



Hazardous substances data bank (HSDB) as a source of environmental fate information on chemicals[☆]

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Abstract

The Hazardous Substances Data Bank (HSDB), a factual data bank on the National Library of Medicine's (NLM) TOXNET (Toxicology Data Network) online system, provides information in areas such as chemical substance identification, chemical and physical properties, safety and handling, toxicology, pharmacology, environmental fate and transformation, regulations, and analytical methodology. This article discusses how environmental fate data is handled in HSDB.

Keywords: Hazardous substances data bank; Information technology; Toxicology data network; Environmental fate

HSDB was created from a precursor file known as the Toxicology Data Bank (TDB). The TDB file content was incorporated into the larger HSDB in 1985, at the time the National Library of Medicine's (NLM) Toxicology Data Network (TOXNET) online system became operational. HSDB is one of 17 files residing on TOXNET which are concerned with toxicology and environmental health. HSDB chemical records are created, updated and searched on this system.

The environmental fate section of the HSDB contains referenced data on the behavior of

chemicals in different types of environmental media, i.e. air, soil, and water; methods of degradation, both abiotic (e.g. photolysis) and biotic (e.g. soil or water, bacterial or fungal populations); environmental transport; bioconcentration; and concentrations of chemicals in animal populations, plant tissue, sediments, water, and finished food products.

HSDB records carry three data quality tags, UNREVIEWED for data that has not been validated by a formal review, QC REVIEWED for data in which the original source document was examined for data accuracy, and PEER REVIEWED for data that has been examined and approved by an advisory group known as the Scientific Review Panel (SRP). The SRP membership includes recognized experts in the subject areas of toxicology, pharmacology, occupational and clinical medicine, environmental chemistry, atmospheric

[☆]For information concerning HSDB or other files which reside on TOXNET, please contact: HSDB/TOXNET Representative, National Library of Medicine, Division of Specialized Information Services, Toxicology and Environmental Health Information Program, Bldg 38A, 8600 Rockville Pike, Bethesda, MD 20894

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chemistry and regulatory affairs. The SRP group examines HSDB records and makes suggestions for improving their quality and completeness.

Chemicals are nominated for HSDB record creation, enhancement and update based on a number of considerations: (1) high priority chemicals on federal regulatory lists generated by agencies such as the United States Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), and the Occupational Safety Health Administration (OSHA); (2) high priority chemicals from lists produced by non-regulatory federal agencies such as the Agency for Toxic Substances Disease Registry (ATSDR), the National Institute of Environmental Health Sciences (NIEHS), the National Institute Occupational Safety and Health (NIOSH), and the National Toxicology Program (NTP); and (3) chemicals of importance to miscellaneous organizations such as the American Council of Governmental and Industrial Hygienists (ACGIH), the International Agency for Research on Cancer (IARC), World Health Organization (WHO) and others.

A variety of sources are utilized in the creation and update of the ENVIRONMENTAL FATE/EXPOSURE POTENTIAL (category 7) section of HSDB (Table 1). These include monographs such as the World Health Organization's Environmental Health Criteria documents, the United States Environmental Protection Agency's Health Assessment Reports and Ambient Water Quality Criteria Documents, and other special research reports. Data is also synthesized from primary journal articles which cover many topics concerned with environmental fate, persistence, monitoring and bioconcentration. Mathematical models are used to derive selected data.

HSDB and the other files which reside on TOXNET have traditionally been accessed through value added networks such as TYMNET, SPRINTNET, and COMPUSERVE. By late 1995, NLM will switch from these data communications providers to the Federal government's new FTS2000 system. INTERNET access is also available.

HSDB is divided into the following broad subject categories:

- (0). Administrative information
- (1). Substance identification

Table 1

Representation of the Environmental Fate/Exposure Potential category (category 7) of the HSDB unit record

