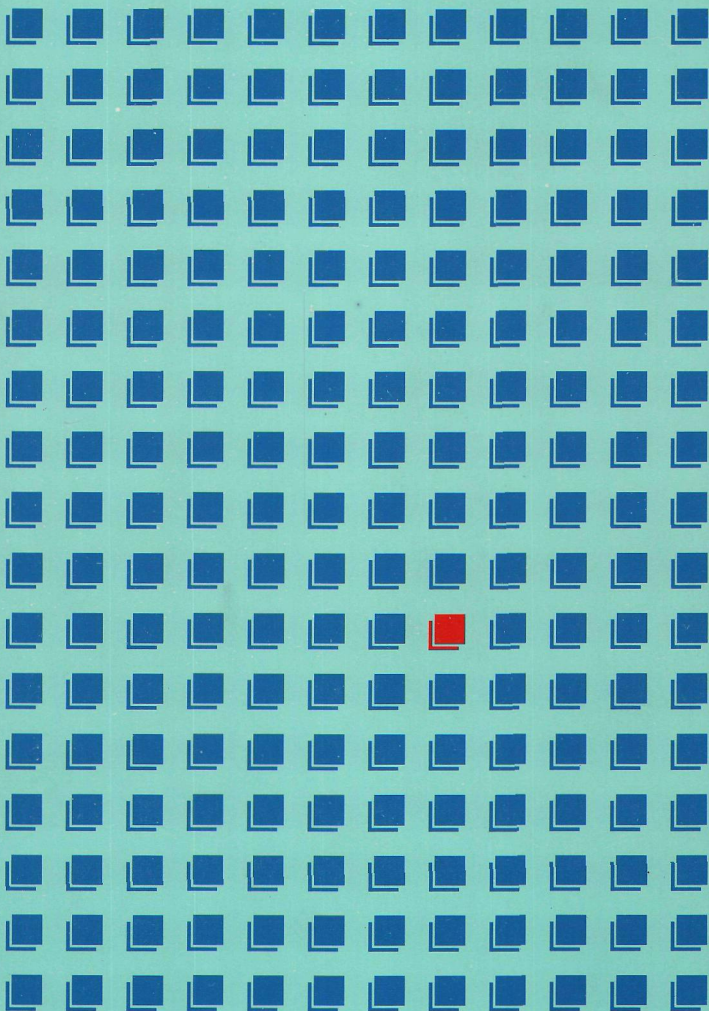




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# A KEY TO RESEARCH FACILITIES



# **A Key to Research Facilities**

**Netherlands Organization for  
Applied Scientific Research**



Issued by:

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## Foreword

This paperback gives a broad outline of R&D facilities available with TNO, the Netherlands Organization for Applied Scientific Research. TNO was established by law in 1930 with the aim of ensuring that applied scientific research is put at the service of the community in the most efficient manner possible. TNO is a fully independent, nonprofit, research organization with a staff of about 5 000 and an annual research volume of approximately \$ 210 million.

In 1983 TNO executed some 20 000 contract R&D projects, commissioned by about 6 000 Dutch and foreign clients. TNO's major target group is trade and industry, the small and medium-sized firms in particular. Other important target groups are: central and local authorities, private organizations, individuals. In some cases collective research is carried out for specific branches of industry.

TNO's main fields of interest are: industrial technology, energy, the environment, food and nutrition, health, defence and infrastructure (including building and living). In this connection TNO's activities can be subdivided into three major categories, viz.: explorative research, applied research and the transfer of know-how.

On page 7ff. the reader will find an alphabetical list of keywords, which may provide easy access to the R&D facilities described in this paperback. In cases where a headword covers several subjects, the subjects are listed both under the headword and as separate keywords.

TNO consists of eight divisions, each with its own specific field of research, viz.: Building and Metal Research, Industrial Products and Services, Technology for Society, Technical Scientific Services, Nutrition and Food Research, Health Research, National Defence Research, and Policy Research and Information. The divisions comprise about 35 institutes. For problems of frequent occurrence it has been found useful to establish committees co-ordinating multi-institute activities. These committees form an important element of TNO's horizontal organizational structure.

TNO publishes informative newsletters on research and innovation in English (e.g. the quarterly 'Applied Research'). Other work is publicized in reports, journals, annual reports, and so on.

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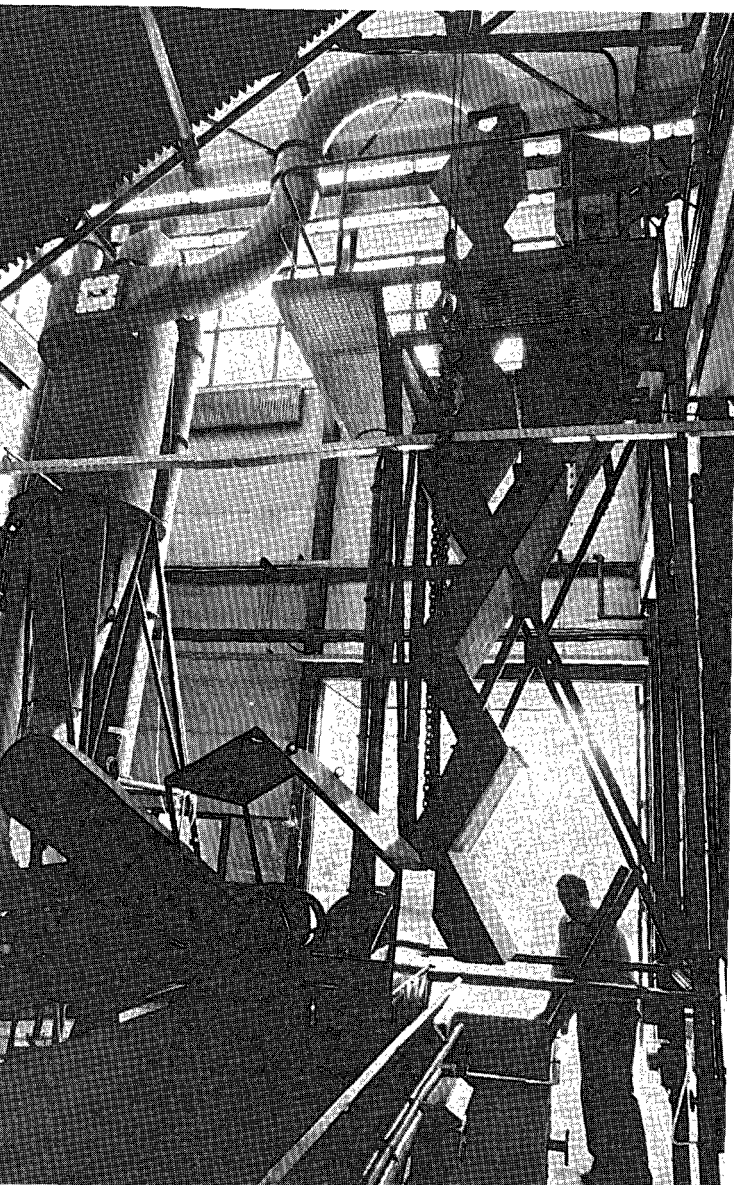


– effects in soil 20  
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*TNO's Division of Technology for Society is engaged on, among other things, problems associated with the environment, energy and safety. The photograph shows an installation for separating municipal waste into recyclable components.*



# Division of Technology for Society TNO

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 217  
2600 AE Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Executive board: Ir. C. J. Duiverman (Division director),  
Ir. C.W. van der Wal, Ir. K.A. Warschauer.

Graduate staff: 170  
Other personnel: 370

## *Organization and scope of activities*

The Division of Technology for Society TNO is an administrative unit of the Netherlands Organization for Applied Scientific Research TNO. It now comprises the Central Laboratory TNO, the Central Technical Institute TNO, The Institute of Applied Chemistry TNO, the Centre for Energy Studies TNO, the Bureau for Industrial Safety TNO and the Emission Registration Project TNO. Research laboratories are located in Apeldoorn, Delft, Utrecht, Zeist en Den Helder.

The main tasks of the Division are: to underpin Government policy by means of research and desk studies; to provide direct advice and assistance to industry; and to help solve problems concerning the environment, energy, public and industrial safety, industrial products and processes, and so on.

The Division carries out research in the fields of chemistry and biochemistry, analytical chemistry, physical measuring techniques, chemical engineering and process development, biology and toxicology, biotechnology, fluid dynamics, wind and solar energy and energy saving, safety in industry and elsewhere, systems analysis, and environmental problems. Most of this research is highly multi-disciplinary.

## *Fields of work*

### **Detection and determination of environmental contaminants**

Methods and (automatic) equipment for the detection, identification and quantitative determination of contaminants in air, water and soil. Measurements of emissions of stench and other pollutants at their sources. Acquisition of information on the monitoring, control and abatement of environmental contamination, and dissemination of this information to government authorities and industry. Collection, registration and processing, at a national level, of data on the discharge of environmental contaminants by industry and other sources, including natural ones.

### **Harmful effects, dispersion and conversion of environmental agents**

Estimation of the toxicity and similar harmful effects of xenobiotics in air, water and soil, including the effects of wastes disposed in soil. Standardized testing systems for effects of harmful wastes and other xenobiotics on marine and freshwater organisms; toxic effects of pollutants on ecosystems in natural waters. Research into the physiological, mutagenic, cytotoxic and genotoxic effects, at a cellular level, of agents in water, air and soil. Research into reactions and reaction products at atmospheric pollutants, including photochemical air pollution and smog. Mathematical models describing the dispersion of chemically reacting and ion reacting air pollutants. Dispersion of evil-smelling and other air pollutants in or near urban areas. Transport and biological degradation of water and soil contaminants. Biological monitoring systems for toxic components in the sea or other waters.

### **Environmental protection and waste treatment**

Abatement of stench and other forms of air pollution. Incineration of purification-plant sludge, industrial sludge and other wastes. Processing of sludges and manure into useful products. Removing or recovering metals from wastes. Improvements of the purification of industrial liquids and process and waste waters. Separation of municipal, industrial and chemical wastes into recyclable components. Waste disposal and its effects. Cleaning of soil contaminated by organic and anorganic components; biological testing of a large variety of fine and bulk chemicals to assess eventual toxicity or mutagenicity.

### **Wind climate in urban and industrial areas**

Assessment and prevention of annoying effects of turbulent wakes caused by wind attack on buildings and other constructions; fluid dynamics and use of atmospheric boundary layer wind tunnels for model investigations.

### **Non-polluting methods of pest control**

Research on natural semiochemicals, in particular the isolation, identification and synthesis of pheromones to fight urban and agricultural insects. Systems based on semiochemicals for the specific detection and effective, selective control of insects and other pests, e.g. rodents.

### **Crop protecting agents and other biocides**

Biochemical/biological research on fungicides, bactericides and other biocides; toxicity towards micro-organisms; mode of action. Toxicity of foreign compounds towards microbial soil organisms; transformation and breakdown of such compounds in plants and soil. Synthesis of new pesticides; isolation of natural products from plants; elucidation of their structures.

## **Products and processes in organic chemistry**

Organometallic compounds, organic pesticides, polymer chemicals and other special organic compounds, including radioactively labelled ones. Custom synthesis (up to 25 kg, or occasionally more) of organic and organometallic starting materials, intermediates and chemicals for new applications; improvement of manufacturing processes, in particular with respect to safety and environmental aspects. Special polymers for, among other things, medical purposes; polymer membranes for separating gases and (organic) liquids; polymers for binding catalysts, biocides, pharmaceuticals, enzymes, and heavy metals; controlled release of certain products. Organometallic and co-ordination chemistry of main group and transition metals; specific compounds, such as antitumour agents.

## **Biotechnology**

Various subjects; application of (immobilized) enzymes to selective chemical conversions and synthesis; special techniques for immobilizing enzymes and providing cheap, non-toxic (food-grade) catalysts for a variety of purposes; enzymatic reactors, fermentation processes.

## **Process technology**

Contribution to improving the operational efficiency of processes and the processing of products; aid to developing countries; testing of products and appliances. Fluid dynamics with the aim of improving the operational efficiency and energy economy of equipment in the processing industry.

Development of separation techniques, in particular the fractional crystallization of organic compounds, cleaning processes of contaminated sludge, soil and refuse.

## **Security and safety**

Assessing safety aspects of a variety of industrial activities and their consequences; risk analysis, decision analysis and system dynamics. Safety studies concerning industrial processes and installations, transport and storage of hazardous materials.

Information systems based on safety data banks. Advice and consultancy on security measures, design and standards of security systems and equipment for industry, government authorities and institutions such as museums, banks and offices.

## **Energy-related studies**

Various studies of the current and future availability, consumption and saving of energy; social and environmental aspects; activities for Dutch National Programmes on energy problems.

## **Energy-related technological research with the emphasis on energy saving**

Theoretical, experimental and field research on heat pumps and heat pump systems, mainly within the framework of housing and industrial

heating; technical and economic evaluation of different types of heat pumps and of systems for combined heat and power generation; testing, on an industrial scale, of installations comprising large prime-mover driven heat pumps.

Estimation of the efficiency of heating systems; assistance concerning their operation; measures for energy saving. Research on heat exchangers in connection with the use of heat pumps; utilization of soil heat. *Measurements, calculations, and counselling on a variety of problems and applications of heat technology.* Utilization of wind and solar energy; research on wind turbines, on the photo-electrochemical production of fuels, such as hydrogen and methanol, and on energy storage systems.

### **The use of coal as a source of energy**

General studies of the implications of the utilization of coal in the Netherlands. Fluidized-bed combustion of coal; operation of an atmospheric FBC-installation (thermal equivalent 4MW) within the framework of a research programme. Identification and abatement of harmful environmental effects caused by the handling and, in particular, by the burning of coal. Hazards of the use of coal. *Characterization and processing of solid wastes from coal combustion. Special analytical methods and techniques for studying the processing and burning of coal.* Chemical characterization of coal.

### **Miscellaneous**

Refrigeration technology as applied to equipment for storage rooms and vans. Research on structural ceramics used in the building industry. Stimulation of innovation in small and medium-sized industries. Systematic analysis of industrial processes and products with a view to energy saving. *Use of systems analysis in studying current problems.* Studies of methods for drawing up and using Environmental Impact Statements in the Netherlands. Analytical chemistry; new analytical methods and ancillary equipment, also for extremely small amounts or low concentrations of substances; automation and improvement of routine methods; advanced analytical research in inorganic and organic chemistry into structures of compounds as well as into the morphology, texture and elementary composition of a variety of materials. Investigations and performance tests, on an industrial scale, on high pressure steam relief valves. Field and laboratory research and detection of highly toxic substances such as dioxines.

### **Equipment**

Equipment includes a wide variety of instruments. Advanced spectrometers: (multi-nuclear) NMR, Fourier Transform Infrared, IDES; computerized GC/MS combinations; scanning electron microscope, provided with energy- and wave-length-dispersive systems for micro-X-ray analysis. Several atmospheric boundary layer wind tunnels.

'Sniffing van', housing facilities for detecting threshold levels of noxious smells. Pilot plant equipment for semi-technical separation of various wastes. Type B en C laboratories for experiments with labelled compounds. Thermovision apparatus for detecting and measuring temperature gradients, temperatures and heat losses. Reaction equipment for synthetic work on a scale of up to 150 litres. Fluidized-bed combustion unit for burning several wastes (thermal equivalent of up to 1/2 MW). Fluidized-bed combustion unit for burning coal (thermal equivalent of 4 MW). Advanced computer facilities for data acquisition and research purposes.

### *International relations*

Staff members of the Division contribute to the work of committees, seminars and congresses mainly in the countries taking part in the European Community, and in the U.S.A.

Regular contacts are maintained with several working groups set up by the OECD.

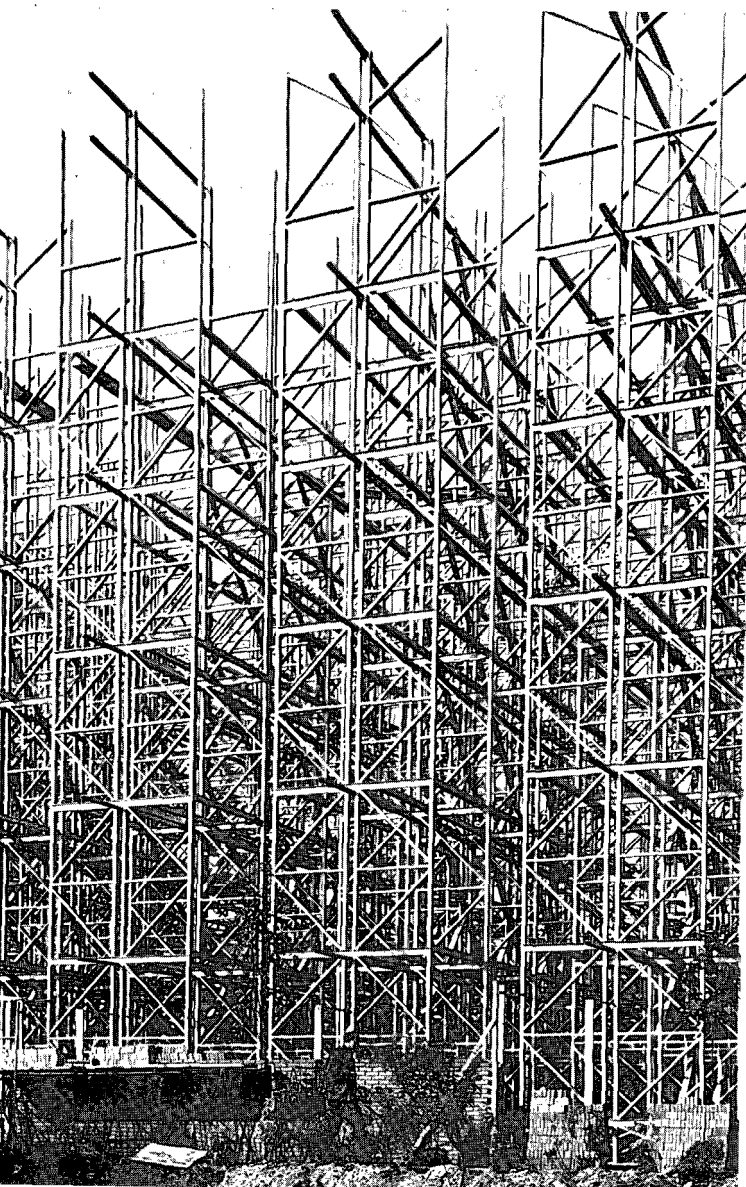
### *Publications*

Confidential reports to sponsors.

Surveys are frequently published in Dutch journals.

Original work and review papers are published, mostly in English, in appropriate international journals and as contributions to books.

*The Division for Building and Metal Research develops and tests, among other things, building materials and structures. Other important research areas are: metal technology and mechanical engineering.*





# Division for Building and Metal Research TNO

Laan van Westenenk 501  
Apeldoorn  
P.O. Box 541  
7300 AM Apeldoorn  
Phone 055 - 77 33 44  
Telex 36395 tnoap nl

Division director: Ir. J. M. Nijpjes  
Board: Ir. F.K. Ligtenberg, Ir. R.A.P.J. Schulze, Dr. Ir. F. E. van Wely,  
Prof. Ir. J. Witteveen

The Division for Building and Metal Research TNO comprises:

- the Institute for Building Materials and Building Structures TNO,
- the Metal Research Institute TNO,
- the Institute for Mechanical Constructions TNO,
- the Planning Committee for Building Research TNO.

## Institute for Building Materials and Building Structures TNO

Lange Kleiweg 5  
Rijswijk, near The Hague  
P.O. Box 49  
2600 AA Delft  
Phone 015 - 13 82 22  
Telex 38270 ibbc nl

Acting director: Prof. Ir. J. Witteveen  
Staff and personnel: 166

### *Scope of activities*

Research and advice on building materials and structures, and fire prevention.

### *Fields of work*

#### **Building materials**

The testing of and investigation into mechanical and chemical properties, durability, on-the-site inspections and non-destructive testing of concrete. New materials, the utilization of waste materials.

#### **Building constructions, heat insulation and moisture problems**

Constructional design methodics; the detailing of components such as windows, roofing slabs and wall elements, rain tightness, joints, finishes, renovation, inspections. Fundamentals for the evaluation of

parts of the built environment.

Physical properties of materials, condensation, dampness, thermal insulation, preservation of historic buildings.

### **Concrete structures, offshore, experimental mechanics**

Investigations into the mechanical behaviour of concrete, timber and masonry structures. Structural safety. Computing techniques, realistic models, structural details, fire resistance of concrete and prestressed concrete. Offshore structures. Methodology of building process systems approach to quality control.

Model testing of structures difficult to analyse.

Visualization techniques and optical measuring techniques.

