OPERATION OF THE PRIOR INFORMED
CONSENT PROCEDURE FOR BANNED
OR SEVERELY RESTRICTED CHEMICALS
IN INTERNATIONAL TRADE

DECISION GUIDANCE DOCUMENTS

Mercury compounds

JOINT FAO/UNEP PROGRAMME
FOR THE OPERATION OF
PRIOR INFORMED CONSENT

United Nations Environment Programme

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Food and Agriculture Organization of the United Nations
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Rome - Geneva 1991; amended 1996

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The inclusion of these chemicals in the Prior Informed Consent Procedure is based on reports of control action submitted to the United Nations Environment Programme (UNEP) by participating countries, and which are presently listed in the UNEP-International Register of Potentially Toxic Chemicals (IRPTC) database on Prior Informed Consent. While recognizing that these reports from countries are subject to confirmation, the FAO/UNEP Joint Working Group of Experts on Prior Informed Consent has recommended that these chemicals be included in the Procedure. The status of these chemicals will be reconsidered on the basis of such new notifications as may be made by participating countries from time to time.

The use of trade names in this document is primarily intended to facilitate the correct identification of the chemical. It is not intended to imply approval or disapproval of any particular company. As it is not possible to include all trade names presently in use, only a number of commonly used and published trade names have been included here.

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ABBREVIATIONS WHICH MAY BE USED IN THIS DOCUMENT

(N.B. : chemical elements and pesticides are not included in this list)

ADI	acceptable daily intake
ai	active ingredient
b.p.	boiling point
bw	body weight
°C	degree Celsius (centigrade)
CCPR	Codex Committee on Pesticide Residues
DNA	Designated National Authority
EC	emulsion concentrate
EEC	European Economic Community
EPA	U.S. Environmental Protection Agency
ERL	extraneous residue limit
FAO	Food and Agriculture Organization of the United Nations
g	gram
µg	microgram
GAP	good agricultural practice
GL	guideline level
ha	hectare
IARC	International Agency for Research on Cancer
i.m.	intramuscular
i.p.	intraperitoneal
IPCS	International Programme on Chemical Safety
IRPTC	International Register of Potentially Toxic Chemicals
JMPR	Joint FAO/WHO Meeting on Pesticide Residues (Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and a WHO Expert Group on Pesticide Residues)
k	kilo- (x 103)
kg	kilogram
l	litre
LC_{50}	lethal concentration, 50%
LD_{50}	lethal dose, median

m	metre
mg	milligram
ml	millilitre
m.p.	melting point
MRL	Maximum Residue Limit.
MTD	maximum tolerated dose
ng	nanogram
NOEL	no-observed-effect level
NOAEL	no-observed-adverse-effect level
NS	Not Stated
OP	organophosphorus pesticide
PHI	pre-harvest interval
ppb	parts per billion
ppm	parts per million (Used only in reference to the concentration of a pesticide in an experimental diet. In all other contexts the terms mg/kg or mg/l are used).
ppt	parts per trillion
sp gr	specific gravity
STEL	Short Term Exposure Limit
TADI	Temporary Acceptable Daily Intake
TLV	Threshold Limit Value
TMDI	theoretical maximum daily intake
TMRL	Temporary Maximum Residue Limit
TWA	Time Weighted Average
UNEP	United Nations Environment Programme
WHO	World Health Organization
WP	wettable powder
wt	weight
<	less than
<<	much less than
$\leq$	less than or equal to
>	greater than
$\geq$	greater than or equal to

MERCURY COMPOUNDS

PRIOR INFORMED CONSENT
DECISION GUIDANCE DOCUMENT

1. IDENTIFICATION

1.1 Common Name:

1.1.1 Inorganic mercury compounds:

Mercuric oxide
Mercurous chloride
Mercuric chloride
Mercury

1.1.2 Alkyl mercury compounds:

Methylmercury acetate
Methylmercury benzoate
Mercuric acetate
Mercury naphthenate
Mercury oleate
Mercury pentanedione
Mercury phenate
Methylmercury acetate
Methylmercury benzoate
Methylmercury nitrite
Methylmercury pentachloropenoxide
Methylmercury propionate
Methylmercury 8-quinolinolate