ENEX ** ENVIRONMENTAL FATE/EXPOSURE POTENTIAL
ENVS <i>Environmental fate/exposure summary</i>
POLL * <i>Pollution sources</i>
NATS <i>Naturally occurring sources</i>
ARTS <i>Artificial sources</i>
FATE <i>Environmental fate</i>
ENVT * <i>Environmental transformations</i>
BIOD <i>Biodegradation</i>
ABIO <i>Abiotic degradation</i>
ENTP * <i>Environmental transport</i>
BIOC <i>Bioconcentration</i>
KOC <i>Soil adsorption/mobility</i>
VWS <i>Volatilization from water/soil</i>
ENVC * <i>Environmental concentrations</i>
WATC <i>Water concentrations</i>
EFFL <i>Effluent concentrations</i>
SEDS <i>Sediment/soil concentrations</i>
ATMC <i>Atmospheric concentrations</i>
FOOD <i>Food survey values</i>
PLNT <i>Plant concentrations</i>
FISH <i>Fish concentrations</i>
ANML <i>Animal concentrations</i>
MILK <i>Milk concentrations</i>
OEVC <i>Other environmental concentrations</i>
HUEX * <i>Human environmental exposure</i>
RTEX <i>Probable routes of human exposure</i>
AVDI <i>Average daily intake</i>
BODY <i>Body burden</i>

- (2). Manufacturing/use information
- (3). Chemical and physical properties
- (4). Safety and handling
- (5). Toxicity/biomedical effects
- (6). Pharmacology
- (7). Environmental fate/exposure potential
- (8). Exposure standards and regulations
- (9). Monitoring and analysis methods
- (10). Additional references

A partial listing of data in the ENVIRONMENTAL FATE/EXPOSURE POTENTIAL (ENEX) category for the organochlorine pesticide chlordecone (kepone) follows in Appendix 1:

APPENDIX 1

Name of substance: Chlordecone

CAS registry number: 143-50-0

Environmental fate/exposure summary

Chlordecone release to the environment has occurred as a result of its manufacture and use as an insecticide and as a degradation product of the insecticide Mirex. Chlordecone released to soil will be expected to adsorb to the soil. However, some leaching to the groundwater may occur, especially in sandy soils and other soils with low organic content. Biodegradation and hydrolysis will not be important fate processes but some evaporation may be observed from the surface of the soil. Chlordecone released to the water will be expected to adsorb to the sediment and to bioconcentrate in fish but may not bioconcentrate in crustaceans or other aquatic organisms. It will not be expected to hydrolyze, or biodegrade, and direct photodegradation is not expected to be significant compared to other processes. Evaporation from water also should not be significant, with a half-life of 3.8-46 years predicted for evaporation from a river 1 m deep, flowing at 1 m/s with a wind velocity of 3 m/s. Chlordecone released to the atmosphere will not be expected to react with photochemically produced hydroxyl radicals or ozone and will not be subject to appreciable direct photodegradation. Chlordecone should be sorbed to particulate matter in the atmosphere and thus subject to gravitational settling. Exposure to chlordecone will occur mainly through the consumption of contaminated foods, especially contaminated fish and seafood. Exposure may also occur in countries may no longer appropriate. [Citation] **PEER REVIEWED**

Natural occurring sources

Keponone is not known to occur as a natural product... [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-Present. (Multivolume work). V20 69 (1979)] **PEER REVIEWED**

Artificial sources

Chlordecone has been released to the atmosphere as a result of its manufacture and use as

an insecticide (1). Its use as an insecticide has been banned in the USA (1). Chlordecone also occurs as a degradation product of the insecticide Mirex (1). [(1) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Environmental fate

Terrestrial fate: If chlordecone is released to soil, it will be expected to adsorb to soils. However, some leaching to groundwater may occur, especially in sandy soils and other soils with low organic content. Biodegradation and hydrolysis will not be important fate processes but some evaporation may be observed from the surface of the soil. (SRC) [Citation] **PEER REVIEWED**

Environmental fate

Aquatic fate: If released to water, chlordecone will be expected to adsorb to the sediment. It will be expected to bioconcentrate in fish but has been shown to not bioconcentrate in certain crustaceans. It will not be expected to hydrolyze, biodegrade, or appreciably evaporate. (A half-life of 3.8-46 years has been predicted for evaporation from a river 1 m deep, flowing at 1 m/s with a wind velocity of 3 m/s). No data were found concerning the photodegradation of chlordecone irradiated at environmentally significant wavelengths. No significant direct photodegradation is expected. (SRC) [Citation] **PEER REVIEWED**

Environmental fate

Atmospheric fate: If chlordecone is released to the air, it will not be expected to directly photodegrade or to react with photochemically produced hydroxyl radicals or ozone. However, chlordecone should adsorb to particulate matter and be subject to gravitational settling. (SRC) [Citation] **PEER REVIEWED**