### **Steel structures**

Investigation into strength and stability of steel structures, including greenhouses, storage racks, scaffolding, etc., structural details, connections, computing techniques. Computer aided design and manufacturing. Model testing, fire resistance, offshore structures.

### **Software engineering department**

Investigation of possibilities of using the computer and modern information theory. Producing computer programs; calculations in the field of applied mechanics. Application of computers to design and to operations scheduling (CAD/CAM).

### **Dynamic problems**

Vibration phenomena, wind loading and problems in connection with piling. Electronic measuring techniques.

### **Technical Centre for Fire Prevention**

The causes, consequences and combating of fire; fire prevention. Behaviour of materials and structures subjected to fire. Smoke hazard and smoke nuisance. Fire detection.

### *Publications*

HERON in co-operation with the Stevin Laboratory of the Delft University of Technology.

Reports published by co-operative research associations, e.g. CUR-VB (concrete), SG (steel), SBR (building research). Numerous publications in building periodicals.

The loose-leaf edition 'Behaviour of building materials and building structures in fire'.

### *Equipment*

Standard testing equipment for all current tests of building materials. Equipment for the non-destructive testing of concrete; corrosion tests; arrangements for the investigation into the weather resistance of building materials and structures, and of their resistance to aggressive

substances.

Equipment and model techniques for testing the rain and wind tightness of façade elements, windows, walls and roofs. A building with adjustable indoor climate to test the thermo-hygric behaviour, the durability and the heat insulation of wall and roof structures. Climatic rooms with adjustable indoor and outdoor climate. A heavy floor, jacks, pumps, frames and a lever pulsator for the full-scale testing of structural elements under static or varying loads, up to the moment of rupture. During these tests with standard apparatus compressive forces up to 10 MN can be applied. The loads can be varied according to an arbitrarily chosen load spectrum. Measuring equipment for the observation of the behaviour of structures, for the registration of phenomena elapsing rapidly or slowly with time, such as vibrations, creep and shrinkage and heat and moisture transfer.

Apparatus for the integrity testing of foundation piles.

Two types of apparatus have been developed for the non-destructive testing of piles and pile foundations. The smaller enables the localization of cracks and discontinuities; the larger apparatus makes it possible to perform a simple non-destructive 'dynamic test loading'. From this the bearing capacity and the mantle friction of a foundation pile can be automatically determined.

Automatic registration facilities for the on-line computer analysis of experimental data.

Equipment for making and testing elastic and realistic models of concrete and steel structures on a reduced scale. Among these are some 'rapid' measuring techniques such as the moiré method, speckle correlation methods and holographic interferometry.

Computer programs and other computation techniques for the rapid calculation of the distribution of forces in complicated structures.

Furnaces and a fire-shed for the determination of the fire resistance of, for example, beams, floors and wall elements. Standard testing equipment for the determination of the material properties which are of importance with respect to fire prevention. Testing facilities for fire-extinguishing equipment; smoke detection, etc.

### *International relations*

The Institute participates in the activities of:

- Comité Européen du Béton (CEB), Paris;
- Réunion Internationale des Laboratoires d'Essais et de Recherche sur le Matériaux et les Constructions (RILEM), Paris;
- Fédération Internationale de la Précontrainte (FIP), Paris;
- International Institute of Welding, London;
- Conseil International du Bâtiment pour la Recherche, l'Etude et la Documentation (CIB), Rotterdam;
- European Coal and Steel Community, Luxemburg;
- Organization for Economic Co-operation and Development (OECD), Paris;
- Inter-Governmental Maritime Consultative organization (IMCO), London;

- International Organization for Standardization (ISO), Geneva;
- Convention Européen des Constructions Métalliques,
- European Economic Community, Brussels.

## Metal Research Institute TNO

Laan van Westenenk 501  
7334 DT Apeldoorn  
P.O. Box 541  
7300 AM Apeldoorn  
Phone 055 - 77 33 44  
Telex 36395 tnoap nl

Managing director: Dr.Ir. F. E. van Wely  
Deputy director: Ir. J. W. Schinkel  
Staff and personnel: 239

### *Scope of activities*

R&D and consultancy on production techniques and qualifications of materials.

### *Fields of work*

#### **Metalworking**

##### *Machine tools*

Workshop lay-out, consultancy on capacity planning and machine tools purchasing, the testing of conventional and NC machine tools, test procedures and their development; organizational aspects of and procedures for preventive maintenance; optimization of the use of jigs and fixtures, pilot plant activities with regard to NC machine tools.

##### *Production control/automation*

Group technology; the automation (software) of process and operation planning (MICLASS, MIPLAN, etc.); the development of programming techniques for NC; the development of computer aided technology; computer aided manufacturing; the computer aided programming of NC machine tools (Miturn).

##### *Documentation*

Documentation on literature and available machine tools.

##### *Machining*

Machining data; optimum selection of machine tools and cutting; cutting tool development; the testing of cutting fluids.

##### *Punching, blanking, metalforming*

Metalforming data; the development of metalforming tools and equipment; product and production method development and

evaluation; the determination of causes of failure in metalforming production lines; metalforming under combined hydrostatic and mechanical pressures; the use of tungsten carbides in punching/blanking tools.

#### *Training courses for industry*

Machining processes (three courses); machine tool testing; punching, blanking, metalforming; the use of metalforming processes; programming with Miturn; the use and justification of NC.

### **Welding and brazing**

#### *Processes*

TIG and pulsed TIG welding, MIG and pulsed MIG welding, micro-plasma welding, plasma welding, pulsed plasma welding, plasma cladding (with transferred arc), submerged arc welding (with long stick-out). Electro-slag metal refining, the construction of thick-walled vessels exclusively from electro-slag weld metal; electron-beam welding, vacuum brazing.

#### *Weldability*

Weld simulator. V restraint hot-cracking test, implant cold-cracking test, reheat-cracking test, internal bore weld-cracking test.

#### *Projects*

One-sided welding; under-water welding; remote controlled welding; the preparation of high purity alloys by electro-slag remelting; the automation of welding processes by feedback control; the study of energy distribution in the electron beam; the quality control of electron beam welds; the influence of brazing parameters in high temperature vacuum brazing on the quality of the brazed joint; stainless steel cladding with the plasma process; the weldability of Al-Zn, Mg alloys, the weldability of high-strength steels; the weldability of concrete reinforcing steels; the weldability of stainless steels; the weldability of Ni-alloys (Incoloy 800); reheat-cracking studies of Cr-Mo steels; the repair welding of materials used in sodium-cooled systems; the non-destructive testing of special weld geometries.

### **Foundry techniques**

#### *Moulding materials and techniques*

Metal penetration and metal-mould reactions, sand preparation and its control for mechanized and automatic mould-lines; sand additives. Reclamation of moulding sands and core sands; mould-coatings and core-coatings.

#### *Ferrous and non-ferrous metals*

Special manufacturing techniques of nodular iron; compatibility of design and casting process; conversion of other constructions into castings, choosing the right alloy.

Influence of the choice of materials and technology on price and quality, designing of heat-treatment programmes, static and dynamic testing of

complete casting; the casting of prototypes up to about 300 kg of iron (abt 45 dm<sup>3</sup>); the casting of off-standards alloys; the deoxidation of high conductivity copper; techniques for inoculation, nodularization, desulphurization, alloying, etc.

#### *Melting and melting units*

Cupola techniques, advanced shaft furnace techniques; the reduction of energy consumption; the substitution of coke by other fuels.

### **Surface treatment and tribology**

#### *Electroplating*

Practical metal finishing, anodizing analyses, process control and improvement; development and evaluation of electrolytes, reduction of effluents, quality of coating.

#### *Sprayed coatings*

Flame-spraying and plasma-spraying of metals, ceramics and cermets.

#### *Tribology*

The interaction of lubricants and contact-surfaces under conditions of sliding and rolling. Wear under conditions of oscillatory movement; brake and clutch materials, cavitation erosion, impingement erosion and abrasive erosion. The development of bearing materials.

### **Strength of materials**

Safety and life-time prediction of materials in structures. Fracture mechanics under elastic, elasto-plastic and visco-plastic conditions. Creep and relaxation. The testing of materials under static and dynamic conditions. Failure analysis of reactor pressure vessels, pipelines, storage tanks, cranes, offshore structures. Wide plate and COD-testing.

Failure analysis and non-destructive testing.

Testing of components under multi-axial loading at room and high temperatures.

### **Corrosion**

Cathodic protection, corrosion of metals and stainless steel, stress-corrosion.

### **Metallographic techniques**

Optical metallography, transmission electron microscopy (including EMMA-analyses), scanning electron microscopy, microprobe analysis, ion probe analysis, X-ray fluorescence analysis, X-ray diffraction, X-ray stress analysis.

### **Special projects**

Improvements of materials with respect to:

- corrosion resistance;
- mechanical strength.

The development of materials and products for special applications.

Corrosion by liquid sodium.

## Institute for Mechanical Constructions TNO

Leeghwaterstraat 5  
2628 CA Delft  
P.O. Box 29  
2600 AA Delft  
Phone 015 - 56 92 18  
Telex 38192 iweco nl

Director: Ir. R.A.P.J. Schulze  
Deputy director: Ir. J. B. van den Brug

### *Scope of activities*

Institute for theoretical and experimental research with a view to improving mechanical and related constructions, the efficiency of which is determined by exacting requirements relating mainly to strength, rigidity and freedom from vibration. On the basis of the most recent data from modern physics and electronics, methods and measuring techniques required for such research are developed. The aim of the institute is to apply the knowledge and skill acquired in the above work in such a way as to bring maximum benefit to industry, and to advise the authorities in this field and inform them of particular technical developments.

### *Fields of work*

#### **Stress and vibration analyses**

##### *Theoretical*

Stress analysis by the finite element method applied to elasticity, plasticity and creep problems.

Fracture mechanics research.

Determination of stationary and non-stationary temperature distributions coupled with stress calculations. The calculations can be related to a wide variety of constructions: pressure vessels, turbines, ship structures, etc.

Theoretical stress analysis related to perforated plates, shell structures, contact problems, etc.

The development of a mechanical impedance method. Shock theory and shock absorbers. Research on damping layers.

Vibration analysis for constructions: deckhouses, ships, antennas, etc. The design of vibration-insulating mountings, machine and hammer foundations.

Advice on mechanisms and dynamics of various machines: looms, etc. Development and application of CAD/CAM systems.

Design of special-purpose machinery.

Advice on automation.

## **Experimental mechanics**

Strain-gauge measurements. Vibration analysis by the mechanical impedance and modal analysis methods. Shock tests; trouble shooting.

Investigation in the field of random vibration and shock. Damping of constructions. Process applications of vibrations, such as: compacting, transporting, fluidizing and separating with the aid of mechanical constructions.

Design of specialized load, motion and strain measuring systems.

## **Bearings and seals**

Theoretical and experimental investigations of fluid lubricated, plain and grooved bearings and seals.

## **Simulaton and control systems**

'Simulation and control systems' covers all facets of the controlling of processes of system analysis and control systems through the training of control operators. The activities are mainly directed to marine applications.

The main subjects and activities are:

*System analysis and (automatic) control systems:*

- feasibility studies on the total systems and/or the control of the system
- design of automatic control systems and supervision of the realization
- evaluation and/or prediction of the performance of the system
- consultation on control systems

*Process automation:*

- analysis and definition of operator tasks
- definition of the automation concepts
- design of the system and supervision of the realization
- consultation on process automation

*Simulator development and process simulation:*

- definition and specification of simulators for training and research purposes
- development and realization of simulators
- analysis, design and evaluation of energy generating/transforming systems using simulation and/or calculation models

*Training with simulators:*

- training courses for ship bridge and engineroom personnel on our ship bridge simulator and engineroom simulator
- studies on training effectivity and fault management

*Ship traffic:*

- studies on the safety and efficiency of ship traffic
- development of simulation models for use in fairway safety and capacity studies
- consultation on the design and realization of ship traffic management systems
- studies on the nautical aspects of harbour design.



## **Fundamental research into measurement**

The design of measuring equipment for mechanical quantities.

## **Instrument evaluation**

Evaluation of commercially available instruments, controllers, integrated control systems and other types of equipment. The accuracy and reliability is established under simulated field conditions.

## *Equipment*

Digital strain-gauge measuring device for 150 measuring points. A high-precision strain indicator (accuracy  $<0.1\mu$  V/V).

Multi-channel strain-gauge measuring devices for dynamic phenomena. A number of accurate electrical standards for calibrating purposes.

Resistance strain-gauge force transducer for nominal 1 kN as well as for 3000 kN. Pressure transducers for nominal 0.1 MPa as well as for 1500 MPa.

'Schlieren' system for the visualization of gas flow.

High-speed cameras, twin single flash, stroboscopic flash equipment. A deadweight standardizing machine which enables compressive and tensile forces to be produced in steps of 5 kN, increasing up to 555 kN. The accuracy is better than 10 ppm.

Force transducers of 2500 kN (16) and 1000 kN (8) with an accuracy  $<.6\%$ .

A number of tape recorders for fast phenomena.

Three concrete heavy floors of 13.5 m x 8.5 m, with a thickness of 2.6 m in a hall of 43 m x 20 m and a height of 11 m.

Various vibration excitators (mechanical, hydraulic or electrical) with sinusoidal signals, wide and narrow/band random. Instruments for the analogue recording of mechanical impedance and transfer functions of harmonic, random and shock excitation.

Various transducers for measuring displacements, velocities and acceleration.

A transportable balancing device.

A pump installation with special features for testing constructions which need a large quantity of water at pressures up to 3.5 MPa.

An analogue as well as a digital computer for the simulation of dynamic systems, calculations or analysing results of measurements.

Spin tunnel for the testing of wheels ( $\varnothing$  500 mm) in vacuum at high revolutions (20.000 rev/min).

A loading machine of 1 MN.

A shock testing machine with the following specifications for a test weight of 500 kg: upward acceleration 400 gee, velocity 8.1 m/s, rise time 3.3 m/s, displacements 55 mm, (downward) deceleration 125 gee.

Shock testing machine for a test weight of 100 kg, some accelerations and velocities.

Computer and software facilities, e.g. Fast Fourier Analyzer, DEC/VAX 11/780, HP1000, digital data handling systems, Modal Analysis

software, CAD systems and software, finite element programs, etc.  
Several ship simulators: ship manoeuvring simulator, ship's bridge simulator, engineroom simulator, supply vessel simulator and ship motion simulator.

Climatic chamber (-60 °C to +130 °C).

Various deadweight testers between 0.1 and 350 bar.

Differential pressure standard for pressure up to 200 bar.

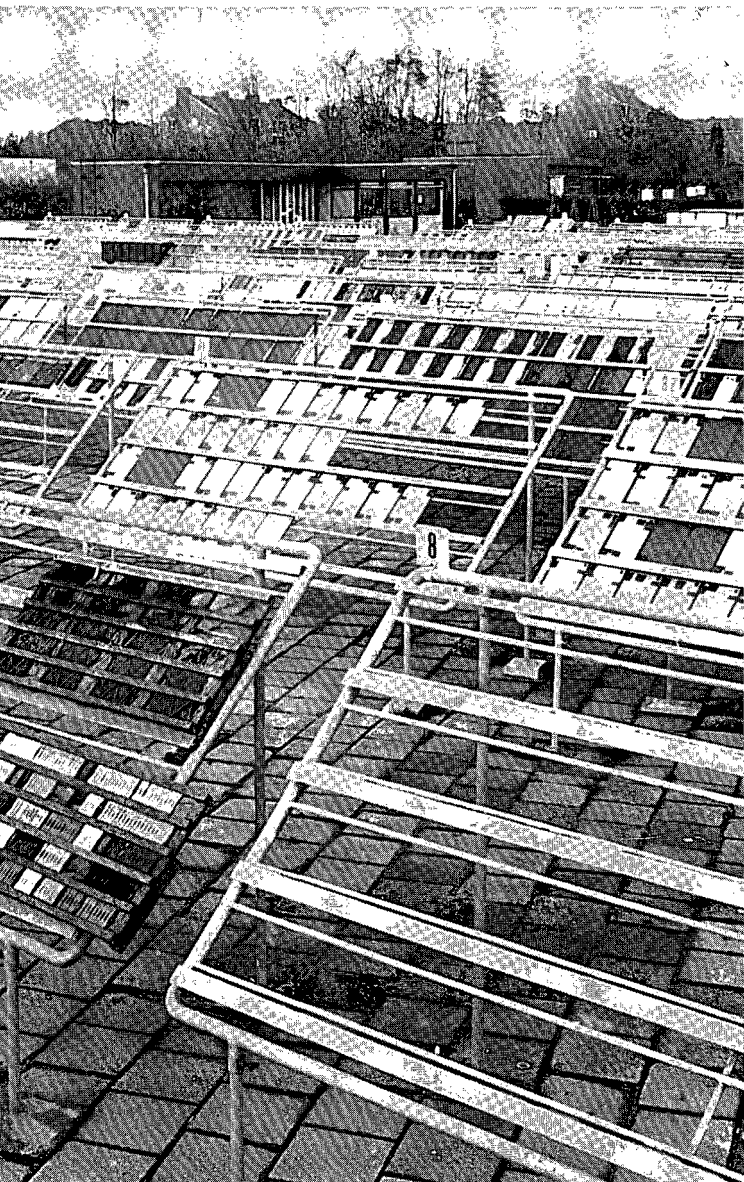
Various mains interference simulators.

Access to various flow rigs for testing flow measuring devices.

## *Publications*

Reports, articles in scientific journals.

*Paint research is but one example of the branch-related research performed by the Division for Industrial Products and Services. Major research areas are: timber, man-made and natural fibres, plastics and rubber, road vehicles, packaging and leather.*



## **Division for Industrial Products and Services TNO**

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 288  
2600 AG Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Division director: Ir. H. Borsten

Board : M. J. van Essen, Ir. W. P. Fornerod, Ir. Drs. P. D. van der Koogh,  
Dr. Ir. L.C.E. Struik, Ing. A. van der Velden, Ir. P.J. van Vlimmeren, Ir. H.  
J. de Vries.

The Division for Industrial Products TNO comprises seven institutes:

- the Forest Products Research Institute TNO,
- the Plastics and Rubber research Institute TNO,
- the Institute for Leather and Shoe Research TNO,
- the Paint Research Institute TNO,
- the Institute TNO for Packaging Research,
- the Fibre Research Institute TNO and
- the Research Institute for Road Vehicles TNO.

### **Forest Products Research Institute TNO**

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 151  
2600 AD Delft  
Phone 015-56 93 30  
Telex 38071 zptno nl

Manager: Ing. A. van der Velden

Staff and personnel: 30

#### *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO for research on and technical testing of wood and woodbase materials, advice to the timber trade and wood-working industries.

#### *Fields of work*

Structure of wood and identification of kinds of wood. Mechanical and physical properties of wood and woodbase materials.

Testing of wood, wood constructions, furniture and joinery work.

Drying properties of wood under both natural and artificial conditions; advice on kilns.

Preservation of wood: its destruction by wood-destroying organisms and its protection against attack or destruction by fungi, insects, fire. Wood chemistry; chemical composition and its influence on durability, discoloration, bleaching and finishing; wood stabilization.

Technological wood research, wood joints (inter alia adhesives) and wood engineering, constructions, sheet materials (veneer, plywood, particle and fibre board), wood waste.

Wood-working (sawing, planning, sanding) and maintenance of tools (sharpening).

Quality and tolerance. Finishing of surfaces with paints, varnishes, foils.

## *Equipment*

Mechanical testing equipment; wood-working machinery; kiln drying plant; incubators for fungal research; plant for semi-industrial impregnation and for the manufacture of boards; measuring-van; wood samples collection.

## *International relations*

Food and Agriculture Organization (FAO).

International Union for Forest Research Organizations (IUFRO).

Organization for Economic Co-operation and Development (OECD).

Forest Products Research Laboratories in many countries.

## *Publications*

Communications, articles in periodicals and journals, leaflets.

## Plastics and Rubber Institute TNO

Schoemakerstraat 97

2628 VK Delft

P.O. Box 71

2600 AB Delft

Phone 015 - 56 93 30

Telex 38071 zptno nl

Director: Dr. Ir. L.C.E. Struik

Staff and personnel: 115

## *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO for research and development and advice on plastics and rubber on behalf of all branches of industry. The activities cover the fields of raw materials, processing, manufacturing, properties of plastics and rubber materials and the testing of end-use products for, for instance, consumers' organizations.

## *Fields of work*

### **Processing**

Research on the basic operating principles for plastics and rubber processing and on processing equipment. Investigations of the relationships between raw material properties, processing conditions and product properties.

Preliminary operations (mixing, compounding, dispersion, granulating); operations to obtain the finished article (compression moulding, injection moulding, extruding, calendering, manufacturing rubber and plastic foams); processing semi-manufactured articles (beading, vacuum forming, machining, welding, glueing, etc.); development of new rubbers and plastics applications, including those in reinforced plastics.

