. Customer billing statements are also available via our online account management system, LABConnect™, and credit card payments can be made as well.

Customer Communications

EMSL seeks feedback from our customers regarding laboratory performance via our Customer Survey (<https://www.surveymonkey.com/r/emslclientfeedback>) as well as maintaining

an open dialogue policy between the customer and the Laboratory Manager and/or National Directors, the Corporate Team, and/or the Quality Assurance department. The goal of our open dialogue policy is clear, continuous, and open communication between the laboratory and the customer which is one of the keys to maintaining a successful, quality operation. Communication should be established prior to the start of any work so that any special instructions, precautions, and/or customer specific needs are clearly understood between the laboratory and the customer.

Customer complaints regarding the quality of data received are thoroughly investigated by EMSL laboratory management. Where errors are found, they will be documented as a non-conformity and handled via EMSL’s corrective action procedures. Typically, if a customer makes a valid complaint about a test result, the sample in question will be reanalyzed where possible. If the second result agrees with the original, the laboratory manager shall advise the customer in writing that a quality control check has confirmed the original analysis.

The laboratory manager or designee will promptly communicate with the customer as it relates to the performance of the analysis and turnaround time. The laboratory must notify the customer if:

- Analysis is to be done at another EMSL network location;
- Analysis cannot be performed on time;
- Integrity of the sample has been jeopardized (either by the laboratory or the customer or customers shipping/delivery carrier);
- A discrepancy in the analysis has been found during QC review. If this deficiency directly affects customer results, the customer will be notified immediately of the problem.

Confidentiality

It is understood that confidentiality and proprietary rights must be respected throughout the performance of services for any customer or for those that may include national security concerns. Information will not be given to those for whom it is not intended and the proprietary rights of our customer will be protected. Data reports and/or other related information will not be given out to any person or agency other than the customer unless we have received prior approval from the customer.



STANDARD OPERATING PROCEDURE & QUALITY CONTROL

Quality control (QC) is the routine application of procedures for obtaining prescribed standards of performance in the analytical process. EMSL's quality control program is established and managed by the National Director of Quality Assurance in cooperation with the National Directors and ensures our laboratories are producing quality data. This process ensures fulfillment of our commitment to our customers that our data is accurate, legally defensible, and that all personnel perform their responsibilities properly in accordance with EMSL's quality policy.

QC is performed continuously throughout the course of laboratory sample analysis regardless of laboratory work-load and is made part of the normal course of laboratory sample analysis. QC data is graphed on control charts designed specifically for each analysis type. QC data is tracked and reviewed daily by the laboratory manager as part of the sample process and final report approval process. Additionally, QC summary reports are reviewed by the corporate Quality Assurance Department on a monthly basis.

QA Oversight of Laboratory Quality - Analytical Performance Criteria

Quality control is performed according to the scope of the laboratories accreditation status and quality control requirements for each type of analysis. Performance criteria are maintained for both individual analysts and for the entire laboratory. The standards for acceptance criteria are documented in the EMSL Standard Operating Procedures and the QMS Manual. EMSL continuously monitors the analytical performance of each laboratory and its analysts. Performance is determined using the following criteria:

- Results from intra/inter-analyst, and/or intra/inter laboratory QC results and Round Robin testing plotted against control/acceptance limits.
- Results from calibration measurements plotted against control/acceptance limits.
- Laboratory performance in Proficiency Testing programs.
- Results of internal and external on-site quality audits. These audits will verify compliance to all QA and QC policies as documented in the EMSL QMS Manual and related SOPs.

Demonstration of Traceability

The quality assurance program is designed to provide a method which achieves traceability of data to national standards. This is accomplished by setting requirements which include:

- Use of Standard Reference Materials (SRMs) as certified and traceable to the National Institute of Standards and Technology (NIST). SRMs are used for QC analysis and training for achieving performance evaluations of analysts and overall laboratory accuracy.
- Calibration of instrumentation against NIST traceable standards

- Laboratory participation in independent (non-EMSL) Proficiency Testing programs
- Analysis of consensus standards
- Participation in Round Robin Programs

Procedures for Dealing with Non-conforming Work

Whenever a deviation from established requirements (i.e., a non-conformity) is discovered, a corrective action review will be initiated in order to determine the root cause of the problem and decide on what action can be taken to prevent reoccurrence. This review may include a review of QC data, sample tracking, data transcription, instrument calibration, training documentation discussion with personnel and risk assessment of situation. If the non-conformity resulted in a deficiency that directly affects customer results, the customer will be notified immediately of the problem. After the implementation of corrective actions, the laboratory will conduct follow-up activities to ensure the effectiveness of those actions.

Customer Support and Access to QC Information

EMSL provides quality assurance information and technical support to the customer to assure continued quality service. The support and information provided in relation to the work performed includes:

- Availability to Laboratory Accreditations/Certifications applicable to the analysis provided;
- Availability of pertinent QC records;
- Access to the Quality Assurance Department for technical assistance;
- Security of data (confidentiality);
- Reasonable access to the relevant areas of the laboratory for the witnessing of analysis;
- Archive and record retention programs.



STANDARD OPERATING PROCEDURE & QUALITY CONTROL

Accreditation and Certification Programs

EMSL Analytical, Inc. maintains various accreditations and certifications all of which require active and efficient QA/QC programs, participation in Proficiency Testing programs, etc. with renewals typically requiring on-site audits and continued acceptable performance in Proficiency Testing. Laboratories obtain necessary accreditations/certifications based on the testing they provide and the state in which they do the work. For individual state certifications, multiple laboratories in the network maintain that state's certification to ensure ample network support. If a customer requests new or additional field-of-testing (FOT) certification for a project or program, EMSL may seek to add that certification dependent on the laboratory capability and the amount of work associated with the request.

EMSL laboratory accreditation programs (see lab listing for specific branch lab accreditation) typically include NVLAP, AIHA, NELAP (TNI), A2LA, and home state certifications as required such as NY ELAP, CA ELAP, NJ DEP, PA DEP, FL DEP, TX DSHS, LA DEQ, etc.

Document Preparation and Control

In order to prepare and distribute documents in an organized fashion, procedures for initiation, preparation, review, approval, and issuance of controlled copies will be followed. EMSL's document control program is a coordinated effort involving both technical review and custodial control. Laboratories are to use only approved, controlled, and current documents for all calibrations, analyses, final reports, and other activities performed in this laboratory.

Archive and Record Retention Policies

All records associated with analytical data are stored in an organized, safe, and retrievable fashion. EMSL stores all records for a minimum of 5 years unless otherwise stipulated by customer contract or external agency requirements.

External agency requirements are listed below:

Agency	Agency Record Retention Requirement
NVLAP	3 Years*
AIHA – IH and EMLAP	3 Years*
AIHA – ELLAP/ EPA NLLAP	5 Years
NYS ELAP	5 Years
<i>Water Data</i>	10 Years
New York City (NYC) Specific	7 Years
California ELAP	3 Years*
<i>Water Data</i>	10 Years
Texas Department of Health	30 Years
Massachusetts (Asbestos Bulk and Air)	30 Years
Minnesota	6 Years
Louisiana Department of Environmental Quality	10 Years
The NELAC Institute (TNI)	5 Years
CDC ELITE Program for <i>Legionella</i>	5 Years

*EMSL retains all records for a minimum of 5 years even when external requirements allow shorter retention times.

The following records are examples of documents that are retained:

- Copy of Chain-of-Custody documents
- Original analytical data recording worksheets
- Quality control data
- All other records relating to the preparation of the customer report
- Staff qualifications and training records

LABORATORY SERVICES





ASBESTOS LAB SERVICES

EMSL

EMSL Analytical, Inc. has over 40 years of experience in providing Asbestos Laboratory Services to Environmental/Asbestos Consultants, Engineering Companies, Remediation Contractors as well as Government Agencies and Authorities. Our asbestos laboratory network has the largest capacity for sample analysis in the world. This capability is a function of the collective strength of our nationwide network of individual laboratories located throughout North America.

Each laboratory has trained and experienced staff along with the necessary equipment and instrumentation to provide quality asbestos analysis for Air, Water, Bulk, Soil, and/or Dust samples by various methodologies (NIOSH, EPA, ISO, ASTM, etc.) utilizing Polarized Light Microscopy (PLM), Phase Contrast Microscopy (PCM), Transmission Electron Microscopy (TEM), and Scanning Electron Microscopy (SEM).

Each of our Asbestos Labs is accredited by NVLAP with additional certifications as needed per individual state certification programs and/or AIHA/A2LA accreditation. The laboratories maintain a five to seven day work week depending on the lab location and have emergency response plans for off hour and/or weekend work. Samples are received during work hours and turnaround times (TATs) are tracked accordingly. TATs offered include same day (3 hr. and 6 hr.), 1 day, 2 day, 3 day, 4 day, 1 week, and 2 week. Costs/rates are weighted based on the TAT requested with our 2 week rates being the most economically cost-effective for our customers.

Sample processing (log-in, analysis data-entry, reporting) is facilitated by our Laboratory Information Management System (LIMS) which tracks the samples and individual projects to meet our clients' specified due dates and any special instruction requirements. Additionally, the LIMS includes security controls to ensure that information is controlled and locked once the data has been entered by our analysts. Since all of our laboratories utilize the same LIMS, all reports are standardized which allows us to use multiple laboratories on large capacity projects while ensuring that work is complete and reported in a similar format. Asbestos reports are delivered at the choice of the customer by email, fax, and/or hard-copy regular mail. Additionally, all clients have 24/7 real-time access to their reports, Chains-of-Custody (COCs), and project invoices via our online account management system, LABConnect™. This is a security enabled online feature that provides various search options so that our clients can find all project results and invoicing information quickly and easily.



