Netherlands organization for applied scientific research

A Key to Research Facilities

Keywords

Keywords

TNO in perspective

TNO is the Netherlands Organization for Applied Scientific Research.
Its primary tasks are to support and assist trade and industry, governments and others in technological innovation and in solving problems. TNO does this by rendering services and transferring knowledge and know-how. Know-how is obtained from TNO's own research, through collaboration with others, or by exchanging or purchasing knowledge.
TNO is a fully independent R&D organization with a staff of about 5000 and a total turnover of nearly 400 million US dollars*) a year.

Features and organization

Features of TNO are:
- Multidisciplinary
- Practice- and market-oriented
- Independent
- Possessing unique know-how and facilities
- International in scope.

TNO's research takes place at a number of institutes and laboratories, spread throughout the Netherlands, most of which can be reached in less than an hour's drive from Amsterdam International Airport Schiphol.

TNO's present organizational structure is outlined on page 2. The management of the Organization is in the hands of the TNO Board of Management.
To make the best possible use of the internal synergy in the Organization, TNO has combined its major activities into seven divisions:
- TNO Environmental and Energy Research
- TNO Building and Construction Research
- TNO Industrial Research
- TNO Nutrition and Food Research
- TNO Health Research
- TNO Defence Research
- TNO Policy Research.

The names of these divisions clearly reflect TNO's major fields of activity. These fields are subject to a multidisciplinary approach.

*) 1 US dollar = NLG 1.87

Organizational structure of TNO

TNO Supervisory Board

TNO Board of Management

F.E. Mathijsen Gerst, M.Sc. *(president)*
Dr. J.H. Parmentier
Prof. dr. A. Rörsch
Dr. W.H.J.M. Wientjens *(secretary)*

Divisions

TNO Environmental and Energy Research

TNO Building and Construction Research

TNO Industrial Research

TNO Nutrition and Food Research

TNO Health Research

TNO Defence Research

TNO Policy Research

Nature of the research

TNO's most important product is knowledge. Its major activities are research, the transfer of know-how and the application of advanced knowledge in products and processes. In this respect three types of activities are distinguished:

- strategic and policy supporting research;
- product and process development;
- services to clients in the form of troubleshooting, testing and analyses.

TNO's research is largely directed at answering questions of practical importance. However, TNO maintains close contacts with basic research institutes, both at home and abroad, in order to translate up-to-date knowledge and insights into practical applications. These relationships range from the execution of joint projects to the establishment of combined institutes.

Clients

Important clients of TNO are governments and industry, both at home and abroad. In addition to carrying out research for individual companies, TNO also works for industrial collectives. This often involves the transfer of knowledge that is of importance for groups of companies or for a whole branch of industry. An important number of industrial clients belong to the small and medium-sized enterprises (SME's).

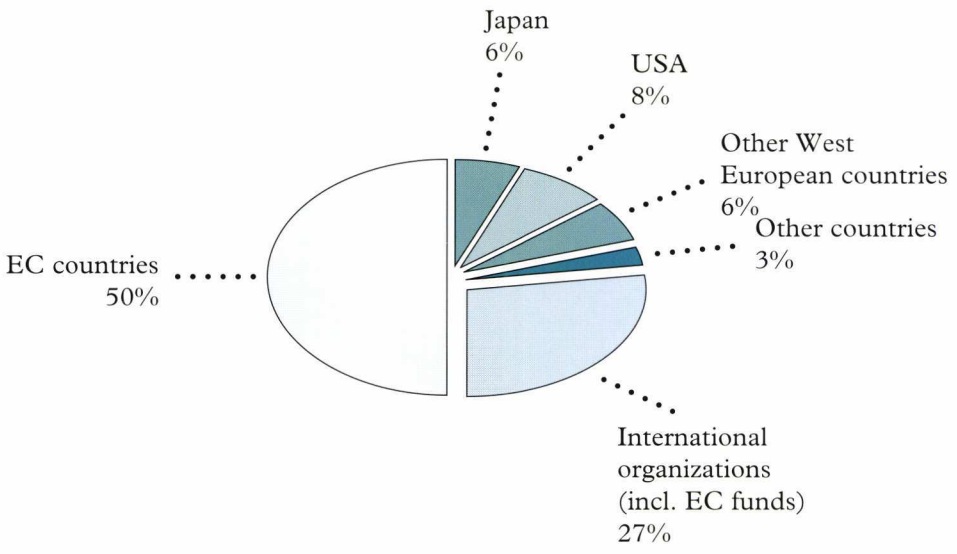
International relations

TNO derives about 23 per cent of its market turnover from contract R&D for the foreign private sector and international organizations. This amounted to some 48 million US dollars in 1991. The foreign clients' share was 35 million US dollars, that of organizations about 13 million US dollars.
A breakdown of TNO's foreign market turnover is shown in the graph below.

TNO's main foreign markets are in Western Europe and in other OECD countries. However, the Organization is broadening its markets in Eastern Europe, the Middle East, the Far East and developing countries.

TNO participates in EC programmes like BRITE, EURAM, ESPRIT, RACE and EUREKA. In addition, TNO has concluded cooperation agreements with several foreign research institutes. These include the Fraunhofer-Gesellschaft (Germany), the British Technology Group (UK), ANVAR (France), the Danish Invention Centre (Denmark), NCTD (Hungary), the Center for Hazardous Materials Research (USA) and the Council of Scientific and Industrial Research (India).
TNO is a member of the European Association of Contract Research Organizations (EACRO), the European Materials Research Consortium (EMARC) and the Federation of European Industrial Contract Research Organizations (FEICRO).

Foreign market turnover
1991: some US $ 48 million



Moreover, TNO carries out contract R&D projects in a number of Third World countries. These involve projects in the fields of water supply, food and nutrition, the transfer of industrial technology, energy, environmental technology, environmentally safe pest control, and projects for small and medium-sized industries.

Unique expertise and facilities

TNO possesses unique expertise and R&D facilities in a wide range of areas. For instance, specific know-how in defence research in areas such as radar, sonar, infrared detection, explosion prevention, protection against toxic agents, rocket technology etc. In the field of product technology TNO offers testing facilities and installations on a semi-technical scale to many branches of industry. Advanced computer simulation packages have been developed in recent years. The facilities for geophysical and groundwater research are also unique, as are those for ecotoxicological research, research in the field of waste treatment and medical-biological research. The Organization also has a large arsenal of special instruments and inspection facilities in all possible fields.
A detailed description of the expertise and R&D facilities of TNO, arranged according to TNO's seven divisions, is given on page 7 ff.

Finance

TNO operates in a business-like fashion, which is keeping with the general philosophy of TNO as an independent research organization.
More than half of TNO's revenue comes from contract research for industry, the government and other bodies. For the part of TNO that is engaged on industrial research this share is considerably greater.
Furthermore, TNO receives government funds to carry out special research projects and for the opening up of new areas of research, for which TNO may determine its own approach.

Doing business with TNO

In principle, research is carried out by TNO under the 'Standard Conditions for Research-and development Instructions given to TNO'. Custom-tailored contracts may also be concluded with TNO, not only regarding the execution of research instructions, but also for the transfer of existing TNO expertise, the granting of patent and know-how licences, consultancy services, and so on. TNO is always prepared to negotiate the terms and conditions under which specific requests of clients can be met.

TNO Marketing Department

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Information officers:
Ms. C.J. de Beer
W.J. van den Brink
A.L. Scholtens

Organization

The TNO Marketing Department comprises the following sections: Strategy and Programme Development; Marketing Planning and Coordination; Contracts Office; International Coordination and Consultancy; and Marketing Communications.

Scope of activities

The TNO Marketing Department supports the TNO organization in preparing and implementing an active marketing and communication policy. Major tasks of the TNO Marketing Department include:

- to maximize coordination between TNO research programmes and the requirements of the national and international markets, including governments, trade and industry, the service sector, contract research organizations, and international funding organizations;
- to coordinate projects involving various discipline-oriented TNO institutes in order to make the best possible use of high-level TNO expertise and know-how;
- to support the TNO organization in formulating overall marketing goals and translate these into specific action programmes.

International cooperation

TNO's foreign markets are mainly in Western Europe and in other OECD countries. However, the Organization is broadening its markets in Eastern Europe, the Middle East, the Far East and developing countries. To implement its international marketing and communication policy, TNO has representatives and agents in various countries.

The TNO Marketing Department operates an inquiry handling desk providing companies and other clients with information about specific TNO expertise and, if applicable, about TNO representatives abroad. Furthermore, the department publicizes TNO through annual reports, brochures, audiovisual presentations and through participation in congresses and exhibitions all over the world.
The free TNO newsletter 'Applied Research' regularly reports on recent findings and developments by TNO.
The department's Bureau for International Coordination and Consultancy acts as a focal point for international projects involving the expertise and know-how of various TNO institutes.

International relations

The TNO Marketing Department represents TNO in the European Association of Contract Research Organizations (EACRO), the European Materials Research Consortium (EMARC), the Federation of European Industrial Contract Research Organizations (FEICRO), and the World Association of Industrial and Technological Research Organisations (WAITRO).

TNO Environmental and Energy Research

Based on the necessity for a sustainable development of society, TNO Environmental and Energy Research aims at contributing, through research and advice, to adequate environmental management, rational energy consumption, and the proper management and use of subsurface natural resources.

TNO Environmental and Energy Research

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Division director:
C.W. van der Wal, M.Sc.
Information officer:
J.J.L. Clavel

Management team:

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Prof. J. Claus, M.Sc.
Prof. W. Harder, Ph.D.
Dr. H. Speelman
Prof. dr. F.B. de Walle
Dr. G.F. Jeurissen (marketing and programme)
M.C. Schravesande, M.Sc. (finance)
G. Visser (personnel)

Organization

TNO Environmental Research comprises four institutes:

- TNO Institute of Environmental and Energy Technology
- TNO Institute of Environmental Sciences
- TNO Institute of Applied Geoscience
- TNO Study Centre for Environmental Research.

TNO Institute of Environmental and Energy Technology

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Deputy directors:
Dr. K.J.A. de Waal
B. Boesmans, M.Sc.
Information officer:
Mrs. F.J.A. van Rede
Staff and personnel:
260

Organization

The institute comprises the following departments: Environmental Technology; Fluid Dynamics; Heat and Refrigeration Technology; Air Pollution Control; Industrial Safety; and Chemical Engineering.

Scope of activities

The Institute conducts R&D on apparatus, systems and working methods that contribute to sustainable developments.

Environmental technology:

R&D on processes, equipment and methods for the abatement or prevention of environmental pollution. Major topics of research include:

- processing of hazardous waste;
- waste recycling, including dismantling of complex products;
- remediation of polluted soils and sediments;
- purification of industrial effluents and groundwater;
- prevention of pollution by process-integrated measures or product developments.

Fluid dynamics:

- Air pollution dispersion (obstacles, dense gas releases);
- wind engineering (wind hindrance, loading);
- wind energy (siting, wake effects, wind mapping, wind loading);
- industrial fluid dynamics (model experiments, computational fluid dynamics).

Heat and refrigeration technology:

R&D and consultancy on domestic and industrial energy technology, heat pumps and refrigeration systems. Topics include:

- testing of domestic central heating boilers and heat recovery units;
- fouling of heat exchangers;
- modelling of energy conversion processes;
- heat pump and heat transformer development and application;
- new refrigeration cycles and fluids.

Air pollution control:

R&D on combustion and gasification of waste and fossil fuels; development and consultancy on air pollution control. Research topics include:

- the incineration of domestic refuse and other waste;
- odour and air pollution abatement by biofiltration and other techniques;
- detection and analysis of odour;
- emissions from industrial installations, boilers and stoves.

Industrial safety:

R&D on the reliability and safety of industrial installations, systems and processes, and of transport and storage facilities. Topics of research include:

- production, storage, transport and use of hazardous substances;
- reliability and maintainability studies of all kinds of technical equipment and complex systems; industrial safety studies: analysis of potential hazards and probability of incidents; risk analysis;
- risk and emergency management: studies of local or regional risks; development of tools for formulating industrial and governmental policies and for decision-making in case of calamities; case studies of accidents and environmental risks;
- development of decision support systems and expert systems for the maintenance of technical equipment, process safety and emergency management.

Chemical engineering:

R&D on new separation processes, with emphasis on the following areas: melt crystallization, membrane technology, new extraction and ad(ab)sorption processes.

Equipment and facilities

- Laboratory and pilot-plant facilities based on physical and chemical technology.
- Atmospheric boundary layer wind tunnels, air pollution dispersion computer models, 2D water flow circuit, double and triple hotwire anemometers, fibre optics Laser Doppler velocity/turbulence measurement equipment, thermistors for wind tunnel measurements of velocities, smoke generators, digital image processing software, computational fluid dynamics software.
- Climate rooms, infra-red camera, test facilities for boilers and small heat recovery units.
- Fluidized-bed furnace (0.4 MWth) for refuse incineration. Facilities for testing incineration equipment, gasifiers and air pollution control equipment. Emission monitoring van with various flue-gas analysers and data acquisition and control system. Special sampling trains for organic microcomponents (e.g. PAH, PCDD/F). Mobile odour detection laboratory for organoleptic detection.
- Software packages for risk analysis: EFFECTS (effects related to outflow, dispersion, explosion, etc.), and RISKCURVES (individual risk contours

and group risk curves). FACTS: industrial accidents databank containing data on a great many accidents involving hazardous substances.
- Various pilot-plants for chemical engineering; explosion-proof test hall.

International relations

The institute takes part in EC and IEA projects.
Scientific contacts through international associations IIR and ASHRAE.
(Multi-)client-sponsored projects are carried out in cooperation with international (petro)chemical industry.

TNO Institute of Environmental Sciences

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Deputy director:
R. Guicherit, Ph.D.
Staff and personnel:
180

Organization

The institute consists of the following departments: Analytical Chemistry, Environmental Chemistry, Biology, and Environmental Biotechnology.

