



Project Summary

Development of a Core Combustion Research Program Plan for EPA

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In a report entitled, "Future Risks: Research Strategies for the 1990s," prepared for then-EPA Administrator Lee Thomas, the EPA Science Advisory Board stated, "EPA should plan, implement and sustain a long-term research program . . . In areas where it has unique responsibilities and capabilities." Combustion and thermal destruction was specifically identified as a candidate core research area. This report describes the plan that evolved from a review of the state of the art in combustion research. A strawman plan was prepared and reviewed by a panel of representatives from industry, academia, and government organizations. The plan identifies four cornerstone areas where technology gaps are perceived to exist, and a keystone of basic and engineering research needed to generalize the technological developments to a variety of systems.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

I. What Is the Problem?

The combustion of fuels and waste will continue to create environmental problems. However, the development of technology to solve these problems will generate major opportunities for U.S. industry.

Combustion, Friend or Foe?

The combustion of fossil fuels and waste plays a major role in our lives. Energy consumed by a country is one measure of its development as an industrialized nation. However, combustion by-products may create problems. They may: 1) constitute health risks, and 2) have the potential to damage the environment. Society must not buy the benefits of combustion at the expense of our environment.

New Problems are Inevitable

In the next decade changes in the composition of wastes and fuels will affect the composition of combustion by-products. The developed countries cannot solve global environmental problems alone. The developing nations must assist in the cost-effective development and deployment of environmentally acceptable combustion technology to prevent the continued deterioration of the global environment.



New Problems will Create New Opportunities

The national and international markets for environmentally acceptable technologies will grow rapidly in the next decade. This creates a major opportunity for U.S. industry. Reduced imports of petroleum products and the export of environmental technologies could help to reduce this country's trade deficit.

II. What Is the Solution?

The EPA has a unique mission to protect the environment and can further it by establishing a core research program in combustion and thermal destruction.

Combustion Research is Crosscutting

Basic combustion processes are common to the combustion of all gaseous, liquid, and solid fuels and wastes. Research on the formation and destruction of a particular combustion by-product is applicable to a wide range of combustion systems. The application of knowledge generated by a basic research program will identify and solve environmental problems of the next 20 years.

Core Research Program Objectives

1) Drive pollutant reduction technology to the limit of technical and economic feasibility. 2) Develop the capability to predict the amount of all pollutants present in the effluent streams of all combustion systems. 3) Promote the development of low pollutant technology for existing equipment and new advanced systems. 4) Provide a technology base for improved regulations.

III. What Is the EPA Role?

The Agency can provide a leadership role by formulating and executing a core research program that will solve environmental problems associated with all types of combustion systems, fuels, and wastes well into the next century.

The EPA can Develop a Core Research Program

The EPA is the only Agency with the authority to regulate all combustion systems that have the potential to emit pollut-

ants in harmful concentrations. Also, the Agency has the unique mission to protect human health and welfare and to conserve the environment. In certain areas the EPA is cooperating with other countries to control pollutants that spread beyond national boundaries. A core research program in combustion and thermal destruction can be started by the Agency to generate basic information that will: 1) provide the impetus for industry to develop new technologies, 2) help the development of future regulation by providing a sound scientific base, and 3) help to identify and solve environmental problems created by combustion of fuels and waste in the future.

Focused on Prevention

The EPA core research plan in combustion and thermal destruction should be distinguished from the efforts of other agencies. It must provide for a balance between in-house and extramural activities. Most importantly, the plan must concentrate upon preventing pollutant formation thereby avoiding the additional complexity and expense of downstream controls.

Results Must be Quantifiable

The plan is closely coupled with real world problems. It is applicable to all fuels and pollutants. It will generate identifiable products in both the near and the long term. These products may be procedures, solutions to problems, or prototype pollution control systems; therefore, the results of the research plan can be readily quantified.

The EPA Role

The EPA can assume a leadership role. The program needs the participation of industry. There should be a balance between in-house and extramural activities. The existing infrastructure within the Agency should be upgraded and a stronger technology base developed. The successful execution of the plan requires that the technical leadership reside within the EPA laboratories. The EPA should make a long-term commitment to combustion research to attract and retain top flight researchers to assume this leadership role. Because of the diversity of equipment manufacturers, there is a need to transfer the results of the research to many industries who can then use the information to develop proprietary products. Industry must take part, but the EPA can serve in an impartial role ensuring that the benefits of this important core research program are readily available.

IV. What is Proposed?

The Core Research Program is based on two components, cornerstones (applied, system-specific development projects) and a keystone (broadly based fundamental research).

Cornerstones and Keystones

Cornerstones are vertically integrated development projects targeted at specific problems with outputs: new systems, retrofit technologies, and design procedures. The keystone is the heart of the plan. It includes basic and engineering research programs that have long-term applicability to a wide range of problems.

Initial Cornerstones Defined

Figure 1 shows the proposed Core Research Program in Combustion and Thermal Destruction. A review of the environmental problems of combustion systems and a survey of the activities of other agencies indicated that the EPA program should concentrate upon incineration, steam generators, area sources, and biomass systems. Figure 1 shows typical cornerstone programs in each of these areas and keystone projects. The format of a typical cornerstone program involves several coupled projects and an integrated government, academic, industry team.

V. What are the Products?

The core research plan was presented to a Blue Ribbon Panel of experts. Based on the panel's recommendations, 10 products have been identified as outputs for the first 5 years.