### **Product development**

Effective design and production not only implies knowledge of properties and of the processing of the basic material, but also of characteristic requirements for construction.

Accordingly, the institute works out special rules for plastics and rubber design and construction, which generally differ from those meant for more conventional materials.

The institute has experience in designing and constructing moulds and other devices.

Prototypes made from the plastic or rubber selected are a major aid to developing the right product. They often supply important information with respect to ultimate product shape, etc.

### **Analysis**

Organic analysis. Quantitative and qualitative analytical investigations and analysis of plastics, rubbers and compounding ingredients by means of infrared spectroscopy, gaschromatography, thin layer chromatography and gel permeation chromatography.

### **Testing**

All types of mechanical, dynamical, chemical, electrical, thermal and ageing tests, which can be carried out according to ISO, A.S.T.M., B.S., DIN en NEN.

Development of new and improvements on existing testing methods, also in co-operation with national and international standardization bodies.

### **Biomedical applications**

For some years the institute has been active in research on the use of plastics and rubber in biomedical techniques. Experience has been gained in selecting the materials, in product development, compatibility with blood and tissues and behaviour in sterilization. Furthermore the institute has a collection of market data on a great number of products.

## *Information and documentation*

Technical information is given to industries. An extensive collection of abstracts, pamphlets and other data regarding scientific, technical and techno-commercial aspects and information on standards is available, as well as a representative collection of rubber and plastics materials and products. Special literature can be consulted in the library.

## *Courses*

The institute frequently runs courses of, among other subjects, the general properties and processing technology of rubbers and plastics, and the wide spectrum of applications of these materials.

## *Equipment*

Machines for grinding, milling, calendering, welding, compression and transfer moulding, extruding, blow-moulding, vulcanization, vacuumforming, injection moulding, fluidized bed, coating, filament-winding, foam manufacturing, etc. on an industrial and a laboratory scale.

Instruments for carrying out analytical and mechanical investigations, and for determining electrical and thermal properties; apparatus for viscosity and relaxation measurements. Equipment for the investigation of the long-term properties of plastics and a fully automatic ozone device for determining resistance to ozone of vulcanized rubbers.

## *Publications*

– 'Plastica' – a monthly in Dutch edited by the Plastics and Rubber Institute TNO, literature service, technical articles in various journals.

## **Institute for Leather and Shoe Research TNO**

Mr. van Coothstraat 55  
5141 ER Waalwijk  
Phone 04160-3 32 55  
Telex 35083 Istno nl

Director: Ir. P.J. van Vlimmeren  
Staff en personnel: 27

## *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO, for research on behalf of the leather, footwear and other leather consuming industries: information and advice relating to technical problems.

## *Fields of work*

### **Leather industry**

Improvement and rationalization of tanning processes, perfection of existing qualities of the various kinds of leather. Waste water and solid wastes problems: the isolation and application of organic and inorganic (trivalent chromium) substances of tannery wastes and the mutual impact of leather technology and the treatment of tannery wastes.

### **Footwear and other leather consuming industries**

Improvement and rationalization of the methods used for the manufacture of ready-made and orthopedic shoes; development of laboratory methods for speedy quality tests on new materials and auxiliary materials; special studies about comfort quality of shoes. Leather goods, garment and upholstery: the use of leather and leather substitutes for these purposes.

The training of fellows from developing countries and short courses in the field of shoe and leather technology.

## *Equipment*

Plant and appropriate machines for the production of practically all modern kinds of leather on a pilot plant scale; special apparatus for the determination of the chemical and physical properties (including resistance to wear) of leather and of other materials used in the leather, footwear and other leather consuming industries.

## *Publications*

Articles in national and international periodicals.

## **Paint Research Institute TNO**

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 203  
2600 AE Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Manager: Ir. H.J. de Vries  
Staff and personnel: 30

## *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO for research on paints, raw materials for paints and the application of paints: advice to producers and users of these materials.



## *Fields of work*

The various aspects of paints and pigments in relation to the substrate; vehicles, pigments, dispersions, application techniques, anti-fouling. Analysis and development of test methods.  
Properties of paint films.  
Trouble shooting and advice to users.  
Corrosion prevention.

## *Equipment*

Equipment for the manufacture of paints, varnishes and related products, for the chemical and physical investigations of their properties and for analyses and tests according to Netherlands and foreign specifications.  
Extensive equipment for different substrate preparation and paint application techniques.  
Equipment for mechanical testing and the accelerated weathering of paint films.

## *International relations*

Co-operation with or membership off:  
Permanent International Committee for Research of the Preservation of Materials in the Marine Environment (COIPM);  
International Organization for Standardization, Technical Committee 35 (ISO-TC 35);  
Fédération d'Associations de Techniciens des Industriels des Peintures, Vernis, Emaux et Encres d'Imprimerie de l'Europe Continentale (FATIPEC)

## *Publications*

Newsletters and articles in national and international periodicals.

## **Institute TNO for Packaging Research**

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 169  
2600 AD Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Manager: Ir. W.P. Fornerod  
Staff and personnel: 25

## *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO for research, development, testing and technology transfer related to packaging, packaging materials and machinery.  
Sponsored work for Government and industry.

## *Fields of work*

Transport packaging, retail packaging, industrial packaging, packaging for agricultural and horticultural products, packaging for hazardous goods.

Packaging of pre-packed food, mechanization.

Environmental studies.

Consultancy, expertise, development of testing equipment.

Testing according to standards of ISO, A.S.T.M., DIN, IMCO, RID, ADR.

Information services, courses, seminars, workshops.

## *Equipment*

Modern testing facilities, of which several have been developed within TNO.

Climate rooms, drop tables, vibration tables, compression testers.

Instruments for testing of shock absorption, permeability to watervapour and gases, stiffness of paper and board, and so on.

## *International relations*

The International Association of Packaging Research Institutes (IAPRI).

The European Packaging Federation (EPF).

The World Packaging Organization (WPO).

The United Nations Industrial Development Organization (UNIDO).

The International Trade Centre (UNCTAD/GATT).

## *Publications*

Articles in international packaging magazines.

Bibliography on packaging.

## **Fibre Research Institute TNO**

Schoemakerstraat 97

2628 VK Delft

P.O.Box 110

2600 AC Delft

Phone 015 - 56 93 30

Telex 38071 zptno nl

Branch laboratory:  
Fibre Research Institute TNO "De Voorzorg"  
Hengelosestraat 715  
7521 PA Enschede  
P.O. Box 671  
7500 AR Enschede  
Phone 053 - 35 41 75

Director: M.J. van Essen  
Deputy: Ir. G.H. van Dorth  
Staff and personnel: 120

## *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO, for research and advice in the field of textiles and paper. Activities are concentrated on fibre research in the broad sense, varying from research on raw materials to research on final products, and in particular on those cases where processing as well as social and economic aspects are involved. Agriculture, trade and industry, government and consumers are among the target groups of the institute.

The institute is engaged in product development, the improvement of processes, quality assessment, etc. with respect to yarns, cloth, non-wovens and final products, such as clothing, fabrics to be used by the furnishing industry and for domestic purposes, and technical textile products.

Research is also carried out for the paper and cardboard industry. The social aspects of either the production or the use of such products are taken into account as well.

## *Fields of work*

Spinning  
Weaving  
Knitting  
Finishing  
Clothing  
Pulp and paper  
Product and machine development.  
Testing, specification, certification, calibration.  
Environmental problems  
Energy saving  
Recycling  
Assistance to developing countries  
Advice to governments, industry, trade and consumers  
National and international standardization and labelling  
Information, documentation and abstract service  
Equipment  
Pilot plants for spinning, weaving, knitting, finishing,

garment-making and paper-making  
Testing equipment  
Mechanical and electronic work-shop

### *International relations*

Contacts are mainly maintained with:

- International Institute for Cotton
- International Wool Secretariat (IWS)
- Hohenstein
- Centexbel
- Svenska Textilforskningsinstitutet
- Centre d'Etudes Techniques des – Industries de l'Habillement
- International Organization for Standardization (ISO)
- European Economic Community (EEG)
- Comitextil
- Institute of Textile Technology, Bandung
- Shirley Institute
- Laboratorium de Meulemeester
- Wool Industries Research Association
- Indian Jute Industries Research Association
- Association Technique de l'Industrie Papetière
- British Paper and Board Makers Association
- Institut für Papierfabrikation

### *Publications*

Communications, pamphlets and literature abstracts, publications and articles in various periodicals.

# Research Institute for Road Vehicles TNO

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 237  
2600 AE Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Director: Ir. Drs. P.D. van der Koogh  
Deputy director: Ir. G.K. Tanis  
Staff and personnel: 77

## *Organization and scope of activities*

Institute of the Division for Industrial Products and Services TNO, for research and development in the field of road vehicles and IC-engines.

## *Fields of work*

Research, development and advice in the field of design and application of road vehicles and their parts.

Special fields of interest:

- internal combustion engines (tuning, exhaust-emissions, noise, efficiency of engines);
- special problems of small two-stroke engines;
- application of alternative fuels (LPG, LNG and alcohol fuels);
- safety, crash phenomena and bio-mechanics;
- optimization and application of restraint-systems for adults and children;
- development and application of dynamic mathematical crash models;
- development of special crash test dummies;
- vehicle and driver dynamics and criteria for stability and manoeuvrability of single and double tracked vehicles;
- general bicycle technology;
- approval testing according to national and international regulations.

## *Equipment*

- Engine dynamometers (2 to 600 hp), roller test benches (moped and car) and a fully equipped emission laboratory.
- Impact rig and complete test machinery for restraint systems and helmets.
- Full scale crash test facility (max. impact speed 100 km/h).
- Cross-wind simulator (max. wind speed 30 m/s).
- Measuring facilities for stability and cardriver experiments (gyrostabilized platform, steering input generator, etc.).
- Interlinked computersystem for on and off line data processing and model calculation.

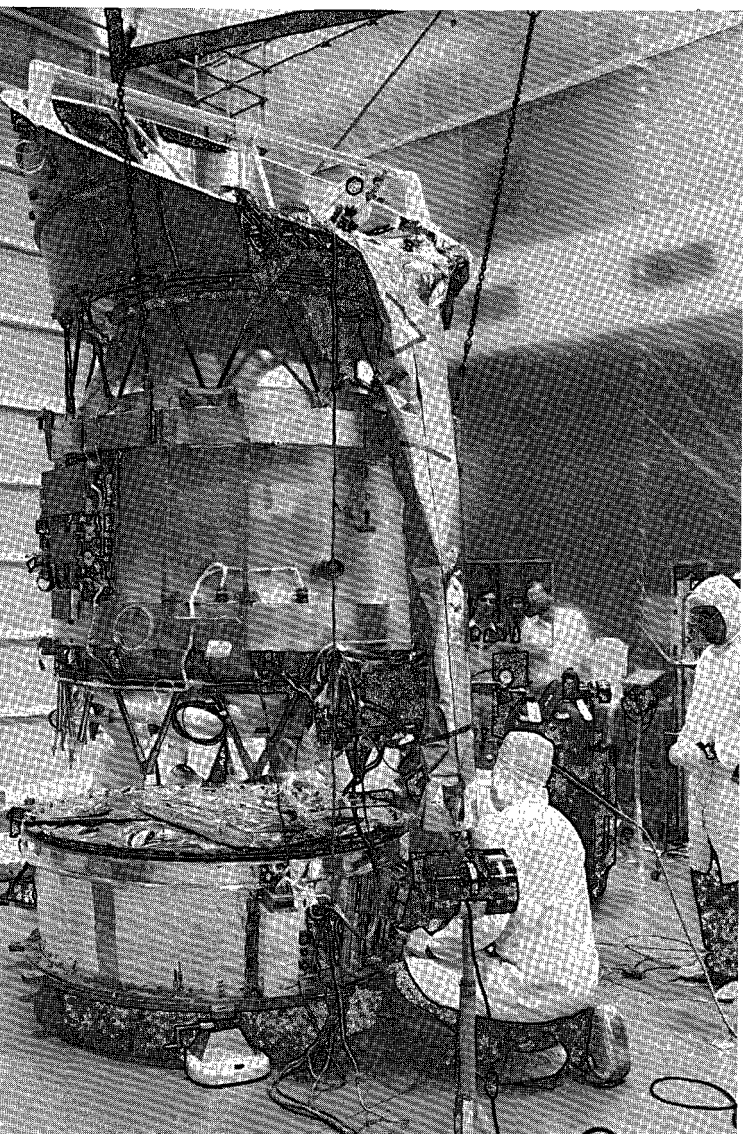
- Fatigue test rigs for bicycles and mopeds.

## *Publications*

For the documentation on road vehicle engineering the institute co-operates with other Dutch institutions and industries.

*The Division for Technical-Scientific Research built the optical instruments for the so-called "Dutch Additional Experiment" on board the Infrared Astronomy Satellite (IRAS).*

*Major research areas are: heat technology, solar energy, acoustics, instrumentation, statistics, product development, microelectronics and groundwater.*



# Division for Technical-Scientific Services TNO

Stieltjesweg 1  
2628 CK Delft  
P.O. Box 155  
2600 AD Delft  
Phone 015 - 78 80 20  
Telex 390891 tpdtdt nl

Division director: Ir. C.J. Remijnse, LL. M.  
Board: Ir. J. Delcour, Dr. Ir. A. Scheepmaker, Ir. J. Remmelts,  
Drs. F. Walter, Ir. G.A. Schwippert

The Division for Technical-Scientific Services TNO consists of five institutes, namely: Ground Water Survey TNO, Instrumentum TNO, Institute TNO for Mathematics, Information Processing and Statistics, the Institute of Applied Physics TNO-TH and the TNO Centre for Micro-Electronics.

## TNO Centre for Micro-Electronics (CME-TNO)

Schoemakerstraat 97  
Delft  
P.O. Box 67  
2600 AB Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Manager: Ir. G.A. Schwippert  
Staff and personnel: 4

### *Organization and scope of activities*

Institute of the Division for Technical-Scientific Services TNO. The main task of the Centre is to be of service to industry, in particular to small and medium-sized firms in their search for new possibilities in the micro-electronic field. The Centre acts both as consultant and intermediary. Having itself no executive tasks, it shows the way to the execution of tasks either by TNO, the Delft University of Technology, service rendering institutions, or industry.

The Centre's staff-members have acquired know-how and experience in the following fields: micro-electronics, high-precision instruments, management science, and informatics.

### *Fields of work*

#### **General advice**

Acting as a guide to applied (micro-)electronics, industrial engineering



and market analyses. Fixed consulting hours in co-operation with, among others, the knowledge transfer centres of the Delft University of Technology and the Governmental Industrial Counselling Service ('Rijksnijverheidsdienst').

Issuing publications and brochures on the applications of micro-electronics to the development and/or improvement of products.

Participation in seminars, conferences, poster sessions and other manifestations meant to provide information about the applications of micro-electronics.

Co-operation in arranging courses in the above mentioned fields.

### **Direct advice**

- co-operation in the development of products, sensors and systems;
- co-operation in technical automation;
- analysis of the industrial aspects of process or product modifications;
- co-operation in making applications for credit and subsidy;
- co-operation in making application for patents, licences, etc.;
- market research in trend analyses;
- techno-scientific support.

### **Development of products, systems, and processes**

- in co-operation with TNO institutes, departments of the Delft University of Technology and any other suppliers of technical know-how, CME gather knowledge, which may lead to the achievement of a total product or system draft;
- calling in the support of service-rendering institutions and industries.

### **Guide function**

- rendering support in the search of concrete information on micro-electronics with the appropriate institutions, organizations, and industrial firms; in this respect CME enlists the services of existing data banks;
- providing surveys of current training courses of micro-electronics.

### **Co-ordination**

- the co-ordination of projects in such a way that optimum benefit is gained from the regulations drawn up by the Ministry of Economic Affairs and the Ministry of Education and Science, and that optimum yield is obtained from the support given by these ministries and other institutions such as the Governmental Counselling Service and the other Centres for Micro-Electronics;

# Ground Water Survey TNO

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 285  
2600 AG Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Director: Drs. F. Walter  
Deputy Director: Dr. G.F.J. Jeurissen  
Staff and personnel: 70

## *Organization and scope of activities*

Institute of the Division for Technical-Scientific Services TNO for research and studies on exploration of energy resources, minerals and groundwater recovery and management.

## *Fields of work*

### **Exploration and assessment of resources**

- Acquisition and processing of reflection seismic data.
- Inventory of hydrological and hydrogeological data.
- Geophysical reconnaissance surveys; application of geo-electrical, gravimetric, magnetic and seismic methods.
- Geothermal investigations and feasibility studies.
- In sites: determination of hydrological constants by means of pumping tests, geophysical well logging, etc.
- Hydro-meteorological investigations.
- Hydrochemical surveys.

### **Management studies**

- Assessment of the available water resources; waterbalance studies.
- Analogue and mathematical studies in view of optimum groundwater exploitation.
- Design of groundwater observation networks.

### **Research and development on**

- Geohydrological and geophysical surveying and interpretation techniques.
- Seismic data processing and interpretation.
- Computer processing of geohydrological data.
- Well completion methods.
- Geophysical and hydrological equipment.

### **Main tasks in the Netherlands**

- Seismic survey related to inventory of coal reserves and to exploration for oil and gas.
- Geohydrological mapping in the Netherlands (scale 1:50000).

- Maintenance of piezometer network and compilation of groundwater level observations.
- Advice to water companies, governmental services and engineering consultants.
- Transfer of knowledge; organization of post-graduate national and international courses and training programmes.

### **Activities abroad**

In 1982 Ground Water Survey TNO was engaged on linkage projects with groundwater institutes in Colombia, North Yemen, Pakistan and Kenya.

## **Instrumentum TNO**

Curaçaostraat 2,  
Delft

Surinamestraat 2  
2612 EA Delft  
Phone 015 - 14 02 81  
Telex 38130 intno nl

Director: Dr. Ir. A. Scheepmaker  
Deputy director: R. Nieuwenkamp  
Staff and personnel: 90

### *Organization and scope of activities*

Instrumentum TNO was established in 1942 as an Institute of the then Industrial Research Organization TNO. In 1981 it was transferred to the Division for Technical-Scientific Services TNO. The institute is active in product development. It uses modern problem solving techniques and serves both Dutch and foreign customers in the government and private sector.

### *Fields of services*

Product design and innovation by using advanced technology in the field of fine mechanics and electronics.

Industrial design.

Design of electronic and microprocessor applications.

Mechanical and electrical engineering.

Production of: parts and units, working models, prototypes, and pilots series.

Tests on units and products according to the list of requirements.

### *Facilities*

Design department with its project groups.

Production, including: workshop, electronic department, assembly department, measuring department, and product inspection.

## **Institute TNO for Mathematics, Information Processing and Statistics**

The Hague section:

Koningin Marialaan 21  
2595 GA The Hague  
P.O. Box 297  
2501 BD The Hague  
Phone 070 - 82 41 61  
Telex 31707 wstno nl

Wageningen section:

Marijkeweg 11  
Staringgebouw  
6709 PE Wageningen  
P.O. Box 100  
6700 AC Wageningen  
Phone 08370 - 1 91 00

Director: Ir. J. Remmelts  
Deputy director: Drs. H. Loeven  
Staff and personnel: 115

### *Organization and scope of activities*

Institute of the Division for Technical-Scientific Services TNO rendering services on statistics and mathematical problems, including operations research, informatics, computation and information processing. Services are rendered both to TNO and to governmental bodies, industries and private individuals.

### *Fields of work*

The fields of work of the Hague and Wageningen sections are the same, although the greater part of the problems dealt with at Wageningen relate to agriculture.

#### **Statistics**

Advice and consultancy on statistical aspects of research projects in all fields both at the stage of design of experiments and, later on, in analysing the data obtained and in interpreting the results.  
Statistical aspects of policy decisions.

#### **Numerical mathematics**

Numerical solutions to mathematical, physical and engineering problems.

## **Operations research**

Linear and non-linear programming, simulation.

## **Data processing for business applications**

Design, programming and operation of automatic systems for accounting, salary and tax calculations, etc.

Consultancy on all aspects of business automation.

## **Informatics**

Data base management and information retrieval systems

## **Computation and information processing**

Advice on information processing with the use of computers.

Development of 'hard software'.

Processing of information offered directly at the central site as well as via data communication facilities (batch processing and time sharing).

## *Equipment*

The Hague:

Control Data Cyber-systems:

- Cyber 730, 1280 Kbytes parallel with Cyber 171, 1280 Kbytes;
- CB 2551 communication computers, 2 127 communication channels;
- disc units 5000 Mbytes;
- magnetic tape units (9 tracks);
- line printers;
- card reader and punch;
- paper tape readers and punch;
- plotter (86 cm).