Scope of activities

Analytical chemistry:

Analytical research, development and services in the field of environmental and materials analysis. The department is operating under a strict quality control system certified by STERLAB, the Dutch laboratory certification authority. Areas of research and services include:

- characterization and quantification of industrial emissions;
- metal analyses with atomic spectroscopy and neutron activation analysis;
- metal speciation;
- organic (trace) compounds in air, water, soil and biota from natural and anthropogenic sources e.g. dioxins in waste gases, terpenes, PCB, DMS;
- abiotic degradation and other GLP studies;
- DNA adducts from exposure to environmental contaminants;
- QA/QC services;
- development of reference materials and analytical standards
- asbestos and man-made fibre analyses, particle characterization;
- trouble shooting.

Environmental chemistry:

Research into the behaviour and fate of pollutants, as well as their effects on the abiotic environment; the assessment of measures against pollution. Areas of research include:

- emission registration and analyses for abatement purposes; environmental audits;
- physics and chemistry of pollutants (photo-chemical conversions and (acid) deposition);
- tropospheric chemistry;
- determination of measuring strategies; validation of dispersion models;
- environmental impact studies of emissions from traffic, industry and other sources;
- effects of air pollution on materials;

- policy studies of the effectiveness and cost of measures; model predictions of future developments;
- risk assessment.

Biology:

Biological research into the environmental fate and effects of chemicals, products and wastes:

- ecotoxicity and biodegradability testing of chemicals and products according to internationally accepted guidelines and OECD principles of Good Laboratory Practice;
- research into the effects of chemicals, polluted sediments, waste water, sludges, solid wastes, oil and other substances on specific organisms, populations of organisms or on communities in model ecosystems under semi-natural conditions;
- development of methods for testing chemicals in aquatic, sediment or soil systems, including microbiological and cell-biological stress indicators;
- mathematical modelling for ecotoxicological purposes.
- biological monitoring of chemicals in rivers, lakes and offshore and field surveys for recordings of animal communities;
- risk analysis and risk assessment of ecological effects of chemicals in the (aquatic) environment and general environmental impact studies.

Environmental biotechnology:

Research into the biotechnological abatement of emissions into the environment and the remediation of polluted air, water and soil. Integration of biological with physico-chemical methods. Development of sensors and monitoring systems. Electrochemical research for the environment as well as for energy storage and conversion.

Research topics:

- biofilter research for cleaning air and off gases;
- biological treatment of domestic and industrial waste water;
- application of specialized micro-organisms or consortia and new reactor configurations using immobilized biofilms;
- testing of the behaviour of household chemicals in an experimental large scale domestic waste water purification plant;
- biocleaning of soils and solid wastes;
- sensor research and development for environmental and industrial process monitoring systems;
- electrochemical degradation and removal of pollutants from waste streams;
- electrochemical energy storage, conversion and use (batteries and fuel cells);
- spontaneous heating of materials (coal, dried sludge, etc.).

Equipment and facilities

Gas generation systems for organic compounds at sub ppb to ppm level, advanced gas chromatography and mass spectroscopy, field laboratory with mobile mass spectrometer, liquid chromatography with multiple detection

systems, laser fluorescence instrumentation for sensitive and selective detection, special laboratory for handling extremely toxic samples and materials, atomic plasma emission and absorption spectroscopy, ultra clean laboratory for trace metal analysis, materials analysis by electron microscopy, X-ray micro analysis and FTIR-microscopic analysis.
Instrument calibration facilities. (High-)precision (air) pollution detection equipment with automated data processing facilities. Software for environmental quality modelling, e.g. models for emissions, dispersion, chemical transformation, and exchange among air, water and soil.
Smog chambers for research into atmospheric chemistry. Instruments for measuring emissions and the dry deposition characteristics of pollutants.
Culturing rooms; specialized equipment for ecotoxicological studies. Aquatic (fresh water and marine), benthic and tidal mesocosms of various sizes (up to semi-field scale). Mobile laboratory for research at sea. Equipment for the chemical and biological characterization of semiochemicals.
Experimental facilities for waste water treatment up to 500 p.e. scale, laboratory fermenters, soil columns, landfarm facilities, battery and fuel cell testing facilities, equipment for electrochemical conversion systems, confocal laser scan microscope, ellipsometer, microcalorimeter, optical and electrochemical sensors.

International relations

Umwelt Bundes Amt (Germany), System Application Inc. (USA), Citepa (France), Norwegian Institute for Air Research (Norway), Atomic Energy Research Establishment (UK), Warren Spring Laboratory (UK), Technische Ueberwachungs Verein (Germany), Battelle (USA, Germany), Institute for Hygiene and Epidemiology (Belgium), Fraunhofer Institut (Germany), Institute of Terrestrial Ecology (UK), Riso (Denmark), Danish Maritime Institute (Denmark), University of Hamburg (Germany), University of East Anglia (UK), University of Madrid (Spain), EIVR (Belgium), Bureau Communitair de Référence (EC Brussels), Centre for Hazardous Materials Research (USA), Gesellschaft für Biotechnologische Forschung (Germany), Center for Industrial Research (Norway).

TNO Institute of Applied Geoscience

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Organization

The institute comprises four departments: Geo-Hydrology; Geo-Information; Geo-Energy; and International Cooperation. The institute has formed cooperative relations with the Delft University of Technology, the University of Amsterdam, and with several universities in Europa.

Scope of activities

- Scientific and technological research and development in geosciences, consultancy on the exploration, exploitation and management of subsurface natural resources, and the transfer of expertise in geosciences.
- The institute is the central body in The Netherlands for groundwater data acquisition and monitoring, data analyses and system assessment, modelling and information management. It supplies comprehensive information and state-of-the-art tools for the efficient management, use and protection of groundwater resources.
- The institute is the main independent body in The Netherlands for gas and oil seismic research, reservoir engineering and information management systems and for geothermal energy and energy storage. It conducts state-of-the-art R&D and provides technical consultancy necessary for the efficient exploration, production and management of gas and oil, geothermal energy and the subsurface storage of energy residues.
- The institute is involved in the strengthening of and knowledge transfer to geoscience institutes and government bodies abroad. It is engaged on institutional strengthening, knowledge transfer and technical consultancy, to contribute to the proper management and use of subsurface natural resources abroad.

Equipment and facilities

Hardware and software: geoscience information management and processing and interpretation systems, both on mainframe computers and workstations. Geoscience equipment: telemetric systems for reflection seismics, geo-electrical and EM instruments, well-logging and well-testing equipment.

International relations

The institute carries out geoscience research projects with R&D institutes and universities in most European countries. In the past decades the institute has carried out numerous projects in Africa, Asia and Latin America.

TNO Study Centre for Environmental Research

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30

Organization

The Centre comprises the sections: Waste management and soil protection, Risk management, Effect and evaluation, and Air management, as well as a Bureau for Environmental Impact Assessment.

Scope of activities

- Studies of the environmentally safe management of hazardous waste streams; the logistics of waste disposal and trends with regard to new material substitutions and small quantity generators. Emphasis is placed on waste reduction and minimization and policy studies.

- Studies regarding risk assessment and risk management; management of control options; the role of the human factor in risk reduction; cost-effectiveness of control options; zoning-studies and management of industrial areas.

- Social and judicial studies for policy development; development of regulatory frameworks; evaluation of decision-making processes; studies regarding the corporate management of environmental issues.

- Global integrated air pollution studies emphasizing management and control options; regional air quality studies.

- Completion of integrated environmental impact studies; prediction of environmental impacts of future activities; environmental evaluation of governmental plan making.

International relations

University of Washington, Department of Environmental Health, Seattle, Washington, USA. US Environmental Protection Agency, Cincinnati, Ohio, USA.
Several EACRO partners. Consultancy and R&D firms in Italy and Spain.

TNO Building and Construction Research

TNO Building and Construction Research provides comprehensive research and development service specifically geared to the needs of the construction and engineering industry.

TNO Building and Construction Research

Main office:

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Director:
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Deputy directors:
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Prof. J.W.B. Stark
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Management team:

Prof. J. Witteveen
Prof. J.W.B. Stark
Th. Monnier, M.Sc. (marketing and programme)
F.A. van Eekelen (finance)
R. Schimmel, B.Sc. (personnel)

Organization

By concentrating all its building oriented R&D and consultancy activities in one division, TNO has created the gateway to a wide variety of disciplines concerned with building and construction research.
TNO Building and Construction Research has one branch in Delft and one in Eindhoven.

Centre for Mechanical Engineering and
Department of Indoor Environment, Building Physics and Systems

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350

Organization

TNO Building and Construction Research consists of the following departments and centres: Building Technology; Centre for Timber Research; Centre for Fire Research; Indoor Environment, Building Physics and Systems; TNO-TUE Centre for Building Research; Computer Integrated Construction; Structural Engineering; Centre for Mechanical Engineering; Computational Mechanics; Strategic Studies and Quality Assurance.

Scope of activities

The division undertakes R&D assignments for government agencies, large and small firms in the building industry, materials suppliers, trade organizations and consortia. Detailed advice is provided on design matters, structural engineering, materials selection, damage mechanisms, quality assurance, maintenance and various aspects of project management.
The division has specific expertise in the fields of materials, building technology, indoor environment, building physics and systems, structural engineering, computational mechanics, dynamics, fire research, computer-integrated construction, strategic studies, quality assurance, and standards and regulations. There is also know-how for a range of mechanical engineering subjects, as well as on marine and offshore structures.

Building materials and structures

Structural design and construction technology; finishing the detailing of building components and product innovation. Principles for the evaluation of parts of the built environment. Physical and mechanical properties of materials, moisture transport, thermal insulation, emission preservation of historic buildings.
The mechanical behaviour of concrete, timber and masonry structures. Reliability of existing structures and of structures in the design phase. Computing techniques, realistic models, structural details; fire resistance of structures. Offshore structures. Methodology of building process, systems approach to quality control and maintenance.
Model testing of structures that are difficult to analyse.
Strength and stability of structures. Structural details, joints. Mechanization in building and construction.
The application of information technology in building. FEM in applied mechanics: linear and non-linear analysis of structures with DIANA, a general

purpose finite-element system; utilization of the research results implemented in the product versions of DIANA.
Dynamic problems: vibration phenomena, wind loading and problems in connection with piling. Electronic measuring techniques. Pile diagnostic systems, monitoring of structures and integrity tests.

Fire research

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

Indoor environment, building physics and systems

Research into factors influencing indoor air quality in occupational and non-occupational environments. Major topics of research are:

- physical and chemical aspects of the working environment in industry and in public utility buildings; technical solutions to control these aspects; policy studies;
- the quality of indoor climate in homes; chemical and biological contamination; indoor climate control systems: humidity and dust control and ventilation problems;
- the relationship between indoor environment quality and energy consumption.
- heat technology: energy saving, solar energy, heat storage, building physics;
- building and room acoustics;
- lighting: daylight and electric lighting; electronic control of light; design of combined daylight and electric lighting conditions.

Mechanical engineering

Research with regard to the lifetime and damage prevention of structures and machines subjected to severe mechanical loads. Topics include:

- investigations into fatigue, collapse and unwanted dynamical- structural behaviour with regard to structures and machines;
- new design techniques for structures and machines;
- determination, assessment and optimization of the mechanical behaviour of structures, installations and equipment with respect to safety, reliability, efficiency, durability and environment;
- design and construction of special-purpose test machines, e.g. shock testing;
- design against underwater explosion included shock; design of proper shock specifications, laboratory testing of shock resistance and field measurements during shock testing of ships at sea;
- design-oriented R&D on composites for naval ships, offshore (housing) and the building industry;
- non-linear dynamics of rotating equipment and robot components.
Worldwide field measurements of mass, strain, stress, pressure, force acceleration, velocity of displacement by means of TNO Building and Construction Research instruments (mostly computer controlled).

The development of condition monitoring systems for rotating equipment on the basis of measurement techniques, tribology, structural mechanics and computer technology.

Timber research

Research into wood and wood-based materials. Testing and technical consultancy. Structure of wood and identification of woodspecies. Mechanical and physical properties of wood and wood-based materials. Testing of wood, timber structures, furniture and joinery work. Drying properties of wood; advice on kilns.
Preservation of wood. Wood chemistry; composition, durability, decolourization, bleaching and finishing; wood stabilization.
Technological timber research: joints (e.g. adhesives) and timber engineering, sheet materials, woodwaste.
Quality and tolerance; finishing of surfaces with paints, varnishes, foils.

Strategic studies and quality assurance

Literature surveys, problem analysis, auditing, research programmes, strategic planning.
Model for quality management (MKS).

Equipment and facilities

- Equipment for all standard and one-off tests of building materials. Equipment for the non-destructive and integrity testing of structures; arrangements for the investigation into the weather resistance and the resistance to aggressive substances of building materials and structures.
- Equipment and model techniques for testing water and air permeability. A building with adjustable indoor climate to test the thermo-hygric behaviour, durability and heat insulation of wall and roof structures. Climate rooms.
- Equipment for the full-scale testing of structural elements under static or varying loads up to failure. Measuring equipment for observing the behaviour of structures and for registering phenomena evolving rapidly or slowly in time.
- Apparatus for the integrity testing of foundation piles and for the non-destructive testing of piles and pile foundations.
  Automatic registration facilities for the on-line computer analysis of experimental data.
- Equipment for making and testing realistic models of wood, aluminium and plastic structures on an appropriate scale.
  Computer programs and other computation techniques for the rapid calculation of the distribution of forces in complicated structures. Linear and non-linear analyses of structures: DIANA. Several CAD/CAM systems for specific types of building.
- Furnaces for determining the fire resistance of building components.
- Equipment for determining the reaction to fire of building materials and building contents; facilities for testing fire-extinguishing equipment; smoke detection, etc.

- Test chamber for indoor climate; test chamber for emission rates. Wide variety of mobile automated measuring and detecting facilities for on-site analysis.
- Cyclic force testing machine; shock testing facilities; vibration test facility; deep-water tank; three floors with a large mass; main interference generators; radio frequency interference test facility.
  Various calibration facilities: torque-generating machine; transfer standards up to 5 MN (2.10^{-4}F); differential pressure standard.
- Mechanical testing equipment and wood-working machinery.
  Kiln-drying plant; Incubators for fungal research; plant for semi-industrial impregnation and the manufacture of boards.
  Measuring-van. Wood samples collection.
- CAD/CAE systems for: electronic design, printed circuit board lay-out and mechanical design and manufacturing.
  Clean rooms (up to class 100). Optical measurement rooms. Experimental laser-machining equipment. Solar test and passive solar test facilities.
- Measuring rooms for airconditioning equipment.
- Test facilities for resilient mountings and resilient shaft couplings.
- Experimental host system for the development of on-line information services.

