



# INVISIBLE TO THE EYE

DMITRIY KANDINSKIY/SHUTTERSTOCK.COM

Post-industrial areas are economically attractive – property developers are often eager to build stylish lofts there. Unfortunately, however, contamination often persists in the soil of such “brownfield” sites for decades.

## Wojciech Wołkowicz

Polish Geological Institute  
– National Research Institute (PGI-NRI)  
in Warsaw

The latter half of the nineteenth and twentieth centuries witnessed rapid industrial development. All over the world, technologies were being adapted to achieve the greatest possible efficiency. As recently as the mid-twentieth century, the notion that

human activity might cause permanent damage to the environment was not widely recognized. Little heed was then paid to the environmental risks posed by the operations of industrial plants, or by the large quantities of harmful waste they generated.

This began to change in the mid-1970s, when the first provisions were enacted to regulate the activities of industrial plants, in terms of both environmental hazards and waste management. In Poland, such processes began in an organized manner with the enactment of the *Environmental Protection Law* in 2001.

However, the lack of concern for the environment in the early stages of industrial development has left behind a devastating aftermath: more than 340,000



## Wojciech Wołkowicz, PhD

is a geologist and geochemist. He studies the impact of landfills on soil and groundwater quality, the historical contamination of brownfield sites, and the environmental impact of modern manufacturing facilities.  
wojciech.wolkowicz  
@pgi.gov.pl

## ACADEMIA FOCUS ON Geochemistry

identified contaminated historical sites in European Union countries. In Poland, the Chief Director of Environmental Protection maintains a register of historical land surface pollution, with more than 1,300 such “brownfield” sites inventoried.

### Regulations

Today’s environmental regulations impose very strict requirements on the operations of modern industrial plants. Entrepreneurs need to obtain special permits (called “integrated” permits), which require them to prove that they will apply the best possible techniques to minimize the environmental impact and oblige them to periodically test the quality of the local environment (soil and groundwater). In such a situation, the risk of contemporary pollution is very low and

is generally limited to technical failures or disasters, especially ones that are transportation-related.

With the economic changes that swept across Central and Eastern Europe in the early 1990s, many industrial enterprises, which were often located in city centers, quickly collapsed. Given their attractive locations, the sites they had occupied began to be re-used for building residential, office, and retail buildings. However, revitalization of such areas often involves considerable pollution-related risks. As such, best practices followed by property development companies and legal regulations now require environmental studies to be carried out before any such project can start and the site has to be brought up to mandated standards.

In many cases, the buildings and installations that were present on former factory sites were simply dismantled and the archival documents about underground installations were destroyed. As the years pass, natural plant succession has encroached on such areas and only the contamination that remains evident in the soil and groundwater serves as a reminder of the post-industrial past.

### Revitalization

In Warsaw, such a situation arose, for example, during the construction of the Arkadia shopping center, on the site of a former railroad loading station. Preliminary investigations of the subsoil identified contaminants from the group of volatile aromatic compounds, mainly xylene, used as a solvent in the production of paints and adhesives. The presence of such contaminants in the ground and groundwater necessitated considerable remediation work to remove them. This involved excavating the contaminated soils and forming them into special bioremediation piles, where bacterial preparations were used to break down the contaminants. The soils so purified were then used in earthworks.

A similar situation occurred in the city of Kraków, during the construction of the Bonarka shopping mall, where preliminary geological investigations identified the presence of large quantities of waste and heavy metal contamination. In this case, the waste and contaminated soil were excavated and taken away for disposal.

Contaminants requiring removal have also been found during the construction of numerous residential buildings. When remediating soil in the immediate vicinity of inhabited buildings, a thorough analysis of the history of the particular site is very important, as well as a detailed identification of the extent of the contamination and its chemical characteristics. The latter allows additional safeguards to be applied during the work, if necessary, and conflict situations and health risks for nearby residents to be avoided.