Hewlett Packard:

- HP 3000, 1 Mbytes
- disc unit 64 Mbytes
- printer.

Wageningen:

Digital Equipment

- VAX 11-750;
  - 3 Mbytes;
  - disc units 336 Mbytes;
  - cassette tape and magnetic tape;
  - line printer;
  - printer/plotter;
  - paper tape reader;
  - plotter;
- connected to the central computer in the Hague.

## **Programming languages**

ALGOL 60, COBOL (ANSI), FORTRAN, SIMULA, PASCAL, APL, BASIC, etc.

## *International relations*

- Biometric Society, Tucson (Arizona).
- International Forum of Control Data Users, Minneapolis.
- European Control Data Users, Geneva.
- HP 3000 International Users Group
- International Microfilm Congress

## *Publications*

Occasional reports, articles in various periodicals.

## **Institute of Applied Physics TNO-TH**

Stieltjesweg 1  
2628 CK Delft  
P.O. Box 155  
2600 AD Delft  
Phone 015 - 78 80 20  
Telex 38091 tpdtd nl

Director: Ir. J. Delcour

Research directors: Dr. Ir. J. de Jong, Ir. G.J. Kleinhoonte van Os

Finance director: Ir. W. Kooijmans

Staff and personnel: 290

## *Organization and scope of activities*

Institute of the Division for Technical-Scientific Services TNO collaborating with the Applied Physics Department of the Delft University of Technology and the Department of Building, Planning and Architecture of the Eindhoven University of Technology, engaged in applied physics research and physical measurements and consulting. Roughly speaking, the activities can be classified in three categories: acoustics and building physics; instrumentation; investigation of materials.

## *Fields of work*

### **Acoustics**

#### *Architectural acoustics*

- Research and consultation on the influence of design, finishing and the use of electroacoustic equipment on the intelligibility of speech and the quality of music in halls.
- Research and advice on noise abatement in buildings.

#### *Environmental acoustics*

- Research into environmental noise problems.
- Predicting noise levels in the vicinity of highways, railways,

tramways and airports and determining the influence of distance, location and screening by barriers.

#### *Industrial acoustics*

- Research and consulting aimed at abating industrial noise for the protection of the environment and of industrial workers.
- Research and consultation directed towards noise control of highway and railway traffic.

#### *Ship acoustics*

- Research, development and consultation on shipboard noise control for the comfort and safety of passengers and crew.

#### *Echo acoustics*

- The development of inspection methods and equipment using echo-acoustic principles, for various applications such as: the non-destructive testing of materials, underwater echo-acoustics medical diagnostics and seismic exploration methods.

### **FAGO-TPD, concerted action between TPD and Eindhoven University of Technology.**

- Research and consultation in the field of building physics, emphasizing an integrated treatment of heat, humidity and acoustic problems.

### **Heat department**

#### *Heat transport*

- Research on the control of the indoor climate and energy consumption in buildings by computer simulation and measurements.
- Study of industrial heat transport processes.
- Evaluating computer calculation programs for central heating and indoor climate control and the promotion of applications to practical building design.

#### *Heat instrumentation*

- Research on the thermal applications of solar energy.
- Development of thermo-physical measuring devices.

### **Optical instrumentation**

#### *Electron optics*

- Development and construction of electron optical equipment.

#### *Physical optics*

- Development of optical electronic measuring methods and equipment.
- Application of lasers e.g. in holography, machining of materials and flow measurements in fluid and gases.
- Development of interferometers for industrial applications.

### *Geometrical optics*

- Design and construction of optical systems for the visible range as well as the X-ray, ultraviolet and infrared range of the spectrum.
- Development and construction of optical instruments such as spectrometers, telescopic systems and projection systems.

### *Instrumentation space research*

- Development of measuring systems and instruments for application in spacecraft, in particular astronomic observing equipment, attitude and navigation sensors and instruments for earth observation.

### *Mechanical construction*

- Design, construction and testing of mechanical equipment.

## **Instrumentation**

### *Electronics*

- Development and application of electronic and micro-electronic components in circuits, systems and sensors. Quality and reliability of electronic equipment.

### *Oceanology*

- Development of sensors and measuring techniques for hydrologic engineering and marine research.

### *Hardware systems*

- Design and realization of electronic circuits and systems for data, transmission, processing and presentation.

### *Signal processing*

- Application of signal processing techniques, computers and special computing equipment in technical systems.
- Research and consultation on vibrations in pipesystems by means of simulation, calculation and measurements.

### *Microprocessors*

- Application of microprocessors in products and in automation of manufacturing processes.

### *Electronic construction*

- Design, construction and testing of electronic equipment; also installation and maintenance thereof.

## **X-ray**

- Collection of X-ray powder diffraction data of pure materials (international co-operation JCPDS)
- Analysis of solid materials by means of X-ray powder diffraction.
- Improvement of X-ray powder diffraction methods and techniques.



## **Glass and ceramics**

### *Glass*

- Research on the improvement of glass properties.
- Study of the technological processes in glass manufacture and secondary operations.
- Development of inspection methods for glassware; quality control on glass products and enamelled objects.

### *Ceramics (Eindhoven)*

- Characterization of ceramic raw materials in order to make possible a better evaluation of the properties of these materials.
- Research and advice on ceramic technologies.

## *Facilities and equipment*

Anechoic room, sound transmission and reverberation rooms, reverberating water tank, mobile acoustic laboratory, spectrometric equipment, X-ray equipment, digital computers, special analogue computers and data processing equipment. Mechanical and electronic workshops, temperature and humidity controlled rooms, clean rooms.

## *International relations*

European Space Agency (ESA).

European Space Research and Technology Centre (ESTEC)

American Society for Testing and Materials (ASTM).

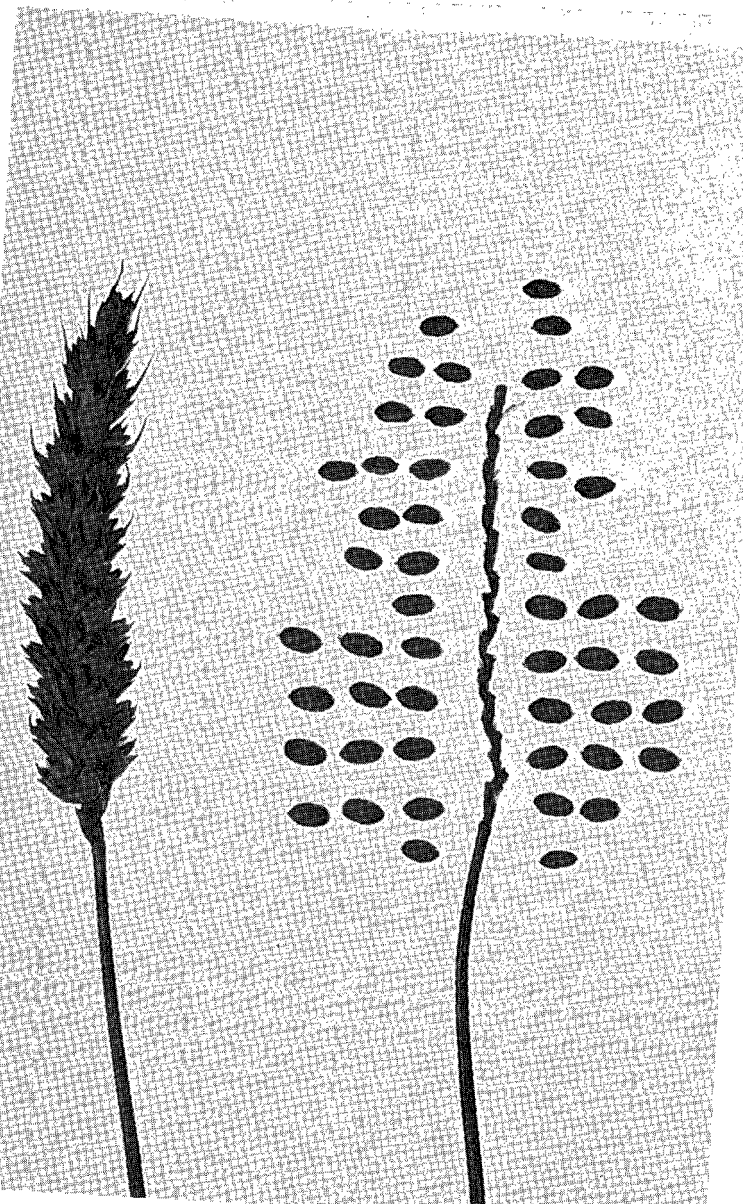
International Organization for Standardization (ISO).

Organization for Economic Co-operation and Development (OECD).

## *Publications*

Articles in various scientific journals, annual report.

*Major research topics of TNO's food and nutrition research programme are the relationship between food and health, nutrition technology, and food and feed analysis.*



# Division for Nutrition and Food Research TNO

Utrechtseweg 48  
P.O. Box 360  
3700 AJ Zeist  
Phone 03404 - 5 22 44  
Telex 40022 civo nl

Division director: Prof. Ir. B. Krol  
Staff and personnel: 500

## *Organization*

The Division is an administrative unit of the Netherlands Organization for Applied Scientific Research TNO. It was formed in 1980 due to a reorganization within TNO, and comprises the following institutes: Institute CIVO\*-Analysis TNO (including Department NIBEM, i.e. the Netherlands Institute for Malting Barley, Malt and Beer), Institute CIVO-Technology TNO (including the Department for Fishery Products TNO), Institute CIVO-Toxicology and Nutrition TNO and the Institute for Cereals, Flour and Bread TNO.

The activities of the Division are naturally connected with food and nutrition, but also extend to the fields of health protection, improvement of labour conditions, protection of the environment, energy saving, and technical assistance to developing countries. The Division carries out scientific research programmes, which are renewed every year. The knowledge gained is put at the service of society in the form of publications, reports, and specific advice or information to governmental bodies, companies or individuals. There is also a possibility for students and scientists to have an individual training in one of the institutes of the Division on the basis of 'learning through participation'. Foreign workers and trainees can be lodged in the Division's guest house.

\*) 'CIVO' is short for 'Centraal Instituut voor Voedingsonderzoek TNO', the Central institute in Zeist, which gave rise to three new institutes.

## Institute CIVO-Analysis TNO

Utrechtseweg 48  
P.O. Box 360  
3700 AJ Zeist  
Phone 03404 - 5 22 44  
Telex 40022 civo nl

Director: Drs. W. J. Klopper

brewing and malting industries, and investigations of soft drinks, wines and spirits.

### **Training**

Every year training courses are given on microbiology of food and on sensory analysis.

### *International relations*

European Brewery Convention (Analysis Committee and Barley Committee)

Food and Agricultural Organization (FAO)

World Health Organization (WHO)

FAO/WHO Codex Alimentarius Committee

European Economic Community (EEC)

International Union for Pure and Applied Chemistry (IUPAC)

International Organization for Standardization (ISO)

### *Equipment*

Gas chromatographs equipped with many different types of detectors, high pressure liquid chromatographs, atomic absorption spectrophotometers equipped with graphite furnace and hydride systems, UV/VIS- and IR spectrophotometers, Autoanalyzer systems. Computerized mass spectrometers, NMR, automatic and computerized analyzer for amino acids, distillation equipment, semi-automatic equipment for the determination of nitrogen according to Kjeldahl.

Pilot plants for malting and brewing.

## **Institute CIVO-Technology TNO**

Utrechtseweg 48

P.O. Box 360

3700 AJ Zeist

Phone 03404 - 5 22 44

Telex 40022 civo nl

Department Institute for Fishery Products TNO

Dokweg 37

1976 CA IJmuiden

P.O. Box 183

1970 AD IJmuiden

Phone 02250 - 1 90 22

Telex 40022 civo nl

Director: Ir. A.J.M. Segeren

## *Fields of work*

### **Food technology**

Food technology includes research on food products, improvement of pertinent methods of processing and studies of pollution problems. The quality of canned, dried and frozen commodities is determined, and technologies for the optimization of these commodities are developed. Catering research, e.g. studies of methods for preparing and heating foods and for keeping them warm, is carried out. Institutional kitchen equipment is tested.

### **Meat and meat products**

The work of this department concerns the chemistry and physics of meat and meat products, e.g. colour, the role of nitrite, meat and non-meat proteins, objective quality measurement.

Technological studies include:

- chilling, cooling and freezing of meat;
- manufacturing many different kinds of meat products;
- processing;
- unit operations used for meat and meat products;
- application of additives, casings and other material;
- energy and water consumption in the meat industry;
- water pollution and noise levels in the meat industry.

Microbiological work is carried out on fresh meat, prepacked meat, pasteurized and sterilized meat products, fermented sausages and other meat products.

Analytical methods and methods for quality control are developed.

A good collaboration on international standards exists with ISO and Codex FAO/WHO.

### **Oils, fats and margarine**

The composition and properties of oils, fats and fat-containing foods are investigated using chemical, physical and sensoric methods.

Products are tested for adulterations and undesirable mixings whereas additives (e.g. antioxidants) are determined.

Standard analytical methods are developed in co-operation with national and international organizations (NMI, IUPAC, ISO and OICC).

Research is done on the physical properties of margarine, such as: crystal size; melting, solidification and crystallization behaviour; consistency; structure stability; and the tendency of margarine and the like to separate oil and/or water.

The quality improvement of cocoa and cocoa products, including the development of suitable analytical methods (e.g. for detecting cocoabutter equivalents) is studied.

Topics of technological work are:

- improvement of common techniques, e.g. extraction, degumming, neutralization, bleaching, deodourization, hydrogenation, fractionation, etc.;
- refining of crude soyabean oil;
- energy consumption;

- manufacturing margarine, low calory spreads, etc.;
- environmental aspects;
- roasting cocoa beans and nibs.

### **Fishery products**

(Bio)chemistry, microbiology and technology of the handling and preservation (canning, salting, smoking, drying, freezing, marinating) of fish and other marine products.)

Advice on the planning of fish processing plants on board ships and ashore.

Tests on materials (ropes, steel cables, nets, containers, packaging) for the fishing and other industries.

### *International relations*

Food and Agricultural Organization (FAO)

World Health Organization (WHO)

FAO/WHO Codex Alimentarius Committee

European Economic Community (EEC)

International Union for Pure and Applied Chemistry (IUPAC)

International Organization for Standardization (ISO)

Office internationale du Cacao et du Chocolat (OICC)

### *Equipment*

Gas chromatographs equipped with many different types of detectors, high pressure liquid chromatographs, atomic absorption spectrophotometers equipped with graphite furnace and hybride system UV/VIS- and IR spectrophotometers. Semi-technical installations for processing oils and fats and producing margarine.

Pilot plant for the manufacture of meat products with (semi-technical) facilities for chilling, cooling, freezing, curing (injectors and immersion), comminuting, stuffing, canning, smoking, sterilization, drying, packaging under standardized conditions. Equipment for food processing, such as: grinders, separators, mixers, driers, freeze-driers, homogenizers, colloid mills, autoclaves, fermentators, upflow-reactors, digestors, incubators. Apparatus for texture measurement.

Pilot plants for canning, smoking, fish meal manufacture, freezing, cold storage, packing; purification of waste water, UV treatment of seawater.

Chemical and microbiological laboratory.

Cable and rope testing equipment

Workshops for metal and wood working, electronics and glass-blowing are available for maintaining, adapting and modifying equipment. These are facilities for joint use by the three CIVO-Institutes in Zeist. A separate workshop is available in IJmuiden.

# Institute CIVO-Toxicology and Nutrition TNO

Utrechtseweg 48  
P.O. Box 360  
3700 AJ Zeist  
Phone 03404 - 5 22 44  
Telex 40022 civo nl

## *Fields of work*

### **Human nutrition and nutritional biochemistry**

Data are collected on the nutritional status of various population groups, including dietary surveys, growth studies in children, medical examination (clinical and anthropometric) and biochemical investigations.

Guidance on similar population studies has been provided in developing countries, e.g. Kenya, Thailand, Surinam, Indonesia. Methods for estimating the nutritional status are developed and evaluated.

The physiology of nutrition, e.g. the influence of body composition and physical performance, including various studies on lipid and energy metabolism, is investigated. Metabolic balance studies on vitamin and mineral absorption and on nutritional value of usual and new protein sources are carried out.

In co-operation with the University Children's Hospital at Utrecht the nutrition of healthy and sick children is researched with emphasis on disturbed digestion and the absorption of carbohydrates, proteins and fats. Research on obesity and blood pressure is also included.

### **Clinical biochemistry**

A wide spectrum of clinical, chemical and hormonal analyses are available to support research projects in the field of clinical nutrition. Vitamin analyses are performed on food and feed.

The institute co-operates with several hospitals in the field of determining and evaluating the vitamin status of specific groups, such as aged people and pregnant women.

Studies are made on vitamin metabolism in metabolic disorders and the incidence of vitamin deficiencies in hospitalized patients.

### **Biological toxicology**

Safety evaluation studies of industrially treated or produced foods and feeds are carried out. Toxicity studies (acute, sub-acute and chronic) are performed on additives and contaminants in foods and feeds, drugs, cosmetics and on environmental contaminants.

These studies, in which various species of laboratory animals are used, are carried out according to the proposed regulations for good laboratory practice (GLP).

Test substances are administered orally, dermally or by inhalation.

Toxic effects are established by the usual physiological, haematological, biochemical and pathological criteria.

Other fields of activities are:

- determination of the utilization of proteins, carbohydrates and other components of food and feeds in various species of laboratory animals;
- metabolic studies with radioactive tracers;
- carcinogenicity studies in rats, mice and hamsters;
- mutagenicity studies using microbial tests (including Ames test), dominant lethal tests, host mediated assay, micronucleus test and spermhead abnormality test;
- teratogenicity studies in rabbits, rats and mice.

The toxicity tests are governed – and the obtained data processed – by a computer system.

### *International relations*

Food and Agricultural Organization (FAO).

World Health Organization (WHO).

FAO/WHO Codex Alimentarius Committee.

United Nations Children Fund (UNICEF).

International Agency for Research on Cancer (IARC).

European Economic Community (EEC).

Organization for Economic Co-operation and Development (OECD).

Centre for Disease Control, Atlanta, GA (USA).

Medical Research Centre, Nairobi, Kenya.

Department of Public Health, Surinam.

### *Equipment*

High pressure liquid chromatographs, discrete auto-analyzer systems for clinical determinations, scintillation and  $\gamma$ -counters with automatic data processing.

Housing facilities for laboratory animals and equipment for semi-automated and automated biochemical and haematological determinations and for mass production of histological preparations.

Electron microscope. Equipment for inhalation toxicology.

Facilities and equipment for biological studies with radioactive tracers.

Metabolic ward for nutritional studies in humans. Tank for human densitometry by underwater weighing. Equipment to measure energy expenditure and physical fitness of men.

Workshops for metal and wood working, electronics and glass-blowing are available for joint use by the three CIVO-Institutes in Zeist.

### *Information*

The three CIVO-Institutes at Zeist have a library and a documentation department for joint use. These play an important role as information centre in the field of nutrition and foods. The collection comprises approximately 17,500 volumes. It is continually extended by 750



subscriptions to periodicals and series and by regular purchase, providing information on the latest developments in nutritional science and food technology.

The 'product legislation' collection is unique in the Netherlands, and is frequently consulted by the industry.

## Institute for Cereals, Flour and Bread TNO

Lawickse Allee 15  
6701 AN Wageningen  
P.O. Box 15  
6700 AA Wageningen  
Phone: 08370 - 1 90 51  
Telex 40022 civo nl

Director: Ir. D. de Ruiter

### *Organization and scope of activities*

Institute of the Division for Nutrition and Food Research TNO for research, testing, trouble shooting, advice and information to the benefit of industries manufacturing foods or mixed feed from cereals, seeds and pulses.

### *Fields of work*

Applied scientific research and technological development in the following fields:

- the suitability of cereals to be processed into food or mixed feed;
- cleaning, mixing, separation, and grinding of granular and powdered raw or processed food materials;
- pelleting and extrusion of powdered materials, pastes, doughs, and batters into foods and feed;
- preparing pastes, doughs, and batters and processing them into foods by drying, cooking, baking or frying;
- rheology of pastes, doughs, and batters, flow properties of powdered and granular materials;
- improvement of keeping quality by deep-freezing, heat sterilization, preservatives, antioxidants, packing;
- mechanization and automation (electrical and mechanical) of equipment for flour processing industry and mixed-feed industry;
- chemical and physical studies in connection with food and feed processing.

Co-operation in national and international research and in the standardization of definitions and methods. Testing raw materials and products for quality. Dissemination of information through scientific and technical papers, lectures and demonstrations.

Advice and technical assistance to food and feed industries.

