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Science, Politics, and Persistent Organic Pollutants
The Role of Scientific Assessments in International Environmental Co-operation

HENRIK SELIN[1] and NOELLE ECKLEY[2]
[1] *Department of Urban Studies and Planning, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139, USA (E-mail: hselin@mit.edu);*
[2] *Belfer Center for Science and International Affairs, John F. Kennedy School of Government, Harvard University, Cambridge, MA 02138, USA*

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Abstract. International measures to address environmental problems increasingly rely on scientific information, and a growing number of international agreements require periodic scientific re-assessments. However, the arena of scientific assessment, governed by a combination of scientific criteria and political interests, is not well-understood, and few case studies have mapped the influence of scientific assessment on the birth and development of environmental policy issues. This article examines the role of scientific assessments and the science-politics interplay in international attempts to regulate persistent organic pollutants (POPs), focusing on the processes within the Convention on Long-Range Transboundary Air Pollution (CLRTAP) and the United Nations Environment Programme (UNEP). The study shows that scientific and political activities are intrinsically linked in international POPs work. Scientific and political agendas are co-constructed with no clear boundary between the science and politics spheres. Scientific assessments played a prominent role in constructing POPs as an issue of international concern, setting agendas and shaping policies.

Keywords: assessment, chemicals, international environmental agreements, persistent organic pollutants, policy, science

Abbreviations: BAT – Best Available Techniques, BEP – Best Environmental Practices, CCC – Chemical Coordinating Centre, CEG – Criteria Expert Group, CFCs – Chlorofluorocarbons, CLRTAP – Convention on Long-Range Transboundary Air Pollution, COP – Conference of Parties, DDT – 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane, ELV – Emission Limit Values, EMEP – Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe, FAO – Food and Agriculture Organisation, HCB – Hexachlorobenzene, HCH – Hexachlorocyclohexane, HELCOM – Helsinki Commission, IFCS – Intergovernmental Forum on Chemical Safety, IOMC – Inter-organisation Programme for the Sound Management of Chemicals, INC – Intergovernmental Negotiating Committee, IPCS – International Programme on Chemical Safety MSC-E – Meteorological Synthesising Centre-East, MSC-W – Meteorological Synthesising Centre-West, OECD – Organisation for Economic Cooperation and Development, PAHs – Polycyclic Aromatic Hydrocarbons, PARCOM – Paris Commission, PCBs – Polychlorinated Biphenyls, PCP – Pentachlorophenol, PIC – Prior Informed Consent, POPs – Persistent Organic Pollutants, SCCP – Short-Chain Chlorinated Paraffins, UNECE – United Nations Economic Commission for Europe,

UNEP – United Nations Environment Programme, WHA – World Health Assembly, WHO – World Health Organisation

1. Introduction

The use of scientific assessments is central in international environmental co-operation. Science and assessments are important in bringing attention to environmental changes and acquiring policy-relevant information, where progress in co-operation is difficult without accepted consensus on the nature of the core problem and the most appropriate means to address it (Caldwell 1990, p. 49; Joyner 1998, pp. 40–41). Further, successful implementation of a growing number of international environmental agreements depends on periodic scientific re-assessments. As such, scientific assessments are a critical battleground in which environmental issues are framed, options are identified, and priorities are shaped (Bäckstrand 2001; Jasanoff and Wynne 1998; Litfin 1994).

Despite the importance of scientific assessments, few case studies have mapped the influence of scientific assessment on the birth and development of international environmental policy issues. We do just that by focusing on the role of scientific assessments in the emergence of the issue of persistent organic pollutants (POPs) from the domain of a few scientists concerned about toxic substances, to a set of chemicals subject to global controls. Specifically, we examine the role of assessments in the two main international regulatory POPs processes: the regional work on POPs under the United Nations Economic Commission for Europe (UNECE) and the Convention on Long-Range Transboundary Air Pollution (CLRTAP), and the global POPs activities under the auspices of the United Nations Environment Programme (UNEP). A CLRTAP POPs protocol was signed in June 1998, and the UNEP Stockholm Convention on POPs was signed in May 2001.[1] Examining the role of scientific assessments of POPs under CLRTAP and UNEP, this study explores the central question of how scientific assessments contribute to the shaping of an international environmental issue and the formulation of co-operative agreements. In doing so, it seeks to identify aspects of the POPs assessments which made them influential in shaping policy.

POPs are anthropogenic organic compounds that are toxic, persistent, bioaccumulate (build up in fatty tissues in individual organisms), and concentrate further, or biomagnify, up food chains (Eckley 2001). POPs can be divided into three categories: pesticides, industrial chemicals, and unintentionally produced by-products. Emissions originate from a wide range of sources, including agricultural use and manufacturing and use of goods; they can also be by-products of production, waste incineration, and combustion. Because POPs are prone to long-range transport, adverse effects can occur both near and distant from emission sources (Wania and Mackay 1996). POPs have been associated with a number of environmental risks. These risks include oestrogenic effects, disruption of endocrine

functions with observed impairments of immune system functions, generation of functional and physiological effects on reproduction capabilities, and reduced survival and growth of offspring (UNECE 1994). Human POPs concentration levels and effects have begun to attract growing scientific and political attention. Data is still sparse, but available information gives cause for serious concern where POPs have been associated with human carcinogenic and tumorigenic effects (Colborn et al. 1996).

In the next section, the role of international scientific assessments is elaborated further. This is continued in section 3 by a brief historical overview of the development of synthesised organic chemicals in the 1920s up to the first international action on POPs as a separate class of pollutants by the late 1980s. Sections 4 and 5 present an examination of the role of the CLRTAP POPs assessments and the UNEP POPs assessments, respectively, including the impact of the CLRTAP assessments on the global process. Data for these examinations are drawn from personal interviews conducted by the authors between 1996–2001 of participants in both the CLRTAP and UNEP processes, personal observations at CLRTAP and UNEP meetings, and primary CLRTAP and UNEP documentation.[2] Finally, we summarise our main findings and highlight some important implications of this case for research and practice of international environmental co-operation.

2. Scientific assessments in international co-operation

The role of international scientific assessments and their relation to environmental decision-making are attracting increasing research interest (Clark 1999; Jaeger 1998). The Global Environmental Assessment Project – which examined a large number of environmental scientific assessments on issues such as climate change, ozone depletion, tropospheric air pollution, and chemicals – found that international scientific assessments of environmental issues are most helpfully viewed as intrinsically dynamic and iterative social processes by which expert knowledge is organised, evaluated, integrated, and presented to inform policy-making (Global Environmental Assessment Project 1997, p. 53). The assessment process can highlight environmental changes, frame issues, generate policy options, and identify needs for further research and development. In these functions, assessments can contribute to shaping the interests and preferences of engaged participants, as well as prompt the concern of new participants.

