

Scenarios for a Regulatory Future of Urban Organic Pollutants

Imre Olivér Kozák

Abstract

Among urban environmental pollutants the group of polycyclic aromatic hydrocarbons (PAHs) is one of the most serious and widespread. Urban traffic, domestic and industrial heating are now the main sources of PAH contamination following major changes in the usage of PAHs in the chemical industry and the implementation of very strict health and safety regulations. The environmental regulation of PAHs is still in development, however, and there are important differences in the regulation systems of different countries. The suggestion of a scenario for PAH regulation in the EU is complicated due to the specific circumstances of PAH analysis, as we have to decide between a strict or flexible boundary between risk assessment and risk management and between local and global expertise, resulting in a regulation system that is always value-laden.

Introduction

Air pollution consisting of both inorganic and organic pollutants is one of the major environmental problems of cities and of heavy traffic and industry. Inorganic pollutants such as CO, CO₂, NO_x, SO_x, are usually present in high concentrations. Their short and long term effects are well described and a relatively satisfactory regulation system has been developed over the years. Organic air pollutants are usually present in much smaller concentrations, but their effects are not as precisely described, and unfortunately their regulation is not as efficient as desired.

Nowadays, one of the most important organic pollutants in urban surroundings is the group of polycyclic aromatic hydrocarbons (PAHs). PAHs have a similar chemical structure to the building blocks of DNA and can therefore easily bond into the DNA chain during cell replication, resulting in mutant DNA strains and development of cancer. Because of this mechanism, even very small amounts of PAHs can result in cancer,

therefore even the relatively small concentrations of PAHs in urban air are considered dangerous.

As the use of PAH in the chemical industry has undergone radical change and very strict health and safety regulations have been set in place, urban traffic, domestic and industrial heating remain as the main sources of PAH contamination. However, urban environmental regulation of PAHs is still in development and there are important differences in the regulation systems of different countries. The easiest way to control PAH contamination is the use of environmental limit values and this is by far the most frequently used method—however, the concentration limits in use differ by several orders of magnitude (Kozák 2002).

What are the main characteristics of urban air PAH regulation systems? What are the main issues behind ineffective PAH regulation? What kind of regulatory future would be possible to handle given the current complex situation of urban air PAH regulation? In answering these questions, we based our considerations on two sources. Regarding the chemical/technical aspects, we used our experience gained through a research project on determining background PAH concentration in Hungary, regarding policy aspects, we used the conclusions of the 1995 Amsterdam workshop on chemical risk, summarised in the book *The Politics of Chemical Risk: Scenarios for a Regulatory Future* (Halffman & Bal 1998). We used the suggestions of this meeting because, even after the serious criticisms and debates that followed it, the conclusions of Bal and Halffman are considered as a respectable alternative to explain regulation related to chemical risk. The conclusions of the Amsterdam workshop were also evaluated and combined with some of the ideas from the discussions held during the Fellow Meeting in May 2004 at IAS-STS Graz.

Bal and Halffman (1998) present four basic scenarios for health and safety regulations for the industry: 'International Experts', 'European Risk Consultation', 'European Coordination of Assessment' and 'Europe as a Translator'. We have attempted to choose one of these as an adequate scenario for urban air PAH regulation. We should stress that the scenarios discussed are *not predictions*, but sketches of what is possible. As each scenario has its own advantages and dynamics, as *choices are to be made* and *possibilities to be explored*, there is no one best way. This is a very important element

of the discussion, as we have noticed several times during our Fellow Meeting that instead of choosing among values and giving way to certain preferences we simply try to find the best applicable scenario for PAH regulation again.

To allow a better understanding of the topic, before passing to the scenario analysis itself, we introduce the reader to the assumptions and criteria used to develop the general scenarios and we also briefly describe the four general scenarios based on the book edited by Bal and Halfman (1998).

Assumptions

Before beginning to discuss the scenarios themselves, we must agree to certain assumptions about the regulation system and the situation in general.