International relations

European Network of Building Research Institutes (ENBRI), Brussels.
Fraunhofer-Gesellschaft (FhG), Germany.
Comité Euro-international du Beton (CEB), Paris.
Réunion Internationale des Laboratoires d'Essais et de Recherches sur les Matériaux et les Constructions (RILEM), Paris.
Fédération Internationale de la Précontrainte (FIP), Paris.
International Institute of Welding (IIW), London.
Conseil International du Bâtiment pour la Recherche, L'Etude et la Documentation (CIB), Rotterdam.
European Coal and Steel Community (ECSC), Luxemburg.
Organization for Economic Cooperation and Development (OECD), Paris.
Inter-Governmental Maritime Consultative Organization (IMCO), London.
International Organization for Standardization (ISO), Geneva.
Convention Européen des Constructions Métalliques (CECM).
European Community (EC), Brussels.
International Shipbuilding Progress (ISP; Delft, Netherlands).
International Cooperation on Marine Engineering Systems (ICMES), Stockholm.
Permanent Committee for Stress Analysis (PCSA; Lyngby, Denmark).
West-European Cooperation in Marine Technology (WEMT; Council Secretariat Delft, Netherlands).
COST (Brussels).
International Instrument Users' Association (IIUA; Breda, Netherlands).
Food and Agricultural Organization (FAO).
International Union for Forest Research Organizations (IUFRO).

TNO Industrial Research

TNO Industrial Research conducts research and renders services in the field of industrial technology. Major target groups are industry, the service sector and the authorities. Industrial technology comprises areas such as physics, chemistry, product development, production technology, materials science, industrial engineering, micro-electronics, computer science and telematics.

TNO Industrial Research

Schoemakerstraat 97
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The Netherlands
Telex 38071 zptno nl
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Phone +31 15 69 69 00

Division director:
K. Vos, M.Sc.
Deputy director:
R.A.P.J. Schulze, M.Sc.

Management team:

K. Vos, M.Sc.
R.A.P.J. Schulze, M.Sc.
P.D. van der Koogh, M.Sc.
Dr. A.P.M. van der Veek
Dr. A. Scheepmaker
J.D. van Zijverden, M.Sc.
T. Frieling, M.Sc.
Prof.dr. A.J. Bogers (programme)
Dr. G.M. Coops (marketing)
W.N. Stassen (finance)
O. de Roos (personnel)

Organization

TNO Industrial Research comprises the following institutes:

- TNO Institute of Production and Logistics Research
- TNO Road-Vehicles Research Institute
- TNO Plastics and Rubber Research Institute
- TNO Product Centre; Institute of Product Design and Development;
- TNO Institute of Applied Physics.

as well as a number of

- Branch-specific Research Centres (see page 34 ff.).

TNO Institute of Production and Logistics Research

Apeldoorn branch:
P.O. Box 541
7300 AM Apeldoorn
The Netherlands
Fax +31 55 41 98 37
Phone +31 55 49 34 93

Acting director:
P.R.M. van Binsbergen, M.Sc.
Staff and personnel:
200

Eindhoven branch:
Horsten 2, building O
5612 AX Eindhoven
The Netherlands
Fax +31 40 43 65 35
Phone +31 40 47 45 17

Acting director:
Prof. dr. A.C.H. van der Wolf

Organization

The main activities of the Institute take place in Apeldoorn. The Eindhoven branch cooperates closely with the Eindhoven University of Technology. The institute has four departments: Production Technology Department, Materials Technology Department (both in Apeldoorn), Production Systems Department and Logistics Management Department (both in Eindhoven).

Scope of activities

Work of the Institute covers a wide range of activities for clients (manufacturers and users of machinery, equipment and installations; suppliers and directly related logistics; and governments and other regulating bodies).

Main fields of activities are:

- materials technology, especially metals and metal matrix composites;
- technology for discrete product manufacturing;
- information technology and process control for both discrete product manufacturing and the processing industry;
- production and logistics management;
- activities concerning the interfaces between these areas.

Apeldoorn branch:

With the emphasis on materials and technology, the Institute is engaged on R&D, consultancy, training and inspections regarding:

- metal cutting operations, sheet metal forming and blanking, laser applications;
- joining technology and assembly processes;
- material engineering, quality, safety and lifetime of products, technical systems and tools.

Activities concerning the design, preparation and production of discrete products; quality, throughput time and delivery reliability.
Activities in the field of production technology and logistics for the clothing and knitwear industry.
Training courses on metal cutting and sheet metalworking technology, machine tool inspection, welding and brazing.

Eindhoven branch:

With the emphasis on information technology applications, process control and logistics management, the Institute concentrates on:

- development and improvement of products, production processes and equipment;
- production scheduling, preparation and materials supply;
- optimization of production processes;
- maintenance and quality control;
- management of internal and external goods flows;
- technical handling of production information.

Equipment and facilities

- Metal cutting and metal forming and blanking: (CNC) machine tools for testing, training, development; flexible manufacturing system (FMS).
- Group-technology based software for production control (MICLASS) and CNC turning (MITURN).
- Equipment for inspection and (acceptance) testing of machine-tools.
- Software for measuring-quipment and machine-tools control.
- Welding and brazing: equipment for submerged arc welding, gas shielded welding, welding robots, high-temperature vacuum furnaces.
- Software for the selection of metal cutting processes.
- Laser facilities: CO2-lasers, Nd-YAG lasers, excimer lasers.
- Equipment for microscopy and analysis (e.g. SEM), chemical analysis and corrosion research.
- Equipment for mechanical testing, fatigue, brittle fracture, creep, tribology.
- General-purpose and dedicated computer facilities.
  The Eindhoven branch has networked access to relevant local and national university computer facilities and has the disposal of the laboratories of Eindhoven University of Technology.
- Dedicated software for process control and simulation (Primal, Dosimis).

International relations

The Institute maintains international working relations with multinationals, universities and research institutes. The Institute participates in some 20 European research projects under ESPRIT, EUREKA, BRITE-EURAM and SPRINT.

TNO Road-Vehicles Research Institute

Schoemakerstraat 97
P.O. Box 6033
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
(Approval Dept: 38335 zptno nl)
Fax +31 15 62 07 66
Phone +31 15 69 69 00

Director:
P.D. van der Koogh, M.Sc.
Assistant director:
G.K. Tanis, M.Sc.
Staff and personnel:
180

Organization

The Institute has three R&D departments: Internal Combustion Engines; Crash Safety Research Centre; Vehicle Dynamics; as well as a Homologation department.

Scope of activities

Research and development on road vehicles and their components. Product evaluation and approval testing regarding properties, design and use of road vehicles and road-vehicle components.

Internal combustion engines:

Application of alternative fuels (LPG, CNG, other gases and alcohols).
Optimization of engines as to efficiency and exhaust emissions for a range of different fuels. Fuel supply and (electronic) control systems.
Mathematical simulation of combustion, heat release and flow processes in engines.

Crash safety research:

Passive safety and biomechanics of injury.
Crash phenomena of vehicles.
Development and application of restraint and protective systems for adults and children.
Development and application of dynamic mathematical crash models.
Development of special crash test dummies.

Vehicle dynamics:

Vehicle-driver dynamics and criteria for stability and manoeuvrability of single and double-tracked vehicles (active safety).
Optimization of vehicle design properties.
Quality aspects of small vehicles.
Transport of handicapped people.

Approval testing:

Testing for vehicle approval in accordance with national and international (EC, ECE, US) regulations.

Equipment and facilities

Engine dynamometers (2 to 600 kW), roller test benches (moped to commercial vehicle) and a fully equipped emissions 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 car-driver experiments (gyrostabilized platform, steering input generator, etc.).
Fatigue and functional test laboratory for small vehicles (bicycles and wheelchairs).
Interlinked computer system for on-line and off-line data processing and model calculation.

International relations

Industries; cooperation with universities in Europe and the USA and with government agencies in a number of countries.
The Institute participates in EC research programmes.

TNO Plastics and Rubber Research Institute

Schoemakerstraat 97
P.O. Box 6031
2600 JA Delft
The Netherlands
Telex 38067 kri nl
Fax +31 15 56 63 08
Phone +31 15 69 69 00

Director:
Dr. A.P.M. van der Veek
Assistent director:
Dr. K.E.D. Wapenaar
Marketing manager:
Dr. J. Olijslager
Information officer:
W. Adriaansen, B.Sc.
Staff and personnel:
150

Zeist branch

Utrechtseweg 48
P.O. Box 108
3700 AC Zeist
Fax +31 3404 5 41 86
Phone +31 3404 4 41 44

Organization and scope of activities

The institute consists of seven working groups and a Business facilities and services group.

Metal-organic chemistry and thin layers

- The synthesis of organic, metal-organic en inorganic compounds on laboratory and semi-technical scale;
- inorganic materials chemistry, e.g. for electrodes, pigments photocatalysts, ceramic fibres, stabilizers;
- (metal organic) chemical vapour deposition (MOCVD).

Polymer chemistry and membranes

- The synthesis of biodegradable, biocompatible, water-soluble polymers, and of functional polymers with, e.g. liquid crystalline, non-linear optical or electrical properties;
- special polymerization processes, e.g. emulsion polymerization, radiation (UV, EB, gamma-)induced polymerization;
- the development of new membranes for separation processes for gases, vapours, aqueous and organic media;
- controlled-release formulations of herbicides, insecticides, repellents, pheromones and of viruses and medicines.

Processing technology and spinning

- Rubber technology: compounding, mixing, moulding and extrusion; new vulcanization systems and recycling;
- injection moulding technology: engineering plastics, SPC, CIM, simulation of the moulding process, technical service;

- spinning technology: hollow fibres for separation and membrane applications and fibres for medical and technical applications;
- processing rheology: computer simulation programs, lateral friction tester, rheological characterization of polymers, recycling, processing technology applications, mixing, extrusion;
- oil rheology: pile-line restart, crystallization, additives.

Composites, joints and durability

- Composite design (CAD), resin transfer moulding (RTM), filament winding, static, dynamic and non-destructive characterization;
- welding and mechanical joints: process development and training;
- adhesive bonding e.g. to plastics, in composites, in moulds, design of adhesive compounds and durability of the bonding;
- long-term behaviour and prediction of mechanical properties of plastics, rubber and composites; influence of the environment.

Functional polymers and applications

- Polymers with specific mechanical, thermal, and processing properties, e.g. main chain liquid crystalline polymers;
- the development of polymers with specific electrical properties, e.g. (piezo-)electrets, EMI-shielding, conducting polymers;
- polymers with other functional properties, e.g. (non-linear) optical, electro-rheological, pyro-active;
- application of these polymers and product development.

Environment, product development and transfer of know-how

- Environmental effects of polymers, life-cycle analyses, recycling, design for recycling, design for disassembly;
- product development, especially for packaging, conduit-pipes, medical and other high-tech applications;
- courses, in-house training, workshops, journals.

Material and product evaluation

- determination of physical-mechanical and chemical-analytical properties in accordance with national, international or in-house developed standards;
- advice, expertise and arbitration with respect to the production and application of plastics and rubber.

Equipment and facilities

Synthetic facilities up to 200 l. MO-CVD and electrochemical equipment. Machines for processing plastics and rubber. Equipment for testing mechanical, dynamical and electricial properties, and weatherability. Analysis techniques, e.g. DSC, GPC, HPLC, FTIR, TGA.
Hollow-fibre membrane spinning equipment.

TNO Product Centre

Institute of Product Design and Development

Oostsingel 209
P.O. Box 5073
2600 GB Delft
The Netherlands
Fax +31 15 60 87 56
Phone +31 15 60 89 09

Director:
Dr. A. Scheepmaker
Information officer:
J.H. Lucas
Staff and personnel:
120

Organization

The Institute comprises several departments: Mechanical and Industrial Design and Engineering; Electronic Design and Engineering; Mechanical Manufacturing; Product Testing; and the CAD Centre.
The Institute collaborates with the Faculty of Industrial Design Engineering of the Delft University of Technology.

Scope of activities

The Institute carries out product development projects for companies both at home and abroad. The goals are to develop new products, renew existing products and to perform applied scientific research on subjects such as CAD in product development, CAD/CAM, CAD/CAD (Product Data Interchange), DFA/DFM, fast prototyping and Design for the Environment.
Assistance is given to industry in every stage of product development.

Product design:

- problem analysis;
- list of requirements and restrictions; specification of product functions;
- brain storming/idea generation;
- concept design;
- visualization (mock ups, renderings and 3D CAD presentations, software prototypes);
- ergonomic studies;
- selection of materials and production methods.

Engineering:

- mechanical construction;
- electronic design/PCB lay out;
- software development;
- simulation;
- test of critical parts;
- selection of manufacturers.

Modelling:

- making of test models and prototypes;
- functional testing;
- preparation for production;
- making pilot series;
- supporting manufacturers.

Product evaluation:

- functionality;
- safety and durability;
- comparative product assessments;
- quality research;
- expertise research.

CAD Centre:

- Consultancy and support to companies regarding the selection, introduction and implementation of CAD/CAM/CAE. Activities include feasibility studies and information analysis, automation plans, the selection of CAD systems, benchmarking, and choice and implementation.
- Product and production development with respect to CAD/CAM/CAE. Projects are carried out for various (groups of) clients and range from short-term, practical orders to longer-term research projects.
- The organization of workshops, seminars, and training courses often in cooperation with industry and suppliers of hardware and software.

Equipment and facilities

CAD system for product design: CAD/CAE system for the design and simulation of electronic hardware. Equipment for the automatic testing of electronic devices, printed boards and components.
Workshop equipped with CNC machines suited for machinery within very narrow tolerances. Fully equipped photo studio and photochemical laboratory. Zeiss machine for high-accuracy, three-dimensional product measurements. Product test facilities.
The Institute's CAD Centre has the disposal of a broad collection of hardware platforms and software programs.

International relations

The TNO Product Centre executes contract work for companies abroad, including product development projects for clients in several European countries and the USA.
The Institute's CAD Centre is involved in the ESPRIT project CIM-Data, as well as in SPRINT and BRITE proposals.
Collaboration with partners in several European countries in the field of PDI (Product Data Interchange).