The influence of scientific assessments on shaping behaviour and decision-making seems to be most helpfully viewed as a function of the attributions given to such assessments by participants in the policy process (Clark et al., forthcoming). Three attributes have been identified as particularly important: *scientific credibility*, *political legitimacy*, and *policy salience*. Scientific credibility reflects the scientific believability of the assessment to a specific user of that assessment. Political

legitimacy is a measure of the political acceptability or perceived fairness of an assessment to a user. Policy salience reflects the ability of an assessment to address the particular policy concerns of a user.[3] The more scientifically credible, politically legitimate, and policy salient an assessment is to a user, the more likely it is to shape that user's behaviour and decision-making. Participants who have different needs and interests can have different views on what is scientifically credible, politically legitimate, and policy salient. As such, it is often necessary to try to conduct assessments so that they become credible, legitimate, and salient to a large number of divergent participants. The often high influence of POPs assessments on POPs policy can partly be attributed to their generally high scientific credibility, political legitimacy, and policy salience to many of the participants, which will be explored further in sections 4 and 5.

In academic literature, there are two different approaches to the relationship between science and politics. An early conceptualisation portrays a bipolar relationship, presenting science and politics as separate domains with their own unique dynamics, functions, purposes and means. In this conceptualisation, a clear-cut boundary exists between the two domains, and there is a unidirectional flow of information and knowledge from science to politics. The role of the scientist is "speaking truth to power" by independently identifying problem and generating relevant scientific knowledge. The task of the policy-maker is to formulate appropriate abatement strategies based on the scientific results (Price 1965). Such a bipolar image can also be found in more recent work such as, for instance, in the epistemic community literature (Haas 1990; Haas 1992).

An increasing number of studies, however, demonstrate that the bipolar image and its separation of scientific consensus formation from policy-making lack empirical support (Jasanoff and Wynne 1998). Scientific information is not simply a reflection of nature, but a complex social construction encompassing shared beliefs, discourses, practices, and goals where scientists interact with a number of other societal actors including colleagues, funding bodies and, not least, policy-makers. Further, societal responses to environmental threats consist of a complex interaction of natural, social, economic and political variables. Studies questioning the bipolar image have their roots in Weinberg's concept of trans-science as a sphere where science and policy overlap (Weinberg 1972). A central feature of the trans-science sphere is the mutually legitimising effects that science and policy have on each other, where policy dictates and sanctions the choice of scientific criteria and models, which in turn are invoked to justify policy.

In more recent work, trans-science has been further developed into the notion of regulatory science (Bäckstrand 2001, pp. 24–27 and 53–63).[4] This work views science not as a monolithic domain, but divides science into core, applied and regulatory science. Core science is conducted mainly within traditional scientific disciplines and is evaluated according to disciplinary criteria (although more and more multidisciplinary environmental research is conducted). Applied science is an extension of core science, where certain demands for policy relevance have

to be met. Regulatory science is further separated from core science in function and means. It is a hybrid area of science and policy aimed at collecting and synthesising existing knowledge from core and applied science, rather than producing new scientific knowledge.

International scientific assessments of environmental issues, including the POPs assessments, are an expression of regulatory science. Governed by a combination of scientific criteria and political interests, knowledge and policy are co-produced at multiple stages in a process of joint evolution from scientific findings, via national and international acceptance of causality, to their use in policy-making. Assessment work is directed at a specific context of policy application, with a mutual construction and evolution of scientific and policy agendas. The boundaries between the science and policy spheres are fluid and open to negotiations. Scientists in their work, to varying degrees, incorporate expectations and demands from policy-makers, such as policy usefulness and relevance. Policy-makers in turn, again to varying degrees, act on assessment results. Scientists may question policies, and policy-makers may question assumptions and structures of scientific assessments.

The use of scientific assessments is not always neutral: assessments can be exploited for political purposes. Stakeholders will often cite scientific reports and claims that support their own position, and try to downplay or even discredit findings that go against their interests (Susskind 1994, p. 33). Further, the unique status of science as a provider of policy relevant information, in combination with an unequal distribution of scientific capabilities and skills for knowledge creation and knowledge sharing among states, involves a risk of biases in the favour of those who hold the means and know-how. Such capabilities and resources are generally limited to Western affluent countries, which can give such states an ability to steer activities and decisions towards fashioning agreements suited to their needs. Scientific assessments thereby run the risk of simply becoming "politics by other means" (Harding 1991, p. 10). Evidence of this – as well as attempts to address such problems – were found in both CLRTAP and UNEP POPs, and will be discussed in sections 4 and 5.

3. The emergence of the POPs issue

The POPs issue emerged on the international agenda as a result of a combination of changing scientific understanding, individual state interests, and actions taken by international organisations. The commercial manufacturing of anthropogenically synthesised organic chemicals began in the 1920s. Production, use and trade of these substances rose sharply after World War II, driven by a desire to produce more and better food and cash crops, protect public health, and facilitate industrial development (Krueger and Selin 2002). Many pesticides such as DDT and industrial chemicals such as PCBs initially were regarded as basically harmless to humans and non-target species (Bowler 1992, pp. 508–509). The

first public warnings about possible dangers came in relation to local environmental effects in the early 1960s, and grew stronger in the 1970s (Carson 1962; Anonymous 1966; Jensen 1972). As such, the chemicals problem was first seen as a local problem.

The first attempts to assess the environmental problems of hazardous chemicals were plagued by analytical limitations. Such difficulties arise from the fact that commercial chemicals are not a single compound, but consist of a multitude of congeners that exist in multiple variances in formulations of commercial mixtures. Environmental, physical, chemical and biological processes may be different for each congener. In addition, sensitivity to POPs has proven to be species- and gender-specific (Shifrin and Toole 1998). Yet, by the 1970s, risk assessments of substances like DDT and PCBs revealed effects severe enough to result in a progressive introduction of domestic regulations of some hazardous organic compounds, mainly in Western industrialised countries. International efforts at the time concentrated on setting up procedures for information sharing (Krueger and Selin 2002). Such regulatory and preventive actions led to a general belief in many industrialised countries that their problem with hazardous chemicals was under control, supported by scientific studies in the late 1970s and early 1980s showing signs of recovery in affected local wildlife. The situation in developing countries was more uncertain, but in general believed to be much worse.

