Faculty of Building Services, Hydro and Environmental Engineering

WARSAW UNIVERSITY OF TECHNOLOGY

RESEARCH TEAMS AT THE WARSAW UNIVERSITY OF TECHNOLOGY

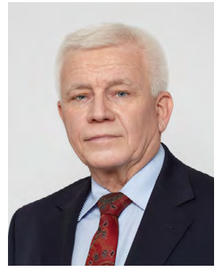
R&D PORTFOLIO

ISBN: 978-83-964993-6-3
DOI: 10.32062/20220506

FOREWORD BY THE FACULTY DEAN

The Faculty of Building Services, Hydro and Environmental Engineering runs its main research operations, applied research and a wide range of services as part of two disciplines, including environmental engineering, mining and energy, and civil engineering and transport.

The teams' research activities are centred around such issues as buildings, energy, water, and the environment. The studies they conduct entail both the development of solutions influencing the provision of best possible conditions of the internal environment of buildings, accompanied by continuous low consumption of energy for building operation purposes, through works covering water supply, wastewater collection, and energy systems (heating and gas networks), waste management under the Circular Economy, analyses of hydro and civil engineering structures, to a broadly understood protection, reclamation and shaping of natural environment elements (atmosphere, hydrosphere and lithosphere) as well as urbanised and degraded areas.



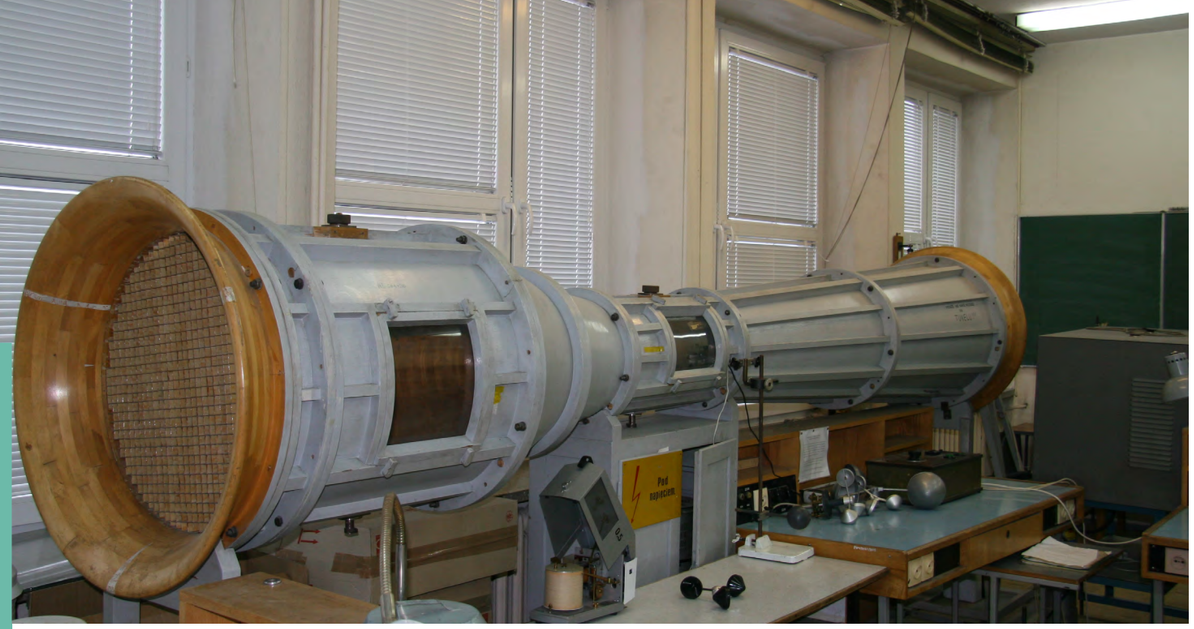
Professor Andrzej Kulig, Ph.D., D.Sc., Dean of the Faculty of Building Services, Hydro and Environmental Engineering 2019-2020

Research and implementation works are carried out by experienced research and teaching staff – experts combining close cooperation with industry and municipal partners, thus being well acquainted with the current needs of the engineering circles, with following latest trends, technological developments and future solutions which are currently presented as concepts in scientific literature.

In addition, the Faculty's interdisciplinary nature allows close collaboration between individual teams with a view to achieving the expected results, taking into account current development perspectives.

We would like to invite the representatives of all organisational units (firms, companies, organisations, and agencies) whose objective is to increase competitiveness through innovative solutions, to explore this presentation of the research teams operating at the Faculty of Building Services, Hydro and Environmental Engineering and to consider our wide range of cooperation options.

TABLE OF CONTENTS



METEOROLOGY TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY, EARTH AND ENVIRONMENTAL SCIENCES

#ATMOSPHERE AND OCEAN DYNAMICS #CLIMATE CHANGE #ATMOSPHERE SCIENCE #NUMERICAL MODELLING #NUMERICAL PREDICTION #WEATHER PREDICTION #ENVIRONMENTAL FLOW MECHANICS #AIR POLLUTION #AIR QUALITY #AIR QUALITY MANAGEMENT

The team operates within the Chair of Environmental Protection and Management at the Faculty of Building Services, Hydro and Environmental Engineering of the Warsaw University of Technology. The most important element of the team's activities is the implementation of the nationwide system of air quality modelling and short-term forecasts of air quality.

During the last ten years the team has been providing forecasts to the Chief Inspectorate for Environmental Protection and local authorities. In 2018, the forecasting system was imnplemented at the Institute of Environmental Protection, as required under the Environmental Protection Act.

CONTACT

Professor Lech Łobocki, Ph.D., D.Sc.
lech.lobocki@pw.edu.pl
(+48) 22 234 76 06
meteo.is.pw.edu.pl, m.is.pw.edu.pl

RESEARCH INFRASTRUCTURE

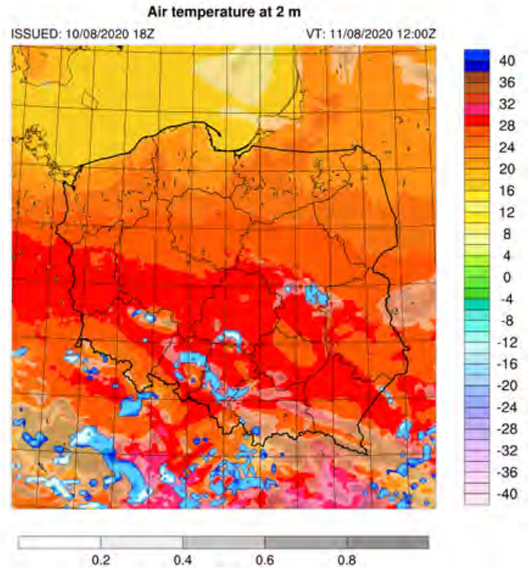
- numerical air quality modelling system GEM-AQ: a global multi-scale model of the atmospheric dynamics integrated with a model of atmosphere chemistry, and photochemistry, and aerosol dynamics model – the only meteorological model with a global coverage, used in operational mode in Poland
- computer cluster

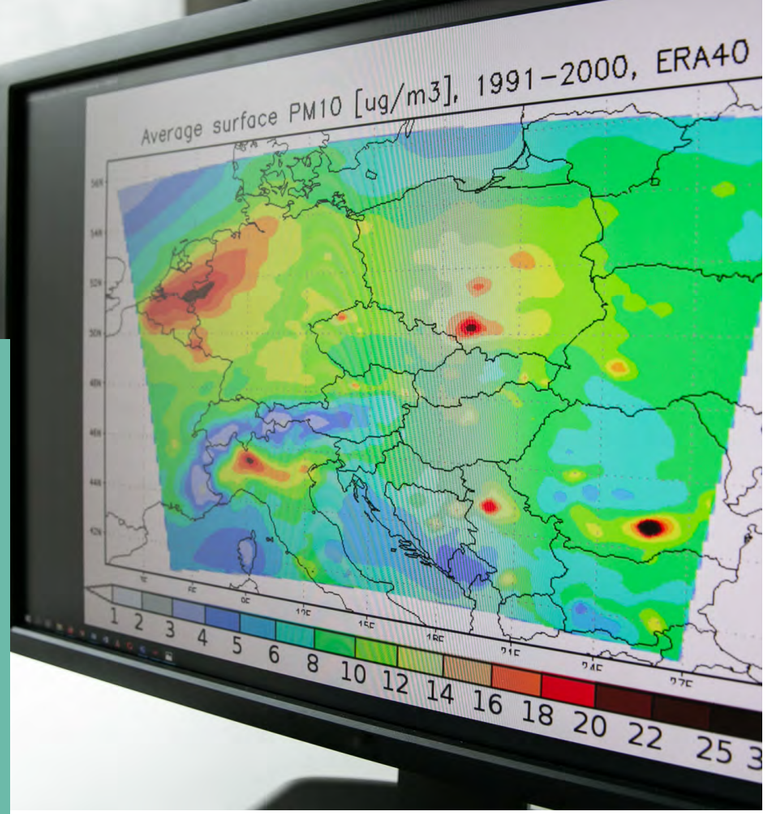
COMPLETED PROJECTS

- Identification of atmospheric pollution transformation mechanisms in continental-scale air quality models, within the Air Quality Modelling Evaluation International Initiative – AQMEII (Ministry of Science and Higher Education)
- Modelling of winter smog over the Cracow agglomeration during the IES-JRC measurement campaign – within the EU Community Research Centre project "Krakow Integrated Methodology Project: From Toxic Emissions to Health Effects" (Ministry of Science and Higher Education; January – February 2005)
- Choice of parameterisations of meteorological processes for air quality modelling systems in typical smog situations on the territory of Poland (Ministry of Science and Higher Education – project implemented as part of the COST 728 action "Enhancing mesoscale meteorological modelling capabilities for air pollution and dispersion applications")
- Chemical Weather – Multi Scale System System for Air Quality Forecasting for Poland" (Ministry of Science and Higher Education – project related to the participation in the COST ES 0602 action "Towards a European network on chemical weather forecasting and information systems")
- Impact of Climate Change on Air Quality and Air Pollution in Central Europe (founded by National Science Centre)

SERVICES OFFERED

- provision of specialised meteorological forecasts and air quality forecasts
- expert opinions on meteorology, air quality, climate change
- wind and solar energy resources





AIR POLLUTION CONTROL TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY, EARTH AND ENVIRONMENT SCIENCES

#AIR POLLUTION AND PROTECTION #AIR QUALITY MODELLING
#PARTICULATE MATTER #PM 2.5
#CHEMICAL COMPOSITION OF PARTUCLATE MATTER
#IDENTIFICATION OF POLLUTION SOURCES
#THE ASSESMENT OF THE HEALTH IMPACT OF AIR POLLUTION

The Air Pollution Control Team at the Faculty of Building Services, Hydro and Environmental Engineering brings together knowledge of atmosphere physics and chemistry, mathematical modelling of atmospheric processes, impact of air pollution on health and environment, air quality evaluation and management methods, with unique skills of scientific research methods and long-standing experience in the sphere of experimental, fundamental and applied research.

The Team specialises in examining the properties of atmospheric particulate matter. These include both experimental research, related to conducting continuous long-term measurement campaigns, as well as theoretical studies related to the application of spatial measurement data analyses, air pollution modelling, the identification of pollution sources and methods for the assessment of health impact.

The Team conducts a vibrant international cooperation and publishes the results of studies in reputable scientific journals. The publications are widely cited by scientists worldwide.

