



## Chapter 9 The Addition of Chemicals— A Living Agreement

Reflecting the dynamic societal, scientific, and industrial time in which we live, the Stockholm Convention anticipates change through the ability to list additional persistent organic pollutants (POPs) as new science becomes available. The United Nations Environment Programme (UNEP) mandate for the POPs negotiation had limited initial consideration to the twelve substances or substance groups. By doing so, negotiators were able to focus on developing generic procedures for addressing POPs, based on the “dirty dozen,” rather than digressing into potentially controversial discussions over additional chemicals that might be added. The mandate emphasized, however, “the need to develop science-based criteria and a procedure for identifying additional persistent organic pollutants as candidates for future international action.” This task was undertaken by technical experts at criteria expert group (CEG) meetings in Bangkok (1998) and Vienna (1999), and during subsequent negotiations. The resulting process and criteria for the addition of chemicals are codified in Article 8 and Annexes D, E, and F of the Stockholm Convention, respectively ([www.unep.ch](http://www.unep.ch)). This chapter summarizes the technical foundation and science-policy basis considered in developing these criteria and procedures, accompanied by contemporary advances in science from the published literature.

Noteworthy in technical discussions on the addition of chemicals was the speed with which consensus was reached among scientists at the CEG meetings. Numerous factors contributed to this consensus, among them: criteria precedents, e.g., UNECE-LRTAP; the “scientific method” based on the provision of data to support opinions; and external academic, industry, and nongovernmental organization (NGO) involvement. Of paramount importance, though, was the inexorable weight of evidence gathered and widespread action already

taken against POPs. Only rarely now do U.S. industry and pesticide manufacturers seek to commercialize a substance with POPs characteristics, particularly if there is the possibility of a dispersive use. This reticence to develop POP/PBT chemicals predates the domestic PBT guidelines and actions, and can be seen as responsive to technical and economic imperatives that the problems associated with this chemical genre of POPs substances far outweigh their benefits.

Over the decades, the academic community has also provided research support to detail ecological and human health problems stemming from POPs. Input from research scientists to deliberations in the United States and Canada on the UNEP POPs negotiation was consolidated through the 1998 SETAC Pellston Workshop on the “Evaluation of Persistence and Long-Range Transport of Organic Chemicals in the Environment.” The report of this workshop (SETAC, 2000) provides an excellent state-of-the-art technical summary on persistence and long-range transport.

The weight of evidence against POPs is also supported by the number of previous domestic, bilateral, and international technical reviews and policy interventions to identify and address this group of chemicals. The screening criteria used in many of the domestic and international POPs/PBT agreements are listed in Table 9-1. The differences in screening criteria values should be interpreted in light of the geopolitical scope of each initiative. The broader the geographic range, the higher the screening criteria values because the more problematic a substance must be to cause transboundary effects at this distance. Integral to interpreting the international POPs screening values is the recognition that they complement domestic initiatives. Most POPs contamination occurs close to the site of release. But because of the propensity of these

**Table 9-1. National and international screening criteria for POPs**

	Long-Range Transport <sup>a</sup>			& <sup>d</sup> Persistence			& <sup>d</sup> Bioaccumulation		& <sup>d</sup> Toxicity
	Remote Measurements	Vapor Pressure Pascals	Air Half-life (days)	Water Half-life (months)	Soil Half-life (months)	Sediment Half-life (months)	BAF/BCF	Log Kow	
Stockholm Convention 2001 <sup>b</sup>	✓		& 2	2	or 6	or 6	5000	5	Adverse effects; risk profile
UNECE-LRTAP 1998 <sup>b</sup>	✓	or <1000 <sup>c</sup>	& 2	2	or 6	or 6	5000	or 5	Risk profile
NAAEC-CEC 1998	✓	or <1000 <sup>c</sup>	& 2 <sup>c</sup>	6	or 6	or 12	5000	or 5	Mutual concern
Canada TSMP 1995	✓		or 2 <sup>c</sup>	6	or 6	or 12	5000	or 5	CEPA defined
US EPA 1998 TSCA PBT - ban pending testing				6			5000		Develop toxicity data
US EPA 1998 TSCA PBT - release controls				2			1000		Develop toxicity data
IJC 1993 immediate action				2			or 5000		or Chr. Aq. Tox. <0.1 µg/L
IJC 1993 initial screen				0.23			or 1000		or Chr. Aq. Tox. <1 µg/L
CMA PTB policy 1996 <sup>d</sup>			5	6	or 12		5000	or calculated, prof. judgment	Exp. judgment. Risk assessment

<sup>a</sup> The “&” terminology should be applied before the “or” term, such that a chemical must have an air half-life greater than 2 days plus the vapor pressure requirement, or this combination could be substituted by remote measurements.

<sup>b</sup> The Stockholm Convention and UNECE-LRTAP POPs protocol state that alternative criteria may be considered if there is evidence that the substance is otherwise sufficiently persistent or bioaccumulative to make it of concern within the scope of the Convention/Protocol.

<sup>c</sup> The air half-life is sufficient for meeting the persistence requirement. Vapor pressure maxima were incorporated to exclude highly volatile substances.

