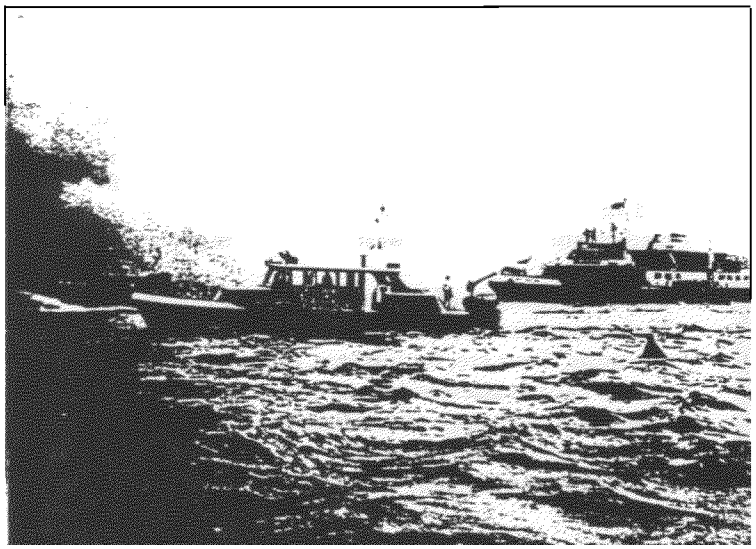
TNO Institute of Environmental and Energy

Research geared
to solving practical problems

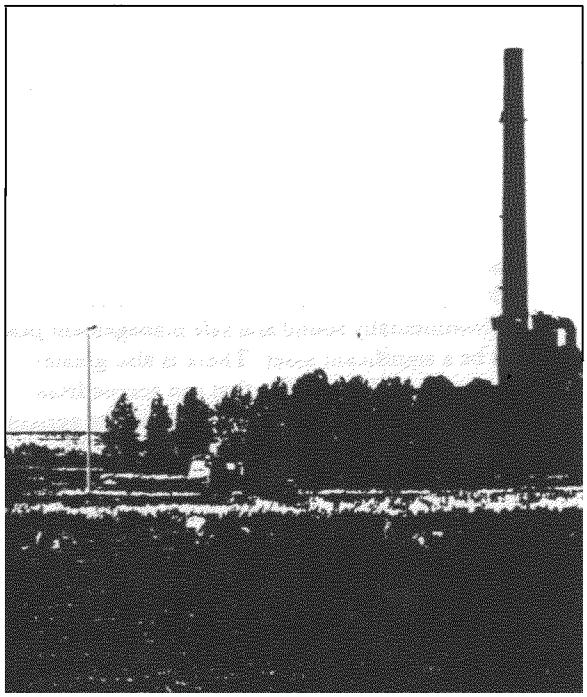
Attachment 4

This brochure is intended to give a broad outline of the work of the TNO Institute of Environmental and Energy Technology, part of the Netherlands Organization for Applied Scientific Research.

The Institute's involvement in the environmental and energy fields can be traced back to the early sixties, when the problems associated with rapid growth in the industrial, agricultural and transport sectors first became apparent These problems received particular attention in the Netherlands, which is not only one of the most densely populated countries in the world, but which also has one of the highest per capita productivity levels, resulting in a high environmental stress.
In response to the growing concern about environmental issues, TNO started to develop a range of methods and systems to treat various types of waste and to prevent and combat air, water and soil pollution. Since the successful implementation of these systems, TNO has continued to play an important part in maintaining and improving the quality of the environment in the Netherlands.
Over the years, TNO has built up a considerable reputation for solving difficult problems and offering its clients soundly based, practical advice. One of the organization's great strengths is that it has access to a vast pool of inhouse expertise, as well as to the latest information from universities and other research institutes throughout the world.



TNO's 'Alarmbel' warning system gives those responsible for river safety that extra edge when dealing with potential disasters



TNO monitors the emissions from incinerators and gives advice on how to improve combustion processes and equipment.

Sustainable development

The TNO Institute of Environmental and Energy Technology collaborates with industry, governments and engineering consultants in projects aimed at developing processes and equipment to prevent and combat environmental pollution Promoting sustainable development is a central theme of the Institute's research programme. Typical examples of projects undertaken by the TNO Institute of Environmental and Energy Technology are the development of:

- soil and sediment remediation technologies;
- high-efficiency energy generation systems and equipment, such as heat pumps and fuel cells;
- methods for risk analysis and studies for safe and reliable production and transport systems for use in the offshore and chemical industries,
- efficient separation and purification technologies, such as membrane and crystallization techniques,
- flow models to predict the dispersion of pollutants in the atmosphere; wind tunnel techniques for studying wind hindrance and wind loads associated with high-rise buildings;
- Policies emphasizing the importance of a professional approach to technology, particularly as this relates to energy, safety and environmental matters.

