



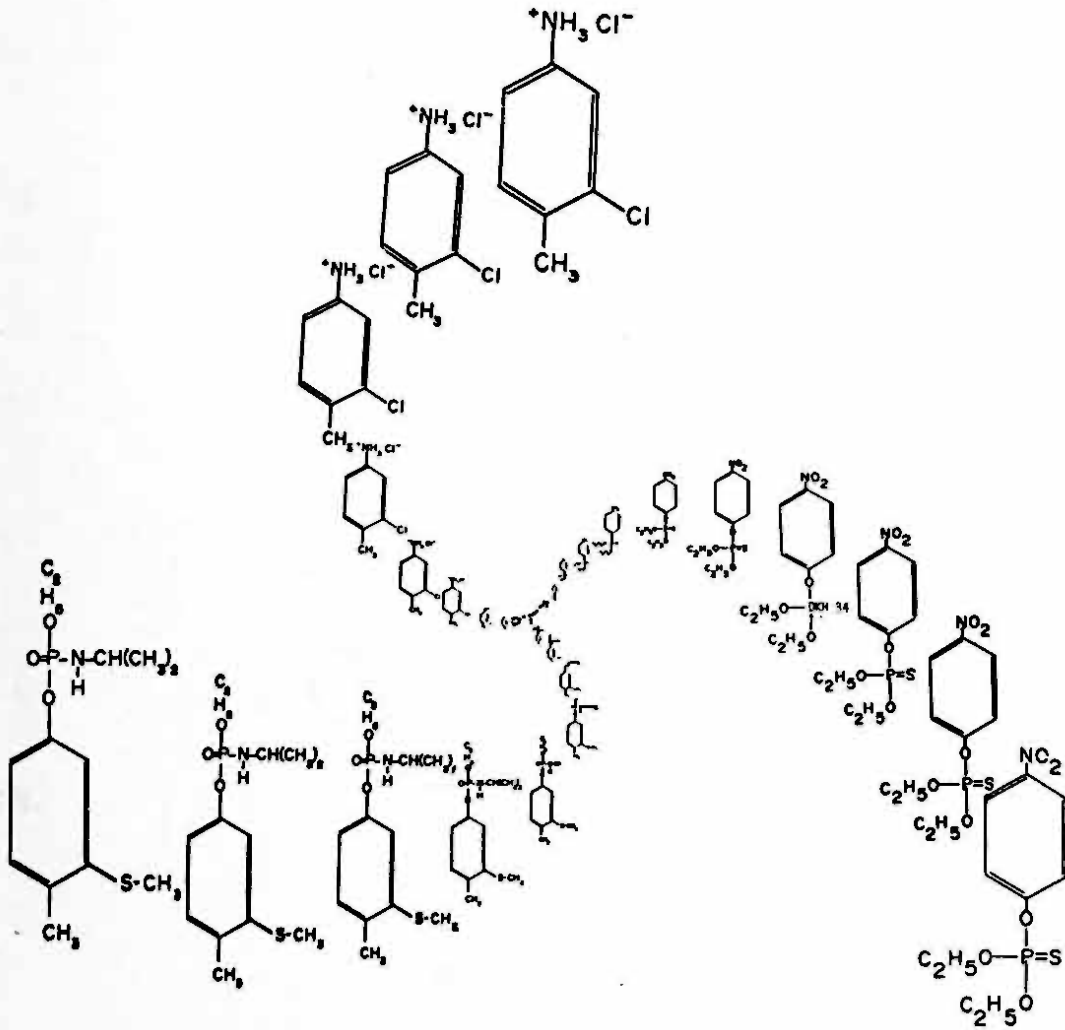
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U.S. Department of Agriculture  
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# Handbook of Toxicity of Pesticides to Wildlife



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# HANDBOOK OF TOXICITY OF PESTICIDES TO WILDLIFE

SECOND EDITION

By Rick H. Hudson  
Richard K. Tucker  
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UNITED STATES DEPARTMENT OF THE INTERIOR  
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## Preface to the Second Edition

This second edition of the *Handbook of Toxicity of Pesticides to Wildlife* is a product of the wildlife research portion of the Environmental Contaminant Evaluation Program of the U.S. Fish and Wildlife Service. The toxicity tests summarized here were performed over a number of years at the Denver Wildlife Research Center. When all responsibility for contaminant research on wildlife was consolidated at the Patuxent Wildlife Research Center in 1976, we decided that an effort should be made to publish the large volume of toxicity data that had accumulated at the Denver Center since the first edition of the handbook was issued in 1970. Financial support for the compilation and publication of this work was provided by the Patuxent Wildlife Research Center during the years 1976-1982. R. H. Hudson has remained with this task throughout the years; this edition has been compiled largely through his efforts.

The original edition of this handbook has stood the test of time; it has become a useful and often-cited reference on what is probably the most basic estimator of chemical hazard, the acute toxicity test; it is used as much today as when it was first released more than a decade ago. This new edition should be even more useful than the earlier one because of its expanded scope and its presentation of additional data supporting toxicity estimates presented in the first edition. The handbook provides toxicity estimates of nearly 200 different chemicals or formulations, each tested on one or more of more than 30 different species. Toxicity estimates for different chemicals may not always be directly comparable, and I emphasize that the results presented here are not to be regarded as the result of a single study; rather, they summarize a large number of studies conducted for a variety of purposes. Although these data are exceedingly useful, like all toxicological data, they should be used with caution for comparative purposes.

The value of acute toxicity tests performed on wildlife has prompted much debate in the past. Even within the Fish and Wildlife Service, researchers at one time were divided over whether short-term (acute) or longer term (subacute) tests were more appropriate. The judgment derived from our cumulative experience in this area is that both types of tests are necessary if the toxicity of a chemical is to be evaluated adequately. Early experimentation showed that acute tests greatly underestimated the hazard posed by chemicals that accumulate in animals through the intake of small amounts in the diet; the subacute test was conceived to deal with this problem. Experience with the subacute test showed that it often gives misleading results with chemicals that are highly labile. Also, the subacute test gives inaccurate results when used with chemicals that tend to produce anorexia (loss of appetite), as do certain pesticides. Each type of test thus provides vital information on the hazards posed by certain types of chemicals; with chemicals for which both types of tests are appropriate, two "benchmarks" are desirable to help in predicting lethal and sublethal effects in the environment. The Patuxent Center's commitment to both types of testing is evidenced by this volume and another on subacute toxicities that will be available soon.

We expect this handbook to be useful to researchers, to government regulators, and to those managing data banks for the benefit of these groups. It is, however, primarily meant to benefit fish and wildlife resource managers. The indications of acute toxicity provided by the handbook constitute one means by which managers can assess potential contaminant threats to wildlife resources. This handbook and others like it, together with the technical and interpretative services provided by the research laboratories, should make somewhat easier the tasks of those charged with conserving the nation's wildlife populations.

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# Handbook of Toxicity of Pesticides to Wildlife

Second Edition

By

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## Introduction

Although the problems resulting from the use of pesticides in wildlife habitats have continued to receive considerable attention in recent years, the relations involved are highly complex and knowledge in many areas is still limited. Research, operational, and administrative personnel concerned with the use of pesticides have had a long-standing need for compendia of pesticide toxicity data for wildlife species that would provide, if not final answers, at least a basis for comparison of one pesticide with another. We believe that the first edition of the *Handbook of Toxicity of Pesticides to Wildlife* (Tucker and Crabtree 1970) helped fill that need, and hope that this second edition will be even more helpful.

When the first edition of this handbook appeared, many compilations of pesticide toxicity data for laboratory animals were already available, notably for rats (Kerr and Brogden 1959; Gaines 1960, 1969; Hayes 1963; Dauterman and Guthrie 1965), but also for dogs (Lehman 1965), fish (Henderson et al., 1960:76-88), snails (Dowdon and Bennett 1965), frogs (Kaplan and Overpeck 1964), and cladocerans (Anderson 1959:94-95; Sanders and Cope 1966). None of these compilations were (or have attempted to be) complete, but they represent ready references to help answer certain simple questions about the acute or chronic toxicity and the hazards of given pesticides. Other compilations of toxicity data for wildlife have recently appeared, notably Heath et al. (1972), Hill et al. (1975), Johnson and Finley (1980), Pimentel (1971), Schafer (1972), Schafer and Cunningham (1972), and Schafer (1983). During the 13 years since the first edition of this handbook was published, the fields of environmental and comparative toxicology have matured greatly. For a recent review of the literature of comparative fish and wildlife toxicology, see Tucker and Leitzke (1979).

Sensitivity to toxicants varies greatly from species to species, even within the same genus. Although toxicity figures for albino rats are often used for wildlife purposes,

they are at best poor indicators of the sensitivity, for example, of pheasants. Recognizing that toxicity figures based on experiments with any one species are inadequate, we have presented data for two or more species whenever possible; birds are almost always represented. To allow the broadest use of these data, we have conducted most tests with species that are common and widely distributed in the United States. The ring-necked pheasant (*Phasianus colchicus*) and northern bobwhite (*Colinus virginianus*), for instance, are among the most frequently bagged upland game birds in this country, and the mallard (*Anas platyrhynchos*) is probably the waterfowl most commonly taken. Often, however, additional species with more restricted ranges, such as the fulvous whistling-duck (*Dendrocygna bicolor*) or the sandhill crane (*Grus canadensis*), have been included. To enable ready comparison among pesticides, nearly all the chemicals we studied were tested on one species, the mallard.

The chemicals chosen for testing included 181 pesticides, 15 other environmental pollutants, and many mixtures and formulations of pesticides. Generally, the pesticide pollutants were those to which wildlife are most likely to be exposed. Most are widely used or represent common families of chemicals used in thousands of pesticide formulations applied to forests, rangeland, aquatic habitat, or agricultural areas lived in or frequented by wildlife. Acute toxicity data and a list of the clinical signs of intoxication observed are presented for each pollutant. For some, particularly those that are likely to be applied repeatedly or to persist for a long time after single application, the results of 30-day repeated oral toxicity or feeding tests are included. Some of the pollutants were also tested for percutaneous (through the skin) toxicity.

## Use of Acute Toxicity Figures

The degree of hazard presented by a pesticide depends on many complex factors. Although no single way of ex-

pressing potential hazard is completely reliable, a rapid and convenient indicator of hazard as represented by a compound's inherent toxicity is the acute oral toxicity test (the single dosage necessary to result in death). Additionally, for granular material, this test is directly applicable for the hazard evaluation.

The usual way of expressing acute toxicity is by means of an LD50 (median lethal dosage) value. The LD50 is a bioassay-based statistical estimate of the dosage (in mg chemical/kg of body weight of the animal exposed) that would be lethal to 50% of the experimental population of the test species. It is also possible to calculate such values as the LD5 or LD99, but they are (for statistical reasons) less precise than the corresponding LD50 and more difficult to determine. Although LD50's give no information on the dosage that would be lethal to every individual of the species, nor on treatment given in some other way than in the test, the LD50 value, with its confidence limits, is probably the most convenient and reliable means available for comparing the inherent toxicity of chemicals.<sup>1</sup>

How the LD50 figures in this handbook are used is largely a matter for the reader to decide, but they should be regarded only as guides or benchmarks. They are meaningful only in the context of other information on the pesticide's physicochemical and biological properties and the rates and methods of application, most of which can readily be found in the scientific literature or in technical bulletins provided by the manufacturers.

When the LD50 is used to evaluate the safety or hazard of a pesticide used in the field, many factors must be considered. To span the gap between the sensitivity of a species in the laboratory (pharmacological vulnerability) and its vulnerability in the field (ecological vulnerability), such factors as the following must be taken into account:

- The amount of pesticides applied per unit area or unit time.
- The degree of contamination of different environmental components such as air, water, vegetation, as influenced by such factors as the carrier in the pesticide formulation, the evenness of application, wind, temperature, vegetative composition, and other possible variables.
- The various species present in the habitat when the pesticide is applied.
- Routes by which the animals contact the pesticide (oral, dermal, inhalation), as well as the amount and duration of contact with different components of the environment (e.g., fish contact water but not trees).
- Persistence of the pesticide (chemical breakdown rates, transferal between environmental components, and other variables).

- Formation of biologically active metabolites and their distribution.
- Degree of accumulation of the pesticide or its active metabolites in the animals.

For a more detailed discussion of the factors involved in extrapolating the field hazard of a chemical from laboratory data, see Dewitt (1966), Kenaga (1968), and Tucker and Leitzke (1979).

Although the acute toxicity figure is the basic one and the one most easily compared from chemical to chemical, it is not always the most sensitive measure of potential hazard. Compounds that are poorly absorbed or are cumulative in action are better tested by long-term feeding (if the chemical does not break down in feed or produce aversion) or by repeated oral doses.

Finally, although mortality is a conveniently measured effect, it should be recognized that levels of pesticide that do not kill may nevertheless produce subtle, yet damaging, effects on animals, such as inhibition of reproduction or impairment of ability to escape from predators. These sublethal effects must be considered in conjunction with the LD50 in any comprehensive evaluation of a pesticide's potential safety.

## Signs of Intoxication

The pattern of clinical signs of intoxication produced by a toxic chemical is often helpful in diagnosis and as a starting point in studies of the mode of action. Therefore, in addition to the acute oral LD50 for each pesticide, the signs and behavioral changes observed in the test animals after dosing are listed (and defined in a glossary when not self-explanatory). We hope that this information will help biologists in the field to know what signs to look for when assessing short-term effects of pesticides on wild populations. The signs may also aid workers to arrive at a tentative identification of the pesticide involved when only a few known pesticides have been applied to an area. Although it is unlikely that signs alone can ever definitively identify a toxicant, they can sometimes eliminate certain known toxicants from further consideration. When the development of toxic signs produced a clear-cut pattern, we have also included notes on the timing of the toxic effects, because such factors as the time of onset, duration, and time of remission (disappearance of toxic signs and recovery of the test animal) can have implications for the speed and thoroughness of absorption, the rate of metabolism or elimination and the cumulation of residues in the tissues.

