

**Session I: PROGRAM APPROACH**

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## THE SYNTHETIC FUELS PROGRAM OF THE FUEL PROCESS BRANCH OF THE IERL-RTP

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The Industrial Environmental Research Laboratory conducts a contractual and in-house research, development, and demonstration program dealing with the control of emissions/discharges from energy related technologies and industrial processes.

The Laboratory is divided into three technical divisions (figure 1):

1. Utilities and Industrial Power Division which primarily addresses the emissions controls for the combustion of fossil fuels to generate steam and electrical power.
2. Energy Assessment and Control Division which develops improved combustion techniques for nitrogen oxide control, advanced combustion systems, and the environmental effects and control techniques for coal processing and conversion of coal to synthetic liquids and gases.
3. Industrial Processes Division which addresses the emission and controls from industrial operations. Additionally, in this Division, analytical and sampling techniques are developed.

The Fuel Process Branch in the Energy Assessment and Control Division conducts programs addressing two major areas (figure 2):

1. *Coal Cleaning*. Development of physical and chemical techniques to remove contaminants from coal; assessment of the environmental consequences from the utilization of coal cleaning processes; and the development of control technology to avoid adverse discharge effects.
2. *Synthetic Fuels*. The assessment of the multimedia discharges and control technique development for technol-

ogies converting coal to gaseous, liquid, and refined solid fuels.

Both programs deal with the multimedia (air, water, and solid) discharge effects. However, the coal cleaning program has the additional responsibility to develop the basic processing technology. On the other hand, the synthetic fuel program only deals with the potential environmental effects and control technology. There is a direct interface of the two programs since characterizations of coal and physical coal processing are both involved in the conversion of coal to synthetic fuels.

The activities in the synthetic fuels program are divided into six major categories (figure 3):

1. *Environmental Assessment*. The identification and quantification of the multimedia discharges, and the potential health and ecological effects of these discharges.
2. *Control Technology Development*. Development of process modification and new control processes that would eliminate any adverse effects of these multimedia discharges.
3. *Special Studies*. Studies addressing particular problems and specific technologies.
4. *Bench Scale Facilities*. Integrated facilities to evaluate generic control systems, evaluations of modification/new technologies, and quantification of multimedia discharges.
5. *Pilot Plant Activities*. Evaluation of the composition and quantities of the multimedia emissions/discharges, their potential environmental effects, and effects of feedstock/process variations on the quality of discharges.
6. *Commercial Activities*. Evaluation of existing commercial operations as to emissions/discharges, efficiencies of control systems, and effects of plant variations.

Each environmental assessment contractor (figure 4) deals with a specific technology for converting coal to synthetic fuels and relates to one of the following categories:

1. Low-Btu Gasification,
2. High-Btu Gasification, and
3. Coal Liquefaction.

The assessments are 3-year studies that will enable the contractor to develop into a center of expertise in each specific area and will address the following types of areas:

1. Background on current process technology,
2. Environmental data acquisition,
3. Current environmental background,
4. Control technology development, and
5. Environmental analysis/evaluation.

The control technology development contractors are the same type, and have the same rationale as the assessment contractors--that is, to develop centers of expertise. Both groups of contractors are responsible for broad technical input and guidance for the synthetic fuels program. However, the control technology contractors' responsibilities are structured differently than those in the environmental assessment area. The control technology contractors relate to specific sections of the conversion plant which will allow the maximum applicability of control development to the following three conversion technologies being addressed (figure 5):

1. *Converter Output Cleanup.* Process units that deal with the removal of undesirable contaminants from the raw gas or liquids.
2. *Products/Byproducts.* Process units that convert the cleaned gas or liquids into marketable products, and recovery of byproducts material, such as sulfur.
3. *Waste, Water, Fugitive Emissions.* Process technology that deals with broad multisource discharge streams.

The special studies activities address par-

ticular problem areas and/or technologies. These studies normally rely upon specific expertise or capabilities in various organizations. Figure 6 depicts the types of studies conducted in this area. These studies range from laboratory evaluations and bench scale process development to broad paper studies.

