

Institute of Environmental Engineering, Polish Academy of Sciences

KEY RESEARCH DOMAINS

environmental engineering, air pollution control, water pollution control, waste and water management, land reclamation, effects of diffuse pollutants on the environment, certified research laboratory

ABOUT THE INSTITUTE

The Institute's activities focus on the following areas: pollution of the air with harmful substances (including industrial, municipal, and transportation-related emissions of pollutants to the air); pollution of surface waters and control of eutrophication of water reservoirs; the use of magnetometry in environmental research; contamination of soil surfaces with heavy metals and organic compounds; technologies for waste treatment; removal of inorganic and organic pollutants by sorption processes; the design and preservation of urban spaces. Our laboratory performs accredited analyzes of water, wastewater, soil, waste and measurements of gas and dust concentrations of air pollutants (quality management system ISO17025:2018, confirmed by PCA certificate AB950).

<https://ipis.pan.pl/en/>

**The Institute of Environmental Engineering of the
Polish Academy of Sciences**



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FEATURED ACHIEVEMENTS & FACILITIES

The Institute is the oldest scientific institution in Poland conducting comprehensive basic and applied research in the field of environmental engineering, dealing with technical, scientific, spatial, legal, and economic issues. The Institute has more than 60 years of experience in scientific and applied research. We are active in the field of protecting the air, water and Earth's Surface.

Offer to collaborate on projects and grants proposals

As a team of scientists - specialists in their respective fields - we turn to you with an offer of cooperation, both in current scientific and research activities and in the implementation of grant projects in our areas of interest and experience.

The following section briefly outlines the main areas of our research and development work, supported by many years of experience.



Water Management and Protection

<http://ipis.pan.pl/ipispan/pl/struktura/zaklad-gospodarki-wodnej-i-ochrony-wod>



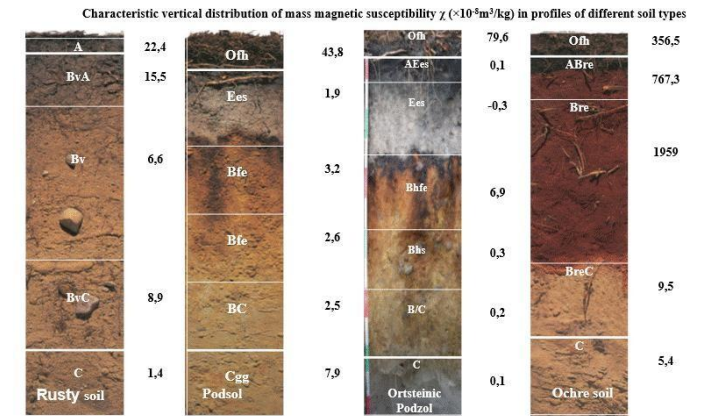
1. Protect natural and anthropogenic lake ecosystems from eutrophication;
2. Reclamation of natural and anthropogenic lakes;
3. Monitoring and risk assessment of surface water pollution by various substances, including metals and persistent organic pollutants;
4. Assessment of the degree of contamination of surface waters, municipal and industrial wastewater, with selected organic pollutants, including compounds used in the plastics industry (phthalates, alkylphenols, bisphenol A) and others such as polycyclic aromatic hydrocarbons;
5. Assessment of the degree of contamination of bottom and sewage sludge with metals and polycyclic aromatic hydrocarbons;
6. Assessment of the ecological and health risks associated with the presence of metals in bottom and sewage sludge;
7. Investigation of speciation forms of metals and phosphorus in bottom sediments of surface waters;
8. Comprehensive investigations of metal speciation forms in sewage sludge, throughout the sewage treatment plant;
9. Optimization of sequential extraction of metals from environmental samples using ultrasound;
10. Research on the direct and technological effects of ultrasonic disintegration of excess sludge;

The Department conducts scientific limnological and technological research in the field of water and wastewater management. It is willing to cooperate in the implementation of projects in the above-mentioned thematic areas.