## Methodology

Data reported in this handbook resulted from research conducted at the Denver Wildlife Research Center, Denver, Colorado, under the program of Pesticide-Wildlife Studies; therefore, at least one source of bias—interlaboratory variation—has been avoided.

<sup>1</sup>Much of the wording in this paragraph has been paraphrased from Hayes (1963:3-4), whose lucid explanation of acute toxicity seemed clearer than any discussion we could produce independently.

### Source of Animals

Healthy pen-reared or captivity-conditioned animals were used for all determinations. The use of biologically active chemicals was avoided on or near the animals during rearing and holding.

The following species, listed in phylogenetic order, were pen-reared from stock lines:

Mallard	<i>Anas platyrhynchos</i>
Greater prairie chicken	<i>Tympanuchus cupido</i>
Sharp-tailed grouse	<i>Tympanuchus phasianellus</i>
Northern bobwhite	<i>Colinus virginianus</i>
California quail	<i>Callipepla californica</i>
Japanese quail	<i>Coturnix japonica</i>
Ring-necked pheasant	<i>Phasianus colchicus</i>
Chukar	<i>Alectoris chukar</i>
Ring-billed gull	<i>Larus delawarensis</i>
Ringed turtle-dove	<i>Streptopelia risoria</i>
Mule deer	<i>Odocoileus hemionus</i> <i>hemionus</i>
Domestic goat	<i>Capra hircus</i>

The following species, listed in phylogenetic order, were live-trapped, donated, or purchased from various sources:

Bullfrog	<i>Rana catesbeiana</i>
Canada goose	<i>Branta canadensis</i>
Fulvous whistling-duck	<i>Dendrocygna bicolor</i>
Mallard (MM)	<i>Anas platyrhynchos</i>
Northern pintail	<i>Anas acuta</i>
Golden eagle	<i>Aquila chrysaetos</i>
Northern bobwhite (HGF)	<i>Colinus virginianus</i>
Ring-necked pheasant (HGF)	<i>Phasianus colchicus</i>
Gray partridge	<i>Perdix perdix</i>
Wild turkey	<i>Meleagris gallopavo</i>
Sandhill crane	<i>Grus canadensis</i>
Rock dove (domestic pigeon)	<i>Columba livia</i>
White-winged dove	<i>Zenaida asiatica</i>
Mourning dove	<i>Zenaida macroura</i>
Horned lark	<i>Eremophila alpestris</i>
House sparrow	<i>Passer domesticus</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
House finch	<i>Carpodacus mexicanus</i>
Dark-eyed junco	<i>Junco hyemalis</i>
White-crowned sparrow	<i>Zonotrichia leucophrys</i>
Albino rat	<i>Rattus norvegicus</i>
Domestic ferrett (European polecat)	<i>Mustela putorius</i>

The mallards denoted by "MM" were provided by the Max McGraw Wildlife Foundation, and have been distinguished from other mallards because of variations in toxicity which may occur through the use of different genetic lines of test animals. For the same reason, the pheasants and bobwhites purchased from a game bird farm have been denoted by "HGF" in the tables.

An index to the species of animals and the toxicants tested with each is provided at the end of this handbook. Bird names are according to the Thirty-fourth Supplement to the American Ornithologists' Union Check-list of North American Birds (1982).

### Selection and Treatment of Test Animals

On the evening before testing, or earlier if necessary, the animals to be tested were taken from a holding pen and placed in the test pens; weak or injured individuals were culled at this time. All test animals underwent a pretreatment fasting period to avoid the effects of variable stomach contents on absorption and to bring each near the basal metabolic state. Fasting periods were 24 h for deer and goats; 2 to 4 h for doves, sparrows, finches, and juncos; and 16 to 20 h for all other species.

On the morning of the test (after the pretreatment fasting period), all animals were weighed. They were then assigned to treatment groups on the basis of body weight, with each toxicant dosage level to be administered to groups including individuals of low, medium, and high body weight. Test animals for feeding studies and water concentration exposure studies were randomly assigned to treatment groups.

Water was available ad libitum in the swimming ponds used for tests on waterfowl, or in appropriate watering devices. Except during the pretreatment fasting periods, food was available ad libitum.

### Source of Chemicals

The tested materials—technical, analytical, or reagent grade samples of known (and generally high) purity—were received directly from their manufacturers, whom we thank for making them available, or from various cooperators. The purities are given in the chemical summaries. Trivial and trade names, as well as chemical names (nomenclature after *Chemical Abstracts*, 9th Chemical Index) and common synonyms of the materials tested, are also given to facilitate identification. In recent years an effort has been made to use the common name for a pesticide, rather than a brand name, whenever possible. Thus, in this edition of the handbook, we have attempted to use the commonly accepted names for the pesticides. Where possible, these and the chemical names have been taken from Blalock et al. (1979). Other names have been taken from technical bulletins, Spencer (1973), and Berg (1975).

### Chemical Administration Methods

Oral administration was accomplished by inserting gelatin capsules containing the test chemical through glass tubing to the level of the crop, proventriculus, or stomach. The capsules were administered to goats and deer orally with a balling gun into the upper esophagus. The test



materials were accurately weighed or microsyringed into the capsules from precisely diluted acetone solutions. The acetone was evaporated at room temperature before the capsules were closed. Some liquid toxicants or suspensions or solutions of toxicants (denoted in the tables by "st") were administered into the esophagus with ball-tipped oral intubation needles.

Pure materials were administered whenever possible. We used carriers (such as distilled water, corn oil, or acetone)

only when absolutely necessary for accurate administration of the toxicant. When a stomach tube was used for toxicant administration, usually the pure material was in liquid form already or was a technical material with a carrier that was of toxicological interest. Toxicants that were administered in a carrier solution are listed in Table 1.

The following methods were used for the percutaneous toxicity determinations with mallards. On the evening before treatment, the feet of the birds were inspected for

Table 1. Carrier and final volume used to administer toxicant to birds and albino rats for oral LD50 determinations.

Chemical and test animal	Type of test <sup>a</sup>	Carrier	Final volume ( $\mu\text{L/g}$ )	
			Mean	Upper limit
<b>Ceresan L</b>				
Mallard	spo	Distilled water	0.11	0.12
Japanese quail	po	Distilled water	0.75	2.00
<b>Chlorpyrifos</b>				
Mallard duckling	po	4% Gum acacia in distilled water	6.63	12.20
Rock dove	po	3% Gum acacia in distilled water	2.69	6.34
Albino rat	po	4% Gum acacia in distilled water	8.82	12.60
<b>Cyolane</b>				
Mallard	po	Distilled water	0.11	0.24
<b>D.M. 7537</b>				
Mallard	po	4% Gum acacia in distilled water	6.87	10.00
Northern pintail	po	1% Gum acacia in distilled water	2.91	4.99
House sparrow	po	Acetone	0.08	0.14
Albino rat	po	4% Gum acacia in distilled water	5.74	9.98
<b>Fenthion</b>				
Mourning dove	po	Acetone and 5% Gum acacia in distilled water	0.20	0.48
House sparrow	po	Acetone	8.84	9.92
House finch	po	Acetone	0.39	0.99
	po	Acetone	0.77	1.49
<b>Mestranol</b>				
Red-winged blackbird	po	Distilled water	12.00	12.00
<b>Mexacarbate</b>				
Mallard duckling	po	4% Gum acacia in distilled water	3.66	5.00
Mourning dove	po	Acetone	0.35	0.79
House finch	po	Acetone	0.26	0.39
<b>Methamidophos</b>				
Mallard	po	Distilled water	0.05	0.10
<b>Nosema locustae</b>				
Mallard	po	Distilled water	4.72	5.85
Ring-necked pheasant	po	Distilled water	10.20	11.60
<b>Nucleopolyhedral virus</b>				
House sparrow	po	Distilled water	17.70	17.70

Table 1. *Continued.*

Chemical and test animal	Type of test <sup>a</sup>	Carrier	Final volume ( $\mu\text{L/g}$ )	
			Mean	Upper limit
<b>Phosphamidon</b>				
Mallard	po	Distilled water	1.20	2.02
Japanese quail	po	Distilled water	1.01	2.15
Ring-necked pheasant	po	Distilled water	0.17	0.24
White-winged dove	po	Distilled water	1.08	1.80
Albino rat	po	0.1% Yuma Chemical "Spreader A" in distilled water	3.86	4.62
<b>Polychlorinated biphenyls:</b>				
Aroclor 1254				
Albino rat	po	Corn oil	0.75	1.01
Aroclor 1268				
Albino rat	po	Corn oil	2.84	3.99
<b>Starlicide</b>				
Mallard	po	Distilled water	0.65	1.54
Mallard	po	Corn oil	0.84	1.73
Mallard	po	Propylene glycol	0.40	0.86
<b>Strychnine</b>				
Ring-necked pheasant	po	Distilled water	1.11	2.40
Mourning dove	po	Distilled water	1.77	3.20
House sparrow	po	Distilled water	6.91	12.80
<b>TCDD</b>				
Mallard	po	Corn oil	—	7.20
Northern bobwhite	po	Corn oil	0.94	2.00
Ringed turtle-dove	po	Corn oil	—	54.00
<b>Zinc phosphide</b>				
Horned lark	po	Corn oil	9.18	35.70
<b>1080</b>				
Mallard	po	Distilled water	2.00	3.22
Mallard duckling	po	Distilled water	0.56	1.27
Mallard	spo	Distilled water	0.50	0.50
California quail	po	Distilled water	0.42	0.84
Japanese quail	po	Distilled water	7.54	14.40
Ring-necked pheasant	po	Distilled water	0.80	1.53
Chukar	po	Distilled water	0.71	1.13
Rock dove	po	Distilled water	3.62	7.99
Mourning dove	po	Distilled water	0.48	0.72
House sparrow	po	Distilled water	1.18	2.00
Domestic ferret	po	Distilled water	2.50	4.00

<sup>a</sup>po = acute oral; spo = subacute oral.

cuts, cracks, or abrasions; only those with feet in good condition were used. The feet were then rinsed in warm water to remove any foreign particles. The next morning, before treatment, the crura were shaved with an electric clipper to facilitate taping of plastic bags which were used to cover the exposed areas. The chemicals were dissolved or suspended by ultrasonic dispersion in corn oil or propylene glycol in quantities to enable application of about 0.6 mL of solu-

tion to each foot. This amount was found to be the minimum amount which would wet the entire surface area. The area covered included the tarso-metatarsus, phalanges, and webbing, which constitutes approximately 12% of the body surface area of a full-grown mallard. Each foot was then covered with a plastic bag which extended midway up the crus. After 24 h, the bags were removed and the feet washed with mild soap and warm water. Control birds were



concurrently sham treated with the carriers. The quantity of toxicant administered was based on the body weight of each individual treated.

### *Acute Toxicity Determinations*

After initial range-finding dosages were administered, two to seven animals at each of several (usually four) dosage levels were used for each LD<sub>50</sub> determination. The number of animals at the dosage levels for each test was kept constant to enable computation of the acute oral LD<sub>50</sub> or percutaneous LD<sub>50</sub> by the methods of Thompson (1947) and Weil (1952).

Final mortality counts were made after a 14-day observation period following treatment, except that when animals were still showing outward evidence of intoxication at 14 days, the observation period was extended until death or remission occurred. This period was never more than 36 days, although with chlorinated organics and mercurials it frequently lasted up to 28 days.

Usually the observations were made continually for 3–4 h after dosing, several more times during the first day of the test, and once daily thereafter. Gross necropsies were performed at the end of the observation period or at death. Survivors were sacrificed by CO<sub>2</sub> asphyxiation.

### *Subacute Toxicity Determinations*

An empirical value that represented the minimum repeated oral dosage (in mg/kg per day) that was lethal in 30-day tests, was determined for some pesticides. This value was found by orally administering the chemical daily for 30 days to three males and three females of the test species. Such groups of six were treated at geometrically spaced dosage levels until levels were found that produced the following: in 30 days, no deaths, one or two deaths, and three to six deaths. The lowest daily oral dosage that produced one or two deaths by the end of the 30-day period was called the 30-day empirical minimum lethal dosage (30-day EMLD). Controls for these tests were run concurrently and were sham dosed with empty gelatin capsules.

Dietary LC<sub>50</sub> studies were performed using the methods of Heath et al. (1972).

### *Acetylcholinesterase Activity Determinations*

When brain acetylcholinesterase (AChE) activity was measured, we used a modification of the method of Michele (1949) (Hawkins and Knittle 1972). Determinations of AChE activity were made on the brains of birds tested with carbaryl (ring-necked pheasant), carbofuran (ring-necked pheasant), dimethoate (ring-necked pheasant), disulfoton (ring-necked pheasant), EPN (mallard), fenitrothion (ring-necked pheasant), leptophos (northern bobwhite), malathion (horned lark), methiocarb (horned lark),

methyl parathion (mallard, northern bobwhite, red-winged blackbird), and phorate (ring-necked pheasant).

## Arrangement of the Handbook

In the following summaries, toxicity information is given separately for each pesticide. Chemicals are arranged alphabetically by their common names whenever possible, or by their most commonly used trade names. Other names (common, trade, and trivial) are also included in the alphabetical sequence for easy cross-reference.

Under each chemical heading are listed any alternative names, the chemical name, the pesticide's primary usages, and the purity of the samples tested. Chemical names follow the current system of nomenclature of *Chemical Abstracts*, 9th Chemical Index. The Chemical Abstract Service (CAS) number, when known, follows the chemical name.

