FUNDAMENTAL FLUIDIZATION RESEARCH PROJECT

DOE/EA 0575

ENVIRONMENTAL ASSESSMENT

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ENVIRONMENTAL ASSESSMENT

This Environmental Assessment (EA) has been prepared by the Department of Energy (DOE) in compliance with the requirements of the National Environmental Policy Act of 1969 (NEPA). It has been prepared in accordance with the President's Council of Environmental Quality (CEQ) regulations implementing NEPA and the DOE Guidelines for compliance with NEPA (10 CFR Part 1021).

As required by Section 1508.9 of the CEQ regulations, the sections contained within this EA include the following:

1.0 Purpose and Need for DOE Action.
2.0 Alternatives Including the Proposed Action.
3.0 Environmental Impacts of the Proposed Action and the No Action Alternative.
4.0 List of Agencies and Persons Contacted.

1.0 PURPOSE AND NEED FOR DOE ACTION

The U.S. Department of Energy's Morgantown Energy Technology Center (METC) proposes to design, construct, and operate a 2-foot diameter, 50-foot high pressurized fluidized-bed unit to explore the fundamentals of fluidization with particular emphasis on operation in the circulating mode. For fossil energy applications, operation of a pressurized fluidized-bed combustor (PFBC) in a circulating mode has potential advantages over operation in a bubbling-bed mode. For example, the circulating PFBC operates at gas velocities (three to five times) higher than bubbling bed which results in a smaller cross sectional bed area and a fewer number of coal feed points. In addition, the circulating PFBC may have better success in removing sulfur using limestone in the bed. In other words, about half the amount of limestone will be required to remove the same amount of SO_2 in a circulating PFBC. Although the bubbling-bed PFBC is a more mature process, current research is focused on circulating-bed PFBC because of its potential advantages.

However, little data are available to design and evaluate pressurized circulating-bed combustion processes. There are no data concerning the effect of pressure on high fluidization velocities. These data are needed for design, evaluation, and scale-up of circulating PFBC process. METC proposes to conduct the Fundamental Fluidization Research Project (FFRP) to obtain this information.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 THE PROPOSED ACTION

2.1.1 Project Description

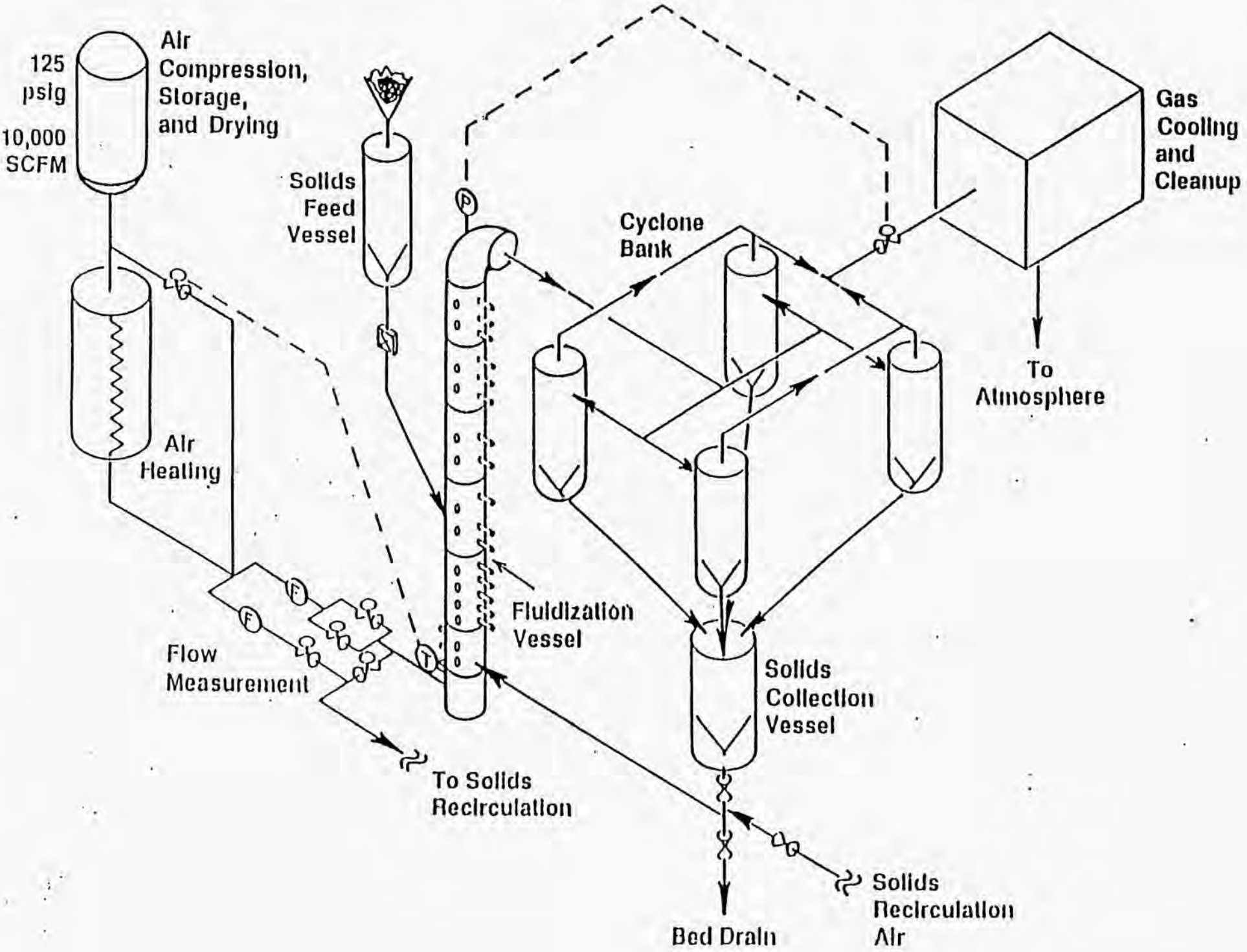
The proposed project would involve design, construction, and operation of a 2-foot diameter, 50-foot high pressurized fluidized bed warm unit to study fluidization characteristics at elevated temperature and pressure conditions ranging from ambient temperature to 700 degrees F and from 20 psig pressure to 75 psig pressure.