1.1.3 Alkyloxyalkyl and aryl mercury compounds:

Cyano (methylmercuric) guanidine
2-(Acetoxymercuric) ethanol phenylmercuric lactate
Hydroxymercury-o-nitrophenol
Methylmercuryhydroxide
Methylmercury 2,3 dihydroxypropylmercaptide
N-(phenylmercuric) urea
Phenylmercuric acetate
Phenylmercuric ammonium acetate
Phenylmercuric ammonium propionate
Phenylmercuric borate
Phenylmercuric carbonate
Phenylmercuric chloride
Phenylmercuric dimethyldithiocarbamate
Phenylmercuric-2-ethylhexonate

Phenylmercuric formamide
Phenylmercuric hydroxide
Phenylmercuric-8-quinolinate
Phenylmercuric lactate
Phenylmercuric laurylmercaptide
Phenylmercuric monoethanolammonium acetate
Phenylmercuric monoethanolammonium lactate
Phenylmercuric napthenate
Phenylmercuric nitrate
Phenylmercuric oleate
Phenylmercuric propionate
Phenylmercuric salicylate
Phenylmercuric thiocyanate
Phenylmercuric triethanolammonium lactate
Sodium ethylmercuric salicylate

1.2 Chemical Type: Inorganic and organic mercurials

1.3 Uses: Fungicide, herbicide, insecticide, microbicide and bacteriostat

1.4 Chemical Names: Refer to listings under 1.1 Common Names, 1.5 CAS Nos., and 1.6 Trade Names/Synonyms

1.5 CAS Nos.:

1.5.1 Inorganic mercury compounds:

21908-53-2 (mercuric oxide)
7546-30-7 (mercurous chloride)
7487-94-7 (mercuric chloride)
7439-97-6 (mercury)

1.5.2 Alkyl mercury compounds:

108-07-6 (methylmercury acetate)
3626-13-9 (methylmercury benzoate)
1600-27-7 (mercuric acetate)
1336-96-5 (mercury naphthenate)
1191-80-6 (mercury oleate)
14024-55-6 (mercury pentanedione)
589-66-9 (mercury phenate)
108-07-6 (methylmercury acetate)
3626-13-9 (methylmercury benzoate)
2591-97-9 (methylmercury nitrite)
unknown (methylmercury propionate)
86-85-1 (methylmercury 8-quinolinolate)

1.5.2 Alkyloxyalkyl and aryl mercury compounds:

502-39-6 (cyano(methylmercuric)guanidine)
4665-55-8 (2-(Acetoxymercuric)ethanol phenylmercuric lactate)
17140-73-7 (hydroxymercuri-o-nitrophenol)
1184-57-2 (methylmercury hydroxide)
2597-95-7 (methylmercury 2,3 dihydoxypropyl mercaptide)
2279-64-3 (N-(phenylmercuric urea)
62-38-4 (phenylmercuric acetate)
53404-67-4 (phenylmercuric ammonium acetate)
53404-68-5 (phenylmercuric ammonium propionate)
102-98-7 (phenylmercuric borate)
53404-69-6 (phenylmercuric carbonate)
100-56-1 (phenylmercuric chloride)
32407-99-1 (phenylmercuric dimethyldithiocarbamate)
13302-00-6 (phenylmercuric-2-ethylhexonate)
22894-47-9 (phenylmercuric formamide)
100-57-2 (phenylmercuric hydroxide)
26114-17-0 (phenylmercuric-8-quinolinate)
122-64-5 (phenylmercuric lactate)
unknown (phenylmercuric laurylmercaptide)
5822-97-9 (phenylmercuric monoethanol ammonium acetate)
53404-70-9 (phenylmercuric monoethanol ammonium lactate)
31632-68-5 (phenylmercuric napthenate)
55-68-5 (phenylmercuric nitrate)
104-68-9 (phenylmercuric oleate)
103-27-5 (phenylmercuric propionate)
28086-13-7 (phenylmercuric salicylate)
16751-55-6 (phenylmercuric thiocyanate)
23319-66-6 (phenylmercuric threthanolammonium lactate)
54-64-8 (phenylethylmercuric salicylate)