The next entry is a summary table of acute oral toxicity values. The test animals are arranged in the first column according to phylogenetic order. When different samples of the pesticide were tested, the purity of the sample used on each test animal is denoted by a superscript number that refers to the "Sample Purity" preceding the table. Such superscript numbers are also used to indicate sample purity associated with alternative names given for some chemicals and in some discussions under "Other Toxicity Data."

The number of animals included in the statistical calculation of the LD<sub>50</sub> is given in the second column. Commonly, more individuals were tested than were used in the calculation.

The sex of the animals tested is given in the third column. Although sex-related differences in susceptibility to pesticides often appear among mammals, notably rats (Kerr and Brogden 1959), our work and that of others (Dahlen and Haugen 1954) indicate that pronounced sex-related differences in acute toxicity are uncommon among birds.

The fourth column gives the age of the test animals in months. When age was not known, a dash appears. Estimated ages were sometimes used; abbreviations appearing in the tabular data are J for juvenile, I for immature, A for adult; and h for hours, d for days, wk for weeks. Differences in sensitivity due to age can be expected, but our work indicates that these are generally small. Immature and senescent animals were avoided in favor of young but sexually mature (or nearly sexually mature) test animals, thus lessening the chance of death unrelated to the treatment. For further discussion of age-sensitivity relations, see Hudson et al. (1972). Unless specifically mentioned in the toxicity tables as a footnote to the age, the test animals were not in active breeding condition, either because they were young of the year and not yet sexually mature, or they were tested at times of the year when they were reproductively inactive and reproductive organs were regressed.

The fifth column gives the LD<sub>50</sub> value in milligrams (or milliliters) of toxicant per kilogram of body weight (mg/kg;

mL/kg). Each LD50 is followed by the 95% confidence limits (CL). When confidence limits were not calculable because of an all-or-none effect at the dosages used, either a dash is placed in the parentheses, or the confidence limits have been replaced by the range from the highest dosage producing no mortality to the lowest dosage producing 100% mortality and this range has been given in brackets instead of parentheses. When no LD50 was calculable because of either heterogeneity of the dose-response data or the limited number of animals available, the two figures bracketing the range where we estimated the LD50 would lie are given (e.g., "200-400"). No confidence limits are shown when (1) few, if any, animals died at the highest dosage given and the LD50 is given as "greater than" (>) the highest dosage; (2) no toxic signs were produced even at the highest level and the LD50 is given as "much greater than" (>) the highest level administered; and (3) no animals survived at any treatment level and the LD50 value is given as "less than" (<) the lowest dosage tested. The conventions described (giving confidence limits in parentheses and estimated ranges in brackets) are followed in the sections on "Other Toxicity Data" as well as in the "Acute Oral Toxicity" summaries.

A list of the toxic signs and behavioral changes in the test animals is given after the summary table. These are the characteristic signs that occurred when the animals were given lethal or near-lethal dosages; they were observed in one or more, but not necessarily all, of the species tested. When pronounced signs occurred at levels much lower than the lethal level, the minimum sign-producing dosage is given. The signs have been listed in their approximate order of onset, but the order can vary from species to species and from individual to individual. A glossary of technical terms used in describing signs of intoxication is given after the references section, near the end of the handbook.

The section on "Other Toxicity Data" lists any additional observations about acute toxicity that may be of value, and gives the results of percutaneous toxicity tests, 30-day repeated oral tests, and chronic feeding tests with the pesticide when those were conducted. The 30-day repeated oral results are expressed as a 30-day EMLD value (this terminology is explained in the section on "Methodology—Subacute Toxicity Determinations"). When too few animals were available for a complete EMLD series, as often happened with mule deer, we have given the two figures that bracket the range in which we would expect the 30-day EMLD to lie.

The value of the 30-day oral test, or similar measurements of chronic toxicity (Hayes 1967), lies in showing the cumulative action of the test chemical. A useful index of cumulation is the ratio of the single oral LD50 (mg/kg) to the 30-day EMLD (mg/kg per day). This ratio, which we have called the "cumulative toxicity index," is also included, along with a few words indicating how the pesticide compares with others in its chemical group. For example, mexacarbate, with an index of  $3.00/1.25 = 2.40$ , shows practically no cumulative action, whereas dieldrin, with an

index of  $381/5.00 = 76.2$ , is highly cumulative, even for a chlorinated organic insecticide.

Other information on a given chemical has been included in a "Notes" section which follows the section on "Other Toxicity Data." For example, the "Notes" section may discuss the results of gross necropsies, or give the results of brain acetylcholinesterase activity measurements.

## Summaries of Toxicological Data for Wildlife

A-33: see Airkem A-33 Dry  
A 363: see aminocarb  
AAT: see parathion  
AAtrex: see atrazine  
Abaphos: see temephos  
Abar: see leptophos  
Abate: see temephos  
Abathion: see temephos  
AC-3422: see parathion  
AC-3911: see phorate  
AC-4049: see malathion  
AC-12880: see dimethoate  
AC-18133: see thionazin  
AC-18682: see dimethoate  
AC-38023: see famphur  
AC-47031: see Cyolane  
AC-52160: see temephos  
Acarin: see dicofol  
Acarol: see bromopropylate  
Accelerate: see endothall  
Accothion: see fenitrothion  
Acenaphthene: see Panasol AN-2

## ACEPHATE

**Alternative Names:** ENT 27822, Orthene, Ortho 12420, Ortran

**Chemical Name:** Acetylphosphoramidothioic acid, *O*, *S*-dimethyl ester (CAS-30560-19-1)

**Primary Use:** Insecticide

**Sample Purity:** 93.2%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	4-6	234 (186-295)

**Signs of Intoxication:** Ataxia, imbalance, hopping and falling, jerkiness, mild spasms in the legs and feet, immobility, wings spread, and intermittent tremors. Signs appeared as soon as 25 min and mortalities usually occurred 2-18 h after treatment. Treatment levels as low as 124 mg/kg produced signs.

**Note:** In the environment, acephate may rapidly degrade to methamidophos (Bull 1979).

Acetylated mexacarbate: see mexacarbate (acylated)

Acetylated Zectran: see mexacarbate (acylated)

ACP M-728: see chloramben

Acraldehyde: see acrolein

## ACROLEIN

**Alternative Names:** Aqualin, acrylaldehyde, acrylic aldehyde, acraldehyde, Magnacide H

**Chemical Name:** 2-Propenal (CAS 107-02-8)

**Primary Use:** Aquatic herbicide, fungicide

**Sample Purity:** 92%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-5	9.11 (6.32-13.1)

**Signs of Intoxication:** Regurgitation, reluctance to leave the swimming pond, slow responses, ataxia, geotaxia, imbalance, phonation, wing tremors, running and falling, asthenia, myasthenia, and withdrawal. Treatment levels as low as 3.33 mg/kg produced signs. Signs appeared as soon as 10 min and persisted up to 36 days after treatment. Mortalities occurred as soon as 32 min; however, several mortalities occurred several days after treatment.

Acrylaldehyde: see acrolein

Acrylic aldehyde: see acrolein

Acti-Aid: see cycloheximide

Actidione: see cycloheximide

Actispray: see cycloheximide

AG-500: see Diazinon

Agridip: see coumaphos

Agrisil: see trichloronat

Agritol: see *Bacillus thuringiensis* (Berliner)

Agritox: see trichloronat

Agrosan: see PMA

Agrotect: see 2,4-D

Agrothion: see fenitrothion

## AGROX

**Alternative Names:** None found

**Chemical Name:** Formulation containing phenyl ureato-*N(N)*mercury and inert carrier materials (CAS 2279-64-3)

**Primary Use:** Fungicide, seed disinfectant

**Sample Purity:** 6.70% (4.0% mercury)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	M	3-4	>2,000

**Signs of Intoxication:** Only occasional mild ataxia between 1st and 4th day following treatment. Profuse regurgitation occurred within 5-10 min of single oral administration.

## AIRKEM A-33 DRY

**Alternative Names:** A-33; for active ingredient: benzalkonium chloride, BTC, Roccal, Zephiran chloride

**Chemical Name:** Mixture of n-alkyl (93% C<sub>14</sub>, 4% C<sub>12</sub>, 3% C<sub>16</sub>) dimethyl benzyl ammonium chloride, tetrasodium ethylene diamine tetraacetate, and essential oils

**Primary Use:** Industrial detergent—bactericide, fungicide, disinfectant, and odor counteractant

**Sample Purity:** 14% Active

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	7	M	3-4	>2,262

**Signs of Intoxication:** Profuse regurgitation, polydipsia, hypoactivity, wings crossed over back, and ataxia. Treatment levels as low as 200 mg/kg produced signs, but no mortalities occurred at levels up to 2,262 mg/kg. Signs appeared as soon as 13 min after treatment and persisted up to 1 week.

## AKTON

**Alternative Names:** Axiom, ENT 27102, SD 9098

**Chemical Name:** Phosphorothioic acid, *O*-[2-chloro-1-(2,5-dichlorophenyl)ethenyl] *O,O*-diethyl ester (CAS 1757-18-2)

**Primary Use:** Insecticide

**Sample Purity:** 98.5%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	23	M	3-5	>2,000

**Signs of Intoxication:** Goose-stepping ataxia, walking on toes, tails pointed sharply upward, wing drop or wings crossed high over back, dyspnea, falling. Signs were noticeable by 15-30 min but not at 24 h. Treatment levels as low as 10 mg/kg produced definite signs; levels greater than 900 mg/kg produced moderate weight losses.

**Note:** Gross necropsies showed petechiation on heart surface, gastrointestinal hyperemia, and congestion of pancreas in some sacrificed birds.

AL-50: see Dicloran

## ALACHLOR

**Alternative Names:** CP 50144, Lasso, Lazo

**Chemical Name:** 2-Chloro-*N*-(2,6-diethylphenyl)-*N*-(methoxymethyl)-acetamide (CAS 15972-60-8)

**Primary Use:** Preemergence herbicide

**Sample Purity:** 88.5%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3	>2,000

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, imbalance, slowness, and tenseness. Signs appeared as soon as 25 min and persisted up to 2 days after treatment.

## ALDICARB

**Alternative Names:** Ambush, ENT 27093, OMS-771, Temik, UC 21149, WHO OMS-771

**Chemical Name:** 2-Methyl-2(methylthio)propanal *O*-[(methylamino) carbonyl]oxime (CAS 116-06-3)

**Primary Use:** Insecticide, acaricide, nematocide

**Sample Purity:** 95%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	3.40 (2.70-4.28)
California quail	20	M	10 <sup>a</sup>	2.58 (1.96-3.40)
California quail	15	F	10 <sup>a</sup>	4.67 (3.32-6.56)
Pheasant	12	F	3-4	5.34 (3.85-7.40)

<sup>a</sup>These birds were in the early stages of reproductive gonadal development.

**Signs of Intoxication:** Signs observed in one or more of the above species after acute oral administration of aldicarb included ataxia, imbalance, shakiness, wing-drop, wings spread, running and falling, regurgitation, sitting, hypo-reactivity, tremors, convulsions, tetany, ptosis, foamy salivation, immobility, and opisthotonos. Signs were produced in mallards by treatment levels as low as 0.45 mg/kg and in pheasants by levels as low as 2.00 mg/kg. Signs appeared as soon as 3 min and mortalities usually occurred between 15 and 40 min after treatment.

**Other Toxicity Data:** The calculated percutaneous LD50 for eight 1-year-old mallard drakes after a 24-h dermal foot exposure was 60.0 (CL 30.0-120) mg/kg. Signs observed after percutaneous treatment, in addition to several of those listed above, included slowness, tenseness, nasal exudate, penile extrusion, and terminal wing-beat convulsions. Mortalities usually occurred between 15 and 85 min after the initiation of percutaneous treatment, and signs persisted up to 2 days after the end of treatment. Mild dermal irritation occurred after percutaneous exposure to aldicarb. When the percutaneous LD50 is compared with the acute oral LD50, aldicarb appears to have a relatively low degree of dermal hazard in mallards.

The 30-day EMLD for mallards ( $n = 12$ ) is 1.20 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $3.4/1.2 = 2.8$ , indicating little cumulative action for aldicarb in mallards.

**Notes:** For data on the effects of age on the sensitivity of mallards to aldicarb, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

## ALDRIN

**Alternative Names:** Aldrite, Aldrosol, Compound 118, ENT 15949, HHDN, Octalene, Seedrin

**Chemical Name:** 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-dimethanonaphthalene (CAS 309-00-2)

**Primary Use:** Insecticide

**Sample Purity:** 95%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Fulvous whistling-duck	8	M	3-6	29.2 [22.2-38.4]
Mallard	16	F	3-4	520 (229-1,210)
Bobwhite	12	F	3-4	6.59 [5.00-8.66]
Pheasant	12	F	3-4	16.8 [14.1-20.0]
Mule deer	4	M	12-18	18.8-37.5

**Signs of Intoxication:** Ataxia, circling, low carriage, nictitating membrane closed for long periods, fluffed feathers, tremors, phonation, violent wing-beat convulsions, seizures, opisthotonos. Deaths occurred 30 min to 10 days after treatment. Weight losses occurred among survivors of the higher treatment levels. Signs observed in deer included several of those listed above, as well as tenseness, fasciculation, eyes opened wider than normal, salivation, falling, sternal recumbancy, thrashing of the head, and violent convulsions.

**Other Toxicity Data:** The 30-day EMLD for mallards 17 to 23 weeks old ( $n = 12$ ) is about 5.0 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $520/5 = 104$ , indicating an extremely high degree of cumulative action, even for an organochlorine compound.

