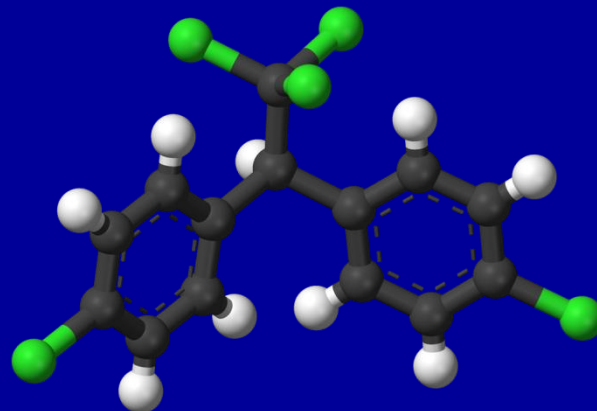


WHAT IS A PERSISTENT ORGANIC POLLUTANT (POP)?



Noelle Eckley Selin

Joint Program on the Science and Policy of Global Change,
Massachusetts Institute of Technology



Atmospheric Chemistry, Climate and Transboundary Air Pollution Workshop
Washington D.C., 9 June 2008

POPs ARE A SCIENCE-POLICY HYBRID

POPs chemicals (e.g. DDT, PCBs) have been regulated for decades, but the term POPs emerged as part of science-policy discussions on regulations

Earlier terms included: *persistent organic contaminants, persistent organic compounds, POC, persistent semivolatile bioaccumulating organic compounds*

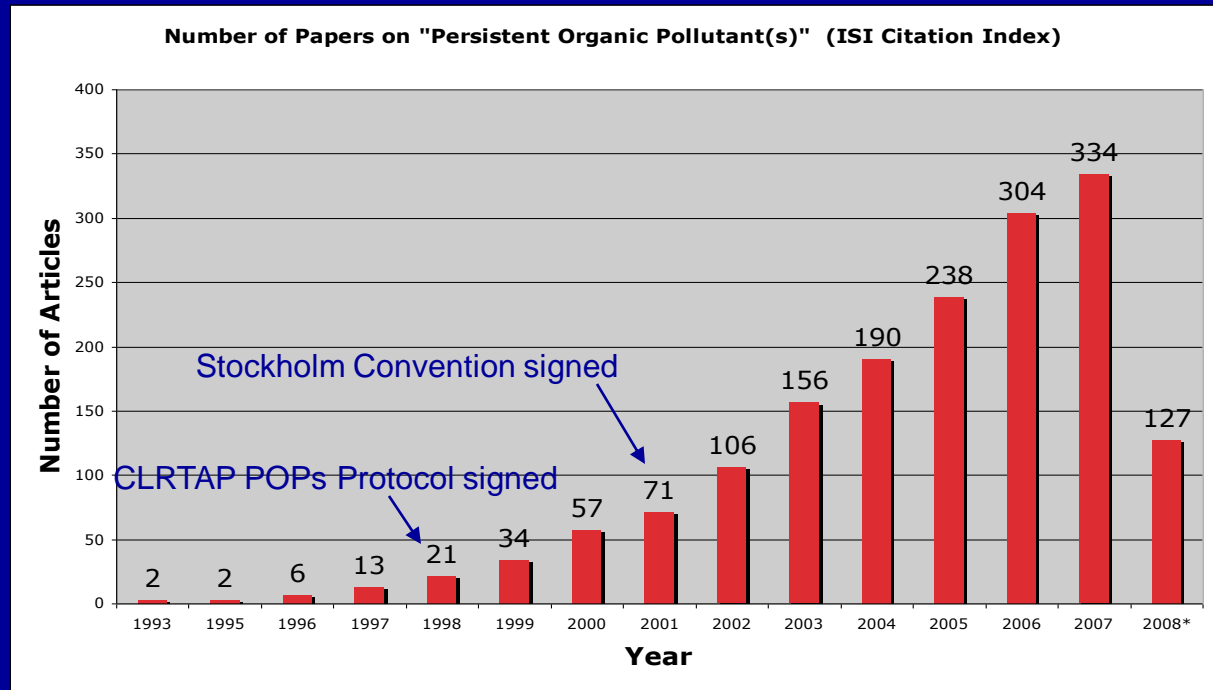
Regulatory criteria for selecting POPs for regulation include:

Persistence

Potential for long-range environmental transport

Bio-accumulation

Adverse effects



[For more discussion see: N.E. Selin, "From Regional to Global Information: Assessment of Persistent Organic Pollutants," in R.B. Mitchell et al., eds., *Global Environmental Assessments: Information and Influence*, Cambridge: MIT Press, 2006.]