1.6 Trade Names/Synonyms:

1.6.1 Inorganic mercury compounds:

mercuric oxide - red precipitate, yellow oxide of mercury
mercurous chloride - calomel, calogreen, cyclosan, caloclor, calo-gran
mercuric chloride - mercury bichloride, corrosive sublimate
mercury - quicksilver

1.6.2 Alkyl mercury compounds:

mercuric lactate - Puratized B-2
methylmercury-8-quinolinolate - Metasol

1.6.3 Alkyloxyalkyl and aryl mercury compounds:

Phenylmercuric acetate - PMA, Agrosan, Cekusil, Gallotox, Hong Nien, Luquiphene, Mersolite, Phenmad, Phix, PMAS, Shimmer-ex, Nylmerate, Scutl, Riogen Phenylmercuric nitrate - Merphenylnitrate, Phermernite
Cyano(methylmercuri)guanidine - Panogen, methyl mercury dicyanodiamide
Phenylmercuric dimethyldithiocarbamate - Merfenel
Phenylmercuric salicylate - Merculine, Mercusol (2-methoxyethyl) mercuric acetate - Mercuran Phenylmercuric ammonium acetate - Setrete
Phenylmercuric chloride - Stopspot
Phenylmercuric monoethanol ammonium acetate - Puratized Apple Spray
Phenylmercuric triethanolammonium lactate - Puratized Agricultural Spray
N-(phenylmercuric)urea - Agrox, Leytosan

1.7 Formulation Types: Liquid, wettable powder, granular, latex paint, formulation intermediate, and soluble concentrate.

Basic Producers: Huls America, Inc., Thor Chemicals, Inc., Troy Chemical Corp., Sierra Crop Protection Co.

2. SUMMARY OF CONTROL ACTIONS

2.1 General: The uses of both inorganic and organic mercury compounds as pesticides include seed treatment (dressings), algicide and slimicide (cooling towers, pulp and paper mills), marine antifoulant paints, in-can preservative for water-based paints and coatings, turf, lumber, tree wound dressing, seed potatoes, apples, fabric and laundry uses. Control actions to ban or severely restrict the uses of mercury compounds have been reported by 22 countries. Actions were taken as early as 1969, with the latest in 1990.

2.2 Reasons for Control Actions: Control actions have been taken because mercury, in both its inorganic and organic forms, is toxic to man. In addition, various forms of mercury are toxic to aquatic organisms, and residues accumulate in the aquatic biota with the result that potentially dangerous residue levels are reached in aquatic foods (e.g. fish and shellfish consumed by man).

2.3 Uses Banned: Twenty-two countries have reported total or partial bans on the uses of certain mercurials. Details on the banned uses and the countries taking the actions can be found in Annex 1.

2.4 Uses Reported to be Continued in Effect: Limited uses remain in effect and these are generally uses that result in little or no mercurial residues in food items and/or very limited potential for residues to enter and contaminate aquatic environments. See Annex 1 for details.

2.5 Alternatives: Although there are alternatives for various mercurial compounds, no specific alternatives have been recommended by countries taking control actions. For further information, contact national or regional pest management centres regarding alternatives, or consult FAO or other appropriate national or international authorities.

2.6 Contacts for Further Information: FAO/UNEP Joint Data Base, IRPTC Geneva; Designated National Authorities in countries taking control actions.