Environmental fate

Aquatic fate: Low concentrations of chlordecone/ can cause reductions in both algal growth and invertebrate populations, thereby, affecting productivity at other trophic levels. [WHO; En-

viron. Health Criteria: Chlordecone p.9 (1984)]
****PEER REVIEWED****

Environmental fate

Aquatic fate:... Chlordecone and Mirex are among the most stable pesticides in the aquatic environment. After 56 days of incubation under both aerobic and anaerobic conditions, there was no evidence of degradation of these two compd. [Murty, A.S. Toxicity of Pesticides to Fish. Volumes I, II. Boca Raton, FL: CRC Press Inc., 1986. V1 25] ****PEER REVIEWED****

Biodegradation

Amount recovered after exposure to marine sediments in sea water under anaerobic and aerobic conditions for 1 year: 95% (1). No evidence of any degradation was detected for chlordecone exposed to hydrosols from a reservoir (not previously exposed to chlordecone) and a creek (contaminated with chlordecone) under anaerobic or aerobic conditions for 56 days (2). No degradation of chlordecone exposed to sewage sludge observed under anaerobic conditions for 120 h (3). No degradation reported of chlordecone exposed to contaminated James River sediments with added autoclaved silty clay loam soil for 52 days at pH 7 (4). [(1) Vind HP et al; Biodeterioration of Navy Insecticides in the Ocean NTIS AD-77310 (1973) (2) Huckins JN et al; J Agric Food Chem 30: 1020-7 (1982) (3) Geer RD; Predicting the Anaerobic Degradation of Organic Chemical Pollutants in Waste Water Treatment Plants from Their Electrochemical Reduction Behavior NTIS PB-289 224 (1978) (4) Gambrell RP et al; J Water Pollut Control Fed 56: 174-82 (1984)] ****PEER REVIEWED****

Biodegradation

Microbial action has been shown to transform chlordecone into monohydro- and... dihydrochlordecone. [Orndorff SA, Colwell RR; Appl Environ Microbiol 39: 398-406 (1980) as cited in WHO; Environ Health Criteria: Chlordecone p.11 (1984)] ****PEER REVIEWED****

Abiotic degradation

Chlordecone is very stable in the environment (1) and is not expected to significantly hydrolyze (SRC). It has been reported that photolysis of chlordecone in the presence of oxygen resulted in the formation of carbon dioxide and hydrogen chloride. However, no data were given concerning the conditions or rates of these processes (1). Irradiation of chlordecone dihydrate with ultraviolet light, including wavelengths <290 nm, resulted in the formation of two compounds which were identical to those formed upon irradiation of Mirex (2). No information was found concerning the absorption spectrum of chlordecone or its behavior when irradiated only at wavelengths >290 nm. In the absence of such data it is not possible to predict the susceptibility of chlordecone to photolysis. No reaction with photochemically produced hydroxyl radicals was predicted (3). [(1) Sanborn JR et al; The Degradation of Selected Pesticides in Soil: A Review of the Published Literature NTIS PB-272 353 (1977) (2) Alley EG et al; J Agric Food Chem 22: 442-5 (1974) (3) GEMS; Graphical Exposure Modeling System. Fate of atmospheric pollutants (FAP) data base. Office of Toxic Substances. USEPA (1986)] ****PEER REVIEWED****

Bioconcentration

BCF of chlordecone: fathead minnow, 1100-2200 (1); *Cyprinodon variegatus*, 1548, *Leiostomus xanthurus*, 1221; *Palaemonetes pugio*, 698, *Callinectes sapidus*, 8.1 (3); No species reported, 8400 (2); *Brevortia tyrannus* (Atlantic menhaden), 2300-9750; *Menidia menidia* (Atlantic silversides), 21700-60200 (4). [(1) Spehar RL; J Water Pollut Control Fed 54: 877-922 (1982) (2) Kenaga EE; Ecotox Env Safety 4: 26-38 (1980) (3) Reisch DJ et al; Marine and Estuarine Pollut 50: 1424-6 (1978) (4) Roberts MH, Fisher DJ; Arch Environ Contam Toxicol 14: 1-6 (1985)] ****PEER REVIEWED****

Bioconcentration

Chlorococcum species (algae) exposed to 100 µg/l/24 h exhibited a bioconcentration factor of

800 \times . [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 788] **PEER REVIEWED**

Bioconcentration

Dunaliella tertiolecta (algae) exposed to 100 $\mu\text{g}/\text{l}/24$ h exhibited a bioconcentration factor of 230 \times . [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 788] **PEER REVIEWED**

