

## Surface Science Laboratory Building 25 – Morgantown

- *The Surface Science Laboratory is an R&D support function at NETL*
- *The Surface Science Laboratories are federally directed but operated and supported by site support contractors and subcontractors*

NETL researchers are using analytical instruments to study *in-situ* reactions of solid and gaseous fossil fuels such as coal and coal derivatives. These studies are important to developing cutting edge technologies including advanced, energy-efficient fossil power plants and CO<sub>2</sub> sequestration. These NETL laboratories have unique capabilities to study reactions at high temperatures and/or pressures. The systems can be used to determine what causes reactions, and the extent of reactions, as well as chemical and physical changes that occur over time. Analytical instrumentation resources used in these studies employ both surface and bulk analysis techniques.

NETL researchers use this analytical equipment in conjunction with facilities that conduct laboratory-scale sorbent and catalyst preparation and bench-scale sorbent and catalyst testing. Studies conducted using these facilities have led to advances in sorbent and catalyst development, gas-solid interactions, and surface characterization.

Desulfurization sorbents have been developed that are applicable to a wide range of temperatures and are suitable for use with different fuel gas streams.

Key instrumentation and techniques include:

- Thermogravimetric Analysis (TGA) Systems
- FTIR Spectrometer with High-Temperature Diffuse Reflectance Accessory and Gas Exposure Cell,
- Scanning Electron Microscope and X-Ray Microanalysis,
- X-Ray Photoelectron and Auger Electron Spectrometers,
- Atomic Force Microscope, and
- Other analytical capabilities for physical and chemical characterization

**Analytical Laboratories  
Building 25 – Morgantown**

- *The Analytical Laboratories are an R&D support function at NETL*
- *The analytical laboratories in Morgantown are staffed by site-support contract employees*

The Morgantown Analytical Laboratories are utilized to perform accurate chemical and physical analysis on a variety of samples.

Analyses performed include helium density, total sulfur, surface area and particle size distribution, mass spectrometry analysis, pH, specific gravity, gas chromatography analysis (hydrogen, nitrogen, oxygen, carbon dioxide, carbon monoxide, methane, ethane, propane, butane, pentane, hexane, heptane, 2-methylbutane, 2,2-dimethylbutane, ethylene, hydrogen sulfide, sulfur dioxide, thiophene, tetrahydrothiophene, carbonyl sulfide, carbon disulfide, methyl mercaptan, dimethyl sulfide, argon and ammonia), and thermogravimetric analysis (TGA). The data is collected and processed using TotalChrome software, the StarLIMS database, and Microsoft Excel, thus a good working knowledge of this software is essential.

The instruments utilized for the preparation and analysis of samples include: a Perkin-Elmer GC, Micromeritics Accupyc 1330 helium density analyzer, a Leco SC-432DR sulfur analyzer, a Quantachrome Autosorb 6 surface area and particle size distribution analyzer, a Perkin-Elmer GC/MS, Perkin-Elmer, Hewlett Packard, HNU, SRI, GOW-MAC and CARLE gas chromatographs, and three thermogravimetric analyzers.

## **Computational Sciences Building 3 – Morgantown**

- *Computation Sciences is an R&D support function at NETL*
- *The visualization research is lead by a team of Federal employees and supported by both professional and technical site-support contract employees*

The mission of the visualization research group is to develop leading edge visualization software and systems to support the research of fossil fuel combustion. We are currently working on projects that visualize transient computational fluid dynamics CFD data and advanced power systems.

### **Tiled Display System**

The tiled display system consists of 9 1024x768 resolution projectors arranged in a 3 x 3 array and 10 PC workstations. With a resolution of over seven million pixels, the tiled display is very useful when visualizing large CFD data sets.

### **Immersive Display System**

The immersive display system uses passive stereoscopic technology to provide realistic 3D graphics. The system consists of 3 wall screens arranged in a wrap around configuration. Each of the wall screens are 8 ft. wide and 6 ft. high. There are 6 projectors, 2 for each screen, one for the left eye view and the other for the right eye view. There are a total of 7 pc workstations driving the graphics, one for each projector and one for user input.

### **Advanced Power System Visualization Software**

The advanced power system visualization software allows engineers to navigate through the power plant, visualize specific components, interact with the process and observe the results of their interaction. This software consists of a graphics programmer interface developed commercially and in-house software to handle the user-interface.

### **Computational Fluid Dynamics Visualization Software**

The CFD visualization software allows engineers to visualize transient CFD data. This software runs on a single workstation or the tiled display system. The graphics software is Paraview which is an open-source software developed by Sandia, Los Alamos, and Lawrence Livermore National Labs. CFD translation software is being developed in house to allow NETL's CFD data sets to be viewed by the graphics software.