3. SUMMARY OF FURTHER INFORMATION ON MERCURY

3.1 Chemical Physical Properties: Mercurial compounds exist in a wide variety of physical and chemical forms, inorganic and organic. Mercury is a silver-white metal and is one-of-the elements found naturally in the earth (earth's crust = 2.7 x 10 -6%) . Generally considered to be ubiquitous throughout nature, mercury is unique among metals as being the only metal in a liquid form at room temperature. Specific gravity of mercury is 13.50 at 0 ^{o}C. Mercury is insoluble in water, alcohol and ether. Elemental mercury is extremely volatile. Upon vaporization its behaviour in the air is that of a colourless vapour with no odour. Mercury has a high ionization potential that explains the capacity of mercury to form various compounds. It forms stable "organometallic" compounds with alkyl, e.g. CH_3Hg^+ and CH_3HgCH_3 (monomethyl and dimethylmercury) and aryl, e.g. $C_6H_5Hg^+$ (phenylmercury) groups. "Organometallic" is used to indicate a covalently bonded compound. The organo-metallic compounds are stable though some are broken down readily by some living organisms, while others are not readily biodegradable. Specific inorganic mercury compounds: mercurous chloride is a white, odourless, crystalline powder that is stable in air and insoluble in water, alcohol and ether and with a specific gravity of 6.99; mercuric chloride is a white, odourless crystal or powder that is soluble in water, alcohol and ether, with a specific gravity of 5.44. Specific organic mercury compounds: phenyl-mercuric acetate is a white to cream prism, slightly soluble in water, soluble in alcohol and benzene, and slightly volatile at ordinary temperatures; phenyl-mercuric borate is a white crystalline powder, slightly soluble in water and soluble in alcohol; phenyl-mercuric chloride is a white satiny crystal, insoluble in water and soluble in alcohol, benzene and ether; phenyl-mercuric hydroxide is a fine white to cream crystal, slightly soluble in water and soluble in acetic acid and alcohol; phenyl-mercuric nitrate is a fine white crystal or grayish powder, very slightly soluble in water and slightly soluble in alcohol; phenyl-mercuric oleate is a white crystalline powder, insoluble in water and soluble in organic solvents and some oils; phenyl-mercuric propionate is a white to off-white, wax-like, free-flowing powder; and phenylmercuric ethanolammonium acetate is a white crystalline solid, soluble in water.

3.2 Toxicological Characteristics:

3.2.1 Acute Toxicology: Toxic effects of mercury and its compounds depend upon the chemical form of mercury. Rat acute oral LD_{50} for several mercury compounds are as follows: mercuric chloride, 37 mg/kg bw; mercurous chloride, 210 mg/kg bw; phenyl-mercuric acetate (PMA), 22 mg/kg bw; ethyl-mercury p-toluene sulfonanilide (ceresan M), 100 mg/kg bw. The LD_{50} for phenylmercuric nitrate via subcutaneous route is 63 mg/kg bw. Phenyl-mercurials are no more toxic than inorganic salts, and there appear to be no significant differences in toxicity among the various phenylmercurials.

3.2.2 Short-term Toxicity: The four major forms of mercury to which humans are exposed are mercury vapour, methylmercury, inorganic (divalent) mercury and phenylmercury. Mercury vapour is absorbed through the lung, retained in the body and primarily damages the central nervous system. Acute exposure to high concentrations of mercury vapour may lead to metal fume fever and pneumonitis. Methylmercury is absorbed almost completely from the gastrointestinal tract, retained in the body tissue and mainly damages the nervous system, the prenatal stage being the most susceptible. The inorganic forms are corrosive poisons, approximately 15% absorbed from the gastro-intestinal tract and retained in body tissues, and mainly affect kidney functions. Phenylmercury is absorbed through the gastrointestinal tract, but penetration of the brain and the foetus is much less than with methylmercury.