Environmental Magnetism and Reclamation

<http://ipis.pan.pl/ipispan/pl/struktura/zaklad-magnetyzmu-srodowiska-irekultywacji>

1. Location of areas of current and historical soil contamination caused by industrial-urban dust deposition;
2. Investigation of trace element contamination of soils using environmental magnetometry (according to ISO 21226:2019 procedure);
3. Identification and localization of anthropogenic horizons in soils in areas of historical mining and industrial activities and former waste dumps;
4. Biomagnetic monitoring of air pollutants in green areas of urban-industrial agglomerations and in traffic routes;
5. Study of chemical, magnetic and biological properties of soils in forest areas and ecotone zone;
Magnetic surveys on archaeological sites to locate shallow seeping artefacts;
6. Biological reclamation of areas degraded by anthropogenic human activity;
7. Microscopic studies of anthropogenic and magnetic particles and microplastics;
8. Redevelopment of urban greenery and its adaptation to the changing climate and local sources of Pollution;
9. Study of chemical and magnetic indicators to help identify the type of biomass burned and the impact of environmental conditions environmental conditions on the ecological quality of biomass;
10. Accumulation of iron and its magnetic forms in plant tissues growing in areas of strong magnetic-geochemical anomalies;
11. Studies on the magnetic properties of diagnostic soil horizons and the possibility of using magnetic indicators in soil taxonomy.



Air Protection – immission

<http://ipis.pan.pl/ipispan/pl/struktura/zaklad-ochronypowietrza-zespol-imisji-zanieczyszczen>

1. Tackling environmental Pollution ;
2. Monitoring of emissions and immissions;
3. Identification of sources of pollution within installations as well as area air Pollution;
4. Sampling and analysis of the chemical composition of various aerosol fractions using impactor methods;

The team has a wide range of automatic sampling equipment, including: low and high flow samplers, personal samplers, optical meters, particle counters, etc., a range of gas analysers conforming to reference methodologies, stationary research infrastructure located in Zabrze and Racibórz, mobile platforms for field tests mobile field test platforms adapted for the measurement of gaseous pollutants, aerosols and meteorological parameters; In addition, the team:

- has a gravimetric laboratory meeting the requirements of EN 12341:2024-01 equipped with scales and microbalances and a weighing robot,
- specializes in organic and elemental carbon content studies in PM samples, and in situ eBC studies using etalometers, has experience in conducting measurement campaigns using various measurement techniques (indicative measurements, sensor measurements) as well as running permanent monitoring stations in the field of dust and gas immissions and deposition, ➤ as a member of ACTRIS ERIC, offers access to the project's research infrastructure, as well as the opportunity to carry out internships and individual projects using the consortium's data and instrumentation resources.
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Air Protection – emissions

<http://ipis.pan.pl/ipispan/pl/struktura/zaklad-ochronypowietrza-zespol-emisji-zanieczyszczen>

The team provides a comprehensive service to clients oriented towards improving the parameters of gaseous emissions into the atmosphere. The offer includes:

1. Testing and assessment of atmospheric contamination;;
2. Measurement of dust and gas emissions from a wide range of production processes,
3. Carrying out tests on emissions of organic substances such as PAHs and VOCs;
4. Determination of atmospheric contamination by carbon dioxide, sulphur dioxide, carbon monoxide, nitrogen oxides and dust from industrial processes,
5. Carrying out QAL2 and AST tests;
6. Carrying out determination of metal concentrations in waste gases as well as in dusts: As, Cd, Cr, Co, Cu, Mn, Ni, Pb, Sb, Tl, V;
7. Evaluation of emissions from coal coking lines using the Mohrhauer method;
8. Tests are also carried out to determine the presence of many other substances, e.g. H₂S, H₂O, HCN and many others by accredited and non-accredited methods;
9. Testing of local noise at workplaces, noise to the environment, noise in residential and public areas;
10. Testing of local and general vibration;
11. Studies on energy expenditure.