Key tests include (but are not limited to) the following:*

AIR by PCM

- NIOSH 7400 (A or B Counting Rules)
- ASTM D7200 or ASTM D7201
- OSHA ID-160

AIR by TEM

- AHERA (40 CFR Part 763 Appendix A subpart E)
- EPA LEVEL II (Yamate)
- NIOSH 7402
- ASTM D6281
- ISO 10312
- ISO 13794 (Indirect Prep)

BULK by PLM

- EPA/600/R-93/116 (Calibrated Visual Estimate, reporting limit to <1%)
- EPA/600/R-93/116 (400 pt count, reporting limit to <0.25%)
- EPA/600/R-93/116 (1000 pt count, reporting limit to <0.1%)
- EPA/600/R-93/116 (1200 pt count, reporting limit to <0.08%)
- EPA/600/M4-82-020 Interim Method (400 pt count, reporting limit to <0.25%)
- NIOSH 9002 (reporting limit to <1%)
- PLM EPA NOB-EPA/600/R-93/116 (Calibrated Visual Estimate, reporting limit as low as <0.25%)
- PLM EPA NOB-EPA/600/R-93/116 (Gravimetric Reduction Prep 400 pt count, reporting limit to <0.25%)
- PLM EPA NOB-EPA/600/R-93/116 (Gravimetric Reduction Prep 1000 pt count, reporting limit to <0.1%)
- OSHA ID-191
- IRSST
- ISO 22262

BULKS by NYS ELAP Methods

- NY ELAP Method 198.1 (for friable samples)
- NY ELAP Method 198.6 (PLM with Gravimetric Prep)
- NY ELAP Method 198.4 (TEM with Gravimetric Prep)
- NYS ELAP Method 198.8 for Vermiculite Containing Materials

WATER by TEM

- EPA Method 100.2 (Long fibers >10 microns only)
- EPA Method 100.2 (All fiber sizes ≥0.5 microns)

BULKS by TEM

- TEM EPA NOB- EPA 600/R-93/116 Section 2.5.5.1
- TEM % by Mass- EPA 600/R-93/116 Section 2.5.5.2
- Chatfield Protocol (semi-quantitative)
- TEM Qualitative via Filtration Prep Technique
- TEM Qualitative via Drop Mount Prep Technique
- NY ELAP Method 198.4 (TEM NOB)

SETTLED DUST by TEM

- ASTM D6480 (Wipe)
- ASTM D5755 (MicroVac)
- Carpet/Textile Sonication EPA/600/J-93/167

SOIL / ROCK / VERMICULITE METHODS

- PLM/TEM Qualitative (Prep by: Milling/Jaw Crusher/etc.)
- ISM Incremental Sampling Methodology (ISM)
- PLM by EPA/600/R-93/116 (Milling Prep with calibrated visual estimation with reporting limit to 0.25% or 0.10%)
- CARB 435 PLM and/or TEM
- ASTM Soil Quantitative PLM and/or TEM
- ASTM D7521 Sieve Method for Soil
- Fluidized Bed Asbestos Segregator (FBAS)

SPECIALIZED ANALYSIS

- German VDI-3492 (Asbestos and Fibrous Glass) by SEM
- Erionite via TEM/SEM/XRD
- Nanoparticle Analysis via TEM/STEM with EDXA
- PCMe Analysis
- SEM

**This is a summary of key tests, call for a full list of tests offered and for pricing.*

See Laboratory listings on pages 5-6 for laboratories that have Testing capabilities for these lab services listed above.

LEAD (Pb) AND METALS LAB SERVICES

EMSL Analytical, Inc. provides Lead (Pb) and other Metals testing for matrices that include: Air, Bulk (paint chips, debris, or materials), Wipes, Drinking Water, Wastewater, Soil and Solid Waste Samples; as well as metals testing on Consumer Products. Each EMSL Metals laboratory has trained and experienced staff along with the necessary laboratory certification(s) to provide analysis by various methodologies, including: NIOSH, OSHA, EPA, ASTM, and Standard Methods. Our laboratory equipment includes Flame Atomic Absorption Spectrometers, and Inductively Coupled Plasma (ICP)/ ICP-Mass Spectrometers.

Each of our Metals Laboratories maintain accreditation by AIHA or A2LA, as well as by State and City regulatory bodies, where applicable. The analytical process for Metals analysis, and reporting of the individual sample, is part of an overall Quality Control program that includes analysis of quality control samples (spikes), instrument QC controls, calibration standard checks, duplicates, and reporting limit controls. All of this to ensure the confidence limits of the data are within the acceptable range, as specified by the method requirements and our Quality Control Programs.

Sample control/processing (log-in, results data-entry, reporting) is facilitated by our computer Laboratory Information Management System (LIMS) which tracks the samples and individual projects to meet our clients' specified due dates and any special requirements. Additionally, the LIMS includes security controls to ensure that information is controlled and locked once the data has been entered by our analysts. Since our laboratories all utilize the same LIMS system, all reports are standardized which allows us to use multiple laboratories on the large capacity projects while ensuring that the work is done and reported in a similar format. The reports are delivered at the choice of the customer which would include email, fax, and/or hard-copy regular mail. Additionally, all clients have 24/7 real-time access to their reports, Chains-of-Custody (COCs), and project invoices via our online account management system, LABConnect™. This is a security enabled extranet feature that provides various search options so that our clients can find all project and invoicing information quickly and easily.

Laboratories operate on a five or six day schedule and all maintain an emergency response plan for off hours and/or weekend operating hours. Samples received during normal work hours and turnaround times (TATs) are tracked on business days from the time samples are received during normal operating hours of the laboratory. Laboratories that maintain extended routine hours will track TATs during all laboratory hours. Lead analysis TATs offered include same day (3 hr. and 6 hr.), 1 day, 2 day, 3 day, 4 day, 1 week, and 2 week TATs. Costs/rates are weighted based on the TAT requested with our 2 week rates being the most economically cost-effective for our customers.



Key tests include* (but are not limited to) the following:

FLAME AA

- Air (NIOSH 7082)
- Paint Chips (SW-846-7000B)
- Wipes (SW-846-7000B)
- Soil (SW-846-7000B)
- Wastewater (SW-846-7000B)

COLD VAPOR AA (CVAA) (Mercury)

- Air (NIOSH 6009, OSHA ID-140)
- Air and Wipes (NIOSH 6009, OSHA 140 / ID-145)
- Aqueous and Solids (SW 846 7470A, 7470B)

ICP/ICP-MS

- Air (NIOSH 7300/7303)
- TSP Lead in Suspended Particulate Matter (40 CFR Part 50)
- Wipes (SW-846-6010D)
- Soil (SW-846-6010D)
- Potable Water (Drinking Water)(EPA 200.5/200.8)
- Non-Potable Water (Groundwater/Wastewater) (SW-846-6010D/200.7)
- Food (AOAC 2011.14/AOAC 2013.06)

HAZARDOUS WASTE

- Toxicity Characteristic Leaching Procedure (TCLP) (Flame AA/ICP)
- Total Threshold Limit Concentration (TTL) (Flame AA/ICP)
- Soluble Threshold Limit Concentration (STLC) (Flame AA/ICP)
- Synthetic Precipitation Leaching Procedure (ICP)

METALS PACKAGES

- CAM 16/CAM 17
- RCRA 8
- TAL Metals/PP Metals
- Solder Metals Profile (air)
- Welding Fumes Profile (air)
- EPA Drinking Water Primary List

CONSUMER PRODUCTS

- Total Lead in Paint and Surface Coatings
- Total Lead in Children's Metal Jewelry/Products
- Total Lead in Children's Non-Metal Products

PRECIOUS METALS

- Wastewater

METALS AVAILABLE*

- | | | | | | |
|------------------|-----------------|-------------------|------------------|------------------|------------------|
| • Ag (Silver) | • Bi (Bismuth) | • Fe (Iron) | • Na (Sodium) | • Sb (Antimony) | • Tl (Thallium) |
| • Al (Aluminum) | • Ca (Calcium) | • Hg (Mercury) | • Ni (Nickel) | • Se (Selenium) | • U (Uranium) |
| • As (Arsenic) | • Cd (Cadmium) | • K (Potassium) | • P (Phosphorus) | • Si (Silicon) | • V (Vanadium) |
| • Au (Gold) | • Ce (Cerium) | • Li (Lithium) | • Pb (Lead) | • Sn (Tin) | • W (Tungsten) |
| • B (Boron) | • Co (Cobalt) | • Mg (Magnesium) | • Pd (Palladium) | • Sr (Strontium) | • Zn (Zinc) |
| • Ba (Barium) | • Cr (Chromium) | • Mn (Manganese) | • Pt (Platinum) | • Th (Thorium) | • Zr (Zirconium) |
| • Be (Beryllium) | • Cu (Copper) | • Mo (Molybdenum) | • S (Sulfur) | • Ti (Titanium) | |

*Not all metals available at all labs. This is a summary of key tests, **call for a full list of tests offered and for pricing.**
See Laboratory listings on pages 5-6 for laboratories that have Testing capabilities for these lab services listed above.



ENVIRONMENTAL MICROBIOLOGY LAB SERVICES

EMSL

EMSL Analytical, Inc. provides Microbiology Laboratory Services for testing related to the Environment, Indoor Air Quality, and Product Testing at our network of laboratories in key cities nationwide. Our qualified staff includes degreed (Ph.D. and M.Sc.) microbiologists, mycologists, and bacteriologists. Our bench analysts and/or technicians have a minimum of a B.S. degree and must complete a rigorous training program before reporting results independently. In addition to offering the traditional direct exams (spore traps and tape lifts) and culture methodologies, we also use state of the art equipment such as GC-FAME, MALDI-TOF, and PCR for identifying individual bacterial and fungal species.

Our key microbiology laboratories maintain accreditation under the American Industrial Hygiene Association (AIHA) or the American Association for Laboratory Accreditation (A2LA) microbiology accreditation programs. Additionally, we participate in the U.S. CDC Environmental *Legionella* Isolation Techniques Evaluation (ELITE) Program for *Legionella* analysis as well as state proficiency programs for bacteriological testing of drinking water, wastewater, and sewage sludge. We also offer customized special project design for non-routine analysis utilizing ASTM, USP, EPA, APHA, AATCC, ISO, JIS, NSF, OECD, MIL, ASM as well as other internationally developed test methodologies.