Bioconcentration

Spartina cynosuroides (giant cordgrass) detritus absorbs kepone from contaminated brackish waters during decomposition. Concentrations of kepone on detritus increased from 0.5 $\mu\text{g}/\text{g}$ dry weight after 14 days of decomposition to 4.5 $\mu\text{g}/\text{g}$ dry weight after 119 days. [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 788] **PEER REVIEWED**

Bioconcentration

Aquatic laboratory model ecosystem was deployed in an evaluation of the insecticides Mirex and chlordecone, and the Mirex photodegradation product, photomirex. Chlordecone was degraded to some extent during the 33-day study period. Neither Mirex nor photomirex produced identifiable levels of decomposition products in the water or organisms. All three compounds were biomagnified by the algal, snail, fish, and mosquito species. Chlordecone was the least and photomirex the most bioaccumulative. [Francis BM, Metcalf RL; Environ Health Perspect 54 (6): 341-6 (1984)] **PEER REVIEWED**

Soil adsorption/mobility

Percent chlordecone leached through soil cylinders 80 cm deep, clay loam, 1.2%; clay, 17.2%; sandy clay loam, 36.8%; sandy loam, 28.1% (1).

Using a reported range of water solubilities of 2.5-3 ppm (2,3), an estimated range of Koc of 2400-2600 was calculated(4, SRC). A Koc of this magnitude is indicative of slight chemical mobility and leaching potential in soil (5). [(1) Sanborn JR et al; The Degradation of Selected Pesticides in Soil: A Review of the Published Literature NTIS PB 272 353 (1977) (2) Zarogian GE et al; Environ Toxicol Chem 4: 3-12 (1985) (3) Kenaga EE; Ecotox Env Safety 4: 26-38 (1980) (4) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Environmental Behavior of Organic Compounds. McGraw-Hill NY p 4-9 (1983) (5) Swann RL et al; Res Rev 85: 17-28 (1983)] **PEER REVIEWED**

Volatilization from water/soil

Percent volatilized from loamy soil outdoors in 1 vegetation period, 16%; Percent volatilized per ml evaporated water at 25°C from 50 ml water, first h, 0.025%; second h, 0.024%; Percent volatilized from soil, 1st h (2nd h), sandy soil, 0.029 (0.036); loamy soil, 0.038 (0.035); humus soil, 0.029 (0.032) (1). Using a reported range of water solubilities of 2.5-3 ppm (2,3) and a reported range of vapor pressures of 1×10^{-5} to 1×10^{-6} mmHg (1,4), a range of Henry's Law constants of 2.2×10^{-6} to 1.8×10^{-7} atm-cu m/mol was calculated for chlordecone (5, SRC). Using this range of calculated Henry constants a half-life of 3.8-46 years was predicted for evaporation from a model river 1 m deep, flowing at 1 m/s with a wind velocity of 3 m/s (5, SRC). [(1) Kilzer L et al; Chemosphere 8: 751-61 (1979) (2) Zarogian GE et al; Environ Toxicol Chem 4: 3-12 (1985) (3) Kenaga EE; Ecotox Env Safety 4: 26-38 (1980) (4) National Research Council; Kepone/Mirex/Hexachlorocyclopentadiene: An Environmental Assessment NTIS PB 280-289 (1978) (5) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Environmental Behavior of Organic Compounds. McGraw-Hill NY pp 15-1 to 15-34 (1983)] **PEER REVIEWED**

Water concentrations

Surface water: Concentration of kepone resi-

dues in water collected from the James River estuary in 1976-78 ranged from 0 to 1.20 ppb. The majority of water samples collected showed no detectable residues. Water column residues varied according to seasonal and spatial differences. Levels peaked during the summer months and averaged higher in the middle reach of the estuary. Residues in the water were 1-5 orders of magnitude lower than reported residues in James River bed sediments. [Lunsford CA; Pestic Monit J 14 (4): 119-24 (1981)] **PEER REVIEWED**

Water concentrations

Drinking water: Hopewell, VA where chlordecone was manufactured -detected, not quantified (1). [(1) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Water concentrations