The bench scale facilities (figure 7) are based on research grants to identify problems, to evaluate generic control technology and new or modified control techniques. The Research Triangle Institute is conducting a comprehensive chemical analysis of the discharges from a small gasifier that can be operated in a nonisothermal mode. This study attempts to correlate operating parameter versus the composition of the off gases. The North Carolina State University will install a 22.5-kg/hr (50-lb/hr) gasifier capable of evaluating various raw gas cleanup techniques and various high and low temperature acid gas purification systems. The University of North Carolina is studying water treatment systems.

The pilot plant activities (figure 8) interface with various pilot plant operations in the private and Federal sectors. These activities vary from development of recommended test programs and procedures to sampling and analysis.

The commercial activities (figure 9) deal with data acquisition at operating commercial facilities to quantify the multimedia discharges and effects of process variations on the composition or quality of the discharges. The evaluation of the Kosovo Lurgi Gasification Plant in Yugoslavia is the largest and most comprehensive of these activities.

Details of these above programs will be dealt with during this symposium.

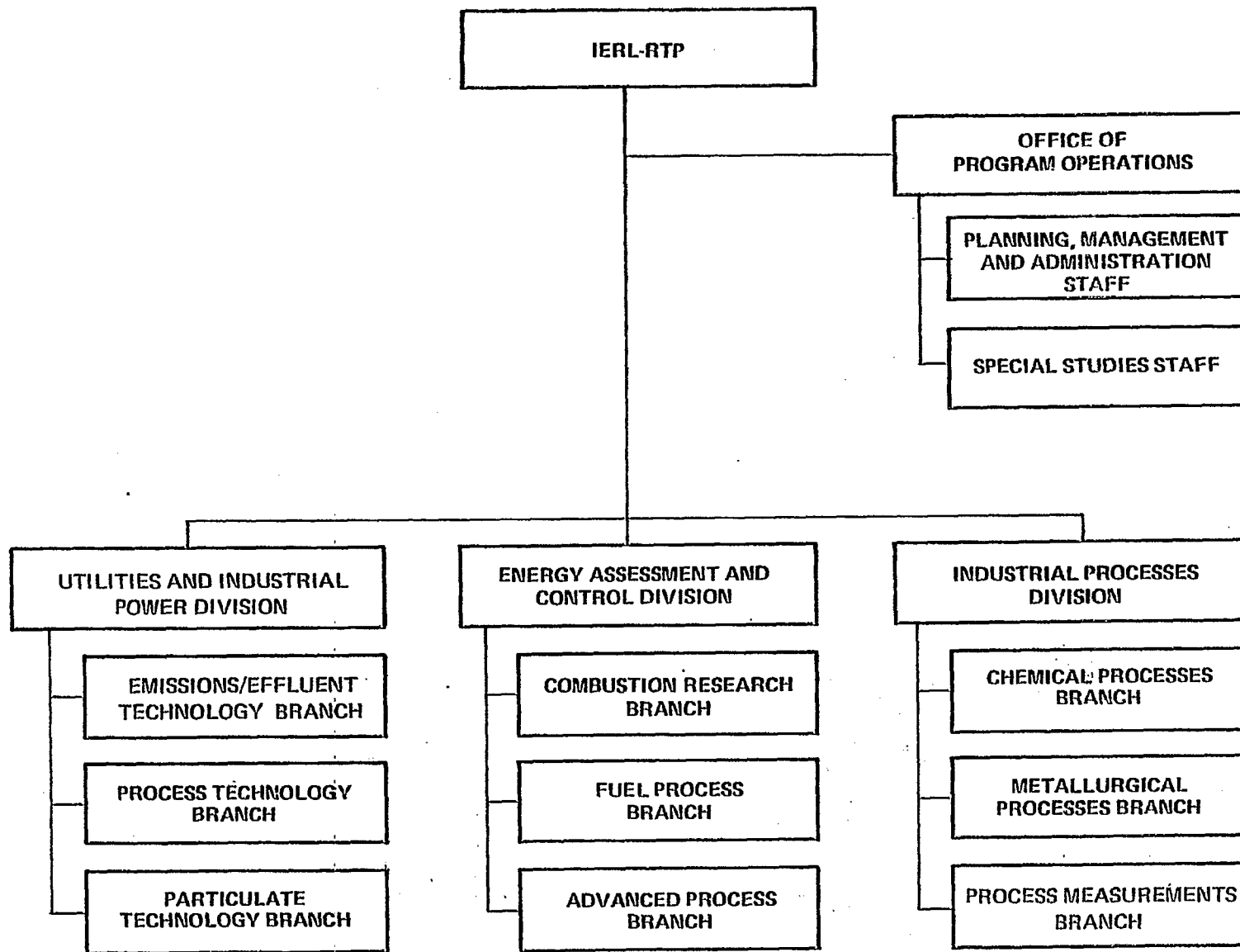
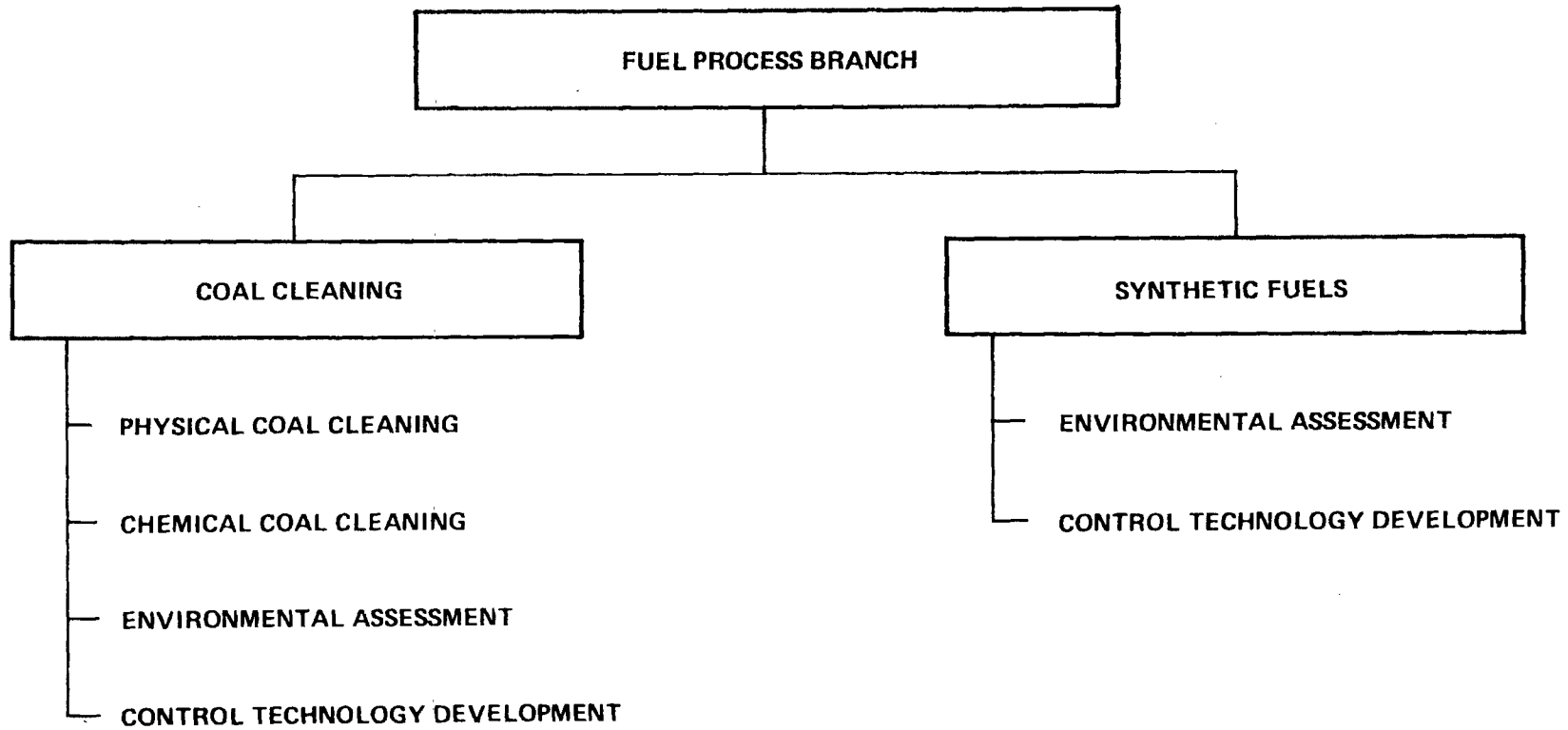


Figure 1. Environmental Protection Agency, Industrial Environmental Research Laboratory, Research Triangle Park, North Carolina.