By the late 1980s, however, new scientific discoveries resulted in changing perceptions, highlighting the transboundary nature of the POPs problem. Many of the discoveries were related to the Arctic region. These discoveries were spurred by both qualitative and quantitative improvements in data samples, measurement and analytical techniques. Three formerly unknown and undesirable connected factors relating to a set of hazardous persistent organic substances were revealed: evidence of systematic atmospheric long-range transport to the Arctic; discoveries of high environmental contamination levels throughout the Arctic region remote from any local emission sources; and indications of actual and potential severe environmental and human health implications, particularly among local indigenous populations. Such substances included pesticides such as chlordane, DDT, endrin, mirex and toxaphene; industrial chemicals such as PCBs; and by-products such as PAHs and dioxins.

Based on a combination of new scientific information, and a heightened sensitivity to the concerns of its northern indigenous populations, Canada was one of the first countries spurred to action. Because of the transboundary character of the problem, Canada believed that international actions were required. For that purpose, Canada brought the emerging scientific information to the attention of several different international organisations, such as the Organization for Economic Co-operation and Development (OECD), the United Nations Food and Agriculture Organisation (FAO), UNEP, and the World Health Organization (WHO). But at the time, there was little interest in chemicals controls on the part of any of the organisations. According to a senior Canadian official involved

in seeking international support at the time, this was because the international organisations did not yet understand the scientific foundation of why POPs were a long-range pollution problem – and no major assessments yet existed to convince them (Interview 1999). Instead, Canada approached UNECE and CLRTAP. Although regional in scope (covering North America, Europe and the area of the former Soviet Union), its coverage of most of the Northern hemisphere and its focus on long-range transboundary air pollution made it a possible forum.

In August 1989, Canada presented a report on hazardous persistent organic chemicals in the Canadian Arctic to the CLRTAP Working Group on Effects, which was the CLRTAP Working Group responsible for assessment activities (UNECE 1989). The initial response from the Working Group on Effects was cautiously positive, but more information was deemed necessary in order to develop a better understanding of the situation and assess the need for CLRTAP actions. To this end, Canada presented a paper on atmospherically transported hazardous organic substances to the Working Group on Effects in August 1990 (UNECE 1990b). On the basis of the paper, the Working Group on Effects decided to recommend that the CLRTAP Executive Body initiate CLRTAP assessments on such substances. Following the recommendation, the Executive Body set up a Task Force on Persistent Organic Pollutants in December 1990. The Task Force worked under the auspices of the Working Group on Technology, the CLRTAP Working Group active on identification and diffusion of pollution control technology, and in co-operation with the Working Group on Effects (UNECE 1990a, para. 38(f)). The primary aim of the Task Force was to prepare a comprehensive assessment report on the POPs situation in the CLRTAP region, focusing on emissions, long-range transport, distribution between media, abatement options, and proposals for international action (UNECE 1990a, annex II).

4. The Convention on Long-Range Transboundary Air Pollution and POPs

This section examines the role of the CLRTAP POPs assessments. It begins by giving a short introduction to the creation of the CLRTAP POPs agreement. It then proceeds to discuss three areas in which the assessments were particularly influential. The section ends with a description of the final political compromise, and the ongoing assessments in support of the implementation of the agreement.

Since the convention was signed in 1979, CLRTAP has addressed issues of transboundary air pollution through eight substantive protocols – one protocol on cost-sharing, and seven pollution-specific protocols: two on sulphur; one on nitrogen; one on volatile organic compounds; one on heavy metals; one on POPs; and one multi-pollutants/multi-effects protocol on acidification, eutrophication, and ground-level ozone (see, for example, Levy 1993; 1995; 1997; Tuinstra et al. 1999; Wettestad 2000; Selin 2000; Bäckstrand 2001; Wettestad 2002). In efforts to develop protocols, CLRTAP has been identified as a model of effective science-policy collaboration (Levy 1995), and those who participated in the CLRTAP POPs

work from a multitude of countries generally cite good scientific assessments as a strong basis for their work (Interviews 1997–2001). The CLRTAP POPs assessments were organised and carried out in the same fashion as CLRTAP assessments on other issues, with the exception that the use of computer models that has been frequent on acidification, eutrophication, and ground-level ozone were not employed in POPs assessments.

The creation of the CLRTAP POPs agreement took place through a series of phases and was informed by a lengthy scientific assessment process (Selin 2000; Eckley 2002). Work was organised in different CLRTAP sub-groups. The Task Force on POPs met four times between 1991 and 1994, and produced a substantive assessment report outlining the state of scientific knowledge on POPs emissions, transport and impacts, and discussed different abatement options. Based on its assessment, the Task Force recommended the creation of a legally binding CLRTAP POPs agreement with mandatory controls. While some, mainly Northern European states, argued for protocol negotiations after the presentation of the Task Force report, this was blocked by others on the grounds of what they saw as insufficient availability of detailed policy alternatives. For that purpose, an Ad Hoc Preparatory Working Group on POPs was established.

The Preparatory Working Group on POPs met four times during 1995 and 1996; it continued the assessments and drafted a composite negotiating text for a POPs protocol. By fall 1996, the assessments of policy alternatives had progressed to a point where it was possible to reach consensus on the initiation of protocol negotiations. The negotiating process began in the Working Group on Strategies, the permanent CLRTAP Working Group for political negotiations, in January 1997. After five negotiation sessions, the POPs protocol was opened for signature in June 1998. Ongoing efforts to put the agreement into force are supervised by the CLRTAP Executive Body, and an ad hoc Expert Group has been set up to produce assessments for future policy-making.

4.1. Influence of the CLRTAP assessments

Scientific assessments on POPs within the institutional arena of CLRTAP are an example of regulatory science – no new CLRTAP-initiated empirical scientific research was conducted, but available external scientific information was collected, organised, and presented for a specific policy context. Several aspects of this regulatory science process contributed to its influence – specifically, the leadership of particular states, and the close linkage between assessments and political decision-making. This helped the assessments to become influential despite uneven participation.

The assessments were open to all CLRTAP parties, but were dominated by a small group of Western countries. The more active states were the traditional "green" countries such as Germany, the Netherlands, Norway, and Sweden. In addition, Canada, Spain, United Kingdom, and the United States provided

important assessment contributions. These countries set important boundaries and procedures for the assessments. They largely relied on the strength of knowledge and ideas to shape the way other participants understood the POPs issue and conceptualised policy options. The influence of these core Western assessment leaders was facilitated by their ability and willingness to invest human, financial and scientific resources. They chaired and organised meetings, co-ordinated activities, and led and sponsored much of the inter-sessional assessment operations. The latter was important since all CLRTAP POPs assessment activities were dependent on direct financing by parties.