While stating clearly at the outset that over the long term we must try to avoid the use of chemicals, at the moment chemicals and the related regulations are present in production processes and they would appear to be here to stay for a considerable period of time. While chemicals have been extensively used in industry for some two hundred years, the regulatory framework for chemicals is incomplete: new chemicals are and will be produced revealing new problems, while old chemicals can bring up new unexpected problems, and the regulatory world will also continue to develop and run into familiar and unfamiliar obstacles. Then we must assume that the basic tensions in the task of regulation are still unresolved, chemicals will remain a central part in production processes for a long time and even when we base the regulations on the general reduction of emissions, we must draw attention to chemicals and make a priority list for those that may be used and those that may not be used.

Our second assumption involves a focus on the EU level of regulation. The EU perspective is particularly important, since the EU will remain the primary source of change and the central place for tensions. The policy developed in the EU will influence national policies and the EU policy is more than the sum of the national regulatory systems of the European countries.

We also assume as our third point that a clear separation between science and policy is the backbone of regulation. We believe that regulation is only feasible when a limiting boundary is established between science (risk assessment) and policy (risk management); since expert assessments can be challenged, separation of experts vs. policy makers is a requirement and political dimensions result in expert choices influenced by political dimensions. The question is to what extent should choices be delegated to experts and how and when should they be reclaimed by political institutions. There are several reasons for maintaining a division between science and policy: the agenda of political institutions is limited, experts can help to focus discussions on political choices, political institutions function at higher costs, political conflicts are present, but experts alone can develop uncontrollable technocracies (loss of pragmatic control of the general process, loss of pragmatic control of negotiations, de-legitimisation of regulation). The question is not whether there should be a boundary between the expert and the policy institution, but about the *attribution of responsibilities* across this boundary and the *organisation of disputes* about the attribution process.

Criteria for general scenarios

A new set of criteria was set up during scenario development allowing four different possibilities for the regulatory future. The first criterion is the nature of expertise. It can be either global, with objective expression of health/environmental sciences and, with uniform-global expertise that can also be transferable across local contexts. When expertise is local, it is a national phenomenon and is tied to social, cultural and political developments and/or institutions. The other criterion is the way the boundary between risk assessment (science) and risk management (policy) is organised. When the boundary is strict, any influence of risk management on risk assessment should be avoided, while we allow a pragmatic attribution of issues when the boundary is flexible. The four possible scenarios are presented on Figure 1.

Figure 1. Criteria used for the organisation of scenarios

		Nature of expertise	
		Global	Local
Organisation of boundary	Strict	I.	III.
	Flexible	II.	IV.

General scenarios

The first scenario, termed *International Experts*, describes the combination of strict boundary and global expertise—in other words chemical risk assessment is regarded as a scientific issue. Experts do not necessarily come from the member states, but are strictly isolated from political issues. Research is carried out at a national level, but controlled by a central agency. In this scenario expertise and science are regarded as identical.

Scenario two, *Consultation at EU Level*, combines a flexible science/policy boundary with global expertise, resulting in risk assessment in consultation between member states, supported by expert assessments. The risk assessment process itself is an exchange of views at several stages with public consultative rounds, including country representatives, interest groups and the wider public. The explicitly public route of the decision making is important, to show the political basis of experts.

EU Coordination of Assessment, the third scenario, is based on a strict boundary and local expertise. Risk assessment is harmonised, but kept at a national level, by negotiations with experts. The objective is to harmonise, in other words to smooth the differences between regulatory approaches of the different states. A committee of experts at EU level tries to align and eliminate national differences. Though negotiators accept the blurred boundary, expertise is regarded as scientific.

Finally, in scenario four, *Europe as a Translator*, the boundary between science and policy is kept flexible and expertise is local. The situation is very interesting, as the starting point for the debates is the differences in regulatory styles and views of risk. The objective is not to eliminate the differences, but to find correspondence and indicate the differences. The central issue of the debate is the boundary between risk assessment and risk management.

