**Ziram**

**Trade and Other Names:**
Trade names for products containing ziram include AAprotect, AAvolex, Antene, Attivar, Carbazine, Corozate, Cuman, Drupine, Fuklasin, Fungostop, Mezene, Milbam, Pomarsol Z Forte, Prodaram, Tricarbamix, Triscabol, Z C Spray, Zerlate, Zincmate, Zinkcarbamate, Ziram, Zirasan, Zirbeck and Zirex. The compound may be found in formulations with other fungicides such as bitertanol, dodine, myclobutanil, thiram, and zineb.

**Regulatory Status:**
Ziram is a General Use Pesticide (GUP) in the U.S. Ziram is a slightly to moderately toxic compound, EPA toxicity class III. Ziram carries the Signal Word DANGER on its label due to eye irritation hazard.

**Chemical Class:** dithiocarbamate

**Introduction:**
Ziram is an agricultural dithiocarbamate fungicide used on a wide variety of plant fungi and diseases. It may be applied to the foliage of plants, but it is also used as a soil and/or seed treatment. Ziram is used primarily on almonds and stone fruits. It is also used as an accelerator in rubber manufacturing, packaging materials, adhesives, and textiles. Another use of the compound is as a bird and rodent repellent. Ziram is often marketed as a wettable powder or as granules. Granules or grains are sifted into water and agitated prior to application.

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**Toxicological Effects:**
- **Acute toxicity:**
  Acute exposure among industrial and farm workers in the former U.S.S.R. caused irritation of the skin, nose, eyes, and throat [1]. The oral LD50 for ziram is 1400 mg/kg in rats and 480 and 400 mg/kg in mice and rabbits, respectively. Ziram has an LD50 of 100 to 150 mg/kg in guinea pigs [4]. The acute dermal LD50 in rats is greater than 6000 mg/kg. Ziram is corrosive to eyes and may cause irreversible eye damage [43].
- **Chronic toxicity:**
Female rats administered relatively small doses of ziram in their diets (2.5 mg/kg/day) for 9 months showed decreased antibody formation. Rats fed doses of 1 to 2 mg/kg/day ziram for an unknown time period exhibited poor growth and development [44]. In a 1-year feeding study with rats, no effects were seen at the low dose of 5 mg/kg/day, nor were any effects seen in weanlings receiving 5 mg/kg/day in their diet for 30 days [4]. A study with dogs fed ziram in their diets showed no harmful effects after 12 months at 5 mg/kg/day [44].

- **Reproductive effects:**
  When female and male rats were given moderate doses of ziram (50 mg/kg/day) for nearly 2 months prior to pregnancy, the rats had marked reductions in fertility and litter size. The rats in this study became largely sterile. A lower dose of 10 mg/kg had no effect on reproduction [1,44]. Female mice fed moderate doses (50 mg/kg/day) of ziram for 15 days exhibited reduced fertility but no effects on fertility appeared in male mice [4]. Wasting away of the testes has been noted as a toxic effect of ziram [45]. Based on these data, reproductive effects in humans are unlikely at normal levels of exposure.

- **Teratogenic effects:**
  Pregnant rats administered ziram at doses of 12.5 to 100 mg/kg/day during the organ forming period of pregnancy showed embryotoxic effects at doses of 25 mg/kg/day and greater. The compound also had a slight growth inhibiting effect on the embryos at 100 mg/kg. Maternal toxicity was observed at all test levels [4]. No teratogenic effects were observed.

- **Mutagenic effects:**
  Numerous tests have established that ziram is mutagenic. For example, there was an increase in the number of chromosome changes in bone marrow cells in mice treated with oral doses of 100 mg/kg/day [4]. Chromosomal changes have also been observed in workers exposed to the compound in industrial settings for 3 to 5 years [1]. The concentration in the air averaged 1.95 mg/L but reached as high as 71.3 mg/L in some of these cases. Thus, there is a risk to humans chronically exposed to ziram at moderate to high concentrations.

- **Carcinogenic effects:**
  A carcinogenicity study was performed on rats and mice exposed to ziram for a 103-week period. Under the conditions of the study, ziram was carcinogenic to male rats, causing an increase in thyroid cancer. There was no increase in carcinogenicity in female rats or in male mice. Female mice showed an increase in lung tumors, but this was complicated by a virus infection making interpretation difficult [45]. Ziram's carcinogenicity is not determinable from current evidence.