The Plan has been Reviewed

A Blue Ribbon Panel of experts from industry, academia, and government reviewed the first plan. Panel members were enthusiastically supportive of the plan. The panel made many suggestions, most of which were incorporated into the final version. Ten priority products were identified for the first 5 years of the program.

The 10 Products

Products 1 through 6 are the result of cornerstone programs and the remainder are products of the keystone.

1. A general assessment procedure to evaluate environmental consequences of new fuels, wastes, and combustion systems.
2. An integrated small scale incinerator.
3. Feed systems for solid and viscous liquid wastes.
4. Optimized biomass combustion systems.
5. Low NO_x combustion systems for liquid fuels.
6. An evaluation of the total pollutant emissions resulting from the use of alternate fuels in internal combustion engines.
7. An investigation of the chemistry of polychlorinated dibenzo-p-dioxin/polychlorinated dibenzofuran (PCDD/PCDF) synthesis from products of incomplete combustion (PICs).
8. An evaluation of metal release from wastes and fuels.
9. The development of surrogates to ensure equipment compliance on a real time basis.
10. An expert system for monitoring and control of combustion systems.

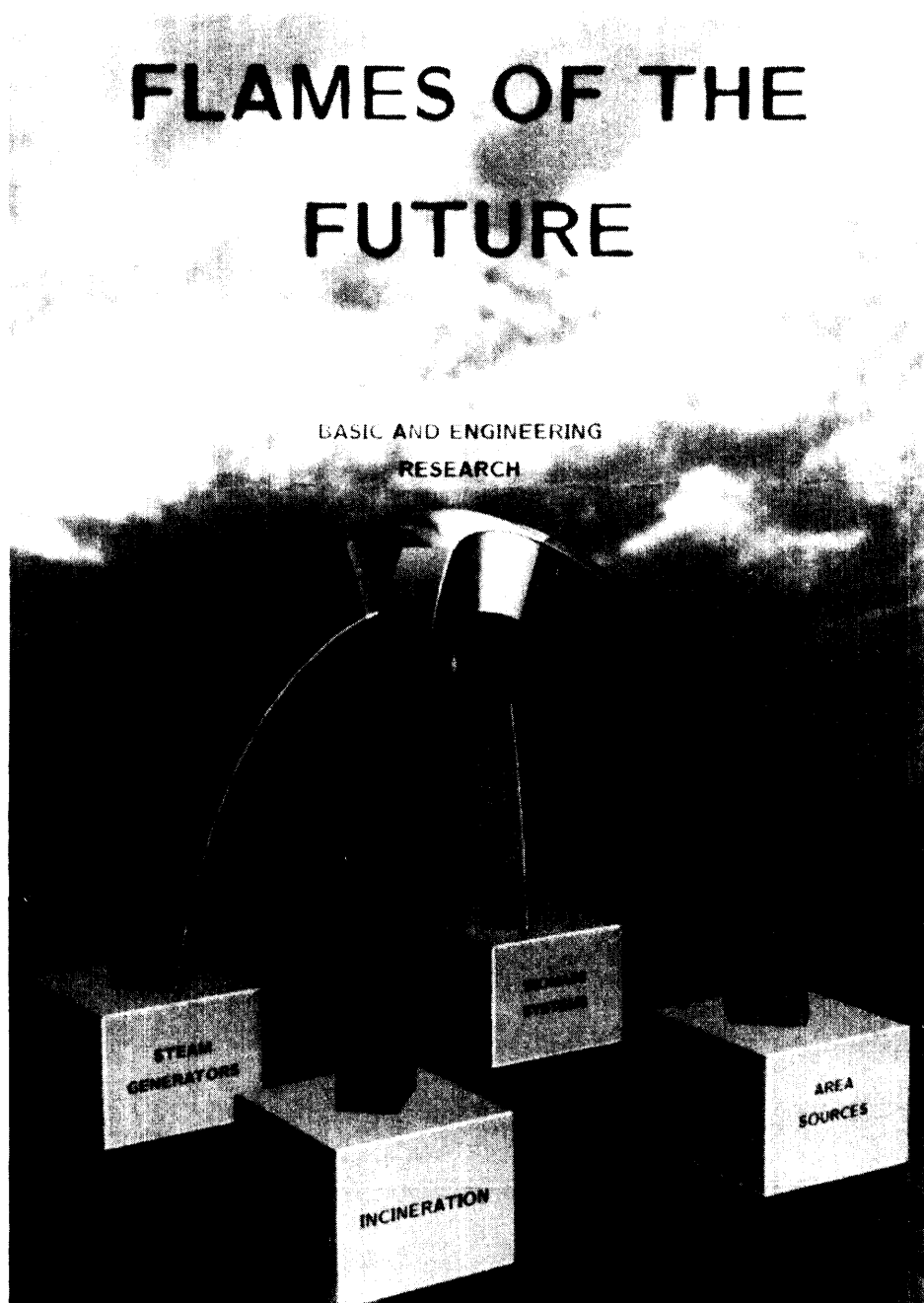


Figure 1. The structure of the Core Combustion and Thermal Destruction Research Program.

The EPA author, (also the EPA Project Officer, see below), is G. Blair Martin. The complete report, entitled "Development of a Core Combustion Research Program Plan for EPA," Order No. PB92-180868/AS; Cost: \$17.00; subject to change) will be available only from:

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