CONTACT

Professor Katarzyna Juda-Rezler, Ph.D., D.Sc.
katarzyna.juda-rezler@pw.edu.pl
(+48) 22 234 72 74
zoa.is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- low-volume fine particulate matter sampler, allowing the determination of mass concentration of PM2.5 and PM1, using the reference method
- meteorological station

COMPLETED PROJECTS

- expert opinions concerning air quality prepared for international institutions, including the World Bank
- identification of various types of atmospheric aerosol particles with the assessment of their impacts (NCN OPUS – a project implemented in collaboration with the Institute of Environmental Engineering of the Polish Academy of Sciences (PAS) and the National Institute of Public Health – National Institute of Hygiene, 2015–2018)
- identification of high concentrations of particulate matter in the atmosphere in selected Polish cities (NCN OPUS – a project implemented in collaboration with CNRS – Université Paris IV Sorbonne, 2012–2015)
- Air Pollution Policies foR Assessment of Integrated Strategies at regional and Local scales APPRAISAL (7th EU Framework Programme, 2012–2015)
- Dependence of particulate matter emission factor on the parameters of coal combustion process in pulverised fuel boilers and on the treatment of flue gases (Ministry of Science and Higher Education, a project implemented in collaboration with Siekierki Combined Heat & Power Plant, 2010–2012)
- Central and Eastern Europe Climate Change Impact and Vulnerability Assessment CECILIA (6th EU Framework Programme, 2006–2009)

SERVICES OFFERED

- research services in the scope of determining the mass concentration and the chemical composition of particulate matter
- research services in the scope of modelling of concentration of pollutants in atmospheric air, the identification of sources and assessment of health impacts of air pollution, with the use of advanced mathematical methods
- research services in the sphere of air quality assessment and management
- workshops, training sessions, post-graduate training on air pollution and protection, and air quality assessment and management
- expert opinions for industry and public administration in respect of atmosphere pollution and protection

LAND PROTECTION TEAM
AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

CONTACT

Leader of the Land Protection Team:
Professor Andrzej Kulig, Ph.D., D.Sc.
andrzej.kulig@pw.edu.pl
(+48) 22 629 30 26

Head of the Land Protection Laboratory:
Professor Agnieszka Pusz, Ph.D., D.Sc.
agnieszka.pusz@pw.edu.pl
(+48) 22 234 57 08; (+48) 22 234 54 17

opz.is.pw.edu.pl

The Land Protection Team (LPT) is part of the Chair of Environment Protection and Management at the Faculty of Building Services, Hydro and Environmental Engineering of the Warsaw University of Technology.

The LPT conducts research and teaching activities in three areas:

- soil protection:
  - soil and groundwater environment contamination tests – on-site environmental audits,
  - surveys, evaluation and improvement of soil fertilisation properties (NPK),
  - determination of the causes of soil pollution (contamination),
  - assessment of requirements for remediation processes of soil and land,
  - methods for remediating the soil and groundwater environment,
  - remediation plan drafts,
  - concepts (approaches) and projects for degraded land reclamation,
  - monitoring and evaluation of the results (effectiveness) of reclamation works;
- protection against odours:
  - identification of odour sources in technological processes in municipal and industrial facilities,
  - assessment of odorants and odours emission,
  - evaluation of odour nuisance,
  - analysis of the possibilities of reducing odour emissions and immission.

In addition, the Team organises and co-organises trainings and workshops related to odorimetry, among others, for the representatives of local government units and operators of municipal management facilities.

- integrated environmental protection:
  - environmental impact assessment of municipal, industrial and infrastructural projects,
  - environmental assessments of existing facilities,
  - including ecological audits of installations,
  - methods to reduce the impact of systems and facilities on the environment,
  - environmental research and monitoring (e.g. chemical pollution, acoustic impact),
  - legal aspects of environmental protection.

There are two labs within the Land Protection Laboratory:

- Soil Contamination Research Lab (SCRL),
- Odour Research Lab (ORL).

SOIL CONTAMINATION RESEARCH LAB

#SOIL/EARTH #LAND PROTECTION #METALS
#SOIL CONTAMINATION #ORGANIC POLLUTION
#CLEANUP OF GROUND-WATER ENVIRONMENT
#REMEDIATION #PHYTOREMEDIATION #REMEDIATION PLAN
ENVIRONMENTAL AUDITS OF THE SITE #DEGRADED SITES
#ASSESSMENT/IMPROVEMENT OF SOIL FERTILISATION PROPERTIES
#LAND RECLAMATION AND DEVELOPMENT #EIA REPORT

SERVICES OFFERED

- assessment of the degree of soil and groundwater contamination (environmental inspections)
- determination of causes of land surface pollution
- testing with assessment and improvement of soil fertilising properties (NPK)
- assessment of needs in the field of soil environment remediation
- concepts and projects for reclamation of degraded sites
- methods of soil and groundwater environment treatment, including preparation of remediation plan drafts
- monitoring and evaluation of the effects (effectiveness) of field remediation and reclamation works
- legal aspects in environmental protection (e.g. opinions for law enforcement agencies and the judiciary)

The scope of the analyses covers: physical and chemical properties of soils, i.e.: sampling of soil and groundwater, soil grain size distribution (Casagrande's areometric method), filtration coefficient, pH, mV (redox potential), conductivity, salinity, carbonates, sulphates, chlorides, organic carbon, properties of the sorption complex, assimilable forms of fertilising components (NPK), sodium, potassium, calcium, lithium, metals (in cooperation with an accredited laboratory): iron, manganese, arsenic, bar, chromium, cadmium, cobalt, copper, molybdenum, nickel, lead and mercury as well as organic compounds, including petroleum hydrocarbons.

RESEARCH INFRASTRUCTURE

- Eijkelkamp's soil augers and field work equipment - sampling of soils and ground with disturbed and intact structure for laboratory tests, drilling and opencast method (0-3 m below the ground level)
- manual (hand-held) core sampler for sampling of soil contaminated with volatile chemicals - standard set for sampling of intact structure in hard soils up to a depth of 5 m
- two sets for long-term monitoring of changes in soil moisture, temperature and electrical conductivity; the set includes the EM50 data logger, 5TE soil moisture, temperature and EC probe (5 pcs), an installation box for the logger
- Eijkelkamp's penetrologger, an electronic device for soil compactness testing up to a depth of 80 cm with 60° cones, built-in GPS receiver and accessories with a probe for measuring soil moisture
- IQ160 meter with stainless steel ISFET pH electrode with a pointed tip for easy insertion into the soil, for direct pH measurement in soil
- laboratory pH-meter/conductivity meter/salt meter CPC-505 by Elmetron Eijkelkamp's calibrated sieves, Prószyński areometers – testing of soil fractional composition, sieve and areometric methods
- Eijkelkamp's filtration apparatus - determination of the soil filtration factor
- Eijkelkamp's calcimeter - determination of carbonate content in soils
- Jenway PFP-7 flame photometer - determination of sodium, potassium, calcium, lithium in soil and water
- Sensomat Scientific (Aqualytic) meter with measuring heads with an infrared interface, classical Oxi-Top heads, with a pressure sensor, microcontroller and clock - BOD determination in soil, water and wastewater
- Selutec's BSB Digi sapromat - measuring system for the determination of biological oxygen demand - BOD in soil, water and sewage (including toxic substances). Possibility to determine BOD at any time with an ongoing recording of results (also in graphic form), measuring range of BOD5 from several to several thousand mg O_2/dm^3, 12 measurement stands
- UV-Vis Spectronic Genesys 2 and Spectronic 20-D spectrophotometer – determination of micro- and macronutrients in soil and water
- Soxhlet apparatus consisting of four measurement stations

ODOUR RESEARCH LAB

#MUNICIPAL MANAGEMENT FACILITIES
#BIOGAS PLANT #WASTE MANAGEMENT
#ENVIRONMENTAL IMPACT ASSESSMENT #ODOUR
#WASTEWATER TREATMENT PLANT #LANDFILLS
#OLFACTOMETER #ODOUR IMPACT #SCENT
#ODOUR NUISANCE #ODORIMETRY #ODORANT
#INTEGRATED ENVIRONMENT PROTECTION #OLFACTOMETRY

RESEARCH INFRASTRUCTURE

- Nasal Ranger portable olfactometers – determination of odour concentration in field conditions
- Scentroid SM-100 portable olfactometer – determination of odour concentration in field conditions and odour emission measurement
- flux chamber type covers – allowing sampling from surface sources
- Wind Tunnel SW60 – a device for sampling air from surface sources, modelled on the Lindvall cover
- static chambers for sampling air from surface sources
- Air Sampling Vacuum Chamber – a device for taking air samples into analytical bags
- VOC detector Dräger X-pid® 9000/9500 with selective determination of compounds
- MultiRAE Pro multi-gas detector – a device for determining the concentration of: hydrogen sulphide, ammonia, methyl mercaptan and total VOC in the air (PID sensor)
- MultiRae Lite detector - device for the determination of explosive gas concentrations - methane
- analytical bags for sampling air (made of Tedlar, Nalofan, PTFE and stainless steel)
- scrubber aspirators for collecting air samples
- equipment for measuring meteorological parameters
- portable air sampler Mas-100 Eco (Merck), suitable for Petri dishes with a diameter of 90 mm - air sampling for microbiological determinations
- sonometer type 2236, calibrator type 4231 (Brüel & Kjær) – determination of the sound level

Determination of odour concentration - portable olfactometers Scentroid SM-100

SERVICES OFFERED

- analysis and assessment of the causes and extent of odour impact on the environment of wastewater management facilities (including pumping stations, wastewater treatment plants, sludge treatment installations) and waste management facilities (including landfills, composting plants, thermal waste treatment plants, biogas plants)
- environmental research and monitoring (including chemical pollution, emission of odorants and odours, smell nuisance –olfactometric tests as well as acoustic impact)
- reports on the environmental impact of planned projects, mainly municipal and industrial undertakings
- environmental assessment of existing facilities, including environmental audits (reviews) of installations, with particular emphasis on the impact of odours

The scope of the analyses includes the determination of selected odour parameters - concentration, intensity and others, determination of the concentrations of selected chemical compounds in the air –ammonia, hydrogen sulphide, methyl mercaptan, methane, carbon dioxide, VOC, as well as measurements and observations of selected meteorological parameters (as part of olfactometric tests).

COMPLETED PROJECTS BY SCRL

- Research and assessment of soil environment pollution of the 2nd stage of construction of the north-east and the western sections of the metro (2020)
- Plan for remediation of the ground environment with the in situ method at the PKN Orlen S.A. Fuel Station (2019)
- Assessment of the soil and water environment pollution on the site at 1 Sierpnia St. in the City of Warsaw (2019)
- Investigation and assessment of soil environment pollution in the area of C08 station of the second metro line (2017)
- Bioremediation of the soil and water environment from petroleum products at the PKN Orlen S.A. Fuel Station – Stage I: development of a pollutants removal technology (2017)
- Soil and earth monitoring studies at the shale gas exploration well in Wysin (2016)
- Opinion on the storage and management of waste on plot no. 391/3 in Cząstków and its impact on the environment (2016)
- Opinion on the causes and degree of degradation of the Park around Fryderyk Chopin's birthplace in Żelazowa Wola (2015)
- Reclamation project for the former industrial waste landfill in Krzemionki Opatowskie, Stage I – technical reclamation (2013); Stage II – technical reclamation project in the detailed, biological stage (2014)
- Tests for the content of trichlorethylene and tetrachloroethene in groundwater in the area of the intakes of Celsa "Huta Ostrowiec" Sp. z o.o. (2011)

CUSTOMERS

SCRL's customers include: Budmex, Annopol, Celsa „Huta Ostrowiec", Przedsiębiorstwo Robót Górniczych „Metro" Sp. z o.o., PGNiG, PKN Orlen, Metro Warszawskie, MPWiK SA w m. st. Warszawie (Municipal Water Supply and Sewerage Company in Warsaw), District Court in Warsaw, in Sochaczew, in Nowy Dwór Mazowiecki and others.

COMPLETED PROJECTS BY ORL

- Identification, inventory, and classification of potential odour emission sources in the north-western part of the city of Białystok (2019)
- Identification of odour sources and characterisation of their contribution to the problem of the odour impact of Kronospan Mielec Plant to develop an odour management program (2016)
- Post-implementation analysis of the project called "Modernisation and expansion of the Wastewater Treatment Plant in Pruszków" in terms of the impact on selected environmental components (2016) and Assessment of the odour impact of the Wastewater Treatment Plant in Pruszków. Stage: before the completion of upgrading and expansion (2015)
- Assessment of the odorous impact of the mechanical-biological waste treatment installations and landfill in Radiowo (2015) and Studies and evaluation of the odour impact of a landfill installation in Otwock-Świerk (2014)
- Post-implementation analysis of projects located on the premises of the "Czajka" Wastewater Treatment Plant in Warsaw, 4/6 Czajki St. in terms of their impact on the environment (2015), Odour impact studies of the "Czajka" Wastewater Treatment Plant in Warsaw (2012) and the study and assessment of the environmental impact of the "Czajka" Wastewater Treatment Plant – the period before and during modernisation and expansion (2010)
- Studies and evaluation of the odour impact of the "Central" sewage pumping station in Legionowo (2015)
- Assessment of the olfactometric impact of facility no. 2 and the tracks to the facility, on the area of the Kabaty Technical and Holding Station and the neighbouring housing estate (2014) and Evaluation of the odour impact of the Kabaty Technical and Holding Station in Warsaw (2011)

CUSTOMERS

Previous clients for ORL were, among others, municipal companies from the municipal managements and services sector (MPWiK w m.st. Warszawie SA, MPO in Warsaw, Wodociągi Białostockie Sp. z o.o.), private enterprises and other entities from the industrial sector (e.g. Kronospan Mielec Sp. z o.o.; Przedsiębiorstwo Robót Górniczych "Metro" Sp. z o.o.), as well as local and government administration units (including the Town and Commune Office in Września, Marshall's Office of the Mazowieckie Voivodeship in Warsaw, Ministry of Environment).