TNO Institute of Applied Physics

Stieltjesweg 1
P.O. Box 155
2600 AD Delft
The Netherlands
Telex 38091 tpddt nl
Fax +31 15 69 21 11
Phone +31 15 69 20 00

Director:
J.D. van Zijverden, M.Sc.
Finance director:
W. Kooijmans, M.Sc.
Head Project Department:
M.R. van der Kraan
Staff and personnel:
300

Organization

The institute comprises five departments: Acoustics; Heat and Materials; Optics; Instrumentation; and Evaluation Centre for Instrumentation and Security Techniques.
The Institute has legally founded cooperative relations with the Delft and Eindhoven Universities of Technology.

Scope of activities

The Institute's mission is to utilize results of the physical sciences, mathematics, electronics, informatics, mechanics and materials science in the development of new and advanced systems for clients.

Acoustics:

Noise control in and around buildings, industries and machines, in traffic and on board ships; anti-noise.

Heat and flow dynamics:

Development and application of numerical models for flow, heat and masstransport, pulsating flow in pipe systems and flow machinery, development of measuring instruments for thermal parameters.

Materials:

Properties and technology of glass, ceramics (whiteware, technical ceramics, structural ceramics and refractories), X-ray diffraction analysis of crystalline materials.

Optics:

Optical systems, spectrometers (from infrared to X-ray), optical detection systems, sensors and instruments for space science, optical sensors and integrated optics.

Instrumentation:

Development of sensors, electronic design and system engineering, data collection and information networks, image processing and image interpretation, computer applications in signal processing and simulation, biomedical instruments, echo-acoustics.

Evaluation of instrumentation and security techniques:

Evaluation of measuring and control systems, the security of data-communication systems, and the fraud resistance of documents and securities.

Equipment and facilities

CAD/CAE systems for electronic design, printed circuit board lay-out and for mechanical design and manufacturing.
Clean rooms (up to class 100). Optical measurement rooms.
Equipment for testing glass products and for research into the preparation of ceramic coatings by Chemical Vapour Deposition (CVD). X-ray diffraction.
Transmission, reverberation and anechoic rooms; reverberating water tank.
Measuring rooms for airconditioning equipment.
Test facilities for resilient mountings and resilient shaft couplings.

International relations

Projects are carried out for companies abroad, multinationals and international institutions.
The institute regularly acts as a prime or a subcontractor in (very) large projects financed by the European Commission and the European Space Agency, ESA.
The Institute participates in a number of European programmes, such as JESSI, ESPRIT, BRITE, DRIVE, UROP and GERDIEN.

Branch-specific Research Centres

Schoemakerstraat 97
P.O. Box 6034
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 56 03 02
Phone +31 15 69 69 00

Acting director:
T. Frieling, M.Sc.
Staff and personnel:
145

Within TNO Industrial Research, branch-specific research is carried out in five centres:

- TNO Centre for Packaging Research
- TNO Centre for Paper and Board Research
- TNO Centre for Leather and Shoe Research
- TNO Centre for Textile Research
- TNO Centre for Coatings Research.

TNO Centre for Packaging Research

Schoemakerstraat 97
P.O. Box 6034
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 69 62 80
Phone +31 15 69 69 00

Director:
C. Sonneveld, M.Sc.
Staff and personnel:
25

Organization

The Centre has four working groups: Packaging of Agricultural Products; Packaging of Hazardous Goods; Packaging of Industrial Products; and Consumer Packaging and Environment.

Scope of activities

Research, development and consultancy on packaging and packaging materials; trouble shooting, information services, courses, seminars, workshops.

Major topics of research include:

- Packaging for transport, retail and industrial purposes; packaging of agricultural and horticultural products and of hazardous goods.
- Studies of environmental aspects of packaging materials and systems.
- The development of computer models for optimizing packaging systems and for the prediction of quality. Simulation techniques.
- Testing in accordance with international standards.

Equipment and facilities

Climate rooms, drop tables, vibration tables, compression testers. Instruments for measuring permeability to water vapour and gases. Equipment for measuring material properties and the shock absorption of packages. Equipment for testing intermediate bulk containers.

International relations

International Association of Packaging Research Institutes (IAPRI).
United Nations Industrial Development Organization (UNIDO).
International Trade Centre (UNCTAD/GATT).
International Standardization Organization (ISO).
International Packaging Consultants (IPC).

TNO Centre for Paper and Board Research

Schoemakerstraat 97
P.O. Box 6034
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 69 65 11
Phone +31 15 69 66 74

Director:
R.P. Versluijs, M.Sc.
Staff and personnel:
20

Organization

The centre consists of two working groups: Process Technology and Product Technology.

Scope of activities

Paper recycling.
Paper manufacturing process technology.
Wet-end chemistry.
Paper production, control systems.
Product testing, specification, normalization.
Ageing of paper.
Energy conservation.
Environmental problems.
Consultancy, information and documentation.

Equipment and facilities

Pilot plant for paper manufacturing. Product testing equipment.
Laboratories for chemical analysis, microscoping and ageing of paper.

International relations

PIRA (UK);
Centre Technique de l'Industry des Papiers, Cartons et Celluloses (CTP);
Papiertechnische Stiftung (PTS);
European Community (EC);
Spanish Institute for Paper (IPE);
Swedish Pulp and Paper Research Institute (STFI).

TNO Centre for Leather and Shoe Research

Mr. van Coothstraat 55
P.O. Box 135
5140 AC Waalwijk
The Netherlands
Telex 35083 lstno nl
Fax +31 4160 4 17 35
Phone +31 4160 8 42 22

Director:
F.J. van Hulten
Information officer:
Ms. G.A. Verhoeven
Staff and personnel:
20

Organization

The Centre has two sections: Shoe Technology/Leather Technology and Biomechanics.

Scope of activities

Research, development and consultancy on leather and footwear production and leather products.
Raw materials; production process design, product development; quality improvement and quality control.
Improvement of production efficiency; product testing; specification of materials and products.
Biomechanical studies; computer-aided design (CAD) projects; footwear design.
Orthopedic shoes, leather goods, garment and upholstery leather, sportshoes and safety shoes.
Training courses on 'Management', 'Shoe Modelling and Design' and 'Leather and Shoe Materials Quality Control'.

Equipment and facilities

Chemical laboratory, physical laboratory.
CAD/CAM facilities for the shoe industry.
Biomechanical laboratory.

International relations

Shoe and Allied Trades Research Association (SATRA).
European Union of Research Institutes for Shoes (EURIS).

TNO Centre for Textile Research

Schoemakerstraat 97
P.O. Box 6034
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 56 03 02
Phone +31 15 69 66 58

Director:
Dr. J.A. van Aken, M.Sc.
Information officer:
R.B.M. Holweg, M.Sc.
Staff and personnel:
40

Organization

The Centre has five working groups: Chemistry; Process Technology; Physics; Mechanical Technology; and Product Research.

Scope of activities

- Textile finishing processes.
- Environmental problems.
- Energy conservation.
- Product development.
- Quality control.
- Consultancy work.
- National and international standardization.
- Testing, specification and calibration.
- Information and documentation.

Equipment and facilities

- Pilot plants for finishing processes.
- Product testing equipment.

International relations

Forschungsinstitut Hohenstein.
Centexbel.
Svenska Textilforskingsinstitutet.
International Standardization Organization (ISO).
European Community (EC).
Wool Industries Research Association.
BTTG (UK); DWI (Germany); ITF (France); DTNW (Germany).
FEP (Germany).
Wool Research and Development Corporation (Australia).

TNO Centre for Coatings Research

Schoemakerstraat 97
P.O. Box 6034
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 61 28 34
Phone +31 15 69 64 61

Director:
Dr. E.J. Bulten
Staff and personnel:
30

Organization

The Centre comprises the following working groups: Product Development; Corrosion Prevention and Antifouling; Product Evaluation and Testing; Expertise and Consultancy.

Scope of activities

Research, development and consultancy on paints and painted objects. Topics include:

- product development: specialty coatings; water-borne and solventless coatings; antifoulings;
- corrosion prevention: substrate pretreatment; paint application and electrochemical corrosion measurement techniques; lifetime prediction of paint films on different substrates; marine corrosion;
- testing paints and painted objects for mechanical properties, corrosion protection, and weatherability; inspections/trouble shooting, coating defects and failure analysis;
- expertise and consultancy: advising on routing and lay-out in paint facilities along with the introduction of quality control systems (e.g. ISO 9002).

Equipment and facilities

Equipment for the manufacture of paints, for substrate preparation and paint application, UV and EB curing. Equipment for testing paints for weatherability, corrosion protection, mechanical properties, rheological behaviour. Seawater and marine exposure sites. Electro-chemical corrosion impedance measurement. Spectrophotometer for 8/d colour measurements.

International relations

Permanent International Committee for Research on the Preservation of Materials in the Maritime Environment (COIPM). International Standardization Organization, Technical Committee 35 (ISO-TC 35). Fédération d'Associations de Techniciens des Industriens des Peintures, Vernis, Emaux en Encres d'Imprimeries de l'Europe Continentale (FATIPEC). European Coil Coaters Association (ECCA).

TNO Nutrition and Food Research

TNO Nutrition and Food Research conducts technological, biotechnological, analytical, nutritional and toxicological research on foods and allied products, including feedstuffs.

TNO Nutrition and Food Research

Utrechtseweg 48
P.O. Box 360
3700 AJ Zeist
The Netherlands
Telex 40022 civo nl
Fax +31 3404 5 72 24
Phone +31 3404 4 41 44

Division director:
Dr. P. Folstar
Information officer:
K. Waterreus

Management team:

- Dr. P. Folstar
- J.W. van der Kamp, M.Sc.
- Prof.dr. R.J.J. Hermus, M.Sc.
- G.J. Oldeman, M.Sc. (marketing and programme)
- J. Wemmenhove, M.Sc. (finance)
- O.K. Meyer (personnel)

Organization

TNO Nutrition and Food Research consists of:

- TNO Food Technology Institute
- TNO Biotechnology and Chemistry Institute
- TNO Toxicology and Nutrition Institute
- RUL-TNO Centre for Phytotechnology.

TNO Food Technology Institute

Utrechtseweg 48
P.O. Box 360
3700 AJ Zeist
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Telex 40022 civo nl
Fax +31 3404 5 72 24
Phone +31 3404 4 41 44

Acting director:
Dr. P. Folstar
Information officer:
K. Waterreus
Staff and personnel:
90

Organization

R&D departments are: Cereals, Feed and Bakery Technology; Fish Technology; Oils, Fat and Cocoa Technology; Netherlands Centre for Meat Technology.

Scope of activities

- Quality control during all process phases, i.e. from the supply of raw materials up to the finished product and its distribution, including GMP and ACCP.
- Production optimization with respect to raw materials, auxiliary compounds, use of energy, waste streams and the re-use of waste.
- Development of new production processes and techniques.
- Consultancy particularly to small and medium-sized enterprises on equipment, materials, process operation.
- Information technology.

Equipment and facilities

Experimental processing lines for research into meat, fishery products, bakery products, animal feed and oils and cocoa. Climate test chambers, freezer tunnels, packaging systems.
A high-pressure unit for studying extractions and reactions with supercritical gases. Special facilities for microbiological, physical and (bio)chemical research.

International relations

Food and Agricultural Organization (FAO).
World Health Organization (WHO).
FAO/WHO Codex Alimentarius Committee.
European Community (EC).
International Union for Pure and Applied Chemistry (IUPAC).
International Organization for Standardization (ISO).
Office Internationale du Cacao et du Chocolat (OICC).
International Association for Cereal Chemistry (ICC).

TNO Biotechnology and Chemistry Institute

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Telex 40022 civo nl
Fax +31 3404 5 72 24
Phone +31 3404 4 41 44

Director:
J.W. van der Kamp, M.Sc.
Information officer:
K. Waterreus
Staff and personnel:
210

Organization

R&D departments are: Molecular Plant Biotechnology (see page 46); Biotechnology; Biochemistry and Biophysical Chemistry; Food Analysis; Structure Elucidation and Instrumental Analysis.

Scope of activities

- Analysis of all kinds of (chemical) compounds in foods, allied products and feedstuffs, involving trace elements, amino acids, carbohydrates, vitamins, additives and veterinary medicines. Often there is a relation to the quality or authenticity of the products or the study of aromas and flavours.
  Sensorial testing of foods and allied products with panels.
- Investigations into foods for the presence of pesticides, micotoxins and other undesirable residues.
- The investigation between packaging and their food contents in relation to their use.
- The use of specialized instrumental analysis like mass spectrometry, nuclear magnetic resonance and near infra red to determine or define (unknown) compounds or biological material.
- Development of methods for quick detection of microbiological infections in the production chains; research into the production of aromas, flavours and antimicrobial compounds (preservatives) through fermentation.
- Biosafety assessment of processes and production.
- (Bio)technological research into malting and brewing.
- Plant biotechnology on monocotyledonous plants.
- Research into biocatalysis and bioprocess technology, fermentation and fermentor technology and applied microbiology.

Equipment and facilities

Automated and other advanced equipment for large-scale sample analysis; advanced analytical instruments like mass spectrometers, nuclear magnetic resonance, and near infrared methods. Laboratories for microbiological and biotechnological research. Continuously stirred and air-lifted fermentors (up to 200 l). Facilities for production, purification and characterization of enzymes. Down-stream processing facilities.
Ultra-modern malting and brewing pilot plants.
Modern laboratories for plant-biotechnological research.

International relations

European Brewery Convention (Analysis Committee and Barley Committee).
Food and Agriculture Organization (FAO).
World Health Organization (WHO)
FAO/WHO Codex Alimentarius Committee.
European Community (EC).
International Union for Pure and Applied Chemistry (IUPAC).
International Organization for Standardization (ISO).

TNO Toxicology and Nutrition Institute

Utrechtseweg 48
P.O. Box 360
3700 AJ Zeist
The Netherlands
Telex 40022 civo nl
Fax +31 3404 5 72 24
Phone +31 3404 4 41 44

Director:
Prof. dr. R.J.J. Hermus, M.Sc.
Information officer:
K. Waterreus
Staff and personnel:
170

Organization

R&D departments are: Human Nutrition; Experimental Biology; Biological Toxicology; Animal Nutrition and Physiology (ILOB).

