POPRC-8/4: Pentachlorophenol and its salts and esters

The Persistent Organic Pollutants Review Committee,

Having examined the proposal by the European Union and its member States parties to the Stockholm Convention on Persistent Organic Pollutants to list pentachlorophenol and its salts and esters in Annexes A, B and/or C to the Convention and having applied the screening criteria specified in Annex D to the Convention,

1. *Decides*, in accordance with paragraph 4 (a) of Article 8 of the Convention, that it is satisfied that the screening criteria have been fulfilled for pentachlorophenol and its salts and esters, as set out in the evaluation contained in the annex to the present decision;

2. *Also decides*, in accordance with paragraph 6 of Article 8 of the Convention and paragraph 29 of decision SC-1/7 of the Conference of the Parties to the Convention, to establish an ad hoc working group to review the proposal further and to prepare a draft risk profile in accordance with Annex E to the Convention;

3. *Invites*, in accordance with paragraph 4 (a) of Article 8 of the Convention, parties and observers to submit to the Secretariat the information specified in Annex E before 11 January 2013.

Annex to decision POPRC-8/4

Evaluation of pentachlorophenol and its salts and esters against the criteria of Annex D

A. Background

1. The primary source of information for the preparation of the present evaluation was the proposal and supporting documents submitted by the European Union and its member States parties to the Convention contained in documents UNEP/POPS/POPRC.7/4, UNEP/POPS/POPRC.7/INF/5, UNEP/POPS/POPRC.7/INF/5/Add.1 and UNEP/POPS/POPRC.7/INF/6.

2. The information provided also included data on pentachloroanisole ($C_7H_3Cl_5O$, CAS No. 1825-21-4), which is a transformation product and a precursor of pentachlorophenol.

3. Additional sources of scientific information included peer-reviewed scientific papers.

B. Evaluation

4. The proposal was evaluated in the light of the requirements of Annex D regarding the identification of the chemical (paragraph 1 (a)) and the screening criteria (paragraphs 1 (b)–(e)):

(a) Chemical identity:

(i) Adequate information was provided in the proposal and supporting documents covering pentachlorophenol, one of its salts and one of its esters;

(ii) The chemical structures were provided;

The chemical identity of pentachlorophenol, pentachlorophenol sodium salt and pentachlorophenyl laurate are clearly established. The proposal includes pentachlorophenol and its salts and esters;

(b) Persistence:

(i) Under normal environmental conditions microflora will adapt and biodegrade pentachlorophenol in water with half-life less than four weeks, in sediment less than 20 weeks and in soil less than 10 weeks. Few data exist on degradation or persistence of pentachloroanisole. Studies indicate that the disappearance of pentachloroanisole from media such as soil and water is mainly driven by dissipation resulting from advective transport, governed by volatilization to air. The esters and the salts of pentachlorophenol are easily degraded or dissociated in the environment into pentachlolorophenol;

(ii) Models predict pentachloroanisole to be persistent. Pentachloroanisole has been detected in remote areas far from point sources, both in biotic and abiotic

matrices (e.g., in snow in the Canadian Arctic, in animals in Greenland, at six Arctic atmospheric monitoring stations, in remote lakes and, as shown by air monitoring campaigns, in various locations in the northern and southern hemispheres);

While there is evidence that pentachlorophenol does not meet the criteria on persistence, there is also evidence that its transformation product (pentachloroanisole) does meet that criterion;

(c) Bioaccumulation:

(i) Reported bio-concentration factors in aquatic species for pentachlorophenol vary between 1 and 1,100 on a whole-body-weight basis, which is below the criterion for the bio-concentration factor of 5,000. The highest values have been observed for fish. A bioconcentration factor of 4,900 was obtained in an early life-stage test experiment aiming at mimicking the environmental exposure of fish. The reported log Kow values vary between 1.3 and 5.86. The large variation in log Kow stems from the dissociation of pentachlorophenol depending on pH. Reported bioconcentration factors in fish for pentachloroanisole vary between 11,000 and 24,000, which is above the criterion of 5,000; log Kow was measured at 5.45, which is above the criterion of 5;