The CLRTAP POPs assessment work, therefore, was largely driven by Western interests, expertise, and resources, while other states tended to imitate the actions of the Western leader states. Financial support to attend meetings was provided to countries with economies in transition (i.e. East European countries). This made it easier for such countries to come to meetings, but this had only a limited effect on their participation in the inter-sessional assessments that were important in moving the POPs issue forward. Such behaviour is consistent with the participation of East European countries in CLRTAP assessments on other issues, in which East European countries have a significantly lower level of participation than Western European countries (Botcheva 2001; VanDeveer 1998).

Task Force and Preparatory Working Group meeting reports, assessment reports and personal communication of assessment information played an important role in establishing a scientific basis for further action, and helped generate the broad feeling of consensus that emerged. Both the communication process and the generation of political support were facilitated because in many cases the same people who conducted the assessments were also delegates to the more political Working Groups, the Working Groups on Strategies and the Executive Body. One influential Western participant in both the assessments and political Working Groups credited the broad degree of acceptance of the assessments to their strong scientific foundation – indicating that parties both directly involved in the assessments and parties less involved tended to attribute scientific credibility to them (Interview 1998).

The communication between the core assessment states and the political Working Groups also ensured that a wide range of parties attributed political legitimacy to the assessments. This is because the political Working Groups had a broad base of participation, in which the majority of parties were represented (if not participating actively). This gave states that were not active in the assessments an opportunity to review the assessments continuously and express their views. This communication process also influenced the policy salience of the assessments, because the repeated interactions between policy-making and assessment bodies ensured that the assessments were addressing issues relevant to the concerns of policy-makers from different parties.

The Task Force and Preparatory Working Group assessments had lasting impacts on several areas of POPs policy. First, they constructed the issue of POPs as an

issue of international concern and pushed the issue of POPs onto the international agenda. Second, they prioritised substances for international regulation. Third, they helped to set up a procedure for future science and policy input for possible adding of additional substances to the protocol. These are examined further in subsections 4.1.1 through 4.1.3.

4.1.1. Constructing the POPs issue

The framing of the POPs issue – and indeed, the category of "POPs" – was constructed by the CLRTAP assessment process. In some of the early CLRTAP documentation, phrases such as "persistent organic contaminants" and "persistent organic compounds" were used as synonyms for this category of chemicals, before the term "POP" came into exclusive use in the CLRTAP assessments. Though a number of national programs had looked at toxic, persistent and bioaccumulative chemicals (e.g. efforts in Canada, Sweden, and the United States), and several international agreements addressed specific chemicals and their contamination problems (e.g. HELCOM and PARCOM), the category of POPs and the term itself gained widespread international acceptance as a result of CLRTAP.

The CLRTAP framing of the POPs issue as one of long-range transport, persistence, bioaccumulation, and toxicity remained the dominant framing even as more and more parties became involved at global level, although other dimensions of the issue (e.g. existing stockpiles and technical assistance) emerged as further concerns. The global framing of the POPs issue will be discussed further in the section on the UNEP assessments. The POPs acronym is currently used frequently both in scientific and policy contexts.

That the POPs issue reached the international agenda at all is a signal that scientists and policy-makers had jointly constructed a concept that was neither fully political nor fully scientific. While policy-makers often point to "scientific" definitions of criteria as defining POPs, scientists are more likely to view the category as a convenient policy construct around a class of particularly dangerous chemicals (Interviews 1999). Because it is a concept that is simultaneously resident in science and policy worlds, the term "POP" has functioned as a "boundary object" (Guston et al. 2000) around which international negotiations have coalesced.

4.1.2. Selecting substances for regulation

A key task of the CLRTAP assessments was to identify which specific hazardous persistent organic substances that warranted controls. The process of selecting candidate POPs was not so much directed at finding new, previously unknown hazardous substances, as it was to evaluate substances already known or suspected to be hazardous for specific CLRTAP POPs purposes. Information was primarily collected from other international fora.[5] Additional information was provided by parties.

To define a POP, certain physical, chemical and biological characteristics that

a substance should possess in order to be of interest in the CLRTAP POPs work were identified (UNECE 1994, para. 3). Several options for detailed screening criteria were considered and compared (United Kingdom 1995). The screening process well demonstrates the close interplay between scientific information and policy priorities in the assessments. In defining screening criteria, scientific choices and screening were guided by policy prioritisations. The aim was to identify substances that were subject to long-range transboundary atmospheric transportation within the CLRTAP region, which at the time of deposition were posing risks to wildlife and human health. While the chosen criteria had their basis in science and the ranking was based on scientific data on substances, the choice of criteria, scoring, and setting of cut-off points were subject to political consideration. One U.S. official referred to the screening process as *a posteriori* science (Interview 1998) – that is, that scoring and cut-off points were chosen based on which substances assessment participants preferred for consideration during the negotiations. While the assessments were not constructed solely to support a predetermined result, as this comment suggests, the fact remains that scientific data and political priorities were shaped together.

The CLRTAP POPs screening was done using a three-stage screening model.[6] In accordance with CLRTAP's focus on long-range air pollution, 107 substances in Stage 1 were screened for their propensities for atmospheric transportation. Three different criteria were used: persistence, vapour pressure, and monitoring evidence. Limits were set to exclude substances of high volatility (e.g. CFCs). Twenty of the 107 substances were eliminated from consideration based on the Stage 1 criteria. At Stage 2, the harm potential of substances was tested by screening substances for bioaccumulation potential, and mammalian and aquatic toxicity. As 17 substances could not be adequately screened due to data insufficiency, only 70 substances were assessed in Stage 2. Scoring and ranking were based on their chemical properties, and the lower scoring half of the substances was eliminated from consideration. After Stage 2, 32 priority substances remained. In Stage 3, a risk assessment of these substances was performed. The risk assessment was conducted to assess the overall case for including a substance in the protocol, and the scientific criteria were reviewed in combination with socio-economic factors. On the basis of the full screening, 14 substances were identified.

The screening model was the primary means by which possible protocol POPs were identified, but states were not bound by its results and opinions diverged on the basis of what was seen as acceptable risk levels and interpretation of the precautionary principle. National proposals for substances to be initially regulated therefore differed, and four substances – short-chain chlorinated paraffins (SCCP), heptachlor, chlordecone and lindane – that had come out below the cut-off point were supported by some states, and together with the other 14 substances became subject to negotiations in the Working Group on Strategies (United Kingdom 1996). Table I presents a list of the 18 possible protocol POPs.

Table I. List of the 18 possible protocol POPs. The substances are grouped according to the categories pesticides, industrial chemicals, and unintentional by-products. HCB as a pesticide an industrial chemical and an unintentional by-product is listed in all three categories.