Scope of activities

- Research into the noxious effects of compounds that may enter the human body by ingestion, by breathing or through the skin. Most of this research, as well as studies of the nutritional value of specific food components, is carried out with the aid of animal tests or in-vitro tests.
- Epidemiological and clinical studies or studies under standard conditions in a metabolic ward of the relationship between man and his food.
- Determination of the state of nutrition and health of people by analysis of blood and urine and metabolic research into syndromes related to ill-balanced nutrition.
- Studies of the relationship between human medicines and food.
- Clinical trials for human medicine testing in a metabolic ward under controlled food conditions.
- Metabolic studies of the digestion of feed and their components and medicines in animals.

Equipment and facilities

Metabolic units for nutrition research and for controlled clinical trials on medicines. Equipment for: determination of body composition, preparing test animal rations, inhalation toxicity tests and making large number of histological preparations. Laboratory animal test rooms for highly toxic or carcinogenic compounds. Scanning electron microscope. Nutrient data collection (NEVO). Allergen databank (ALBA). Modern analytical instruments like high pressure liquid chromatographs connected to computer systems, spectrometers, fluorometers, enzyme automatons, auto-analysers, liquid scintillation and gamma counters. Metabolic units for studies on digestion with animals. C-unit for studies with radio-isotopes and well-equipped surgery room.

International relations

World Health Organization (WHO). FAO/WHO Codex Alimentarius Committee. International Agency for Research on Cancer (IARC). European Community (EC). Organization for Economic Cooperation and Development (OECD). Food and Drug Administration USA (FDA), Toray Research Center, Japan.

RUL-TNO Centre for Phytotechnology

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Management:
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Dr. F. Heidekamp (TNO)
Dr. A.J. Vijverberg (RUL)
Information officer:
K. Waterreus
Staff and personnel:
35

Organization

The Centre for Phytotechnology represents the collaboration on plant biotechnology between the Department of Molecular Plant Biotechnology (see page 43) and the Department of Plant Molecular Biology from the Leiden University (RUL).

Scope of activities

- Molecular biology and cell biology of monocotyledonous plant species with particular emphasis on the molecular basis of dormancy, on lipid metabolism and protein secretion in germinating barley seeds.
- Research (protein engineering) on anti-nutritional factors in plants (in particular lectins present in leguminous plant species) aiming at a more economic inactivation of lectins prior to consumption.
- Research on the genetic transformation of plants with particular emphasis on monocotyledonous and leguminous plant species using modern plant cell biological methods (including ballistics).
- Research on the regeneration of monocotyledonous and leguminous plant species from multi- and unicellular (cell suspensions, calli, explants, protoplasts, microspores) levels, anthers.
- Production and application of (monoclonal) antibodies for research and for analysis of components of interest in plant material (including non-destructive seed analysis).
- Isolation of natural food preservatives.

Equipment and facilities

Plant growth chambers for controlled growth of plants. Equipment (particle gun) for genetic transformation of plants. Flow cabinets and tissue culture rooms for in vitro culture and regeneration of plants. Equipment for cell biological and biochemical research including spectrophotometers, fluorimeters, liquid chromatographs, liquid scintillation counters. Containment laboratories for research using radio-isotopes and for recombinant DNA research with micro-organisms and plants. Greenhouses. Non-destructive seed analyser.

International relations

Carlsberg Research Centre (Copenhagen). Max Planck Institute (Cologne). Swedish University of Agricultural Sciences (Stockholm).

TNO Health Research

TNO Health Research aims at improving the prevention and treatment of human diseases and disorders by making fundamental and problem-oriented, medical-biological, psycho-social and epidemiological knowledge applicable to public health and health care.

TNO Health Research

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Division director:
Dr. W.F. Stevens

Management team:

- Dr. W.F. Stevens
- Prof. dr. J.J. Haaijman
- Prof. dr. W.R.F. Notten
- Prof. D.L. Knook, Ph.D.
- Dr. J.H.B.M. Willems
- E.J. de Ruyter, M.Sc. (marketing and programme)
- E.J. van der Staak, M.Sc. (finance)
- H.G. van den Bergh, M.LL. (personnel)

Organization

TNO Health Research comprises the following institutes:

- TNO Institute of Applied Radiobiology and Immunology (including TNO Radiological Protection Service)
- TNO Medical Biological Laboratory
- TNO Institute of Ageing and Vascular Research (including the Centre for Medical Technology)
- TNO Institute of Preventive Health Care.

TNO Institute of Applied Radiobiology and Immunology

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Director:
Prof. dr. J.J. Haaijman
Deputy directors:
Prof. dr. J.J. Broerse
H.W. Julius, M.Sc.
Marketing manager:
C. van Leeuwen, M.Sc.
Staff and personnel:
150

Organization

The TNO Institute of Applied Radiobiology and Immunology is a merger of the former TNO Radiobiological Institute, TNO Primate Centre and TNO Radiological Protection Service (see page 51).
The scientific work is organized in four departments: Experimental Dosimetry, Radioprotection, Gene Therapy, and Chronic and Infectious Diseases.
The institute also comprises a Department of Laboratory Animal Sciences (including non-human primates).

Scope of activities

The scientific programme of the Institute is focused in particular on studies of the risks of ionizing radiation and of the genetic predisposition for, and immunobiology of, certain chronic disorders and infectious diseases. On the basis of insight into the mechanisms, and on the basis of the recognition of factors influencing the pathogenisis of these diseases, preventive and curative intervention strategies are evaluated in preclinical animal models. These models provide the baselines for clinically applied treatments and medication.
Some of the research topics are:

- prevention of detrimental effects in man due to exposure to ionizing irradiation, investigation of the risk-benefit balance and quality assurance in medical applications also for the purpose of advising government and industry;
- the operation of a service for individual dose monitoring of radiological workers in the Netherlands (see page 51). Monitoring of radiation levels in the environment, of industrial equipment and in consumer goods. Research on the radiation burden of man in support of governmental policy decisions;
- understanding immuno-regulation and haemopoiesis in order to clarify the pathogenesis of diseases which are influenced by, or related to the immune system with the aim to develop therapies. Therefore, interaction of cytokines with the haemopoietic stem cell and T-cells are studied.
- experimental animal models for chronic diseases (arthritis, Multiple sclerosis, Parkinson's disease) have been developed. Novel (immuno)therapies are evaluated in these models;
- prevention, early diagnosis and therapy of important infectious diseases (AIDS, hepatitis, malaria) using preclinical models;

- the development and testing of gene therapies and pharmaceutical products for the treatment of chronic and infectious diseases as well as the generation of animal models using transgenic mouse and embryo stem cell technology. Exploiting a unique facility for the preclinical evaluation of gene therapy procedures in non-human primates;
- research in the field of molecular pathology and human genome analysis with respect to the biology of the individual cell focused on the detection and quantitation of cells and cellular components;
- detection and treatment of 'Minimal Residual Disease' in leukaemia;
- breeding and handling of rodents and non-human primates (rhesus monkeys, chimpanzees, marmosets, and saimiris), biotechnical support of experiments.

R&D at the institute is performed according to a quality system which is based on NEN 2653 and Good Laboratory Practice according to OECD guidelines.

Animal models

- Arthritis (induced by collagen in rats and rhesus monkeys).
- Encephalomyelitis (induced by myelin basic protein in rats and rhesus monkeys).
- Glomerulonephritis (rat, mercury induced).
- Infection and disease model (respectively in chimpanzees and rhesus HIV_1 HIV_2 / SIV monkeys).
- Monkey models for the evaluation of 'human derived biologicals'.
- Rodent models for efficacy studies of anticancer drugs (leukaemias, solid tumours).
- Rodent models for multidrug resistance studies (anticancer drugs).
- Acute myelocytic leukemia rat model (BNML).
- Lymphatic Leukemia model L4415 (rodents).
- Transgenic mice.
- Total/selective decontaminated animal models (rhesus monkeys, rats).
- Alcohol addiction model (rhesus monkey).

Equipment and facilities

Facilities for housing circa 800 rhesus monkeys *(Macaca mulatta)* including a sizable breeding colony; approximately 100 chimpanzees *(Pan troglodytes)* including a breeding colony of circa 30 females; 100 marmosets *(Callithrix jacchus)* including a breeding colony of approximately 50 animals; 50 squirrel monkeys *(Saimiri sciureus)*. All non-human primates are MHC typed and screened for virus antibody titres (including herpes-B).

A specially designed isolation facility for research into high-risk agents in non-human primates. P3-4 conditions are available for experiments. Reversed isolation facilities are also available.
A rodent breeding nucleus is maintained under germ-free conditions, while the expansion colony is specific pathogen free (rats: 10 strains; mice: 24 strains). The rodent models include germ-free and pathogenic-free mice and rats.
A transgenic mouse facility.
Rooms especially equipped for surgery on large and small animals.
A Microbial Identification System for automated microbial identification.
Immunoassays for all three main types of human and rodent interferons, ELISA systems detecting cytokines of both human and non-human origin, and ELISA's specific for rat TNF-alpha and interleukin-4.
Radiation sources include: X-ray machines, specific dosimetric equipment for photons and neutrons, a Co-60 source (11×10^{12} Bq) for dosimetry experiments, an Sr 90/Y-90 beta source, two-source Cs-137 gamma irradiation facility (27×10^{12} Bq), a mammography installation (Senographe I CGR, tube voltage 20-40 kV, Mo-anode), a Radon exposure chamber, a linear accelerator (Philips MEL SL75), and a Van de Graaff K2N 3000 neutron generator.
Facilities for the handling and counting of radio-isotopes.
A confocal laser scanning microscope, and a variety of flow cytometers (including the Zapper: analysing and selecting 10^5 cells per second) all interfaced with computer systems.

International relations

The TNO Institute of Applied Radiobiology and Immunology has served as WHO Reference Center for MHC typing of non-human primates since 1990. The institute has been an EC sponsored Central Facility for AIDS Research in chimpanzees since 1988, and provides central facilities for malaria research.

Radiological Protection Service

(TNO Institute of Applied Radiobiology and Immunology)

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Director:
H.W. Julius, M.Sc.

Organization

The Radiological Protection Service of the TNO Institute of Applied Radiobiology and Immunology comprises three sections:
Individual monitoring for workers exposed to radiation; General radiation protection investigations and advice; R&D in external and internal radiation dosimetry including radon.

Scope of activities

The Service covers the following fields:

- individual monitoring of workers exposed to external sources;
- National Dose Registration and Information Service (NDRIS);
- internal contamination measurements of individuals;
- calibration of radiation protection measuring instruments;
- radiological safety investigations and advice;
- quality assurance in diagnostic radiology;
- radio-ecological research projects (radon, models);
- gamma spectrometry of samples (e.g. building materials, food);
- development and application of TLD.

Equipment and facilities

- Various calibrated Cs-137 and Co-60 sources;
- X-ray machines (10-250 kV);
- secondary standard for beta dosimetry (Sr/Y-90, TI-204, Pm-147);
- four automatic Thermoluminescence Dosimetry (TLD) systems;
- gammaspectrometer (Ge-detector in low background shielding);
- whole body counter;
- various radiation measuring instruments.

International relations

Participation in international organizations, such as EURATOM, ISO, IEC.
Cooperation with research institutes, e.g.: EML (New York, USA); GSF (Neuherberg, FRG); SCK (Mol, Belgium); NRPB (Harwell, UK).

TNO Medical Biological Laboratory

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Deputy director:
C.J. Lucas, Ph.D.
Information officer:
A.G. Scheffer, M.Sc.
Staff and personnel:
150

Organization

The institute comprises the following research departments and sections: Department of Pharmacology; Department of Neurotoxicology; Department of Genetic Toxicology; Department of Molecular Genetics and Gene Technology; Department of Occupational Toxicology; Department of Immunology and Microbiology.

Scope of activities

Research into the prevention and therapy of intoxication with chemical agents, microbial infection, radiation damage, chronic neurological diseases. Molecular genetics.

Research into chemical agents:

- development of methods and strategies to quantify the external exposure via inhalatory and dermal route and to investigate factors influencing dermal exposure;
- development of methods and strategies for biological monitoring;
- establishment of health-based recommended occupation exposure limits;
- the (neurotoxic) effects of toxic materials and pertinent antidotes on intact animals and isolated organs;
- the mechanism of action of neurotoxic chemicals at the molecular level;
- effects on DNA; detection and identification of reaction products;
- cellular repair of damage in DNA;
- the mechanism of chemical mutagenesis;
- the relation between DNA damage and biological effects of mutagenic and carcinogenic compounds; evaluation of health risk involved in exposures to such compounds; skin protection; methods for biological monitoring and for detecting early health effects;
- general classification of and information about poisonous substances;
- tumour therapy.

Microbiological research:

- immunology of the respiratory tract;
- the mechanism of protection against aerogenic infection;
- bacteriology of laboratory animals;
- CARA.

Research on the biological effects of radiation:

- effects on microorganisms and cells of higher organisms;
- the induction of DNA strand breaks and their persistence; the detection and identification of other DNA lesions;
- dosimetry of ionizing radiation on the basis of DNA damage induced;
- risk evaluation of skin exposure to UV; effects of microwaves on laboratory animals;
- the mechanism of action of radio-protective agents.

Recombinant DNA research:

- study of the regulation of the expression of genetic information in bacteria, eukaryotic microorganisms and mammalian cells;
- the development of vaccines based on parts of the coat protein of infectious viruses;
- the development of host/vector systems for various organisms suitable for the production of, among other things, proteins of medical interest;
- the development of bioconversion methods for, e.g. waste disposal.

Immunological research:

- the improvement of monoclonal antibody generation;
- the possible role of (synthetic) peptides in the antigen presentation in the immune system;
- AIDS and multiple sclerosis research;
- mucosal immunity;
- oral vaccination;
- allergic reactions;
- immunotoxicology.

Equipment and facilities

Electron microscope, Laser scan microscope, Gas Liquid Chromatography, High Performance Liquid Chromatography, Atomic Absorption Spectrophotometer, and Mass spectrometer. Isotope laboratories. CI, CII and CIII facilities for recombinant DNA experiments. Facilities for handling mutagenic and carcinogenic substances. Equipment for long-term inhalation studies; equipment for animal behavioural studies.