**Fitness Center**  
**Building 3 – Morgantown**

- *The Fitness Center is an ancillary support function at NETL*
- *The fitness center is staffed by site-support contract employees*

The fitness center provides a variety of cardiovascular and weight equipment. Along with the equipment, programs are offered to improve the health of employees. The programs offer development and implementation of fitness and health programs that provide employees the opportunity to enhance and maintain healthy lifestyles. Services will include individual and group exercise programs to promote cardiovascular conditioning, muscular strength, endurance, and flexibility; weight management, nutrition, and smoking cessation programs to help encourage positive lifestyles changes; and health education programs to provide the opportunity, motivation, and tools for self-improvement. All of the programs offered are designed to meet employee's needs and interests.

**Occupational Health Unit in MGN  
Building 3, Room 140 -- Morgantown**

- *The Occupational Health Unit is an ancillary support function at NETL*
- *The OHU is staffed by site-support contract nurses*

The Occupational Health Unit provides medical, occupational health, and wellness services to NETL employees.

**Medical Services**

Non-emergency and emergency First-aid  
Cardiopulmonary resuscitation  
Automatic External Defibrillator (AED)  
Initiate Workers' Compensation paperwork  
Medical Doctor on site one day a week

**Occupational Health Services**

NETL employees, whose job tasks place them at risk for routine exposure to hazards, are required to complete a medical surveillance (mandatory) health evaluation. These evaluations are offered annually based on current and/or previous job exposures. All other NETL employees are offered a voluntary health evaluation (annually for age 45 and over; biennially for under age 45) on a space available basis. Health evaluations include medical history (past and present), fasting blood work, blood pressure check, EKG, hearing test, vision test, pulmonary test, urinalysis, and medical examination by the on-site physician.

**Wellness Services**

The OHU's offer health programs such as Weight Watchers, smoking cessation, blood pressure and blood sugar monitoring, flu clinic, foreign travel care, employee counseling, and educational materials. Each site has a fitness facility with cardiovascular and weight equipment. The fitness facility in MGN is located in Building 3.

## **Fuel Cell, Gas Turbine and Hybrid Systems Research Building 4 – Morgantown**

- *Fuel Cell, Gas Turbine and Hybrid Systems Research is an R&D support function at NETL*
- *The fuel cell/hybrid research is lead by a team of Federal employees and supported by both professional and technical site-support contract employees.*

The projects in Building 4 support NETL's gas turbines, fuel cell and hybrid systems R&D programs. The objectives of these projects are to improve efficiency, reliability, and fuel flexibility for these systems while reducing emissions of NO<sub>x</sub> and CO.

Key projects in this facility and activities staffed by the site support contractor for this research include:

- DOE Fuel Cell Test Facility — This is a test facility designed to evaluate performance and degradation of SOFC prototype units in the 5 to 15 KW size range. The facility was built to verify performance of units developed by NETL contractors. The units often run 24 hours a day, but are generally only manned for a standard 8-hour daylight shift.
- Hybrid Test Facility— The hybrid test facility is a Gas Turbine-Fuel Cell Hybrid test facility that began operation in February of 2004. The purpose of this project is to examine controls issues associated with operation of hybrid systems and to develop suitable control strategies for GT-FC Hybrid systems.
- SOFC Cell Facility— The Solid Oxide Fuel Cell test facility is comprised of a number of fuel cell test stands that are used to collect fuel cell performance data for the purposes of validating advanced fuel cell models.
- Multi-Cell Array – NETL's MCA is a mobile test skid designed to measure degradation of fuel cell performance in the presence of coal gas contaminants. The skid is designed to be transported to coal gasification sites around the country and to operate for extended periods of time (several weeks at a time) on a slip stream containing coal gas. The unit was designed by federal personnel and fabricated by support contractor personnel. Support contractor personnel support testing both on the DOE site as well as during field operations.
- Low Pressure Development Combustor – This facility is used for testing of new combustion concepts, assessment of combustion dynamics (combustion generated pressure oscillations), testing of fuel flexible combustion strategies and for instrumentation development to support NETL's turbines program. The analysis involves specialized skills for signal processing including cross spectral analysis, Fast Fourier Transforms, image processing (including ensemble averaging, image acquisition using ICCD cameras and high speed cameras), acoustic analysis (including measurement of acoustic impedance and analytical description of acoustic transfer matrices), and Mathcad modeling.