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Figure 2. Fuel process branch.

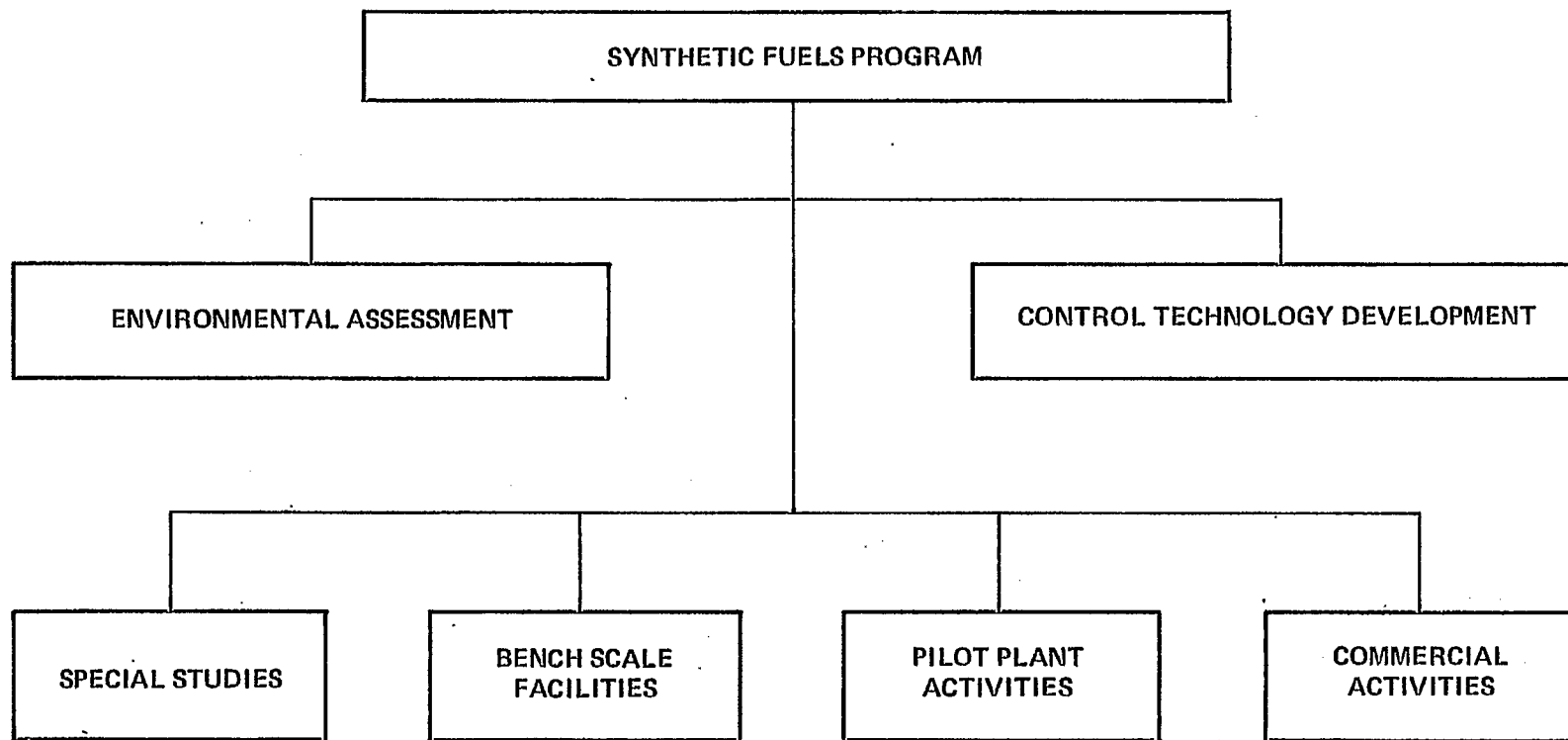


Figure 3. Synthetic fuels program.