WATER MANAGEMENT AND HYDROLOGY TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#SURFACE WATER PROTECTION #FLOOD
#WATER BALANCE ANALYSIS #WATER MANAGEMENT
#MODELING OF HYDRODYNAMICS AND TRANSPORT OF POLLUTANTS
#DROUGHT #ENVIRONMENTAL FLOWS #WATER QUALITY MONITORING
#SMALL RETENTION MEASURES #GROUNDWATER PROTECTION

The Water Management and Hydrology Team is located at the Faculty of Building Services, Hydro and Environmental Engineering at WUT at the Chair of Environmental Protection and Management. It consists of specialists in research and analysis of the quantitative and qualitative state of water resources - both surface and groundwater.

The team has extensive experience in comprehensive water assessment (measurements, data analysis, numerical modelling, inference) and actively participates in research, development and implementation projects.

It cooperates with many Polish and foreign research centres, implements projects in cooperation with industry and state institutions (including Celsa "Huta Ostrowiec", KGHM, GAZ-SYSTEM SA, PGNiG, PKN Orlen, KWB Konin, GIOŚ (Chief Inspectorate of Environment Protection), MGMiŻŚ (Ministry of Maritime Economy & Inland Navigation), Regional Water Management Authority, Polish Waters).

RESEARCH INFRASTRUCTURE

- GROUNDWATER AND SURFACE WATER RESEARCH LABORATORY has equipment that enables both quantitative and qualitative research into groundwater and surface water resources. The team has the appropriate software and measuring equipment for a comprehensive assessment of the state of water resources, the development of water monitoring data, modelling of the transport of pollutants in surface and groundwater:
  - dataloggers: Levellogger Junior Edge M5 (water level and temperature) barologger Edge M1.5
  - dataloggers vented AquaTroll (water level, conductivity and temperature)
  - Acoustic Doppler Velocimeter (ADV®) FlowTracker
  - Electromagnetic Flow Meter (VALEPORT 801 8008/80)
  - Rugged Conductivity Meter
  - echosounder HD370
  - GPS RTK V60 GNSS
  - Multiparameter Water Quality Sonde EXO
  - Multiparameter Water Quality Meter ProDSS
  - filtrometer, gradientometer
  - sample ring kits (vented) to take soil samples (Eijkelkamp Soil & Water)

SERVICES OFFERED

- design of surface and groundwater monitoring networks and development of measurement programs
- numerical modelling of water flow and mass transport in surface waters and groundwater
- geographic information systems (GIS) in water management, hydrology and water protection
- water balance analysis
- water management in river catchments containing valuable aquatic and water-dependent ecosystems
- planning and management in water systems
- hydrological documentation and water law surveys
- assessment of the pressures from industry, agriculture and hydro engineering structures on the surface waters status
- assessment of the availability of surface and groundwater resources, taking into account the requirements of channel and off-channel water ecosystems
- assessment of water retention needs and possibilities and development of small / natural water retention programs
- development of theoretical grounds for the water-management decision rules for hydro engineering structures with a computed decision support system (DSS)
- groundwater level and temperature tests using automatic dataloggers
- groundwater level and conductivity testing with a Rugged Conductivity Meter (up to 100 m depth)
- testing the quality of surface and groundwater using an automatic multi-parameter probe
- determination of water flow in rivers using hydroacoustic or electromagnetic sensors
- quantitative measurement of water exchange between the river and the aquifer
- determining the bathymetry of inland reservoirs with the use of echosounder
- determination of coordinates (x, y, z) with geodetic accuracy using GPS RTK

COMPLETED PROJECTS

- Modelling of groundwater – surface water interactions for analysing ecological state of aquatic and riparian habitats (National Science Centre – OPUS 11, 2017–2020)
- Monitoring and model studies of trichlorethylene and tetrachloroethene concentrations in soils and in groundwater in Ostrowiec Świętokrzyski (Celsa „Huta Ostrowiec" Steelworks, 2009–2011)
- Integrated Drought Management Programme in Central and Eastern Europe (Global Water Partnership Central and Eastern Europe & World Meteorological Organization project, 2013–2015)
- Development of a method of injecting geothermal waters for energy purposes into selected geological structures –model studies (RPOWM (Regional Operational Programme of the Mazowieckie Voivodeship) 2014–2020 – „Geotermia Mazowiecka" S.A., 2017–2018)
- Mathematical modelling of the salinity of the Vistula River as a result of the discharge of brine from the leaching of the Damasławek salt deposit in connection with the planned construction of the Underground Gas Storehouse and an ecological study of the Vistula below the brine discharge site with a one-time measurement campaign (Gas Transmission Operator GAZ-SYSTEM S.A., 2014)
- Environmental impact assessment of water treatment plants on surface waters – a practical course as part of a project carried out in 2015–2016 in cooperation with the Environmental Chemistry Team (project supported by Norway Grants and national funds)

CONTACT

Grzegorz Sinicyn, Ph.D.
grzegorz.sinicyn@pw.edu.pl
(+48) 22 234 55 16
gwih.is.pw.edu.pl

WASTE MANAGEMENT TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#BIO-WASTE #MUNICIPAL SOLID WASTE
#CIRCULAR ECONOMY #INDUSTRIAL WASTE
#RECYCLING #HAZARDOUS WASTE
#WASTE TREATMENT #RECOVERY
#INTEGRATED WASTE MANAGEMENT

The Waste Management Team is a part of the Chair of Environment Protection and Management at the Faculty of Building Services, Hydro and Environmental Engineering.

The team has years of experience in waste management, especially in the field of waste processing technologies (including recycling and recovery) and urban area maintenance.
In this area, researchers have experience in many years of collaboration with local governments and industry. The team's recent years of research have focused on source separated bio-waste (including food waste), biological treatment of process gases and on waste management within the Circular Economy.

RESEARCH INFRASTRUCTURE

- research laboratories enabling:
  - research into the technological properties of municipal solid waste, industrial waste and sewage sludge
  - research into the optimisation of recovery technology (including recycling) and waste disposal
  - study of the impact of waste treatment installations and landfill sites on the environment
  - development of new waste recovery and disposal technologies

CONTACT

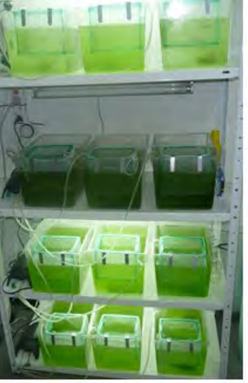
Piotr Manczarski, Ph.D.
piotr.manczarski@pw.edu.pl
(+48) 22 234 74 83
go.is.pw.edu.pl/Contact.htm

SERVICES OFFERED

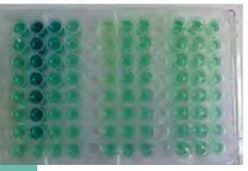
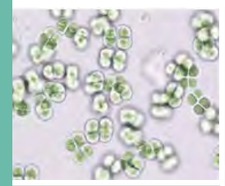
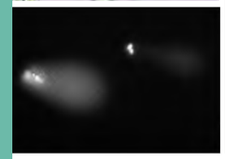
- research on the technological properties of municipal solid waste, industrial waste and sewage sludge
- evaluation and selection of optimal recovery (including recycling) and waste disposal technologies
- studies of the environmental impact of waste management
- comprehensive analyses on the impact of waste treatment installations and landfill sites on the environment
- waste management surveys and plans for industrial facilities
- waste management strategies implementing circular economy
- development of concepts, programmes and plans for the management of municipal and industrial waste, and sewage sludge
- development of new recovery and waste disposal technologies
- opinions and consultations on:
  - municipal and industrial waste management
  - waste technological properties sampling techniques
  - environmental impact assessment
  - the impact of industrial, municipal and infrastructure projects on the environment and human health
  - environmental assessment of existing facilities, i.e. ecological surveys
  - environmental research and monitoring (incl. chemical pollution)
  - environmental permits (including integrated permits)
  - urban cleanliness maintenance programmes
  - legal protection of the environment

COMPLETED PROJECTS

- Development of the innovative two-stage membrane biofilter, using waste materials, intended for the purification and deodorisation of process gases from selected industries (POIR 2014–2020, 2017–2020)
- Research on the environmental impact of waste vitrification from thermal conversion of biomass (GEKON programme, 2017)
- Environmentally friendly and economically viable technologies for water, wastewater and waste management in shale gas extraction EKOŁUPKI (Blue Gas - Polish Shale Gas Programme, 2013–2016)
- Assessing, Capturing & Utilising Methane from Expired and Non-operational landfill; ACUMEN (EU LIFE+, 2012–2015)






ECOTOXICOLOGY TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#ECOTOXICITY #GENOTOXICITY #RISK ASSESSMENT
#AQUATIC AND SOIL ECOSYSTEM ORGANISMS

The Ecotoxicology Team consists of researchers from Biology Department at the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology. The Team has carried out research projects and prepared expert opinions for numerous public administration entities, research institutes, universities, and enterprises.

The research services performed by the Team were used for, i.a.:

- the selection of products characterised, by the lowest possible environmental impact,
- the assessment of wastewater treatment processes,
- the assessment of the genotoxicity of potable water and wastewater,
- supplementing information in safety data sheets of chemical substances and products,
- the ecological hazard and risk assessment, including the risks related to the exploration and extraction of shale gas resources.

CONTACT

Professor Monika Załęska-Radziwiłł, Ph.D., D.Sc.
(+48) 22 234 53 06,
(+48) 22 621 29 79,
monika.radziwill@pw.edu.pl
is.pw.edu.pl/zb/

RESEARCH INFRASTRUCTURE

- LUMIStox, DeltaTox, MARA system with a microplate reader
- thermocycler for PCR
- epifluorescence microscopes Eclipse 50i (NIS Elements AR 3.0 software)
- microscope Eclipse 80i (NIS Elements AR 3.0 software)
- respirometric measurements systems: Lovibond and AL606
- TOC analyser: TOC-VCSH
- gas chromatographs: HP 5890 and HP 7890A with 5975C mass detector, Head Space Sampler 7964 and Purge Stratum PTC

COMPLETED PROJECTS

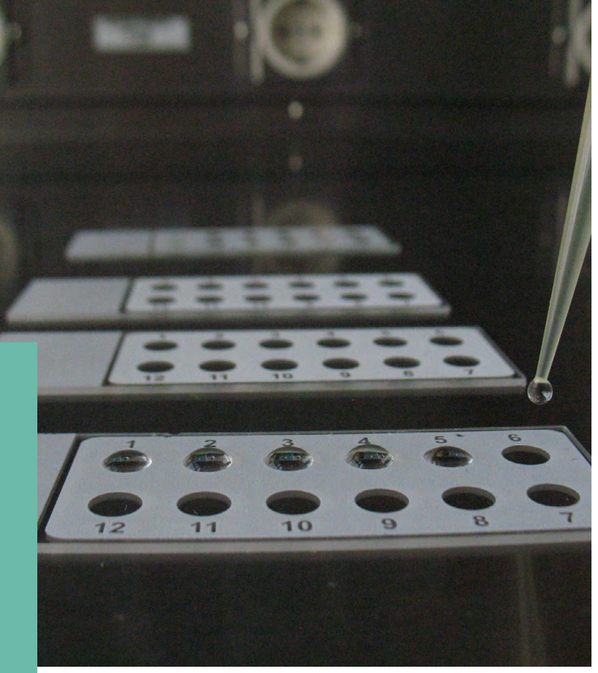
- Blue gas – Polish shale gas. Monitoring logistics and technologies and environmental protection methods prior to commencing works, during drilling, as part of hydraulic fracturing operations and at the extraction stage, including the monitoring of groundwater, air, noise, soil, gas emissions and other elements (a project implemented as part of the Blue Gas - Polish Shale Gas programme)
- Intelligent functions of packages with the addition of nanomaterials for food protection (ERA – NET MNT)
- Ecotoxicological hazard and risk assessment due to the presence of selected pharmaceuticals in surface waters (Ministry of Science and Higher Education)
- An innovate method for the on-site remediation of polluted soil under existing infrastructures (CLEANSOIL) (INCO project)
- Assessment of impact of polycyclic aromatic hydrocarbons on the biocoenosis of bottom sediments (Ministry of Science and Higher Education)
- Assessment of changes in structure and functioning of water ecosystems in the presence of selected organochlorine pesticides based on ecotoxicological studies (Ministry of Science and Computerisation)