International relations

Various foreign universities. North Atlantic Treaty Organization (NATO). Anglo-Netherlands-Norwegian Collaboration Projects (ANNCP). International Commission for Protection against Environmental Mutagens and Carcinogens (ICPEMC). European Neuroscience Association (ENA). World Health Organizatioin (WHO). United Nations Development Programme. International Society Neuroimmunology Inc. International Neurotoxicology Association (INA). European Community (EC). Sister laboratories for Nuclear, Biological, Chemical (NBC) research in UK, USA, Belgium, France, West Germany and Norway.

TNO Institute of Ageing and Vascular Research

Gaubius Laboratorium
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P.O. Box 430
2300 AK Leiden
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Phone +31 71 18 18 18

Managing director:
Prof. D.L. Knook, Ph.D.
Director of research:
Prof. P. Brakman MD, Ph.D.
Assistent director:
Jhr. F.J. de Ranitz, MSc.

Organization

The Institute is a merger of the former TNO Gaubius Institute, TNO Institute of Experimental Gerontology, and TNO Medical Technology Unit. Research has been organized in five departments: Endothelial Cell and Lipids; Pathology and Immunogerontology; Fibrinolysis and Proteolysis; Dementia and Cell Physiology; and the Centre for Medical Technology (see page 55).

Scope of activities

Biomedical research with emphasis on understanding, diagnosis and alleviation of age-related diseases and on diagnosis, therapy and prevention of vascular disease.
Mechanism of organ ageing; molecular biology, cell- and organ physiology.
Impact of nutrition on the process of ageing.
Pathophysiology of immunological system with age.
Pathophysiology of the fibrinolytic system, including its relation to rheumatic disorder.
Drug testing of hypolipidemic and fibrinolytic agents.
Pathophysiology of the endothelium.
Protein targeting and development of monoclonal antibodies.
Medical technology (see Centre for Medical Technology, page 55).

Equipment and facilities

General biochemical equipment.
Culture of human cells and tissues.
Ageing colonies of mice and rats.
Histology and pathology facilities including electron microscopy.
Transgenic mice technology.
Facilities for producing and characterizing monoclonal antibodies.

International relations

EC: European Late Effects Group (EULEP) and ECAT (EC concerted action for the detection of the tendency to trombosis).
Research projects are carried out in close cooperation with research groups abroad and with internationally operating biotechnology and pharmaceutical companies.

Centre for Medical Technology

(TNO Institute of Ageing and Vascular Research)

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Head:
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Information officer:
J. Boter, B.Sc.

Organization

The Centre is part of the TNO Institute of Ageing and Vascular Research. The Centre also includes the Health Care Technology Assessment (HCTA) programme of TNO Health Research.

Scope of activities

Support to health care institutions, the medical devices industry, governmental and private organizations, with respect to medical technological subjects. The Centre provides information and consultancy services.

- Calibration and testing of medical ultrasonic equipment.
- Development of quality guidelines for medical devices.
- Application of the Directives of the European Communities (EC) and pertinent laws and standards for all kinds of medical devices.
- Development of quality procedures for health-care institutions and supporting hospital management in this field.
- Testing of medical devices and installations with respect to performance, safety, Electric Magnetic Compatability (EMC) and other aspects for industries, hospitals and governmental bodies.

Equipment and facilities

Measuring instruments and other facilities for testing the performance and safety aspects of medical appliances under various conditions. Database on medical devices and related data, literature, applicable standards and alerts.

International relations

Test houses for medical equipment e.g.: TUV (Germany); B.S.I. (UK); VTT (Finland); GLEM (France).
Advisory Institutions on medical equipment (e.g. ECRI in the USA).
Governmental institutions in Italy, UK and France.
World Health Organization (WHO).
Member of EMEDCA.

TNO Institute of Preventive Health Care

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Deputy directors:
Dr. A. Dijkstra
Prof. dr. F.D. Pot
Information officer:
A.A. Jurriëns, M.Sc.
Staff and personnel:
165

Organization

The scientific work is organized in the following departments: Public Health and Epidemiology; Child Health; Environment, Behaviour and Health; Occupational Health Research; Work Research; Posture and Movement Research; Statistics and Informatics; Education.
The institute also comprises two study groups on specific fields of research: Tuberculin Research Unit and Centre for Medical Informatics.
In addition, the institute accommodates bureaus of the following coordinating and advisory committees: TNO Expert Committee on Humanization of Work (HUMAR), Occupational Health Research Committee (CARGO) and TNO Rheumatic Diseases Research Committee.

Scope of activities

The institute supports preventive actions in society by means of applied scientific research, educational activities, advice and services. This support is given to the government, authorities and professional groups within the preventive health care system and to industry (employers and employees). Within the broad area of prevention the institute concentrates on five fields of research.

Public health and epidemiology

- Health policy development;
- development and organization of preventive health care;
- healthy ageing.

Child health

- Perinatal and paediatric epidemiology;
- morbidity surveillance and monitoring child health;
- preventive child health care (0-19 years); evaluation of effects of preventive programmes and measures;
- social and community paediatrics;
- preventive dental health care.

Environment, behaviour and health

- Safety;
- perception of/and behaviour towards environmental pollution;
- mobility, elderly and health;
- strategies for intervention.

Work and health

- Epidemiology of diseases/sickness absenteeism;
- mental stress;
- preventive occupational health care and occupational health services;
- quality of working life policy in companies;
- work, technology and organization;
- accessibility of the labour process for the handicapped;
- physical factors and work;
- posture and movement research.

Statistics and (medical) informatics

In the field of preventive health care the institute contributes to the improvement of community and occupational health data systems through:

- advice on setting up computerized information systems and registrations;
- advice on the statistical and methodological aspects of data analysis;
- the development of expert systems and specific-purpose software.

Education

An essential condition for the practical application of the results of scientific research is the transfer of knowledge to professionals in the preventive health care system. The institute therefore provides post-doctoral training to physicians on the following subjects: occupational health care; child health care; public health care; environmental health care. In addition, individual courses are given in social medicine, focused on one particular area. Furthermore, specific seminars and courses are organized.

Equipment and facilities

Laboratory for posture and movement analysis. VAX-computer system for statistical analyses in epidemiological, psychological and sociological research projects.

International relations

World Health Organization (WHO). Commission of European Communities. Medical Research Council, London. International Labour Organization (ILO). National Institute of Health (USA). Fraunhofer Gesellschaft (Germany). Institutes of Public Health. Institutes of Occupational Health. International Union against Tuberculosis.

TNO Defence Research

The organization of defence research in the Netherlands is unique. Contrary to the other NATO countries where defence research laboratories occupy an isolated position, most of the research in the Netherlands is carried out by TNO Defence Research. The research is coordinated by the National Defence Research Council.

TNO Defence Research

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Division director:
C.M.N. Belderbos, M.Sc.

Management team:

- C.M.N. Belderbos, M.Sc.
- P. Spohr, M.Sc.
- E.B. van Erp Taalman Kip, M.Sc.
- Dr. A. van Meeteren
- Dr. H.J. Pasman (marketing and programme)
- J.A. Vrijmoet, (finance)
- H.P.C. Steijvers, M.Sc. (personnel)

Organization

TNO Defence Research consists of three institutes:

- TNO Physics and Electronics Laboratory
- TNO Prins Maurits Laboratory
- TNO Institute for Perception.

TNO Physics and Electronics Laboratory

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Phone +31 70 3 26 42 21

Managing director:
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Director of research:
Dr. J.W. Maas
Information officer:
W.L. Smith
Staff and personnel:
514

Organization

The institute comprises five R&D departments: Operations Research; Information Technology and System Development; Radar and Communication; Physics and Acoustics; and Technical Development.

Scope of activities

Policy support:

The institute's policy support activities concern decision-making on the procurement of matériel, operational requirements, tactics, training and force structure analysis. The primary areas of application include air defence, anti-armour warfare, submarine warfare, mine warfare, airbase operations and integrated logistics.

Topics are:

- defining relevant key factors;
- structuring the weighing process of conflicting factors;
- quantifying the consequences of policy issues;
- optimizing the deployment of systems based upon agreed effectiveness criteria;
- increasing the speed of decision processes by developing decision-support systems;
- improving military staff readiness by creating management games and tactical trainers.

Information technology and telecommunication:

- Information technology research is directed towards the integration of existing and new techniques for use in the design of military information systems. Current items of research are: data fusion; artificial intelligence; computer assisted instruction; neural computing; high-speed parallel processing; real-time simulation of sensors and visual systems; security of information systems; software engineering.
- Communications research serves to evaluate the use of military communication networks and radio links and to develop future system concepts. Current subjects include: tactical data links and net radio; network management; integrated services networks; mobile communication on HF, VHF and UHF; the influence of propagation effects on link reliability; security of communication systems.

Sensor technology:

Efforts focus on sensors in the microwave range (radar), in optics and IR (infrared), and in acoustics. The activities encompass the characteristics of sensors proper as well as subjects closely connected with the use of sensors, such as propagation effects, target signatures and signal processing.
Current items of research are:

- Radar
  Properties of multifunction radar for detection, tracking and target classification; active phased-array radar antennas with gallium-arsenide MMIC's (monolithic microwave IC's); SAR (synthetic aperture radar) technology; millimetre wave propagation; radar signatures of targets and backgrounds; ESM (detection, localization and classification of radar and radio transmitters); remote sensing of sea surface and land surface.

- Optics and IR
  Propagation effects in the atmosphere; CCD (charge coupled device) sensors; signal and image processing; integrated optics; laser sensors; IR signatures of targets and backgrounds; automated detection of heat sources; IR multi spectral discrimination.

- Acoustics
  Sound propagation in the ocean; sonar range predictors; target motion analysis; towed-array configurations, technology and signal processing; seismic sensors for battlefield surveillance.

System development:

This area of activity covers the evaluation of weapon and sensor systems as well as the design and development of information and communication systems, sensor systems, trainers and simulators.
Current subjects include: command and control information systems; phased-array radar systems; SAR systems; towed-array sonar systems; CCD camera systems; IR detection and measurement systems; traffic control systems; communication terminals; trainers and simulators for education, tactical training and operator training.

Equipment and facilities

EMP generator. Near-field RCS. MMIC-development facilities. Anechoic room. TEMPEST test arrangement. CAD/CAM.

TNO Prins Maurits Laboratory

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Director:
E.B. van Erp Taalman Kip, M.Sc.
Programme director:
M. van Zelm, M.Sc.
Information officer:
P.P.M.M. Wittgen, Ph.D.
Staff and personnel:
270

Organization

The Institute comprises three R&D departments:

- Toxic substances, with research groups on: Respiratory protection and Adsorption; Skin Protection and Decontamination Control; Chemical Toxicology; Analytical Chemistry;
- Munition Technology and Explosion safety, with research groups on: Properties of Energetic Materials; Pyrotechnics and Energetic Materials; Rocket Technology; Explosion Prevention and Protection;
- Weapons and Platforms, with research groups on: Ballistics; Weapon Effects; Pulse Physics.

Scope of activities

Toxic substances

R&D in the field of protecting humans against toxic substances (chemical warfare agents, in particular); R&D with respect to chemical problems of interest to the armed forces. Investigations for civilian clients.
Areas of research include:

- Study of the mechanism of action of toxic compounds and the development of effective antidotes for prophylactic and therapeutic application.
- Identification and quantitative determination of toxic compounds in the environment with the aid of modern analytical chemical techniques; the development of detection and warning systems.
- R&D on effective means of protecting humans against toxic compounds (respiratory protection, skin protection and decontamination, purification of air, decontamination of materials and equipment contaminated with toxic substances).
- Study of problems in the field of weapon control and disarmament and verification measures connected with it.
- Dispersion of gas and aerosol clouds in relation to risk analysis.
- Small-scale energy supply.

Munition technology and explosion safety

R&D in the area of processing, testing and functioning of pyrotechnic substances, propellants and explosive charges. Research on the safe use of such hazardous materials and the promotion of safety during production, transport and storage. This expertise is applied in the area of munition technology and the safe storage of munition as well as in the area of propellant technology for space applications and explosion safety in the process industry.

Areas of research include:

- Development of pyrotechnic compositions (including igniters), functional testing and ageing studies.
- Plastic-bonded energetic materials: research on compositions, processing behaviour and processing techniques for less sensitive explosives.
- Initiation, deflagration to detonation transition, detonation, detonation trains.
- Explosive (de)forming of metals, explosive compaction of ceramic powders.
- Explosive ordnance disposal techniques.
- Thermal stability, compatibility and explosion behaviour of energetic materials.
- Testing and lifetime prediction of rocket motors including high-performance, chlorine-free, solid propellants and gas generators for space application.
- High-speed, air breathing engines, solid and fuel ramjets, ducted rockets.
- Research on mechanisms of gas, dust and mist explosions: experimental determination and numerical simulation of the explosion and possible preventive measures.
- Quantification of the effect of explosions: propagation of blast and shock waves, interaction with structures.
- Protection: protective measures for explosion safety, risk analysis of munition storage and transport classification of dangerous goods.

Weapons and platforms

Research and technology development in relation to munitions, guided weapons and present and future cannon and weapon systems. Research on the improvement and evaluation of ballistic protection and vulnerability of platforms against the effects of explosions and projectile impact.

Areas of research include:

- Terminal ballistics, fragmentation of munitions, penetration of projectiles, functioning and performance of shaped charges.
- Ballistic protection: reactive armours, composite armours, ceramic armours, personnel protection.
- Pulsed-power research, physics of power compression and switching of high currents.
- Electromagnetic launch research: studies of sliding contacts, plasmas and accelerators, hypervelocity impact projectile concepts, electromagnetic cannon systems.

- Vulnerability studies of weapon platforms and systems: vehicles, ships, fixed-wing aircraft, helicopters and missiles.
- Lethality models, survivability of systems, weapon-target interaction studies.
- Combat simulations.

Equipment and facilities

Laboratories for the synthesis and investigation of highly toxic substances and radioactive-labelled chemical compounds. Equipment for testing means of protection. Explosion prevention laboratory. Pyrotechnic laboratory. Test-stand for rockets. Equipment for testing explosives. Ballistics laboratory. Pulse physics laboratory.

International relations

North Atlantic Treaty Organization (NATO). European Community (EC). Organization for Economic Cooperation and Development (OECD). United Nations (UN).