Rice seed treated with 2.5 g/kg of 44.2% aldrin and 1.56 g/kg of a 3.51% active formulation of Ceresan L was administered to adult fulvous whistling-ducks ( $n = 8$ ). The calculated acute oral LD50 for the treated seed is 7.94 (CL 5.83-10.8) g/kg, or about 4 g of dry rice per duck (about 166 seeds). This amount is much less than such ducks would ingest in one feeding. The LD50 amount is equivalent to 8.77 mg/kg aldrin and 0.279 mg/kg Ceresan L—thus most of the toxic action could apparently be attributed to aldrin.

A 2:1 mixture of aldrin (95%) and Ceresan M (7.7% active) was administered to gray partridge cocks ( $n = 12$ ), 9 to 20 months old. The calculated acute oral LD50 is 33.1 [26.2-41.6] mg/kg; this dosage is 22.1 mg/kg aldrin and 11.0 mg/kg Ceresan M. Aldrin apparently con-

tributed predominantly to the toxicity of this mixture, since the LD50 for Ceresan M has been determined to be 550 mg/kg.

**Note:** Gross necropsies revealed liver adhesions to the parietal peritoneum in some birds.

Aldrite: see aldrin

Aldrosol: see aldrin

Alfa-tox: see Diazinon

Aliphatic amine, primary: see Armeen OD

Alkron: see parathion

Alkylbenzenes: see Panasol AN-2

Alleron: see parathion

## ALLETHRIN

**Alternative Names:** Allyl homologue of cinerin I, ENT 17510, pallethrine, Pynamin

**Chemical Name:** 2,2-Dimethyl-3-(2-methyl-1-propenyl)-cyclopropanecarboxylic acid, 2-methyl-4-oxo-3-(2-propenyl)-2-cyclopenten-1-yl ester (CAS 584-79-2)

**Primary Use:** Insecticide

**Sample Purity:** 90%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	M	3-4	>2,000

**Signs of Intoxication:** None.

**Note:** Allethrin is the allyl homologue of cinerin I, which is one of the constituents of pyrethrum, the oldest known insecticide.

Allisan: see dicloran

Alltex: see toxaphene

Allyl homologue of cinerin I: see allethrin

Altosid: see methoprene

Alvit: see dieldrin

Ambush: see aldicarb

Amchem 66-206: see chloramben

American Cyanamid 3422: see parathion

American Cyanamid 3911: see phorate

American Cyanamid 18133: see thionazin

American Cyanamid 38023: see famphur

American Cyanamid 43064: see Cyolane

Amerol: see amitrole

Amiben: see chloramben

Amine, primary aliphatic: see Armeen OD



## AMINOCARB

**Alternative Names:** A 363, BAY 44646, ENT 25784, Matacil

**Chemical Name:** 4-(Dimethylamino)-3-methyl-phenol, methylcarbamate(ester) (CAS 2032-59-9)

**Primary Use:** Insecticide

**Sample Purity:** 97%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	8	22.5 (17.8-28.3)
Pheasant	12	M	3-4	42.4 (33.7-53.4)
Mule deer	3	M	13-15	7.50-15.0

**Signs of Intoxication:** Ataxia, tenseness, lacrimation, salivation, tachypnea, feathers fluffed or drawn tightly against body, piloerection, diarrhea, dyspnea, tracheal congestion, wing-beat convulsions or opisthotonos. Mortality among birds usually occurred in the first hour after treatment.

## 6-AMINONICOTINAMIDE

**Alternative Names:** DID 764, DRC-3492

**Chemical Name:** 6-Aminonicotinamide

**Primary Use:** Experimental rodenticide

**Sample Purity:** 100%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	7.95 (6.35-10.1)

**Signs of Intoxication:** Ataxia, imbalance, ptosis, falling, and tremors. Signs appeared as soon as 30 min and mortalities usually occurred 1-2 days after treatment; however, one drake died 12 days after treatment. Signs persisted up to 3 or 4 weeks after treatment. Weight losses in the survivors 30 days after treatment were substantial.

Aminotriazole: see amitrole

Amino Triazole: see amitrole

## AMITROLE

**Alternative Names:** Amerol; aminotriazole; Amino Triazole; Amizol; 3,A-T; ATA; Cytrol; ENT 25445; Herbizole; Weedazol

**Chemical Name:** 1,2,4-Triazol-3 amine (CAS 61-82-5)

**Primary Use:** Herbicide

**Sample Purity:** 90%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	M	3-4	>2,000

**Signs of Intoxication:** Ataxia, weakness, slight wing-drop during the first 3 days after single oral administration.

Amizol: see amitrole

Amoben: see chloramben

Amoxone: see 2,4-D

## ANILAZINE

**Alternative Names:** B-622, Direz, Dyrene, Kemate, Triasyn

**Chemical Name:** 4,6-Dichloro-N-(2-chlorophenyl)-1,3,5-triazin-2-amine (CAS 101-05-3)

**Primary Use:** Fungicide

**Sample Purity:** 95.5%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3-4	>2,000

**Signs of Intoxication:** Regurgitation, ataxia, weakness, falling when walking. The weakness and ataxia persisted from the 1st through the 10th day.

Anofex: see DDT

Anthon: see trichlorfon

4-AP: see Avitrol 200

Aphamite: see parathion

Aphoxide: see tepa

APO: see tepa

Appex: see tetrachlorvinphos  
 Aprocarb: see Baygon  
 Aquacide: see diquat dibromide  
 Aqua-Kleen: see 2,4-D  
 Aqualin: see acrolein  
 Aquathol: see endothall  
 Aqua-Vex: see silvex  
 Arasan: see thiram  
 Arkotine: see DDT

## ARMEEN OD

**Alternative Names:** None found

**Chemical Name:** Primary aliphatic amine of high molecular weight

**Primary Use:** Mosquito control agent (pre-imago stage), wetting and dispersing adjuvant, ingredient in 492 Mosquito Larvicide Oil

**Sample Purity:** Undetermined

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	12	>2,000

**Signs of Intoxication:** Slowness, ataxia, asthenia, and sitting. Signs appeared on the 2nd day after treatment and remission had occurred by the 5th day.

Aroclor: see polychlorinated biphenyls  
 Aromatic solvent: see Panasol AN-2  
 Arprocarb: see Baygon  
 Arsan: see Silvisar-510  
 Aspon: see chlordane  
 Aspor: see zineb  
 Asuntol: see coumaphos  
 3,A-T: see amitrole  
 ATA: see amitrole  
 Atlas "A": see sodium arsenite  
 Atratul: see atrazine

## ATRAZINE

**Alternative Names:** AAtrex, Atratul, ENT 28244, G-30027, Gesaprim, Primatol A

**Chemical Name:** 6-Chloro-*N*-ethyl-*N'*-(1-methylethyl)-1,3,5-triazine-2,4-diamine (CAS 1912-24-9)

**Primary Use:** Herbicide

**Sample Purity:** 80% Wettable powder

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	6	>2,000
Pheasant	3	M	3	>2,000

**Signs of Intoxication:** Weakness, hyperexcitability, ataxia, tremors; weight loss occurred in mallards. Signs appeared in mallards 1 h after treatment and persisted up to 11 days. In pheasants, remission had occurred by 5 days after treatment.

Avicol: see PCNB

## AVITROL 200

**Alternative Name:** 4-AP

**Chemical Name:** 4-Pyridineamine (CAS 504-24-5)

**Primary Use:** Avian chemical frightening agent

**Sample Purity:** 95%<sup>1</sup> and 99.9%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	12	M	3-4	4.36 (3.36-5.66)
Mallard <sup>2</sup>	12	M	3-4	5.19 (4.00-6.73)

**Signs of Intoxication:** Polydipsia, ataxia, stumbling, running and falling, high stance, wing-drop or wings crossed high over back, wing shivers, tremors, rapid nictitating membrane flicker, circling, dyspnea, loss of righting reflex, convulsions and wing-beat convulsions, and tetany. Signs appeared as soon as 10 min and mortalities occurred between 21 and 125 min after treatment. Some survivors displayed signs up to 2 weeks after treatment.

Axiom: see Akton

Azide: see potassium azide

## AZINPHOS-METHYL

**Alternative Names:** 17/147, BAY 9027, BAY 17147, Carfene, Cotnion-Methyl, DBD, ENT 23233, Gusathion, Gusathion M, Guthion, Methyl Guthion, metiltriatioz, R-1582

**Chemical Name:** Phosphorodithioic acid, *O,O*-dimethyl *S*-

[(4-oxo-1,2,3-benzotriazine-3(4*H*)-yl)methyl] ester (CAS 86-50-0)

milligram of product contains 16,000 International Units of activity

**Primary Use:** Insecticide

**Primary Use:** Insecticide

**Sample Purity:** 90%<sup>1</sup> and 240 g/L formulation<sup>2</sup>

**Sample Purity:** 50 × 10<sup>9</sup> Spores per gram

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	12	M	3-4	136 (97.8-188)
Bobwhite <sup>1</sup>	4	M	24	60.0-120
Pheasant <sup>1</sup>	12	M	3-5	74.9 (59.5-94.3)
Pheasant <sup>2</sup>	8	M	3-4	283 (200-400)
Chukar <sup>1</sup>	12	M	3-4	84.2 (53.0-134)
Mule deer <sup>1</sup>	2	M	15-16	32.0-64.0

**Signs of Intoxication:** Regurgitation, goose-stepping ataxia, withdrawal, lethargy, salivation, tremors, hypoactivity, anorexia, wing-drop, wing spasms, tenesmus, diarrhea, myasthenia, dyspnea, prostration, terminal wing-beat convulsions or opisthotonos. Signs appeared as soon as 15 min and mortalities usually occurred between 1 and 22 h after treatment; one mortality, however, occurred 3 days after treatment. Signs persisted up to 1 week.

**Other Toxicity Data:** The 30-day EMLD of the 90% sample for mallards (n = 18) appears to lie between 4.38 and 8.75 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $136 / \sim 6.2 = \sim 22$ , indicating a relatively high degree of cumulative action for azinphos-methyl in mallards.

**Note:** Based on the amount of active chemical present, the toxicities of the technical grade and the 240 g/L formulation of azinphos-methyl are nearly identical for pheasants.

Azodrin: see monocrotophos

B-622: see anilazine

B-1776: see DEF

### **BACILLUS THURINGIENSIS (Berliner)**

**Alternative Names:** Agritol, Bactospeine WP, Bakthane, Biotrol, Biotrol BTB, BTV, Dipel, Larvatrol, Thuricide, Tribactur

**Chemical Name:** A bacterial toxin in parasporal bodies of *Bacillus thuringiensis* (Berliner), the pure culture containing 25 billion viable spores per gram of product; each

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	3-4	> 2,000

**Signs of Intoxication:** No noticeable effects on appearance, behavior, or body weight at treatment levels up to 2,000 mg/kg.

Bactospeine WP: see *Bacillus thuringiensis* (Berliner)

Bakthane: see *Bacillus thuringiensis* (Berliner)

### **BALAN**

**Alternative Names:** Balfin, Banafine, benefin (a close analog of trifluralin), Benfluralin, Bethrodine, Binnell, Blulan, Bonalan, Carpidor, EL-110, Quilan

**Chemical Name:** *N*-butyl-*N*-ethyl-2,6-dinitro-4-(tri-fluoro-methyl)-benzenamine (CAS 1861-40-1)

**Primary Use:** Herbicide

**Sample Purity:** 97.2%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	3-4	> 2,000

**Signs of Intoxication:** Ataxia, weakness, falling. Regurgitation also occurred in the first 2 h after treatment. The other signs occurred 2 to 14 days after treatment. Although no birds died, considerable weight losses had occurred by the end of the 14-day observation period.

Balfin: see Balan

Banafine: see Balan

Barbasco: see rotenone

Basanite: see dinoseb

Basudin: see Diazinon

BAY 13/59: see trichlorfon

BAY 5505: see ethamphenphion

BAY 8173: see demeton

BAY 9010: see Baygon

BAY 9027: see azinphos-methyl



BAY 10756: see demeton  
 BAY 17147: see azinphos-methyl  
 BAY 19639: see disulfoton  
 BAY 21097: see oxydemetonmethyl  
 BAY 21116: see oxydemetonmethyl  
 BAY 21199: see coumaphos  
 BAY 25141: see fensulfothion  
 BAY 25648: see clonitralid  
 BAY 29493: see fenthion  
 BAY 37289: see trichloronat  
 BAY 37344: see methiocarb  
 BAY 38819: see Gophacide  
 BAY 39007: see Baygon  
 BAY 41831: see fenitrothion  
 BAY 44646: see aminocarb  
 BAY 68138: see Nemacur  
 BAY 69469: see ethamphenphion  
 BAY 71628: see methamidophos  
 BAY 77488: see phoxim  
 BAY 78418: see edifenphos

### BAY 93820

**Alternative Name:** None found

**Chemical Name:** 2-[(Aminomethoxyphosphinothioyl)oxy] benzoic acid, 1-methylethyl ester (CAS 24353-61-5)

**Primary Use:** Insecticide

**Sample Purity:** 89%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3	1.19 (0.858-1.65)
Pheasant	12	F	3-4	3.36 [2.83-4.00]

**Signs of Intoxication:** Stumbling, falling, immobility, and terminal wing-beat convulsions. Signs appeared as soon as 15 min and mortalities usually occurred between 30 and 90 min after treatment.

### BAY 98663

**Alternative Name:** DRC-4575

**Chemical Name:** Benzenesulfonic acid, [(3-amino-2,4,6-trichloro phenyl)methylene]hydrazide

**Primary Use:** Experimental rodenticide

**Sample Purity:** Technical grade

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	12	353 (196-637)

**Signs of Intoxication:** Regurgitation, ataxia, sitting, wing-drop, fear-threat displays, ataraxia, fluffed feathers, using wings for pedestrian locomotion, slowness, falling, asthenia, dyspnea, spasms, emprosthotonos-type spasms, ptosis, lacrimation, clonic convulsions, bradypnea, immobility, and emprosthotonos. Signs appeared as soon as 1 h, and mortalities occurred up to 22 h after treatment.