SERVICES OFFERED

- ecotoxicological monitoring of water, wastewater, sludge, soil, and leachates
- ecotoxicological studies on chemical substances, including pharmaceuticals and nanoparticles, water and wastewater at various treatment process stages with the use of conventional single-species tests, multispecies tests and molecular tests, including hormonal homeostasis and genotoxicity (RAPD-PCR, DeltaTox®II, SCGE (Comet Assay), SOS-Chromotest, MARA, YES/YAS assay)
- health and environmental risk assessment with the use of deterministic and probabilistic methods

INTERNATIONAL PATENT

- Processes for obtaining intelligent food packages (RO130496-A0)



ENVIRONMENTAL BIOTECHNOLOGY AND MICROBIOLOGY TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#MICROBIOLOGICAL ANALYSES #SANITARY CONTROL #BIODEGRADATION #BIOREMEDIATION #OIL #ANTIBACTERIAL PROPERTIES

The Environmental Biotechnology and Microbiology Team consists of the staff of the Biology Department of the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology. The works performed by the Team include:

- in biotechnology:
  - the biological elimination of organic and inorganic compounds from water, wastewater, soil, and air,
  - bioremediation of soil contaminated with petroleum products (including halogen derivatives),
  - biological treatment of waste gases,
  - biodegradation of used metalworking fluids and refractory compounds in wastewater,
  - biosorption and bioleaching of heavy metals from wastewater and soild waste,
- in environmental microbiology:
  - microbiological assessment of the environment and technical systems,
  - research on microbiological corrosion of building and construction materials,
  - research on antibiotic-resistant microorganisms in water, wastewater and sludge,
  - testing antibacterial properties of nanoparticles and other materials used for the surface protection (coatings, varnishes, plastic foil, packaging)

RESEARCH INFRASTRUCTURE

- thermocycler for PCR
- epifluorescence microscopes Eclipse 50i (NIS Elements AR 3.0 software)
- microscope Eclipse 80i (NIS Elements AR 3.0 software) for the analyses of environmental samples
- microbiological air samplers: Merck Mas100 and Mas100 Eco, Sampl'air AES Laboratoire, SAS Super ISO
- respirometric measurements systems: Lovibond and AL606
- TOC analysers: TOC-VCSH and TOC-5000
- gas chromatographs: HP 5890 and HP 7890A with 5975C mass detector, Head Space Sampler 7964 and Purge Stratum PTC

CONTACT

Professor Adam Muszyński, Ph.D., D.Sc.
Professor Ewa Karwowska, Ph.D., D.Sc.
adam.muszynski@pw.edu.pl;
ewa.karwowska@pw.edu.pl
(+48) 22 234 78 85, (+48) 22 234 59 44,
is.pw.edu.pl/zb/

COMPLETED PROJECTS

- Development of innovative combined biofilter using waste material to treat and deodorize the selected industrial process waste gases (POIR (Smart Growth Operational Programme) 2014-2020, 2017–2020)
- Smart functions of packages containing nano-structured materials in food preservation – Smartpack (ERA-NET MNT, 2012–2015)
- Assessment of relationships between operational parameters and microbial community structure in activated sludge of full--scale wastewater treatment plants with enhanced nutrients removal (own research project, 2012–2014)
- The removal of heavy metals from industrial waste using mixed microbial consortia (Ministry of Science and Higher Education, 2009–2012)
- An innovate method for the on-site remediation of polluted soil under existing infrastructures (CLEANSOIL – INCO project, 2005–2008)

CUSTOMERS

Adgar Sp. z o.o. sp.k., Bio-Set Sp. z o.o. sp.k., Chemwik Sp. z o.o., CA IMMO International, CORP SA, Cushman & Wakefield Polska Sp. z o.o., Ericsson Sp. z o.o., Foundation for Polish Science, Global Partners Group Sp. z o.o, GO4IT Sp. z o.o. sp.k., Hydrogeotechnika Sp. z o.o., Infinity Doradztwo Inwestycyjne, Linegal Chemicals Sp. z o.o., McKinsey&Company Poland Sp. z o.o., NASK, Nokia Polska, Otwockie Przedsiębiorstwo Wodociągów i Kanalizacji Sp. z o.o. (Otwock Water Supply and Sewerage Company), PAMAR, PMG Partner For Business Sp. z o.o., Polish Air Navigation Services Agency, Przedsiębiorstwo Państwowe „Porty Lotnicze" ("Polish Airports" State Enterprise), Purinova Sp. z o.o., Reckitt Benckiser Production (Poland) Sp. z o.o., Sodexo Polska Sp. z o.o., Sopur Sp. z o.o., SPIE Polska Sp. z o.o., Tarnobrzeskie Wodociągi Sp. z o.o. (Tarnobrzeg Water Supply Company), TOPAK DRUK, Zakład Wodociągów i Kanalizacji Sp. z o.o. w Grodzisku Mazowieckim (Water Supply and Sewerage Enterprise in Grodzisk Mazowiecki).

SERVICES OFFERED

- microbiological analyses of air, water, wastewater, sludge and soil
- sanitary and microbiological monitoring of HVAC systems, water supply and heating networks, and industrial installations (including the detection of *Legionella*)
- quantitative and qualitative analysis of biocoenosis in biological wastewater treatment systems, including the identification of filamentous bacteria (qFISH, PCR)
- biodegradation tests (OECD, ISO and CEN standards)
- preparation of inoculum for bioaugmentation and microbiological monitoring of soil bioremediation, waste gas treatment and removal of refractory compounds from wastewater
- assessment of the antimicrobial properties of materials and coatings

PATENTS AND OTHER ACHIEVEMENTS

- International patent: Processes for obtaining intelligent food packages (RO130496-A0)
- Polish patents:
  - Bioreactor for the removal of heavy metals from industrial wastewater (210890)
  - Method for the biotechnological disposal of used metalworking fluids (204489)
  - Method for the microbiological removal of metals from wastewater and sludge (199954)
  - Method for the microbiological remediation of soil from petroleum products (180141)
  - hygienic approval issued by the National Institute of Public Health – Environment Health Safety Department: BIOREM biological preparation (approval No. BK/M/0251/01/2019)
  - medal at the IV Genius International Invention Exhibition in Budapest in 2002 for the technology of "Microbiological leaching of heavy metals from sewage sludges"
  - bronze medal during the International Warsaw Invention Show 2007 for a technology called: "Removal of heavy metals from electroplating wastewater and sludge"

SOIL-STRUCTURE INTERACTION AND BUILDING STRUCTURE MONITORING TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#MONITORING OF BUILDING STRUCTURES #MONITORING SYSTEMS
#NUMERICAL MODELLING #SOIL-STRUCTURE INTERACTION
#IMPACT ON NEIGHBOURING FACILITIES #SOIL TESTS
#THE ASSESSMENT OF THE TECHNICAL CONDITION OF BUILDING STRUCTURES
#INTERPRETATION OF CONTROL MEASUREMENT RESULTS

The team runs its activities at the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology in collaboration with the WUT Institute of Applied Research. As regards works which require the application of geophysical studies, the team cooperates with the Department of Applied Hydrogeology and Geophysics of the University of Warsaw. Monitoring systems are designed in collaboration with Neostrain Sp. z o.o. and SHM System Sp. z o.o., also delivering projects aimed at implementing state-of-the-art monitoring systems.

The Team completed numerous studies concerning the impact of new building projects on neighbouring premises and monitoring projects, as well as numerical analyses of building structures. The team performed contracts for ASTALDI S.A., BURO Happold Sp. z o.o., Doraco Sp. z o.o., Energoprojekt S.A., GSBK Biuro Konstrukcyjne Sp. z o.o., GSG Industria Sp. z o.o., PGE Energia Odnawialna S.A, PORR S.A., Pro Invest Sp. z o.o., Strabag Sp. z o.o., and Warbud S.A.

CONTACT

Professor Paweł Popielski, Ph.D., D.Sc.
pawel.popielski@pw.edu.pl
(+48) 22 234 57 07;
(+48) 601 294 696
is.pw.edu.pl

COMPLETED PROJECTS

- The numerical analysis of displacement of the CBD building and the neighbouring development caused by the implementation of a building project at the corner of Marszałkowska and Świętokrzyska St. taking into account the transfer of loads between diaphragm walls, the bottom slab and the rectangular piles
- The impact of the construction of the designed complex of three high-rise buildings with a deep underground part at Sienna and Towarowa St. in Warsaw on the state of the security of neighbouring building, including on the security and conditions of the operation of metro facilities
- The analysis of underlying soil displacement during the construction of the "Centrum Marszałkowska" building in Warsaw at ul. Marszałkowska 126/134 together with the assessment of impact on neighbouring buildings/ structures: 10 Moniuszki St., 35 Świętokrzyska St., 31/33A Świętokrzyska St. 12/14 Sienkiewicza St. (from Moniuszki St.), Exit W3 and Station C11 of Metro Line 2
- The numerical analysis of displacements of Warsaw Metro structures (stations and route tunnels and M1/M2 interchange track) caused by the construction of a main duct for communication lines and utilities in front of the Palace of Culture and Science in Defilad Square in Warsaw
- The technical assessment and analysis of the design for a monitoring system at the Southern Warsaw Ring Road in S2, Z1 and S1 areas
- The system for the monitoring of the technical condition of selected structural components for a project called Central Point Stages 2–4 – design of monitoring system elements in a diaphragm wall of the metro excavation support system, soil underlying the foundation slab and groundwater levels. The supplementation of the system with automated monitoring components of Station A14 segments (monitoring of the underground part of the CP facility)
- The concept for the upgrade of the drainage system of the main building of "Kozienice" Power Plant in Swierże Górne – ENEA Wytwarzanie Sp. z o.o.

SERVICES OFFERED

- geotechnical studies of physical, mechanical, filtration and compactibility parameters of soil with the determination of numerical analysis parameters
- development of numerical models of building structures, e.g. to assess impact on neighbouring structures and the soil and aquatic environment
- monitoring system designs for building structures, including the definition of the expected values based on numerical simulations
- analyses of measurement data and mathematical modelling results in order to verify numerical models and monitoring systems
- the evaluation of the technical condition of building structures with the use of the monitoring being conducted, and of the consistency of the measurement data with mathematical modelling results
- calculations and analyses of building structure safety taking into account the changes to groundwater ratios and phenomena taking place in the soil under the influence of filtrating water (erosion, suffosion, clogging of soil pores)

RESEARCH INFRASTRUCTURE

- SOIL MECHANICS AND GEOTECHNICAL ENGINEERING LABORATORY: foundation soil testing, testing of natural soil and man-made materials in order to evaluate the geotechnical conditions of building structure foundations and in terms of the possibility to incorporate building structures into earth structures, the determination of essential geotechnical parameters and interdependencies between physical, filtration, compactibility and mechanical parameters, the research into the issues of filtration and filtration deformation (i.a., mechanical suffosion, erosion or clogging of soil pores) resulting from water flows through non-cohesive soil, studies entailing the determination of stress-strain characteristics of cohesive and non-cohesive soils with the possibility to measure strain values of < 0.1% with the use of LVDT sensors; identification of parameters for advanced soil models (e.g. Hardening Soil Small model)
- COMPUTER LABORATORY FOR GEOTECHNICAL AND HYDRO ENGINEERING ANALYSES: issues related to numerical computations in the field of geotechnical and hydro engineering, including hydraulic calculations of watercourses in steady and transient motion, the analysis of civil engineering structures located on the analysed water bodies
- HYDRAULIC LABORATORY: tests on sectional models, small-scale models of hydro-engineering structures, hydraulic analyses of hydro-engineering structures

TEAM FOR THE ANALYSIS AND EVALUATION OF HYDRO ENGINEERING STRUCTURES

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#THE ASSESSMENT OF THE TECHNICAL CONDITION OF HYDRO ENGINEERING STRUCTURES #SAFETY OF DAMMING STRUCTURES #SAFETY OF WATER DEVICES #SOIL TESTS FOR CONSTRUCTION PURPOSES #MONITORING OF HYDRO ENGINEERING STRUCTURES #HYDRAULICS #ATKZ #STRUCTURE TESTS #NUMERICAL MODELLING #PERIODIC INSPECTION OF WATER ENGINEERING STRUCTURES #INTERPRETATION OF CONTROL MEASUREMENT RESULTS

The Team runs its activities at the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology in collaboration with WUT Institute of Applied Research. As regards works which require the application of geophysical studies, the team cooperates with the Department of Applied Hydrogeology and Geophysics of the University of Warsaw. The basic operations of the Team include the assessment of the technical conditions and security of hydro engineering structures and devices, in particular combustion waste flotation tailings storage sites, hydraulic transport systems, low head dams, water intakes and storm water holding tanks, and their periodic inspections.