All Microbiology Labs maintain a five or six business day laboratory operation schedule. We have emergency response plans in place for off hours and/or weekend operating hours when needed. Turnaround times (TAT) are tracked by the number of business days from the time samples are received in the laboratory. Microbiology TATs for direct exams include same day (3 hr. and 6 hr.), 1 day, 2 day, 3 day, 4 day, 1 week, and 2 week. Culture analyses are provided with a 6-14 day turnaround based on the individual incubation period requirements. Costs/rates are weighted based on the TAT requested with our 2 week TAT rates the most economical for our customers.

Sample control/processing (log-in, results data-entry, reporting) is facilitated by our computer Laboratory Information Management System (LIMS) which tracks individual projects to meet our clients' specified due dates. Additionally, the LIMS includes security controls to ensure that information is controlled and locked once the data has been entered by our analysts. Since all of our laboratories utilize the same LIMS, all reports are standardized which allows for network support (intra-lab transfer) for sample overcapacity issues. We offer a variety of reporting formats for our most popular tests including our Expanded Fungal Report for total spore count and direct exam analyses. We can also design customized reporting options for long term and special projects. Reports are delivered depending upon client preference (email, LABConnect™, fax, or all). All clients have 24/7 real-time access to their reports, Chains-of-Custody (COC), and project invoices via our online account management system, LABConnect™. This is a security-enabled online portal that provides various search options so that our clients can find all project and invoicing information quickly and easily.



Key tests include* (but are not limited to) the following:

FUNGI (MOLD and YEAST)

- Spore Trap Analysis
- DNA Sequencing
- PCR
- ERMI
- ID and Enumeration of Culturable Fungi (Genus Level ID)
- ID and Enumeration of Culturable Fungi (Includes Species ID of *Penicillium*, *Aspergillus*, *Cladosporium* and *Stachybotrys*)
- Expanded Fungal Species ID Services
- ID of Fungal Structures via Direct Examination (Tape Lift, Bulk, Swab, Wipe)
- *Cryptococcus neoformans*
- *Histoplasma capsulatum*

WATER ANALYSIS

- Heterotrophic Plate Count (HPC)
- Total Coliform w/*E. coli* screen
- Fecal Coliform
- Enterococci
- *Pseudomonas aeruginosa*
- Microscopic Algae Screen

LEGIONELLA

- Standard ISO 10-14 Day Culture Test
- Rapid Legiolert 7 Day Culture Test
- Quantitative Polymerase Chain Reaction (qPCR) Test (identifies *L. pneumophila*, *L. pneumophila* serotype 1 and *Legionella* spp. in one qPCR test)
- Whole Genome Sequencing (WGS) (identifies *Legionella* strains for infections source tracking and outbreak investigations)

BACTERIA

- *Bacteroides* (sewage screen)
- DNA Sequencing

- PCR
- ID and Enumeration of Culturable Bacteria
- Nosocomial Pathogens (MRSA, *C. diff*)
- Sewage Contamination in Buildings
- Mycobacteria
- USP <797>
- Iron-Related Bacteria (IRB)
- Sulfate-Reducing Bacteria (SRB)
- Slime-Forming Bacteria (SLYME)
- Biofilm-Associated Bacteria (Group: IRB, SRB, SLYME)
- Denitrifying Bacteria (DN)
- Nitrifying Bacteria (N)
- Heterotrophic Aerobic Bacteria (HAB)
- Endotoxin Testing

AQUATIC MICROBIOLOGY

- Phytoplankton identification
- Chlorophyll a, b, c
- Algae Toxins
- *Cryptosporidium* and *Giardia* (EPA 1623.1)
- Microscopic Particle Analysis (MPA)

VIRUS AND PATHOGENS

- SARS-CoV-2 (COVID-19), N1 and N2 Markers

SPECIAL PROJECTS

- Antimicrobial Testing
- Product Resistance to Mold and Bacteria
- Time-kill Studies
- MIC/MLC Testing
- UV-kill Studies
- Disinfectant Effectiveness

HEALTHCARE-ASSOCIATED INFECTIONS (HAIS)



INDUSTRIAL HYGIENE TESTING

EMSL

EMSL Analytical, Inc. provides Industrial Hygiene (IH) Laboratory Services for air, wipe, and bulk matrices on an extensive list of NIOSH, OSHA, ASTM, and EPA test methods, boasting five IH laboratory location within North America: EMSL's Corporate Laboratory in Cinnaminson, NJ; Indianapolis, IN; Charlotte, NC; Huntington Beach, CA (LA Testing); and our Canadian location in Toronto, ON.

Our team of qualified and experienced professionals include board-certified Industrial Hygienists (CIH), as well as highly trained project managers and analysts that welcome client interaction at project inception to ensure the laboratory data will meet all of the intended goals of the event, as well as communication during and after the event, as well as while samples are in-house. We believe clear and concise communication is imperative to each project's success.

EMSL maintains AIHA accreditation for tests performed by the IH laboratories, which includes on-site laboratory audits, formal document review program, staff experience and education criteria, and Proficiency Testing Program as part of the Accreditation process. Additionally, as required by various states, EMSL IH laboratories hold most applicable state certifications for fields of testing for air samples. Regarding media and pumps, EMSL offers a "free IH sampling pump program" for clients, provided the analysis is performed by one of our IH laboratories. We also offer an extensive list of products and media for sale, including: pumps, badges, field equipment/monitors, etc., all of which can be viewed via our website.

EMSL has state of the art equipment within each of our five IH laboratory locations, including: GC-ECD/GC-FID/GC-MS, LC, MS, MS/HPLC/LC/MS/IC/XRD/UV-VIS/ICP-AES, OES/ICP-MS, etc. The analysis and reporting of each individual sample includes analysis of Quality Control (QC) samples, programs such as Instrument QC controls, calibration standard checks, spiked media, and reporting limit controls; all to ensure the confidence limits of the data are within the acceptable range as specified by the method requirements and our Quality Control Program.

Our labs maintain normal business day operational hours with weekend scheduling availability as needed for critical response situations. Samples are received during regular business hours and turnaround times (TATs) are tracked on business days. Laboratory TATs are offered for same day or next day, as well as for 2 day, 3 day, 4 day, 1 week, and 2 week Standard TATs. Costs/rates are based on the TAT requested with our 2 week TAT rates being the most economically cost-effective for our customers.

Sample control/processing (log-in, results data-entry, reporting) is facilitated by our Laboratory Information Management System (LIMS) which tracks the sample job (batch) and provides the laboratory with work log (due dates) to help ensure all the work is organized and processed in accordance with the client's needs. Additionally, the LIMS includes security controls to ensure that information is controlled (locked) once the data has been documented and entered by the bench chemists. Reports are delivered at the choice of the customer which would include email, hard-copy regular mail, or both. Additionally, EMSL can provide Electronic Data Deliverables (EDD) as well as various QC Data Packages if required. Contact us for package pricing.



Key tests include (but are not limited to) the following:*

NIOSH

- NIOSH 0500
- NIOSH 0600
- NIOSH 1003M
- NIOSH 1005M
- NIOSH 1007
- NIOSH 1013
- NIOSH 1019
- NIOSH 1024
- NIOSH 1300
- NIOSH 1301
- NIOSH 1400M
- NIOSH 1401
- NIOSH 1402
- NIOSH 1403
- NIOSH 1405
- NIOSH 1450
- NIOSH 1453
- NIOSH 1457
- NIOSH 1500M
- NIOSH 1501M
- NIOSH 1550M
- NIOSH 1603M
- NIOSH 1604
- NIOSH 1606M
- NIOSH 1610
- NIOSH 1612
- NIOSH 1615
- NIOSH 1616
- NIOSH 2000M
- NIOSH 2016M
- NIOSH 2500M
- NIOSH 2532
- NIOSH 2537
- NIOSH 2546M
- NIOSH 2551M
- NIOSH 3500
- NIOSH 5008M
- NIOSH 5026
- NIOSH 5040
- NIOSH 5041
- NIOSH 5042M
- NIOSH 5503M
- NIOSH 5506M
- NIOSH 5510M
- NIOSH 5523
- NIOSH 5524
- NIOSH 5600
- NIOSH 5601M
- NIOSH 6004M
- NIOSH 6009M
- NIOSH 6010M
- NIOSH 6011
- NIOSH 6013
- NIOSH 6014
- NIOSH 6016
- NIOSH 7082
- NIOSH 7401
- NIOSH 7500
- NIOSH 7501
- NIOSH 7602
- NIOSH 7906
- NIOSH 7907
- NIOSH 7908
- NIOSH 7908M
- NIOSH 9111M

OSHA

- OSHA 07
- OSHA 42/47M
- OSHA 56
- OSHA 58M
- OSHA 64
- OSHA 80
- OSHA 83M
- OSHA 91
- OSHA 99M
- OSHA 104
- OSHA 109
- OSHA 1007
- OSHA 1008
- OSHA 1010 V2
- OSHA 1014
- OSHA 1018
- OSHA 1019
- OSHA 103M
- OSHA 5001
- OSHA CSI
- OSHA ID-113
- OSHA ID-140
- OSHA ID-145
- OSHA ID-165SG
- OSHA ID-182
- OSHA ID-188M
- OSHA ID-190
- OSHA ID-214
- OSHA ID-215 V2
- OSHA PV2061
- OSHA PV2111
- OSHA PV2119

Other Methods

- 40CFR50, Appendix B
- 40CFR50, Appendix J
- 40CFR50, Appendix L
- AssayTech LP 575
- ASTM D5504
- EPA IP-10A
- EMSL In-House Methods

If you are looking for a method that is not listed, please contact us immediately to confirm if we can perform. Our list of services is being expanded regularly.

**This is a summary of key tests, call for a full list of tests offered and for pricing.*

See Laboratory listings on pages 5-6 for laboratories that have Testing capabilities for these lab services listed above.