<sup>d</sup> The Chemical Manufacturers Association (CMA), now American Chemistry Council (ACC), considers long-range transport to be additional to the definition of a PTB chemical.

chemicals to persist, bioaccumulate, and be transported long distances, POPs contamination is dispersed widely and cannot be mitigated solely through domestic activity. Exacerbating the transboundary nature of POPs contamination are ecosystem peculiarities, particularly in the polar regions where cold temperatures and the high lipid content of animals make these areas especially vulnerable to adverse effects.

### The Addition Process

All the POPs agreements in Table 9-1 anticipate the addition of substances through a process of screening followed by a more detailed technical assessment. Under the Stockholm Convention, the scientific and technical work necessitated by these activities will be performed by a Persistent Organic Pollutants Review Committee (POPRC). The following general procedures will be followed:

1. *Screening* (process Articles 8-1 to 8-5; criteria Annex D): Screening acts as a mechanism to exclude chemical proposals that have insufficient data or do not fulfil the screening criteria, thereby facilitating efficient use of technical experts.
2. *Risk profile* (process Article 8-6; Annex E): A detailed technical report is prepared expanding on the screening criteria data and additional information requirements and assessing if: “the chemical is likely as a result of its long-range environmental transport to lead to significant adverse human health or ecological effects such that global action is warranted.”
3. *Risk management/socioeconomic considerations* (process Article 8-7; Annex F): Subsequent to an affirmative finding from the

risk profile, management options are evaluated for the proposed substance, taking into consideration technical and socio-economic considerations.

4. *Recommendation to, and decision by, the Conference of the Parties (COP; process Article 8-9):* Based on the risk profile and management options, a technical recommendation is made to the COP whether a chemical should be considered for listing in Annexes A, B, and/or C and what control measures should be invoked. Ultimate decisionmaking rests with the COP. Set-aside and review procedures are detailed in Articles 8-5 and 8-8.
5. *Ratification of amendments (Article 22-4):* Each Party to the Stockholm Convention may opt to review its concurrence with the addition of each new chemical to the Annexes. For the United States, entry into force for additional chemicals is likely to require an affirmative statement agreeing to be bound by this addition, although domestic implementation details have not been finalized.

### **Scientific Foundation for Adding Chemicals**

The basic process for adding POPs chemicals is consistent across a range of international agreements (UNECE-LRTAP, 1998; NAAEC, 1998) and with the conclusions of scientific bodies charged with developing such procedures (CEG, 1998; SETAC, 2000). The process and criteria recognize the complexity of real world environments, and the necessary balance between codifying indicative guidance criteria versus flexibility and the need for expert judgment. Earth's environments vary from steamy, microbe-rich jungles to frozen waters and anerobic sediments, all of which may play a part in the environmental fate of a POP. Reversing this scenario, the many and varied physico-chemical properties of the individual POPs influence how they passage through, accumulate, and sequester in and over the Earth. This section summarizes the technical considerations in evaluating a substance

for inclusion as a POP. Additional details on screening criteria development can be obtained from Rodan et al. (1999); on persistence, transport, and modeling from SETAC (2000); and on bioaccumulation from the Great Lakes Water Quality Criteria support documents (U.S. EPA, 1995).

### **Screening Criteria**

Annex D of the Stockholm Convention provides a hierarchical structure for the initial screening of POPs candidates. This screening requires satisfying all four criteria categories of (1) persistence, (2) bioaccumulation, (3) long-range environmental transport, and (4) adverse effects (toxicity). Flexibility and expert judgment are stipulated, however, wherein a low value for one criterion should be weighed against values for other criteria and environmental fate and monitoring considerations.

### **Persistence**

Persistence is the ability of a substance to remain in the environment. It is measured as either a half-life (time for half the amount of substance to degrade) or a residence time (average time for a molecule to remain in that environment = half-life x 0.693). These measurement units assume first-order or pseudo-first-order decay kinetics, which is considered a reasonable assumption at the screening stage (SETAC, 2000). As detailed in Table 9-1, persistence screening values for the Stockholm Convention and UNECE-LRTAP POPs protocol are set at a half-life of 2 months in water or 6 months in soil or sediment. These values are tacitly based on temperate climates, where much of the research has taken place. Persistence times can increase dramatically in dark (buried), cold (polar), sterile, or dry (desert) environments. It is recognized that such data should not be misused to inappropriately torque a chemical into meeting the screening guidance values. Evaluation of the screening criteria also anticipates taking into consideration the environmental medium into which the POP is released, preferentially distributed (air, water, soil, and/or sediment), and passes through in its transboundary movement (i.e., before it can reach cold environments such as the Arctic; SETAC, 2000).