Pesticides	Industrial chemicals	Unintentional by-products
Aldrin	Hexabrombiphenyl	Dioxins
Chlordane	PCBs	Furans
DDT	PCP	HCB
Dieldrin	SCCP	PAHs
Endrin	HCB	
HCB		
Mirex		
Toxaphene		
Chlordecone		
Heptachlor		
Lindane/HCH		

In connection with the substance screening work, discussions were held on possible formats for controls. During the assessments, it was decided to develop separate annexes similar to the ones used in previous CLRTAP protocols. One reason for designing separate annexes and control actions originated in the fact that emissions from pesticides, industrial chemicals, and unintentionally produced by-products are the result of highly different processes. This makes it inappropriate to regulate them in a uniform manner. A second reason was the desire of some states not to introduce total bans on all pesticides and industrial chemicals, but to allow identified exemptions for some substances. This was opposed by others, who argued that POPs are of such a hazardous nature that they should be completely banned.

Several control options were considered, with a focus on proposals for production, use, import and export. Activities on production and use concerned how best to regulate national activities to minimise emissions and possible exemptions. On import and export, discussions revolved around whether CLRTAP as a regional environmental forum should design trade restrictions, and potential conflicts with the GATT/WTO. While some European states saw trade restrictions as an important part of designing effective POPs controls, others, mainly the United States and Canada, argued that it would be inappropriate for CLRTAP to impose legally binding import and export restrictions.

On the unintentional by-products, work focused on identifying mobile and stationary emission sources and developing control options for the major sources. Control options centred on combinations of Best Available Techniques (BAT) and Emission Limit Values (ELV). Work on control options in the Preparatory Working Group resulted in the generating of a few prominent policy alternatives

for all three categories of substances, but no final decisions on how they should be designed or which activities should be covered by the protocol were taken.

4.1.3. Designing a mechanism for assessing additional substances

As a way to move forward with CLRTAP action on POPs, a two-track approach was developed, and scientific assessments played a significant role in this development. Track 1 was to establish a quick protocol on a small list of substances that had already been acted upon in many CLRTAP countries, or for which available risk assessments were considered sufficient, using the substance screening model. This would enable fast action on a first set of hazardous substances. Additionally, it could help in persuading countries that might be sceptical towards signing a protocol with a longer initial list to become parties to the agreement. Track 2 was to set up a mechanism for future screening of additional substances for possible control actions to be incorporated under the protocol. This would allow more time to conduct risk assessments for substances where existing information was more sparse in order to determine whether control actions were needed, and also to improve the long-term effectiveness of the agreement. This was believed to work as an incentive for countries that wanted a longer list of initial substances not to push too hard during the protocol negotiations.

Two main proposals for the design of the Track 2 mechanism were discussed. The two options differed in degree of formalisation, and centred on predictability versus flexibility. Canada and the United States argued in favour of detailed specifications of the substance data that needed to be provided (including numerical values) for a substance to be considered for inclusion in the protocol, together with clear stipulations for how the substance assessments should be performed. The benefit of such an approach is that it provides clarity and conformity in data requirements and assessment procedures. A second group of mainly northern European nations wanted a more flexible mechanism. They argued that scientific knowledge of POPs advances continuously, and any criteria specified in detail could easily become outdated as knowledge advances, binding the parties to obsolete requirements – especially since it generally takes several years before a protocol enters into force. By having less detailed criteria, each future evaluation could be based on the latest scientific understanding. Moreover, having specified numerical criteria would indicate that there is a clear line between substances that are hazardous and substances that are harmless, something they wanted to avoid projecting. While the options for the procedure for assessing additional substances for possible future inclusion in the protocol became more clearly identified, no consensus on the design of the mechanism could be reached in the Preparatory Working Group.

4.2. Reaching a political agreement

A development in focus that had begun in the Preparatory Working Group of paying less attention to further assessment of the physical character of the POPs problem and giving more weight to policy issues continued during the negotiations in the Working Group on Strategies.[7] Now the aim was to gain political consensus around a particular set of policy solutions, and more attention was given to policy alternatives and suggestions for compromises. Yet, scientific information was still used, primarily to support a particular policy action for certain substances under negotiation, i.e. their inclusion on or exclusion from the initial list. In such cases, scientific studies were used in combination with judgements of what was deemed technically, economically, and politically feasible.

Whereas some states during the assessments had spoken in favour of total bans on all the 15 pesticides and industrial chemicals that were considered for the initial list based on the assessments, not all states agreed. Of the 15 pesticides and industrial chemicals, 7 substances were more or less unproblematic.[8] For these, there was no remaining production or use in the UNECE region by the late 1990s, and they would thus not require any new domestic limitations for any state. The other 8 pesticides and industrial chemicals, however, were all still in production and/or use in one or several states, and required negotiation to find consensus on joint regulatory actions. On chlordecone, HCB, DDT and PCBs there was a general acceptance that they should be included in the protocol and the negotiations concerned whether they should be completely banned, or if exemptions should be given under the protocol. For lindane, heptachlor, PCP and SCCP, their inclusion was questioned per se. For the four unintentional by-products, there was agreement that they should be in the protocol and negotiations concerned different types of possible control options for the substances for both stationary and mobile emission sources.

In February 1998, a final political compromise was reached. The core of the POPs protocol consists of the 16 initially regulated compounds and their controls, including exemptions. SCCP and PCP were not included on the initial list. Substances are grouped into three main annexes. Annex I contains pesticides and industrial chemicals whose production and use are to be eliminated and stockpiles disposed of in an "environmentally sound manner." Parties commit to "endeavour to ensure" that the disposal of Annex I substances is carried out domestically, but with no principal ban against export or import of waste for disposal purposes. Annex II contains pesticides and industrial chemicals scheduled for restrictions on use, where only specifically identified exemptions are permitted. No trade restrictions on substances were introduced, but the issue was referred to the UNEP process. The four unintentional by-products are listed in Annex III and regulated through a combination of BAT and ELV controls specified in five detailed technical annexes. As a compromise on the Track 2 mechanism, "indicative" assessment criteria were listed in a separate Executive Body Decision, taken

a few months before the signing of the protocol. This was intended to give both predictability, by having a detailed criteria decision before the signing of the protocol, and flexibility, in that the criteria was merely guiding and amendments to the criteria could be made in the Executive Body without having to re-negotiate the whole protocol.