BAY E-605: see parathion

Bayer 73: see clonitralid

Bayer E-601: see methyl parathion

### BAYGON

**Alternative Names:** aprocarb, arprocarb, BAY 9010, BAY 39007, Blattanex, ENT 25671, OMS-33, propoxur, Sendran, Suncide, Tendex, Unden

**Chemical Name:** 2-(1-Methylethoxy)phenol methylcarbamate (CAS 114-26-1)

**Primary Use:** Insecticide

**Sample Purity:** 97%<sup>1</sup> and 98%<sup>2</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	8	M	—	595 [500-707]
Canada goose <sup>1</sup>	20	M,F	—	5.95 (4.89-7.24)
Mallard <sup>2</sup>	12	F	4-6	11.9 [10.0-14.1]
Mallard <sup>2</sup>	12	F	4-6	9.44 (7.49-11.9)
Sharp-tailed grouse <sup>1</sup>	12	F	12-48	120 [84.8-170]
California quail <sup>1</sup>	12	F	3-7	25.9 (14.9-45.0)
Japanese quail <sup>1</sup>	8	F	20	28.3 [20.0-40.0]
Pheasant <sup>2</sup>	8	M	3-5	20.0 (10.0-40.0)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Chukar <sup>2</sup>	12	M,F	4-6	23.8 [20.0-28.3]
Sandhill crane <sup>1</sup>	14	M,F	—	> 60.0
Rock dove <sup>1</sup>	20	M,F	—	60.4 (38.0-96.1)
Mourning dove <sup>1</sup>	8	M,F	—	4.20 [3.54-5.00]
House sparrow <sup>1</sup>	12	F	—	12.8 (9.26-17.8)
House finch <sup>1</sup>	12	M,F	A	3.55 (2.25-5.69)
Dark-eyed junco <sup>1</sup>	8	M	A	4.76 [4.00-5.70]
Mule deer <sup>1</sup>	2	F	11	100-350
Domestic goat <sup>1</sup>	4	M	12	> 800

<sup>1</sup>Except as noted.

**Signs of Intoxication:** Nutation, lacrimation, ataxia, miosis, lethargy, asynergy, imbalance, salivation, hypoactivity, goose-stepping ataxia, falling, tachypnea, dyspnea, fasciculation, ptosis, diarrhea, immobility, tremors, convulsions, wings spread in tetany, and opisthotonos. Depending on the species, signs appeared as soon as 5 min, mortalities occurred between 5 and 45 min or overnight, and remission occurred from 90 min to several days after treatment.

**Other Toxicity Data:** The 30-day EMLD for pheasants ( $n = 6$ ) is greater than 6.0 mg/kg per day for both sexes. For mallards ( $n = 12$ ) the 30-day EMLD is 6.0 mg/kg per day. The resulting cumulative toxicity index for mallards is  $11.9/6.0 = 2.0$ , indicating little or no cumulative action. Mallard and pheasant survivors of the treatment level at 6.0 mg/kg per day showed normal fertility, and their eggs hatched at the same rate as those of controls.

**Notes:** For a discussion of the comparative toxicity of Baygon, see Tucker and Haegele (1971).

For effects of age on the sensitivity of mallards to Baygon, see Hudson et al. (1972).

BAY H-321: see methiocarb

BAY L-13/59: see trichlorfon

Bayluscide: see clonitralid

Baymix: see coumaphos

Baytex: see fenthion

Baythion: see phoxim

BBC 12: see Nemagon

BDH 10131: see mestranol

Belt: see chlordane

Benefin: see Balan

Benfluralin: see Balan

Benzabor: see TBA

Benzac: see TBA

Benzac 1281: see TBA

Benzahex: see benzene hexachloride

Benzalkonium chloride: see Airkem A-33 Dry

## BENZENE HEXACHLORIDE

**Alternative Names:** 666, Benzahex, Benzex, BHC, DBH, Dol, Dolmix, ENT 8601, FBHC, HCCH, HCH, hexachlor, hexachloran, hexachlorocyclohexane, Hexafor, Hexyclan, Isotox, Lintox, Soprocide

**Chemical Name:** 1,2,3,4,5,6-Hexachlorocyclohexane (CAS 608-73-1)

**Primary Use:** Insecticide

**Sample Purity:** 88 to 90%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	15	F	3	≥ 1,414
Pheasant	12	F	3-4	118 (93.6-148)

**Signs of Intoxication:** Polydipsia, regurgitation, hyperexcitability, ataxia, ptosis, fluffed feathers, hyporeactivity, imbalance, slowness, stumbling, phonation, tenseness, shakiness, jitteriness, sitting, ataraxia, withdrawal, tremors, masseter tenseness, spasms, aggressiveness, fear-threat displays, backing, circling, asthenia, tongue protruding sideways from the bill (mallards), and immobility. Prolonged signs included falling, sitting, using wings for pedestrian locomotion, ataraxia, and withdrawal. Signs appeared as soon as 30 min in mallards and 2 h in pheasants, and mortalities usually occurred between 2 and 5 days in mallards and between 4 and 9 days after treatment in pheasants. Remission took up to 20 days.

**Note:** Emaciation, enlarged livers, and small spleens were observed on necropsy of mortalities and sacrificed survivors.

Benzex: see benzene hexachloride

Benzofurolin: see resmethrin

Bethrodine: see Balan

BHC: see benzene hexachloride

Bidrin: see dicrotophos

Binnell: see Balan

BIO-5462: see endosulfan

Bioethanomethrin: see RU 11-679

Bioresmethrin: see resmethrin

Biothion: see temephos  
 Biotrol: see *Bacillus thuringiensis* (Berliner)  
 Biotrol BTB: see *Bacillus thuringiensis* (Berliner)  
 Bird clean-up agent: see Shell Sol 70  
 Birlane: see chlorfenvinphos  
 Black Leaf 40: see nicotine sulfate  
 Bladan: see parathion, TEPP  
 Bladex: see cyanazine  
 Blattanex: see Baygon  
 Blulan: see Balan  
 Bo-Ana: see famphur  
 Bonalan: see Balan

## BORDEAUX MIXTURE

**Alternative Names:** None found

**Chemical Name:** Mixture of copper sulfate solution and suspension of calcium hydroxide

**Primary Use:** Fungicide

**Sample Purity:** 12.75% as copper

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3-4	> 2,000
Pheasant	3	M	3	> 2,000

**Signs of Intoxication:** Only mild ataxia and wings crossed high over back from 30 min to 1 day after treatment.

Borolin: see picloram  
 Botran: see dicloran  
 Botrilex: see PCNB  
 Bovinox: see trichlorfon  
 Brassicol: see PCNB  
 Bromchlophos: see naled  
 Bromex: see naled

## BROMOPROPYLATE

**Alternative Names:** Acarol, ENT 27552, GS-19851, Neoron

**Chemical Name:** 4-Bromo- $\alpha$ -(4-bromophenyl)- $\alpha$ -hydroxy benzeneacetic acid, 1-methylethyl ester (CAS 18181-80-1)

**Primary Use:** Acaricide

**Sample Purity:** 97.5%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	3	> 2,000

**Signs of Intoxication:** Tachypnea, ataxia, imbalance, and hyperexcitability. Signs appeared as soon as 15 min and generally persisted for a few hours after treatment.

Brush Killer: see 2,4,5-T

Brush-Rhap: see 2,4,5-T

BTC: see Airkem A-33 Dry

BTV: see *Bacillus thuringiensis* (Berliner)

## BUFENCARB

**Alternative Names:** Bux, ENT 27127, metalkamate, Ortho 5353, RE-5353

**Chemical Name:** 3-(1-Ethylpropyl)phenylmethylcarbamate and 3-(1-methylbutyl)phenyl methylcarbamate (CAS 8065-36-9)

**Primary Use:** Insecticide

**Sample Purity:** 68.9%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	10.5 [8.84-12.5]
Pheasant	12	M	3	88.0 (61.6-126)

**Signs of Intoxication:** Ataxia, dyspnea, wing-drop, tremors, regurgitation, ptosis, and wing-beat convulsions or tetany. Signs appeared as soon as 15 min and mortalities usually occurred between 20 min and 1 h after treatment.

## BUTYLATE

**Alternative Names:** R-1910, Sutan

**Chemical Name:** Bis(2-methylpropyl)-carbamothioic acid, S-ethyl ester (CAS 2008-41-5)

**Primary Use:** Herbicide

**Sample Purity:** 98%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	3	>2,000

**Signs of Intoxication:** Wide stance, high carriage, ataxia, imbalance, slowness, stumbling, regurgitation, and goose-stepping ataxia. Signs appeared as soon as 10 min and persisted up to 9 days after treatment.

Bux: see bufencarb

C-12: see C-12 trichlorfon

**C-12 TRICHLORFON**

**Alternative Names:** C-12; Dylox derivative; trichlorfon, C-12 derivative

**Chemical Name:** Phosphonic acid, (2,2,2-trichloro-1 *N*-do-decanoxyethyl) dimethyl ester

**Primary Use:** Experimental insecticide

**Sample Purity:** >99%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	18	M	3	566 (152-2,107)
Bobwhite	12	M	7	187 (149-236)
California quail	12	F	5-7	96.4 (55.4-168)
Pheasant	24	M	3-5	1,599 (1,210-2,114)

**Signs of Intoxication:** Signs observed in one or more species included polydipsia, regurgitation, high carriage, goose-stepping ataxia, imbalance, ataxia, geotaxia, tremors, falling, sitting, using wings to aid pedestrian locomotion, withdrawal, wing-drop, wings spread, hyporeactivity, ataraxia, foamy salivation, dyspnea, lethargy, ptosis, nutation, bradypnea, convulsions, immobility, loss of righting reflex, and terminal wing-beat convulsions and tetany. Signs generally appeared as soon as 10 min after treatment. Remission took up to 5 or 6 days for several survivors. Mortalities occurred according to 2 patterns—several mortalities occurred rapidly (between 15 min and 3 h); however, many mortalities occurred from several hours to several days after treatment and some as long as 7 and 8 days after treatment.

**Notes:** C-12 trichlorfon differs from trichlorfon by the addition of a long carbon chain in place of the hydroxyethyl group. Four birds of the same species and sex and approximately the same ages were tested with both trichlorfon and C-12 trichlorfon. The acute oral LD50 for C-12 trichlorfon is 15.4, 16.7, 8.3, and 1.6 times the acute oral LD50 for trichlorfon to mallards, pheasants, bobwhites, and California quail, respectively. Thus, the addition of the carbon chain to trichlorfon substantially decreased the toxicity of that compound to mallards, pheasants, and bobwhites, and appeared to decrease the toxicity of the compound to California quail. See trichlorfon for comparative data.

C-570: see phosphamidon

C-1983: see chloroxuron

C-2059: see fluometuron

**C-2307**

**Alternative Name:** ENT 27625

**Chemical Name:** (*E*) phosphoric acid, 3-(methoxymethylamino)-1-methyl-3-oxo-1-propenyl dimethyl ester (CAS 25601-84-7)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 75%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	3.86 (2.97-5.00)
Pheasant	12	M	3-4	2.37 (1.83-3.08)

**Signs of Intoxication:** Goose-stepping ataxia, regurgitation, polydipsia, miosis, lacrimation, salivation, ataraxia, dyspnea, tremors, wing-drop, wing-beat convulsions, and opisthotonos. Signs appeared in less than 10 min and mortalities usually occurred between 15 and 57 min after treatment.

C-6989: see fluorodifen

Calcium hydroxide: see Bordeaux Mixture

Camphchlor: see toxaphene

**CAPSULE WALL MATERIAL**

**Alternative Names:** None found

**Chemical Name:** Poly-amide compound

**Primary Use:** Encapsulating material for an encapsulated formulation of methyl parathion

**Sample Purity:** Technical grade

Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	12	>2,000

**Signs of Intoxication:** Ataxia and shakiness were observed on the day of treatment.

### CAPTAN

**Alternative Names:** Captane, ENT 26538, Merpan, Orthocide, Orthocide 406, SR 406, Vancide 95RE, Vondcaptan

**Chemical Name:** 3a,4,7,7a-Tetrahydro-2-[(trichloromethyl)thio]-1*H*-isoindole-1,3(2*H*)-dione (CAS 133-06-2)

**Primary Use:** Fungicide

**Sample Purity:** 91%

Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3-4	>2,000

**Signs of Intoxication:** Ataxia, tremors. Remission took up to 1 week.

Captane: see captan

### CARBARYL

**Alternative Names:** Carin,<sup>5</sup> ENT 23969, Hexavin, Karbaspray, Ravyon, Septene, Sevin, Sevin-4-Oil,<sup>4</sup> Tricarnam, UC 7744

**Chemical Name:** 1-Naphthalenol methylcarbamate (CAS 63-25-2)

**Primary Use:** Insecticide

**Sample Purity:** 50%,<sup>1</sup> 85%,<sup>2</sup> 95%,<sup>3</sup> 480 g/L formulation,<sup>4</sup> 240 g/L formulation,<sup>5</sup> and 98%<sup>6</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	3	M	—	>4,000
Canada goose <sup>1</sup>	12	M,F	—	1,790 (1,480-2,180)
Mallard <sup>2</sup>	4	F	3	>2,564
Sharp-tailed grouse <sup>2</sup>	10	M,F	—	<1,000
California quail (st) <sup>4</sup>	7	M	10 <sup>a</sup>	>2,000
California quail (st) <sup>1</sup>	4	M	10 <sup>a</sup>	>2,000
Japanese quail <sup>2</sup>	24	M	2	2,290 (1,740-3,020)
Pheasant <sup>1</sup>	3	M	3-4	>2,000
Pheasant (st) <sup>4</sup>	8	F	3-4	707 [500-1,000]
Chukar <sup>6</sup>	12	M,F	4	1,888 (1,498-2,378)
Rock dove <sup>2</sup>	32	M,F	—	1,000-3,000
Mule deer <sup>1</sup>	2	F	11	200-400

<sup>a</sup>These birds were in the early stages of reproductive gonadal development.