TNO Institute for Perception

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Dr. A. van Meeteren
Assistant director:
Prof. J. Moraal
Information officer:
J. Boogaard
Staff and personnel:
115

Organization

Research is conducted in the following departments: Perception; Information Processing; Skilled Behaviour; and Work Environment.

Scope of activities

Basic and applied research in the main areas of human information processing in relation to the task environment.

Sensory processes:

- Vision: observer performance with electro-optical devices; target detection and acquisition; visual search; colour vision; ergonomics of visual aids.
- Speech and hearing: speech transmission and speech processing; voice control; tone perception and hearing thresholds; noise annoyance; hearing loss and protection; acoustics.
- Vestibular sensing: effect of g-forces on spatial orientation; dose-effect relations of the vestibular system, motion sickness.
- Heat-balance: climatic conditions, clothing and physical effort; protection in cold conditions; work-rest schedules for heavy work in protective clothing.

Information processing:

- Cognitive skills: memory; (distributed) decision making; command and control systems; knowledge elicitation for expert systems; pattern recognition.
- Process control: information presentation on VDU's; network analysis in complex processes; monitoring behaviour of operators; computer graphics.
- System control: ship control modelling; remotely piloted vehicles (RPV's); vehicle handling; attention distribution in the visual field; information systems for roadways and vehicles.

Ergonomics/human factors:

- Workplace design: mock-ups and simulations; multi-purpose workstations; control-room design; interfaces for vehicle control; lighting and illumination.
- Roads and traffic: lighting, signs, delineation; ergonomics of vehicle design and roads; analysis of accidents and road environment.

- Clothing and packing: backpacks and equipment for the military; professional civilian clothing; the effects of clothing and equipment on task performance.
- Visual ergonomics: readability of printed material; visual aids.

Human skill and task load:

- Mental load: measurement of mental load and the development of standard equipment.
- Stress: stress-evoking working conditions; vulnerability for stress; physiological correlates of fatigue and stress; the effects of stress on task performance.
- Selection and training: dimensions of skill development, advanced computerized learning systems, training aids and simulation; validation of training aids; selection for heavy tasks (flying, diving); the retention of skills.

Equipment and facilities

Visual and auditory test facilities (high-noise, anechoic and reverberation rooms), speech communication evaluation equipment, driving and ship navigation simulator, instrumented car for road user studies, command and control laboratory, climate chambers, equipment for vestibular research (tilting room, longitudinal acceleration device, ship motion simulator, rotating chair).

TNO Policy Research

On the basis of strategic research, TNO Policy Research advises trade and industry, governments and service-rendering organizations on technological developments, technology management and spatial organization. In this regard, services are provided concerning innovation, creativity, quality care, and literature and patent searches.

TNO Policy Research

Schoemakerstraat 97
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2600 JA Delft
The Netherlands
Fax +31 15 56 48 01
Phone +31 15 69 67 91

Division director:
Dr. C.L. Ekkers
Information officer:
Ms. A.J. van der Voort

Management team:

- Dr. C.L. Ekkers
- F. le Clercq, M.Sc.
- Dr. R.E.H.M. Smits
- J.C. Daamen, MA (marketing and programme)
- E. Jensen (finance)
- J.P. Kaper, MA (personnel)

Organization

TNO Policy Research comprises three institutes that perform policy research:

- TNO Institute of Spatial Organization;
- TNO Centre for Technology and Policy Studies;
- TNO Technology Management Group.

TNO Institute of Spatial Organization

Schoemakerstraat 97
P.O. Box 6041
2600 JA Delft
The Netherlands
Fax +31 15 62 43 41
Phone +31 15 69 68 68

Director:
F. le Clercq, M.Sc.
Deputy Director:
A.G.G. Op 't Veld, M.Sc.
Staff and personnel:
65

Organization

The Institute comprises the following sections: Demographic Analysis, Application and Consultancy; Housing; Spatial Economy and Technology; Ecology and Policy; Logistics; Traffic and Transport; and Strategic Urban Management.

Scope of activities

- Research in the fields of urban and regional development, ecology, traffic, transport and logistics in Western Europe in general, and in the Netherlands in particular.
- Analysis of demographic developments and their consequences for e.g. physical planning, housing programming, including maintenance and improvement, labour market problems.
- Analysis of and research on economic and technological restructuring and modernization processes. Advice on economic and physical development and related land-use problems. Development and application of concepts and models concerning regional and sectoral economic developments.
- Research and advice on (future) transport demands; practical aspects of quantitative planning models; financial economic aspects, urban and regional processes and related land-use problems; environmental aspects in the broad sense; application of information technology and the structure of information systems.
- Analysing developments in the logistical organization of companies especially regarding transcompany and intercompany aspects; developing instruments for the strategic logistical decision making of companies.
- Spatially oriented information systems.
- Policy analysis related to urban and regional development, methods of strategic planning and decision making.
- Ecological aspects of urban and regional development and related decision making.

International relations

Université de Lille, (France); John Hopkins University Baltimore (USA); Organization for Economic Cooperation and Development (OECD), Paris (France); Fraunhofer Gesellschaft (Germany). EC, Brussels (Belgium).

TNO Centre for Technology and Policy Studies

Laan van Westenenk 501
P.O. Box 541
7300 AM Apeldoorn
The Netherlands
Telex 36395 tnoap nl
Fax +31 55 42 14 58
Phone +31 55 49 35 00

Director:
Dr. R.E.H.M. Smits
Information officers:
J. Bonzet
B.M. van de Ven
Staff and personnel:
35

Organization

The Centre comprises three research teams: Technology, Economy, Organization and Strategy; Technology and Society; and Information Technology, Telematics and Media.

Scope of activities

Technology and economics:

Research to contribute to industrial and technological policy reviews; long-term research programmes on diffusion of technology; the evaluation and monitoring of different technology policy instruments; industry and service sector studies.

Technology and labour:

Studies of the interaction between technological developments and the qualitative and quantitative changes in labour; studies to enhance the insight into the possibilities of guiding the processes of technological and organizational change; the exploration of feedback mechanisms of social criteria and norms to the technical design of production processes.

Technology and education:

Effects of technological change on the educational system; the development of methods and instruments to prognosticate the effects of technology on the education system.

Biotechnology:

The social and economic aspects of new biotechnology; industrial and social basis for new developments.

Technology assessment:

Factors that influence the process of public or social decision-making on science and technology.

Technology and environment:

The development of environmental technology policy; clean technologies and economic aspects of sustainable development and integrated chain management.

Communication of industrial risks and environmental regulation:

Studies of the public concern about industrial hazards; risk perception by individuals; problems associated with the communication of industrial risks to people.

Information technology, telematics and media:

Research into the development of (electronic) information and communication services in relation to social, economic, technological and institutional processes of change.

Equipment and facilities

Database and library on topics related to the scope of activities.

International relations

ISI-Fraunhofer Gesellschaft (Karlsruhe, Germany), SPRU (Brighton, UK), IDATE (Montpellier, France), TPU Aston Business School (Birmingham, UK), CEM Tufts University (Medford, USA), EC-DGXII and DGXIII, Belgium).

TNO Technology Management Group

Acting director:
Dr. C.L. Ekkers
Staff and personnel:
52

Organization

The TNO Technology Management Group comprises four professional units - specialized in different aspects of technology management - that provide consultancy, training and information services:

TNO Innovation Consultancy Group
Schoemakerstraat 97
P.O. Box 6042
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 56 08 25
Phone +31 15 69 68 23

TNO Centre for Information and Documentation
Schoemakerstraat 97
P.O. Box 6043
2600 JA Delft
The Netherlands
Telex 38071 zptno nl
Fax +31 15 56 08 25
Phone +31 15 69 68 00

TNO Patent Information Office
Patentlaan 2
P.O. Box 309
2280 AH Rijswijk
The Netherlands
Fax +31 70 3 99 91 76
Phone +31 70 3 98 66 66

TNO Quality Management Project Group
Laan van Westenenk 501
P.O. Box 342
7300 AH Apeldoorn
The Netherlands
Telex 36395 tnoap nl
Fax +31 55 49 34 39
Phone +31 55 49 34 40

Scope of activities

Technology is a key resource of profound importance for industrial profitability and growth. The TNO Technology Management Group assists organizations who seek full utilization of this resource for their competitive position, both at a strategic and an operational level.

Innovation consultancy

The Innovation Consultancy activities focus on three areas: innovation management, technology management, and business development SME's.

Innovation management
Using a combination of specialized consulting skills and the expertise of TNO in various fields of technology, the Group aims to increase the innovative performance of companies. Special working areas are:
- Consultancy work for organizations in search of new activities; this work is characterized by a systematic approach from strategic analysis to business development, targeting for new products, services, markets and technologies.
- Supporting company management on the subject of vision building and strategy development, using creative and analytical techniques and research on trends in technology, market and society.
- Creative problem solving in deadlock situations in the areas of technology, market and management that need break-through solutions.
- Training and workshops on 'Innovation Management', 'Strategy Development' and 'Creative Problem Solving'.

Technology management
Technology management deals with strategic issues associated with technology. In cooperation with specialists from other TNO institutes the Group provides consultancy and research services to the management of R&D-intensive companies on:
- policy, programming and organization of R&D;
- evaluation of new technologies and technology audits;
- marketing of R&D results;
- R&D cooperation at intra- and intercompany level.

Business development SME's
The Group aims to stimulate in practice business development in small and medium-sized enterprises (SME's). To this end use is made of various specially developed methods and techniques, the validity of which has been proven over an extended period of time. Key activities are:
- Special forms of entrepreneurship and development assistance to newly established firms, mostly New Technology Based Firms (NTBF's). General consultancy to small and medium-sized industrial firms.
- Organizing workshops for managers of small and medium-sized enterprises (SME's), addressing different aspects of company development, strongly based on the exchange of experiences among participants (Starter Inns, Manager Inns).
- Advice to intermediary organizations on SME-policy.

Information and documentation

- The TNO Centre for Information and documentation provides information retrieval services based on published technical and scientific information published, as well as references to marketing, business and management information and factual data. The Centre has access to over 1000 international databases, mostly on an on-line interactive basis.
- Current awareness services on a weekly or monthly basis; the latest literature and patents can be monitored for new developments.
- Setting up inventories of on-going technological research in different fields, in cooperation with the Netherlands Research Database (NOD).
- Training for information managers regarding information retrieval systems.
- Consultancy on computerized information retrieval methods, database building and information management.

Patent information

The TNO Patent Information Office provides services in the field of patents and patent information for industrial firms and patent attorneys. Services are rendered to clients all over the world, and comprise: collection searches, novelty searches, validity searches, infringement searches, searches for counterparts, name searches, and information about the status of patent applications in various countries.

The Office has access to the collection of the European Patent Office as well as to the collection of the Dutch Patent Office, containing patents and patent journals from a large number of countries and volumes of some 850 technical periodicals, textbooks, manuals, abstract journals, and so on. Furthermore, the Office has direct computer links with several large European and US data bases covering a wide range of patent, technical and scientific literature.

Quality management

- Quality assurance
  Development of practical methods for setting up a quality strategy, meeting quality standards, assessing quality costs and education. Application in different branches of industry, as well as in the service sector. Workshops on quality management around ISO-9000 series. Development and application of computer-assisted assessment methods.
- Introducing and applying planning and structuring tools for organization efficiency, such as Management By Objective (MBO), allocation and delegation responsibilities and authorities.

International relations

The TNO Centre for Information and Documentation is a member of the European Association of Information Services (Eusidic) and the European Consortium of Information Consultants (GAVEL). Staff of the Centre are members of the Institute of Information Scientists, the American Chemical Society-Literature Division, the Association of Strategic Policy Development, and the Society of Competitor Intelligence Professionals.

Institutions connected with TNO

TNO Committee on Hydrological Research

Schoemakerstraat 97
P.O. Box 6067
2600 JA Delft
The Netherlands
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Phone +31 15 69 72 61

Chairman:
Prof. dr. J.C. van Dam
Information Officer:
J.C. Hooghart
Staff and personnel:
3

Organization

About 100 Dutch institutes, departments, services and other organizations, active in the field of hydrology and water management research, are members of the TNO Committee on Hydrological Research. The main organizations have a representative to the board of the Committee. The Bureau of the Committee is assisted by several working groups.

Scope of activities

Fostering and promoting coordination and cooperation in the field of hydrology and water management research.
Encouraging and facilitating the transfer of research results and technical know-how. The exchange of information; the organization of symposia and technical meetings, and the setting up of working parties.

International relations

Committee on Water Resources (COWAR).
Economic Commission for Europe (ECE).
Hungarian Hydrological Society (HHS).
International Association of Hydrogeologists (IAH).
International Association for Hydraulic Research (IAHR).
International Association of Hydrological Sciences (IAHS).
International Commission on Irrigation and Drainage (ICID).
International Institute for Applied System Analysis (IIASA).
International Union of Geodesy and Geophysics (IUGG).
United Nations Educational, Scientific and Cultural Organization - Division of Water Sciences (UNESCO).
World Meteorological Organization (WMO) - Department of Hydrology and Water Resources and Commission for Hydrology.

TNO Cleaning Techniques Research Institute

Schoemakerstraat 97
P.O. Box 6062
2600 JA Delft
The Netherlands
Fax +31 15 56 02 58
Phone +31 15 69 77 75

Director:
F.R. Bogtstra, M.Sc.
Staff and personnel:
40

Organization

Institute with the legal status of foundation, affiliated to TNO.

Scope of activities

Research and consultancy on products, machines and processes for cleaning in general. Fields of work include:

- cleaning techniques: study, performance testing, analysis and quality assessment of processes, detergents, machines and substrates to be cleaned;
- professional laundering, drying, dry-cleaning and finishing of textile;
- domestic laundering, drying, dishwashing and cleaning in general;
- cleaning in general (e.g. floor maintenance, office cleaning);
- hygiene of laundering, cleaning or dry-cleaning; disinfection and sterilization;
- management: quality assessment and insurance systems, education, organization of production, transport, client relations, automation, costing systems, and surveys;
- resources management and environmental aspects.