4.3. Ongoing assessments and implementation

Efforts to put the CLRTAP POPs agreement into force involve both international and domestic assessment activities. The CLRTAP Secretariat functions as a co-ordination centre for the gathering of implementation information, including the collecting of domestic emission data and the preparing of implementation progress reports. These reports form a basis for scientific and political decision-making. Further, two centres under the Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP) – the Chemical Coordinating Centre (CCC) and the Meteorological Synthesizing Centre-East (MSC-E) – guide and monitor domestic implementation, specifically focusing on a small group of selected POPs: lindane, PAHs, seven specific PCB congeners, and some dioxins and furans (UNECE 1999, section 2.5).[9] CCC is developing standard operating procedures, creating quality control routines for sampling and chemical analysis, and setting up an international measurement programme on POPs using five sampling sites: Scandinavia/Baltic, the northern Atlantic region, continental Europe, the Mediterranean region, and the south Atlantic region. MSC-E is responsible for the modelling of POPs, studying the physical and chemical properties of the selected POPs, and analysing and summarising scientific results obtained under the international and national programmes. In doing so, MSC-E co-operates with the Meteorological Synthesizing Centre-West (MSC-W) and the experts of the CLRTAP Task Force on Emission Inventories in the verification of POPs emission data quality.

Assessments under the track 2 mechanism will be important for the long term effectiveness of the agreement, and will have a potentially large impact on future POPs abatement. Future assessment and policy actions on POPs involve several activities. One is the possible tightening of exemptions for the substances on the initial list. Second, there is the option to re-assess substances that were excluded from the protocol at the last stage of the negotiations, i.e. SCCP and PCP. Third, the mechanism can be used to assess substances that were not considered under Track 1, but where new information points to undesired environmental and human health effects. Assessment work under Track 2 has started, repeating the same participation pattern as in the earlier assessments with domination of the traditional Western leader states. At a workshop in October 1999, governmentally designated experts together with experts from MSC-E reviewed the latest scientific developments since the protocol negotiations (UNECE 2000b, para. 38–39). Based

on a recommendation from the participating states, an ad hoc Expert Group was established by the Executive Body. The Expert Group, which held its first meeting in November 2000, will continuously consider new information both on substances covered by the protocol and additional substances for possible future controls once the protocol enters into force (UNECE 2000a).

5. The United Nations Environment Programme and POPs

This section examines the role of the UNEP POPs assessments. It begins by giving a short introduction to the formation of the UNEP POPs agreement. It then proceeds to focus on four aspects of the global co-operation process in which assessments had a prominent role. It also discusses the interactions between CLRTAP and UNEP POPs assessments and negotiations.

After having declined to pick up the POPs issue in the late 1980s, it was only after the CLRTAP scientific assessments had started to produce results that a global organisation began to show some real interest in POPs. In March 1995, UNEP Governing Council decided to begin global assessments of 12 identified POPs; these are listed in Table II (UNEP 1995a).[10] Factors contributing to this decision were the scientific assessments generated under CLRTAP showing that POPs were a transboundary problem and the political pressure from influential CLRTAP states also to take global actions (e.g. the United States, Canada, and the EU member states). Pre-empting the result of the global assessments, the Conference to Adopt a Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, held in Washington in October 1995, adopted a declaration supporting the 1995 UNEP Governing Council decision, and recommended the development of a global legally binding instrument to control POPs (UNEP 1995b, annex II, para. 17).

International organisations were more involved in the UNEP assessments than they had been in the CLRTAP assessments. Based on the 1995 UNEP Governing

Table II. List of the 12 UNEP POPs. The substances are grouped according to the categories pesticides, industrial chemicals, and unintentional by-products. Unlike in CLRTAP, PCBs are listed also as a by-product.

Pesticides	Industrial chemicals	Unintentional by-products
Aldrin	PCBs	Dioxins
Chlordane	HCB	Furans
DDT		HCB
Dieldrin		PCBs
Endrin		
Heptachlor		
Mirex		
Toxaphene		
HCB		

Council decision, the Inter-Organization Programme for the Sound Management of Chemicals (IOMC), together with the International Programme on Chemical Safety (IPCS) and the Intergovernmental Forum on Chemical Safety (IFCS), led the assessments. The main assessments were conducted by the IFCS Ad Hoc Working Group on POPs, focusing on available information on the chemistry, sources, toxicity, environmental dispersion, and socio-economic impacts of the 12 POPs.

Together with the international organisations that led the global process, the same states that were pushing for action on POPs in CLRTAP were strong advocates of global regulations. The global assessments and negotiations, however, also included a few other key developed countries, e.g. Australia, New Zealand and Japan. Early on, Australia and New Zealand in particular raised questions about whether POPs were a global problem, as opposed to merely a northern hemisphere problem. Eventually, however, Australia and New Zealand became supporters of the POPs convention negotiations, based on a combination of political considerations and the accumulating scientific assessment evidence. The global process also involved a large number of developing countries. The addition of many developing countries particularly affected the global assessment process, and UNEP Governing Council in 1995 specifically stated that the global assessments should take into account the circumstances of developing countries and countries with economies in transition.

The IFCS Ad Hoc Working Group on POPs presented its findings at an expert meeting in Manila in June 1996 (IFCS 1996). The Working Group concluded that the assessments clearly demonstrated that there was sufficient information to justify the creation of a global legally binding agreement on POPs, and recommended that the UNEP Governing Council and the World Health Assembly (WHA) initiate political negotiations. This led the UNEP Governing Council to adopt a decision in February 1997, requesting that UNEP together with other international organisations convene an Intergovernmental Negotiating Committee (INC) on POPs. At its second meeting, also in February 1997, IFCS decided that the Ad Hoc Working Group on POPs would continue to assist in preparations for the negotiations. In May 1997, the WHA endorsed the recommendation of the IFCS Ad Hoc Working Group on POPs, and requested that WHO participate actively in the negotiations. The first INC meeting began in June 1998, and an agreement was completed in December 2000 after five sessions. The resulting Stockholm Convention on POPs was signed in May 2001.

5.1. The UNEP assessments and their influence

The UNEP assessments also are a clear case of regulatory science. This section explores how these assessments became influential in terms of their credibility, salience, and legitimacy. It focuses specifically on four different areas of the UNEP assessments that were important for the global process.

Similar to the CLRTAP case, the global assessments became influential by being scientifically credible and securing political legitimacy to a broad range of parties, including many developing countries. The scientific credibility of the global assessments was not much questioned – most countries believed that the scientific quality of this information was high. Political legitimacy was achieved by making use of a series of global reviews, primarily through the meetings of the IFCS Ad Hoc Working Group on POPs. These assessments were perceived as fair because a broad range of countries were represented in these forums and could give input to the assessments. Policy salience, on the other hand, was a more difficult issue. Alternate assessments to the IFCS Ad Hoc Working Group on POPs assessments, in the form of regional awareness-raising workshops, described further in subsection 5.1.4, provided salient information to mainly developing countries (Eckley 2000).