The Team has performed around a dozen studies concerning the analysis and assessment of the condition of hydro engineering structures based on monitoring findings and numerical analyses. The team performed contracts for EDF, ENEA Wytwarzanie Sp. z o.o., KGHM Polska Miedź S.A., PGE GiEK S.A., PGE Energia Ciepła S.A, Tauron Polska Energia S.A.

CONTACT

Professor Jan Winter, Ph.D., D.Sc.
Professor Paweł Popielski, Ph.D., D.Sc.
jan.winter@pw.edu.pl;
pawel.popielski@pw.edu.pl
(+48) 22 234 57 07;
(+48) 601 294 696
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- GEOTECHNICAL ENGINEERING LABORATORY: foundation soil testing, testing of natural soil and man-made materials in terms of the possibility to incorporate building structures in earth structures, the determination of essential geotechnical parameters and interdependencies between physical, filtration, compactibility and mechanical parameters, the research into the issues of filtration and filtration deformation (i.a., mechanical suffosion, erosion or clogging of soil pores) resulting from water flows through non-cohesive soil, studies entailing the determination of stress-strain characteristics of cohesive and non-cohesive soils with the possibility to measure strain values of < 0.1% with the use of LVDT sensors; identification of parameters for advanced soil models (e.g. Hardening Soil Small model)
- COMPUTER LABORATORY FOR GEOTECHNICAL AND HYDRO ENGINEERING ANALYSES: issues related to numerical computations in the field of geotechnical engineering (i.e. earth structure calculations, soil-structure interaction, stability of natural slopes, filling and excavations, as well as water flow and heat exchange) and hydro engineering (including hydraulic calculations of watercourses in steady and transient motion, the analysis of civil engineering structures located on water bodies)
- HYDRAULIC LABORATORY: tests on sectional models, small-scale models of hydro-engineering structures, hydraulic analyses of hydro-engineering structures

PATENTS

- A device for testing filtration deformations of non-cohesive soil in low-thickness layers (No. 153836)
- A drainage system to remove surface and ground water from an area around excavation (No. 157336)

SERVICES OFFERED

- geotechnical studies of physical, mechanical, filtration and compactibility parameters of soil with the determination of numerical analysis parameters
- the supervision of hydro engineering structures, the assessment of their technical conditions with the use of measurement data from the conducted monitoring and periodic inspections, the performance of numerical models for the assessment of the safety of hydro engineering structures
- the design of monitoring systems for hydro engineering structures together with the definition of expected values based on numerical simulations
- analysis of measurement data and mathematical modelling results in order to verify numerical models and monitoring systems

COMPLETED PROJECTS

- Interpretation of control measurement results and the assessment of hydro engineering structures of the "Rybnik" barrage – since 1973 until present
- Scientific and technical supervision over (ZB) "JELNIA" Combustion Waste Storage Site at Tauron Wytwarzanie S.A. – Stalowa Wola Power Plant – since 1979 until present
- Scientific and technical supervision over Combustion Waste Storage Site and water intake facilities on the Wisłok river at PGE Energia Ciapła S.A., CHP Branch in Rzeszów, since 1994 until present
- The geotechnical analysis of the extension of the Żelazny Most reservoir with the preparation of the optimum technical solutions for the safeguarding of the stability of the deep bed with the use of MES analysis
- The assessment of the technical condition of left-bank escarpment at the exit of the "Dębe" Hydraulic Power Plant
- Failure risk analysis covering the closing dike of the upper reservoir of the Porąbka-Żar Pumped Storage Hydropower Plant

TEAM FOR THE ANALYSIS AND EVALAUATION OF THE CONDITION OF LARGE-SIZED COLLECTORS AND PIPELINES

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#COLLECTORS #GEOTECHNICAL ENGINEERING #PIPELINES
#HYDRAULICS #COLLECTOR MONITORING #HYDRAULIC SURGE
#ANALYSIS OF OPERATING CONDITIONS OF COLLECTORS AND PIPELINES
#ANALYSIS OF THE HYDRAULIC CONDITIONS OF SYSTEM OPERATION
#ASSESSMENT OF CONDITION #SOIL-STRUCTURE INTERACTION

The team runs its activities at the Faculty of Building Services, Hydro and Environmental Engineering at the Warsaw University of Technology in collaboration with WUT Institute of Applied Research. Whenever it is necessary to solve specific problems, the team invites specialists representing relevant fields of study to cooperate, e.g. geophysics specialists (from the Applied Hydrogeology and Geophysics Department at the University of Warsaw), or wastewater chemistry (Department of Information Science and Environment Quality Research) etc.

The projects implemented by the team are focused on broadly understood analysis of the state and operating conditions of large-diameter collector sewers and pipelines, taking into account the hydraulic aspects, soil-structure interaction, and wear and tear. The objective of research works is to monitor technical conditions, define the conditions for emergency situations and the methodology of the safe operation of large-diameter collectors and pipelines.

So far, the team has conducted several studies concerning large-diameter pipelines and collector sewers for KGHM Polska Miedź S.A., MPWiK w m. st. Warszawie S.A. (Municipal Water Supply and Sewerage Company in Warsaw) Our customers also include the Michałowice Commune, WARBUD S.A., JLF Consulting Engineers Polska Sp. z o.o., Przedsiębiorstwo Usług Górniczych Metro Sp. z o.o., DHV Hydroprojekt Sp. z o.o., Aft Sp. z o.o., Przedsiębiorstwo Budownictwa Wodnego w Warszawie S.A., ZWIK Sp. z o.o., Uponor Intra Sp. z o.o.

CONTACT

Apoloniusz Kodura, Ph.D., D.Sc.
Professor Paweł Popielski, Ph.D., D.Sc.
apoloniusz.kodura@pw.edu.pl;
pawel.popielski@pw.edu.pl
(+48) 22 234 78 81; (+48) 605 554 483
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- COMPUTER LABORATORY FOR GEOTECHNICAL AND HYDRO ENGINEERING ANALYSES – the range of content-related tasks performed at the laboratory includes issues related to numerical computations in the sphere of geotechnical engineering and hydro engineering. As regards geotechnical engineering, soil-structure interaction calculations are made
- 2 sets for the measurement of pressure in pressure pipes (recording of transient phenomena in pressure pipes)
- Cooperation with a laboratory dealing with the performance of X-ray and SEM tests

COMPLETED PROJECTS

- The numerical analysis of pressure propagation in slurry pipelines during the hydraulic surge phenomenon for the top elevation of the Mining Waste Disposal Facility with a range between 180 and 195 metres above sea level (KGHM Polska Miedź S.A.)
- Expert opinion on the actual condition of pipelines made of GRP, causes of failures and their impact on the security of the structure and durability of pipelines (Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji w m. st. Warszawie S.A. (Municipal Water Supply and Sewerage Company in Warsaw)
- Analysis covering the selection of repair methods for the process piping on site of the new buildings of the Praga Water Treatment Plant (Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji w m. st. Warszawie S.A.
- Preparation of functional specifications for a project consisting in the design and performance of construction works covering the modernisation of a collector sewer in Krakowska Ave. in Warsaw, along a section from the "Ochota" pumping station for Rękodzielnicza St. with a total length of approx. 2730 m (Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji w m. st. Warszawie S.A.)
- Preparation of an expert opinion on the correctness of solutions adopted in the specifications and drawings for the reconstruction for the Mian Inlet Chamber of the Group Wastewater Treatment Plant of the Łódź Agglomeration (GOŚ_ŁAM) in Łódź at 66 Sanitariuszek St. (WARBUD S.A.)

SERVICES OFFERED

- hydraulic analyses of system operating conditions
- analysis of the hydraulic surge phenomenon in a system
- the assessment of the technical conditions of large-diameter collector sewers and pipelines
- geotechnical studies of physical, mechanical, filtration and compactibility parameters of soil with the determination of numerical analysis parameters, taking into account the state of soil adjacent to linear structures
- development of numerical models of the structures being analysed, e.g. to assess impact on neighbouring structures
- monitoring system designs for collector sewers and pipelines, including the definition of the expected values based on numerical simulations
- analysis of measurement data and mathematical modelling results in order to verify numerical models and monitoring systems
- technical condition assessment based on the conducted monitoring
- concepts for the methods for the repair and modernisation of collector sewers and pipelines

PATENTS

- Fibre-optic channel with the function of pressure stabilisation in a pipeline intended for the transfer of liquids (PAT.234067)
- Dynamic pressure stabiliser (PAT.233063)

HYDRO-ENGINEERING MATERIALS AND STRUCTURES TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#MASS CONCRETE #HYDRO-ENGINEERING CONCRETE
#BUILDING MATERIALS #SELF-HARDENING SLURRIES
#HEAVY METAL LEACHING #BUILDING MATERIAL CORROSION
#COMBUSTION BY-PRODUCTS #WASTE REUSE IN CONSTRUCTION ENGINEERING
#CIRCULAR ECONOMY #LOW-EMISSION BINDERS

The team works at the Faculty of Building Services, Hydro and Environmental Engineering in the Hydro-engineering and Hydraulics Department.

It specialises in research into the broadly understood utilisation of combustion by-products in building materials, considering their environmental impact (e.g. resulting from the release of heavy metals) and in the aspect of circular economy. It also offers expert opinions in the field of hydraulic and civil engineering concrete structures and concrete technology.

The services of the team were used, among others, by PGE Górnictwo i Energetyka Konwencjonalna S.A. within the framework of the project: Material and construction studies on the modification of the low-water ash storage technology in the aspect of alternative design solutions for the Lubień landfill (2013–2014).