ENVIRONMENTAL CHEMISTRY TESTING



EMSL Analytical, Inc. provides Environmental Chemistry Laboratory Services primarily at the Corporate Headquarters Lab in Cinnaminson, NJ but also core regional capabilities at our labs in Indianapolis, IN; Orlando, FL; Charlotte, NC; Huntington Beach, CA; and Toronto, ON. Environmental Chemistry Testing includes a wide array of testing including sampling for RCRA (Resource Conservation & Recovery Act), SPDES (State Pollution Discharge Elimination System), NPDES (National Pollution Discharge Elimination System), CWA (Clean Water Act), SDWA (Safe Drinking Water Act), CAA (Clean Air Act) as well as for Environmental Site Investigations (i.e.: Phase I, Phase II), Remediation Projects, and various Municipal, City, or State programs requiring the testing and analysis of Drinking Water, Wastewater, Surface Water, Groundwater, Bulk Waste, Soil, Solids, Oils, and/or Air Samples. Samples are analyzed by approved EPA and Standard Methods, NIOSH Methods, ASTM, or OSHA ID Methods as well as various state-specific methodologies. EMSL's process for the analysis and reporting of the individual sample is part of an overall program that includes analysis of Quality Control (QC) samples and programs such as instrument quality controls, calibration standard checks, duplicates, and reporting limit verifications to ensure the confidence limits of the data are within the acceptable range as specified by the method requirements and our Quality Control Programs.

The Laboratory maintains primary TNI (The NELAC Institute) certification from our home state (NJDEP) as well as multiple certifications from various states. As part of the certification status, our Chemistry Lab complies with regular on-site audits from regulatory agencies and participates in a rigorous and extensive proficiency testing program. Fields of Testing certification parameters routinely are updated by the State regulatory agencies so EMSL provides the most current copy of our test parameter certifications on our web site. If a new state certification or field of test is requested by a client for our laboratory, EMSL may update our certification accordingly.

The laboratory provides testing for Organics (by GC-FID, GC-ECD, GC/MS and LC/MS/MS), Metals (GF-AA, CV-AA, ICP, ICP/MS), and Wet Chemistry (IC and various conventional test methods). Testing is primarily performed at our Corporate Environmental Chemistry Lab in New Jersey with some Metals Testing and limited Wet Chemistry Testing capabilities at our other laboratories supporting local programs and/or projects. Our Environmental Chemistry laboratories maintain business day operational hours including weekend scheduling availability as needed for critical response situations. Samples are received during regular business hours and turnaround times (TATs) are tracked on business days. Laboratory TATs offered include same day or next day, as well as for 2 day, 3 day, 4 day, 1 week, and 2 week Standard TATs. Costs/rates are weighted based on the TAT requested with our 2 week TAT rates being the most economically cost-effective for our customers.

Sample control/processing (log-in, results data-entry, reporting) is facilitated by our Laboratory Information Management System (LIMS) which tracks individual samples and Sample Delivery Groups (SDG) to help ensure we meet the clients specified due dates and special instruction directives such as reporting value data objectives and/or special QC requirements specific to the SDG. Additionally, the LIMS includes security controls to ensure that information is controlled (locked) once the data has been documented and entered by the laboratory analysts. Reports are delivered at the choice of the customer which would include email, hard-copy regular mail, or both. Additionally, EMSL can provide Electronic Data Deliverables (EDD) as well as various QC Data Packages (RDD, ASP, CLP, etc.) if required.

Key tests include (but are not limited to) the following:*

ORGANIC

- Volatile Organic Compounds (VOCs)
- Semi-Volatile Organic Compounds (SVOCs)
- Glycols (Ethylene, Propylene)
- Petroleum Hydrocarbons/DRO/GRO
- Extractable Petroleum Hydrocarbon (EPH)
- Pesticides/ Herbicides
- Polychlorinated Biphenyls (PCBs)
- Polychlorinated Aromatic Hydrocarbons
- Phthalates
- EDB, DBCP, 123-TCF
- PFNA/PFOA/PFOS

METALS (ICP, ICP/MS, CVAA, FLAA)

- See Lead and Metals Testing Division

TCLP / HAZWASTE

- Ignitability, Corrosivity, Reactivity
- TCLP VOA
- TCLP BNA
- TCLP Pesticides
- TCLP Herbicides
- TCLP Metals
- Priority Pollutant List TAL/TCL Lists
- Hazwaste Metals: See Lead and Metals Testing Division

WET CHEMISTRY

- Acidity/Alkalinity/pH/Anions by IC/BOD/COD/Dissolved Oxygen/Color/Chlorine/Chloramines/Cyanide/Flashpoint/Free Liquid/Hexavalent Chromium/Langlier Index/Nitrogen (Ammonia/ Organic/TK
- Oil and Grease (polar and non-polar)
- Phenols/Phosphorous/ Sulfide
- Solids (TDS, TSS, TVS, TVSS)
- Specific Conductance
- Surfactants (MBAS)/Turbidity





MATERIALS SCIENCE TESTING

EMSL

EMSL Analytical, Inc. provides Environmental Chemistry Laboratory Services primarily at the Corporate Headquarters Lab in Cinnaminson, NJ but EMSL Analytical, Inc. provides a wide variety of materials testing, characterization, and forensic laboratory services at the Materials Science Lab in New Jersey. Our team includes Ph.D. scientists with substantial industry and academic credentials, and professionals with many years of experience in materials testing services.

Our team can design and implement testing programs, and offer solutions to challenges in manufacturing, quality assurance, and research and development. Using a broad array of instrumentation, we regularly provide Elemental Analysis (WDXRF, EDX, ICP, AA), Structural Analysis (XRD, NIR, FTIR), Microscopy Analysis (Light and Electron Microscopy SEM/TEM), Mechanical and Metallurgical Testing, and Particle Size and Distribution. The Particle Identification Analysis package is designed to cover multiple levels of complexity and includes Common Particle Identification, Full Particle Identification, and Unknown Material Identification. Additionally, we provide customized analyses for Contamination & Quality Control, Surface Analysis, Characterization of coatings and thin films, Failure & Forensic Analysis of manufactured devices and materials including electronics and semiconductors and polymer/composite materials, Electronics Packaging Failure, and Polymers Characterization to name only a few. Our capabilities allow us to quickly develop new methodologies to meet new industry challenges and client needs. We often function as “virtual resources” to our clients, complementing their own capabilities.

Our Materials Science Lab maintains a five-day operational hours schedule as well as emergency response plan for off hours and/or weekend operating hours. Samples are received during regular business hours and turnaround times (TATs) are tracked on business days from the time samples are received at the laboratory. The TATs offered include rush same day or next business day as well as 3 day, 4 day, 1 week, or 2 week. Costs/rates are weighted based on the TAT requested with our 2 week TAT rates being the most economically cost-effective for our customers.

Key tests include (but are not limited to) the following:*

MATERIAL IDENTIFICATION/CHARACTERIZATION

- Common Particle ID of large components such as fibers
- Full Particle ID of common indoor/outdoor contaminants
- Basic Materials Identification of solid components
- Advanced Materials Identification of all components (solid and liquid)

COMBUSTION-BY-PRODUCTS

- NIOSH 5000-Carbon Black, Black Carbon/Soot, Wildfires and Residential Fire Debris, Source Confirmation

COMBUSTIBLE DUST

- Sample Characterization, Minimum Explosive Concentration (MEC), Minimum Ignition Temperature (MIE), Maximum Normalized Rate of Pressure Rise (Kst), Class II Testing

PARTICLE SIZING

- Mechanical Sieve, Sonic Sieve, Microscopy, Dynamic Light Scattering (DLS), Zeta Potential, Pore Size Analysis

PHYSICAL TESTING

- Compression, Tension, Torsion Flexure, Hardness, Unconfined Compression

PETROGRAPHIC AND SOILS

- Full Petrographic Analysis, Soil Grain Size, Liquid and Plastic Limits, Soil Classification

RoHS - RESTRICTION OF HAZARDOUS SUBSTANCES (by XRF, ICP, CVAA, GC/MS)

- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent Chromium (Cr (VI))
- Polybrominated biphenyls (PBBs)
- Polybrominated Diphenyl Ethers (PBDEs)

OTHER COMMON METHODS/APPLICATIONS

- Microstructural characterization by electron microscopy (SEM/TEM) — grain structure, defects, boundary/interfaces, quantitative image analysis
- Thin films/coatings analysis by XRD, FTIR Raman, XRF, SEM

- Multi-layer thickness, stoichiometry, roughness, preferred orientation, depth profiling Metallurgical analysis by optical microscopy (OM) — microstructure, fracture mode, porosity, inclusion rating, volume fraction count.
- Microelectronics analysis-failure analysis defect and contamination identification, packaging and inspection services, X-Ray, C-SAM, SEM, CT
- Thermal analysis by DSC, TGA—characterization of polymer blends, polymer crystallization and degradation, glass and phase transition, melting temperatures, thermal stability, residual solvent levels
- Alloy Characterization
- Pharmaceutical products: USP testing
- Failure analysis—fractography, corrosion, material evaluation, manufactured materials/devices, electronics and semiconductors
- Forensic analysis—product integrity, chemical identification, residual analysis
- Product evaluation and comparison—compliance, conformance, performance.
- Method development and validation.
- Explosive Residue EPA 8330A/B (17 common explosives)
- Surface Tension ASTM D1331
- GERMAN VDI3492 Asbestos and Fibrous Glass by SEM
- Asbestos-Free Validation Used for Talc Mines etc. (PLM, SEM, TEM, XRD)
- Paint Identification: ID the Type of Paint, Fillers, Pigments
- Integrated Circuit Support: including Focused Ion Beam-SEM/TEM 3D X-Ray Micro and Nano CT, Inspection Services
- Cleaning/Remediation Confirmation
- Weatherization aging studies
- Medical Devices Testing
- Process Validation
- Sample preparation—sectioning, grinding, electro- and ion polishing, cryo-milling, filtering, pressing, fusion, heat treatment.
- Consulting and expert witness services.
- Various ASTM, AATCC, ISO, NIOSH Methodologies (call for list)





FOOD TESTING LAB SERVICES

EMSL

EMSL Analytical, Inc.'s Food Division caters to the analytical testing needs of the Food and Beverage Industries. Microbiology, Chemistry to include Nutritional Labeling, and Specialty Analysis testing services highlight our areas of expertise.