- ◆ LOW-BTU GASIFICATION – RADIAN CORPORATION
- ◆ HIGH-BTU GASIFICATION – TRW ENERGY SYSTEMS
- ◆ COAL LIQUEFACTION – HITTMAN ASSOCIATES

Figure 4. Environmental assessment.

- ◆ CONVERTER OUTPUT CLEANUP – HYDROCARBON RESEARCH, INC.
- ◆ PRODUCTS AND BYPRODUCTS – CATALYTIC
- ◆ WASTE, WATER, FUGITIVE EMISSIONS – PULLMAN/KELLOGG

Figure 5. Control technology development.



- ◆ COMBINED CYCLES ENVIRONMENTAL PROBLEMS
- ◆ CONVERSION RESIDUES LEACHANT
- ◆ SYNTHETIC FUEL WATER REQUIREMENT
- ◆ ADVANCED FUEL CONTAMINANT REMOVAL CHEMISTRY
- ◆ DESULFURIZATION/DINITROGENATION OF LIQUIDS

Figure 6. Special studies.

- ◆ NONISOTHERMAL POLLUTANT IDENTIFICATION
- ◆ RAW AND ACID GAS CLEANUP FACILITIES
- ◆ WATER TREATMENT FACILITIES

Figure 7. Bench scale facilities.

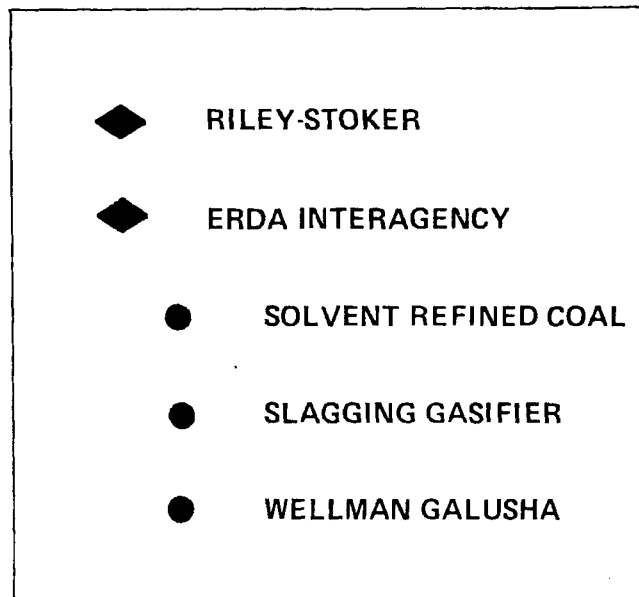


Figure 8. Pilot plant activities.

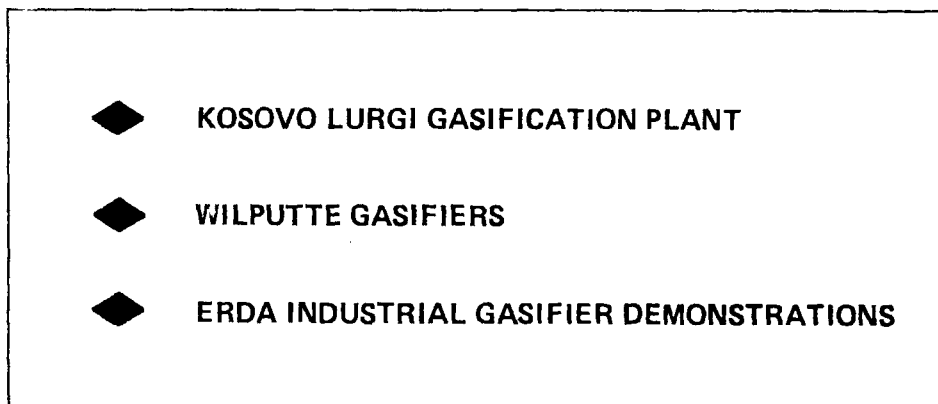


Figure 9. Commercial activities.