3.2.3 Chronic Toxicity: Once absorbed, mercury in all forms is distributed via the bloodstream to all tissues of the body. However, in the case of methylmercury, tissue distribution is more uniform. Mercury vapour and methylmercury readily cross the blood-brain and placental barriers. Depending upon the form of mercury and level of intake, effects on the adult nervous system can range from reversible paresthesis and malaise to irreversible destruction of neurons in the brain, leading to permanent signs of ataxia and constriction of vision. Pre-natal life is the stage of the life cycle most sensitive to methylmercury poisoning. All pre-natal effects are irreversible. Allyl mercury compounds have a particularly high degree of toxicity, may be stored in the body, and have a propensity to accumulate in the brain to critical levels. A severe neurological disorder caused by mercury is called Minamata disease. The disease is characterized by widespread involvement of the central nervous system, resulting in loss of sensation in the extremities of hands and feet and areas around the mouth, loss of coordination in gait, slurred speech, tremors, loss of vision and of hearing. Severe poisoning can cause blindness, coma and death. Persons may be occupationally exposed for many years to phenylmercurials in concentrations many times the accepted threshold limit value of 0.1 mg/m^3 in air without any evidence of poisoning. Generally speaking, mercury and its compounds are not mutagenic despite widespread and long-term human exposures. No carcinogenic activity has been reported for mercury.

3.3 Environmental Characteristics:

3.3.1 Fate: Mercury in many forms and degrees of volatility can circulate in the environment: water, soil and atmosphere. The rate of vaporization increases with increased temperatures. Mercury compounds are transported into the aquatic environments through volatilization, run-off, leaching and discharges. Aryl mercury and mercury salts in river and lake bottoms can be converted into highly toxic methyl or alkyl mercury by methylation. Methylation is a chemical or biological process by which mercury or mercury compounds are converted to methylmercury, which is highly toxic. Methylation of inorganic mercury in aquatic

sediments is a key step in the transport of mercury in aquatic food chains. When introduced into an aquatic environment, mercury becomes attached to particulate matter and settles to become part of the bottom sediments. Micro-organisms in the sediment convert the mercury from inorganic or metallic forms into methylmercury. Both methylation and its reverse reaction, demethylation, take place in both fresh and marine environments. Environmental levels of methylation depend upon the balance between bacterial methylation and demethylation. Methylation in fish appears to arise from bacterial methylation of inorganic mercury, either in the environment or in bacteria associated with fish gills, surface or gut. There is little evidence that fish themselves either methylate or demethylate mercury. Mercury levels then accumulate in the aquatic biota with the result that significant residue levels are reached in aquatic foods consumed by humans and animals. For example, chinook salmon fed 3 ppm accumulated mercury in liver to 30.5 ppm and 17.5 ppm in kidney and analysis of pike muscle suggest biological concentration factors from water to pike in the order of 3000. Elimination of methylmercury for fish and other aquatic organisms is slow (months to years). Bacterial synthesis of methylmercury also takes place in the terrestrial environment. Once methylmercury is released from the microbial system, it enters the food chain. Terrestrial organisms become contaminated. This is best shown in the case of birds where the forms of retained mercury are more variable than for the aquatic organisms and depend upon the species, organ and geographical areas. However, marine birds and those feeding in estuaries are the most contaminated. Large portions of organic mercury (ethylmercury acetate and phenylmercuric acetate) applied to soil were found in organomercury forms after a period of 30 to 50 days. Increasing moisture in soil caused a decrease in the amount of escaping mercury vapour.