Waste Management and Environmental Analyses

<http://ipis.pan.pl/ipispan/pl/struktura/zaklad-gospodarki-odpadami-i-analizsrodowiskowych>

1. Removal of micropollutants, including metal ions and metalloids, metal nanoparticles, pharmaceuticals from water and wastewater by adsorption methods using mineral and waste materials, biopolymers, and studies of their susceptibility to release. These topics are in line with newly established European standards and wastewater treatment plants will be required to introduce an additional wastewater treatment system, as current systems are not adapted to effectively remove micropollutants. Improving the management of wastewater treatment plants with regard to the removal of micropollutants will lead to an improvement in the quality of the surface water from which drinking water is obtained and will contribute to achieving one of the European Union's objectives, i.e. access to clean drinking water. The method of adsorption of metal ions from wastewater may also provide a means of recovering metals, including critical elements.
2. Development of research methodologies, investigating the mobility of metals/metalloids and their species in various elements of the environment (soils, waters, bottom sediments) using spectroscopic techniques such as ICP-OES, ICP-MS and combined HPLC-ICP-MS.
3. Investigating the impact, mobility and environmental transformations of Technology Critical Elements (TCE) in the context of the storage and treatment of electro-waste as well as the use of photovoltaics as a RES.



Impact of Diffuse Pollutants on the Environment

<http://ipis.pan.pl/ipispan/pl/struktura/zaklad-wplywu-zanieczyszczenobszarowych-na-srodowisko>

Investigation, monitoring, identification and development of methods to prevent and reduce the long-term impact on the terrestrial and aquatic environment of so-called diffuse (non-point) pollution from industrial emissions to the atmosphere, their long-range transmission, including transboundary and deposition over large areas; landfilling of various types of waste; agriculture; means of transport, etc., including historical pollution.

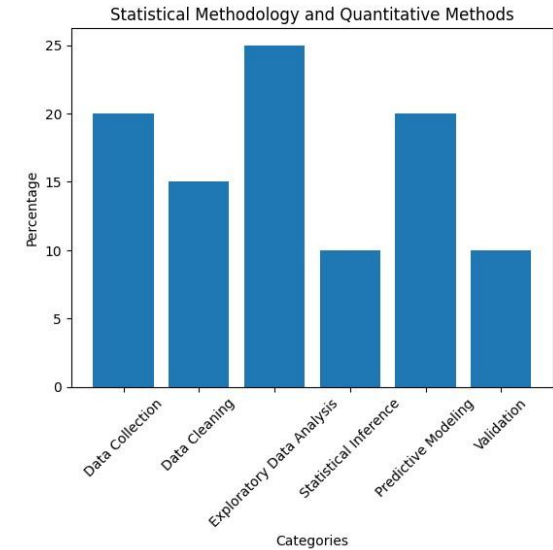
The research work includes:

1. Precise determination of the total cumulative deposition of area pollution using natural archives of nature;
2. Elucidation of the processes of contaminant migration in soil, uptake by plants, translocation in tissues and accumulation in edible parts of plants; effects of climate change on these processes; selection of plant-hyperaccumulators of contaminants for their safe non-invasive removal from soil by phytoremediation;
3. Research on crop-excluder plants that do not assimilate contaminants for food security;
4. Biogeochemical transformations of waste over time and migration of contaminants in waste pore waters, soil and soils of the aeration and carbonation zone, to determine and prevent their long-term impact on the soil-soil-water environment; Carrying out work for industry and local administrations in:
 - Determine environmental impacts.
 - Developing methods to prevent negative environmental impacts.
 - The remediation of the environment contaminated by various industrial and economic activities, including expert opinions on the impact of historical pollution on the soil-soil-water environment.