## *Equipment*

Milling apparatus on laboratory and semi-technical scale. Equipment for preparing pastes and baking products on laboratory and semi-technical scale. Roasting ovens. Equipment for the extrusion dissolution, gelatinization and heat sterilization of starchy materials. Screen dryers and a drum dryer. Climate chambers for investigating product stability. Universal and specific instruments for research in rheology, polarography, IR spectroscopy, electrophoresis, chromatography, ultracentrifugation, particle size determination.

## *International relations*

International Association for Cereal Chemistry (ICC).

United Nations Food and Agricultural Organization (FAO)

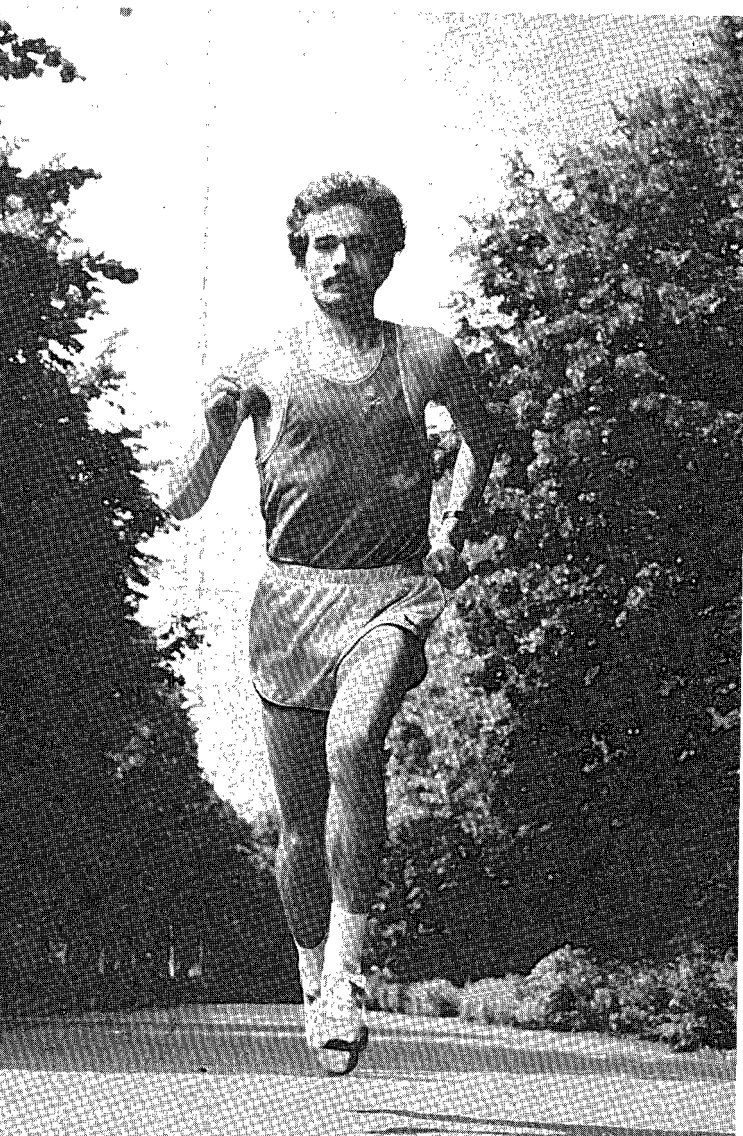
International Organization for Standardization (ISO).

Various committees of the European Economic Community (EEC).

## *Publications*

Reports; articles in scientific journals, reprints of which are issued separately as a series of communications.

*Major research items of TNO's health research programme are: cancer, aging, virology, toxicology, cardiovascular diseases, social health care and medical systems.*



## **Division for Health Research TNO**

Eysingahuis  
Rijnsburgerweg 100  
2333 AE Leiden  
P.O. Box 188  
2300 AD Leiden  
Phone 071 - 17 20 41

Division director: Dr. P. Brakman.

Division board: Dr. P. Brakman, Dr. M. J. Hartgerink.

The division for Health Research TNO comprises:

- the Gaubius Institute for Cardiovascular Diseases TNO
- the Medical Biological Laboratory TNO
- the TNO Research Institute for Environmental Hygiene
- the Netherlands Institute for Preventive Health Care TNO
- the Radiobiological Institute TNO
- the Institute for Experimental Gerontology TNO
- the Primate Centre TNO
- the Central Institute for the Breeding of Laboratory Animals TNO
- the Radiological Service Unit TNO

## **Gaubius Institute for Cardiovascular Diseases TNO**

Established as a Working Group on the Prevention of Atherosclerosis in 1965; since 1973 the institute has been part of the Organization for Health Research TNO, which in 1981 was changed into the Division for Health Research TNO.

Herenstraat 5D  
2313 AD Leiden  
Phone 071 - 13 13 45

Director: Dr. P. Brakman

Deputy director: Dr. L.W. Hessel

Graduate staff: 20

Other personnel: 35

### ***Scope of activities***

Screening, prevention and therapy of hyperlipoproteinemias.

Screening, prevention and therapy of hemostatic disorders.

Special fields of interest: frequently occurring genetic disorders of cholesterol metabolism; derangements in the fibrinolytic system.

## *Equipment*

General biochemical equipment, ultracentrifugation, cell cultures, etc.

## *International relations*

European Atherosclerosis Group  
European Lipoprotein Club  
European Artery Club  
European Society for Clinical Investigation  
European Thrombosis Research Organization  
European Concerted Action for detection of the tendency to Thrombosis (EEC).

## *Publications*

Contributions to internationally accessible scientific periodicals.

## **Medical Biological Laboratory TNO**

Established in 1947 as Medical Biological Institute of the National Defence Research Organization TNO; in 1954 the name was changed into Medical Biological Laboratory TNO. In 1977 the Laboratory joined the Organization for Health Research TNO, which in 1981 was changed into the Division for Health Research TNO.

Lange Kleiweg 139  
2288 GJ Rijswijk (near the Hague)  
P.O. Box 45  
2280 AA Rijswijk  
Phone 015 - 13 87 77  
Telex 38034 pmtno nl

Director: Dr. E. Meeter  
Co-director: Dr. W.F. Stevens  
Advisers: Dr. A.Th. Ariëns, Prof. Dr. C. van der Meer,  
Prof. Dr. O. Vos, Prof. Dr. K.C. Winkler.  
Staff and personnel: 120

## *Scope of activities*

Laboratory for background studies in toxicology and related fields of medical biological research.

## *Fields of work*

Research aiming at the prevention and therapy of:

- intoxication with chemical agents;
- microbial infections;

## **Indoor climate**

Character and influences of indoor climate as a resultant of building construction, use of the building (dwelling, office, factory, etc.), outdoor climate and airconditioning installation; consumption of energy in dwellings.

## **Sound**

Character and influences of sound, sound problems in dwellings and in industry.

## **Light**

Character and influences of daylight, artificial light and sunshine, equipment for the evaluation of lighting and insolation situations.

## **Housing and living**

Socio-psychological aspects and hygienic aspects of housing.

## *Equipment*

Oxidation ditch and oxydenitro installation for experimental purposes; inhalation testing room for dusts, gases and vapours; reverberation room, anechoic room, rooms for sound insulation measurements; testing room for indoor climate measurements; analogue computer for air-distribution investigations; analogue computer for non-stationary heat flow; windtunnel with low air velocities for scale model research.

## *International relations*

Abwassertechnische Vereinigung E.V.

Building Research Establishment.

Building Services Research and Information Association.

Commission Internationale de l'Eclairage.

Conseil International du Bâtiment.

Deutsch-niederländische Zusammenarbeit auf dem Gebiet des Umweltschutzes.

Economic Commission for Europe.

European Coal and Steel Community.

European Economic Community.

Electricity Council Research Centre.

Illuminating Engineering Society.

International Organization for Standardization.

Kommission Reinhaltung der Luft.

Organization for Economic Co-operation and Development.

Representatives of European Heating and Ventilation Associations.

Verein Deutscher Ingenieure.

World Health Organization.

## *Publications*

Reports, publications in scientific periodicals, annual report, brochures, info-sheets.

## Netherlands Institute for Preventive Health Care TNO

Wassenaarseweg 56  
2333 AL Leiden  
P.O. Box 124  
2300 AC Leiden  
Phone 071 - 17 04 41

Director: W.M.J. van Duyn, physician  
Co-directors: Dr. A. Dijkstra, Dr. C. L. Ekkers.  
Graduate staff: 67  
Other personnel: 86

## *Organization and scope of activities*

The Institute has its own building with household staff, administrative staff, library and documentation section, statistics section, physics section and a small chemical support group. Scientific work is mainly organized in specific project teams. Post-graduate training courses in social medicine and epidemiology are given in relation to the fields of work of the Institute.

## *Fields of work*

### **Child and adolescent health care**

Development of methods for early detection of anomalies.  
Research into environmental conditions that may affect the physical and mental health of children.  
Exploratory epidemiologic research (determination of standard values, validation of test methods).

### **Man and work**

Investigations on absence due to illness; research into relationships between job-situations and employees' physical and mental health; physical and mental factors influencing industrial and other work; labour hygiene and general occupational medicine.

### **Man and environment**

Psycho-social factors pertaining to types of housing and to the layout of residential areas.

### **Health services research**

Organizational aspects of the implementation of R & D results obtained

in the other fields of activity of the institute.  
Research into the organizational patterns, the effectiveness and economy of health services.

### **Post-graduate training courses (in Dutch)**

Basic course in public health.  
Occupational and industrial medicine.  
Child health care.  
Public health administration.  
Seminar on environmental problems.

### *Equipment*

Soundproof room, manual and automatic audiometers, equipment for metabolism investigations, photoplethysmograph, instrumental setup for psycho-physiological experiments, polygraph for psycho-physiological measurements, electroencephalograph, computer PDP 11/34, ergometers.

### *International relations*

World Health Organization.  
Commission European Communities.  
Comité CRM.  
Medical Research Council, London.  
Association of Institutions responsible for advanced teaching in public health and Schools of Public Health in Europe.

### *Publications*

Reports and articles in various medical and other scientific journals.

## **Radiobiological Institute TNO**

Lange Kleiweg 15  
Rijswijk  
P.O. Box 5815  
2280 HV Rijswijk  
Phone 015 - 13 69 40  
Telex 32785 repgo nl  
Cables REPGO RIJSWIJK ZH

Director: Prof. Dr. D.W. van Bekkum  
Deputy director: Prof. Dr. L.M. van Putten  
Graduates: 46  
Other personnel: 162



## Organization and scope of activities

Institute of the Division for Health Research TNO for fundamental and applied research in the fields of radiobiology, radiation protection, experimental radiotherapy, experimental hematology, cancer chemotherapy, immunology, transplantation and gnotobiology. Through members of its staff, the institute is affiliated with the medical faculties of the Universities of Rotterdam, Amsterdam and Leyden.

### Fields of work

The programme of the institute consists of two major parts: cancer research and radiation protection research. These two subjects are closely interrelated and the programme is kept extremely flexible, so that it can be adjusted to prevailing needs from the field.

Radiation damage to the living cell is investigated by means of biochemical and histological techniques, using not only tissues from animals exposed to radiation but also simpler systems such as mammalian cells cultured *in vitro*. These studies are aimed at advancing the knowledge of the response of normal and malignant cell populations to irradiation.

Part of the programme covers investigations concerning biological effects of neutrons on both normal tissues and tumours; the aim of this work is to provide more insight into the Relative Biological Effectiveness (RBE) of fast neutrons in relation to health protection programmes and insight into the application of fast neutrons to the treatment of human tumours.

Other fields of interest for tumour therapy are covered by studies of tumour cell population kinetics, the vascularization of tumours and responses of cells from tumours and normal tissues to cytostatic drugs. For experimental studies on chemotherapy, radiotherapy and immunotherapy of cancer, a variety of models in laboratory animals is being developed or maintained.

The experimental oncology projects are closely integrated in the programme of the European Organization for Research on Treatment of Cancer (EORTC) and in the programme of the comprehensive Cancer Centre Rotterdam, in which the Radiobiological Institute participates.

Special projects are devoted to leukemia studies covering causative factors and mechanisms as well as various forms of experimental treatment, including extra-corporeal irradiation of the blood.

A specific field of study relates to the prevention and treatment of radiation disease, in which preclinical investigations on bone-marrow transplantation in monkeys and dogs currently play an important role.

The aim of these investigations is: on the one hand to improve the possibilities of treating radiation victims; on the other hand to apply bone-marrow transplantation to the treatment of severe combined deficiency, bone-marrow aplasia, leukemia and related cancers. In monkeys and man, cell separation methods are used to improve the results in this programme. In addition, various immunological problems

are studied that are directly associated with phenomena observed after the transplantation of bone-marrow. The technique of bone-marrow transplantation is also applied in studies of the function of haemopoietic stem cells and the mechanisms of repopulation after irradiation. A programme of tissue typing for histocompatibility factors is carried out in *M. rhesus* monkeys at the TNO Primate Centre, and in dogs at the TNO Radiobiological Institute, the results being applied to the problem of donor selection for bone-marrow transplantation. Late effects of ionizing radiation are investigated, with emphasis on late damage to normal tissues related to radiotherapy, and on radiation carcinogenesis. In the latter area, studies are made to come to a better understanding of the mechanism of radiation carcinogenesis and thus support the rational establishment of risk estimates for low-dose exposures in human populations. These programmes are integrated into similar studies carried out at the Institute for Experimental Gerontology TNO.

### *Equipment*

300 kVp Philips-Miller X-ray apparatus (3).

1200 c 137 Cs gamma source.

High-Voltage Engineering neutron generator (400 kV, Van de Graaff).

Texas Nuclear Corporation neutron generator (250 kV high-voltage generator).

Isotopes department, computer department.

Cell separation department: light-activated cell sorter (FACS II, Becton and Dickinson), freeflow cell electrophoresis (Elphor Va P5, Bender & Hobein), sedimentation and equilibrium density centrifugation.

Specific Pathogen Free colonies of inbred mice and rats.

Colony of gnotobiotic animals.

### *International relations*

Many research projects are carried out under the auspices of, or on contract with, the International Atomic Energy Agency, Euratom, EULEP, the European Organization for Research on Treatment of Cancer (EORTC), the International Commission on Radiobiological Protection, and the National Cancer Institute, USA.

### *Publications*

Reports and articles in scientific periodicals.

Annual reports in English and in Dutch.

# Institute for Experimental Gerontology TNO

Lange Kleiweg 151  
Rijswijk  
P.O. Box 5815  
2280 HV Rijswijk  
Phone 015 - 13 69 40  
Telex 38191 repgo nl  
Cables REPGO RIJSWIJK ZH

Director: Prof. Dr. C.F. Hollander  
Deputy director: Prof. Dr. D.L. Knook  
Graduates: 15  
Other personnel: 35

## *Organization and scope of activities*

Institute of the Division for Health Research TNO for fundamental and applied research in the fields of age-associated pathology, immunogerontology, cell and organ physiology.

The task of the Institutes can be described as 'to conduct basic and applied biomedical research in the field of gerontology in order to approach rationally the health problems of the aged, as well as to improve the quality of life in this phase of human existence'.

Through members of its staff, the institute is affiliated with the medical faculties of the Universities of Utrecht and Brussels.

## *Fields of work*

The fields of work include four main topics:

1. Research into the *mechanisms of organ aging* with emphasis on physiology, molecular biology and cell kinetics. This enables the correlation of age-associated physiological changes of organs with changes in their cellular metabolism. The organs currently studied are the liver and the brain. In the liver, in addition to above mentioned topics, an effort is made to understand the changes in drug metabolism with age.
2. Investigations into *changes in the immunological system with age* with emphasis on the decrease in resistance against infections, the rôle played by auto-immune reactions in the process of aging and the physiology and pathology of the immunoglobulins. A major effort is being applied to the separation of monoclonal and polyclonal antibodies, mainly directed against human immunoglobulins.
3. *Life span studies* into mortality and morbidity in mice, rats, mastomys and primates. These investigations are essential to the development of appropriate animal models for aging research, to studies on the relationship between cancer and aging and to the interpretation of toxicological studies.
4. Studies on the late effects of various kinds of environmental influences. Studies in which ionizing radiations are involved are

- conducted in co-operation with the Radiobiological Institute TNO.
- Several of these projects are pursued in collaboration with other European Centres under the auspices of EURAGE, an EEG concerted action on cellular ageing and diseases (topics 1 and 2), or of EULEP, European Late Effects Project Group (topic 4).

## *Facilities*

- The institute has a number of *animal rooms* especially designed for long term experiments. These house aging colonies of mice, rats and mastomys.
- Ultramicrotechniques have been developed to assess organ function in small animals, as well as separation and culture procedures for various types of liver cells.
- The institute operates a histology and a pathology service for its own needs and for those of the Radiobiological Institute and the Primate Centre TNO. Among the equipment available for this purpose is a Philips' electron microscope EM 410.
- The facilities also include equipment for analytical and preparative immunochemistry, quantitative immunofluorescence, biochemistry and cell separation procedures.

## *International relations*

Research projects are carried out under the auspices of, or on contract with, the European Late Effects Project Group (EULEP), EEC Concerted Action on Cellular Ageing and Decreased Functional Capacities of Organs (EURAGE), and the European Commission on Atomic Energy (EURATOM).

## *Publications*

Reports and articles in scientific periodicals. Annual reports in English and Dutch.

## **Primate Centre TNO**

Lange Kleiweg 151  
2288 GJ Rijswijk  
P.O. Box 5815  
2280 HV Rijswijk  
Phone 015 - 13 69 40  
Telex 38191 repgo nl  
Cables REPGO RIJSWIJK ZH

Director: Dr. A.A. van Es  
Deputy director: Dr. H. Schellekens  
Graduates: 12  
Other personnel: 29

## *Organization and scope of activities*

Institute of the Division for Health Research TNO for immunogenetic, virological and ethological research in non-human primates.

The task of the institute can be described as to conduct basic and applied biomedical research in the preclinical primate models in order to approach rationally the health problems of the immunologically and virologically affected individuals, as well as to apply ethological methods in the management of psychiatric disorders.

Through members of its staff the institute collaborates with many national and international universities as well as non-university institutions.

## *Fields of work*

*Phylogenetic and immunogenetic studies on tissue antigens* of non-human primates. These investigations are relevant to practical problems of organ transplantation and disease associations in man and to fundamental issues of immunobiology. The Primate Centre is the international reference centre for tissue typing in primates (under the auspices of the International Council for Laboratory Animal Science or ICLAS).

*A virology programme* serves to study, monitor and eradicate dangerous simian viruses in the colony. In addition, work on human viruses and vaccines against them is being carried out in chimpanzees. The chimpanzee and rhesus monkey are also used as research models to search for new therapeutic approaches to human viral diseases.

*The ethological studies* concentrate on pathological behaviour. Experiments performed with non-human primates are aimed at investigating the causes of abnormal behaviour. Related descriptive studies on psychiatric patients are carried out in collaboration with investigators of various clinics. Those studies are directed towards the early detection of pathological behaviour and its development.

## *Facilities*

The Primate Centre houses about 1000 macaques, including a sizable breeding colony of rhesus monkeys (*Macaca mulatta*). It also maintains one of the world's largest chimpanzee colonies (approx. 100 animals); this includes a breeding nucleus of 30 females with a yearly production of about 10 baby chimpanzees. A marmoset (*C. jacchus*) breeding colony of about 100 animals is also maintained at the centre. A specially designed isolation facility is available for research with high risk agents in non-human primates. Experiments can be carried out under P3 conditions in the building.

## *International relations*

As the Primate Centre possesses the only isolation facilities for carrying

out virological research there are collaborations with industrial as well as non-industrial institutions.

## *Publications*

Reports and articles in scientific periodicals. Annual report.

## Central Institute for the Breeding of Laboratory Animals TNO

Woudenbergseweg 55,  
3707 HW Austerlitz/Zeist  
P.O. Box 167  
3700 AD Zeist  
Phone 03439 - 16 46  
Telex 43413 NEC-NL att. CPB-TNO

Director: Dr. H. Zwenk  
Graduates staff: 2  
Other personnel: 62

## *Scope of activities*

The institute has been set up to provide institutes working in the field of public health and pharmaceutical industries with high quality laboratory animals.

Laboratory facilities are available for quality control and background research in laboratory animal science.

## *Fields of work*

### **Animal production**

The yearly production capacity of the different species is some 400,000 rats, 400,000 mice, 15,000 hamsters, 15,000 guinea pigs, 5,000 rabbits, 1,000 dogs and 2,000 cats.

### **Quality control**

The SPF animals are hysterectomy derived and barrier maintained. The barrier is monitored periodically. Every three weeks a sample is taken from every animal house for an extensive bacteriological investigation. Virological screening takes place every three months. The investigation of dead and diseased animals by the pathological department is a routine. The geneticist is responsible for the genetic stability of the populations in subsequent generations.