With a network of ISO/IEC 17025:2017 accredited labs across the U.S., EMSL analytical, Inc. offers both routine and non-routine analysis. Services range from standard qualitative and quantitative analyses of food and environmental samples to several specialized projects such as shelf-life tests, challenge studies, and FDA detain analysis. Contact EMSL today for our most current list of accredited laboratories.

EMSL employ FDA/BAM, AOAC, USP, and CMMEF methodologies (along with client specific methods where applicable) to generate verification data for food safety and quality programs that support Global Food Safety Initiatives, Hazard Analysis and Critical Control Points (HACCP) plans, current Good Manufacturing Practices (GMP), and Food Safety Modernization Act programs.

We also provide support for new product development for the food industry by creating FDA-compliant (2020) Nutritional Facts Panels utilizing laboratory-based analysis, database analysis, or a combination of both. EMSL may also support new product development by conducting real-time and accelerated shelf life studies.

In addition to providing full-spectrum testing service, we offer sampling supplies to our clients.

EMSL's Special Project and Materials Science Division works closely with our Food Division to offer full service analysis for specialty projects and atypical testing needs. We provide cutting edge technology to provide MALDI-TOF bacterial identifications, Whole Genome Sequencing (WGS), and Metagenomics. Contact us today to discuss your atypical challenge.

Key tests include (but are not limited to) the following:*

FOOD MICROBIOLOGY

- Pathogen Testing
 - *Salmonella*
 - *Listeria*
 - *E. coli* O157:H7
 - Shiga Toxin-Producing *E. coli* (STEC)
 - *Campylobacter*
 - Additional tests available
- Indicator Organism Testing
 - APC (Aerobic Plate Count)
 - YM (Yeast/Mold)
 - Total Coliform/*E. coli*
 - Lactic Acid Bacteria
 - *Enterobacteriaceae*
 - *Staphylococcus aureus*
 - Additional tests available
- Bacterial and Fungal Identification via VITEK-MS

FOOD CHEMISTRY

- Nutritional Analysis
 - Mandatory NLEA Analysis
 - Restaurant Packages
 - Nutritional Database Approach
 - Pet Food Packages
- Proximate Testing
 - Moisture/Solids/Loss on Drying
 - Protein
 - Fat
 - Ash (Residue on Ignition)
 - Carbohydrates by Difference
 - Calories
 - Total Dietary Fiber
 - Crude Fiber
 - Salt (as NaCl)
 - Sugar Profile
 - Alcohol Content

- Wet Chemistry
 - Titratable Acidity
 - Rancidity of Fats
 - Peroxide Value
 - Free Fatty Acids
 - TBA (Thiobarbituric Acid)
- Organic Acids (HPLC)
- Vitamins and Minerals Testing
 - Nutritional Minerals
 - Heavy Metals and Lead
 - Trace Minerals
 - Vitamins A, C, and D
- Color Analysis
 - Hunter L.a.b.
 - ICUMSA
 - Lovibond
- Contaminant Identification
 - Foreign Materials Identification
 - Multi-residue Pesticide Analysis
 - Artificial Colors by HPLC
 - Mycotoxins (Aflatoxin, Ochratoxin, Deoxynivalenol, Zearalenone, etc.)
 - Allergens (by ELISA): Egg, Milk, Soy, Casein, Shellfish, Gluten/Gliadin, Peanut, Treenuts, Sesame as well as many others

SPECIALTY ANALYSIS

- Shelf-Life Studies
- Challenge Studies
- FDA Detain





RADIOCHEMISTRY



EMSL's Radiological Department is a diversified laboratory which provides a full set of radiochemical analysis. The division includes analysis of radon in air and water as well as capabilities to detect alpha, beta, and gamma radiation in a wide variety of environmental samples. The radiochemistry laboratory can analyze various matrices which include, but are not limited to, food, water, soil, vegetation, wipes, and other unique sample matrices. The laboratory possesses a liberal radioactive materials license and can fulfill any customer need on radiation detection and analysis.

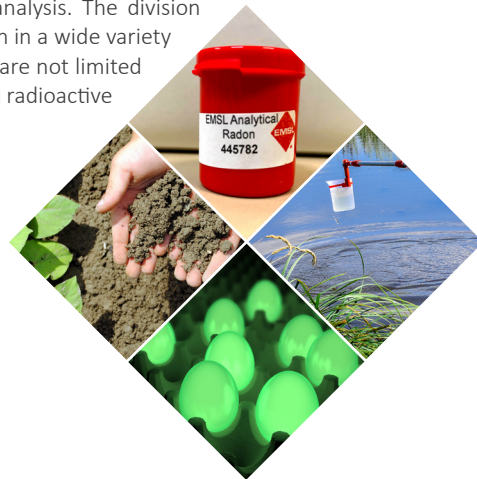
Key tests include (but are not limited to) the following:*

ANALYSIS CAN BE GROUPED INTO CATEGORIES BASED UPON THE TYPE OF POTENTIAL RADIATION:

- Gross Alpha
 - EPA 900.0
 - New Jersey Rapid Gross Alpha ECLS-R-GA.R8
- Gross Beta
 - EPA 900.0
- Gamma Emitters
 - EPA 901.1
- Gross Alpha, Gross Beta, and Gamma Emitters

ANALYSIS CAN BE PERFORMED LOOKING FOR SPECIFIC ISOTOPES OR GROUPS OF ISOTOPES:

- Americium: Am-241
- Nickel: Ni-63 (ECD Wipes)
- Plutonium: Pu-238, Pu-239, Pu-240
- Radium: Ra-226
 - EPA 903.0
- Radium: Ra-228
 - EPA 904.0
- Radon in Water: Rn-222
 - EPA 913.0
 - SM 7500 Rn-B
- Strontium: Sr-89, Sr-90
 - EPA 905.0
- Technetium: Tc-99
- Thorium: Th-230, Th-232, Th-228
- Tritium: H-3
 - EPA 906.0
- Uranium: U-235, U-234, U-238 or Total
 - EPA 908.0
 - EPA 200.8



ANALYSIS CAN ALSO BE PERFORMED BY LOOKING FOR COMMON PACKAGES OF ISOTOPES:

- FDA Standard (US)
 - Pu-238, Pu-239, Am-241
 - Ru-103/106, I-131, Cs-134/137
 - Sr-90
- CODEX Standard (European)
 - U-235, Pu-238, Pu-239, Pu-240, Am-241
 - Co-60, Ru-103, Ru-106, I-131, Cs-134, Cs-137, Ce-144, Ir-192
 - Sr-89, Sr-90, Tc-99
- Gamma Emitters
 - U-238 (Pa-234m), U-234, Th-232, Ra-226, Ra-228, Ac-228, Bi-214, Pb-214, Bi-212, Ti-208, K-40, Mn-54, Co-58, Co-60, Zn-65, Zr-95, Ru-103, Ru-106, Cd-109, I-131, Cs-134, Cs-137, Ba-140, La-140, Ce-144
 - EPA 901.1

KEY ANALYTICAL INSTRUMENTS INCLUDE

- 16- Alpha Spectroscopy Detectors
- 4- Germanium Gamma Spectroscopy Detectors
- 8- Gas Flow Proportional Counters (40 Detectors)
- 4- Perkin Elmer Liquid Scintillation Counters

**This is a summary of key tests, call for a full list of tests offered and for pricing.*

See Laboratory listings on pages 5-6 for laboratories that have Testing capabilities for these lab services listed above.



AIR TOXICS TESTING

EMSL

Volatile organic compounds (VOCs) encompass a wide range of chemicals used in many products and materials. These VOCs can be emitted into the air from certain solids or liquids, and many have the potential to cause adverse health effects, either from long-term exposure or from elevated levels over a shorter period of time.

Concentrations of many VOCs are consistently higher indoors than outdoors since they are emitted from so many products found in modern homes and buildings. Examples of common sources include: paints, paint strippers, and other solvents; wood preservatives; aerosol sprays; cleaning supplies, disinfectants and pesticides; air fresheners; stored fuels and automotive products; hobby supplies; dry-cleaned clothing; building materials and furnishings; glues and adhesives.

EMSL Analytical, Inc.'s network of laboratories provides testing services for VOCs in air, water and soil. In addition, we provide chamber studies for consumer product off-gassing analyses so that retailers and manufacturers understand what their products are emitting and can comply with regulations. These same services are available to the public so that they know what they are being exposed to in their homes.