Persistence in water, soil, or sediment is necessary for the chemical to be available for uptake by biological organisms, as a means of physical accumulation, and as a reservoir for, or receptor of, long-range environmental transport. The mechanism by which persistence leads to the buildup of chemicals in the environment is demonstrated in Figure 9-1. For this theoretical scenario, Figure 9-1a plots the accumulation over time of two hypothetical chemicals with half-lives of 1 and 12 months, in either soil, water or sediment. Two modes of release to the environment are shown for each chemical. The first models a single release of one hypothetical unit of chemical at the start of each year, and the second assumes a continuous release totaling one unit per year. The release of chemicals at the start of each year, such as would occur with once-annual pesticide application, leads to an immediate increase of 1 unit, followed by decline over the remainder of the year. Annual repetition leads to the saw-tooth appearance. Continuous release over the entire year, such as from an ongoing byproduct emission, results in a roughly linear increase in the environmental concentration until steady state is reached. At steady state for both release scenarios (after ~5+ half-lives), the amount emitted to the environment equals the amount degraded, the latter being a function of the total accumulation in the environment.

Taken a step further, Figure 9-1b graphs the relationship between chemical half-life and the concentration at steady state. In other words, based on steady state having been reached for all chemicals, the graph displays the resulting steady-state level for each and every chemical half-life. This figure demonstrates that there is no theoretical cut-off value for persistence that separates a problematic chemical from a nonproblematic one. Indeed, the accumulated concentration ( $C$ ) in the environment at steady state is linearly proportional to the half-life ( $T_{1/2}$ ), following the equation  $C = RT_{1/2} / \ln 2$ , where  $R$  is the application rate (Rodan et al., 1999). The longer the half-life, the greater the amount of physical accumulation that occurs. As demonstrated by extension from Figure 9-1b, a chemical with a half-life of 10 years will build up in the environment over a half century of use to a

concentration 14 times the concentration that would have resulted from a single, annual application. This physical accumulation is additional to bioaccumulation, further magnifying the chemical in living creatures.

Another approach to setting screening criteria for POPs is to examine measured laboratory and field data for substances already widely acknowledged to be of concern, e.g., the “dirty dozen,” compared with data on other substances that are not considered POPs (Figure 9-2). These data can then be

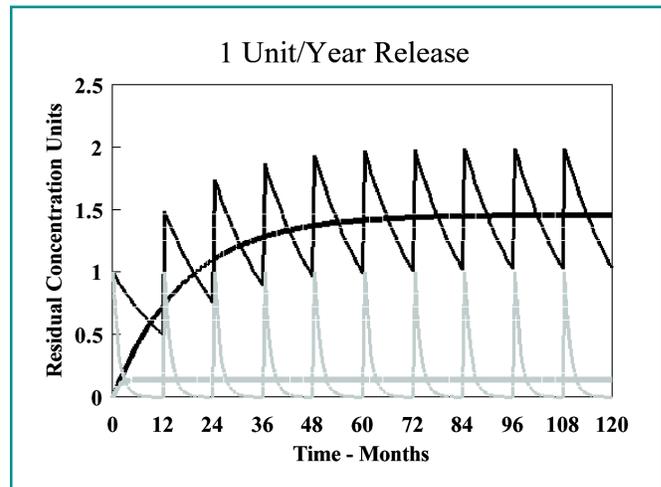


Figure 9-1a. Accumulation curves. Upper graph half-life 12 months, lower graph half-life 1 month.

Source: Rodan et al. (1999).

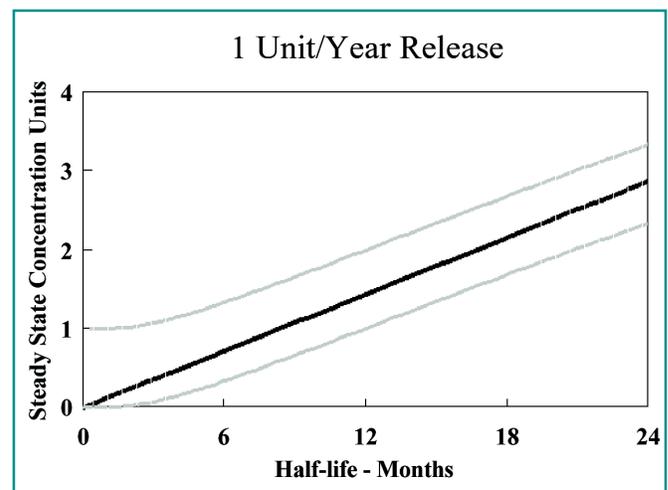


Figure 9-1b. Accumulation curves. Central line represents continuous release totaling one unit per year. Upper and lower lines bound the oscillation from a single release of one unit repeated annually.

Source: Rodan et al. (1999).