### **Chemical Handling Building 33 -- Morgantown**

- *The Chemical Handling Facility is an ancillary support function at NETL*
- *The hazardous waste facility in Morgantown is staffed by site-support contract employees*

NETL is a large quantity generator, and B-33 is a 90 day accumulation facility. Waste is collected and transported from about 45 satellite accumulation areas to B-33, where the waste is evaluated and prepared for shipment off-site. Typical wastes include waste chemicals, lead paint, aerosol cans, fluorescent lights, paint, coal/fuel wastes, and batteries.

### **Clarifier/NPDES Permit Morgantown**

- *The Clarifier is an ancillary support function at NETL*
- *The Clarifier is staffed by site-support contract employees*

At the Morgantown site, NETL retains two permits under the NPDES. One pretreatment permit, Morgantown Utility Board (MUB) Permit 012, was issued by MUB for the discharge of sanitary and pretreated industrial wastewater to Morgantown's municipal sewer system Publicly Owned Treatment Works (POTW). This permit was renewed in July 2000. Industrial wastewater consists of laboratory sink waste-water, motor pool waste-water, condensates, and boiler blow-down. The waste-water is pretreated by a 16-ft-diameter clarifier and a 12 x 16 ft sludge drying bed. The waste-water is also treated to control pH. Discharge monitoring reports are submitted monthly for water quality parameters and annually for organic parameters.

The other Morgantown site permit issued under the NPDES is a general storm water permit for industrial activities, for the discharge of storm water to Burroughs Run and West Run. NETL is required under to (1) monitor semiannually and report annually to the State of West Virginia from three outfalls; and (2) maintain a storm-water pollution prevention plan and a groundwater protection plan, both to be retained on site and made available for state review as requested.

## **CT Scanner Laboratory Building 17 -- Morgantown**

- *The CT Scanner Laboratory is an R&D support function at NETL*
- *The CT Scanner Laboratory is federally directed and is operated and supported by site support contractors and subcontractors.*

Contractor and subcontractor employees maintain and operate the laboratory, analyze data, and contribute towards research publications. Computed Tomography (CT) scanning allows researchers to observe the inner structures of geological core samples. Used in conjunction with NETL's Core Flow Laboratory and computational research capabilities, the CT Scanner Laboratory enables researchers to evaluate what happens to materials as a result of carbon sequestration. Carbon sequestration is a promising technique for reducing greenhouse gases, such as carbon dioxide (CO<sub>2</sub>) emissions, by injecting captured CO<sub>2</sub> into geologic formations. This technique also has been shown effective in enhancing oil recovery and displacing coal bed methane.

The CT Scanner Laboratory provides imaging data that can be used for computer simulations, economic evaluations, and site characterizations. The scanner generates a three-dimensional (3-D) image of an object's structure by collecting and combining many 2-D X-ray images. Coal, rock, and other geological samples are imaged to measure how liquids, gases, and solids flow through them, or to measure other rock-fluid phenomena, such as how CO<sub>2</sub> is adsorbed or absorbed in coal cores. The measurements provide information on the actual distribution of minerals and fluids inside samples, rather than providing merely average measurements.

CT Scanner Laboratory researchers collaborate with colleagues from other CT laboratories, including those of Pennsylvania State University and Lawrence Berkeley National Laboratory.

### **CT Scanner Features:**

- Manufacturer: Universal Systems, Inc.
- Model: HD350 E, refurbished and upgraded medical unit
- Up to 140 kV and 400 mA tube power with up to 4s scan time/slice
- Small voxel size: 250 micron spatial resolution, 25 micron detection limit, 1mm slice thickness
- Large core scanning capability
- Dual energy scanning capability for determination of atomic numbers

**Shipping/Receiving**  
**Building 19 – Morgantown**

- *The Shipping/Receiving operation is an ancillary support function at NETL*
- *The shipping/receiving facility is staffed by site-support contract employees.*

Shipping and receiving personnel perform the following functions:

- Inspect material for physical damage, procurement requirements, as well as ES&H and quality control requirements;
- Complete claims on incoming shipments with shortages or damages;
- Coordinate with requestor/requisitioner with receipt problems;
- Coordinate pick-up/delivery;
- Maintain a complete audit trail to minimize/discourage waste, fraud, and abuse;
- Provide delivery of storeroom stock via the shuttle, of procured items and other stored materials to PGH facilities;
- Check and account for all required documentation;
- Review and coordinate all freight invoices and freight claims for over billing or carrier negligence;
- Coordinate outgoing shipments;
- Utilize transportation mode/carrier based on approved DOE ATMS Module “Rate Route” schedule primarily based on economical considerations, than transportation performance;
- Entering applicable data into the Automated Transportation Mobility System
- Unload/load shipments from tractor trailer trucks utilizing hydraulic scissors lift and other materials handling equipment;
- X-ray inbound packages and US Mail;
- Coordinate receipt of compressed gas cylinders

**Machine Shop/Calibration/Instrumentation Laboratories  
Building 19 -- Morgantown**

- *The Machine Shop/Calibration/Instrumentation Laboratories are an R&D support function at NETL*
- *The machine, calibration and instrumentation shops are staffed by specialist technical site-support contract employees*

The machine shop in Morgantown comprises various machining tools that are used to support all the research conducted at NETL Morgantown.