Key tests include (but are not limited to) the following:*

VOLATILE ORGANIC COMPOUNDS (VOCs) VIA EPA TO-15

- VOC Organic Scan 74 Compounds
 - w/ Library Search
 - w/ Full Deliverable Package
 - w/ Library Search and Full Deliverable Package

VOLATILE ORGANIC COMPOUNDS (VOCs) VIA NJDEP

- VOC Organic Scan Low Level NJDEP Scan
 - w/ Library Search
 - w/ Full Deliverable Package
 - w/ Library Search and Full Deliverable Package

TO-15 REPORTING OPTIONS:

- ACGIH = American Conference of Governmental Industrial Hygienists
- AURA Personal Sampler
- CA HHSL = California Human Health Screening Levels (CHHSLs) for Indoor Air
- CA HHSL = California Human Health Screening Levels (CHHSLs) for Shallow Soil Gas (<5')
- CA Office of Environmental Health Hazard Assessment
- USEPA Vapor Intrusion Screening Levels (VISL)
- USEPA Industrial Regional Screening Levels (RSL) at THQ 0.1
- USEPA Industrial Regional Screening Levels (RSL) at THQ 1.0
- USEPA Residential Regional Screening Levels (RSL) at THQ 0.1
- USEPA Residential Regional Screening Levels (RSL) at THQ 1.0
- Indiana Department of Environmental Management – Screening Levels
- NC DENR DWM – Non-Residential Vapor Intrusion Screening Concentrations
- NC DENR DWM – Residential Vapor Intrusion Screening Concentrations
- NH DES – Waste Management Division- Indoor Air
- NH DES – Waste Management Division- Soil Gas
- NIOSH and OSHA Exposure Limit Comparisons
- NJ DEP Vapor Intrusion Indoor Air Screening Levels
- NJ DEP Vapor Intrusion Soil Gas Screening Levels
- OH EPA Indoor Air Standards due to Vapor Intrusion (Commercial Land Use Category)
- OH EPA Indoor Air Standards due to Vapor Intrusion (Residential Land Use Category)

- PA DEP – Table 5. Indoor Air Statewide Health Standard Vapor Intrusion Screening Values (SVIA)
- PA DEP – Table 4. Sub-Slab Soil Gas Statewide Health Standard Vapor Intrusion Screening Values (SVSS)
- PA DEP – Table 3. Near-Source Soil Gas Statewide Health Standard Vapor Intrusion Screening Values (SVNS)
- Possible Background Sources of Contaminants
- Target Compound Results Summary
- Target Compound Results PPMV Summary
- Tentatively Identified Compound Results Summary
- Tentatively Identified Compound PPMV Results Summary
- Total Volatile Organic Compounds (TVOC) Results Summary
- Total Volatile Organic Compounds (TVOC) Results Summary
- Vermont DEC – Waste Management and Prevention Division, IROCP Air Screening Levels at THQ 1.0
- Vermont DEC – Waste Management and Prevention Division, IROCP

FIXED GASES

- Methane
- Sulfur Gas Profile
- Ammonia
- Carbon Dioxide
- Carbon Monoxide
- Hydrogen Sulfide
- Oxygen
- Water Vapor
- C1-C6 Hydrocarbons





PHARMACEUTICAL TESTING

EMSL

EMSL Analytical, Inc. completed the acquisition of Marypaul Laboratories, Inc. on November 1, 2015 and rebranded the laboratory and their highly skilled staff as MPL Laboratories (MPL). Founded in 1985, MPL has a long, established, and successful history, providing quality microbiological analytical services for over 35 years. Our full-service laboratory occupies 20,000 sq. ft. in Sparta, New Jersey. The facility is in beautiful Sussex County, which is approximately one hour from New York City.

MPL is custom designed to expedite microbiological testing of pharmaceuticals, cosmetics, personal care products, foods, nutritional and dietary supplements, as well as raw and finished goods and pharmaceutical waters. MPL is U.S. Food and Drug Administration (FDA) and U.S. Drug Enforcement Administration (DEA) registered, and New Jersey Department of Environmental Protection (NJDEP) certified. We provide our customers with high quality, reliable test data in a timely manner along with experienced customer service. Our cutting-edge microbiology testing laboratory follows Current Good Manufacturing Practice (cGMP) and is accredited to the ISO/IEC 17025:2017 standard.

Our leading team of microbiologists includes M.S. and B.S. degreed microbiologists and other dedicated scientists. We offer traditional, culture-dependent bioburden and identification methods as well as Biolog, MIDI, VITEK MS, DNA Sequencing, Real-Time Polymerase Chain Reaction (PCR), and Whole Genome Sequencing (WGS) advanced identification technologies primarily through our laboratory located in Cinnaminson, New Jersey.

Key tests include (but are not limited to) the following:*

- USP <51> Antimicrobial Effectiveness Testing
- USP <60> Tests for Burkholderia Cepacia Complex
- USP <61>, <62> Microbiological Examination of Nonsterile Products
- USP <85> Bacterial Endotoxins Test
- USP <797> Pharmaceutical Compounding – Sterile Preparations
- USP <1231> Water for Pharmaceutical Purposes
- USP <2021>, <2022> Nutritional and Dietary Supplements
- Personal Care Products Council (PCPC) Testing – Methods M-1 through M-6
- Suitability Studies and Preparatory Testing
- Cosmetic Microbiology – ISO Methods
- AOAC International Methods
- FDA BAM Methods
- Environmental Sample Analysis
- NJDEP Compliant Water Analysis



**This is a summary of key tests, call for a full list of tests offered and for pricing.*

See Laboratory listings on pages 5-6 for laboratories that have Testing capabilities for these lab services listed above.



DNA and PCR LAB SERVICES

EMSL

Quantitative Polymerase Chain Reaction (qPCR) is a cutting-edge molecular technology that analyzes for the genetic material called deoxyribonucleic acid (DNA) that is found in every cell. DNA is unique for every individual organism. Using qPCR allows for the detection of fungi, bacteria, and certain microorganisms by identifying the presence of their specific DNA in their genome.

qPCR analysis of fungi and certain bacteria is performed at EMSL Analytical, Inc. under a Patent License Agreement with the EPA National Exposure and Research Laboratory. EMSL is currently developing several methods using qPCR for the detection of pathogenic bacteria that are of interest to the indoor air quality, food, consumer products, and pharmaceutical industries. EMSL has DNA sequencing capacity for bacteria, fungi, and animal identification.

qPCR can detect the presence of small quantities of organisms whether they are alive, dead, or cannot be cultured. For these reasons, qPCR is a fast, accurate, sensitive, and specific alternative analysis that has many advantages over traditional microbiological methods that involve microscopic direct examination or culturing.

Key tests include* (but are not limited to) the following:

PCR - WATER DAMAGE PANELS

- Environmental Relative Moldiness Index (ERMI)
- Water Damage 10 Panel
- Water Damage 15 Panel
- Water Damage 20 Panel
- *Aspergillus/Penicillium* Screen

PCR - ASPERGILLUS PANELS

- *Aspergillus* Comprehensive 15 Panel
- *Aspergillus* Common 10 Panel
- *Aspergillus* Nosocomial 6 Panel

PCR - PENICILLIUM PANELS

- *Penicillium* Comprehensive 13 Panel
- *Penicillium* Comprehensive Mycotoxin 9 Panel

PCR - FECAL CONTAMINATION INDICATORS

- Total *Enterococcus*
- Total *Bacteroides*
- Human *Bacteroides*

PCR - FOOD

- Meat Species Identification

PCR - LEGIONELLA TESTING

- Broad Screen for 50 *Legionella* spp. and *Legionella pneumophila*
- *Legionella pneumophila*
- *Legionella pneumophila* serogroup 1
- *Legionella micdadei*
- *Legionella saintelensi/cincinnatiensis*
- *Legionella maceachernii*

PCR - PATHOGEN DETECTION PACKAGES

- *Mycobacterium tuberculosis*
- *Salmonella*
- *Histoplasma capsulatum*
- *Cryptococcus neoformans*
- *Giardia* spp.

PCR and DNA SEQUENCING

- Bacteria DNA ID
- Fungi DNA ID
- Whole Genome Sequencing utilizing Next-Generation Sequencing (NGS)

PCR – VIRUSES

- SARS-CoV-2 (COVID-2019)
- Human adenovirus
- Human norovirus
- Human polyomavirus
- Human rotavirus
- Human enterovirus
- Human astrovirus

PCR – OTHER

- Bed Bug (*Cimex lectularius*)
- Ticks- Lyme Disease Pathogen *Borrelia burgdorferi*
- *Candida auris*
- Mycotoxin-Producing Fungi



*This is a summary of key tests, call for a full list of tests offered and for pricing.

See Laboratory listings on pages 5-6 for laboratories that have Testing capabilities for these lab services listed above.



PRODUCTS DIVISION

EMSL

EMSL's Products Division was established based on demands of our clients to provide the most sophisticated and up-to-date sampling instruments available in the Environmental Industry. The products division encompasses an extensive variety of equipment including, Air Sampling Supplies, IAQ Instruments, Bulk Sampling and Analytical Supplies, Remediation Equipment as well as a full line of Rental Equipment. Our Products Division staff has a vast knowledge of equipment and applications to help with any project requirements. All client orders are monitored and processed through our East and West coast warehouses to assure that clients receive orders at the most cost-effective rates (FedEx ,UPS) and within the time constraints needed to complete the job.

Key tests include* (but are not limited to) the following:

IAQ SAMPLING

- Impactors
- Agar Plates
- Spore Traps
- Carpet Sampling Kits
- Swabs and Tape Lifts
- Allergen Sampler
- Mold Sampling Kits
- Accessories

CALIBRATION

- Primary Calibrators
- Rotameters

HIGH VOLUME PUMPS

- High Volume Sampling Pumps and Kits
- Sampling Stands
- Tubing
- Parts and Accessories

LOW VOLUME PUMPS

- Low Volume Sampling Pumps and Kits
- Tube Holders
- Parts and Accessories

AIR SAMPLING CASSETTES AND SUPPLIES

- PCM/TEM Cassettes
- PVC Cassettes
- PCR/Virus sampling Cassettes
- Cyclones
- Parallel Particle Impactors (PPI)
- MCE Cassettes
- Pre-Weighed Cassettes Specialty Filters

AIR SAMPLING DUST MONITORS

- PM10 Monitors
- Dust Monitors
- PM2.5 Monitors

TUBE SAMPLING

- Smoke Tubes
- Detector Tubes
- Hand Pumps
- Air Current Tubes

BULK SAMPLING AND ANALYTICAL SUPPLIES

- Acetone Vaporizers
- Coverslips
- Whirl-Pak Bags
- Slides
- Coring Modules, T-handles, Drill drivers
- Bulk Asbestos Accessories

MICROSCOPES

- Phase Contrast
- Polarized Light
- Stereo
- On Site PCM Kits

WATER SAMPLING

- pH Meters
- Sampling Bottles
- Dissolved Oxygen Meter
- Water Testing Kits

SURFACE SAMPLING

- Meth Wipes
- Lead Swabs
- Ghost Wipes
- Asbestos Wipes
- Centrifuge Tubes

IAQ INSTRUMENTS

- Thermal Cameras
- PIDs
- Moisture Meters
- Temperature/RH Meters
- Gas Detection
- Particle Counters
- Noise Dosimeter
- Borescope
- IAQ Meters
- Sound Level Meters