Subsections 5.1.1 through 5.1.3 explore specific aspects of the UNEP assessment process: global framing and agenda-setting, the initial substance list and the mechanism for future evaluation of additional substances; they are followed in subsection 5.1.4 by an explanation of the circumstances of developing countries in the global assessments. Particularly for the issues discussed in the first three subsections, CLRTAP assessments were of high importance.

5.1.1. Global framing and agenda-setting

As was explored in 4.1.1, the CLRTAP assessments constructed POPs as a distinct international issue category through science and politics interplay. The CLRTAP POPs framing was largely adopted by the global process, and the CLRTAP framing of the POPs problem consisting of long-range transport of toxic persistent substances also carries through at the global level. The global adoption of the CLRTAP framing was done without controversy. The CLRTAP POPs framing, which had been agreed to by the United States, Canada and the European Union, who are all influential actors in international chemical co-operation, allowed the framing of the global agreement to coalesce around something that had already been agreed to on a regional basis. This served to bound the scope of the global agreement.

Early global assessment work on POPs – though independent of the CLRTAP process – made use of CLRTAP information and assessments, which allowed the initial global assessments to be conducted quickly and without much controversy, setting the agenda for the global negotiations. Of use were the CLRTAP POPs assessments of both the physical nature of the problem and identification of policy options. For the former, information about use areas of substances, emission sources, transport patterns, and environmental and human health effects after deposition was utilised. The CLRTAP work on policy options helped identify important activities that needed be covered by the global agreement, and ways in which controls and procedures could be designed.

5.1.2. The initial substance list

One of the most striking ways in which the CLRTAP assessments influenced the global POPs process was in the selection of substances for global agreement. The list of twelve chemicals established by the UNEP Governing Council in 1995 was based largely on the then ongoing screening scheme in CLRTAP. At the meeting, a tentative CLRTAP substance list was circulated and agreed to rapidly, with little if any domestic deliberation by countries not involved in CLRTAP.[11] This quick and fairly uncritical acceptance seems to have been a combination of the political influence of the CLRTAP countries (e.g. mainly the United States, Canada, and the EU member states), and the extensive CLRTAP scientific assessment on substances. The choice of the 12 substances was politically safe for many key countries. The substances were all well-known, banned or severely restricted in many countries, so agreeing to the list was relatively easy for them. In this respect the list was to a large extent a political construct. However, it was a political construct with a good deal of scientific assessment behind it, demonstrating the hazardous nature of the 12 substances. Thus, while the selection of substances for action under the CLRTAP POPs protocol was a significant area of disagreement, this was one of the least controversial aspects of the global POPs process, and the list of twelve substances remained unchanged in the negotiations.

In the global negotiations, regulatory measures focused on controls on production, use, import, and export. While there was broad consensus on the inclusion of all 12 substances, opinions diverged about for which of the 10 pesticides and industrial chemicals production and use should be completely banned, and for what activities and for whom exemptions should be granted. Like the CLRTAP POPs protocol, the Stockholm POPs Convention groups substances into annexes. Annex A contains the nine pesticides and industrial chemicals for which it was decided that use and production should be prohibited, although certain specifically listed exemptions are given. Annex B lists the one POP – DDT – on which there are restrictions on use and production, subject to certain production and use exemptions. While rejected in CLRTAP, import and export controls of pesticides and industrial chemicals were accepted in the global negotiations. Trade restrictions cover both Annex A and B substances. The Stockholm POPs Convention also includes provisions for identifying stockpiles, articles in use, and wastes of Annex A and B substances, requiring that they are managed and disposed of in an environmentally sound manner. Annex C identifies four unintentional by-products, source categories, and general guidelines on BAT and Best Environmental Practices (BEP). Guidelines on BAT and BEP will be adopted by a later decision of the Conference of the Parties.

5.1.3. The mechanism for future assessments of additional substances

The Stockholm POPs Convention, like the CLRTAP POPs protocol, is designed as a two-track agreement. A major issue in which scientific information and political decision-making interacted in the global negotiations (as in CLRTAP) was the development of criteria and a procedure for possible future adding of substances to the convention. That is, it is envisioned that additional chemicals are likely to be added to the initial list of 12 after the convention enters into force. The UNEP Governing Council requested at its February 1997 meeting that the first INC meeting establish an expert group for the development of science-based criteria and procedure for assessing substances in addition to the already identified 12, as candidates for future controls. The Criteria Expert Group (CEG) that was subsequently established at the first INC meeting met twice (before and after the second INC meeting), drafting a proposal for criteria and assessment procedure.

In both the CLRTAP and UNEP agreements, the procedure for adding substances is based on specified criteria, consisting of threshold values of persistence and bioaccumulation, combined with a risk characterisation. Although the global process explicitly conducted its own complete criteria development process, claiming to start from ground zero, the idea of such criteria came out of the CLRTAP process, and CLRTAP assessments in this area were quite prominent. The result of the CEG deliberations was a proposed set of criteria for selecting POPs that to a high degree resembled the CLRTAP criteria. These were largely accepted by the INC, making the UNEP criteria virtually identical to the CLRTAP criteria. That the UNEP process came out with the CLRTAP criteria was not predestined by any obvious scientific choice (Rodan et al. 1999). The parties considered the CLRTAP criteria and cut-offs to be "reasonable" – a signal that this is the product not of science or policy alone, but of a science-policy interplay.

The CEG work may be viewed as largely unnecessary given the extensive related CLRTAP assessments and that the CEG result bore a high resemblance with the CLRTAP criteria. Yet, the CEG assessments were a way to include all – both CLRTAP and non-CLRTAP parties – in every decision to achieve a broad understanding and consensus on the choice of criteria, cut-off values and assessment procedure. This is essential both for the signing of the agreement and for the future successful application of the global procedure. This procedure allowed these assessments to secure political legitimacy to parties in the global negotiations. The procedure for assessing additional substances, including the criteria for assessments, is outlined in Annexes D, E and F of the Convention. The assessments will be conducted by a POPs Review Committee that, based on the risk profile and risk management evaluation, will recommend whether a proposed substance should be considered by the COP for listing.

5.1.4. Encouragement of developing country participation

The CLRTAP POPs assessments asked questions that were relevant to northern developed countries, addressing issues such as long-range transport and impacts on northern biota. Developing countries, on the other hand, were interested in issues such as local problems, the selection of substitute chemicals for tropical climates, and setting up domestic chemicals management infrastructure. To address these sorts of issues, and achieve a level playing field between developed and developing countries, it was seen as essential to raise scientific awareness in developing countries. As part of the preparation of the global negotiations, UNEP and IFCS held eight regional awareness raising workshops on global issues associated with POPs between 1997 and 1998. Locations included Bangkok, Buenos Aires, St. Petersburg, and Bamako.[12] The workshops involved national decision-makers from the regions who presented case studies on POPs problems in their countries, as well as experts from international organisations and countries beyond the region. The holding of these meetings prompted many developing countries to assess their domestic regulatory status on POPs, and collect their own scientific information about the selected substances. This aided capacity building among developing countries, and provided useful information in their preparation for the negotiations.