3.3.2 Effects: The various forms of mercury are toxic to fish and other aquatic organisms. Mercuric salts and, to a much greater extent, organic mercury are readily taken up by aquatic organisms. Organic forms of mercury are generally more toxic to aquatic organisms than inorganic forms. For mercuric chloride, the 96 hour LC_{50} for several fish species is as follows: catfish, 0.35 mg/l; rainbow trout, 0.22 mg/l; stripped bass, 0.09 mg/l; brook trout, 0.075 mg/l; and mummichog, 2.0 mg/l. A wide variety of physiological and biochemical abnormalities have been reported after exposures of fish to sublethal concentrations of mercury. Fish reproduction is also adversely affected by mercury. Mercuric chloride at 0.5 mg/l caused a 50% inactivation of photosynthesis of giant kelp, *Macrocystis pyrifera*, during a four-day exposure period. For phytoplankton, minimum lethal concentrations for mercury salts range from 0.9 to 60 mg/l. Toxic effects of mercury are increased by the presence of trace amounts of copper. For aquatic invertebrates, methylmercury is more toxic than aryl or inorganic mercury with the larval stage the most sensitive stage of the life cycle. Levels of 1 to 10 µg/l normally cause acute toxicity for the most sensitive developmental stage in many invertebrates. In addition, some forms of mercury bioconcentrate greatly in aquatic plants, invertebrates and fish. Some examples for inorganic mercury, mercuric chloride, show bioconcentration in algae, 8537; duckweed, 70; mussel, 664; pond snail, 795; grass shrimp, 333; mayfly, 38; and rainbow trout (whole body), 5-26. Some examples for the organomercury, phenylmercuric acetate, show bioconcentration in pond snail, 1280; water flea, 3570; and mayfly, 900. Some examples for the organo-mercury, methylmercuric chloride, show pike (liver), 2000 and rainbow trout (whole body), 4225-8033. Organomercury compounds are more toxic than inorganic mercury to birds and cause reproductive effects. For the inorganic mercury, mercuric chloride, the acute oral LD_{50} for Japanese quail is 42 mg/kg and for the organomercury, methylmercury chloride, the acute oral $LD_{50}$is 18 mg/kg. The acute oral $LD_{50}$for the organomercury, phenylmercuric

acetate, for the pheasant is 169 mg/kg and for the mallard, 878 mg/kg. For the dietary LC_{50}s for birds, mercuric chloride for Japanese quail is 5086 ppm; pheasant, 3790 ppm; and mallard >5000 ppm. For methylmercuric chloride the Japanese quail LC_{50} is 47 ppm; methylethyl mercury chloride, 1750 ppm; and phenylmercuric acetate, 614 ppm.- For phenylmercuric acetate, the pheasant LC_{50} is 2350 ppm and the mallard, 1175 ppm. For methoxyethyl-mercury chloride the pheasant LC_{50} is 1102 ppm and the mallard, 280 ppm. Investigations show that grain treated with ethylmercury phosphate poisoned bobwhite quail in 13 to 20 days. When pheasants were fed methylmercury-treated wheat (20 ppm) for nine days, their eggs had reduced hatchability, and residues ranged from 1. 3 to 20 ppm. In seed-eating birds, mercury residues increased significantly in late spring and early autumn, indicating a correlation with the spring and autumn sowing of treated seed.

3.4 Exposure:

3.4.1 Food: There are no Codex MRLs for any of the mercury compounds. Mercury normally binds to soil particles, which may reduce its availability to plants. The uptake of inorganic and methylmercury compounds is primarily through oral ingestion. The major means of human exposure to mercury (methylmercury) is in the diet, through consumption of fish and fish products. Highest concentrations of methylmercury are found in large predatory fish at the top of the food chain. The misuse of treated seeds (for planting) has resulted in food contamination (when fed to animals as feed or when contained in grain used for making bread).

3.4.2 Occupational/Use: Dermal and inhalation routes are likely routes of exposure from occupational use. Both organic and inorganic mercury can be absorbed dermally and through inhalation.