Surface water: James River, VA: 1979, 20-65 km from mouth, 1-10 parts per trillion, avg 6 parts per trillion chlordecone (1); During dredging operation, July 15 1976, seven stations, 71% pos, concn showed wide variation at different sampling times, surface, 1 sample, 77 parts per trillion, 1.5-6 m depth, 8 samples, 63% pos, 46-579 ppt, avg of pos, 500 parts per trillion (2); Centrifuged and filtered sediment supernatant, 902 ppm, surface water, 897 ppm (2). Chesapeake Bay, July, 1976, 0.04-0.08 ppm (3). Lake Ontario, Lake St. Clair, identified, not quantified, Lake Erie, not detected (4). [(1) Bender ME, Huggett RJ; Rev Environ Toxicol 1: 5-51 (1984) (2) Saleh FY et al; J Environ Sci Health A13: 261-94 (1978) (3) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979) (4) Great Lakes Water Quality Board; An Inventory of Chemical Substances Identified in the Great Lakes Ecosystem vol. 1 - Summary. Report to Great Lakes Quality Board; Windsor Ontario, Canada (1983)] **PEER REVIEWED**

Effluents concentrations

Hopewell, VA: sludge near town's sewage treatment plant, 200-600 ppm chlordecone, waste-

water at sewage treatment plant, 0.1-10 ppm (1). [(1) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Sediment/soil concentrations

Sediments: James River, VA: Jan-March, 1976, 49-870 ppb chlordecone (1); April, 1976, 2070 ppb, July, 15 (during dredging operations), 1400 ppb (1); Dec, 1976-July, 1977, bottom sediments (seds), <0.01-0.15 ppm, channel seds, nd (upstream from source in Hopewell, VA) to 0.18 ppm (approx 30 km downstream from source), bed sediments, <0.03 (Chesapeake Bay, near mouth of James River) to >2.0 ppm (near source) (2). Hopewell, VA, area: Appomatox River, <20 ppb, Bailey Creek, up to 10 ppm (1). *Soils:* Concn 12 year after application of 1 µg/g mirex, 0.02 ppm (3). [(1) Saleh FY et al; J Environ Sci Health A13: 261-94 (1978) (2) Huggett RJ et al; Contaminants and Sediments 1: 33-52 (1980) (3) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Sediment/soil concentrations

Chlordecone detected in soil at a level of 0.02 years after application of 1 µg/g of mirex. [DHHS/NTP; Fourth Annual Report On Carcinogens p.273 (1985) NTP 85-002] **PEER REVIEWED**

Atmospheric concentrations

Source dominated: Hopewell, VA, 1975, near manufacturing plant, concn, ng/cu m (km distance from plant), May 6, 1.74 (5.21), 1.04 (15.75), 0.17 (20.6), 0.84 (22.72), May 12, not detected, (15.75), 4.94 (22.72), May 18, 4.57 (0.21), 3.63 (5.21), 14.7 (12.57), 20.7 (13.18), May 30, 0.19 (15.75), 1.93 (20.6), 1.41 (22.72) chlordecone (1). Town 16 miles from Hopewell plant, 0.1-20 ng/cu m; Samples 100 m from plant, 0.2-50 mg/cu m (2). [(1) Lewis RG, Lee RE Jr; pp 5-51 in Air Pollution From Pesticides and Agricultural Processes; Lee RE Jr ed CRC Press Cleveland OH (1976) (2) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Food survey values

No data

Plant concentrations

Chlordecone increased both the quality and quantity of the cotton yield. Residues in seeds were always <1 mg/kg, despite different application rates. [Gawaad AAA et al; Biol Abstr 61: 5840 (1976) as cited in WHO; Environ Health Criteria: Chlordecone p.34 (1984)] **PEER REVIEWED**