The machinists work from blue-prints that are designed by NETL researchers, assist in the design working with NETL researchers, or devise and create the rough drawings based on discussions with the NETL research staff.

Some of the machines utilized in the shop include:

- Several metal lathes
- Drill Presses
- Milling Machines
- Band Saws
- Metal sheers
- MIG welder
- TIG welder
- Arc welder
- Metal brakes
- Grinders
- Sanders

The Calibration Laboratory at NETL-Morgantown provides NIST traceable calibration and repair of electronic, analytical, pressure, flow, and temperature-measuring instruments to in-house research and development projects. The technical staff is trained in numerous areas of instrumentation and calibration. The lab is a member of the National Conference of Standards Laboratories International (NCSLI) and the Government Industry Data Exchange Program (GIDEP) Metrology Data Bank.

A common area is located in the laboratory which serves as a fabrication area that electricians and instrument technicians use to assemble panels, valve accessories, etc.

## **Bulk Gas Storage and Distribution Morgantown**

- *The Bulk Gas Storage and Distribution systems are an R&D support function at NETL*
- *The bulk gas storage and distribution system is staffed by site-support contract employees.*

NETL dispenses nitrogen gas from storage tanks at their Morgantown facilities for use in the laboratories and is located from the Bulk Gas Storage Facility between B-16 and B-24. The NETL Morgantown site nitrogen system consists of 9,000 gallon capacity storage tank, seven ambient air vaporizers, high pressure ASME storage vessels, and two cryogenic, high-pressure, reciprocating pumps. The gaseous nitrogen system supports both high and low pressure needs and the distribution systems ends at the specific building isolation and check valves.

**Cylinder Gas Receiving/Storage Facility  
Building 16 – Morgantown**

- *The Cylinder Gas Receiving/Storage Facility is an R&D support function at NETL*
- *The cylinder gas receiving/storage facility is staffed by site-support contract employees*

The cylinder gas receiving/storage facility provides procedures for the safe handling, storage, and distribution of compressed gas cylinders, utilized in the various projects at NETL, at the main storage area located in Morgantown outside of Building 16 with usage destination areas in buildings B-1, B-3, B-4, B-5 and B-25.

**Air Compressor Facility**  
**Building 8 – Morgantown**

- *The Air Compression Facility is an R&D support function at NETL*
- *The Air Compression Facility is staffed by site-support contract employees*

The air compressor facility provides compressed air at 100 and 700 psig to R&D research areas across the complex and represents several such systems that are strategically located on the site. Compressed gases are routed to facilities across the site via a network of overhead and underground distribution lines. The utility is provided on demand and the service is requested on a weekly basis via pre-arranged planning meetings with research personnel. The units frequently operate on a continuous basis over multiple days.

**Library**  
**Building 2, Room 30 -- Morgantown**

- *The Library is an ancillary support function at NETL*
- *The Library facility is staffed by site-support contract employees.*

The NETL Library System is composed of a library in B2 Room 30 in Morgantown, a library in B84 Room 110 in Pittsburgh and a library in B1 Room 219 in Albany. The library system houses a large collection of government reports in both microfiche and paper copy, journal subscriptions both online and in paper format, reference material and publications in many fields of energy research and related fields.

The NETL Library System provides these services:

- Literature searching
- Citation searching
- ILL (Interlibrary Loans)
- Training on Information Retrieval
- Reference Questions
- General Searching for Information
- Assist with purchasing of books and reports
- Photo duplication of articles
- Microfiche copying of reports
- Assist with obtaining copies of theses
- Obtaining purchasing information on publications or subscriptions
- Distribution of electronic subscriptions
- Outreach requests to the public

**Day Care Center**  
**Building T-41 – Morgantown**

- *The Day Care Center is an ancillary support function at NETL*
- *The Day Care Center is staffed by site-support contract employees.*

NETL has on-site, fee based day care facilities at both the Morgantown and Pittsburgh locations.

They are state-of-the-art facilities that are completely designed for the needs of children and include:

- An educational curriculum that engages all 5 senses and the most important sense, the sense of *FUN*
- An early Childhood program and the School-Age Program
- Music, creative movement, really messy arts and crafts
- Room to run, climb and explore
- Really fun field trips