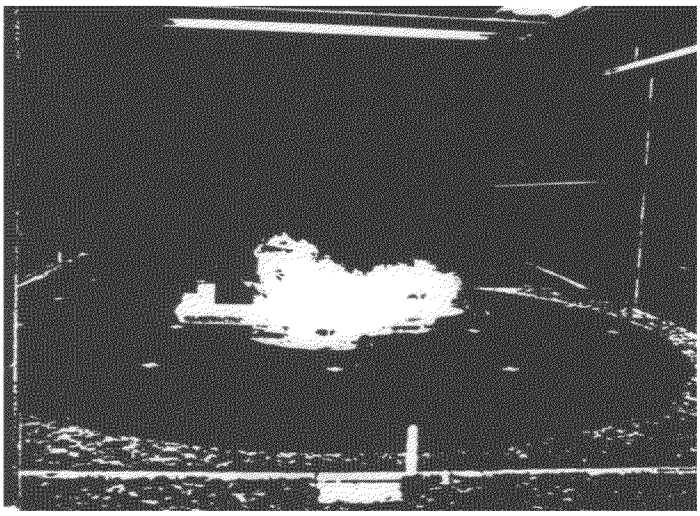
R&D geared to meeting the needs of industry

Many companies, and particularly those in the process industry, can bear witness to the fact that environmentally sound and safe management practices can be a significant asset. There is also greater awareness of the benefits that can accrue from responsible environmental policies in the agricultural sector and the service industry.

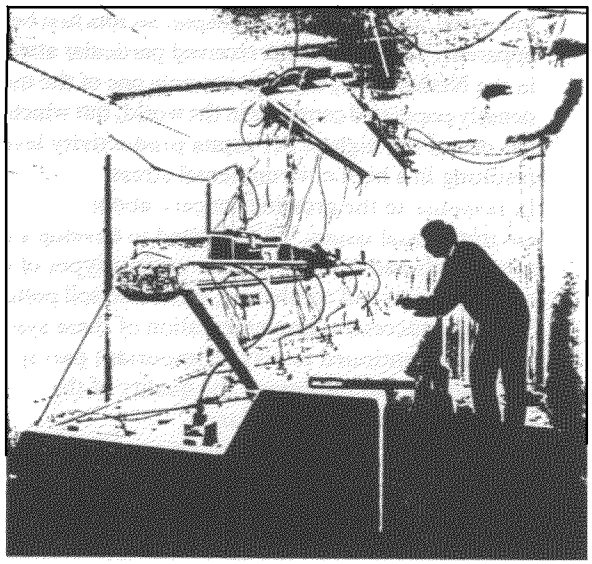
The TNO Institute of Environmental and Energy Technology develops special equipment and systems for industry, which are aimed at protecting the environment and conserving energy. All projects are carried out in close collaboration with clients, with careful attention being paid to relevant economic aspects. Typical projects have included the development of:

- gas absorption membranes and equipment for treating biogases and flue gases;
- reprocessing and recycling methods for wastes containing heavy metals such as nickel and cadmium,
- sampling and analysis techniques for determining the concentration of dioxins in flue gases from incinerators, as well as methods for reducing dioxin concentrations in such gases;
- high-quality brick making processes requiring reduced energy inputs;
- biofiltration systems to combat obnoxious smells and toxic gases.

Wind tunnel tests are used to determine the dispersal patterns of dense gases released from tankers



The TNO Institute of Environmental and Energy Technology regularly cooperates with designers and manufacturers in developing new equipment and processes Tests can be carried out on both a pilot plant and demonstration scale.



Refrigerated display units are monitored to ensure optimum efficiency

Current projects include the development of:

- cost-effective membrane techniques for drying gases and vapours;
- alternatives to CFC-based refrigerants, which will minimize damage to the ozone layer;
- techniques to dismantle redundant equipment so as to facilitate the recycling of components and materials;
- air-conditioning systems to purify the air in buildings and vehicles;
- mathematical models for waste incineration processes.

The TNO Institute of Environmental and Energy Technology also undertakes inspections and approvals. Tests are, for instance, carried out on a regular basis to assess industrial emission levels. In addition, a wide range of certification tests are performed such as approvals for refrigerated trucks that transport perishable foodstuffs.