INTERNATIONAL CRITERIA FOR POPs

Bioaccumulation:

Bio-accumulation factor (aquatic) > 5000 or log Kow > 5, OR
 Evidence of high bioaccumulation in other species, high (eco)toxicity, OR
 Monitoring data in biota

Persistence:

Half-life of 2 months in water, or 6 months in soil, or 6 months in sediment, OR
 Evidence of sufficient persistence to justify consideration

Long-range transport potential:

Measured levels in locations far from releases, OR
 Monitoring showing long-range environmental transport may have occurred, OR
 Environmental fate properties or model results showing potential for transport
 Air half-life > 2 days for chemicals transporting through air

Adverse effects

Criterion		Stockholm	CLRTAP
Bioaccumulation	Log Kow	5	5
	Bioaccumulation Factor	5000	5000
Persistence	Water	2 months	2 months
	Soil	6 months	6 months
	Sediment	6 months	6 months
Transport	Air	2 days	2 days

Log Kow=octanol-water partition coefficient, measure of lipophilicity
 Bioaccumulation factor: takes into account environmental and dietary sources

[Eckley, *Environment*, 2001;
 Rodan et al., *ES&T*, 1999]

POPs Included and Proposed under Major Agreements

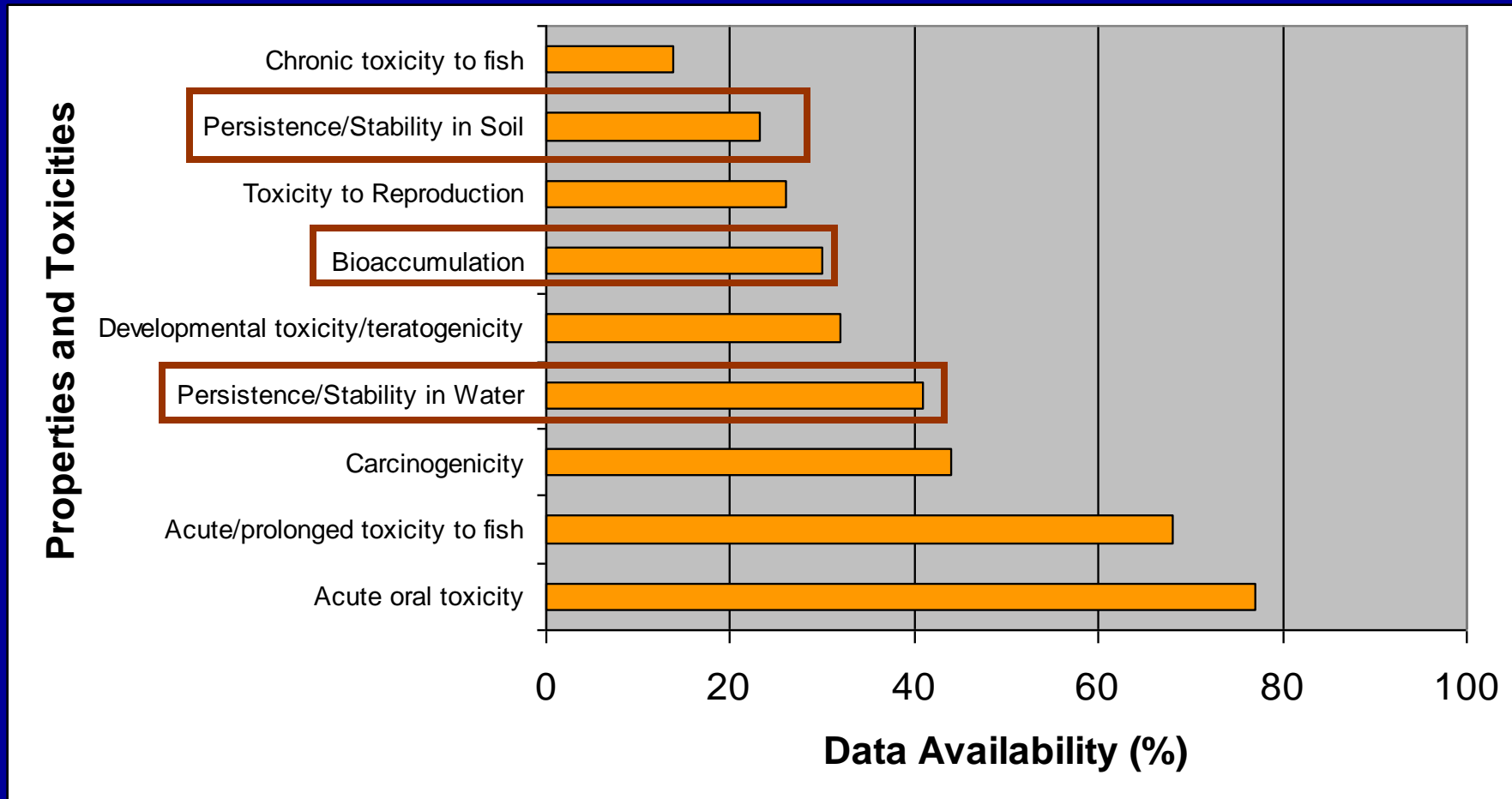
Pesticides Industrial chemicals Byproducts