Statistical methodology and quantitative methods <http://ipis.pan.pl/ipispan/pl/instytut/o-instytucie>

1. Production of standard and in-depth statistical reports covering all statistical techniques and analyses starting from the analysis and identification of unidimensional distributions, correlation and regression analysis at any measurement scale of random variables - from nominal to quotient, time series analysis together with the development and production of dedicated quantitative analytical reports. Analyses and statistical reports are performed for the assessment of phenomena related to air impact, waste management and environmental analyses, water management and water protection, the impact of impact of area-based pollution on the environment, and other.
2. Identification of multidimensional phenomena with the use of statistical modelling in static terms, including ANOVA variance analysis family models, PCA principal components, factorial models, cluster analysis models together with segmentation of phenomena and post hoc processes.
3. Development and full implementation of causal stochastic models for variables at any measurement scale in the frequency domain and dynamic models, including the GLM (Generalized Linear Model), GRM (General Regression Models), DLNM (Distributed Lag Linear and Non-Linear Models) families.
4. Identification and forecasting of one-dimensional and multidimensional phenomena in dynamic terms (time series and stochastic processes) using dynamic models, including econometric, Box-Jenkins ARIMA, Fourier and others.
5. Identification of factors using any statistical models with full development of standard and dedicated model identification process, reporting and visualisations.
6. Assessment of health impacts of air pollutants using statistical and exploratory models.



Certified Research Laboratory

The Institute operates an accredited Research Laboratory. The Laboratory functions within a system compliant with the PN-EN ISO/IEC 17025:2018-02 standard.

The Laboratory's primary tasks include performing routine analyses to support the scientific activities of all research departments within the Institute, as well as analyzing commercial samples provided by external clients.

An experienced staff, state-of-the-art research equipment, certified materials, and reference materials ensure the highest quality of testing. This is confirmed by the Laboratory's performance in national and international interlaboratory studies and proficiency tests.

For a range of analyses, the Laboratory holds accreditation in accordance with certificate number AB 950, granted by the Polish Centre for

Accreditation, detailing the scope of its accreditation.

We offer analyses and expert evaluations for: Quality control, Environmental impact, Introduction of new products;

We specialize in techniques such as: ICP-MS - Inductively Coupled Plasma Mass Spectrometry, ICP-EOS - Inductively Coupled Plasma Optical Emission Spectrometry, IC - Ion Chromatography with Conductometric and Pulsed Amperometric Detection, GC-MS - Gas Chromatography-Mass Spectrometry, GC-FID - Gas Chromatography with Flame Ionization Detection.

Our laboratory is equipped for: Sample mineralization (microwave digester, fusion furnace), Grinding, Extraction (shaker, ultrasonic bath) The laboratory is focused on non-standard analyses that require expertise and innovative approaches to problems. We are open to all forms of collaboration, including the development of new analytical procedures and research projects.

The laboratory offers comprehensive analyses of inorganic substances: ions, metals and metalloids



Parameter	Analytical technique	Matrix
Li ⁺ , NH ₄ ⁺ , Na ⁺ , K ⁺ , Mg ²⁺ , Ca ²⁺ F ⁻ , Cl ⁻ , Br ⁻ , SO ₄ ²⁻ , NO ₃ ⁻ , NO ₂ ⁻ , PO ₄ ³⁻	Ion chromatography with conductometric detection (IC/CD)	Water and wastewater Soils Waste Atmospheric dust Flue gas samples collected in absorbing solutions And others
Ca, Mg, K, Na, Eu, Zn, Ti, Cr, Mn, Co, Ni, Cu, Se, Rb, Sr, Mo, Cd, Sn, Sb, Te, Ba, W, Pb, Si, Al, P, Fe	Optical Emission Spectrometry with Inductively Coupled Plasma (ICP-OES)	Water and wastewater Soils Waste Atmospheric dust Flue gas samples collected in absorbing solutions And others
Zn, Ti, Cr, Mn, Co, Ni, Cu, As, Se, Rb, Sr, Mo, Ag, Cd, Sn, Sb, Te, Ba, W, Au, Tl, Pb, Ge	Inductively Coupled Plasma Mass Spectrometry (ICP-MS)	Water and wastewater Soils Waste Atmospheric dust Flue gas samples collected in absorbing solutions And others