The conflict between industrialised countries and developing countries over resource allocation that has been evident in other global environmental negotiations was visible also in the POPs negotiations. Many developing countries early on in the negotiations stressed the importance of provisions for financial and technical assistance for successful implementation. In the end, it was a joint process of scientific assessment, political capacity-building workshops, and political promises from the developed nations during the negotiations that helped bring the developing countries on board. The final agreement commits developed country parties to provide "timely and appropriate technical assistance" to developing countries, and requires that developed countries provide financial resources to help developing countries fulfil their obligations under the convention (article 12).

6. Concluding remarks

Scientific and political activities are intrinsically linked in international POPs work with no clear boundary between science and politics. Important decisions were made in organisational settings that were populated both by scientific experts, often appointed by national governments, and political negotiators. Scientific POPs assessments, as an expression of regulatory science, became influential by generally securing scientific credibility, political legitimacy, and policy salience to a broad range of parties. In both CLRTAP and UNEP POPs, scientific credibility was not a major issue – the scientific believability of the assessments was typically thought to be high. Although assessments in both cases were often conducted

by a small group of Western states, political legitimacy was secured by having those assessments reviewed and/or reassessed in representative international fora (e.g. the CLRTAP Working Group on Strategies and IFCS). This gave states which had not been involved in conducting the assessments the opportunity to ask questions and provide input. Policy salience was achieved in the CLRTAP case through repeated communication between the assessment and negotiating bodies; in the UNEP case, policy salience was a more pressing problem, but was in part addressed by the conducting of regional awareness-raising workshops.

Both the CLRTAP and the UNEP POPs assessments were influential on several policy issues. POPs emerged as an issue of international concern through a combination of changing scientific understanding and political interests. The CLRTAP POPs assessments aided in constructing "the POPs issue" and pushing it onto the international agenda. In this process, assessments were integral in prioritising substances for international regulation, and helping to design a procedure for future science and policy input for possible additional substances to the protocol. UNEP assessments constructed POPs as a global issue, raised awareness of the POPs issue among a large number of developing countries, and influenced the development of a mechanism for assessing additional substances for global regulation.

The POPs case points to several implications for both research and practice in the area of international environmental co-operation. As shown in this study, as well as others (Bäckstrand 2001; Jasanoff and Wynne 1998; Litfin 1994), scientific assessments are crucial to international environmental co-operation, yet they are underexamined in the academic literature. Further research should compare the ways in which scientific assessments become influential across different issue areas. In exploring why the POPs assessments were influential, the attributions of credibility, legitimacy, and salience by users of those assessments were found to be helpful. Additional research in other issue areas could examine whether these attributions are useful in other case studies, as well as explore if other attributions are of importance in those areas.

Given the experience of the POPs cases, those designing assessment processes may wish to think further about how to make assessments more scientifically credible, politically legitimate, and policy salient to particular users. The high influence of the scientific assessments makes capacity to participate in assessments critical in influencing policy outcomes. If less scientifically advanced countries, which also generally lack necessary economic and human resources, are to participate fully in international environmental policy-making, it is necessary to find ways to include them in the assessments, and not just during the political negotiations. This is important both for the making of legitimate policy, and to achieve successful implementation.

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Notes

1. A list of signatories and ratifications to the CLRTAP POPs protocol can be found at http://www.unece.org/env/lrtap/. A similar list for the Stockholm POPs Convention can be found at http://www.chem.unep.ch/pops/POPs_Inc/dipcon/dipconsignat.htm.
2. Personal observations were conducted at eight CLRTAP POPs meetings and five global POPs meetings. The CLRTAP meetings were: i) Third meeting of the Ad Hoc Preparatory Working Group, May 1996; ii) The Working Group on Strategies, August 1996; iii) Fourth meeting of the Ad Hoc Preparatory Working Group, October 1996; iv) First negotiating session, January 1997; v) Second negotiating session, June 1997; vi) Third negotiating session, October 1997; vii) Final negotiating session, February 1998; and viii) Executive Body meeting, December 1998. The global meetings were: i) IFCS Ad Hoc Working Group meeting, June 1996; ii) Third INC session, September 1999; iii) Fourth INC session, March 2000; iv) Fifth INC session, December 2000; v) Diplomatic Conference, May 2001.
3. From Oxford English Dictionary, 2nd edition: salience (noun) 2a: the fact, quality or condition of being salient . . . b: the quality or fact of being more prominent in a person's awareness or in his memory of past experience. salient (adjective): 5b: standing out from the rest, prominent, conspicuous.
4. Other similar descriptions of regulatory science found in literature on science-politics interplay are mandated science, post-normal science and hybrid science.
5. Information was gathered particularly from the Oslo-Paris Commission for the Protection of the Marine Environment of the North-East Atlantic, the European Union, the Organization for Economic Co-operation and Development, the World Health Organisation, and the Intergovernmental Forum on Chemical Safety.
6. For more on the substance screening process, see Selin and Hjelm, 1999.
7. For more on the CLRTAP POPs negotiations, see Selin 2000.
8. These seven substances were aldrin, chlordane, dieldrin, endrin, mirex, hexabrombiphenyl, and toxaphene.
9. On EMEP, see Carlos di Primio, 1998.
10. See note 7.
11. Although the CLRTAP POPs protocol addressed four additional substances, the UNEP list is a reasonable facsimile of the CLRTAP list as it existed in 1995. However, the list that was circulating at the 1995 UNEP Governing Council meeting and on which the UNEP Governing Council based its decision was not identical with the CLRTAP draft list. Preferences also varied

among states in CLRTAP. Specifically, there was some confusion over the UNEP inclusion of heptachlor, which at the time was not on the CLRTAP list, but was identified by UNEP Governing Council. CLRTAP actions on heptachlor were in part affected by the UNEP POPs work. In the Modified Task Force Methodology, heptachlor was screened out in Stage 1. However, when heptachlor was identified by UNEP, voices were quickly raised within CLRTAP that it should also be included in the CLRTAP list. This was supported by the autumn 1996 re-evaluation, which identified new monitoring evidence of depositions in the polar environment, leading to its reintroduction in CLRTAP.

12. For the reports of the UNEP regional awareness-raising workshops on POPs, see http://www.chem.unep.ch/pops/POPs_Inc/proceedings/coverpgs/procovers.htm.

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