REMEDIATION EQUIPMENT

- Pressure Recorder
- Negative Air Machines
- Hepa Vacuums
- Air Velocity Meters
- Remedial Coatings

PERSONAL PROTECTIVE EQUIPMENT

- Respirators
- Replacement filters
- PAPR
- Gloves
- Protective Clothing

TRAINING LIBRARY

- Books
- Software

RENTAL EQUIPMENT





PROJECT EXPERIENCE, REFERENCES AND CASE STUDIES

EMSL utilizes the resources, scientific knowledge, and expertise from our varied divisions by utilizing the abilities from our scientists within their field of expertise working in a collaborative manner as necessary to measure, evaluate, or obtain data objectives for our customers. We maintain core division competencies, but also provide diversity expertise. Project experience/case studies below demonstrate our unique abilities and/or core competencies that allow us to provide services for high profile, cutting-edge programs. Some key highlights are as follows:

Acrylamide in Roasted Coffees

A large coffee shop operating numerous franchises nationwide had imported exotic coffee from various international points in order to offer consumers a “one-of-a-kind” experience in their shops. The acrylamide content of numerous select raw beans, various grind levels, and final brewed coffees was evaluated to determine if any of the product posed unusual health risks to consumers or workers. EMSL was able to handle the project using methods established but not attempted with coffee at the time, and the results showed that the coffees contained very low levels of acrylamide with detection limits of 10ppb.

Food Allergen Testing in Allergen-Free Products

A manufacturer of tofu desserts was concerned that their co-packaging facility had inadvertently introduced milk into their desserts. The equipment was previously used to make similar desserts with milk and milk products and may not have been adequately cleaned between uses. Purchasers of the tofu desserts include people with milk allergies. Therefore, the manufacturer had to make sure their product was acceptable to release. EMSL was able to test the desserts for any residual milk allergens and showed there was none detected.

Asbestos - On-site Laboratory Services

EMSL Analytical, Inc. was requested by the U.S. EPA to initially provide mobile laboratory services at a large asbestos Superfund designated project of national importance in Libby, MT. Eventually, EMSL established a fully-staffed, fixed laboratory location to continue to support the EPA with time critical results. Work performed over the past 15 years includes PLM, PCM, SEM and TEM analyses on thousands of samples for varying turnaround times. EMSL participates in technical conferences and has been instrumental in providing method development and modification to existing methods in order to provide legally defensible, fully-validated results in unique and non-routine matrices.

Asbestos - World Trade Center NY, NY

EMSL Analytical, Inc., under contract with the U.S. EPA, has been providing extensive asbestos, lead, silica, and man-made vitreous fiber (MMVF) analysis at the World Trade Center site and surrounding areas in downtown New York, as a result of the terrorist attack in September 2001. EMSL Analytical, Inc. has also

provided consulting regarding analytical methodologies, method development and in-depth studies characterizing the particles in the dust that was deposited throughout lower Manhattan. Over 100,000 tests have been performed by EMSL since the inception of the project, including PLM, PCM, SEM, XRD, and TEM analysis, with turnaround times varying from 24 hours to 72 hours.

Biological - Mold in Hospital

A hospital was experiencing an increased occurrence of infections in one of their intensive care units. EMSL was hired to determine the cause of the problem. Initial Air Quality analysis revealed an unusually high concentration of airborne mold spores. Additional testing narrowed the problem to an air conditioning unit that was collecting the water condensed by the cooling coils producing a natural incubator for mold growth. The problem was compounded by the fact that the contaminated water was next to the fresh air intake for that wing of the hospital.

Clandestine Drug Labs Cleanup

A large contract laboratory was providing services to Certified Home Inspection Companies after homes were deemed to be unsafe due to drug residues on surfaces and in HVAC ductwork. The laboratory wanted a screening assay to cover multiple illicit compounds that might persist even after thorough cleaning. EMSL developed a surface wipe assay that could monitor for the presence of these abused substances at the lowest levels requested of 0.1ug/wipe using Ion Trap LC/MS/MS while providing rapid turnaround time in 24 hours.

Contamination Testing - Manufactured Ice Cream Scoops

A manufacturer of ice cream scoops found white powder within sealed bags containing their product. The ice cream scoops were found to be made of uncoated aluminum. Once placed within the individually sealed packages moisture resulted in oxidation of the metal and formation of aluminum oxide, which is a white powder. Subsequent analysis on several variations of their product, including anodized and polymeric coatings resulted in similar oxide formation. Even repeated cycles of cleaning using a standard home dishwasher resulted in oxide formation. The analysis which included microscopy, Energy Dispersive X-Ray Spectrometry, and X-Ray Diffraction Spectrometry resulted in the conclusion to buy stainless steel and leave aluminum out of the kitchen.



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Corrosion - Airplane Wings on Jet Fighter Chicago, IL

Pieces of airplane wings from jet fighters, based on aircraft carriers, were brought to EMSL to compare the degree of corrosion following the application of various solvents used to desalt the airplanes. A small piece of the metal from each wing was embedded in epoxy and polished to a smooth finish. A detailed analysis with SEM and EDX was performed, and the level of corrosion was assessed in each sample. The results were used to pick the most effective desalting solvent.

Degradation - Space Telescope Component

A deterioration in the performance of a high precision optical component used in a space telescope led to investigation of the aluminum thin film deposited on its surface. Using AES and ion sputtering, the depth profiles of Al+ and O- in the aluminum coating were obtained. The results illustrate that the aluminum thin film had multiple internal oxidation layers. Therefore, the failure of the optical component was linked to inconsistent vacuum levels during deposition process.

Environmental Testing – PCBs in Caulking

A major metropolitan city system conducted a pilot testing program for the presence of PCBs in Caulking building materials. EMSL analyzed thousands of samples utilizing U.S. EPA methods. Extensive quality control, sample matrix challenges and sample modification issues, aggressive deadlines, and quick TATs were necessary to complete this high profile work without compromise to the laboratory data integrity.

Environmental Testing – PCB testing for ship components

Complying with a directive by the EPA, an extensive sampling program for PCBs in ship components was necessitated. The project was complicated due to international (Europe) client directives and import requirements for China which was the final destination for this ship that was to be disassembled in its entirety. Testing of various non-traditional components including, but not limited to, insulations, caulking, rubbers, gaskets, plastics, as well as traditional matrix materials such as oils, was conducted. The laboratory data was reviewed and accepted by the EPA and third party data validators. The project was completed on time, data of high quality was delivered, and the objectives of both the US and International clients and U.S. regulators were achieved.

European Regulatory Compliance - Mycotoxins in Ginger

A beverage bottling company was interested in verifying that their source for ginger was in compliance with European regulations related to aflatoxins and Ochratoxin A. The current regulation requires less than 10ppb. EMSL was able to develop a method for the gin-ger using LC/MS/MS with detection limits low enough to meet the regulations allowing the use of the key ingredient.

Failure Analysis - Automotive Brackets

Metal brackets used on certain automobiles were breaking. This could result in a potentially dangerous outcome if the vehicle is in operation at the time of failure. Physical testing of the brackets revealed that they had a tendency to break at forces below the intended limit by both Tensile and Flexural analysis. Further testing by microscopy was employed on cross-sectioned pieces of the fractured parts. The result of testing indicated that the parts were of inferior quality. Instead of high-grade steel, the parts were made from standard steel and coated with chrome. In addition, the steel used was found to have microscopic air voids within the metal. The part, which was made in China, was inferior and did not meet the specifications of the design engineer.

Failure Analysis - Ceramic Sinks in Hotels

A building contractor working on a renovation of a large hotel in New York City encountered repeat installation failures of ceramic sinks produced by a major bathroom fixtures provider. Numerous ceramic sinks were fracturing in an unexpected but very similar way during the installation or very shortly after. The contractor wanted to find out if the problem was related to the poor installation procedure or was due to a defective product. The analysis performed by EMSL (light microscopy, SEM/EDX, XRD analysis, ink testing) determined that all the sinks had the same type of defect at the same location, therefore pointing to a manufacturing defect acquired at the slip casting stage.

Fire Debris Analysis - Black Carbon/Soot

Combustion by-products/Fire debris analysis (Black carbon/soot, char, ash)- Fire insurance claims, especially due to the increasing wildfires incidents, have risen considerably. Considering the materials and the conditions that are involved in fires (residential or wildfire) the analysis of fire residues (combustion by-products) usually covers black carbon/soot, char and ash. Black carbon/soot is similar with carbon black in terms of morphology and size, but black carbon/soot is used in conjunction with “unwanted” products of incomplete combustion of hydrocarbons, as opposed



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to the “wanted” and controlled process that produces the industrial carbon black. Char is defined in ASTM D 6602 as being composed of particles that are larger than $1\mu\text{m}$ and may preserve the original cellular morphology of the material that was burnt. The generic term of carbonized material applies to char, ash, and coke/coal. Char is mostly elemental carbon, but it may also contain trace concentrations of mineral components and ash. Ash is also elemental carbon, with trace concentrations of minerals. However, the main difference between ash and char is that ash may not preserve any of the original morphology of the precursor and it may have a higher concentration of inorganic components due to the complete consumption of the organic matrix. As an example, analysis performed by EMSL Analytical, Inc. of samples collected from homes impacted by wildfires by a composite analysis involving TEM w/EDX (the mandatory method for black carbon/soot analysis) and light microscopy, determined the levels of contamination of various locations in homes with wildfire debris; the information could be used for mapping of impacted areas and accurate assessment for cleaning and decontamination needs.