3.4.3 Environment: Contamination by mercury may result from natural soil sources, mercury-containing pesticides, tailings from lead mining, or from a variety of chemical wastes. Air levels as high as 10,000 Ag μg Hg/m^3 have been found where mercury fungicides were used. Estimates of average atmospheric levels range between 2-10 mg Hg/m^3. Mercury level ranges in aquatic systems are as follows: open oceans, 0.5-3 ng/l; coastal water, 2-15 ng/l; and rivers and lakes, 1-3 ng/l. The mechanism of synthesis of methylmercury compounds from inorganic precursors in both terrestrial and aquatic environments is via bacterial synthesis. Once methylmercury is released from microbial system, it enters food chains as a result of rapid diffusion rate. Fatalities and severe poisonings in birds have been reported as well as outbreaks of human poisonings. Birds found dead in the area near Minamata Bay showed characteristic pathological changes in the nervous system (as in Minamata disease). Dead fish from the Bay contained high levels of methylmercury, and fish-eating and scavenging birds were also killed. Agricultural use of organomercury fungicides has caused poisoning in birds, and there is a statistically significant correlation between the mercury content of bird eggs and reproductive failure. The organomercury seed dressings have caused death to field birds, mostly grain-eating and predatory birds. Mercury contamination has been implicated in the lack of breeding success in some predatory birds, both in Europe and North America, where residues have equalled those found to cause reproductive problems in laboratory tests.

3.4.4 Accidental Poisonings: Worldwide concern regarding harmful effects of mercury arose primarily with events that occurred near Minamata Bay, Japan (1955). Severe brain damage

occurred in infants whose mothers, during pregnancy, had ingested fish and shellfish contaminated with methylmercury. The source of mercury was factory discharges into the Bay; consequently the residues concentrated, especially in shellfish. Similar cases of severe brain damage from methylmercury poisoning also occurred in Iraq (1971-1972) when farming families consumed home-made bread prepared from wheat treated with a methylmercury fungicide. There were 6350 persons hospitalized and 409 deaths associated with this accident. In the USA, a farming family fed methylmercury-treated seeds to hogs (1969). The family subsequently consumed the hogs, and a family member gave birth to a blind and retarded child, an event attributed to methylmercury poisoning. Also in the USA, a child developed a rare form of mercury poisoning (acrodynia) after the family home was painted with paint containing mercury. Phenyl mercuric acetate had been used as an in-can preservative for latex paint. Mercury is a cumulative poison, and its continued ingestion should be carefully controlled.

3.5 Measures to Reduce Exposures: Many countries have taken actions to ban and/or severely restrict the use of mercury containing pesticides. Exposure of the general public should be eliminated or at least reduced significantly. Because of the potential for aquatic contamination, mercurial compounds are generally considered too toxic for use in open recirculating cooling systems for control of biological fouling. When used as seed treatments, treated seed should contain a dye to clearly identify the seed, and extreme caution must be taken to ensure treated seed is not fed to food animals and treated seeds do not become part of the food supply (e.g. flour for baking bread). Exposure of fish and shellfish may be reduced by controlling effluent from manufacturing plants, avoiding spraying near water, and by banning or severely restricting all uses that have a potential for water contamination. Human exposure may be reduced through use of protective clothing. Refer to FAO Guidelines on Good Labelling Practices.

3.6 Packaging and Labelling: Follow FAO Guidelines on Good Labelling Practice for Pesticides and Guidelines for Packaging and Storage of Pesticides.

3.7 Waste Disposal Methods: Guidelines are under development. This section will be updated when guidelines are available.

3.8 Maximum Residue Limits (MRLs): There are no MRLs for any of the mercurial pesticides.

4. MAJOR REFERENCES

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ANNEX 1
SUMMARY OF CONTROL ACTION AND REMAINING USES FOR MERCURY COMPOUNDS, AS REPORTED BY COUNTRIES

BANNED:

Belize	(NS)	Mercuric chloride banned.
Belize	(NS)	Phenyl mercury acetate banned.
China	(1971)	Phenyl mercury acetate banned as agricultural chemical
Ecuador	(1985)	Mercury compounds banned
EEC-countries*	(1988)	Plant protection products containing alkoxyalkyl or aryl mercury compounds as active ingredient are banned.
EEC-countries*	(1988)	Plant protection products containing inorganic mercury compounds as active ingredient are banned.
Mexico	(1982)	Mercury banned as agricultural chemical.
Norway	(1966)	Alkyl mercury compounds banned as agricultural chemicals.
Panama	(1987)	Mercury compounds banned as agricultural chemicals.
Republic of Korea	(NS)	Phenyl mercury acetate banned.
Republic of Korea	(NS)	Pheny1 mercuric triethanolammonium lactate. (PTA-B) banned.
Sweden	(1966)	Alkyl mercury compounds banned.