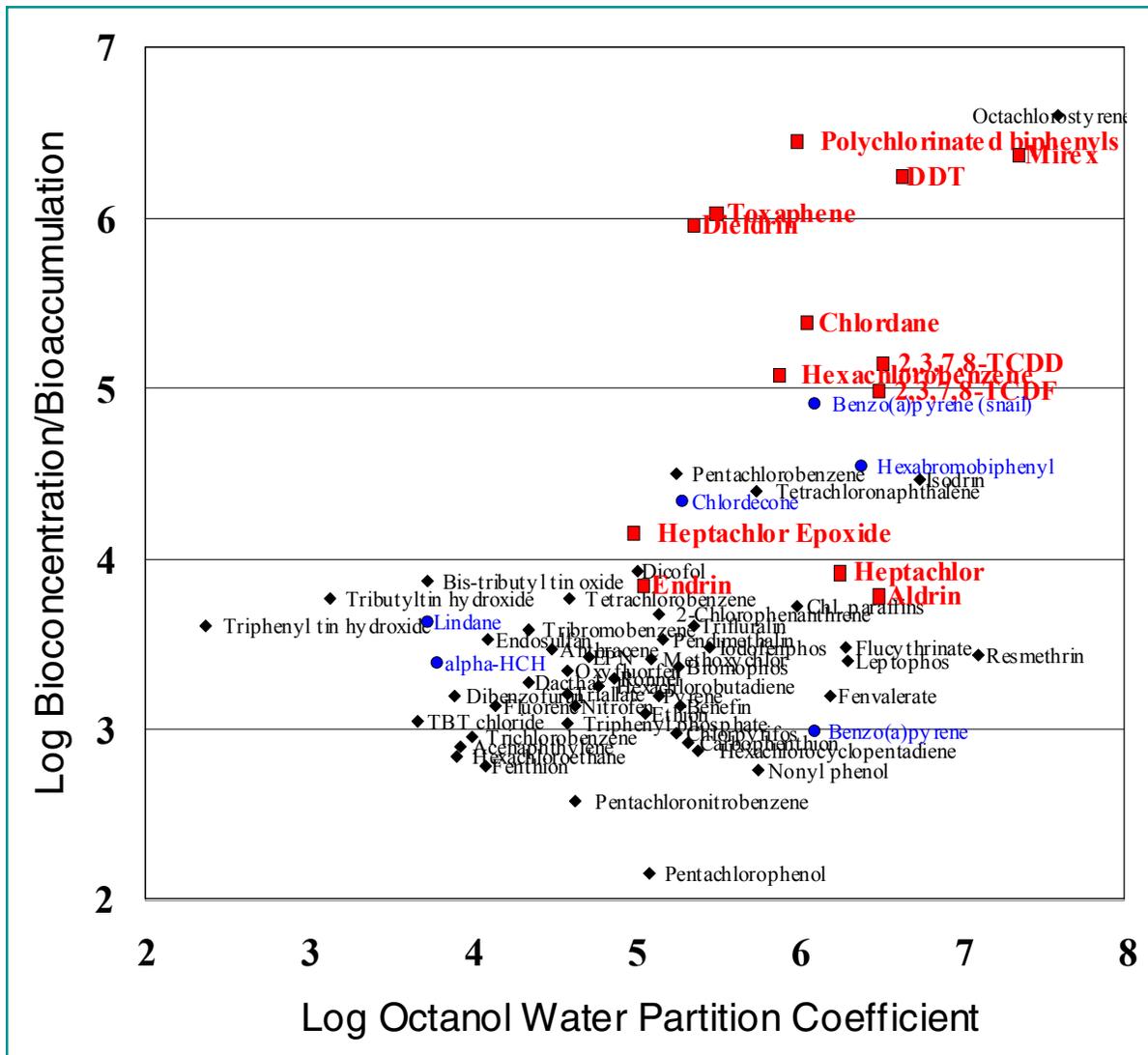


Figure 9-3. Bioaccumulation v. Kow graph. Bioaccumulation factor is normalized to 5% lipid.

Source: Rodan et al. (1999).

graph because of the extreme Kow and bioaccumulation values for the POPs. A base 10 logarithm value of 5 equals  $10^5$ ,  $10 \times 10 \times 10 \times 10 \times 10$ , or 100,000;  $10^6 = 1,000,000$ ; and  $10^{3.7} = 5,000$  (which is the BAF/BCF screening value in the Stockholm Convention). If Figure 9-3 had been graphed on a linear scale with the BCF value of 1 set at 1 millimeter height, then the page would need to be more than 6 kilometers (4 miles) long to fit the PCB bioaccumulation value of  $\sim 6,480,000$ .

In addition to confirming the extreme BAF/BCF values for the POPs, Figure 9-3 also demonstrates a number of technical issues pertinent to

bioaccumulation and which factor into the appraisal of screening values:

- \* There is an approximate linear relationship between the octanol-water partition coefficient and bioaccumulation for the majority of the organic chemicals (see Isnard and Lambert, 1988), albeit not for the organometals. This relationship provides a mathematical link between the screening values of  $\log Kow > 5$  and  $BCF/BAF > 5,000$ .
- \* The slope of this graph increases after  $\log Kow$  values of  $\sim 5$ , demonstrating biomagnification in the food chain.

- \* The metabolism of some organic chemicals in more phylogenetically developed species can limit bioaccumulation, in this case demonstrated by differences in benzo[a]pyrene bioaccumulation between snails and fish.
- \* The majority of organic chemicals (bottom left of graph) do not possess the extremes of bioaccumulation exhibited by POPs.

Recall that the combination of data on two of the four POPs screening values in Figure 9-2 (bioaccumulation and soil persistence) commences a process of isolating chemicals that may pose transboundary or global problems from the majority of organic chemicals. The inclusion of data on the remaining two screening factors of toxicity and long-range environmental transport further informs this separation.