### **Research and development**

Not only is the scientific staff of the institute involved in quality control. Many research projects in the field of laboratory animal science were

initiated, ranging from extensive background pathology programmes in rats and dogs to the development of a milking machine for rabbits.

### *Equipment/facilities*

20 independently operating animal units  
germfree department  
isolators, autoclave, central washing machine

### *International relations*

International Committee for Laboratory Animal Science (ICLAS)  
Laboratory Animal Science Association (LASA)  
Gesellschaft für Versuchstierkunde (GV-SOLAS)  
Société Française d'Expérimentation Animale (SFFA)

### *Publications*

Various internal reports and publications in scientific periodicals.

## Radiological Service Unit TNO

Utrechtseweg 310  
6812 AR Arnhem  
Phone 085 - 45 70 57

Director: Drs. H.W. Julius  
Graduate staff: 2  
Other personnel: 21

### *Scope of activities*

The institute renders services and performs research and development in the field of radiation protection, radiation dosimetry and nuclear medicine.

### *Fields of work*

#### **Radiation protection**

Periodic measurements of radiation doses from external sources to radiation workers (individual monitoring).  
Internal contamination measurements.  
Radiological safety investigations.  
Advice on protective shielding and constructions.

#### **Radiation dosimetry**

Calibration of radiation protection instruments.  
Development of dosimetric equipment (TLD).  
Calibration of radiation therapy facilities.

Low activity measurements.  
Radiation therapy in situ dosimetry.

### **Nuclear medicine**

Development of methods and instrumentation.  
Quantitative organ scanning.  
Metabolic studies.

### *Equipment*

Radiation facilities for X-rays, gamma rays and betas; instruments for radiation dose measurements (ionization chambers, thermoluminescent dosimetry systems); computer (PDP 8) facilities; six detector whole-body counter; quantitative organ scanner.

### *International relations*

European Communities (Euratom).  
International Standardization Organization.  
International Electrotechnical Commission.  
International Radiation Protection Association.  
Bureau of Radiological Health USA.  
National Radiological Protection Board UK.  
Comitato Nazionale per l'Energia Nucleare, Italy.  
Studiecentrum voor Kernenergie ('Study Centre for Nuclear Energy'), Belgium.

### *Publications*

Various internal reports and publications in scientific periodicals.

## **Tuberculin Research Unit TNO**

Riouwstraat 7  
2585 GP The Hague  
P.O. Box 146  
2501 CC The Hague  
Phone 070 - 55 86 00  
Telex 31660 tnogv nl

Director: Dr. M.A. Bleiker  
Graduate staff: 2  
Other personnel: 2

### *Scope of activities*

In co-operation with the World Health Organization and the International Union against Tuberculosis, TNO co-ordinates the activities of a world-wide tuberculosis surveillance programme. The



aim of the programme is to assist both developing and industrialized countries all over the world to measure their tuberculosis problem by means of tuberculosis infection rates in samples of the population. Research teams visit participating countries to implement tuberculosis programmes, which include the training of local personnel. After a few years the country is visited again, and a sample of the population is tested again. The information obtained is processed centrally at TNO.

Advice is given on vaccination methods and on the tracing of sources of tuberculosis.

### *International relations*

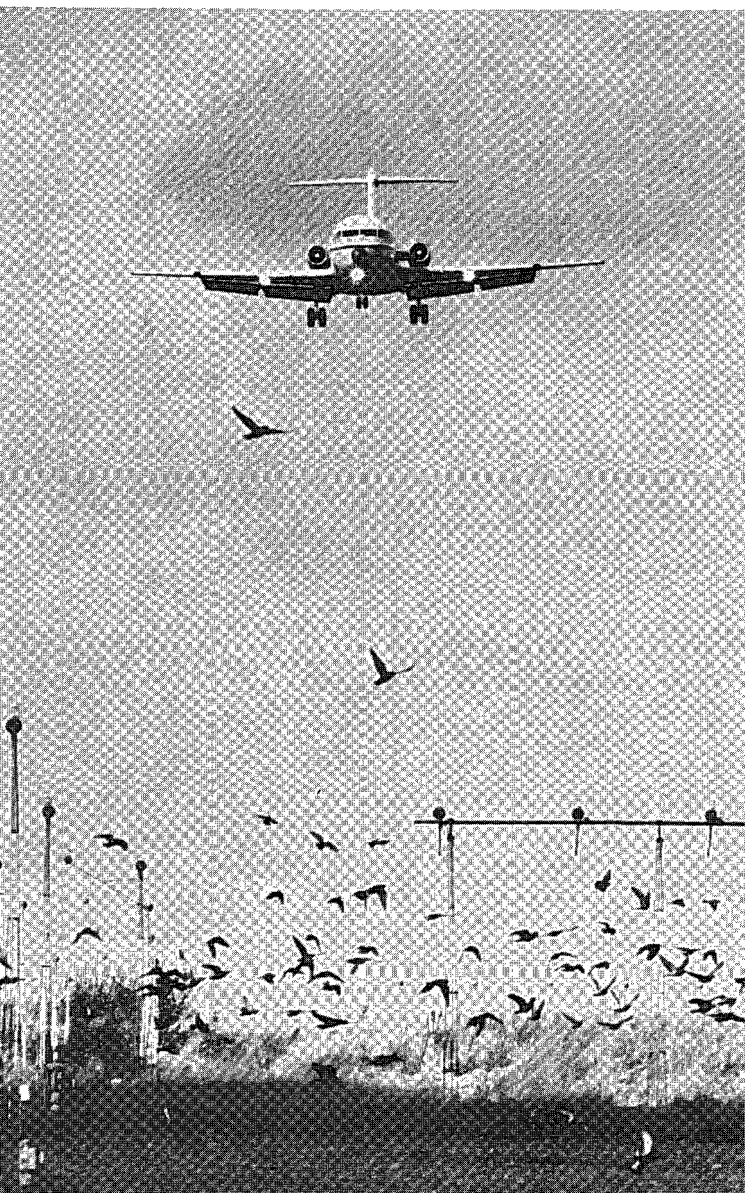
World Health Organization

International Union against Tuberculosis

International Tuberculosis Surveillance Centre

Tuberculosis Surveillance Research Unit.

*An example of TNO's national defence research concerns the danger birds can cause to air traffic. Important research areas are: sensory perception, radar, sonar, infrared observation techniques, toxicology and explosives.*



## **Division for National Defence Research TNO**

Koningin Marialaan 21  
2595 GA The Hague  
P.O. Box 208  
2501 CE The Hague  
Phone 070 - 81 44 81  
Telex 31660 tnogv nl

Division director: Dr. Ir. P. L. Walraven

The Division for National Defence Research TNO comprises:

- the Laboratory for Electronic Developments for the Armed Forces TNO.
- the Physics Laboratory TNO.
- the Prins Maurits Laboratory TNO, Institute for Chemical and Technological Research.
- the Institute for Perception TNO.

### **Laboratory for Electronic Developments for the Armed Forces TNO (LEOK)**

Established in 1955 as a laboratory of the Ministry of Defence. In 1977 it was transferred to the National Defence Research Organization TNO, which in 1981 became the Division for National Defence Research TNO.

Haarlemmerstraatweg 7  
2343 LA Oegstgeest  
P.O. Box 1260  
2340 BG Oegstgeest  
Phone 01711 - 1 92 10  
Telex 39319 dleok nl

Acting director: Ir. R.A. Kasper  
Deputy director: Ir. P.H. Max  
Staff and personnel: 160

#### ***Scope of activities***

Laboratory engaged on applied electronic research, technical assistance in projects of the Armed Forces and the development of electronic equipment.

#### ***Fields of work***

Radar systems and techniques.  
Signal processing.

Microwave equipment and techniques.  
Electronic warfare projects: ESM, ECM, ECCM.  
Weapon systems; proximity fuses.  
Data handling and data processing.  
Display techniques.  
Simulators and trainers for weapon systems.  
Passive sonar projects and techniques.

## Physics Laboratory TNO

Established in 1927 as the Ministry of War Physics Laboratory; in 1948 it was transferred to the National Defence Research Organization TNO as the Physics Laboratory TNO. In 1981 it became part of the Division for National Defence Research TNO.

Oude Waalsdorperweg 63  
2597 AK The Hague  
P.O. Box 96864  
2509 JG The Hague  
Phone 070 - 26 42 21  
Telex 32397 pltno nl

Director: Ir. M.W. van Batenburg  
Deputy director: Ir. J.J. Meinardi  
Assistant directors: Ir. A.J. Leenhouts, Ir. F. Möhring  
Staff and personnel: over 300

### *Scope of activities*

Laboratory for operations research and for research on physics and electronics on behalf of the national defence.

### *Fields of work*

Operations research. Analysis and optimization of systems and procedures; cost-effectiveness studies for acquisition of material by the armed forces.

Physics and electronics research, in particular on:

- sensors, including laser techniques, for infrared and visible light.  
Investigation of the limiting atmospheric conditions;
- equipment for detection, ranging and tracking of land-based and airborne targets;
- systems research;
- telecommunications;
- underwater acoustics;
- special-purpose information processing;
- mine countermeasures.

# Prins Maurits Laboratory TNO Institute for Chemical and Technological Research

Established in 1978 as a merger of the Chemical and the Technological Laboratory of the National Defence Research Organization TNO. The former had been founded in 1939 as Central Laboratory of Headquarters of the Commander-in-Chief of Army and Navy, the latter in 1888 as the Chemical Laboratory of the Netherlands Government Artillery Works. Both institutes were transferred to the National Defence Research Organization TNO in 1948, which in 1981 became the Division for National Defence Research TNO.

Lange Kleiweg 137 - 139  
2288 GJ Rijswijk  
P.O. Box 45  
2280 AA Rijswijk  
Phone 015 - 13 87 77  
Telex 38034 pmtno nl

Director: Dr. A.J.J. Ooms  
Director Technological Research: Dr. Ir. H.J. Pasman  
Director Chemical Research: Ir. M. van Zelm  
Assistant Director Chemical Research: Dr. H. Kienhuis  
Advisory committee: Prof. Drs. P.J. van den Berg, Prof. Dr. Ir. C. Boelhouwer, Ir. C. H. Buschman  
Staff and personnel: 264

## *Scope of activities*

Laboratory for chemical and technological research and development. The objective of the chemical research is protection against toxic compounds in the environment, primarily protection of the armed forces against chemical warfare agents. The institute has had for 30 years experience in this field. The increased demand, especially during the last decade, for research on environmental protection and occupational health in industrialized and densely populated areas has widened the scope of work of the institutes and its co-operation with other disciplines within TNO.

Technological research comprises the field of propellants, pyrotechnic compositions, explosives and ammunition. The experience gained in testing and handling explosive materials is used to investigate hazardous industrial products and processes, and to predict safety distances in and around plants and storage sites.

## *Fields of work*

### **Protection against the effects of toxic substances**

- determination and evaluation of characteristic properties of noxious substances, in particular chemical warfare agents and pesticides;
- study of the mechanism of action of noxious substances, in particular chemical warfare agents and pesticides, in the human and animal organism;
- development of new antidotes against intoxication by chemical warfare agents and pesticides;
- development of detection, identification and alarming systems and procedures with regard to atmospheric contaminants;
- cloud dispersion of vapours and aerosols;
- determination of the chemical and physical characteristics of atmospheric aerosols;
- evaluation and development of means and equipment (protective clothing, filter media, respiratory protective equipment) for use in contaminated environments;
- decontamination and purification of water, materials and equipment contaminated with noxious substances, in particular chemical warfare agents and pesticides.
- research as regards chemical problems related to environmental hygiene.

### **Preparation, qualification and evaluation of explosive materials**

- performance, hazards, chemical analyses;
- development of compositions, casting, pressing and extrusion;
- investigation of detonation, deflagration and thermal explosion processes;
- stability, sensitivity to initiation by shock and thermal stimuli, compatibility;
- risk analyses with respect to manufacture, storage, transport and use of energetic materials;
- vapour cloud explosions and confined gas and dust explosions.

### **Investigation of proper functioning of ammunition and weapons**

- interior ballistics of guns and rockets;
- storability of rocket motors and propellant charges;
- reliability of ignition and detonation trains.

### **Effects of weapons and protective measures**

- shell and warhead fragmentation, shaped charge effects and projectile penetration;
- effects of shock waves in air, water and soil;
- ballistic protection and target vulnerability studies;
- blast resistance of structures and components.

# Institute for Perception TNO

Established in 1949 as a Working Party for Perception RVO-TNO. In 1956 the status of institute was received and the name was changed into Institute for Perception TNO. In 1981 the institute became part of the Division for National Defence Research TNO.

Kampweg 5  
3769 DE Soesterberg  
P.O. Box 23  
3769 ZG Soesterberg  
Phone 03463 - 14 44

Director: Dr. Ir. A. van Meeteren  
Assistant director: Prof. Dr. A.F. Sanders  
Advisor: Prof. Dr. M.A. Bouman  
Staff and personnel: 105

## *Scope of activities*

Institute for research on Physiology of the sense organs, perceptual psychology and human engineering for national defence and civil interests.

## *Fields of work*

### **Vision**

- instrumental vision;
- colour vision;
- pattern recognition,
- visual electrophysiology;
- visual ergonomics;
- eye protection;
- visual testing.

### **Hearing and speech**

- ear protection and noise annoyance;
- detection and discrimination of sounds;
- speech intelligibility, speech analysis and synthesis.

### **Experimental Psychology**

- perceptual motor load;
- reaction time;
- decision making, risk perception;
- software ergonomics;
- electroencephalography;
- influence of drugs, sleep deprivation and other stressors;
- fatigue.

### **Human engineering**

- design of work spaces and equipment;
- design of navigation bridges, command centres, engineroom control and accommodation in ships;
- design of visual presentation of information;
- development of simulators and simulation techniques;
- process simulation.

### **Road User Behaviour**

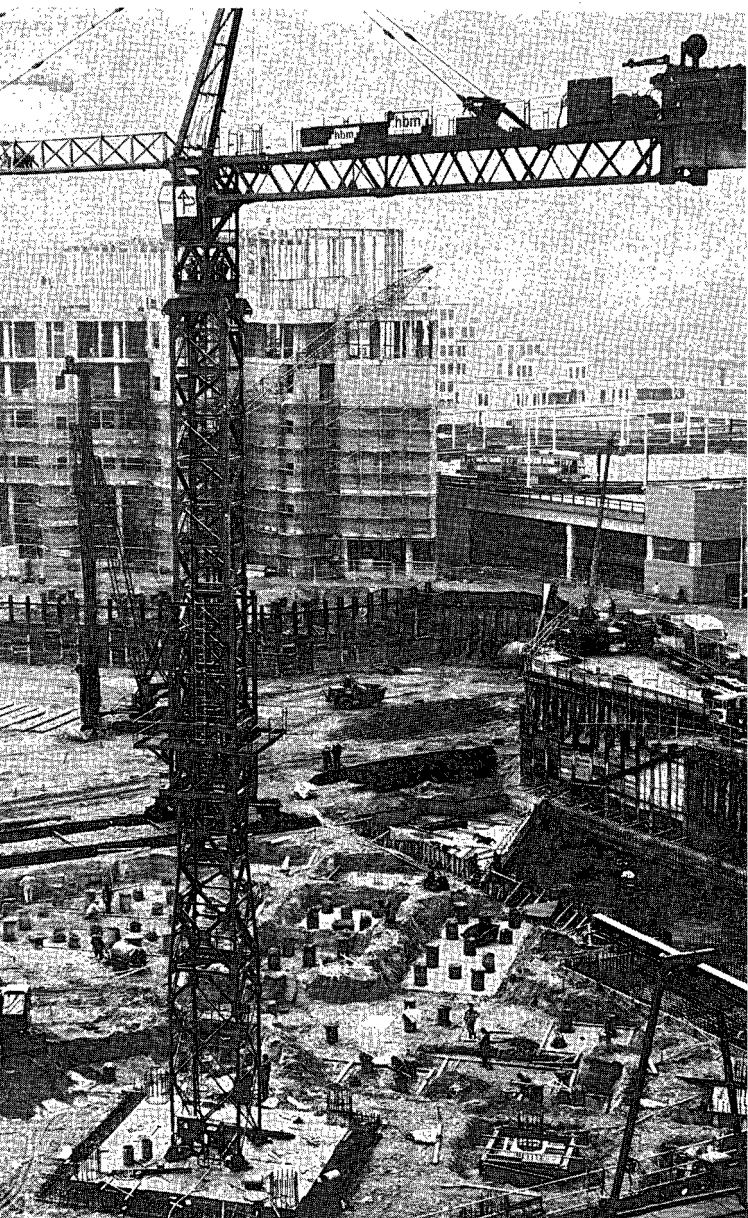
- basic perceptual processes of the driving task;
- driver education and testing;
- vehicle and road ergonomics;
- design and legibility of traffic signs;
- development of a driving simulator.

### **Thermophysiology**

- thermophysiological aspects of clothing;
- risk of heat disorders;
- physical fitness;
- respiratory load;
- thermophysiological modelling.



*Urban renewal is one of the research items of TNO's Group Policy Research and Information. Important research areas are: physical planning, labour, innovation and science policy.*



# Group Policy Research and Information TNO

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 215  
2600 AE Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Group director: Prof. W. C. L. Zegveld  
Management team: C.A. Brezet, Dr. J.D. Buissink, J.P.H. Huijskens,  
J.W. Plevier, Prof. Ir. E.J. Tuininga, Drs. P. Winkel.

The Group Policy Research and Information TNO comprises the TNO units which perform studies in the field of environmental research, physical planning, innovation, labour, science policy and decision-making, and which offer various forms of service on scientific, technical, economic information and patents.

One of the main objects of the Group is to make multi-disciplinary policy studies which may contribute to the development of decision-making processes.

The Group consists of the Centre for Technology and Policy Studies TNO, the Research Centre for Physical Planning TNO, the Study and Information Centre on Environmental Research TNO, the Centre for Technical and Scientific Information and Documentation TNO, and the Patent Information Office, formerly NIDER.

## Centre for Technology and Policy Studies TNO

Laan van Westenenk 501  
7334 DT Apeldoorn  
P.O. Box 541  
7300 AM Apeldoorn  
Phone 015 - 77 33 44  
Telex 36395 tnoap nl

Head: Prof. Ir. E.J. Tuininga  
Staff: 17

### *Scope of activities*

The Centre for Technology and Policy Studies TNO carries out studies of technological developments and their effects on society. Many of these studies are sponsored by government agencies, international organizations, industrial firms or by the TNO organization itself.

Within the Centre these activities are grouped around the themes of innovation, labour, science policy and decision-making.

## *Fields of work*

### **Innovation**

These last few years there has been a growing interest in the possibilities of industrial innovation. On the one hand this can be ascribed to the economic recession compelling people to look for new

number of scientific and technological developments have been initiated which may exercise a great influence on both industrial and social developments (e.g. biotechnology, micro-electronics, energy technology).

As a result there is an increasing need for government agencies to get a clear view of the possibilities of controlling these technological innovations in view of societal objectives.

The Centre studies both the theoretical aspects of the innovation and the practical ones, the latter often in close collaboration with other TNO institutes. A special innovation consultancy unit is linked to the Centre.

### **Labour**

In many West European countries the care for employment of good quality has become a central feature of government policy. As a result of the economic recession, the demand for labour will not increase, while at the same time an ever-growing number of highly educated people will be looking for a job. Technology also plays an important role as the recession compels many (industrial) firms to increase their productivity by rationalization and automation. For this reason more and more attention has to be devoted to the quality of work, conditions at work, working relations and working environment.

The activities of the Centre in this field are directed towards the solution of problems that have arisen at different levels as a result of the interaction of labour and technology.

### **Science policy and decision-making**

Nowadays scientific methods are applied to decision-making processes at many levels. These last fifteen years a growing number of methods have been developed for, among other fields, planning, policy analyses, project evaluations, and forecasting. The Centre pays attention to these developments, and takes a special interest in scientific contributions to processes leading to decisions and in the role scientific information plays in this respect. The Centre also takes a historical interest in the risk aspects of certain technological developments.

# Research Centre for Physical Planning TNO

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 45  
2600 AA Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Director: Dr. J.D. Buissink  
Deputy director: Ir. H.R. Heida  
Staff: 30

## *Scope of activities*

The main task of the Centre is to carry out research on physical planning in Western Europe in general, and in the Netherlands in particular. The aim of this research is twofold, namely:

- to provide the authorities responsible for planning with information necessary for formulating and implementing physical planning policies
- to evaluate the impact of such policies and pertinent measures.

Another task of the Centre is to support activities that may be of benefit to the cause of physical planning in the Netherlands and in (Western) Europe.