Forensic - Explosion of Tanker

An explosion and subsequent fire in a cargo tanker caused the ship to sink along with its cargo of iron pellets. EMSL was asked to determine if the cargo of iron pellets, known as Direct Reduced Iron (DRI), could have caused the accident. Analysis utilizing the SEM revealed aberrations in the protective coating applied to the pellets which allowed access points for moisture to contact the sensitive inner surface of the DRI. Analysis was then performed to measure and identify gasses produced from the pellets when exposed to the conditions indicative of a ship's hold. It was determined that the DRI pellets would act as a catalyst to separate the hydrogen and oxygen in the water vapor found in the ship's holds. Furthermore; the cargo was sufficient to replace the air in the holds, three times over, with a combination of free hydrogen and oxygen. One spark is all it would take to ignite the hydrogen that would then be fed by the oxygen resulting in an explosion capable of causing the accident that befell the cargo ship.

Indoor Air Quality - Respiratory Problems

Respiratory problems were being experienced in a four-story post office building. EMSL requested air samples from the consultant hired to solve the problem for the client. SEM revealed the dominant presence of bacteria with concentrations diminishing with increased floor level. Conversations with the consultant revealed that pigeons socialized near the buildings' AC system located outside the building at ground level. EMSL requested a pigeon feather and was able to match the bacteria on the pigeon feather with the airborne bacteria within the building.

Industrial Hygiene - Engine Exhaust

Two projects that we have recently completed involve one at a Hospital with a Helipad and a facility near a major metropolitan airport. Both facilities had the same problem—too much engine exhaust. Occupants were complaining about feeling nauseous and other related breathing problems. EMSL recommended that the consultant collect samples for volatile organic compounds (VOCs) using either TO-15 or EMSL's new Multiple NIOSH method. By using the Multiple NIOSH method, EMSL could also identify and quantitate any fuel vapors that may be in the air using NIOSH 1550. EMSL recommended that the client perform formaldehyde analysis at the JFK site. Formaldehyde is a known combustion product of diesel and jet fuel. EMSL also strongly recommended a CO (carbon monoxide) monitor be placed in the affected area due to the imminent hazard of CO in an exhaust area.

Industrial Hygiene - Sewer Gas Odor ID

One of EMSL IAQ workshop attendees wanted us to test for various ‘gaseous’ components. He was working for a school district that has a cafeteria kitchen that experienced pre-meal flatulence of a sort. During certain food preparation activities, a sewer gas odor was noticed and caused concern. Recent excavation activities adjacent to the kitchen may have punctured a gas or sewer main or both. EMSL was able to rent the consultant a Draeger CMS handheld instrument which will measure over 30 different compounds in the vapor form. The client used it to measure hydrogen sulfide and mercaptans. The client also took samples in TO-15 minicans and analyzed the air samples for methane. EMSL was able to assist the consultant in identifying the source through this sampling protocol.

Lead Paint - White Pigment Lead

EMSL was asked to determine if the paint covering the woodwork of an apartment building contained a specific type of lead pigment, which would point to a certain paint manufacturer. With SEM and EDX it was shown that the lead-based paint was present in only the three innermost (oldest) layers. By collecting paint only from these layers and performing X-Ray Diffraction Analysis (XRD) the presence of the specific lead pigment sought was established.

Lead (Pb) and Asbestos Investigation Program – New Technology Program

EMSL Analytical, Inc. processed over 50,000 samples via the EnvironmentalReports.com data collection program utilized by a Consultant inspecting facilities for US Army bases nationwide. Sample data were collected via handheld PDA devices and data was seamlessly transmitted to the laboratory for log-in processing. Reports were exported via the system which automated data calculations and report generation.



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Microbiological

Antibacterial activity of semiconducting photo catalytic materials. A European company was interested in testing their newly developed ceramic for antimicrobial activity. Based on discussions with the client, ISO 27447 was the method of choice because they had incorporated photo catalytic materials. The ceramic was inoculated with bacteria, then exposed to different UV intensities. EMSL was able to show the product was effective at 0.01 mW/cm² which is comparable to the intensity received during the daytime in a room at about 3 meters from the window.

Odorous Drywall – AKA Chinese Drywall Syndrome

“Chinese Drywall”, also called odorous gypsum wallboard, is an emerging issue in the IAQ community. The material, which has been identified in new and remodeled homes in Florida, Louisiana, Texas, and reported elsewhere, has been determined to emit chemicals that cause characteristic sulfide odors, black discoloration of metal fixtures, electrical components, and domestic water piping, as well as black sulfide corrosion of HVAC components leading to failure. There are also reports of health effects associated with the material. The selection of the most appropriate analysis approach to determine the source or the sources of the sulfur-based odor in the sub-par drywall is still controversial. EMSL Analytical, Inc. offers a panel of tests that covers a range of issues associated with the odorous drywall problems. The elemental analysis of the bulk drywall is performed to determine the concentration of impurities (such as iron, strontium, magnesium, phosphorus, chlorine) in a direct comparison with samples of domestically-produced drywall tested negative for all the problems associated with the “Chinese drywall” syndromes. The exact identity of the compounds formed by these elements is still under investigation; however, SEM/EDX analysis of selected impurities extracted from the odorous drywall revealed the presence of sulfur in association with Fe and Sr, indicating the presence of possible pyrite (FeS₂) and strontium sulfide (SrS). These compounds could decompose in hot and humid conditions. SrS, for example, slowly releases H₂S in moist air. It is speculated that the presence of these compounds in low concentrations as impurities is related to mined gypsum. X-ray Diffraction (XRD) is used to determine the crystalline components in the samples. Off-Gas Sampling by GC/MS is a method that directly addresses the odor associated with the problem. Samples of the gases collected from wallboard samples in the laboratory via environmental chamber approach consistently showed elevated levels of carbon disulfide and carbonyl sulfide. Corrosion propensity of the odorous drywall is performed in simulated corrosion experiments performed

in our laboratory using drywall that was tested positive for sulfur-containing gases. The simulated corrosion testing showed variable timeframes for developing the black copper corrosion process. In accelerated conditions, the advanced corrosion in the form of black films of copper sulfide developed on the surface of copper coupons in as fast as 13 days of exposure at 95% humidity and 98°F. In gentler exposure conditions, the corrosion was less advanced and it developed in 6-8 weeks of exposure. The microbiological analysis covers the approach where the sulfur odors may be produced when certain aerobic and anaerobic bacteria utilize certain molecules for growth. Therefore, endotoxin analysis for Gram-negative bacterial contamination and sulfur reducing and iron related bacterial tests are recommended.

PCR (Polymerase Chain Reaction) DNA Sequencing – *Bacteroides*: qPCR

Microbial source tracking (MST) is based on the assumption that specific strains of bacteria are associated with specific host species. MST methods are attractive because their application on environmental samples could help define the nature of water quality problems in impaired aquatic resources. Until recently, Coliform and *E. coli* testing has been used as common targets for over 50 years to determine the presence of fecal contamination in recreational water. EMSL was awarded several multiple year contracts with the U.S. EPA to perform qPCR analysis for recreational beach studies targeting *Bacteroides*. The objective of the study is to evaluate and apply fast and reproducible DNA-based technology that can detect and track fecal contamination back to its source in complex environmental matrices, including recreational and drinking water resources. As a result of this study, it has been concluded that *Bacteroides* is a more reliable and robust fecal indicator of sewage contamination in recreational waters.

Product Testing - Counterfeiting Fraud

A reputable company producing maintenance products for automobiles (metal polishing lotions, leather care) received complaints from their clients that the quality of their products declined, especially for products bought in Canada. They suspected that their products were being counterfeited. They contacted EMSL to perform a comparative analysis of genuine and suspected counterfeited products, sold under their name. Complex analysis employing various techniques (light microscopy, SEM/EDX, physical properties measurements) revealed that indeed the products were not identical. The analysis was key evidence in a 2010 lawsuit.



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Product Testing - Light Transmission Through Glass

A manufacturer of specialty glass containers needed to verify the effectiveness of coatings used to limit the transmission of light. The containers are used for holding light-sensitive liquids. Analysis was performed using transmission spectrometry. Wavelengths from 300nm to 2500nm were tested over several lots of bottles. The data collected revealed that two of the lots were outside of the tolerance limits and could result in premature deterioration of the contents.

Product Testing - Transmission of Phthalates

A U.S. manufacturer of soft sided lunch pails requested EMSL to perform a saliva transfer study for phthalates. EMSL utilized GC/MS analysis for several phthalates using simulated saliva. EMSL was able to determine that phthalates can be transmitted off children's lunch boxes.

Raw Materials Testing – Mycotoxins

Nivalenol and Aflatoxin B in malt for beverages-A major supplier of malt was concerned that a new source would not be able to meet their strict requirements for quality. As part of their QA program, the supplier sent EMSL samples to determine if any mycotoxins were present. The laboratory was able to quickly develop an extraction and analytical method in one week using LC/MS/MS giving the supplier the needed conformity to allow the use of the new malt.

Raw Materials Testing - Nicotine and Tobacco

A Canadian importer was interested in verifying the label claim of a shipment of imported flavored molasses. The molasses matrix is very complex and is difficult to assay using wet chemical methods. EMSL was able to extract the alkaloids from the molasses matrix and determine that the alkaloid content was low enough to meet the label claim of 0.1% by LC/MS/MS.

Research & Development - Allergen Study

A university researcher contacted EMSL to help with a study they wanted to conduct. The researcher was studying intervention methods for different species of cockroaches that are common in households in New Orleans. The German and American cockroach is most prevalent and has been implicated in increased asthma in children in other studies. EMSL was able to perform cockroach allergen testing for the Bla g 1 allergen, providing the researcher with a quantitative estimate of the total antigen present in the house dust.

Shelf Life Study - Chemotherapy Drugs

A large Pharmaceutical Manufacturer was interested in learning about their extended shelf life of an injectable chemotherapy formulation. The main focus was to determine whether the primary degradation had in fact started to occur during storage. EMSL developed an assay that could monitor for the presence of the degradation product at 0.1% or less as required using Ion Trap LC/MS/MS while providing rapid turnaround for the method in two weeks.

The above case studies and project experience are a high-light of our vast and highly diversified capabilities. Please go to www.emsl.com to see many more studies and related capability information.