### Long-Range Environmental Transport

Fundamental to the need for a global POPs convention is the transboundary nature of the problem, on a scale greater than can be resolved through bilateral or even regional agreements. With this understanding, the long-range environmental transport criterion can be informed by either (1) measured or monitored levels distant from sources of release to the environment or (2) modeling of a substance's environmental fate properties, compared with known POPs substances.

Measured levels of potential concern in remote locations can unambiguously satisfy the long-range transport criterion. Indeed, the long-range transport properties of many of the "dirty dozen" were originally highlighted by their being found at significant levels in remote locations, such as the Arctic and mid-Pacific. It would be inappropriate, however, to await elevated levels in remote locations before anticipatory action is taken: thus, the additional criterion options of monitoring levels in transport media and modeling based on chemical properties.

For transport monitoring and modeling, it has been demonstrated that the substance's persistence in the transport medium (air or water) strongly governs the distance traveled (Rodan et al., 1999;

SETAC, 2000). This analysis of persistence in a transport medium differs from the theoretical soil persistence analysis presented above, because it incorporates a finite time limitation, namely the time necessary for a substance to move from source to site of deposition. The key question is how long a substance needs to remain airborne or waterborne to constitute a problem warranting international action. This time period is directly related to the geographic scale of interest. For a global negotiation, that scale can be considered the transoceanic or transcontinental level. Assuming a scale of ca. 4,000 kilometers (2,500 miles), it can be shown that approximately 7 to 10 days would be required for atmospheric transport from source to site of deposition. This assumption is based on average air movement rates across the United States of 7 m/sec (Draxler et al., 1991) and computer modeling of air movement on a global scale (Mason and Bohlin, 1995). As demonstrated in Figure 9-4, for a chemical with a 2-day degradation half-life in air, the amount remaining after this approximate 8-day period is 1/16 ( $2^{-4}$ ) of the original release. Lower atmospheric half-lives lead to considerably smaller residual amounts after 8 days, due to the shape of the mathematical relationship between the proportion of chemical remaining at time  $t$  ( $m_t/m_0$ ) and the degradation half-life ( $\tau_{1/2}$ ) [ $m_t/m_0 = \exp(-\ln(2)t/\tau_{1/2})$ ]. This is consistent with the use of a 2-day half-life screening guidance for degradation in air.

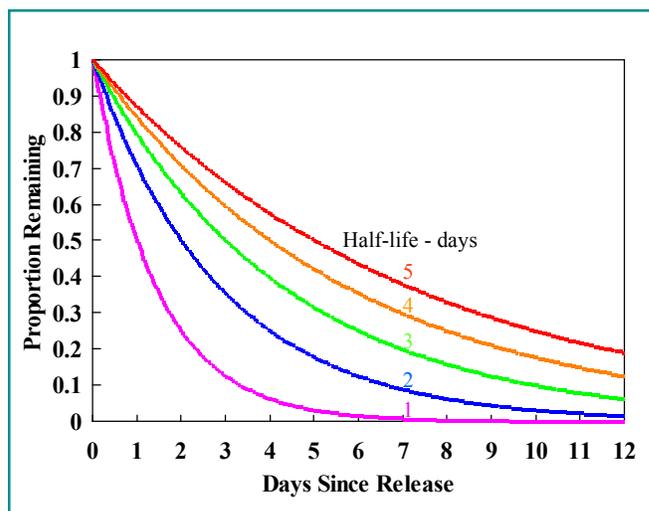


Figure 9-4. Proportion of a POP release remaining for various atmospheric half-lives.

A similar analysis can be performed for water transport, although it will be more complex because water movement rates are considerably slower and much more variable. Figure 9-5 provides oceanic surface current estimates in the Pacific and Atlantic Oceans based on drifter analysis ([www.aoml.noaa.gov/phod/dac/dacdata.html](http://www.aoml.noaa.gov/phod/dac/dacdata.html)). The scale for the arrows of 25 cm/sec is equivalent to 0.9 km/hr or 0.56 mph. As discussed in Chapter 7, rapid oceanic currents are evident for the Gulf Stream (U.S. East Coast) and Kuroshio current (east Asia). Average oceanic surface water speeds are estimated at around 10 cm/sec (0.36 km/hr) (SETAC, 2000). Certain oceanic currents can rapidly move large masses of water long distances,

such as the Gulf Stream off the U.S. East Coast with a speed of around 1 knot (1.7 km/hr) off Cape Hatteras, up to 6 knots (10 km/hr) maximum, and transporting as much as 100 million cubic meters of water. Rivers generally move at 1–3 km/hr in nonflood situations.