## *Fields of work*

### **Population studies**

The development of the population in its regional diversity is essential to physical planning. The activities in this field fall under two headings, namely:

- research on the motivation underlying inter-regional and intra-regional movements of population
- development of monitoring systems for (regional) population forecast models.

### **Urban renewal**

In the research carried out, the economic viz job opportunity aspects of the problem are emphasized.

### **Urban problems**

Attention is paid to the factors underlying the deterioration of the urban environment in general, and of the environment in the (historical) inner-cities in particular.

### **Evaluation of planning instruments**

It is essential to know whether measures taken to implement planning policies have the desired impact and, if not, to discover what went wrong. Apart from this ex post facto evaluation research, ex ante facto

research is necessary, too.

### **Decision-making**

Society has become so complex that both decision-makers and the general public experience difficulties in getting a clear overview of the factors they have to take into account when taking a (far-reaching) decision. Various multi-criterion models are being developed.

### **The quality of life in the urban environment as influenced by physical factors**

For the present the research is concentrated on the way in which the urban structure, i.e. size and situation of buildings and building block, open spaces, street pattern, and so on, influences 'wind' in the urban environment.

### **The demand for housing**

The emphasis lies on the development of a monitoring system in relation to housing demand models.

### **Geocoding**

The development of a data/information system to meet the requirements of physical planners.

### **Permanent registration**

The development of a permanent registration system for research projects on planning. The system will be basic to programming research.

## **Study and Information Centre on Environmental Research TNO**

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 186  
2600 AD Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Head: Drs. P. Winkel  
Staff: 18

### *Scope of activities*

The tasks of the Study and Information Centre on Environment. Research TNO are:

- to draw up an inventory of the environmental research, reports and publications in the Netherlands
- to analyse environmental problems in order to pinpoint items that call for more research

- to support the activities of national co-ordinating committees
- to make research results more widely available and comprehensive, and to indicate how these results can be made operational
- to promote the co-operation and communication among research workers, representatives of government authorities and other parties concerned with environmental problems
- to make environmental policy studies.

### *Fields of work*

The Centre has so far given high priority to drawing up an inventory of environmental research projects carried out in the Netherlands. Such an inventory provides a basis for attuning environmental research to the government's environmental policy, for indicating fields in which research is needed, and for stimulating co-operation among research institutions. Catalogues of environmental projects in the Netherlands were published in 1972, 1975, 1978 and 1981.

For the various environmental problems listed, the Centre makes a selection of topics for its working programme according to the following criteria:

- the multi-disciplinary and multi-institutional character of the research involved
- the urgency of the problems
- the regional, national or international character of the problems and of the appropriate research.

Staff act as secretaries or project co-ordinators of steering groups and committees. They prepare working papers and research proposals and consult with the individual members of the group or with other experts.

The Information Section of the Centre collects and files information on environmental research, such as:

- sources of scientific literature
- policy-oriented information
- data received from institutions engaged in environmental research.

# Centre for Technical and Scientific Information and Documentation TNO

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 36  
2600 AA Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

Head: J.W. Plevier  
International contacts and marketing: Drs. Ch.L. Citroen  
Staff: 10

## *Scope of activities*

The Centre for Technical and Scientific Research and Documentation TNO provides TNO staff and parties outside TNO, such as industry, research institutions, consumers' organizations, and individuals both with published technical, scientific, socio-economic, marketing, business and management information, and with factual data. CID is consulted by TNO staff in the planning stage of most research and development projects. Apart from state-of-the-art information, CID provides information on energy aspects, size of the market, safety aspects, etc., not only to TNO staff but also to parties outside TNO.

Part of the inquiries received have a more limited scope, and relate to problems occurring in everyday practice, e.g. an inquiry concerning a method for welding copper and stainless steel, or an inquiry concerning the export volume of a specific chemical, and so on.

## *Fields of work*

CID has access to over 200 bibliographical and factual data bases. These bases cover virtually all information in the technical and scientific fields and socio-economic information, such as information on marketing and management and on current research.

The activities mainly consist of:

- Searching for bibliographic information specifically requested. This involves both patent and other literature searches.
- Searching for factual data, such as statistical data, physical properties of chemical compounds, and data of firms.
- Current awareness services. Clients are regularly informed of articles recently published in journals, and on patents, reports, etc. in their fields of interest.
- Photocopies of patent publications, reports and articles in journals which are difficult to obtain are supplied on request.

CID staff provide assistance in defining the problem and in formulating the request for a search.

If a client needs help in evaluating and implementing the information supplied, CID will locate the appropriate expert inside or outside the TNO organization. In this respect there is a formal co-operation with the Centre for Industrial Services TNO.

## Patent Information Office, formerly NIDER

Patentlaan 2  
2288 EE Rijswijk  
P.O. Box 309  
2280 AH Rijswijk  
Phone 070 - 90 78 58  
Telex 31622 nider nl

Head: C.A. Brezet  
Staff: 10

### *Scope of activities*

The Patent Information Office offers industrial firms and patent attorneys various forms of paid service in the field of patents and documentation.

The office uses the fully classified collection of the European Patent Office. As a matter of fact it can also use the collections of the library of the Dutch Patent Office which, apart from patents or the patent journals of a large number of countries, contains volumes of some 1200 technical periodicals, textbooks, manuals, abstract journals, etc.

### *Fields of work*

The classification system and the completeness of the patent documentation enable the office to be of service to clients throughout the world.

This service comprises the execution of:

- collection searches
- novelty searches
- validity searches
- infringement searches
- searches for counterparts
- name searches, and
- information of the status of a Dutch patent publication.

Photocopies of all specifications available at the library of the Dutch Patent Office are supplied at short notice. This library contains patent specifications from 26 countries.



## *Multi-institute Research Groups*

TNO consists of a number of research institutes, each with its own expertise and specialties. In many cases the solution to practical problems requires expertise and know-how which can be realized by the collaboration of several TNO-institutes. Some of these problems occur only incidentally, others occur most frequently. For the latter problems it has been found useful to give this multi-institute approach more definite shape, and this has led to TNO establishing a number of Committees which co-ordinate multi-institute R&D activities in a specific field of interest. These committees form an important element of TNO's horizontal organizational structure.

The most important functions of the committees are: to co-ordinate activities in a relatively wide R&D field; to delegate R&D work to the right party within TNO; to expedite contacts with parties outside TNO; and to initiate, promote and, if necessary, administer research projects.

Until now TNO has established Committees co-ordinating multi-institute R&D activities in the field of:

- energy research
- environmental research
- industrial safety
- biotechnology
- building research
- toxicology
- humanization of work
- hospital technology

## **TNO Steering Group on Energy Research**

Laan van Westenek 501  
7334 DT Apeldoorn  
P.O. Box 342  
7300 AH Apeldoorn  
Phone 055 - 77 33 44  
Telex 36395 tnoap nl

Chairman: Dr. J.H. Parmentier  
Secretary: Ir. J.A. Knobbout

### *Scope of activities*

The management and co-ordination of multi-institute TNO activities and projects in the field of energy research.

TNO Divisions and Institutes taking part in the Steering Group are:

- Division of Technology for Society TNO (cf. page 19)
- Division for Building and Metal Research TNO (cf. page 25)
- Division for Industrial Products and Services TNO (cf. page 36)
- Institute of Applied Physics TNO-TH (cf. page 54)

## TNO Committee for Environmental Projects

Bureau for Environmental Projects TNO  
Dr. A.J.M. Schoot Uiterkamp

Schoemakerstraat 97  
2628 VK Delft  
P.O. Box 217  
2600 AE Delft  
Phone 015 - 56 93 30  
Telex 38071 zptno nl

### *Scope of activities*

The management and co-ordination of multi-institute TNO Research activities and projects with respect to the outdoor environment. The Bureau for Environmental Projects TNO is the executive body of the Committee.

The functions of the Bureau are, inter alia, to initiate projects and act as a central point of access for those concerned with problems which occurring in the working field of the Committee.

All the TNO Institutes participate in the Committee.

## TNO Committee on Industrial Safety

Chairman: Dr. H. Kienhuis  
Secretary: Ir. A. C. van Mameren

Bureau for Industrial Safety TNO

Lange Kleiweg 117  
2288 GJ Rijswijk (near The Hague)  
P.O. Box 45  
2280 AA Rijswijk  
Phone 015 - 13 87 77  
Telex 38034 pmtno nl

### *Scope of activities*

Research to promote the safety of industrial activities (e.g. production, storage, transportation and handling of hazardous substances): prevention of failure of systems, processes and installations, reduction of the consequences of possible incidents, risk calculations and studies on perception and social decision making.

The functions of the Committee are, inter alia, to design strategic research programmes and to realize and co-ordinate research projects in the field of industrial safety in which several TNO divisions participate. The Bureau for Industrial Safety is the executive body of the Committee.

Divisions taking part in the Committee are:

- Division of Technology for Society TNO (cf. page 19)
- Division for Building and Metal Research TNO (cf. page 25)
- Division for National Defence Research TNO (cf. page 87)
- Division for Nutrition and Food Research TNO (cf. page 59)
- Division for Health Research TNO (cf. page 70)
- Division for Technical-Scientific Services TNO (cf. page 48)
- Group Policy Research and Information TNO (cf. page 94)

## TNO Bureau for Biotechnology

Utrechtseweg 48

3704 HE Zeist

P.O. Box 108

3700 AC Zeist

Phone 03404 - 5 54 44

Chairman (deputy): Dr. W.F. Stevens

Secretary: Drs. C. van Bochove

### *Scope of activities*

The planning and co-ordination of TNO research activities in the field of biotechnology and recombinant DNA techniques.

The Bureau acts as a central point of access for those concerned with problems occurring in these fields.

Specialisms of the institutes participating are:

#### **Division of Technology for Society TNO (cf. page 19)**

- application of biocatalysts
- enzyme reactor technology (membrane reactor, multi-phase reactor)
- biological waste water treatment
- downstream processing
- microbial detoxification of soil and refuse
- fermentation technology: continuous processes of alcohol production with the aid of bacteria.

#### **Division for Nutrition and Food Research TNO (cf. page 59)**

- studies on the production of flavours
- degradation of organic waste by anaerobic production into biogas
- biodegradation of waste streams
- investigations in the fields of agriculture, chemistry, microbiology and technology with regard to malt and beer for or on behalf of maltings and breweries and affiliated industries

#### **Division for Health Research TNO (cf. page 70)**

TNO Research Institute for Environmental Hygiene:

- sewage treatment

Medical Biological Laboratory TNO:

- recombinant DNA research
- monoclonal antibodies

**Potato Processing Research Institute (cf. page 115)**

- enzymatic modification of starch
- anaerobic treatment of waste water of potato starch production

## Planning Committee for Building Research TNO

Bureau of the Planning Committee for Building Research TNO

Lange Kleiweg 5

2288 GH Rijswijk (near The Hague)

P.O. Box 238

2600 AE Delft

Phone 015 - 13 82 22

Head: Ing. G.H.C. Kortenhoff

The Planning Committee for Building Research TNO co-ordinates the research activities of the TNO divisions and institutes which are either partly or entirely engaged on research in the field of building and living. Since 1977 the Committee has had the disposal of a bureau which is the executive body of the Committee, and acts as a central point of access to all the TNO building research activities.

The aim of the Committee is:

- to create an overall insight into the joint TNO activities in the field of building and living;
- to perform co-ordinating tasks;
- to further that building research is put at the service of the community in the most efficient manner possible;
- to further that pertinent expertise, know-how and capacity present within TNO is utilized in the most efficient way;
- to deal with the financial aspects of projects and working groups;
- to further contacts with public organizations, industry and research organizations.

The term 'Building Research' may be said to comprise, inter alia, the following fields:

the construction of dwellings and buildings, civil engineering and offshore constructions; environmental aspects of building; energy issues; and the interaction of built environment, traffic, living and working conditions and economy. Furthermore, 'Building research' can be understood to include changes in the built environment which are due to new buildings being added to it, modifications being made on buildings, and so on.

The TNO activities in the field of building and living have been subdivided into a number of main fields, namely:

- building materials;
- building constructions;
- physical aspects of building;

- socio-psychological and hygienic aspects of housing and living;
- physical planning;
- special subjects (e.g. energy, safety and offshore constructions).

**TNO Divisions and institutes taking part in the Committee are:**

- Institute TNO for Building Materials and Structures (cf. page 25)
- Metal Research Institute TNO (cf. page 28)
- Division for Building and Metal Research TNO (cf. page 25)
- Division for Technology for Society TNO (Apeldoorn branch, cf. page 19)
- TNO Research Institute for Environmental Hygiene (cf. page 73)
- Forest Products Research Institute TNO (cf. page 36)
- Plastics and Rubber Research Institute TNO (cf. page 37)
- Netherlands Institute for Preventive Health Care TNO (cf. page 75)
- Research Centre for Physical Planning (cf. page 96)
- Institute of Applied Physics TNO-TH (cf. page 54)
- Paint Research Institute TNO (cf. page 40)
- Prins Maurits Laboratory TNO; Institute for Chemical and Technological Research (cf. page 89)

## Toxicology TNO (TOX-TNO)

Utrechtseweg 48  
 3704 HE Zeist  
 P.O. Box 360  
 3700 AC Zeist  
 Phone 03404 - 5 22 44  
 Telex 40022 civo nl

Secretary: Miss Fl. de Vrijer

### *Scope of activities*

Toxicology TNO (TOX-TNO) is a committee responsible for the co-ordination of toxicological research within TNO.

Toxicological research is performed in the fields of mammalian toxicology and ecotoxicology. The programme consists of fundamental and applied research, the development of methods and the performance of a wide range of contract studies.

Toxicology TNO provides general information about the toxicology programme of TNO and, when requested, the committee assists with establishing contacts with the appropriate TNO institutes. Toxicology TNO also serves as a consultant in matters concerning toxicity testing. Specialisms of the institutes participating in TOX-TNO:

### **Division for Nutrition and Food Research TNO**

- Institute CIVO-Toxicology and Nutrition TNO:  
complete programme for mammalian toxicity testing
- Institute CIVO-Analysis TNO:  
toxicological analysis

### **Division of Technology for Society TNO**

- Biology Department:  
complete programme for ecotoxicity testing
- Institute of Applied Chemistry TNO:  
studies of degradation and metabolism of toxic compounds in plants or in soil, both in the laboratory and in the field; effects on fungi and bacteria.

### **Division for Health Research TNO**

- Medical Biological Laboratory TNO:  
biological monitoring of humans exposed to chemicals in the industrial environment; detection of toxic effects on various organs by non-invasive methods.
- REP/TNO-institutes:  
toxicity tests on monkeys and germ-free animals
- TNO Research Institute for Environmental Hygiene:  
development of criteria and advisory values for the quality of atmospheric air on the basis of epidemiological and experimental research.

### **Division for National Defence Research TNO**

- Prins Maurits Laboratory TNO; Institute for Chemical and Technological Research:  
Laboratory scale synthesis of (labelled) toxic compounds and measurement of physical chemical properties in accordance with OECD guidelines  
Study of mechanism of action of toxic compounds  
Research and development of effective means for the protection of humans against toxic compounds (i.e. in vitro skin penetration measurements).

# TNO Committee on Humanization of Work

Chairman: H. Hoolboom, physician

Secretary: Dr. C.L. Ekkers

Co-ordinating Bureau for Activities in the Area of Humanization of Work TNO

Staff: Ir. C.K. Pasmooij and Mrs. G. Broekema

Wassenaarseweg 56

2333 AL Leiden

P.O. Box 124

2300 AC Leiden

Phone 071 - 17 04 41

## *Scope of activities*

The TNO Committee on Humanization of Work functions as a central point of access for those who apply to TNO for research and advice on humanization of work, in particular for such research and advice concerning the interrelationship of technology and labour.

In this respect particular attention is devoted to physical conditions at work, ergonomics and work content.

The Co-ordinating Bureau for Activities in the Area of Humanization of Work is the executive body of the Committee.

The functions of the Bureau are, inter alia, to carry on consultations with commissioners, to delegate research projects to the appropriate TNO institute, and to initiate joint ventures if a project to be carried out comes within the scope of more than one TNO institute.

All the TNO institutes participate in the Committee.

## TNO Bureau for Hospital Technology

Da Costakade 45

3521 VS Utrecht

P.O. Box 5011

3502 JA Utrecht

Phone 030 - 93 51 41

Head: Dr. B. van Eijnsbergen

## *Scope of activities*

The functions of the TNO Bureau for Hospital Technology are to draw up an inventory of TNO expertise and research in the field of hospital technology, and to act as a centre of information and co-ordination on behalf of those concerned with hospital technology.

The Bureau furthermore manages, co-ordinates and administers projects in process of execution, and initiates and promotes research to be carried out by TNO on behalf of hospitals.

TNO institutes and divisions participating in the Bureau are:  
Institute for Building Materials and Building Structures TNO (cf. page 25)  
Central Institute for the Breeding of Laboratory Animals TNO (cf. page 82)  
Prins Maurits Laboratory TNO: Institute for Chemical and Technological Research (cf. page 89)  
Gaubius Institute TNO (cf. page 70)  
Institute for Cereals, Flour and Bread TNO (cf. page 67)  
Forest Products Research Institute TNO (cf. page 36)  
Instumentum TNO (cf. page 51)  
Plastics and Rubber Research Institute TNO (cf. page 37)  
Institute for Leather and Shoe Research TNO (cf. page 39)  
Medical Biological Laboratory TNO (cf. page 71)  
TNO Research Institute for Environmental Hygiene (cf. page 73)  
Research Centre for Physical Planning TNO (cf. page 96)  
Netherlands Institute for Preventive Health Care TNO (cf. page 75)  
Radiobiological Institute TNO (cf. page 76)  
Radiological Service Unit TNO (cf. page 83)  
Institute for Cleaning Techniques TNO (cf. page 113)  
Division of Technology for Society TNO (cf. page 21)  
Institute of Applied Physics TNO-TH (cf. page 54)  
Institute for Packaging Research TNO (cf. page 41)  
Fibre Research Institute TNO (cf. page 42)  
Division for Nutrition and Food Research TNO (cf. page 59)  
Institute for Mechanical Constructions TNO (cf. page 31)  
TNO Institute for Mathematics, Information Processing and Statistics (cf. page 52)  
Institute for Perception TNO (cf. page 91)  
Patent Information Office, formerly Nider (cf. page 100)



## *Council based on the TNO Act of 1930*

### **National Council for Agricultural Research (NRLO)**

Adelheidstraat 84  
2595 EE The Hague  
P.O. Box 297  
2501 BD The Hague  
Phone 070 - 47 10 21  
Telex 31660 tnogv ni

Chairman: Ir. A. de Zeeuw  
Secretary: Ir. G. Wansink

#### *Organization*

In the National Council for Agricultural Research (NRLO) participate organizations which administer and execute agricultural research, and representatives of organizations which use the results of this research. The research participants in NRLO are the Netherlands Ministry of Agriculture and Fisheries, the Agricultural University, the Veterinary Faculty of the State University of Utrecht, the Netherlands Organization for Applied Scientific Research (TNO), the IJsselmeerpolders Development Authority, the Netherlands Institute for Dairy Research, and the Sugar Beet Research Institute. Furthermore, agreements have been made for the participation of research administered by the Ministry of Welfare, Health and Cultural Affairs, the Ministry of Transport and Public Works, and the Ministry of Housing, Planning and the Environment.

A large number of organizations which use the results of research participate in NRLO themselves; they may be divided into three categories, namely: ministries and other governmental bodies, organizations of agricultural industry, and community groupings. Any new body can in principle join NRLO, conditional on its participation being a positive contribution to the realization of the goals of NRLO, and provided that the new participant is prepared to accept the rules applied within.

#### *Scope of activities*

Agricultural research includes activities such as:

- Conservation, developments and use of soil, water, forests, etc.
- Protection against harmful biotic and non-biotic factors
- Efficient production and quality improvement
- Product development and processing
- Efficient marketing, including pricing and quality
- Development of human research, economics of communities, areas etc.

The research covered is directed not only towards agriculture in the Netherlands; a number of activities are performed within the framework of development co-operation, in some cases in collaboration with other countries taking part in the European Community.

## *Objectives and tasks*

The objectives of NRLO can be described as follows:

- to promote that agricultural research is attuned to the needs of the community in the best possible way, and to further that the most efficient use is made of the means available.

To realize these objectives NRLO executes several tasks, which are mainly in the field of planning and co-ordinating research. In the statutes of NRLO, the tasks have been formulated more extensively as follows:

- to promote that the applied science serves agriculture and land-use planning in the most efficient manner and to provide solicited or unsolicited advice
- to promote a good organization, co-operation and internal communication within agricultural research
- to further the connection between agricultural and other research wherever required
- to study or have studies scientific, economic and organizational aspects of agricultural research
- to take care of a systematic registration of all research projects for the needs of agriculture and land-use planning
- to periodically frame results of research and needs for agriculture and land-use planning
- to promote the creation of common facilities, which can be of interest to the whole of agricultural research.