CONTACT

Agnieszka Machowska, Ph.D., D.Sc.
agnieszka.machowska@pw.edu.pl
(+48) 22 234 53 33
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- LABORATORY OF BUILDING MATERIALS, BINDERS AND HYDRO-ENGINEERING CONCRETE:
  - research on the physical properties of binders, combustion by-products and other waste materials with respect to: density, Blaine's specific surface area, fineness, soundness, setting time, pozzolanic activity, water demand, calorimetry (only for scientific purposes); performing analyses of pore liquid in concrete
  - a part of works related to the tests determining leachability of heavy metals from materials (water extracts collected using the batch test, tank test and percolation method)
  - equipment for the testing of the properties of grouts and mortars: Vicat apparatus, Le Chatelier rings, water bath, laboratory shaker, strength testing machine, frost-heave chamber
  - equipment for the testing of the properties of freshly mixed concrete: bulk density, consistency (flow table, VeBe apparatus, slump test), air content measurement using the pressure method
  - equipment for the testing of the properties of hardened concrete: strength testing machine, frost-heave chamber

INNOVATIONS

- Development of know-how technology:
  - grout composed of fractionated fly ash from lignite combustion (Pątnów Power Plant) and Portland cement (CEM I) intended for flood embankment sealing
  - grout composed of fluidized-bed fly ash from lignite combustion (Turów Power Plant) and Portland cement (CEM I) intended for flood embankment sealing
  - grout composed of fluidized-bed fly ash from lignite combustion (Turów Power Plant) and blast furnace slag cement (CEM III) intended for flood embankment sealing

SELECTED PATENT

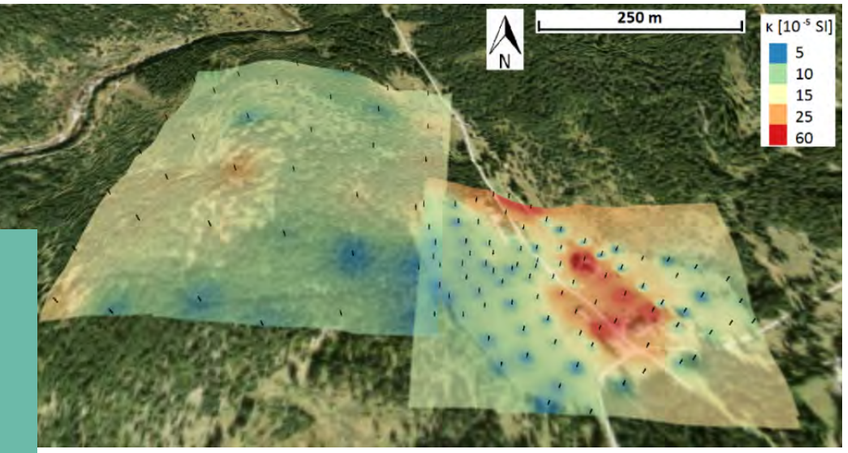
- Self-hardening slurry for construction works (No. 212762)

SERVICES OFFERED

- testing of the physical properties of binders and combustion by-products: density, Blaine's specific surface area, fineness and soundness, setting time, pozzolanic activity and water demand
- determination of pore liquid reaction, chloride and sulphate content, as well as sulphates in concrete
- determination of heavy metal content in building materials, anthropogenic heavy metals in construction materials and in water extracts obtained using batch test, tank test or percolation method
- testing of grouts and mortars: compressive and bending strength, density, consistency, setting time, soundness, frost resistance
- testing of fresh concrete mix: density, consistency (slump, VeBe and flow table), air content
- hardened concrete testing: compressive strength, splitting tensile strength, frost resistance

OTHER ACHIEVEMENTS

- Team award in the 'Feniks 2016' contest in the category of scientific unit, awarded by the Polish Union of Combustion By-Products for many years of research and development of materials for ground sealing, as well as mortars and concretes based on anthropogenic minerals



ENVIRONMENTAL STATISTICS AND REMOTE SENSING TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY,
EARTH AND ENVIRONMENT SCIENCES

#STATISTICS AND GEOSTATISTICS #IT APPLICATIONS
#ENVIRONMENTAL PHYSICS #ENVIRONMENT REMOTE SENSING
#NATURAL AND ANTHROPOGENIC ENVIRONMENT
#ANALYSIS OF SOIL PROPERTIES: MAGNETOMETRY, POLLUTION, MOISTURE
#VEGETATION ECOSYSTEMS #CLIMATE CHANGE

The team operates within the structures of the Department of Information Science and Environment Quality Research at the Faculty of Building Services, Hydro and Environmental Engineering.

It is a nationally and internationally recognized Team for statistical and geostatistical knowledge running vibrant research and educational activities, i.a., in the scope of the description, analysis of spatial continuity of phenomena occurring in the environment, or the integration of environmental measurements, e.g. geophysical ones. The Team is also involved in planning of measurement networks, geostatistical simulations in environmental research, the assessment of environmental resources and the environmental uncertainty as well as risk analyses and inventories.

The Team has implemented projects in collaboration with, i.a., PGNiG S.A., Institute of Environmental Engineering of the Polish Academy of Sciences (PAS), Centre for Space Studies PAS, the Institute of Agrophysics PAS and international partners. It also carried out some activities for such entities as the Kampinoski National Park.

CONTACT

Professor Jarosław Zawadzki, Ph.D.
jaroslaw.zawadzki@pw.edu.pl
(+48) 22 234 54 26
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- advanced software for statistics, geostatistics, GIS and satellite image analysis, both available free-of-charge or on a commercial basis: e.g. R, Statistica, GS+ Gamma Design Software, SGemS (Stanford Geostatistical Modeling Software, SADA (Spatial Analysis and Decision Assistance), GNU software (General Public Licence) e.g., geoR, GStat, ISATIS Geovariances, QGIS, ArcGIS, SAGA GIS, Sentinel Application Platform (SNAP), PC Geomatica

COMPLETED PROJECTS

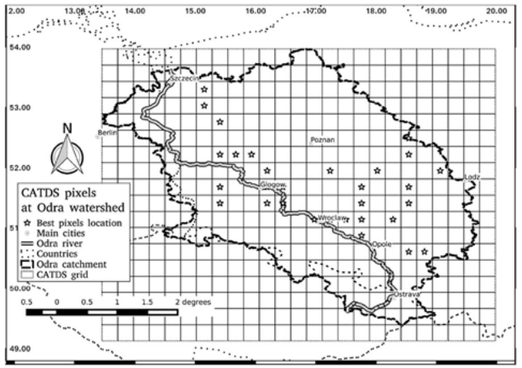
- Blue Gas – Polish Shale Gas – an electromagnetic method for the estimation of the degree of proppant penetration in the fracturing process – design and production of marker materials (cooperation with PGNiG, 2015–2016)
- Development of integrated geophysical/geochemical methods of soil and ground water pollution assessment and control in problematic areas (Polish-Norwegian Research Programme, cooperation with the Institute of Environmental Engineering PAS, and Norwegian partners, 2013–2016)
- Ground Based Monitoring of Soil, Water and Energy Exchange Conditions in Poland for Validation Purposes of the ESA mission SMOS (research programme of the European Space Agency, together with the Centre for Space Research PAS, and the Institute of Agrophysics PAS in Lublin, 2009–2011)
- Statistical and geostatistical analysis of the possibility to apply the field magnetometry methods for the initial assessment of soil pollution from industrial and urban particulate matter (grant from the Ministry of Science and Computerisation)
- Research of the spatial distribution of soil moisture and its variability over time (Kampinoski National Park, 2009–2011)

SERVICES OFFERED

- analyses in the scope of statistics and geostatistics of natural and anthropogenic environments
- chosen applications of computer science in environmental research
- analyses of satellite images

OTHER ACHIEVEMENTS

- outstanding achievements in the research of natural and anthropogenic environment, i.a. soil research (soil magnetometry, soil moisture) and vegetation ecosystems
- participation in the development of international standard ISO 21226:2019, Soil quality – Guideline for the screening of soil polluted with toxic elements using soil magnetometry
- participation in the development of proppants having magnetic properties to extract shale gas as part of the BLUE GAS Programme



VENTILATION AND AIR-CONDITIONING LABORATORY

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#AIR DISTRIBUTION #VENTILATION AND AIR CONDITIONING
#VAV SYSTEMS #MEASUREMENT TECHNOLOGIES
#FLOW VISUALISATION

The Team consists of the employees of the Department of Heating and Ventilation at the Faculty of Building Services, Hydro and Environmental Engineering. The Team has long-standing experience in the field of conducting laboratory tests, on-site measurements and participation in research and development works related to the development of new products.

It carries our research based on the Ventilation and Air Conditioning Laboratory, including studies related to ventilation air distribution in a given room and the identification of parameters of air supply components used in ventilation and air-conditioning systems.

Research works conducted at the laboratory are related to the analysis of the functioning of such ventilation components as air vent covers, diffusers, louvres, swirl flow diffusers, floor registers and other elements. A number of works are also related to the study of air flow adjusters used in VAV systems. Research skills and development work are further enhanced by the cooperation with the staff of the Indoor Air Quality Lab and the Cooling and Heat Pumps Laboratory.

CONTACT

Jacek Hendiger, Ph.D.
jacek.hendiger@pw.edu.pl
(+48) 22 234 60 10
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- VENTILATION AND AIR-CONDITIONING LABORATORY:
  - a measurement station equipped in an air intake system and a testing chamber interned for the determination of the characteristics of various types of flow diffusers supplying air to premises - the size of the testing chamber corresponding to the real-life premises allows the performance of full-scale tests; the configuration and equipment of the station allow the preparation and performance of tests of numerous components of ventilation and air-conditioning systems; it is possible to determine the flow characteristics of devices and prepare guidelines for the construction of new components
  - multi-channel thermal anemometer system for the testing of the distribution of air speed and temperature within the operating field of air supply components
  - air flow visualisation devices
  - multi-functional transducers and meters for the measurement of air temperature, humidity, pressure and speedba
  - air parameter loggers

COMPLETED PROJECTS

- The development and testing of prototypes and new structures of ventilators with changeable stream characteristics for ventilation and air conditioning systems. The development of innovative operation method, laboratory tests of the prototype, the determination of range characteristics, pressure reduction and the adjustment characteristics of a ventilator having unique parameters in relation to other devices of similar use
- The study of VAV air flow adjusters in terms of the optimisation of shape and the layout of components for the measurement of the air volume flow rate. The development of a structure ensuring very good metrology properties, allowing the operation of adjusters at low air speed
- The application of flow visualisation technologies for research into ventilation and air conditioning. The application of a new visualisation technology using the BOS Background Oriented Schlieren method with digital image analysis

SERVICES OFFERED

- anemometric measurements of air speed, definition of air flow range, air flow speed profile, boundaries of the ventilation flow, the preparation of characteristics of air intake or exhaust components
- visualisation of indoor air flow
- study of the characteristics of pressure reduction in ventilation system components, determination of pressure loss for air intake and exhaust components, flow adjusters, dampers and other devices intended for the assembly in the ventilation duct network
- study of the tightness of ventilation system components

REFRIGERATION AND HEAT PUMPS LABORATORY

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY,
CIVIL ENGINEERING AND TRANSPORT

#REFRIGERATION #CO2
#COOLING AGENTS #HEAT PUMPS
#DIDACTIC MODELLING #COOLING CIRCUIT
#VISUALISATION OF PROCESSES TAKING PLACE IN SYSTEMS

The Refrigeration and Heat Pump Team runs its activities at the Faculty of Building Services Hydro and Environmental Engineering, focusing on research into refrigeration technologies and heat pumps.

Team members have gained experience in designing and constructing compressor refrigeration units and heat pumps, as well as in the design, analysis and study of refrigeration and air-conditioning units and systems. The focus of numerous works performed by the Team in recent years was the analysis of the possibilities to use carbon dioxide as a cooling agent both in traditional compressor units and in cascade and auto-cascade refrigeration systems, in particular in low-temperature conditions outdoors. As part of their research and educational activities, numerous refrigeration and heating devices were designed and produced, including multi-functional didactic models and demonstration stations.

The Team also conducts many research and development works as part of Faculty operations in close collaboration with the Ventilation and Air Conditioning Laboratory. The team's business partners include such companies as Alfaco, Carel, CBRE, Daikin, Euros Energy, Klima-Therm, Mitsubishi Electric, New Age Refrigeration Solutions, Plum, PPUCh Tarczyn, PROZON, Sanhua, and Swep.