* Multiple categories

Chemical	CLRTAP	Proposed-CLRTAP	Stockholm	Proposed-Stockholm
Aldrin	√		√	
Chlordane	√		√	
Chlordecone	√			P
DDT	√		√	
Dieldrin	√		√	
Dioxins	√		√	
Endosulfan				P
Endrin	√		√	
Furans	√		√	
Heptachlor	√		√	
Hexabromobiphenyl	√			P
Hexachlorobenzene*	√		√	
Hexachlorobutadiene		P		
Hexachlorocyclohexane	√			P
Mirex	√		√	
Octabromodiphenyl ether		P		P
PCB*	√		√	
Pentabromodiphenyl ether		P		P
Pentachlorobenzene		P		P
Perfluorooctanesulfonate		P		P
Polychlorinated naphthalene		P		
Polycyclic aromatic hydrocarbons	√			
Short-chain chlorinated paraffins		P		P
Toxaphene	√		√	

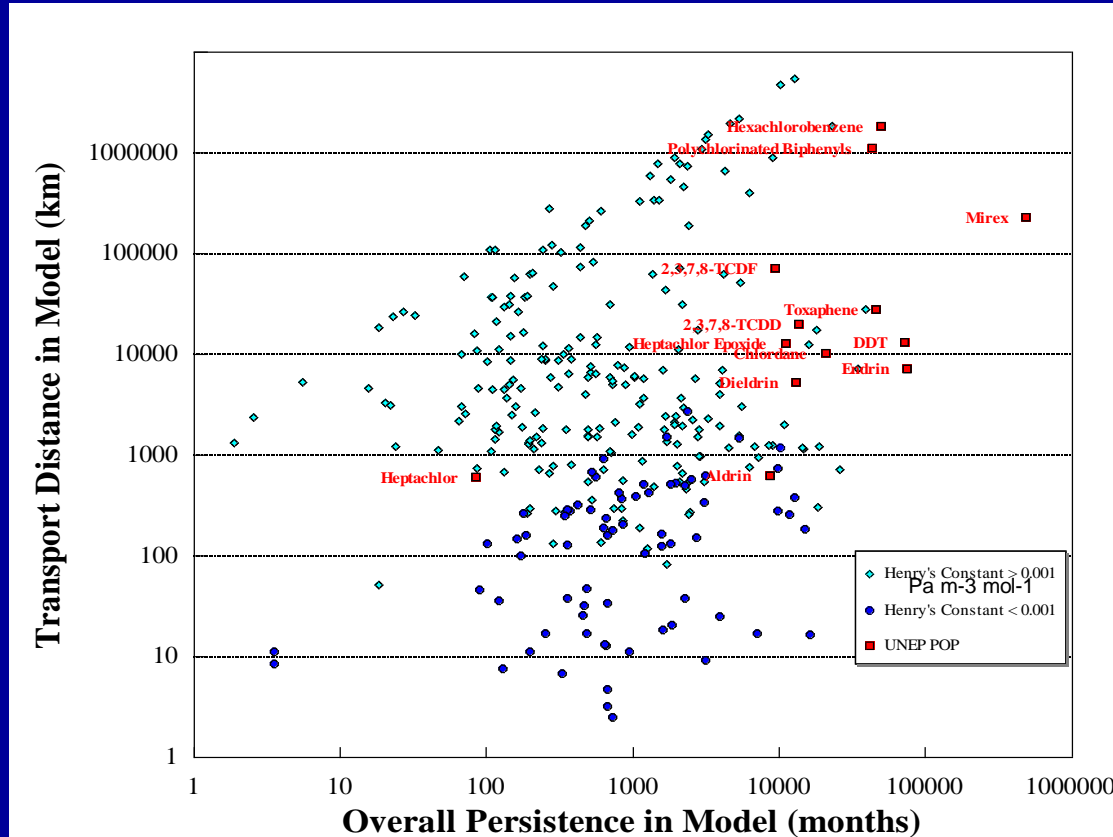
[Selin and Selin, *Review of European Community and International Environmental Law*, 2008]

Availability of Data on 2465 High Production Volume Chemicals; some illustrative properties and toxicities (IUCLID Database, 1999)



SCREENING FOR ADDITIONAL POPs

Transport Distance v. Model Overall Environmental Persistence



[Rodan et al., *ES&T*, 1999]

Other approaches to identify POPs:

Model overall environmental persistence (sometimes, different results from half-life approach, see *Klasmeier et al. 2006*)

Screening based on quantitative structure-property relationships (*Muir and Howard, 2006* identified 30 with bioconcentration potential and 28 with transport potential)

But, challenges in monitoring and measurement exist.

ADDITIONAL CONSIDERATIONS AND CHALLENGES

Known, regulated POPs (e.g. PCBs, “dirty dozen” pesticides) have data available, but many of the intentionally-produced ones are no longer produced

“Byproduct” POPs (dioxins, furans) regulated in industrialized countries, continue to grow elsewhere

Candidate POPs (e.g. PFOS, PBDEs) have some data, and are emerging problems.

Unidentified POPs -- ???