Scenarios for urban organic pollutants

We have observed a serious problem during the discussion of PAH regulation: when we do not make a clear distinction about which area of regulation we are talking about, we often lose ground during reasoning. We thus find it important to frame three different areas of PAH regulation: PAH usage of the industry, PAH emission into the air from combustion processes and finally the area of background PAH concentrations. Despite the diverse nature of these fields, we can of course, make use of observations from across these different areas. In this paper we focus on PAH emission of combustion sources and further narrow down our analysis to urban environments. This seems reasonable as the pattern of PAHs from our previous studies suggests local sources rather than long-range transport of air pollutants, while possible local sources are industrial, urban, and traffic activities. The results indicate that the incomplete combustion of fuel is largely responsible for air quality in the areas under investigation (Kozák et al. 2003).

Unfortunately, as a result of technical difficulties, practices from the heavily expert based PAH regulation for industrial use cannot be transferred directly to urban air PAH regulation. For most chemicals, risk assessment forms the basis of the regulation, with the major factors for risk assessment being *concentration* (probability) and *NOEC levels* (effect) (No Observed Effect Concentration) of PAHs. We face serious complications, however, in determining both PAH concentration and NOEC levels in urban air (Kozák forthcoming).

PAH *concentrations* in urban air are so low that special analytical techniques had to be developed to be able to measure PAH concentration in the first place. Ideas and approaches differ from country to country, but using snow samples in Nordic countries and moss samples in temperate areas is becoming an accepted trend (Kozák et al. 2003). Because of the nature of these procedures, we are only able to compare PAH concentrations inside datasets, requiring a strong background of local knowledge to evaluate the results. In other words, no chemical analysis method has been found to determine PAH concentrations in urban air that could be used universally around the world in very different measurement environments.

Therefore, it is unavoidable to base the regulation on local expertise, with the possibility for reflection and comparison in a central forum, where differences are put into a clear perspective.

The determination of *NOEC levels* is also problematic, as we need to deliver values about the exposition to low PAH concentration during long periods of time, when concentrations are hard to measure and the twenty, thirty years of exposure are too long to deal with in the scope of a single research project. Although extrapolation of NOEC levels of high concentrations and short exposure times—using the values from the existing regulations of PAHs in industry and in working environments, such as chemical and medical laboratories—is mathematically possible, it easily leads to conclusions on a shaky basis (Kozák forthcoming). It is also suggested to avoid these extrapolations and to consider instead alternative ways to fix environmental limit values for urban air PAH concentrations. The regulation system should reflect the fact that while the possible effects have been outlined, clear dose-response relationships have not been established yet, suggesting that more space be given to risk management, i.e. policy, in urban air PAH regulation, but with no specific preference for either risk assessment or risk management. As Ötvös et al. (2004) have found that most of the sites showed a positive linear relationship between PAH levels and traffic volume ($r^2=0.83$; $P<0.001$) while no relationship existed between PAH levels and population ($r^2=0.01$; $P>0.1$), the emphasis in urban air PAH regulation should be put on traffic emission sources and not on industrial and domestic heating, with space given to social values, economical and technical feasibility in the development process.

We thus arrive at scenario four, *Europe as a Translator*, where local knowledge is combined with a flexible boundary between science and policy. We must take into consideration, however, that this scenario assumes the existence and development of one of the other scenarios and it can be a priority for further development, but cannot take over the role of existing decision making institutions (Halffman & Bal 1998). According to the contributions of McCutcheon and Sedee at the same Amsterdam discussion, regulatory practices are generally between scenario two (*European risk consultation*) and scenario three (*European coordination*

of assessment), closer to scenario three than two, but preference is given to decentralisation of risk assessment from 'Brussels' in the long term (Halffman & Bal 1998).