The 2-foot diameter, 50-foot high pressurized fluidized-bed unit (Figure 1) would be an open-loop system designed to suspend inert particles using warm air. Atmospheric air would be compressed to 75 pounds per square inch, gauge (psig), and heated to 750°F. The maximum air flowrate would be 16,000 actual cubic feet per minute. The air would be fed to the bottom of the fluidization vessel, where it would contact and suspend inert particles fed from the top of the bed. Limestone, sand, or plastic would be used as the inert particles. At the top of the vessel, four cyclone separators would collect and return particles to the bottom of the vessel through the solid collection vessel. When the unit is operated at an elevated temperature, the warm air exiting the vessel would flow through a spray water cooler before entering a baghouse to remove fine particles. The air heaters would be fired with natural gas, and the exhaust flue gas would be discharged to the atmosphere. The unit would operate approximately 36 hours per week for about one year.

The 2-foot diameter, 50-foot high pressurized fluidized-bed unit would be constructed in an existing building, Building-22, at METC. The dimensions of the building are 30-foot X 30-foot X 65-foot high. The pressurized fluidized-bed vessel and its components (e.g., cyclones, solid feed hopper, and solid collection vessel) would occupy the entire building. The air compressor is installed in a separate building, Building-22A, located adjacent to Building-22. Except for the baghouse, the fluidization vessel and all the major components are already installed. However, remaining equipment, such as piping and instrumentation, would need to be installed for the project. The 2-foot diameter, 50-foot high pressurized fluidized-bed unit would be built and operated in compliance with all applicable local, State, and Federal regulations.

The primary objective of the proposed research would be to study the dynamics of fluidization under elevated temperature and pressure conditions. Fluidized-bed reactors for fossil energy applications would operate in many different flow regimes (e.g., minimal fluidization, bubbling, slugging, turbulent, and fast

FIGURE 1. 24-FOOT DIAMETER PRESSURIZED FLUIDIZED-BED UNIT



fluidization). Determining the flow regime of operation would be essential for proper design and scale-up of fluidized-bed reactors and prediction of reactor performance. The tests planned for the Fundamental Fluidization Research Project would characterize the fluidization flow regimes and their transitions at elevated temperature and pressure. The test program would investigate the effects of bed temperature (i.e., ambient to 750°F), bed pressure (i.e., 20 to 75 psig), static bed height (i.e., 1 to 12 feet), and various physical properties of the solid materials such as particle shape, density, and size distribution. The test program would also investigate gas/solid mixing, circulation patterns, and heat transfer in fluidized-beds. The anticipated result of the proposed project would be a better understanding of the pressurized fluidization process at high velocities. This better understanding would provide a sound basis for design and scale-up of circulating PFBC for fossil energy applications.