**Signs of Intoxication:** Signs observed in one or more species included inactivity, ataxia, regurgitation, weakness, fluffed feathers, salivation, slowness, lethargy, tachypnea, tremors, ataxia, tetany, paralysis, coma, and convulsions. Signs appeared as soon as 25 min after treatment. Mortalities occurred from 26 min to 3 days after treatment. Remission typically took up to 1 week, but in one species required up to 12 days.

**Other Toxicity Data:** The 30-day EMLD for the 85% formulation in mallards of both sexes ( $n = 12$ ) is about 125 mg/kg per day. Survivors of this 30-day EMLD test reproduced normally. The 30-day EMLD for the 480 g/L formulation in pheasants of both sexes ( $n = 12$ ) appears to be greater than 350 mg/kg per day. The resulting cumulative toxicity index is  $707 / >350 = <2$ , indicating little or no cumulative action for Carbaryl in ring-necked pheasants.

**Notes:** Necropsies of the sacrificed survivors of the 30-day EMLD test in pheasants (480 g/L formulation) revealed several small spleens. When compared with their controls ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min} = 1.331$ ,  $s = 0.029$ , range = 1.299-1.366), the pheasants that were sacrificed after receiving the dosage of 175 mg/kg per day for 30 days showed a brain cholinesterase inhibition of 1% ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min} = 1.318$ ,  $s = 0.070$ , range = 1.234-1.401). When compared with their controls ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min}$

= 1.097,  $s = 0.068$ , range = 0.996–1.159), the pheasants that had received the dosage of 350 mg/kg per day for 30 days showed no brain cholinesterase inhibition ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.261$ ,  $s = 0.067$ , range = 1.142–1.327).

For information on the eggshell-thinning effects of carbaryl, see Haegele and Tucker (1974).

Carbicon: see dicrotophos

Carbofos: see malathion

## CARBOFURAN

**Alternative Names:** Curaterr, D 1221, ENT 27164, FMC-10242, Furadan, NIA 10242

**Chemical Name:** 2,3-Dihydro-2,2-dimethyl-7-benzofuranol methylcarbamate (CAS 1563-66-2)

**Primary Use:** Insecticide, miticide, nematocide

**Sample Purity:** 98.8%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Fulvous whistling-duck	8	F	3–6	0.238 [0.200–0.283]
Mallard	20	M	12 <sup>a</sup>	0.480 (0.381–0.604)
Mallard	20	F	12 <sup>b</sup>	0.510 (0.410–0.635)
Mallard	12	F	3–4	0.397 (0.315–0.500)
Bobwhite	12	F	3	5.04 (3.64–6.99)
Pheasant	12	F	3	4.15 (2.38–7.22)

<sup>a</sup>These drakes were either in active breeding condition or had gonads in the early stage of regression.

<sup>b</sup>Most of these hens were in active egg-laying condition.

**Signs of Intoxication:** Ataxia, wings crossed high over back, nutation, diarrhea, phonation, salivation, lacrimation, immobility with wings spread, dyspnea, miosis, terminal wing-beat convulsions or opisthotonos. Signs in survivors persisted up to 7 days. Mortalities occurred as soon as 5 min after treatment.

**Other Toxicity Data:** The 30-day EMLD is 0.2 mg/kg per day for mallards of both sexes ( $n = 12$ ), indicating little or no cumulative toxicity. The 30-day EMLD for pheasants of both sexes ( $n = 12$ ) is 4.2 mg/kg per day. The resulting cumulative toxicity index is  $4.15/4.2 =$

0.99, indicating no cumulative action for carbofuran in pheasants. As little as 2 mg/L carbofuran in the drinking water of fulvous whistling-ducks ( $n = 15$ ) was lethal in 7-day exposures, and 1 mg/L produced signs of intoxication.

**Notes:** Acetylcholinesterase activity measurements were made on the brains of the mortalities and sacrificed survivors of the pheasant EMLD determination. When compared with their controls ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.331$ ,  $s = 0.029$ , range = 1.299–1.366), pheasants that had received 2.10 mg/kg per day for 30 days showed 4.9% inhibition ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.266$ ,  $s = 0.124$ , range = 1.025–1.363). When compared with their controls ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.097$ ,  $s = 0.068$ , range = 0.996–1.159), sacrificed survivors that had received 4.20 mg/kg per day for 30 days showed no inhibition ( $n = 4$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.209$ ,  $s = 0.177$ , range = 1.065–1.446), whereas mortalities from the treatment level at 4.20 mg/kg per day showed 47.6% inhibition ( $n = 2$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.575$ ,  $s = 0.016$ , range = 0.564–0.586).

For data on the effects of age on the sensitivity of mallards to carbofuran, see Hudson et al. (1972).

The 1-year-old mallards reported in the preceding table were in active breeding condition. Thus, it appears that the breeding condition of mallards has little effect on their sensitivity to acute oral administration of carbofuran.

## CARBOPHENOTHION

**Alternative Names:** Dagadip, ENT 23708, Garrathion, R-1303, Stauffer R-1303, Trithion

**Chemical Name:** Phosphorodithioic acid, *S*-[[[(4-chlorophenyl)thio]methyl]*O,O*-diethyl ester (CAS 786-19-6)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 94.65%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	12	M	3–4	121 (95.9–152)
Sharp-tailed grouse	5	M	A	75.6–170
Pheasant	12	M	3–4	269 (194–373)

<sup>a</sup>Except as noted.



**Signs of Intoxication:** Rubber-legged goose-stepping ataxia, wing-drop, ataxia, imbalance, high carriage, using wings to aid pedestrian locomotion, jitteriness, hyperexcitability, falling, nutation, lacrimation, tremors, immobility with wings spread, convulsions, and dyspnea. Signs appeared as soon as 25 min and mortalities usually occurred between 1 and 3 h or overnight after treatment. Signs persisted up to 34 days in pheasants and 14 days in mallards.

Carfene: see azinphos-methyl  
 Carin: see carbaryl  
 Carpidor: see Balan  
 Casoron: see dichlobenil  
 Casoron 133: see dichlobenil  
 CCC: see chlormequat chloride  
 CD-68: see chlordane  
 Cekufon: see trichlorfon  
 Cekusan: see DDVP

## CERESAN L

**Alternative Names:** Granosan (Granosan also refers to Ceresan M, Ceresan M-DB, and Ceresan Red)

**Chemical Name:** (3-Mercapto-1,2-propanediolato-S) methylmercury and (Aceto-O) methylmercury (CAS 8003-37-0)

**Primary Use:** Seed disinfectant, fungicide

**Sample Purity:** 2.89% of the first ingredient and 0.62% of the second (2.25% mercury)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Fulvous whistling-duck (st)	8	M	3-6	1,680 [1,414-2,000]
Mallard (st)	6	M	3	>2,000
Bobwhite (st)	12	M	2-3	1,060 (841-1,330)
Japanese quail (st)	12	F	4	1,498 (1,190-1,888)
Pheasant (st)	12	M	3-4	1,190 [1,000-1,414]

**Signs of Intoxication:** Ataxia, ataraxia, low carriage, hunching up with feathers fluffed, wing-drop, neck pulled in, blinking, dyspnea, immobility. The mallards showed only ataxia for 3 days following treatment. Mortalities in the pheasants, bobwhites, and fulvous whistling-ducks took 1 to 9 days after single oral administration. This compound acts very slowly and complete

recovery from signs among surviving pheasants took up to 21 days.

**Other Toxicity Data:** The 30-day EMLD for mallards of both sexes ( $n = 18$ ) is about 30 mg/kg per day. The resulting cumulative toxicity index is  $>2,000/30 = >66$ , indicating a high degree of cumulative action for Ceresan L in mallards.

**Notes:** Surviving Japanese quail that were sacrificed showed enlarged spleens at gross necropsies.

For data on rice seed treated with Ceresan L, see the "Other Toxicity Data" section for aldrin.

See also the "Notes" section for PMA.

## CERESAN M

**Alternative Names:** Granosan (Granosan also refers to Ceresan L, Ceresan M-DB, and Ceresan Red)

**Chemical Name:** Ethyl (4-methyl-N-phenylbenzenesulfonamidato-N) mercury (CAS-517-16-8)

**Primary Use:** Seed disinfectant, fungicide

**Sample Purity:** 7.7% formulation (3.2% mercury)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	18	F	3	>2,262
Mallard duckling	15	M,F	6-8 d	>2,262
Prairie chicken	12	M,F	—	360 (233-566)
Japanese quail	12	F	2 <sup>b</sup>	668 (530-842)
Pheasant	12	F	12	360 [286-454]
Chukar	12	M,F	4	841 [707-1,000]
Gray partridge	12	F	9-20	550 (385-786)
Rock dove	12	M,F	—	714 (437-1,164)

<sup>a</sup>Except as noted.

<sup>b</sup>Several of these hens were in egg-laying condition.

**Signs of Intoxication:** Mallards displayed regurgitation, polydipsia, salivation, goose-stepping ataxia, and slow reactions, but no deaths. Other species showed blinking, eyes closed, feathers fluffed, neck pulled in (giving the animal the appearance of a "ball"), anorexia, diminished righting reflex, lethargy, diarrhea, ataraxia. Mortalities usually occurred a few days to a few weeks after treatment.

**Other Toxicity Data:** Pheasant survivors of 30-day exposures to repeated oral treatment at 20 mg/kg per day ( $n = 3$ ) produced eggs with slightly less hatchability than did controls treated with empty gelatin capsules.

For toxicity data on a mixture of aldrin with Ceresan M see the section on "Other Toxicity Data" for aldrin.

**Notes:** For information on the effects of Ceresan M on eggshell thickness, see Haegele and Tucker (1974) and Haegele et al. (1974).

See also the "Notes" section for PMA.

## CHE 1843

**Alternative Names:** Preseed, Vancide PA

**Chemical Name:** (*E*)-1,1'-[1,2-Ethenediylbis(sulfonyl)]bispropane (CAS 1113-14-0)

**Primary Use:** Fungicide

**Sample Purity:** 96%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	16	F	4-5	2,000 (246-16,270)
California quail	15	F	12 <sup>a</sup>	1,120 (408-3,076)

<sup>a</sup>One hen had well-developed ovaries; all others had regressed ovaries.

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, imbalance, slowness, myasthenia, asthenia, disorientation, fluffed feathers, phonation, falling, ataraxia, withdrawal, immobility, dyspnea, and tachypnea. Signs appeared as soon as 25 min after treatment. Mortalities occurred as soon as 1 h after treatment, but normally occurred between 12 and 24 h after treatment in mallards and between 5 and 10 days in quail. Remission took up to 30 days.

Chemagro 1776: see DEF

Chemagro B-1776: see DEF

Chemathion: see malathion

Chem Bam: see nabam

Chem-Hoe: see IPC-400

Chemox General: see dinoseb

Chemox P.E.: see dinoseb

Chem Pels C: see sodium arsenite

Chem-sen: see sodium arsenite

Chem Zineb: see zineb

Chipco Thiram 75: see thiram

Chipco Turf Herbicide "D": see 2,4-D

## CHLORAMBEN

**Alternative Names:** ACP M-728, Amchem 66-206, Amiben, Amoben, Vegaben, Vegiben, Verbigen

**Chemical Name:** 3-amino-2,5-dichloro benzoic acid (CAS 133-90-4)

**Primary Use:** Herbicide

**Sample Purity:** 94.86%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Pheasant	3	F	3	>1,500

**Signs of Intoxication:** None.

Chlordan: see chlordane

## CHLORDANE

**Alternative Names:** Aspon, Belt, CD-68, chlordan, Chlor Kil, Corodane, ENT 9932, Kypchlor, Niran, Octachlor, Octa-Klor, Ortho-Klor, Synklor, Topiclor 20, Velsicol 1068

**Chemical Name:** 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1*H*-indene (CAS 57-74-9)

**Primary Use:** Insecticide

**Sample Purity:** 100% Active (60% of named compound and 40% related compounds)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	4-5	1,200 (954-1,510)
California quail	12	M	12	14.1 (9.14-21.7)
Pheasant	4	F	3	24.0-72.0

**Signs of Intoxication:** Hypoactivity, ataxia, imbalance, tail up, use of wings for balance in walking, falling, ataraxia, fear-threat displays, ptosis, phonation, neck muscle twitches, tremors, wing-beat convulsions, and tetany. Signs appeared as soon as 5 min and mortalities occurred



usually between 1 and 8 days after treatment. Remission took up to 4 weeks in some birds.

**Note:** The acute oral LD50 reported above for California quail may be the lowest oral LD50 on record for chlordane in any vertebrate species.

## CHLORDECONE

**Alternative Names:** decachlorotetracyclodecanone, ENT 16391, GC-1189, Kepone

**Chemical Name:** 1,1a,3,3a,4,5,5a,5b,6 Decachlorooctahydro-1,3,4-metheno-2H-cyclobuta[cd]pentalen-2-one (CAS 143-50-0)

**Primary Use:** Insecticide, fungicide

**Sample Purity:** 93.1%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	167 (120-231)

**Signs of Intoxication:** Jerky gait, miosis, intermittent tremors, use of the wings to aid locomotion, immobility, and myasthenia. Signs appeared within 1 h and mortalities occurred usually between 1 and 8 days after treatment. Remission took up to 35 days.