Equipment and facilities

Pilot plant for professional laundering. Test bay for domestic laundering, drying, and dishwashing.
Laboratory-scale laundering and cleaning facilities.
Data acquisition systems for various process parameters. Equipment for analysing and testing textiles and other materials to be cleaned for detergent characterization, etc.

International relations

The institute is a member of:

- International Scientific and Technical Committee on Laundering (ISTCL);
- International Dry Cleaning Research Committee (IDCR);
- International Technical Committee for Textile Care Labelling.

TNO Institute of Carbohydrate Research

Rouaanstraat 27
9723 CC Groningen
The Netherlands
Fax +31 50 12 88 91
Phone +31 50 13 03 41

Director:
Dr. J.P. Geerts
Staff and personnel:
40

Organization

The institute comprises research groups on: Crop Research; Chemical Analysis; Organic Chemistry; Structure and Properties of Carbohydrates; Microbiology and Waste Water Purification; Biochemical Research; and Physical Research.

Scope of activities

Scientific research into starch and its derivatives for the Dutch starch industry.
The Institute is also engaged on, among other subjects, the abatement of the serious waste water pollution that attends starch manufacturing processes.
Other topics of research are:

- powder physics;
- investigations into residues;
- analyses of new races.

Equipment and facilities

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, multi-angle laser light scattering detector, etc.).
Glass house and climate rooms.

TNO Certification

Laan van Westenenk 501
P.O. Box 541
7300 AM Apeldoorn
The Netherlands
Fax +31 55 49 32 88
Phone +31 55 49 34 68

Director:
B. Dane, M.Sc.

Organization

TNO Certification is an independent foundation, which has access to and benefits from the expertise available within the TNO organization.

Scope of activities

- Product certification;
- quality certification;
- conformity certification.

Product certification

Manufacturers can obtain the right to apply the TNO Certification Quality Mark to their products. Products are inspected on the basis of an assessment guideline drawn up in consultation with the parties concerned. Tests for certification take place in TNO's well-equipped laboratories.

Quality system certification

Suppliers can obtain the right to use the TNO Certification Quality Mark on their letterhead and in their advertising material. The quality systems are assessed on the basis of the ISO 9000 series of standards.

Conformity certification

Manufacturers or their representatives van obtain the right to apply the CE mark to their products. These products should meet European Directives, which are often further specified in harmonized standards.

Institute for Rehabilitation Research

Zandbergsweg 111
6432 CC Hoensbroek
The Netherlands
Phone +31 45 22 43 00

Director:
M. Soede, M.Sc., Ph.D.
Information officer:
Ms. M. Verstappen
Staff and personnel:
45(*)

Organization

The Institute was established by SWOR, the Foundation for Scientific Research into Rehabilitation. SWOR is a grant-aided foundation in which TNO, the Cooperating Rehabilitation Centres (SRL) and the University of Limburg participate. The main task of SWOR is to perform scientific research into rehabilitation and into provisions for handicapped people.

Scope of activities

Research in the field of rehabilitation and handicap covers the following areas:

- Augmentative and alternative communication.
  Understanding communication/interaction problems of people with motoric and cognitive impairments; the development of aids for communication.
- Independence in living, working and mobility.
  Organization, ergonomic aspects of work and handicap. The development of technology to increase independence (robot manipulators, intelligent houses). Research into and development of equipment for mobility. Functionality of wheelchairs.
- Patient-related research.
  Evaluation of the effects of rehabilitation and developing new treatments. Treatment of cognitive impairments after head injury. Chronic pain. Sitting posture and movement. Aftercare and the development of handicap.
- Information collection and dissemination in all areas of the physically handicapped (to be started in 1993).

International relations

European Community (EC).
Rehabilitation Engineering Society of North-America.
International Society of Prosthetics and Orthotics.
European Society for Research into Rehabilitation.
International Society for Augmentative and Alternative Communication.
University of Dundee, Microcomputer Centre.
University of Delaware, Applied Science and Engineering Department.
Swedish Handicap Institute

(*) The Rehabilitation Information Centre (RIC) in Hoensbroek, with a staff of 12, will join the Institute in 1993.

Eurotech

Schoemakerstraat 97
P.O. Box 6070
2600 JA Delft
The Netherlands
Fax +31 15 62 73 11
Phone +31 15 69 49 23

Contact:
Ms. S. van Dijk-Struyk

Organization

EUROTECH is the largest European Community network for the transnational transfer and licensing of technologies. Its members operate as centres for dealing with offers and requests for new technology in a standardized way, enabling them to work on each other's behalf.

Scope of activities

The primary objective of the network is to assist universities, technical institutes, research laboratories, small and medium-sized enterprises and private inventors in the commercial exploitation of innovative technology. The working mechanism of EUROTECH is based on the rapid distribution of selected technological opportunities among the members.
EUROTECH deals with a large number of technologies which may have potential in many sectors. Use is made of the know-how and experience of major organizations engaged in technology transfer. In this way, advice is given on the best possible use of technological opportunities, at the lowest possible costs.

Eurotech members

The members of EUROTECH are:
IRSIA-IWONL, Belgium; DTI-DIC, Denmark; ANVAR, France; FhG-P sT, Germany; ELKEPA-ITE, Greece; EOLAS, Ireland; CNR, Italy; JNICT, Portugal, CDTI, Spain; BTG,United Kingdom; and TNO, The Netherlands.

Addresses of TNO institutes and institutions connected with TNO

(situation on 1 October 1992; bracketed numbers refer to pages)

For information about international projects and relations:
TNO Bureau for International Coordination and Consultancy (5)
Schoemakerstraat 97
P.O. Box 6070, 2600 JA Delft
Fax +31 15 62 73 13
Phone +31 15 69 69 00

For information about specific research areas and R&D facilities:
TNO Marketing Department (5)
Schoemakerstraat 97
P.O. Box 6070, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 61 24 03
Phone +31 15 69 69 69

For general information about TNO:
TNO Public Affairs and Information Department
Schoemakerstraat 97
P.O. Box 6050, 2600 JA Delft
Fax +31 15 62 73 35
Phone +31 15 69 69 00

TNO Supervisory Board (2)
Schoemakerstraat 97
P.O. Box 6000, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 62 73 83
Phone +31 15 69 69 00

TNO Board of Management (2)
Schoemakerstraat 97
P.O. Box 6000, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 62 73 83
Phone +31 15 69 69 00

TNO Environmental and Energy Research (7)
Schoemakerstraat 97
P.O. Box 6010, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 69 72 85
Phone +31 15 69 69 00

TNO Institute of Environmental and Energy Technology (8)
Laan van Westenenk 501
P.O. Box 342, 7300 AH Apeldoorn
Telex 36395 tnoap nl
Fax +31 55 41 98 37
Phone +31 55 49 34 93

TNO Institute of Environmental Sciences (11)
Schoemakerstraat 97
P.O. Box 6011, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 61 68 12
Phone +31 15 69 69 00

TNO Institute of Applied Geoscience (14)
Schoemakerstraat 97
P.O. Box 6012, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 56 48 00
Phone +31 15 69 71 84

TNO Study Centre for Environmental Research (15)
Schoemakerstraat 97
P.O. Box 6013, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 61 31 86
Phone +31 15 69 69 00

TNO Building and Construction Research (17)
Lange Kleiweg 5, Rijswijk
P.O. Box 49, 2600 AA Delft
Telex 38270
Fax +31 15 84 39 90
Phone +31 15 84 20 00

Departments of Computational Mechanics; Computer Integrated Construction; Building Technology; Structural Engineering; Strategic Studies and Quality Assurance; Centre for Fire Research. (18)

Centre for Mechanical Engineering and Department of Indoor Environment, Building Physics and Systems (18)
Leeghwaterstraat 5
P.O. Box 29, 2600 AA Delft
Telex 38192
Fax +31 15 60 85 53
Phone +31 15 60 86 08

TNO-TUE Centre for Building Research
c/o Eindhoven University of Technology (18)
P.O. Box 513, 5600 MB Eindhoven
Fax +31 40 43 85 95
Phone +31 40 47 27 15

TNO Industrial Research (23)
Schoemakerstraat 97
P.O. Box 6030, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 62 51 09
Phone +31 15 69 69 00

TNO Institute of Production and Logistics Research (24)
Apeldoorn branch
Laan van Westenenk 501
P.O. Box 541, 7300 AM Apeldoorn
Fax +31 55 41 98 37
Phone +31 55 49 34 93

Eindhoven branch
Horsten 2, Building O,
5612 AX Eindhoven
Fax +31 40 43 65 35
Phone +31 40 47 45 17

TNO Road-Vehicles Research Institute (26)
Schoemakerstraat 97
P.O. Box 6033, 2600 JA Delft
Telex 38071 zptno nl
(Approval Dept: 38335 zptno nl)
Fax +31 15 62 07 66
Phone +31 15 69 69 00

TNO Plastics and Rubber Research Institute (28)
Schoemakerstraat 97
P.O. Box 6031, 2600 JA Delft
Fax +31 15 56 63 08
Phone +31 15 69 69 00

Zeist branch
Utrechtseweg 48
P.O. Box 108, 3700 AC Zeist
Fax +31 3404 5 41 86
Phone +31 3404 4 41 44

TNO Product Centre Institute of Product Design and Development (30)
Oostsingel 209
P.O. Box 5073, 2600 GB Delft
Fax +31 15 60 87 56
Phone +31 15 60 89 09

CAD Centre (31)
Curaçaostraat 2
P.O. Box 5073, 2600 GB Delft
Fax +31 15 60 87 56
Phone +31 15 60 89 08

TNO Institute of Applied Physics (32)
Stieltjesweg 1
P.O. Box 155, 2600 AD Delft
Telex 38091 tpddt nl
Fax +31 15 69 21 11
Phone +31 15 69 20 00

Branch-specific Research Centres (34)
Schoemakerstraat 97
P.O. Box 6034, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 56 03 02
Phone +31 15 69 69 00

TNO Centre for Packaging Research (35)
Schoemakerstraat 97
P.O. Box 6034, 2600 JA Delft
Fax +31 15 69 62 80
Phone +31 15 69 69 00

TNO Centre for Paper and Board Research (36)
Schoemakerstraat 97
P.O. Box 6034, 2600 JA Delft
Telex 38071 zptno nl
Fax +31 15 69 65 11
Phone +31 15 69 66 74

TNO Centre for Leather and Shoe Research (37)
Mr van Coothstraat 55
P.O. Box 135, 5140 AC Waalwijk
Telex 35083 lstno nl
Fax +31 4160 4 17 35
Phone +31 4160 8 42 22

TNO Centre for Textile Research (38)
Schoemakerstraat 97
P.O. Box 6034, 2600 JA Delft
Fax +31 15 56 03 02
Phone +31 15 69 66 58

TNO Centre for Coatings Research (39)
Schoemakerstraat 97
P.O. Box 6034, 2600 JA Delft
Telex 38071 zptno nl
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Phone +31 15 69 64 61

TNO Nutrition and Food Research (41)
Utrechtseweg 48
P.O. Box 360, 3700 AJ Zeist
Telex 40022 civo nl
Fax +31 3404 5 72 24
Phone +31 3404 4 41 44

TNO Food Technology Institute (42)
Utrechtseweg 48
Telex 40022 civo nl
P.O. Box 360, 3700 AJ Zeist
Fax +31 3404 5 72 24
Phone +31 3404 4 41 44

TNO Biotechnology and Chemistry Institute (43)
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Phone +31 3404 4 41 44

TNO Toxicology and Nutrition Institute (45)
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RUL-TNO Centre for Phytotechnology (46)
Wassenaarseweg 64, 2333 AL Leiden
Telex 40022 civo nl
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Phone +31 71 27 49 14

TNO Health Research (47)
Zernikedreef 9
P.O. Box 2215, 2301 CE Leiden
Fax +31 71 18 19 10
Phone +31 71 18 18 18

TNO Institute of Applied Radiobiology and Immunology (48)
Lange Kleiweg 151
P.O. Box 5815, 2280 HV Rijswijk
Fax +31 15 84 39 98
Phone +31 15 84 28 42

Radiological Protection Service (51)
Utrechtseweg 310
P.O. Box 9034, 6800 ES Arnhem
Fax +31 85 45 07 87
Phone +31 85 56 30 55

TNO Medical Biological Laboratory (52)
Lange Kleiweg 137-139
P.O. Box 45, 2280 AA Rijswijk
Fax +31 15 84 39 89
Phone +31 15 82 28 42

TNO Institute of Ageing and Vascular Research (54)
(incl. Centre for Medical Technology; p. 55)
Gaubius Laboratorium
Zernikedreef 9
P.O. Box 430, 2300 AK Leiden
Fax +31 71 18 19 00
Phone +31 71 18 18 18

TNO Institute of Preventive Health Care (56)
Wassenaarseweg 56
P.O. Box 124, 2300 AC Leiden
Fax +31 71 17 63 82
Phone +31 71 18 11 81

TNO Defence Research (59)
Schoemakerstraat 97
P.O. Box 6006, 2600 JA Delft
Fax +31 15 62 73 19
Phone +31 15 69 69 00

TNO Physics and Electronics Laboratory (60)
Oude Waalsdorperweg 63
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Phone +31 70 3 26 42 21

TNO Prins Maurits Laboratory (62)
Lange Kleiweg 137
P.O. Box 45, 2280 AA Rijswijk
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TNO Institute for Perception (65)
Kampweg 5
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TNO Policy Research (67)
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TNO Institute of Spatial Organization (68)
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TNO Centre for Technology and Policy Studies (69)
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TNO Technology Management Group: (71)

TNO Innovation Consultancy Group (71)
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This 'Key to research facilities' gives a broad outline of R&D facilities available with TNO, the Netherlands Organization for Applied Scientific Research. The information reflects the situation on 1 October 1992, unless otherwise stated.
At the beginning you will find an alphabetical list of keywords, which may provide easy access to the facilities and laboratories described. In cases where a headword covers several subjects, the subjects are listed both under the headword and as separate keywords.
General information about features of TNO, the nature and scope of work, and (inter)national contacts is given under 'TNO in perspective' (page 1). A survey of R&D facilities, arranged according to TNO's seven divisions, is given in the respective sections (page 7 ff).

One of the primary tasks of TNO is to support clients (both in the private and public sector) by translating research results into practical applications and technological innovations, and by problem-solving. To facilitate your access to TNO, you are advised to contact first:

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