WITHDRAWN:

None reported.

SEVERELY RESTRICTED:

Hungary (1983) Organic mercury compounds are no longer in use for seed dressing. They were replaced by less toxic and less environment-polluting product.

Poland (NS) Use of mercury compounds discontinued.

Poland (NS) Phenyl mercury acetate no longer used in agriculture and sanitary hygiene.

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* **EEC-countries** - Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and United Kingdom.

Only remaining uses allowed:

Bulgaria (NS) Used for treatment of seeds only.

EEC-countries * (1988) Plant protection products containing alkyl mercury compounds as active ingredient are prohibited, except for treatment of sugarbeet seed.

EEC-countries * (1988) Plant protection products containing mercuric oxide as active ingredient are prohibited, except for use as a paint to treat Nectria galligena (canker) on pomaceous fruit trees after harvesting and until budding.

EEC-countries * (1988) Plant protection products containing mercurous chloride (Calomel) as active ingredient are prohibited, except for use against Plasmodiophora on Brassicae and for treatment of onion seeds and plant against Sclerotium.

Norway (NS) Phenylmercury acetate registered for use as seed-dressing only.

USA (1976) All uses cancelled except use as a fungicide in treatment of textiles and fabrics intended for continuous outdoor use, as a fungicide to control brown mould on freshly sawn lumber, as a fungicide treatment to control Dutch elm disease, as an in-can preservative in water-based paints and coatings used for exterior application, as a fungicide to control winter turf diseases such as *Sclerotinia borealis*, and grey and pink snow mould.

Specific uses reported as not allowed:

Argentina (1971) Phenylmercury acetate prohibited for use in cultivation, commerce, storage and industrial processing of tobacco.

Canada (1970) Prohibited to advertise, sell or import toys, equipment or other products for use by children in learning or play that have applied to them a decorative or protective coating containing a number of substances, including any mercury compound introduced as such.

Japan (1980) Organomercury compounds should not be detectable in textile products such as diaper cover, underwear, gloves, hosiery, intermediate wear, outer wear, cap, hat, bedding, carpet and knitting wool, adhesives, paint, wax and shoe polishers.

Liechtenstein (NS) Liechtenstein forms a customs and economic union with Switzerland, and the same laws concerning mercury and mercury compounds apply.

Nigeria (1983) Prohibited to manufacture, import, export, distribute and sell any cosmetic product containing mercury or any of its salts in amounts exceeding 1 ppm.

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* **EEC-countries** - Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and United Kingdom.

Togo (1980-83) Mercury and organomercury compounds, generally formulated as powders to be used as such or as wettable powders for coating mercury compounds, are no longer used as fungicides for treatment of aerial parts plants (1980). Use of mercury compounds as seed disinfectants is reduced except for cotton seed (1983).

Switzerland (1986) The following is prohibited: A) the supply by manufacturers of products and articles containing mercury; B) the import of products and articles containing mercury as commercial goods; C) the use of elementary mercury, mercury compounds and products containing mercury. Prohibition shall not apply to the supply by manufacturers or the import as commercial goods of: pharmaceutical products, seed dressings for agricultural purposes, sealing agents for trees, antiques. If there is no replacement product which does not contain mercury and provided no more than the minimum amount of mercury necessary for the intended use is employed, the prohibitions shall not apply to the supply by manufacturers or the import as commercial goods of: measuring or control instruments, bulbs and light tubes, artists' colours for restoration, products for dental fillings, auxiliary substances for manufacturing process.

Use permitted only with special authorization:

None reported.