**Other Toxicity Data:** Chlordecone caused no significant eggshell thinning in tests with mallards. For a discussion of this study, see Haegle and Tucker (1974).

## CHLORFENVINPHOS

**Alternative Names:** Birlane, Compound 4072, ENT 24969, Sapecron, SD 7859, Supona

**Chemical Name:** Phosphoric acid, 2-chloro-1-(2,4-dichlorophenyl)ethenyl diethyl ester (CAS 470-90-6)

**Primary Use:** Insecticide

**Sample Purity:** 91%  $\beta$ , 8%  $\alpha$  isomers

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	85.5 (44.5-164)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bobwhite	3	M	12	80.0-160
Pheasant	12	F	3-4	63.5 (45.8-88.1)

**Signs of Intoxication:** Goose-stepping ataxia, wing-drop or wings crossed high over the back, wing shivers, ataxia, ataraxia, fluffed feathers, high stance, nutation, tenseness, falling when walking, lacrimation, dyspnea, tremors, and terminal wing-beat convulsions and tetany. Signs appeared as soon as 3 min and mortalities usually occurred between 40 and 70 min after treatment. Remission took up to 3 weeks. Mallards had generally lost small but abnormal amounts of body weight by the end of the extended observation period.

**Note:** Gross necropsies of sacrificed mallard survivors revealed one of each of the following abnormalities: distended gall bladder, blister on Glisson's capsule on the liver, hemorrhagic ovaries, and enlarged flaccid heart.

Chlorinated biphenyls: see polychlorinated biphenyls

Chlorinated camphene: see toxaphene

Chlor Kil: see chlordane

Chlormequat: see chlormequat chloride

## CHLORMEQUAT CHLORIDE

**Alternative Names:** CCC, chlormequat, chlorocholine chloride, Cycocel

**Chemical Name:** 2-Chloro-*N,N,N*-trimethylethanaminium chloride (CAS 999-81-5)

**Primary Use:** Plant growth regulator

**Sample Purity:** 98%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	265 (211-334)

**Signs of Intoxication:** Ataxia, miosis, falling, sitting, using wings for pedestrian locomotion, tremors, tetanic seizures, immobility, opisthotonos, and frequent spasms. Signs appeared as soon as 5 min and mortalities usually occurred between 15 and 40 min after treatment. Remission took up to 3 days.

Chlorocholine chloride: see chlormequat chloride

Chlorofos: see trichlorfon  
 Chloro-IPC: see CIPC  
 Chlorophen: see PCP  
 Chlorophenothane: see DDT  
 Chlorophos: see trichlorfon  
 Chloroprotham: see CIPC  
 Chloroxifenidim: see chloroxuron  
 Chloroxone: see 2,4-D

## CHLOROXYURON

**Alternative Names:** C-1983, chloroxifenidim, Norex, Tenoran

**Chemical Name:** N'-[4-(4-chlorophenoxy)phenyl]-N,N-dimethyl urea (CAS 1982-47-4)

**Primary Use:** Herbicide

**Sample Purity:** 50% Wettable powder

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	3-4	>2,000

**Signs of Intoxication:** Ataxia, weakness, sideways walking, falling. Signs were not apparent until the third day after single oral administration, then persisted for up to 14 days.

Chlorphos: see trichlorfon

Chloroprotham: see CIPC

## CHLORPYRIFOS

**Alternative Names:** Dowco 179, Dursban, ENT 27311, Lorsban, Trichlorpyrphos

**Chemical Name:** Phosphorothioic acid, O,O-diethyl O-(3,5,6-trichloro-2-pyridinyl) ester (CAS 2921-88-2)

**Primary Use:** Insecticide

**Sample Purity:** 94.5%<sup>1</sup> and 99%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	2	M	—	>400
Canada goose <sup>2</sup>	3	M,F	—	40-80
Mallard <sup>2</sup>	12	F	—	75.6 (35.4-161)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard duckling (st) <sup>2</sup>	9	M,F	15-19 d	112 (11.5-1,089)
California quail <sup>1</sup>	12	F	5-7	68.3 (40.7-115)
Japanese quail <sup>1</sup>	12	M	2.5	15.9 (10.5-24.0)
Japanese quail <sup>1</sup>	12	M	2	17.8 (15.0-21.2)
Pheasant <sup>1</sup>	12	M	4-12	8.41 (2.77-25.5)
Pheasant <sup>1</sup>	16	F	3-5	17.7 (12.5-25.0)
Chukar <sup>2</sup>	24	M	3-5	61.1 (47.5-78.6)
Chukar <sup>2</sup>	16	F	3-5	60.7 (43.8-84.1)
Sandhill crane <sup>1, 2</sup>	3	M	—	25-50
Rock dove (st) <sup>1</sup>	16	M,F	—	26.9 (19.0-38.1)
House sparrow <sup>1</sup>	20	M	—	21.0 (5.59-79.1)
Albino rat (st) <sup>2</sup>	12	M	—	151 (179-252)
Domestic goat <sup>1</sup>	2	F	—	500-1,000

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Excessive blinking, hypoactivity, hyperexcitability, polydipsia, ataxia, tachypnea, myasthenia, exophthalmia, epistaxis, tremors, piloerection or fluffed feathers, salivation, lacrimation, diarrhea, polyuria, prostration, loss of righting reflex, clonic spasms, tetany, coma, convulsions. Mortalities usually occurred between 1 h and 9 days after treatment.

**Other Toxicity Data:** The 30-day EMLD for mallards is less than 2.5 mg/kg per day for both sexes (n = 20). The resulting cumulative toxicity index is  $75 / < 2.5 = > 30$ , indicating a high degree of cumulative action for an organophosphate.

**Notes:** Numerous gross pathological changes were seen at necropsy in tissues of sacrificed survivors.

For most species, the slope of the acute dose-response curve was low (decreasing dosage levels did not produce proportional decreases in the response). This finding would indicate a reduced safety margin for the chemical because mortalities frequently occurred at levels much lower than the calculated LD50's.

For a discussion of the comparative toxicity of chlorpyrifos, see Tucker and Haegele (1971).

For a discussion of the effects of age on the sensitivity of mallards to chlorpyrifos, see Hudson et al. (1972).

Chlorthiepin: see endosulfan  
*Chrysanthemum cinerifolium*: see pyrethrum  
 Chryson: see resmethrin  
 CIBA 709: see microtophos  
 CIBA 1414: see monocrotophos  
 Ciodrin: see crotoxyphos

## CIPC

**Alternative Names:** Chloro-IPC, chloroprotham, chloroprotham, Furloe, Sprout Nip, Spud-Nic, Taterpex, Triherbide-CIPC, Y-3

**Chemical Name:** (3-Chlorophenyl)-carbamic acid, 1-methylethyl ester (CAS 101-21-3)

**Primary Use:** Herbicide

**Sample Purity:**  $\geq 99\%$

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	3-4	>2,000

**Signs of Intoxication:** Ataxia, use of wings to aid in locomotion from the 5th to 8th day after administration.

Cismethrin: see resmethrin  
 CL 38023: see famphur  
 CL 47031: see Cyolane  
 CL 47676: see Starlicide

## CLONITRALID

**Alternative Names:** BAY 25648, Bayer 73, Bayluscide, M73, Molluscicide Bayer 73, SR 73, Yomesan

**Chemical Name:** 5-Chloro-*N*-(2-chloro-4-nitrophenyl)-2-hydroxy benzamide compd. with 2-aminoethanol (1:1) (CAS 1420-04-8)

**Primary Use:** Lampricide, piscicide, molluscicide

**Sample Purity:** 70%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard (MM)	24	F	A	>2,000
Bobwhite (HGF)	24	M	4-6	>2,000
Ring-billed gull	12	F	A	500 (77.8-3,210)

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Masseter tenseness, regurgitation, high carriage, polydipsia, sitting, hyporeactivity, abnormal reactivity, ataraxia, ataxia, wing-drop, imbalance, tachypnea, dyspnea, tremors, and tetanic seizures followed by death. Signs appeared as soon as 15 min and mortalities occurred usually between 30 min and 3 h after treatment. Remission took up to 24 h.

**Other Toxicity Data:** No mortalities were caused by clonitralid in a 48-h water concentration test when the chemical was introduced into the drinking and swimming water of mallards (n = 5 M and 5 F in each treatment group) at concentrations of 0.01, 0.1, and 1.0 mg/L.

Studies of a mixture of clonitralid (0.7%) with TFM in dimethylformamide indicated that clonitralid contributed only slightly to the toxicity of the mixture. See the discussion under TFM.

**Note:** For a more detailed discussion of these data, see Hudson (1979).

Clor Chem T-590: see toxaphene  
 Compound 118: see aldrin  
 Compound 269: see endrin  
 Compound 497: see dieldrin  
 Compound 604: see dichlone  
 Compound 1080: see sodium monofluoroacetate  
 Compound 3956: see toxaphene  
 Compound 4049: see malathion  
 Compound 4072: see chlorfenvinphos  
 Copper sulfate: see Bordeaux Mixture  
 Co-Ral: see coumaphos  
 Corodane: see chlordane  
 Corothion: see parathion  
 Cotnion-Methyl: see azinphos-methyl  
 Cotoran: see fluometuron

## COUMAPHOS

**Alternative Names:** Agridip, Asuntol, BAY 21199, Baymix, Co-Ral, ENT 17957, Meldane, Muscatox, Resistox, Resistox

**Chemical Name:** Phosphorothioic acid, *O*-(3-chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl) *O,O*-diethyl ester (CAS 56-72-4)

**Primary Use:** Insecticide

**Sample Purity:** 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	29.8 (21.5-41.3)
Pheasant	12	F	3-4	7.94 (5.73-11.0)

**Signs of Intoxication:** Spraddle-legged walking, wing twitching, slowness, hypoactivity, ataxia, wing-drop, falling, nutation, prostration with wings spread, lacrimation, immobility, wing-beat convulsions, and tetany. Signs appeared as soon as 40 min in mallards and 90 min in pheasants and mortalities usually occurred between 2 and 3 h after treatment. Remission took up to 14 days.

CP-14957: see isobenzan  
 CP-47114: see fenitrothion  
 CP-50144: see alachlor  
 Crop Rider: see 2,4-D

## CROTOXYPHOS

**Alternative Names:** Ciodrin, ENT 24717, SD 4294

**Chemical Name:** (*E*)-3-[(Dimethoxyphosphinyl)oxy]-2-butenic acid, 1-phenylethyl ester (CAS 7700-17-6)

**Primary Use:** Insecticide

**Sample Purity:** 85%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	790 (411-1,520)

**Signs of Intoxication:** Ataxia, leg weakness, wings crossed high over back, opisthotonos. Most mortalities occurred about 1 h after administration.

## CRUFOMATE

**Alternative Names:** Dowco 132, ENT 25602, Ruelene

**Chemical Name:** Methylphosphoramidic acid, 2-chloro-4-(1,1-dimethylethyl)phenyl methyl ester (CAS 299-86-5)

**Primary Use:** Insecticide, helminthicide

**Sample Purity:** 92%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	20	M	12	265 (170-414)

**Signs of Intoxication:** Ataxia, imbalance, geotaxia, polydipsia, regurgitation, penile extrusion, stumbling, fall-

ing, sitting, wing-drop, wings spread, lacrimation, fluid exuding from nares, tremors, dyspnea, clonic convulsions, immobility, nutation, and ataraxia. Prolonged signs included unkemptness, myasthenia, and slowness; penile extrusion persisted in some survivors for up to 13 days after treatment. Signs appeared as soon as 5 min and mortalities usually occurred between 1 and 3 h after treatment; some mortalities, however, occurred overnight after treatment.

**Note:** One survivor was never able to retract his penis and it eventually dropped off.

Cubé: see rotenone  
 Cubé extractives: see rotenone  
 Cubé resins: see rotenone  
 Curaterr: see carbofuran

## CYANAZINE

**Alternative Names:** Bladex, DW 3418, Payze, SD 15418, WL 19805

**Chemical Name:** 2-[[4-Chloro-6-(ethylamino)-s-triazin-2-yl]amino]-2-methylpropanenitrile (CAS 21725-46-2)

**Primary Use:** Herbicide

**Sample Purity:** >95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	9	F	3-5	>2,400
Bobwhite	9	F	3	445 (281-707)

**Signs of Intoxication:** Loss of balance, goose-stepping ataxia, fluffed feathers, wing shivers, wings crossed high over back, falling when walking, tremors. Remission took up to 2 to 4 weeks after treatment. Although no mallard mortalities occurred at levels below 2,400 mg/kg, as little as 150 mg/kg produced signs.

**Note:** Regurgitation of part of the dosage given, the low dosage that produced toxic signs, and the prolonged recovery period may be indications that the acute toxicity of this material is greater than the LD50 indicates and its toxic action on mallards might be cumulative.

Cyclodan: see endosulfan

## CYCLOHEXIMIDE

**Alternative Names:** Acti-Aid, Actidione, Actispray, ENT 15541, naramycin A

**Chemical Name:** 4-[2-(3,5-Dimethyl-2-oxocyclohexyl)-2-hydroxyethyl]-2,6-piperidinedione (CAS 66-81-9)

**Primary Use:** Fungicide, growth regulator (abscission agent)

**Sample Purity:** 88.7%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	82.5 (54.3-126)
Pheasant	12	F	4	9.38 (6.91-12.7)

**Signs of Intoxication:** Goose-stepping ataxia, polydipsia (in mallards), regurgitation (in mallards), ataxia, imbalance, wing-drop, wings crossed over the back, wing shivers, tremors, slowness, hypoactivity, periodic falling, ataxia, prostration. Signs appeared as soon as 10 min and mortalities usually occurred overnight after treatment. Remission took up to 1 month.