To account for this variability in oceanic current speeds, Figure 9-6 presents a modified version of the theoretical analysis presented for air in Figure 9-4. Figure 9-6 again sets the necessary transport distance at 4,000 kilometers (2,500 miles), but this time plots oceanic current speed on the x-axis versus the percentage remaining at 4,000 kilometers on the y-axis. Different half-lives in water are represented by the different lines (color-coded) on the graph. Examples of representative oceanic current speeds are marked on the table (from SETAC, 2000; Leonard et al., 1997; Brown, 1991; Ross, 1978, 1982). Point X provides an example of how to use Figure 9-6, representing a substance with a half-life in water of 2 months, caught in the Gulf Stream. After 2,500 miles transport at ~1 knot, 30% of the original release would remain. Further informing the evaluation of a pertinent half-life criterion in water is the approximate 1/40 ratio for wind speed to oceanic surface current (UK Ministry of Defense, 1973). These analyses are consistent with the Stockholm Convention half-life criterion in water of 2 months (under Annex D, 1(a)), but are clearly highly dependent on which waterbody and current are under consideration.

Beyond these first-order transport comparisons, a number of multimedia environmental fate and transport models have undergone recent development (SETAC, 2000). It is anticipated that these or similar models may be used to satisfy the Stockholm Convention long-range environmental transport modeling requirements. Multimedia models are necessary because POPs distribute to, and move between, air, soil, water, and sediment media. To adequately understand the fate and transport of POPs in the environment, it is necessary to know how they will disperse among these media, each of which exhibits different degradation

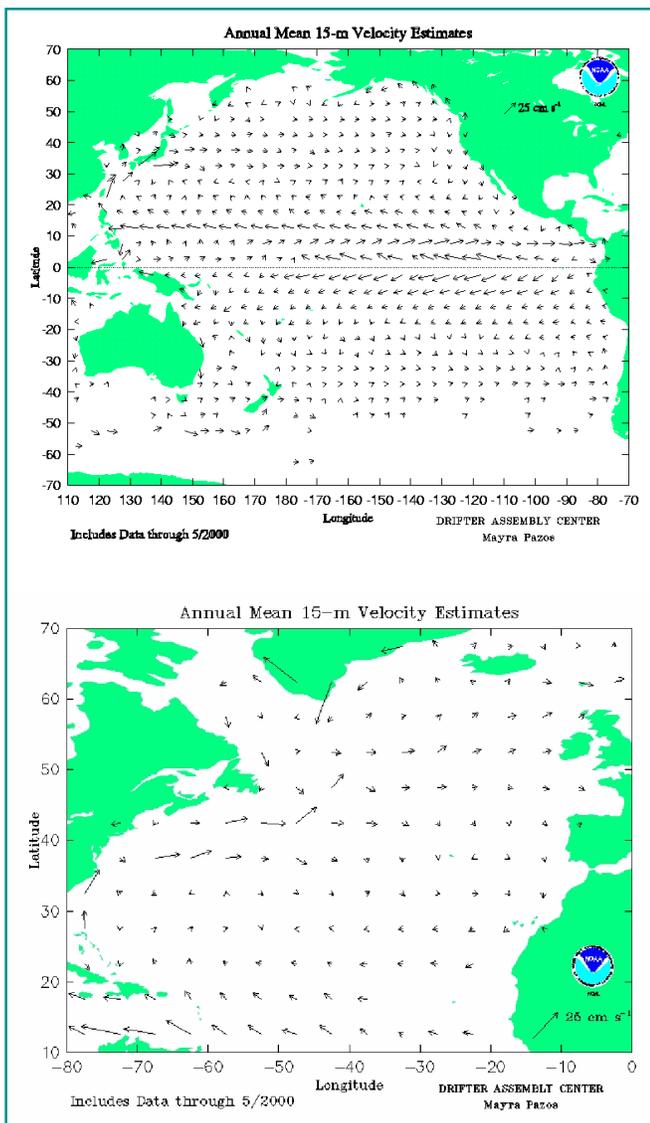


Figure 9-5. Oceanic surface current speeds (NOAA).

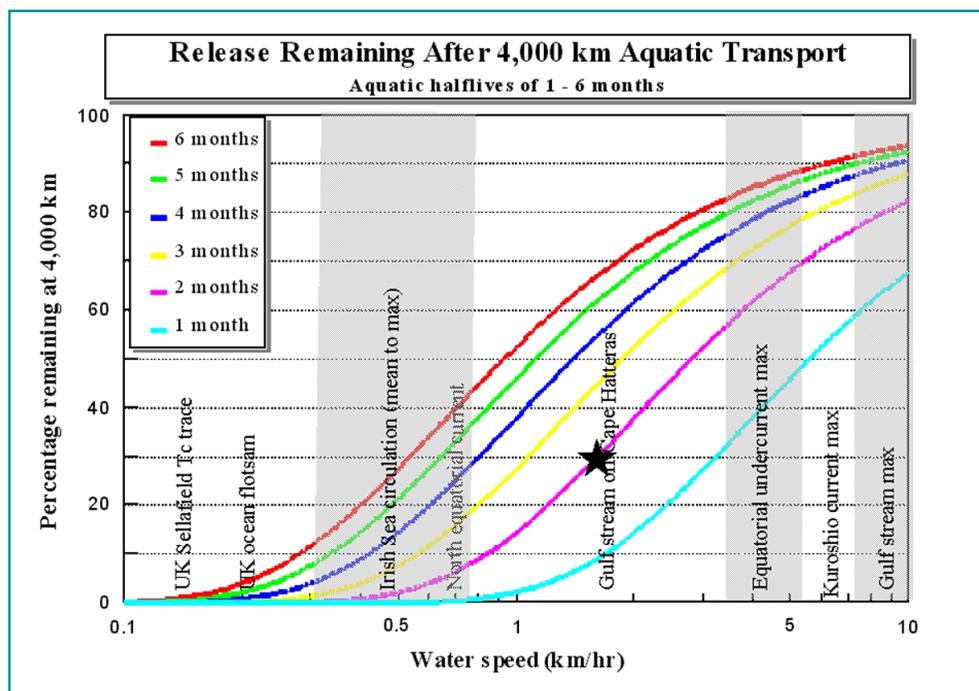


Figure 9-6. Water transport model.

rates and ability to act as storage reservoirs or transport media.