(ii) A biomagnification study on polar bears and ringed seals reports a biomagnification factor above 1, indicating bioaccumulation of pentachlorophenol (Ref. 1). The source of pentachlorophenol could not be clearly established; it could be metabolites from hexachlorobenzene and/or pentachlorophenol emissions that accumulated through the food chain. To date, however, there has not been any evidence that marine mammals are capable of metabolizing hexachlorobenzene. Elevated concentrations of pentachlorophenol are detected in humans throughout the Arctic, but data remain limited geographically and exposure routes and time trends are not elucidated (Ref. 2). In humans, pentachlorophenol is eliminated via urine both as unmetabolized pentachlorophenol and as glucuronide conjugate (Ref. 3);

(iii) Pentachloroanisole was detected in adipose tissue and blood of polar bears and ringed seals in the Arctic. Pentachloroanisole was detected in adipose tissues of animals in Greenland;

There is sufficient evidence that pentachloroanisole, the transformation product of pentachlorophenol, meets the criterion on bioaccumulation;

(d) Potential for long-range environmental transport:

(i) Pentachlorophenol was detected in polar bears and ringed seals. Pentachloroanisole was detected in biotic matrices in Greenland;

(ii) Pentachloroanisole was detected in abiotic matrices far from point sources of pentachlorophenol, including at six Arctic atmosphere monitoring stations, in snow in the Canadian Arctic and, as shown by air monitoring campaigns, in various locations in the northern and southern hemispheres;

(iii) An atmospheric half-life of 19 d was calculated for pentachlorophenol and of 9.8 d for pentachloroanisole. Modelling work has shown that pentachlorophenol can be transported over 1,500–3,000 km and pentachloroanisole over 2,110 km;

There is evidence that pentachlorophenol and pentachloroanisole meet the criterion on potential for long-range environmental transport;

(e) Adverse effects:

(i) There is a wealth of reported information on adverse effects of pentachlorophenol in mammals. The data show developmental, immunotoxic and neurotoxic effects and that human survivors of toxic exposures may suffer permanent visual and central nervous system damage. The data on pentachloroanisole indicate some toxicity to reproduction and possible mutagenic and carcinogenic effects, but current knowledge is insufficient to make a conclusive statement on those two endpoints. When considering the toxicity of pentachloroanisole, there is a need to take into account the fact that

the main metabolite of pentachloroanisole in biota is pentachlorophenol, which is shown to be highly toxic;

(ii) There is a wealth of information on the ecotoxicity of pentachlorophenol. Pentachlorophenol is highly toxic to aquatic organisms. Reported acute LC50 values for fish vary between 20 µg/L and 600 µg/L. The lowest chronic no observed effect concentrations (NOECs) observed in the freshwater fish test varied between 2 µg/L and below 15 µg/L. Pentachloroanisole is highly toxic to aquatic organisms. A reported LC50 value for fish is 27 µg/L. When considering eco-toxicity of pentachloroanisole, there is a need to take into account the fact that the main metabolite of pentachloroanisole in biota is pentachlorophenol, which is shown to be highly toxic;

There is sufficient evidence that pentachlorophenol and pentachloroanisole meet the criterion on adverse effects.

C. Conclusion

5. While the pentachlorophenol molecule does not meet all the screening criteria specified in Annex D, the Committee concluded, taking into account its transformation product pentachloroanisole, that pentachlorophenol and its salts and esters meet the screening criteria specified in Annex D.

References

1. Robert J. Letcher et al., (2009). Environment International 2009, 1118-1124. Bioaccumulation and biotransformation of brominated and chlorinated contaminants and their metabolites in ringed seals (*Pusa hispida*) and polar bears (*Ursus maritimus*) from East Greenland.

2. AMAP Assessment 2009: Human health in the Arctic, AMAP, Oslo 2009.

3. WHO (1987) Pentachlorophenol. Geneva, World Health Organization, International Programme on Chemical Safety (Environmental Health Criteria 71).