Fish/seafood concentrations

James River, VA, wet weight, long term residents: Fish, 9 species, 159 samples, range of species avg, 0.04-2.7 ppm, overall avg 1.32 ppm, shrimp, 2 species, 11 samples, species avg 0.62-2.0 ppm, overall avg 0.98 ppm, crabs, 3 species, 226 samples, species avg 0.19-0.81 ppm, overall avg 0.31 ppm, oysters, 1 species, 140 samples, 0.16 ppm, clams, 1 species, 12 samples, 0.09 ppm; Short term residents: fish, 5 species, 188 samples, species avgs 0.03-0.81 ppm, overall avg 0.46 ppm; Chesapeake Bay, concn, ppm, at 0, 20, 40 and 100 km from James River, respectively: Bluefish, 0.3, 0.18, 0.6, 0.22, croaker, 0.9, 0.09, 0.06, 0.04, spot, 0.8, 1.2, 0.05, 0.03, trout, 0.16, 0.1, 0.08, 0.07, flounder, not reported, 0.16, 0.15, 0.05 ppm chlordecone, respectively (1). James River, VA, fish: 1976 2 species, 62 samples, avgs 0.04-0.18 ppm, overall avg 0.07 ppm, 1980, 5 species, 193 samples, species avgs 0.15-0.59 ppm, overall avg 0.29 ppm, 1981, 4 species, 155 samples, avgs 0.25-0.42 ppm, overall avg 0.41 ppm (6). Virginia, 6 rivers, 67% pos, Mattaponi River, 4 species, 30 samples, 57% pos, range of avgs of pos, <0.01-0.05 ppm, Chickahominy River, 2 species, 18 samples, 100% pos, range of avgs 0.02-0.55 ppm, Pamunkey River, 2 species, 6 samples, 100% pos, avg 0.01 ppm, James River, 4 species, 44 samples, 100% pos, range of avgs pos 0.05-2.8 ppm, Potomac River, 3 species, 8 samples, 0% pos, Rappahannock River, 3 species, 8 samples, 0% pos (2). Estuarine clam (*Rangia cuneata*), James River (Rappahannock River), monthly avg, wet weight,

Sept 1978-Aug 1979, 5 samples each, Tar Bay area, 0.080-0.332 ppm, overall avg 0.21 ppm (0.002-0.329 ppm, overall avg 0.20 ppm), Cobham Bay area, 0.029-0.187 ppm, overall avg 0.10 ppm (0.002-0.219 ppm, overall avg 0.10 ppm) (3). James River, Chesapeake Bay, blue crab eggs, 0.01-0.55 ppm (4). James River estuary, mullet, 0.560 ppm, Chesapeake Bay: Crab, 0.634-1.36 ppm, croaker, 0.066-0.726 ppm, 0.100-0.534 ppm, spot, 0.235-0.670 ppm (5). USA, fish by-products, 1976, found infrequently, not quantified (7). Fish, location (number of samples), ppm concn: 9 sites, 37 samples, 100% pos, Nanticoke (5), <0.02-0.04, Potomac (5), 0.02-<0.05, Sassafras (2), <0.02, Bohemia (5), <0.02, Little Elk (2), <0.02-0.03, Choptank (5), <0.02-0.04, James (5), <0.07-0.09, Rappahannock (4), 0.03-0.08 (8). [(1) Huggett RJ et al; Contaminants and Sediments 1: 33-52 (1980) (2) Loesch JG et al; Estuaries 5: 175-81 (1982) (3) Lunsford CA, Blem CR; Estuaries 5: 121-30 (1982) (4) Reish DJ et al; J Water Pollut Control Fed 54: 786-812 (1982) (5) Reish DJ et al; J Water Pollut Control Fed 52: 1533-75 (1980) (6) Bender ME, Huggett RJ; Rev Environ Toxicol 1: 5-51 (1984) (7) Duggan RE et al; Pesticide Residue Levels in Foods in the United States from July 1, 1969 to June 30, 1976; Washington, DC FDA Div Chem Technol (1983) (8) Brookhart G, Johnson LD; Analysis of Fish for Kepone, Mirex, Atrazine, Linuran, and Alachlor USEPA/903-9-78/018 (1977)] **PEER REVIEWED**

Animal concentrations

Chlordecone residues were found in several species of birds that inhabit the Southeastern United States coast, such as the blue heron, mallard duck, coot, black duck, wood duck, herring gull, Canada goose, hooded merganser, and bald eagle. Residue levels as high as 13.23 mg/kg /were reported/, but typically between 0.02 and 2 mg/kg. Eggs from bald eagles and the osprey... contained residue levels ranging from 0.14 to 0.19 mg/kg, and 0.06 to 1.5 mg/kg, respectively. [Dawson GW; Kepone Mitigation Feasibility Report: Appendix A NTIS Pub No.PB-286085 as cited in WHO; Environ Health Criteria: Chlordecone p.20 (1984)] **PEER REVIEWED**

Milk concentrations

Southeastern USA, Feb, 1976, mothers milk, 200 samples, 4.5% pos for chlordecone, detected, not quantified. [(1) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Milk concentrations

When chlordecone was fed to dairy cows in concentrations of 0.25-5.0 mg/kg in hay and in feed-concentrate for 60 days, the highest residue level in milk recorded from an individual cow was 0.44 mg/l. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-Present. (Multivolume work). V20 74 (1979)] **PEER REVIEWED**