An example of such a multimedia model related to the 12 priority POPs is provided by Scheringer et al. (2000), and replicated here in Figure 9-7. In this graph, the x-axis represents total persistence in the environment; the y-axis shows spatial range normalized to the Earth's circumference. Total persistence is the weighted average of residence times in all the media, a method of merging persistence values in different media into a single figure. The spatial range is the distance a chemical could theoretically travel in the model before reaching a predetermined cut-off level. From this graph, it is evident that distance traveled is not linearly related to total environmental persistence. This lack of linearity is due to differences in the strength of binding to particles in soil or sediment, their immobility limiting movement. This is combined with the fundamental link between transport distance and the half-life in the transport medium, which sets a maximum possible distance function irrespective of degradation rates in soil or sediment. A similar modeling analysis by Rodan et al. (1999) confirmed the potential for the 12 priority POPs to

travel long distances. It is important to note that these models only compare the relative distance traveled by chemicals. This is because the termination decision used for model concentration and distance is arbitrary yet consistent; that is, when is the environmental concentration low enough to say that the chemical is gone and has finished moving?

### Adverse Effects/Toxicity

Toxicity is perhaps the most difficult criterion to quantify in the screening process because it inherently encompasses considerations of dose, the complexity of which is best dealt with at the risk profile stage. Merely finding a chemical at extremely small levels with modern laboratory equipment cannot be considered a *prima facie* case for toxic risks. This caution must be balanced against the technical limitations of toxicology and ecotoxicology to detect and quantitate subtle adverse effects and the need to not await the demonstration of overt toxicity in remote locations before action is taken—a precautionary approach. Guidance on how to resolve this dilemma, and achieve a balance between providing information at the screening stage versus the more detailed risk pro-

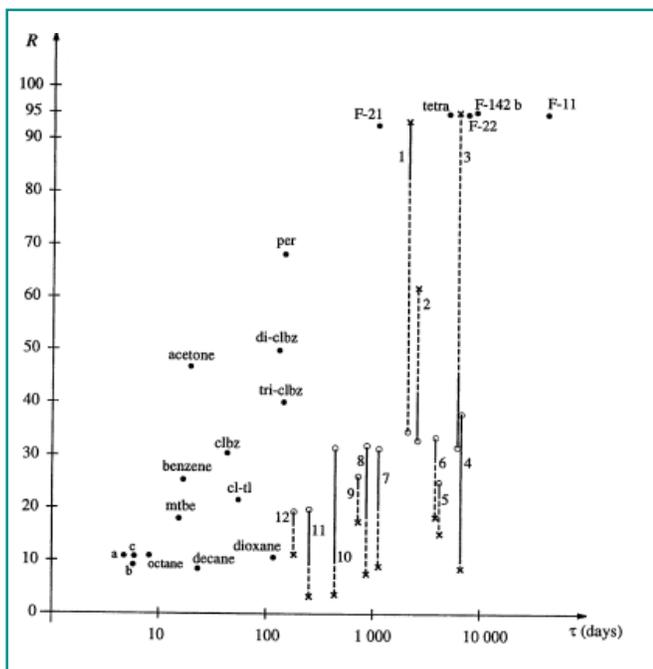


Figure 9-7. Spatial range  $R$  (normalized to the earth's circumference) and persistence  $\tau$  of various chemicals based on results of the global model proposed by Scheringer (2000). 1: hexachlorobenzene, 2: hexachlorobiphenyl, 3: mirex, 4: endrin, 5: DDT, 6: toxaphene, 7: chlordane, 8: dieldrin, 9: TCDD, 10: aldrin, 11: heptachlor, 12: lindane. See Scheringer et al. (2000) for a more detailed interpretation of this plot.

file, is best found by analyzing the text of the Stockholm Convention (Annex D.1.(e) & D.2):

D. 1. ... (e) Adverse effects:

- (i) Evidence of adverse effects to human health or to the environment that justifies consideration of the chemical within the scope of this Convention; or
- (ii) Toxicity or ecotoxicity data that indicate the potential for damage to human health or to the environment.

2. The proposing Party shall provide a statement of the reasons for concern including, where possible, a comparison of toxicity or ecotoxicity data with detected or predicted levels of a chemical resulting or anticipated from its long-range environmental transport ....