- **Organ toxicity:**
  The primary target organ is the thyroid, as shown in a study of workers who experienced thyroid enlargement after ziram exposure [45].

- **Fate in humans and animals:**
  Ziram is poorly absorbed in the absence of oils. However, it may be readily absorbed into the body in the presence of oil, including through the skin. Rats that had been fed low doses (30 mg/kg/day) of the compound for 2 years had very low levels in their livers (0.03 mg). However, the zinc component of the parent compound is stored in the body to a slightly higher degree. The amount of zinc in bone was related to the dose over a 2-year experiment. Female rats had some water soluble residues in blood, kidneys, liver, ovaries, spleen, and thyroid 24 hours following a single oral dose [4]. Ziram that had remained unchanged in the rat was excreted in the feces [4]. This indicates that, though ziram has only a slight potential to persist and concentrate in living tissue, the compound may be selectively localized in the body, as are other dithiocarbamates, at sites where toxicity may occur. The highest concentrations of zinc after ziram exposure are found in the male reproductive system and specifically in the prostate. High concentrations also are found in bone, liver, kidney, pancreas, and endocrine glands. Rats that were fed low doses of ziram followed by ethyl alcohol had higher alcohol levels in their bloodstream over a 4-hour period [4].

**Ecological Effects:**
• **Effects on birds:**
  Toxicity of ziram to birds will vary from essentially non-toxic to moderately toxic. Its LD50 is 100 mg/kg in European starlings and red-wing blackbirds. In a 2-year study, the dietary LC50 in quail was 3346 ppm [13]. In chickens, doses of 56 mg/kg were toxic [44]. Ziram has an antifertility action in laying hens. When given to chickens under unspecified conditions, there were adverse effects on body weight and retarded testicular development [4].

• **Effects on aquatic organisms:**
  Based on data from only one species, the goldfish, the compound appears to be moderately toxic to fish. The 5-hour LC50 for ziram in goldfish was between 5 and 10 mg/L [3]. Based on its low solubility in water, ziram should have a low bioconcentration potential [13].

• **Effects on other organisms:** No data are currently available.

**Environmental Fate:**

• **Breakdown in soil and groundwater:**
  Ziram has not been detected in groundwater [19]. In soils with medium to high content of soil organic matter, ziram will be moderately bound. A field half-life of 30 days has been estimated for ziram [21], indicating a low to moderate persistence.

• **Breakdown in water:**
  Of the metallic dithiocarbamate fungicides, ziram is the most stable. Because the compound is toxic to bacteria, biodegradation in sediment may be rather slow, or occur only at very low concentrations. If ziram gets to the bottom of bodies of water, it may persist for months [19].

• **Breakdown in vegetation:**
  On plants, persistent breakdown products were formed. A significant amount of carbon disulfide was released during the breakdown process. The leaf surface was slightly acidic, probably due to dissolved carbon dioxide [4].

**Physical Properties:**

• **Appearance:** Ziram is an odorless powder at room temperature [3].
• **Chemical Name:** zinc bis(dimethyldithiocarbamate) [3]
• **CAS Number:** 137-30-4
• **Molecular Weight:** 305.83
• **Water Solubility:** 65 mg/L [3]
• **Solubility in Other Solvents:** s. in alcohol, acetone, benzene, and carbon tetrachloride [3]
• **Melting Point:** 240-244 C [3]
• **Vapor Pressure:** Negligible at room temperature [3]
• **Partition Coefficient:** Not Available
• **Adsorption Coefficient:** 400 (estimated) [21]

**Exposure Guidelines:**

• **ADI:** 0.02 mg/kg/day [33]
• **MCL:** Not Available
• **RfD:** Not Available
• **PEL:** Not Available
• **HA:** Not Available
• **TLV:** Not Available

**Basic Manufacturer:**

FMC Corporation
Agricultural Chemicals Group
1735 Market Street
Philadelphia, PA 19103

- **Phone:** 215-299-6565
- **Emergency:** 800-331-3148

**References:**

References for the information in this PIP can be found in Reference List **Number 4**

**DISCLAIMER:**
The information in this profile does not in any way replace or supersede the information on the pesticide product labeling or other regulatory requirements. Please refer to the pesticide product labeling.