## *Substructure and working procedure*

To execute its tasks NRLO has the disposal of a central secretariat and the so-called 'substructure', i.e. a system of substructural organs. The latter shows a differentiated structure, which is caused by agricultural research comprising a broad field with a multitude of subjects areas, research workers and interested parties. The majority of activities of NRLO do not pass the council or central secretariat, but take place in this substructure.

In 1981 total research expenses of the participating organizations amounted to approx. Dfl. 410 million. There are over 100 institutes, field stations and subject divisions, about 1,000 research workers, approx. 4,000 research projects and several hundreds of groups interested in results of research. To make consultations proceed effectively in such a complex situation with such a wide variety of interests and specialists, a differentiated structure is essential, as it allows persons with similar tasks to meet and discuss problems they have in common.

The substructure shows four components with the following main characteristics:

1. Programme-advisory committees: committees in which parties interested in research results (the 'demand side') are grouped. The *most important function of these committees is to introduce their wishes for research into the process of planning.*
2. Co-ordination committees with their subordinate contact committees, working parties and study committees. These are groups in which research workers and research leaders (the 'supply side') meet and consult to come to agreements on the planning and co-ordination of research in their field.
3. Divisions: groups in which government officials and research management authorities, representatives of research leaders and worker and social organizations interested in research meet and consult to come to agreements on main features of research policies for a substantial area (NRLO has divided its total field into five large divisional sections).
4. *Study and policy-preparing committees. The task of these committees is to prepare by means of study and consultation adequate policies with respect to special subjects. The committees consist of people involved in the subject and specialists in the field in question, and may be instituted at various levels of the substructure.*

## *Institutions connected with TNO*

### Foundation ILOB-TNO, Institute for Agricultural Research on industrial biological, biochemical and chemical products

Haarweg 8  
6709 PJ Wageningen  
P.O. Box 9  
6700 AA Wageningen  
Phone 08370 - 1 91 34  
Telex 45938 ilob nl

Director: Dr. Ir. P. van der Wal  
Deputy director: Dr. Ir. E.J. van Weerden  
Staff and personnel: 45

### *Organization and scope of activities*

ILOB is a foundation in the board of which are represented: the Agricultural University, the Division for Nutrition and Food Research TNO, and industry.

The main objectives of the research carried out at ILOB are in the field of animal nutrition. The nutritional and toxicological evaluation of feed ingredients and additives forms a major part of ILOB's activities.

Digestion and metabolic pathways of nutrients and toxic substances are studied, as well as nutrient requirements of animals. The effects of nutritional aspects on animal products, excreta and environment of the animals are examined.

### *Service*

Experiments with poultry, pigs, calves, ruminants and laboratory animals to examine various aspects in relation to animal nutrition.

### *Equipment*

For its objectives, the institute has the disposal of experimental facilities for ruminants, veal calves, swine, poultry and laboratory animals.

The experimental departments are backed by an analytical laboratory, a statistics group, and an unit preparing experimental rations.

### *International relations*

FAO, UNU (United Nations University).  
A large number of research groups, industries and universities in Europe and the United States of America.

## *Publications*

In various journals.

Special issues of the Dutch "Landbouwkundig Tijdschrift".

## Institute for Cleaning Techniques TNO

Schoemakerstraat 97

2628 VK Delft

P.O. Box 70

2600 AB Delft

Phone 015 - 56 93 30

Director: J. Hoogland

Staff and personnel: 40 (incl. 4 travelling technical officers)

## *Organization and scope of activities*

Institute with the legal status of foundation, affiliated to the Netherlands Organization for Applied Scientific Research TNO, for research and advise on products, machines and processes for cleaning in general, inter alia washing and drycleaning of textiles; and related subjects.

## *Fields of work*

### **General**

Planning of laundries and drycleaning plants, mechanization, automation, lay out, work flow, organization, internal and external transport, productivity, management.

Costing, cost control, budgetting, automatic processing of administrative data.

Personnel management, educational courses at various levels.

Development of methods and task descriptions for office, laboratory and hospital cleaning and drawing up standards for pertinent quality assessment.

Chemical analyses of water, detergents, bleaching agents, solvents and other auxiliaries.

Advisory visits to laundries and drycleaning plants.

Investigation of damaged, shrunk or discoloured, washed or drycleaned textiles.

Determination of soil and stain removal from textiles soiled in normal use.

Effects of washing, bleaching, drycleaning, drying, etc. on natural and synthetic fibres, fabrics, knitwear, flame retardants and other textile finishes.

Textile care labelling.

Development and application of: fabrics containing characteristic soils and stains; clean test pieces; methods for testing machines, detergents, bleaching agents, softeners and other finishers, solvents, disinfecting

agents and other chemicals.

Clothing for calenders (ironers) and presses, nets and other industrial fabrics.

Textile management, including valuation of textile stocks in hotels, institutions etc.

Advice on linen hire.

Washing up by hand and in dish washing machines.

### **Washing, industrial and domestic**

Composition, analyses, testing, usefulness and application of: detergents, enzymes, optical whites, bleaches, starches, softeners, disinfecting agents, waterproofing and flame retardant finishes etc. Water softening and purification, reduction of water usage and COD of effluents (waste water).

Washing machines, hydro-extractors and centrifuges, shakers, spreaders, feeders, calenders (ironers), folding machines, stackers, presses, tumblers, drying cabinets and tunnels, packaging machines. Processes for washing, bleaching, rinsing, sizing and disinfection.

### **Drycleaning**

Composition, usefulness and application of: solvents, detergents, filter powders, preparations for stain removal, sizing and re-texturing agents, softeners and antistatics, moth repellents, disinfecting and waterproofing agents, flame retardants.

Machines and apparatus for drycleaning, re-texturing, waterproofing and stain removal, solvent vapour recovery units, rotary dryers, garment-form finishers, presses, steam cabinets and tunnels, and other finishing machines.

Processes for drycleaning, re-texturing, waterproofing, flame-proofing, disinfecting, etc.

Lay out, ventilation and lighting of work shops.

### **Equipment**

Pilot plants for industrial washing, drycleaning and related treatments.

Test bay for domestic laundering, drying and ironing equipment.

Miniature washers.

Various mechanical and physical measuring instruments, for, among other things, determining soil and stain removal, wear, colour (whiteness), and the creasing of fabrics as a result of washing, drycleaning and drying; solvent losses; temperature and distribution of mechanical pressure on press surfaces, etc.

### **International relations**

Member of the International Scientific and Technical Committee on Laundering (ISTCL).

Member of the International Dry Cleaning Research Committee (IDRC).

Member of the International Technical Committee for Textile Care Labelling.

Member of the subcommittee on 'Apparatus for washing textiles' of the International Electro-technical Committee.

## *Publications*

Communications. Articles in Dutch and foreign periodicals.

## Potato Processing Research Institute

Rouaanstraat 27  
9723 CC Groningen  
Phone 050 - 13 03 41

Director: Dr. T.J. Buma  
Graduate staff: 5  
Other personnel: 24

## *Organization and scope of activities*

Institute with the legal status of foundation, affiliated to the Netherlands Organization for Applied Scientific Research TNO, for research on potatoes and potato products.

## *Fields of work*

Influence of agricultural factors on the processability of potatoes for starch production as well as on the quality of finished products; research on waste water of potato-starch factories; research for potato-starch production; fundamental research into starch and its derivatives; enzymatic modifications of starch. Standardization of analytical methods in the field of starch and its derivatives.

## *Equipment*

Equipment for microbiological processes on a pilot plant scale.  
Pilot plant for the preparation of starch.  
Rheological equipment.  
Analytical instruments: liquid chromatographs, gas chromatographs, spectrophotometers, etc.

# **TNO Research Facilities**

## **Addresses of Institutes and other Establishments**

### **Division of Technology for Society TNO (MT-TNO)**

Schoemakerstraat 97, 2628 VK Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

#### **Delft Branch**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 217, 2600 AE Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

#### **Apeldoorn Branch**

Laan van Westenenk 501, 7334 DT Apeldoorn  
P.O. Box 342, 7300 AH Apeldoorn  
Telex 36395 tnoap nl  
Phone 055 - 77 33 44

#### **Biological Fieldwork (Den Helder Branch)**

Ambachtsweg 8a, 1785 AJ Den Helder  
P.O. Box 57, 1780 AB Den Helder  
Phone 02230 - 3 29 24

#### **Institute of Applied Chemistry**

##### **Utrecht Branch (Institute for Organic Chemistry)**

Croesestraat 79, 3522 AD Utrecht  
P.O. Box 5009, 3502 JA Utrecht  
Phone 030 - 88 27 21

##### **Zeist Branch (Institute for Physical Chemistry)**

Utrechtseweg 48, 3404 HE Zeist  
P.O. Box 108, 3700 AC Zeist  
Phone 03404 - 5 54 44

#### **Bureau for Industrial Safety TNO**

Lange Kleiweg 117, 2288 GJ Rijswijk  
P.O. Box 45, 2280 AA Rijswijk  
Telex 38034 pmtno nl  
Phone 015 - 13 87 77

#### **Centre for Energy Studies TNO**

Laan van Westenenk 501, 7334 DT Apeldoorn  
P.O. Box 342, 7300 AH Apeldoorn  
Telex 36395 tnoap nl  
Phone 055 - 77 33 44



**Project for Emission Registration TNO**

Laan van Westenenk 501, 7334 DT Apeldoorn  
P.O. Box 342, 7300 AH Apeldoorn  
Telex 36395 tnoap nl  
Phone 055 - 77 33 44

**Energy Research Project Office TNO**

Laan van Westenenk 501, 7334 DT Apeldoorn  
P.O. Box 342, 7300 AH Apeldoorn  
Telex 36395 tnoap nl  
Phone 055 - 77 33 44

**Bureau for Environmental Projects TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 217, 2600 AD Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**TNO Bureau for Biotechnology**

Utrechtseweg 48, 3404 HE Zeist  
P.O. Box 108, 3700 AC Zeist  
Phone 03404 - 5 54 44

**Division for Industrial Products and Services TNO (IPD-TNO)**

Schoemakerstraat 97, 2628 VK Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Forest Products Research Institute TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 151, 2600 AD Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Plastics and Rubber Research Institute TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 71, 2600 AB Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Institute for Leather and Shoe Research TNO**

Mr. van Coothstraat 55, 5141 ER Waalwijk  
Telex 35083 lstno nl  
Phone 04160 - 3 32 55

**Paint Research Institute TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 203, 2600 AE Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Laboratory for Applied Marine Research TNO**

Ambachtsweg 8a, 1785 AJ Den Helder  
P.O. Box 57, 1780 AB Den Helder  
Phone 02230 - 3 29 24

**Institute for Packaging Research TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 169, 2600 AD Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Fibre Research Institute TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 110, 2600 AC Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Research Institute for Road Vehicles TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 237, 2600 AE Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Division for Technical-Scientific Services TNO  
(TWD-TNO)**

Stieltjesweg 1, 2628 CK Delft  
Telex 38091 tpddt nl  
Phone 015 - 78 80 20

**Ground Water Survey TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 285, 2600 AG Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

**Instrumentum TNO**

Surinamestraat 2, 2612 EA Delft  
Curaçaostraat 2, Delft  
Telex 38130 intno nl  
Phone 015 - 14 02 81

## **TNO Institute for Mathematics, Information Processing and Statistics**

Koningin Marialaan 21, 2595 GA The Hague  
P.O. Box 297, 2501 BD The Hague  
Telex 31707 wstno nl  
Phone 070 - 82 41 61

## **Institute of Applied Physics TNO-TH**

Stieltjesweg 1, 2628 CK Delft  
P.O. Box 155, 2600 AD Delft  
Telex 38091 tpddt nl  
Phone 015 - 78 80 20

## **TNO Centre for Micro-Electronics**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 67, 2600 AB Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

## **Division for Nutrition and Food Research TNO (VV-TNO)**

Utrechtseweg 48, 3704 HE Zeist  
Telex 40022 civo nl  
Phone 03404 - 5 22 44

### **Institute CIVO-Analysis TNO**

Utrechtseweg 48, 3704 HE Zeist  
P.O. Box 360, 3700 AJ Zeist  
Telex 40022 civo nl  
Phone 03404 - 5 22 44

### **Institute CIVO-Technology TNO**

Utrechtseweg 48, 3704 HE Zeist  
P.O. Box 360, 3700 AJ Zeist  
Telex 40022 civo nl  
Phone 03404 - 5 22 44

### **Institute CIVO-Toxicology and Nutrition TNO**

Utrechtseweg 48, 3704 HE Zeist  
P.O. Box 360, 3700 AJ Zeist  
Telex 40022 civo nl  
Phone 03404 - 5 22 44

### **Institute for Cereals, Flour and Bread TNO**

Lawickse Allee 15, 6701 AN Wageningen  
P.O. Box 15, 6700 AA Wageningen  
Phone 08370 - 1 90 51

**Research Group for Meat and Meat Products**

Utrechtseweg 48, 3704 HE Zeist

P.O. Box 360, 3700 AJ Zeist

Telex 40022 civo nl

Phone 03404 - 5 22 44

**Bureau Toxicology TNO**

Utrechtseweg 360, 3704 HE Zeist

P.O. Box 360, 3700 AJ Zeist

Telex 40022 civo nl

Phone 03404 - 5 22 44

**Division for Health Research TNO (GO-TNO)**

Eysingahuis

Rijnsburgerweg 100

2333 AE Leiden

P.O. Box 188

2300 AD Leiden

Phone 071 - 17 20 41

**Gaubius Institute TNO**

Herenstraat 5d, 2313 AD Leiden

Phone 071 - 13 13 45/13 45 48

**Medical Biological Laboratory TNO**

Lange Kleiweg 139, 2288 GJ Rijswijk

P.O. Box 45, 2280 AA Rijswijk

Telex 38034 pmtno nl

Phone 015 - 13 87 77

**TNO Research Institute for Environmental Hygiene**

Schoemakerstraat 97, 2628 VK Delft

P.O. Box 214, 2600 AE Delft

Telex 38071 zptno nl

Phone 015 - 56 93 30

**Netherlands Institute for Preventive Health Care TNO**

Wassenaarseweg 56, 2333 AL Leiden

P.O. Box 124, 2300 AC Leiden

Phone 071 - 17 04 41

**Radiobiological Institute TNO**

Lange Kleiweg 151, 2288 GJ Rijswijk

P.O. Box 5815, 2280 HV Rijswijk

Telex 38191 repgo nl

Phone 015 - 13 69 40

**Institute for Experimental Gerontology TNO**

Lange Kleiweg 151, 2288 GJ Rijswijk  
P.O. Box 5815, 2280 HV Rijswijk  
Telex 38191 reppo nl  
Phone 015 - 13 69 40

**Primate Centre TNO**

Lange Kleiweg 151, 2288 GJ Rijswijk  
P.O. Box 5815, 2280 HV Rijswijk  
Telex 38191 reppo nl  
Phone 015 - 13 69 40

**Central Institute for the Breeding of Laboratory Animals TNO**

Woudenbergseweg 25,  
3711 AA Austerlitz/Zeist  
P.O. Box 167, 3700 AD Zeist  
Phone 03439 - 16 46

**Radiological Institute TNO**

Utrechtseweg 310, 6812 AR Arnhem  
Phone 085 - 45 70 57

**Tuberculin Research Unit TNO**

Riouwstraat 7,  
2585 GP The Hague  
P.O. Box 146, 2501 BD The Hague  
Phone 070 - 55 86 00

**Co-ordinating Bureau for Activities in the area  
of Humanization of Work TNO**

Wassenaarseweg 56, 2333 AL Leiden  
P.O. Box 124, 2300 AC Leiden  
Phone 071 - 17 04 41

**TNO Bureau for Hospital Technology**

Da Costakade 45, 3521 VS Utrecht  
P.O. Box 5011, 3502 JA Utrecht  
Phone 030 - 93 51 41

**Division for National Defence Research TNO  
(DO-TNO)**

Koningin Marialaan 21, 2595 GA The Hague  
Telex 31660 tnogv nl  
Phone 070 - 81 44 81

**Laboratory of Electronic Developments for the Armed Forces TNO**

Haarlemmerstraatweg 7, 2343 LA Oegstgeest

P.O. Box 1260, 2340 BG Oegstgeest

Telex 39319 dleok nl

Phone 01711 - 1 92 10

**Physics Laboratory TNO**

Oude Waalsdorperweg 63, 2597 AK The Hague

P.O. Box 96864, 2509 JG The Hague

Telex 32397 pltno nl

Phone 070 - 26 42 21

**Prins Maurits Laboratory TNO****Institute for Chemical and Technological Research**

TNO-complex Plaspoelpolder

Lange Kleiweg 137, 2288 GJ Rijswijk

P.O. Box 45, 2280 AA Rijswijk

Telex 38034 pmtno nl

Phone 015 - 13 87 77

**Institute for Perception TNO**

Kampweg 5, 3769 DE Soesterberg

P.O. Box 23, 3769 ZG Soesterberg

Phone 03463 - 14 44

**Group TNO Policy Research and Information  
(BI-TNO)**

Schoemakerstraat 97, 2628 VK Delft

Telex 38071 zptno nl

Phone 015 - 56 93 30

**Research Centre for Physical Planning TNO**

Schoemakerstraat 97, 2628 VK Delft

P.O. Box 45, 2600 AA Delft

Telex 38071 zptno nl

Phone 015 - 56 93 30

**Study and Information Centre TNO on  
Environmental Research**

Schoemakerstraat 97, 2628 VK Delft

P.O. Box 186, 2600 AD Delft

Telex 38071 zptno nl

Phone 015 - 56 93 30

### **Centre for Technology and Policy Studies TNO**

Laan van Westenenk 501, 7334 DT Apeldoorn  
P.O. Box 541, 7300 AM Apeldoorn  
Telex 36395 tnoap nl  
Phone 055 - 77 33 44

### **Centre for Technical and Scientific Information and Documentation TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 36, 2600 AA Delft  
Telex 38071 zptno nl  
Phone 015 - 56 93 30

### **Patent Information Office (formerly NIDER)**

Patentlaan 2, 2288 EE Rijswijk  
P.O. Box 309, 2280 AH Rijswijk  
Telex 31622 nider nl  
Phone 070 - 90 78 58

### **Bureau of the Netherlands Industrial Council for Oceanology**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 215, 2600 AE Delft  
Telex 38134 iro nl  
Phone 015 - 56 93 30

### **Bureau of the Project Industrial Innovation**

Laan van Westenenk 501, 7334 DT Apeldoorn  
P.O. Box 910, 7301 BD Apeldoorn  
Telex 36395 tnoap nl  
Phone 055 - 33 97 91

## **Institutions connected with TNO**

### **Institute for Agricultural Research of industrial biological, biochemical and chemical products TNO**

Haarweg 8, 6709 PJ Wageningen  
P.O. Box 9, 6700 AA Wageningen  
Telex 45938 ilob nl  
Phone 08370 - 1 91 34

### **Institute for Cleaning Techniques TNO**

Schoemakerstraat 97, 2628 VK Delft  
P.O. Box 70, 2600 AB Delft  
Phone 015 - 56 93 30

**Netherlands Corrosion Centre**

c/o Schoemakerstraat 97, 2628 VK Delft

P.O. Box 203, 2600 AE Delft

Telex 38071 zptno nl

Phone 015 - 56 93 30

**Netherlands Institute for Welding**

Laan van Meerdervoort 2b, 2517 AJ The Hague

Phone 070 - 60 09 37

**Potato Processing Research Institute**

Rouaanstraat 27, 9723 CC Groningen

Phone 050 - 13 03 41

**Council based on the TNO Act of 1930****National Council for Agricultural Research**

Adelheidstraat 84, The Hague

P.O. Box 297, 2501 BD The Hague

Telex 31660 tnoqv nl

Phone 070 - 47 10 21

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January 1984



## **Erratum**

The list on page 117 is not complete.

The following names and addresses should be added:

## **Division for Building and Metal Research TNO (BM-TNO)**

Laan van Westenenk 501, 7334 DT Apeldoorn

Telex 36395 tnoap nl

Phone 055 - 77 33 44

## **Institute for Building Materials and Building Structures TNO**

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This paperback gives a broad outline of R&D facilities available with TNO, the Netherlands Organization for Applied Scientific Research. TNO is a fully independent, nonprofit, research organization with a staff of about 5 000 and an annual research volume of approximately \$ 210 million.

The organization's main fields of interest are: industrial technology, energy, the environment, food and nutrition, health, defence and infrastructure (including building and living). In this connection TNO's activities can be subdivided into three major categories, viz.: explorative research, applied research and the transfer of know-how.

This paperback comprises an alphabetical list of keywords, which may provide easy access to the R&D facilities described.

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