An image from 1984 (top) shows a site in the Polish town of Walbrzych with a large number of industrial installations. By 2017 (bottom), no traces of them remained on the surface of the site



Comparison of land use in the region of what is now the Radoslaw traffic circle in Warsaw, from 1955 (left) and 1997 (right). Zones from which contaminated soil was excavated are marked in red

For instance, during the excavation and removal of contaminated soil in the area of the historic small chemical factory on Ostroroga Street in Warsaw, harmful volatile pollutants with a strong odor were emitted into the air. This triggered protests from nearby residents and prompted municipal, sanitary, and environmental services to intervene. The company carrying out the work was forced to change its techniques in order to eliminate the danger to people. A special tent was then built in which negative air pressure was induced to keep contaminated air from escaping. It was pumped into special filters and, after purification, re-released into the atmosphere. After these safeguards were applied, further work went smoothly and the environment was restored to its proper quality. Cases where pollution is found in areas of planned development are usually resolved by the private parties involved in the construction process.

## Responsibility

However, in addition to a large number of relatively small historically polluted areas, there are also large-scale degraded areas where large quantities of waste, including hazardous waste, are also present. These are sometimes referred to as “ecological bombs.” There are several such sites in Poland, all of them having in common very serious contamination of the soil and water environment, a complicated formal and legal situation, and very high environmental cleanup costs. Therefore, the existing legislation needs to be modified so as to enable the procedure of environmental remediation of these sites to be carried out efficiently in the formal and technical sense, and to provide financial resources for the implementation of the planned work. Under the current legal system, it has proven impossible to carry out effective remediation of such sites for almost 20 years now.

Nevertheless, despite certain imperfections in the regulations governing historical contaminated sites and the activities of modern industrial facilities, the

quality of the environment at brownfield sites can be considered to be managed effectively. Over the past few years, however, a serious threat has been emerging in the form of a “grey” or even black market for waste management.

More than 400 illegal landfill sites have sprung up across Poland, containing hundreds of thousands of tons of toxic waste from both Polish and foreign sources. Most often, these are storehouses or storage yards situated in secluded locations, without specialized safeguards preventing the migration of possible contaminants into the soil. Originally, these were usually sites officially slated for temporary storage of waste intended for further processing, where drums or pallet-boxes 1,000 liters in capacity can legally be kept for a maximum of three years. More often than not, the companies operating such sites simply go bankrupt and disappear, leaving the problem to be dealt with by local governments and the owners of land where the waste has accumulated. Removing and disposing of these pollutants will cost vast sums, reaching into the tens of millions of zlotys just for one medium-sized site.

Given the high risk of liquid contaminants leaking into the ground and groundwater, as well as the considerable fire hazard, it seems that a comprehensive approach to solving this problem needs to be taken at the state level. The situation is somewhat reminiscent of the problem of landfills where expired pesticides were accumulated in Poland until the 1980s (colloquially referred to as “burial sites”). There were about 400 such facilities and they were decommissioned by 2015, with the harmful waste that had been accumulated there being taken away for disposal at specialized hazardous waste incinerators. As this was a legacy of the communist-era system, the process was financed with Polish state funds. All indications are that due to the significant hazards they pose for the environment and human health, the problem of dealing with illegal landfill sites will also fall to the Polish state budget. ■

### Further reading:

Bardos P., Spencer K.L., Wardz R.D., Maco B.H., Cundy A.B., Integrated and Sustainable Management of Post-industrial Coasts, *Frontiers in Environmental Science* 2020, doi: 10.3389/fenvs.2020.00086

Payá Pérez A., Rodríguez Eugenio N., Status of local soil contamination in Europe: Revision of the indicator “Progress in the management of contaminated sites in Europe”, 2018, doi: 10.2760/093804

Starczewski K., Rogatka T., Kukulska-Kozieł A., Noszczyk T., Cegielska K., Urban green resilience: Experience from post-industrial cities in Poland, *Geoscience Frontiers* 2023.