The laboratory offers comprehensive analyses of organic substances

Parameter	Analytical technique	Matrix
Low molecular weight carboxylic acids (formic, acetic, propionic acids)	Ion chromatography with conductometric detection (IC/CD)	water and wastewater soils waste atmospheric dust flue gas samples collected in absorbing solutions and others
PAH (including benzo(a)pyrene) Phenols, alkylphenols,- Phthalates Mineral oil components- Petroleum-derived substances Other volatile organic compounds	Gas chromatography coupled to mass spectrometry (GC/MS)	water and wastewater- soil waste atmospheric dust waste gas samples taken for absorbent solutions and sorbents and others
Volatile organic compounds, including BETX, aliphatic compounds	Gas chromatography with flame ionisation detection (GC/FID)	water and wastewater - soils, waste atmospheric dust waste gas samples taken for absorbent solutions and others
Biomass combustion markers and sugars	Ion chromatography with pulsed amperometric detection (IC/PAD)	water atmospheric dust

The Institute's experience in implementing major projects

- Project title: *Air quality information system in the Polish-Czech border area of Silesia and Moravia*, AIR SILESIA Manager: Krzysztof Klejnowski, PhD, Duration: 2010-2013. Foreign partner: Czech Republic (CHMU, ZU, VSB) The project is also supported by the Ministry of Science and Higher Education as an international co-funded project <http://www.air-silesia.eu>
- Project title: *Characteristics of current traffic pollutants deposited in roadside soils under varying climatic conditions development and testing of a new concept for traffic pollutant monitoring*. Director: Prof. Tadeusz Magiera, International partner: Institute of Geological Sciences, University of Tübingen (Germany) - project implemented under the agreement between the Ministry of Science and Higher Education and the DFG of 5 December 2005. National Partner: University of Opole, Warsaw University, Duration 2010-2014
- Project title: *Development of integrated geophysical/geochemical methods of soil and groundwater pollution assessment and control in problematic areas* Acronym (IMPACT). Head: Prof. Tadeusz Magiera, Prof. Irena Twardowska, International partner: Norwegian University of Science and Technology in Trondheim, Department of Chemistry (Norway), Geological Survey of Norway, University of Warsaw (Polish partner) National partner: Warsaw University of Technology Duration: 2013-2016;
- Project title: *Mobility of arsenic, antimony and chromium speciation forms in selected rivers ecosystems of Upper Silesia* (MoSpeSil) POI-Nor/205627/55/2013, Small Grant Scheme 2012; the Polish-Norwegian Research Programme Projects manager: Magdalena Jabłońska-Czapla PhD, Associate Professor, Duration: 2013-2015;
- Project title: *New chance for Polluted Lands: Recovery of agricultural soil function by non-food farming and adapted soil management at degraded sites* (PoLaRecCE, nr CE0200635) Interreg Central Europe, Head: Prof. Tadeusz Magiera, Duration: 01.06.2024-30.11.2026,
- Project title: *Ścieki bez granic - problem mikrozanieczyszczeń*, Interreg Czechy-Polska 2021-2027, Head: Agnieszka Dzieniszewska PhD, partners: Uniwersytet Techniczny w Libercu (Lider), Sieć Badawcza Łukasiewicz – Instytut Ciężkiej Syntezy Organicznej „Blachownia”, Duration: 2025-2028

IPIŚ PAN as Associated Partner

- In the ongoing project RI-URBANS (Horizon 2020) - Declaration of cooperation in the project entitled. *‘Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban and Industrial Areas’*, Project duration: 01.10.2021 - 30.09.2025, Manager at IPIŚ PAN: Krzysztof Klejnowski, PhD.
- In the ongoing project BioPrep (Seed Money Facility (SMF) under the Danube Region Interreg Programme) - declaration of cooperation in the project entitled.
- *‘Biotechnological Innovations for Sustainable Flat Displays Recycling’*, Project duration: 01.09.2024 - 31.08.2025, Head at IPIŚ PAN: Magdalena Jabłońska-Czapla, PhD Prof. IPIŚ PAN