CONTACT

Michał Sobieraj, Ph.D.
Piotr Ziętek, Ph.D.
michal.sobieraj@pw.edu.pl;
piotr.zietek@pw.edu.pl
(+48) 22 234 50 21
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- mass flow meter (measurement range: 0-250 kg/h, uncertainty: ±0.1 %)
- electronic scales (measurement range: 0-10000g, uncertainty: ± 0.5 g)
- multi-channel data loggers
- pressure transducers (measurement range: 0-35 bar, class 0.5)
- temperature sensors PT100 (measurement range: -100-10000g, uncertainty: ± 0.1 K)
- multi-channel temperature transducers
- measurement equipment for the detection of leaks in devices and systems
- equipment for refilling and emptying systems with cooling agents
- refrigeration test chamber (under construction)

COMPLETED PROJECTS

- Development and construction of an air-to-water heat pump adjuster (NCBR – National Centre for Research and Development, POIG 200–2013)
- The development of a production technology for compact service water heaters with a heat pump (NCBR – GEKON1)
- The study of an auto-cascade refrigeration unit allowing the use of carbon dioxide in the subcritical cycle. The construction of a testing station and the investigation of heat exchangers
- Multifunctional mobile didactic station for the refrigeration laboratory (PROZON, 2018)
- Design and construction of a multi-functional testing and didactic cooling and heating system with the use of a water loop

INVENTIONS

- Tube heat exchanger and refrigeration method (P-427655)
- Auto-cascade refrigeration unit (P-427633)

SERVICES OFFERED

- expert opinions and positions in respect of the design and operation of refrigeration and air-conditioning systems
- design of refrigeration units and devices and heat pumps, including thermodynamic analysis and selection of components
- construction of didactic and demonstrative models
- study of the parameters of refrigeration systems and heat pumps
- study of the boiling process of natural cooling agents
- study of the effectiveness of tube and plate heat exchangers

INDOOR AIR QUALITY LABORATORY

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#AIR QUALITY #MODELLING #CLEAN ROOMS #MEASUREMENTS IN SITU
#HYGIENIC ASPECTS OF VENTILATION AND AIR-CONDITIONING SYSTEMS
#BIOFILTRATION #MOISTURE AND MYCOLOGICAL HAZARD
#HEALTH CARE FACILITIES #EDUCATIONAL BUILDINGS
#PROTECTION OF MUSEUM ARCHIVES AND COLLECTIONS #BIOPHILIA
#IMPACT OF AIR QUALITY ON INDIVIDUAL WORK PERFORMANCE

The team operates at the Faculty of Building Services, Hydro and Environmental Engineering at the Air Conditioning and Heating Department. In close cooperation with the Ventilation and Air Conditioning Laboratory, the team members develop innovative methods and techniques for indoor air quality (IAQ) assessment, energy-saving and ecological technologies for IAQ shaping, and on setting standards defining the area of good indoor air quality for room users.

The team actively participates in projects devoted to energy efficiency in buildings, analysing the potential impact of thermo-modernisation measures on indoor air quality. The staff organises a series of conferences, "IndoorAir Quality Problems in Poland."

The services offered by the team have so far been used by: the National Museum in Warsaw, the Central Archives of Historical Records in Warsaw, the Museum of the History of Polish Jews, Zachęta - National Gallery of Art, Przeczno Parish, and FLORABO Sp. z o.o.

CONTACT

Jerzy Sowa, Ph.D.
jerzy.sowa@pw.edu.pl
(+48) 22 234 74 28
is.pw.edu.pl, iaq.is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- instruments and devices for measuring and mobile recording of basic microclimatic parameters, selected concentrations of indoor air pollutants, noise, visible light intensity, and photosynthetically active radiation
- set of instruments for testing the airtightness of buildings and rooms

COMPLETED PROJECTS

- Research and development works aimed at creating a prototype of the FLORABO diagnostic and biological air filtration system (RPMA, 2016–2018)
- The concept of adapting two selected buildings to the almost zero-energy standard (EEA Grant, 2015–2017)
- STEP - Thermomodernisation of public buildings conducted in accordance with the conditions of sustainable development (EEA Grant, 2006–2011)
- SURE-BUILD Sustainable rehabilitation of buildings (grant from the Norwegian Ministry of Foreign Affairs, 2002–2005)
- Controlling the efficiency of mechanical ventilation systems based on continuous measurements of carbon dioxide concentration (grant from the Scientific Research Committee, 2001–2006)

SERVICES OFFERED

- assessment of the hygienic condition of ventilation systems and its impact on the quality of supplied air
- testing of indoor air quality in office buildings and assessing its effect on comfort and individual work performance
- indoor air quality testing in educational buildings
- tests of hygrothermal conditions, cleanliness, and airflow in operating theatres in hospitals
- assessment of the mycological risk of archival storerooms
- microclimate studies and environmental risk assessment of museum collections in exhibition halls and storerooms
- studies evaluating the impact of plants on indoor air quality

OTHER ACHIEVEMENTS

- Recommendation of the Minister of Health (2017) for the publication: *Guidelines for the design, implementation, acceptance, and operation of ventilation and air conditioning systems for entities performing medical activities* - to be used as auxiliary material in the design and modernisation of infrastructure operated by entities conducting health care activities

THERMAL COMFORT, PRODUCTIVITY AND WELL-BEING ANALYSIS TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#HEAT COMFORT #HEAT EXCHANGE #COMFORT #ENVIRONMENTAL ASSESSMENT #PROTECTION #INTERVENTION RESEARCH #INDIVIDUAL CHARACTERISTICS #PRODUCTIVITY #PERFORMANCE #DISCOMFORT #INDOOR ENVIRONMENT #COMMISSIONING #PROTECTIVE CLOTHING #INDOOR ENVIRONMENT QUALITY #VENTILATION #AIR CONDITIONING

The team working at the Air-Conditioning and Heating Department of the Faculty of Building Services, Hydro and Environmental Engineering, focuses on research and analysis of broadly defined thermal interactions between human beings and surroundings and the influence of the thermal environment on comfort, productivity and well-being of occupants, including individual characteristics.

The research carried out by the team includes the analysis of, among others, heat and mass exchange between human body and environment, human impact on indoor environment parameters, indoor environment conditions in terms of user comfort and building energy consumption, conditions in rooms occupied by people with special requirements (patients, surgeons, school and preschool children, the elderly), human thermophysiology including individual variability (gender, age, body build, health status).

Research is conducted on the human sensation on thermal environment conditions, questionnaire studies on the perception of the indoor environment by various user groups, modelling of human-environment heat exchange and designing individual solutions increasing the thermal comfort of users.

CONTACT

Professor Anna Bogdan, Ph.D., D.Sc.
anna.bogdan@pw.edu.pl
(+48) 22 234 51 37
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- a set of mobile microclimate meters
- a set of meters for the measurement of local surface temperature in rooms
- a set of meters to measure metabolic rate
- a set of anemometers to measure local air velocity
- a set of mobile meters for supplementary measurement of indoor environment quality (air quality, noise, lighting)
- a set of psychological questionnaires and validated procedures for measuring comfort and productivity (including work efficiency, perceptiveness, attention, concentration, mood and fatigue)

CO-AUTHORING OF PATENTS

- in the field of innovative protective clothing ensuring the comfort of work in hot environment conditions: cooling waistcoat solution
- phase change material as a cooling element
- in the field of application of phase change compounds in construction to reduce energy consumption
- individual ventilation module to ensure comfortable thermal conditions for office space users

SERVICES OFFERED

- analysis of the indoor environment in existing facilities in terms of ensuring comfort, high productivity and well-being of users (analysis of quantitative and qualitative parameters)
- support in the process of designing buildings to ensure the highest conditions of the indoor environment
- support in the development of innovative solutions for ventilation and air conditioning of rooms
- development of concepts for the modification of user comfort management

COMPLETED PROJECTS

- Improvement of indoor conditions for patient recovery in Polish hospitals
- Hospital of the future - developing air conditioning solutions for operating theatres
- Ergonomics and comfort of work in operating rooms
- The human thermal simulator as a tool for the assessment of internal environment conditions
- Intervention measurements including the assessment of indoor environment impact on office workers' productivity
- Development of a new solution for ventilation and air conditioning of residential buildings to ensure the highest quality of the indoor environment for users

DISTRICT HEATING ENGINEERING TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#HYDRAULIC MODELLING OF DISTRICT HEATING NETWORKS
#HEAT NETWORK SIMULATION AND OPTIMISATION
#HYBRID AND POLYGENERATION ENERGY #HEAT STORAGE
#HEATING SYSTEM MANAGEMENT #HEAT EFFICIENCY
#ENERGY EFFICIENCY OF DISTRICT HEATING SYSTEMS AND HEAT SOURCES

The District Heating Engineering Team operates within the District Heating and Gas Systems Department. The most important research areas of the team include comprehensive research and hydraulic analysis of network systems in various operating conditions, including operational analysis regarding the integration of district heating networks (DHN) with central and distributed thermal energy storages (TES), designing of heat accumulators, research on the integration of renewable energy sources in district heating systems, and the reduction of heat losses in DHN, assessment of the risk level in DHN.

Scientific and research activity is closely related to the current challenges facing the Polish thermal energy sector: reducing the emission of pollutants into the atmosphere, replacing carbon in thermal plants with renewable sources, optimising the operating parameters of thermal plants and pumping stations, including load distribution, heat demand forecasting.

The area of expert activity of the team members is also the use of renewable energy sources for the purposes of supplying district heating systems and other facilities as well as the integration of combined heat and power production systems in power plants and their cooperation with the district heating network.

The team cooperates with the operators of district heating systems, associated in the Polish District Heating Systems Chamber of Commerce, and conducts international cooperation with the Danish Board of District Heating DBDH.

CONTACT

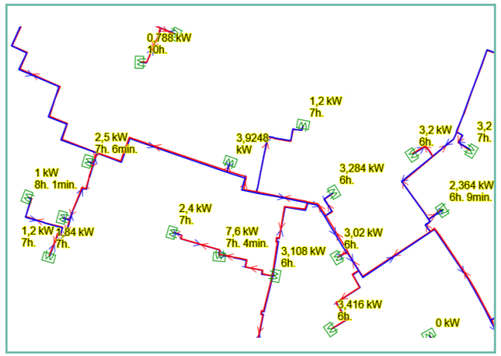
Małgorzata Kwestarz, Ph.D., D.Sc.
malgorzata.kwestarz@pw.edu.pl
+48 22 234 75 06
www.sc.is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- LABORATORY OF DISPATCHING SYSTEMS IN THE DISTRICT HEATING SYSTEMS INDUSTRY
- district heating network simulator of any configuration: SimNet SSHeat

COMPLETED PROJECTS

- Preparation of a conceptual design for a Green Fuel Station with a proposal for the application and implementation of technical and technological solutions (2019)
- Energy efficiency of large cooling water systems (2018)
- Municipal waste and sewage sludge as energy sources for municipal district heating systems (2017)
- Study of the impact of thermo-modernisation on the Warsaw District Heating System (2017)
- Recovery of Energy from Municipal Waste and Biomass (2015 –2016)
- Design and site supervision over the implementation of the Thermal Energy Storage storageat CHP Siekierki in Warsaw (2008–2009)

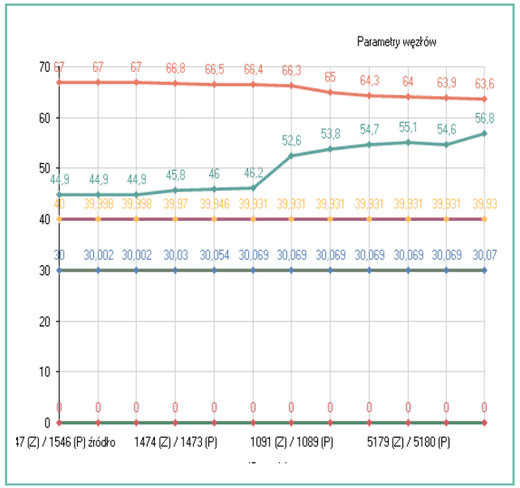


SERVICES OFFERED

- expert opinions and positions on the design and operation of district heating and cooling systems
- design of thermal energy storages, including thermodynamic analysis and selection of elements
- analysis of the operating parameters of thermal plants and pumping stations (in partnership with Fluid Systems Ltd.)
- analysis of cooperation between renewable energy sources and district heating systems
- energy audits of district heating systems

OTHER ACHIEVEMENTS

- Statuette of the Promotional Emblem "Teraz Polska" for the thermal energy storage for district heating systems in Poland (2017)



GAS ENGINEERING TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#COMPUTATIONAL METHODS FOR GAS TRANSPORT AND DISTRIBUTION
#TECHNICAL PROBLEMS OF GAS TRANSMISSION AND DISTRIBUTION
#MEASUREMENT TECHNOLOGY IN GAS INDUSTRY
#OPERATING GAS NETWORKS #GAS UTILISATION

The Gas Engineering Team is a renowned research team in Poland and abroad in the field of transmission, distribution and end-use of gas. The most important scientific activities of the team are related to hydraulic modelling, simulation and optimisation of gas networks, mathematical modelling of network non-pipe elements, including the energy efficiency improvements of pressure regulator gas stations and compressor stations.