Finally, we stress once again that there is no 'one best way' and therefore we had to make choices along the lines of values and preferences, decide which factors are more important for us and which are put aside. Our personal experience shows that this situation is very hard for the participants to accept during the debates, as when we have to decide between local and global expertise and between a strict and flexible boundary—between risk assessment and risk management—, our regulation system will be unavoidably value-laden.

Conclusions

In the present study we tried to analyse a possible regulation structure for urban organic air pollutants, polycyclic aromatic hydrocarbons. Our starting point of the discussion was the general scenarios elaborated at the 1995 Amsterdam workshop of experts from different science and policy fields. After introducing the general criteria and assumptions, we summarised four general scenarios and then discussed the different possibilities for urban air PAH regulation.

In conclusion and based on our personal experience of PAH analysis, we suggest choosing a flexible boundary between risk assessment and risk management for the environmental regulation of PAHs, as opposed to the practice in the chemical industry. In the latter case, the health/safety issues are well known, whereas for urban air PAHs we do not exactly know the long term health/environmental effects yet, hence we exercise caution; while the highly different local methods of chemical analysis used to determine ambient air PAH concentration suggest the use of local expertise. Therefore our scenario of choice, after the discussion of the different advantages and dynamics, would be scenario four, *Europe as a Translator*, for the environmental regulation of PAHs, being more a choice of the consideration of the current techniques of chemical analysis than merely our preference.

Acknowledgements

We gratefully acknowledge contributions of the discussions at the fellow meetings of our research colleagues of IAS-STS Graz (Austria), namely G. Hajo, T. Peltola, A. Bolotova, A. Pobol, B. Wieser, and S. Karner. The help in the evaluation and interpretation of the results of V.K. Sharma from FIT Melbourne (USA) is gratefully acknowledged. The project was partly funded by IAS-STS Graz and the Environmental Sciences Partnership Program of the USA State Department. Finally, we appreciate comments of I. Hronszky from BUTE Budapest (Hungary).

References

- Bal, Roland and Willem Halffman (Eds.) (1998), *The Politics of Chemical Risk: Scenarios for a Regulatory Future*, Dordrecht: Kluwer.
- Halffman, Willem and Roland Bal (1998), 'The politics of chemical risk—Scenarios for regulatory policy', in Roland Bal and Willem Halffman (Eds.), *The Politics of Chemical Risk: Scenarios for a Regulatory Future*, Dordrecht: Kluwer, 303–322.
- Kozák, Imre Olivér (2002), 'A határértékek szerepe a modern környezeti szabályozásban' [In Hungarian, The role of limit values in the modern environmental regulation], *BME GTK Műbelytanulmányok* 1: 107–113.
- Kozák, Imre Olivér (2003), 'Worldwide concentration and distribution of Polycyclic Aromatic Hydrocarbons (PAHs)—Review', in *Yearbook of the BUTE-FIT Environmental Sciences Partnership Programme*, Budapest: BUTE-FIT: 141–146.
- Kozák, Imre Olivér, Melinda Kozák, Jenő Fekete and Virender K. Sharma (2003), 'Concentration of Polycyclic Aromatic Hydrocarbons (PAHs) in Moss (*Hypnum cupressiforme*) from Hungary', *Journal of Environmental Science and Health Part A—Toxic/Hazardous Substances & Environmental Engineering* A38: 2613–2619.
- Kozák, Imre Olivér (forthcoming), 'The concepts of incertitude, risk, uncertainty and ignorance in the environmental regulation of organic air pollutants', in *Yearbook of the BUTE-FIT Environmental Sciences Partnership Programme*, Budapest: BUTE-FIT.
- Ötvös, Edit, Imre Olivér Kozák, Jenő Fekete, Virender K. Sharma and Zoltán Tuba (2004), 'Atmospheric deposition of Polycyclic Aromatic Hydrocarbons (PAHs) in Mosses (*Hypnum cupressiforme*) in Hungary', *Science of the Total Environment* 330: 89–99.