2.1.2 Description of Project Location

2.1.2.1 General Description of the Area

METC (Figure 2) occupies 145 acres and is located in Morgantown, West Virginia. The City of Morgantown, located in Monongalia County in northern West Virginia approximately 70 miles southwest of Pittsburgh has a population approximately 60,000 residents. METC is surrounded by low-density residential areas on its southern, eastern, and western borders and by the Monongahela River on its northern border. West Fork Run and its tributary, Burroughs Run, form the eastern and southern boundaries at METC.

2.1.2.2 Description of Project Site

METC is one of two Energy Technology Centers of the U.S. Department of Energy's Office of Fossil Energy. Its mission is to develop technologies that use coal, oil, and gas and transfer these technologies to the private sector for commercialization. There are 40 buildings on the METC site. The 2-foot diameter, 50-foot high pressurized fluidized-bed unit, as shown in Figure 3, would be installed in an existing, steel frame, metal clad building (Building-22) located at METC.

2.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, DOE would not proceed with the proposed project at METC, and the proposal is not otherwise expected to be implemented. Therefore, the impacts described in this EA as a sequence of the proposed action would not occur.

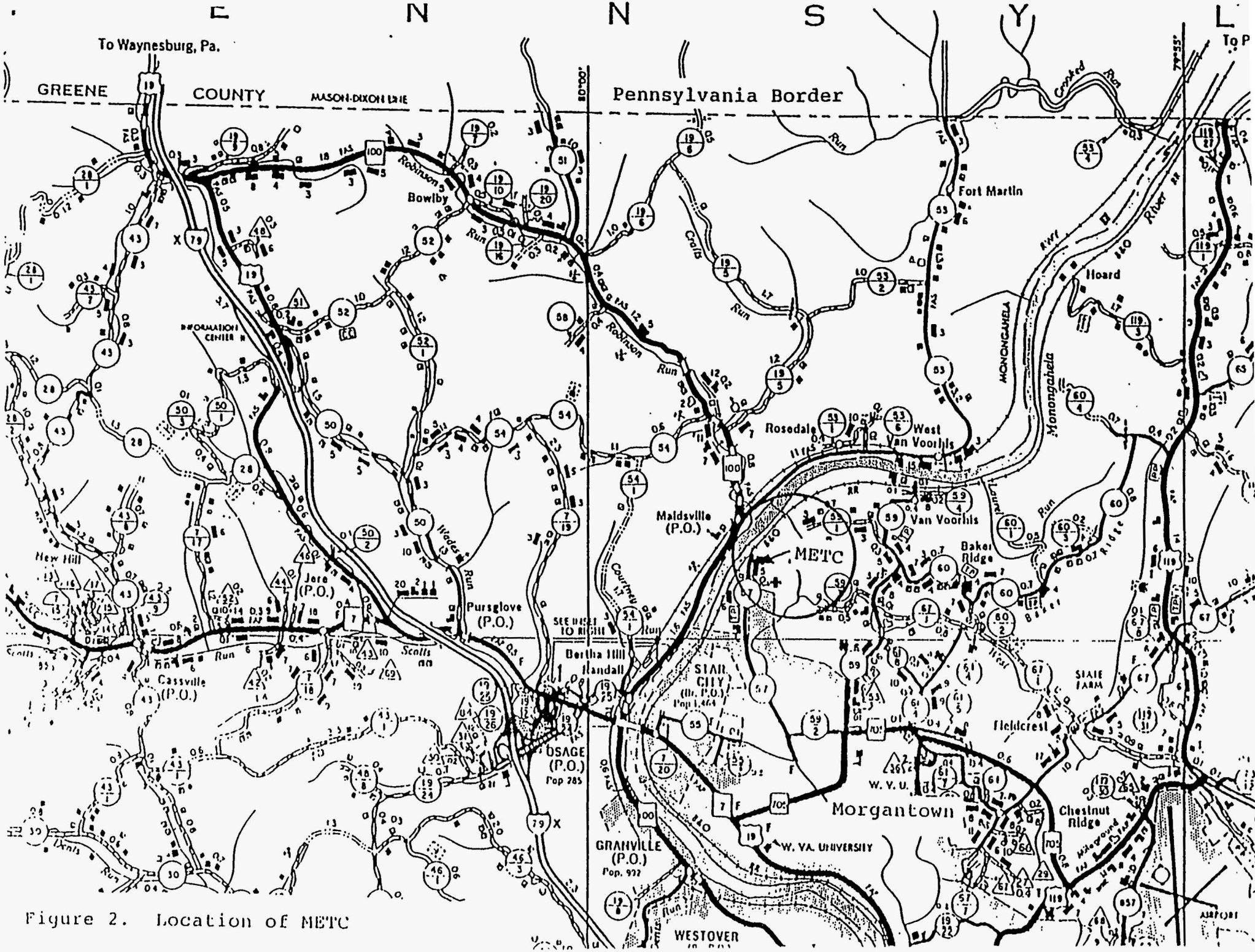


Figure 2. Location of METC

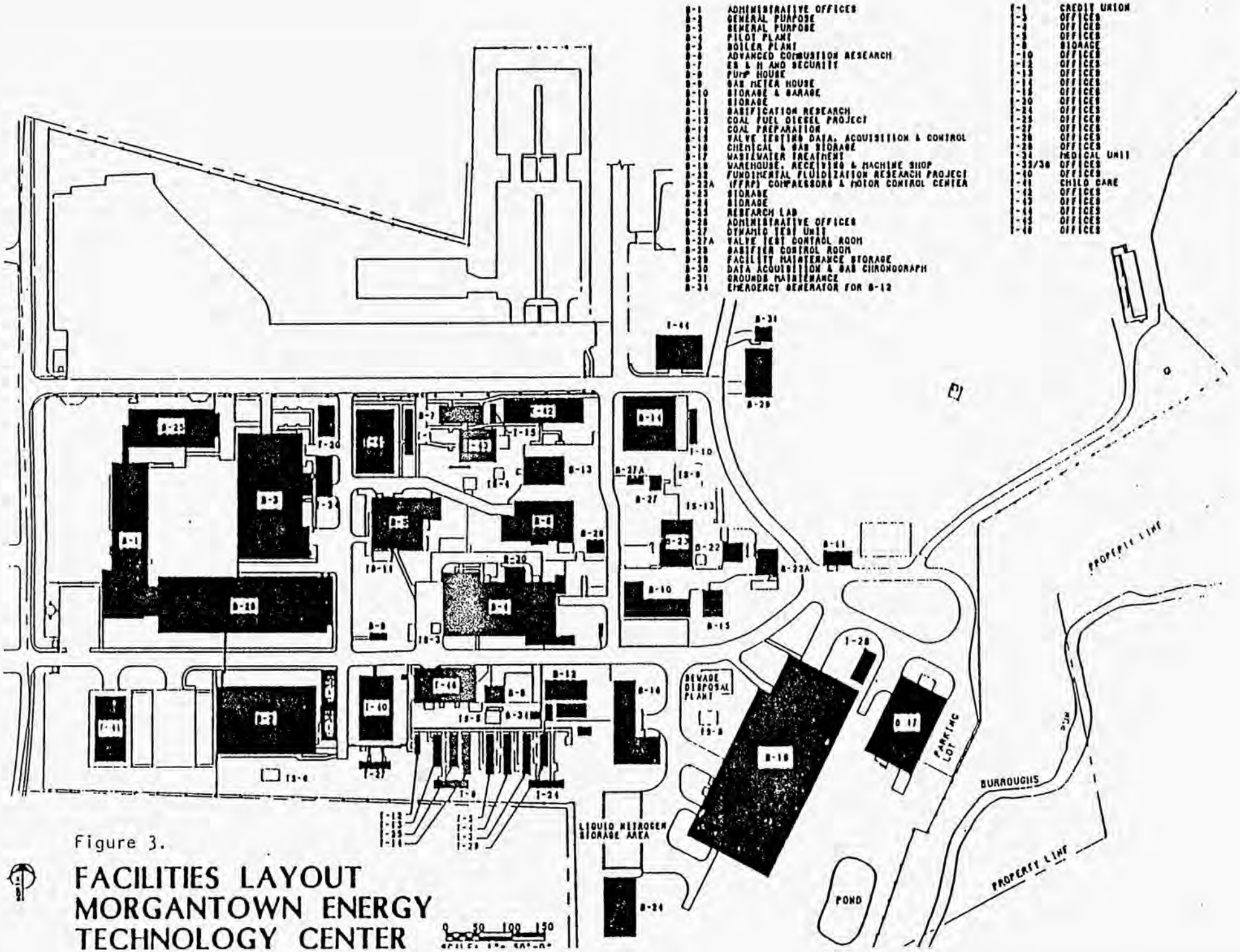


Figure 3.

FACILITIES LAYOUT MORGANTOWN ENERGY TECHNOLOGY CENTER