The team conducts research in the field of flow and gas quality measurement technologies, state estimation, gas consumption forecasting, SCADA systems, leak detection and localisation in gas networks, risk management in gas networks, reliability and safety of pipeline network operations and the role of gas networks in the process of energy systems' integration and sector coupling (multi-energy systems, hydrogen economy).

The team cooperates with gas pipeline operators associated in the Chamber of the Gas Industry and conducts international cooperation with the Department of Transport, Energy and Climate at the European Commission Joint Research Centre in Petten.

CONTACT

Professor Maciej Chaczykowski, Ph.D., D.Sc.
maciej.chaczykowski@pw.edu.pl
+48 22 234 50 57
www.ig.is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- a local computer network with hydraulic modelling, simulation and optimisation software for gas networks:
  - SimNet SSGas, SimNet TSGas
  - software for thermodynamic analysis and optimisation of energy conversion systems GateCycle 6.1, Cycle-Tempo
- FLOW MEASUREMENT LABORATORY FOR TESTING FLOW METERS with two types of reference meters:
  - critical flow nozzles
  - turbine gas meters with a measuring range of 400 m³/h
- SCADA SYSTEMS LABORATORY:
  - Telegyr TG8000 All-In-One software
  - TelWin SCADA software

INVENTIONS AND UTILITY MODELS

- A method of reducing the pressure of gaseous fuels, patent No. PAT.230197 (2016)
- A hybrid gas heating system in pressure regulator stations using renewable energy sources. Utility model application (submitted) W.126555 (2017)
- Gas heating system in pressure regulator stations using renewable energy sources. Utility model application (submitted) W.126554 (2017)
- System and method of hydrogen blending in natural gas network, patent application No. P.429432 (2019)

SERVICES OFFERED

the team offers a wide range of computational services covering the analysis of gas networks, including computational algorithms development (monitoring, simulation, optimisation, control, databases, GIS, SCADA); the services are provided in partnership with Fluid Systems Ltd.; the remaining research work concerns:

- the development of network control algorithms and implementation of software-based leak detection and localisation systems
- preparation of gas network management programmes for system operators (linepack management, gas quality tracking)
- local automated control systems used in the natural gas industry, including hydrogen and biomethane injection processes
- workshops, trainings, postgraduate education in the field of Gas Engineering

SELECTED PROJECTS

- Gas metering uncertainty study for Tommeliten Alpha field development, for PGNiG Upstream Norway AS (2019–2020)
- Gas composition tracking in transient pipeline flow, for Gassco (2017–2018)
- Development of optimal concepts for the use of unconventional gas resources, taking into account environmental and social aspects (ResDev) The National Centre for Research and Development Grant, Blue Gas – Polish Shale Gas Programme (2014–2016)
- Analysis of the possibility of using turboexpanders for waste energy recovery in gas pressure regulator stations for Gas Transmission Operator GAZ-SYSTEM S.A. (2013)

SMART WATER SUPPLY AND WASTEWATER TREATMENT SYSTEMS TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#WATER SUPPLY SYSTEMS #WASTEWATER COLLECTION SYSTEMS
#INTEGRATED MANAGEMENT SYSTEMS FOR TECHNICAL INFRASTRUCTURE
#SMART DIAGNOSTIC SYSTEMS #OPERATION
#MODELLING #MONITORING #GIS
#WATER QUALITY IN DISTRIBUTION SYSTEMS

The research and implementation team is composed of the employees of the Warsaw University of Technology from the Faculty of Building Services and Hydro and Environmental Engineering, from the Faculty of Environmental Engineering at the Lublin University of Technology and Megabit Sp. z o.o. They specialise in water supply and wastewater collection networks, computer science, automation, geodesy and management. The team runs research and R&D activities, implementing projects contracted by industry representatives, state administration and local government units.

The Team's scientific staff (from Lublin and Warsaw Universities of Technology) create theoretical foundations and prepare assumptions which constitute the basis for implementing projects with a substantial share of Megabit Sp. z o.o. R&D projects entitled "Preparation of assumptions and implementation of a Company Technical Infrastructure Integrated Management System" for MPWiK "Wodociągi Puławskie" Sp z o.o. and "Smart Management System for the Water Supply and Wastewater Collection Network at MPWiK w Żywcu Sp. z o.o." may serve as perfect examples of such cooperation as part of the Team's activities.

PATENTS

Team members acquired over 40 domestic and international patents, including:

- a patent awarded a Platinum Medal at the 2016 International Warsaw Invention Show: The method for mapping the location of water quality measurement sites in water supply networks (PAT.222928)
- a patent awarded a Gold Medal at the 2016 International Warsaw Invention Show: The method for mapping the location of flow measurement sites in water supply networks (PAT. 222929)

CONTACT

Professor Marian Kwietniewski, Ph.D., D.Sc.
marian.kwietniewski@gmail.com
(+48) 601 394 432
is.pw.edu.pl

- a patent awarded a Bronze Medal at the 2016 International Warsaw Invention Show: Method for mapping the location of water pressure measurement sites in water supply networks (Patent No. 222930)
- Method and system to reduce pressure in water supply networks (Patent No. PAT.216560)
- Vodopravìdna mereža transportuvannâ ta kondiciûvannâ vodi (Ukrainian patent No. UA PAT. 103970)
- a patent awarded a Gold Medal at the 2019 International Warsaw Invention Show: "Sewer Chamber"
- Gold Medal for Patent "Sewage Well" at the International Exhibition of Innovation, Research and New Technologies EUREKA 2019 in Valencia
- Silver Medal for Patent „Universal Pipe Saddle for Water Supply Pipelines Drilling" at the 2019 International Warsaw Invention Show (IWIS)

RESEARCH INFRASTRUCTURE

- a stationary environmental analysis laboratory which may perform a full range of water and wastewater quality determinations required by the legal system in force in Poland and in Europe, and moving beyond the scope of such requirements (i.a. gas chromatography and liquid chromatography coupled with mass spectrometry and ICP, TOC analyser, etc.)
- a stationary laboratory allowing the examination of linear and local resistance coefficients in pipelines and fittings with a diameter of up to 150 mm
- devices for the monitoring of hydraulic parameters of the operation of water supply networks - pressure transducers, flow meters and a mobile water quality analyser
- software for the numerical modelling of water supply networks, including water quality in a network, and wastewater networks (EPANET, SWMM, WaterGems, SewerGems)
- software for the modelling of water and pollutant movement in soil and groundwater – FEFLOW
- software for the modelling of flow phenomena in pressurised conduits (migration of pollutants, pressure loss, etc.)

SERVICES OFFERED

- planning and implementation of smart integrated management systems for technical infrastructure, including, I.A. GIS, Mb GIS Utility, models of water supply and wastewater collection systems, the assessment of failure frequency and risks related to water supply and wastewater collection systems, remote collection of water meter readings etc.
- planning and implementation of GIS databases in small and medium-sized waterworks
- construction and calibration of numerical models of water supply and wastewater networks – based on "paper" data or GIS databases provided by enterprises
- assessment of hydraulic conditions for the operation of water supply and wastewater collection systems, control tests and studies aimed at the calibration of numerical models of the systems
- planning of monitoring systems for water supply and wastewater collection networks (hydraulic and water quality parameters) with particular attention to the optimum location of measurement sensors
- definition of the location of flow, pressure and water quality monitoring sites, including water disinfection sites, and the required dosage of chlorine
- integration of data stored in GIS databases – network monitoring data – remote water meter readings – simulation calculation results
- development of smart diagnostic systems for water supply and wastewater collection networks
- optimisation of the setting of cooperating water pumping stations in terms of minimising energy consumption and improving the operational effectiveness of pumping stations
- evaluation and assessment of failure frequency and water supply and wastewater collection risks in settlement units
- assessment and identification of secondary water contamination in water supply networks and the implementation of methods to counteract the results of such contamination
- the examination of linear and local resistance coefficients of water supply piping and fittings with a diameter of 8 to 150 mm

WATER SUPPLY AND FIRE PROTECTION INFRASTRUCTURE TEAM

AT THE WARSAW UNIVERSITY OF TECHNOLOGY

CIVIL ENGINEERING AND TRANSPORT,
ENVIRONMENTAL ENGINEERING, MINING AND ENERGY

#CORROSION OF FIRE PROTECTION SYSTEMS #HYDRAULIC SURGE
#CORROSION OF WATER SUPPLY SYSTEMS #WATER LAW SURVEY
#WATER SUPPLY SYSTEMS #FIRE PROTECTION SYSTEMS
#HYDRODYNAMIC REACTIONS #WATER AGGRESSIVENESS
#WATER QUALITY #RAINWATER MANAGEMENT

The team is composed of researchers from different departments of the Faculty of Building Services, Hydro and Environmental Engineering, thus enabling wide activity area and comprehensive solutions of research and engineering issues.

The members of the group performed research services for City of Warsaw, Municipal Water and Sewerage Company in Warsaw, Polish Airports, Regional Inspectorate for Environmental Protection in Warsaw, Town Hall in Pruszków, and the Polish Agency for Enterprise Development. The members of the group also have unlimited authorisation to design hydroengineering facilities.

CONTACT

Agnieszka Malesińska, Ph.D., D.Sc.
agnieszka.malesinska@pw.edu.pl
(+48) 506 030 127
is.pw.edu.pl

RESEARCH INFRASTRUCTURE

- ENVIRONMENTAL CHEMISTRY LABORATORY equipment:
  - atomic absorption spectrometer fitted with an atomizer in the flame and graphite furnace – for the metals determination
  - TOC – for organic compounds determination
  - gas chromatograph GS-MS
  - a wide-range spectrometer for the analysis of chemical indicators
  - filtration kit
  - vortex mixer
  - ultrasound thickness gauge Metrison Sono M610, measurement accuracy 0.1 mm (measurements of steel elements' thickness, also covered with paint)
  - temperature chamber (range: from 5°C above ambient temp. up to 300°C)

PARTICIPATION OF TEAM MEMBERS IN PROJECTS

- participation in the project "Water under pressure" – practical course of assessment of the pressure of municipal facilities on surface waters (Scholarship and Training Fund programme of the Norwegian Financial Mechanism)
- energy recovery from municipal waste and biomass (NCBR – GEKON)
- numerical analysis of pressure propagation in sludge pipelines during the hydraulic surge phenomenon for the top elevation of the Mining Waste Disposal Facility with a range between 180 and 195 metres above sea level (KGHM Polska Miedź S.A.)
- Laboratory tests conducted on physical model of part of a siphon for sewage transport from left shore Warsaw to the CZAJKA Wastewater Treatment Plant below the bottom of the Vistula river (MPWiK Warszawa S.A.)
- Analysis of technical quality of the road projects co-financed by EU funds along with recommendations of optimisation and detailed technical conditions of the design, execution, operation and maintenance of road civil engineering structures (Ministry of Infrastructure)

SERVICES OFFERED

- water composition analysis – quality, corrosion parameters, composition stability
- wastewater composition analysis – quality and aggressiveness
- solid phases' investigation – soils, synthetic materials, concretes concerning composition and environmental impact
- Java, C++ programming, Matlab modelling and programming, databases, building of measurement devices
- investigation of capacity of channels/ditches/networks/systems
- corrosion in water supply systems
- corrosion in fire protection systems
- water law survey
- rainwater management
- transient phenomena in water supply systems
- emergency system in rainwater management

SELECTED PATENTS

- Fibre-optic channel with the function of pressure stabilisation in a pipeline intended for the transfer of liquids (P.234067)
- Patent application: Fibre-optic channel with the function of pressure stabilisation in a pipeline intended for the transfer of liquids (P.424575)

Catalogue of Research Teams at the Warsaw University of Technology. R&D Portfolio

Faculty of Building Services, Hydro and Environmental Engineering

Graphic design and typesetting:
Klaudyna Nowińska, Gabriela Hołdanowicz, Paweł Huras, Marcin Karolak, Aleksandra Wycisk, PhD
Dział Badań i Analiz Centrum Zarządzania Innowacjami i Transferem Technologii PW

Coordination:
Katarzyna Modrzejewska, PhD

Cover photo by:
Andrzej Chomczyk

ISBN: 978-83-964993-6-3

DOI: 10.32062/20220506

Issue 1

Warsaw, 2022

Centrum
Zarządzania Innowacjami
i Transferem Technologii
POLITECHNIKA WARSZAWSKA

ISBN: 978-83-964993-6-3

Politechnika
Warszawska