Here, a hierarchy of toxicity evidence is anticipated. Priority is given at the screening stage to actual “evidence of adverse effects,” justifying

consideration in this global Convention. The adverse effects screening criterion can also be fulfilled with “data that indicate the potential for damage,” again emphasizing the need for data—not speculation—but not at the expense of awaiting irreversible harm. The criterion category is then followed by a statement of concern (Annex D.2) at the screening stage, in which the proponent Party is to include, where possible, a comparison of data with detected or predicted levels. These efforts to provide quantitative information on adverse effects—measured or predicted—are to be further elaborated upon and evaluated by the POPRC in the risk profile stage (below).

A wide variety of human health and ecotoxicity data are anticipated under this criterion. For human health, numerous national and international expert scientific bodies assess data to determine if a hazard exists to humans. Many of these bodies develop standards considered protective of health. The EPA reference dose, for example, is an estimate of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime ([www.epa.gov/iris](http://www.epa.gov/iris)). The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) develops Minimal Risk Levels (MRLs) for many environmental contaminants ([www.atsdr.cdc.gov](http://www.atsdr.cdc.gov)). Internationally, the WHO and International Agency for Research on Cancer (IARC) are central to developing health standards. Reliance on all of these standards should, however, be tempered by an understanding of how they are derived, the use of uncertainty factors and public health protective assumptions that reduce numerical values below the actual research data findings, and details and differences in the specific wording of the standards (e.g., tolerable versus minimal risk versus safe). Ultimately, an expert appraisal, including analysis of the primary published literature, should be undertaken to fully inform deliberations.

For ecotoxicity, a similar process of problem formulation is undertaken to identify stressors and the animals and plants at risk. Quantitative data for chemical stressors can come in the form of dose estimates related to toxic endpoints or as tissue levels associated with adverse effects. Ideally,

laboratory studies of toxic doses will include the tissue levels associated with these effects, but this is not always the case. The complexity of ecotoxicity data is accentuated by species differences, interaction with the species' ambient environment, multiple simultaneous stressors, and difficulties in determining low levels of toxicity, especially in field situations (SETAC, 1996). Expert judgment is again essential in exercising appropriate caution in determining the potential for adverse effects.

### **The Risk Profile**

The risk profile is central to the ultimate determination of whether a substance is a POP warranting action under the Stockholm Convention. The emphasis on a detailed scientific review and expert judgment is paramount in recommendations by scientific bodies (SETAC, 2000; CEG, 1998). The complexity of the detailed risk profile can appear, however, somewhat contrary to a more straightforward application of numerical screening criteria, with its expeditious, yet possibly inaccurate, clarity. With this in mind, it merits emphasis that passing the screening phase of the addition of chemicals process does not necessarily imply listing as a POP. This determination can only be made after a critical review and analysis of all the pertinent data. As stated in Annex E:

The purpose of the review is to evaluate whether the chemical is likely, as a result of its long-range environmental transport, to lead to significant adverse human health and/or environmental effects, such that global action is warranted.

The information requirements for the risk profile include elaboration and review of the Annex D (screening criteria) information, supplemented by Annex E information on sources, hazards, environmental fate and models, measured levels, and national and international assessments and status. The profile will be prepared by the POPRC, with data input from Parties and observers (e.g., industry, nongovernmental, and intergovernmental organizations). It is recognized that more detailed initial submission packages by proponent Parties covering these points will expedite the process.

### **Risk Management Options**

After a determination is made by the POPRC that a substance is likely to be a chemical warranting global action, information is then obtained on Annex F management options and socioeconomic considerations. A clear separation is considered important between the risk profile and management stages so that potential implementation considerations do not affect the scientific evaluation of whether a substance should be included under the Stockholm Convention. After such a determination is made, however, Annex F explicitly requires consideration of technical and socioeconomic factors in determining the best course(s) of action in dealing with a chemical. To facilitate such decisions by the COP, the report on management options by the POPRC will review the efficacy and efficiency of possible control measures, alternative products and processes, impacts on society of implementing possible control measures, waste and disposal implications, and additional factors influencing the ability of Parties to implement obligations.

### **The Decision**

The ultimate decision to list a chemical in the Annexes and on appropriate control strategies rests with the Conference of the Parties. This decision must give due consideration to, but is not bound by, the recommendations of the POPRC in the risk profile and management report. In doing so, the Stockholm Convention seeks to maximize the input of scientific information from multiple sources (intergovernmental, government, industry, non-government organizations) into a transparent decisionmaking process. Consistent with standards maintained during the negotiation of the Stockholm Convention, decisions by the COP are to be reached by consensus. Absent such consensus, a 3/4 majority vote is necessary to add a chemical. Changes to the information requirements and criteria in Annexes D (screening), E (risk profile), and F (risk management/socioeconomics) can be made only by consensus, to maintain a consistent standard for evaluating proposals to add chemicals.

## The Future

During the May 2001 signing ceremony for the POPs Convention in Stockholm, Sweden, agreement was reached to commence work on defining the structure and process for the Persistent Organic Pollutant Review Committee. Proposal dossiers for the addition of chemicals may be pursued on a national basis in anticipation of the entry into force of the Convention and commencement of POPRC review functions.

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