

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

### General Populations

- The predominant route of exposure of the general population to DDT (1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane) and its metabolites is through the diet.
- DDT was widely used as insecticide from 1939 until the early 1970s.
- The main sources of DDT in food are meat, fish, poultry, and dairy products.
- The amount of DDT in food has greatly decreased since DDT was banned in the U.S. in 1972.
- Residues are more likely to occur in food imported from countries where DDT is still used.

### Occupational Populations

- There are currently no producers of DDT in the United States. Consequently, there are no populations exposed through production, formulation, or packaging of DDT.
- Since the use of DDT was banned in the United States in 1972, there are no populations exposed to DDT through application of this pesticide.
- Potential occupational exposure to DDT and related compounds may be limited to workers cleaning up hazardous waste sites where these substances may have been disposed.

### Toxicokinetics

- Absorption of DDT through the lungs is minimal largely because the large particle size of DDT prevents it from penetrating deep into the lungs.
- Oral exposure to DDT, DDE (1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethylene), or DDD (1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane) results in preferential absorption by the intestinal lymphatic system.
- A study in volunteers showed that orally administered DDT was readily absorbed and reached peak serum concentrations 3 hours after ingestion.
- DDT, DDE, and DDD are distributed to all body tissues and stored preferentially in fat tissue.
- The major metabolite of DDT is DDA (2,2-bis(*p*-chlorophenyl) acetic acid, produced by a sequence of reactions in the liver and kidneys.
- DDT metabolites are excreted mainly in the urine.

### Normal Human Levels

- In a national survey (2001–2002) of subjects 12-year-old and older from the United States, the geometric mean serum level of *p,p'*-DDE, the environmentally-relevant metabolite of DDT, was 1.81 ppb (whole blood).

### Biomarkers

- Serum and adipose tissues levels of DDT, DDE, or DDD are useful biomarker of exposure to these chemicals.
- High ratios of DDD or DDT to DDE are thought to indicate more recent exposure than lower ratios.

### Environmental Levels

#### *Air*

- Mean concentrations of DDT and DDE over the Great Lakes in 1998 were 38 and 59 pg/m<sup>3</sup>, respectively.

#### *Sediment and Soil*

- Maximum concentrations of *p,p'*-DDD, *p,p'*-DDE, and *p,p'*-DDT in sediment from 168 sites sampled along the southeastern coast of the U.S. in the mid 90s were 151, 34, and 35 µg/kg, respectively. The median concentrations were below the detection limit.

#### *Water*

- No recent data were located.

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for DDT/DDD/DDE (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

# ToxGuide™ for DDT/DDD/DDE

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U.S. Department of Health and  
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## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### DDT is a Synthetic Chemical

- DDT is a synthetic organochlorine pesticide. Technical grade DDT is a mixture of three isomers: *p,p'*-DDT (85%), *o,p'*-DDT (15%), and *o,o'*-DDT (trace amounts). DDT, DDE, and DDD are white crystalline solids.
- Technical grade DDT may also contain DDE and DDD as contaminants.
- DDT was widely used as a pesticide in agricultural crops and insects that carry diseases such as malaria and typhus.
- DDD was also used as pesticide, but to a much lesser extent than DDT. *o,p'*-DDD has been used to treat cancer of the adrenal gland. DDE has no commercial use.
- Both DDE and DDD are degradation products of DDT.

- Inhalation (breathing) – Negligible route of exposure for the general population.
- Oral (mouth) – The predominant route of exposure of the general public to DDT is through the diet. Exposure through drinking water is considered negligible.
- Dermal – Not a significant route of exposure for the general population.

### DDT in the Environment

- DDT, DDE, and DDD in air are rapidly degraded by sunlight. Half-lives range from 17 to 37 hours.
- DDT, DDE, and DDD that evaporate from contaminated water and soil can be carried long distances in the atmosphere.
- DDT, DDE, and DDD adhere strongly to soil. Most DDT in soil is biodegraded slowly to DDE and DDD. The half-life of DDT in soil can vary between 2 and 15 years, depending on the soil acidity and temperature.
- DDT has very low solubility in water so that only small amounts will move through soil into groundwater.
- DDT, DDE, and DDD accumulate in fatty tissues with concentrations typically increasing with the trophic level of the organism.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

### Minimal Risk Levels (MRLs)

#### *Inhalation*

- No inhalation MRLs were derived for DDT, DDE, or DDD.

#### *Oral*

- No oral MRLs were derived for DDE or DDD.
- An MRL of 0.0005 mg/kg/day has been derived for acute-duration oral exposure to DDT ( $\leq 14$  days).
- An MRL of 0.0005 mg/kg/day has been derived for intermediate-duration oral exposure to DDT (15–364 days).
- No MRL was derived for chronic-duration exposure to DDT ( $\geq 1$  year).

### Health Effects

- Acute-duration exposure to high concentrations of DDT can induce tremors and seizures which usually disappear after the exposure ceases.
- Several studies in humans suggest that high DDT/DDE burdens may be associated with alterations in end points controlled by hormonal action, such as duration of lactation, maintenance of pregnancy, and fertility.

### Health Effects (con't)

- Many studies in humans have examined the association between exposure to DDT and cancer at various sites, particularly breast cancer. Taken together, the results have shown no clear evidence that exposure to DDT causes cancer in humans.
- Long-term exposure to DDT, DDE, or DDD has induced liver cancer in mice.
- DHHS has determined that DDT, DDE, and DDD may reasonably be anticipated to be human carcinogens. IARC has determined that DDT, DDE, and DDD are possibly carcinogenic to humans. The EPA has established that DDT, DDE, and DDD are probable human carcinogens. These classifications are based primarily on inadequate evidence of cancer in humans and sufficient evidence in animals.

### Children's Health

- It is not known if children are more susceptible to DDT poisoning than adults.
- High DDE in blood has been associated with having preterm and small-for-gestational-age infants, and height abnormalities in children.
- DDT and metabolites can cross the placenta and have been found in human milk.