Milk concentrations

Chlordecone was found in 9 out of 298 samples of human milk with a relatively high detection limit (1 mg/kg). [WHO; Environ Health Criteria: Chlordecone p.19 (1984)] **PEER REVIEWED**

Other environmental concentrations

No data

Probable routes of human exposure

General population exposure to kepone will occur mainly through the consumption of contaminated fish and seafood. (SRC) [Citation] **PEER REVIEWED**

Probable routes of human exposure

Exposure may result from dermal absorption or by inhalation. [WHO; Environ Health Criteria: Chlordecone p.9 (1984)] **PEER REVIEWED**

Probable routes of human exposure

Two sources of chlordecone exposure for in-

fants are insect traps and human milk. [WHO; Environ Health Criteria: Chlordecone p.19 (1984)] **PEER REVIEWED**

Probable routes of human exposure

NIOSH (NOES Survey 1981-1983) has statistically estimated that 12 600 workers are potentially exposed to chlordecone in the USA (1). The manufacture and use of chlordecone have been restricted (2), which may have affected the number of people exposed(SRC). [(1) NIOSH; National Occupat Exposure Survey (1984) (2) Hawley GG; Condensed Chemical Dictionary 10th ed Von Nostrand Reinhold NY p 592 (1981)] **PEER REVIEWED**

Probable routes of human exposure

Individuals who smoke tobacco which may have been treated earlier with chlordecone. [WHO; Environ Health Criteria: Chlordecone p.19 (1984)] **PEER REVIEWED**

Average daily intake

No data

Body burdens

Southeastern USA, Feb, 1976, mothers milk, 200 samples, 4.5% pos, detected, not quantified (1). Concn in blood of workers who manufacture kepone, 32 workers, 0.165-26 ppm (1). [(1) IARC; Some Halogenated Hydrocarbons 20: 67-81 (1979)] **PEER REVIEWED**

Body burdens

Chlordecone was found in 9 out of 298 samples of human milk with a relatively high detection limit (1 mg/kg). [WHO; Environ Health Criteria: Chlordecone p.19 (Date)] **PEER REVIEWED**

Body burdens

Of 216 blood samples obtained from healthy members of the general population living within a

one mile radius of a chlordecone manufacturing facility, 40 were found to contain detectable amounts of chlordecone ranging from 0.005-0.033 mg/l. [Baselt RC; Biological Monitoring Methods for Industrial Chemicals p. 76 (1980)] **PEER REVIEWED**

Body burdens

Serum concentrations of chlordecone in 11 occupationally exposed subjects ranged from 0.120-2.109 mg/l and average 0.734 mg/l. The average serum half life was found to be 96 days and the average blood/serum concentration ratio, 0.57. [Baselt RC; Biological Monitoring Methods for Industrial Chemicals p. 76 (1980)] **PEER REVIEWED**

Body burdens

Chlordecone was found present in blood and biopsy tissues of 32 chemical workers exhibiting symptoms of toxicity; average: 5.8 mg/l (blood), 76 mg/kg (liver), 22 mg/kg (fat). [Cohn WJ et al; Gastroenterology 71: 901 (1976) as cited in Baselt RC; Biological Monitoring Methods for Industrial Chemicals p.77 (1980)] **PEER REVIEWED**

Data may be retrieved from HSDB by TOXNET's direct (also called command line) mode of searching, requiring a knowledge of specific search commands and syntax. Also available are two modes of user-friendly menu searching: (1) HSDB's concept menus, built into TOXNET, and (2) NLM's GRATEFUL MED software, a PC-resident package allowing users to formulate their searches offline, without incurring charges until dialing up to run the actual search. A wide variety of display and print options are available, including the downloading and FTPing (via INTERNET) of search results.

Among TOXNET's other files are: The TRI Series (Toxic Chemical Release Inventory), listing releases of toxic chemicals to the environment as reported annually by facilities around the country, IRIS (Integrated Risk Information System) which assists in evaluating risks of chemical substances, CCRIS (Chemical Carcinogenesis Information System) providing carcinogenesis, tumor promotion and mutagenesis studies, GENE-TOX (Genetic Toxicology Databank) providing highly evaluated mutagenesis studies, RTECS (Registry of Toxic Effects of Chemical Substances) providing acute toxicity information and regulatory data, and bibliographic files on teratogenesis and mutagenesis.