**Note:** Necropsies frequently revealed congestion of various organs.

Cycocel: see chlormequat chloride

Cygon: see dimethoate

Cynem: see thionazin

## CYOLANE

**Alternative Names:** AC-47031, American Cyanamid 43064, CL 47031, E. I. 47031, ENT 25809, phosfolan (proposed)

**Chemical Name:** Phosphoramidic acid, 1,3-dithiolan-2-ylidene, diethyl ester (CAS 947-02-4)

**Primary Use:** Insecticide

**Sample Purity:** 85.9%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard (st)	12	M	3	3.18 (2.52-4.00)

**Signs of Intoxication:** Polydipsia, ataxia, wings spread, wing-drop, falling, prostration, using wings for pedestrian locomotion, immobility, wing tremors, bradypnea,

dyspnea, spasms, tonic convulsions, terminal wing-beat convulsions and opisthotonos. Signs appeared as soon as 8 min and mortalities usually occurred about 30 min after treatment. Prolonged signs included asthenia and myasthenia. Remission took up to 1 week.

Cytel: see fenitrothion

Cythion: see malathion

Cytrol: see amitrole

## 2,4-D

**Alternative Names:** Agrotect, Amoxone, Aqua-Kleen, Chipco Turf Herbicide "D," Chloroxone, Crop Rider, Dacamine, Ded-Weed, Dormone, Esteron, Estone, Fernesta, Fernimine, Fernoxone, Feroxone, Hedonal, Pennamine D, Salvo, Tributon, Vergemaster, Vertron 2D, Visco-Rhap Low Volatile 4L, Weed-Ag-Bar, Weedar 64, Weed-B-Gon, Weedez Wonder Bar, Weedone

**Chemical Name:** (2,4-Dichlorophenoxy)-acetic acid (CAS 94-75-7)

**Primary Use:** Herbicide

**Sample Purity:** Technical grade acid (>99%),<sup>1</sup> technical grade sodium salt,<sup>2</sup> and 480-g acid equivalent per liter of the amine<sup>3</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	9	M	4	>2,000
Mallard <sup>2</sup>	5	M	3-5	>2,025
Mallard (st) <sup>3</sup>	1	M	7	<2,000
Mallard <sup>1</sup>	2	F	3-5	>1,000
Japanese quail <sup>1</sup>	12	M	2	668 (530-842)
Pheasant <sup>1</sup>	12	F	3-4	472 (340-654)
Chukar <sup>1</sup>	4	M,F	4	200-400
Rock dove <sup>1</sup>	12	M,F	—	668 (530-842)
Mule deer <sup>1</sup>	3	M,F	8-11	400-800

**Signs of Intoxication:** Polydipsia, ataxia, imbalance, slowness, fluffed feathers, tachypnea, tremors, prostration, ptosis, salivation.

**Other Toxicity Data:** The acid was orally administered to 2 mule deer does daily for 30 days. One survived 80 mg/kg per day and the other 240 mg/kg per day; they showed only slight toxic effects, but no weight loss. Combinations of 1,000 mg/kg 2,4-D amine and 1,000 mg/kg

Tordon 22K or 2,000 mg/kg of each, administered by stomach tube, were not lethal to two mallard drakes.

**Notes:** Gastrointestinal and endocardial hemorrhages were seen at necropsy.

For 2,4-D effects on eggshell thickness, see Haegele and Tucker (1974).

D 1221: see carbofuran

Dacamine: see 2,4-D; 2,4,5-T

Dagadip: see carbophenothion

Dalf: see methyl parathion

Dalmation Insect Flowers: see pyrethrum

Danex: see trichlorfon

Daphene: see dimethoate

Dasanit: see fensulfothion

Dazzel: see Diazinon

DBCP: see Nemagon

DBD: see azinphos-methyl

DBH: see benzene hexachloride

2,6-DBN: see dichlobenil

DCMU: see diuron

DCNA: see dicloran

DDD: see TDE

## DDT

**Alternative Names:** Anofex, Arkotine, chlorophenothane, Dedelo, dichlorodiphenyltrichloroethane, Dicophane, Didimac, DND, ENT 1506, Genitox, Gesapon, Gesarex, Gesarol, Guesapon, Guesarol, Gyron, Ixodex, Kopsol, Neocid, Pentachlorin, p,p'-DDT, Rukseam, Zerdane

**Chemical Name:** 1,1'-(2,2,2-Trichloroethylidene)bis[4-chlorobenzene] (CAS 50-29-3)

**Primary Use:** Insecticide

**Sample Purity:** >99% (set point, 105.4°C),<sup>1</sup> 77.2%,<sup>2</sup> technical grade<sup>3</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Bullfrog <sup>2</sup>	3	F	—	>2,000
Mallard <sup>2</sup>	8	F	3	>2,240
California quail <sup>1</sup>	12	M	6	595 (430-825)
Japanese quail <sup>2</sup>	12	M	2	841 (607-1,170)
Pheasant <sup>1</sup>	15	F	3-4	1,334 (894-1,990)
Sandhill crane <sup>1</sup>	5	M,F	A	>1,200
Rock dove <sup>2</sup>	20	M,F	—	>4,000

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Ataxia, wing-drop, jerkiness in gait, continuous whole-body tremors, falling, convulsions. Mortalities usually occurred from 1 to 2 days after single oral administration.

**Other Toxicity Data:** The acute tests reported above were based on DDT administered orally in gelatin capsules. However, DDT in corn oil was given by stomach tube to another group of cranes and was not lethal at 1,200 mg/kg, the highest level tested.

The 30-day EMLD<sup>2</sup> for male or female mallards (n = 6) is 50 mg/kg per day. The resulting cumulative toxicity index for mallards is  $>2,240/50 = >44.8$ , indicating a high degree of cumulative action.

A single female adult sandhill crane given 1,000 mg/kg per day<sup>1</sup> showed toxic signs by the 10th day and died after 12 dosages.

Adult mallards were fed 100 ppm DDT in the diet. The first mortality occurred at 43 days and the last at 417 days after treatment began. Median lethal time was about 1 year.

In a 90-day feeding study doses of 30 ppm were not lethal to mallards or bobwhites of either sex. Two California quail cocks, 1 bobwhite cock, and 1 bobwhite hen survived a 60-day feeding exposure to 100 ppm technical grade<sup>3</sup> DDT; no signs of intoxication were observed, and eggshell thickness appeared to be normal.

**Notes:** DDT is more readily absorbed from materials with a high lipid content.

One of the primary metabolites of DDT is DDE [2,2-bis(p-chlorophenyl)-1,1-dichloroethylene], a widespread environmental contaminant. It has been shown to cause eggshell thinning in several species of birds. For information on eggshell thinning and other reproductive effects in birds caused by DDT and DDE, see Haegele et al. (1974), Haegele and Tucker (1974), and Haegele and Hudson (1973, 1974, 1977).

DDVF: see DDVP

## DDVP

**Alternative Names:** Cekusan, DDVF, Dedevap, dichlorophos, dichlorvos, Divipan, ENT 20738, Herkol, Mafu, Marvex, Nogos, No-Pest, Nuvan, Oko, Phosvit, Vapona

**Chemical Name:** Phosphonic acid, 2-2-Dichloroethyl di-methyl ester (CAS 62-73-7)

**Primary Use:** Insecticide

**Sample Purity:** 93%



## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	5-7	7.78 (6.00-10.1)
Pheasant	12	M	3	11.3 (8.99-14.3)

**Signs of Intoxication:** Goose-stepping ataxia, use of wings to aid in balance, tremors, convulsions.

**Note:** Various internal hemorrhages were found at necropsy in sacrificed survivors of both species.

Decachlorotetracyclodecanone: see chlordecone

Dechlorane: see mirex

Dedelo: see DDT

Dedevap: see DDVP

Ded-Weed: see 2,4-D; silvex

Ded-Weed Brush Killer: see 2,4,5-T

## DEF

**Alternative Names:** B-1776, Chemagro 1776, Chemagro B-1776, De-Green, E-Z-Off D, Fos-Fall "A," Ortho Phosphate Defoliant, tributyl phosphorothioate

**Chemical Name:** Phosphorotrithioic acid, S,S,S-tributyl ester (CAS 78-48-8)

**Primary Use:** Defoliant

**Sample Purity:** 92%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	2,934 (1,686-5,109)
Pheasant	12	F	4	273 (191-390)

**Signs of Intoxication:** Jerkiness, neck-stretching, lacrimation, limited regurgitation (in mallards), slowness, wing-drop, fluffed feathers, and greatly prolonged ataxia. Signs appeared as soon as 1 h and mortalities usually occurred between 1 and 4 days after treatment. Remission took up to 30 days.

**Note:** Although the LD50 for mallards is 2,934 mg/kg, some mortalities occurred at treatment levels as low as 800 mg/kg, and treatment levels as low as 200 mg/kg produced signs of intoxication.

De-Fend: see dimethoate

Deflubenzon: see difluron

De-Green: see DEF

Delnav: see dioxathion

Delsan: see thiram

DEMETON<sup>1</sup>

**Alternative Names:** BAY 8173, BAY 10756, demeton O + demeton S, Demox, E-1059, ENT 17295, ISO-Systox, mercaptofos, mercaptophos, Systemox, Systox

**Chemical Name:** Phosphorothioic acid, O,O-diethyl O-[2-(ethylthio)ethyl] ester; and O,O-diethyl S-[2-(ethylthio)ethyl] phosphorothioate (CAS 8065-48-3)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 92%<sup>1</sup> and 99%<sup>2</sup>

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	8	M	—	562 (178-1,780)
Mallard <sup>2</sup>	12	M	3	7.19 (5.19-9.97)
Sharp-tailed grouse <sup>1</sup>	8	M,F	A	4.76 (4.00-5.66)
California quail <sup>1</sup>	12	M	6	10.6 (8.41-13.4)
Japanese quail <sup>1</sup>	12	F	2 <sup>b</sup>	8.48 (6.73-10.7)
Pheasant <sup>2</sup>	12	F	2	8.21 (5.69-11.9)
Chukar <sup>1</sup>	12	M,F	3	15.1 (12.0-19.0)
Rock dove <sup>1</sup>	12	M,F	—	8.48 (6.73-10.7)
House sparrow <sup>1</sup>	12	F	—	9.52 (6.87-13.2)
House finch <sup>1</sup>	6	F	—	2.38 (2.00-2.83)
Mule deer <sup>1</sup>	1	F	A	< 10.0
Domestic goat <sup>1</sup>	4	M,F	—	8.00-18.0

<sup>a</sup>Except as noted.

<sup>b</sup>Several of these hens were in active egg-laying condition.

**Signs of Intoxication:** Polydipsia, weakness, goose-stepping ataxia, lacrimation, salivation, tremors, tachypnea, dyspnea, prostration, convulsions with miosis and apnea, tetany or opisthotonos. Signs appeared as soon as 6 min after treatment and mortalities usually occurred in 1 to 3 h. Remarkable uniformity in signs and timing among species was noted. Remission took up to 1 day for

all species except bullfrogs, for which 2 days were required. **Sample Purity:** 89%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog	4	F	—	>2,000
Mallard	16	M	3-4	3.54 (2.37-5.27)
Pheasant	12	M	3-4	4.33 (3.02-6.22)

**Signs of Intoxication:** Goose-stepping ataxia, wing spasms, wing-drop, hunched back, dyspnea, tenesmus, diarrhea, salivation, lacrimation, ptosis, prostration, opisthotonos-like seizures or wing-beat convulsions.

Diazol: see Diazinon

Dibrom: see naled

Dibromochloropropane: see Nemagon

## DICHLLOBENIL

**Alternative Names:** Casoron, Casoron 133, 2,6-DBN, Duprex, ENT 26665, NIA 5996

**Chemical Name:** 2,6-Dichlorobenzonitrile (CAS 1194-65-6)

**Primary Use:** Herbicide

**Sample Purity:** 98.7%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	9	F	3	>2,000
Pheasant	9	M	8-9	1,189 (446-3,165)

**Signs of Intoxication:** In both species ataxia and fluffed feathers with the neck pulled in were typical at levels as low as 500 mg/kg. Birds tended to stand in place for prolonged periods with the eyes closed. Mortalities typically occurred 10 to 16 days after single oral administration. Survivors suffered extreme weight losses in the first few weeks after treatment.

**Note:** Hemorrhaging of the intestinal mucous membrane was noted at necropsy.

## DICHLONE

**Alternative Names:** Compound 604, ENT 3776, Phygon, Phygon XL, Phygon Seed Protectant

**Other Toxicity Data:** The 30-day EMLD<sup>2</sup> for mallards is 2.5-5.0 mg/kg per day for both sexes (n = 12). The resulting cumulative toxicity index is 7.19/2.5-5.0 = 1.4-2.9, indicating little cumulative action for mallards.

The calculated percutaneous LD50<sup>1</sup> for 10-month-old mallard drakes (n = 8) after a 24-h dermal foot exposure is 24.0 (CL 6.00-96.0) mg/kg. Signs observed after percutaneous treatment included, in addition to several of the above, running and falling, hyporeactivity, myasthenia, slowness, ataxia, asthenia, and sitting. Signs appeared as soon as 1 h and mortalities usually occurred from 5 to 20.5 h after the initiation of treatment; however, one mortality occurred between 6 and 7 days after treatment. Mild dermal irritation occurred after percutaneous exposure to demeton. Dead mallards exhibited penile extrusion. When the percutaneous LD50 is compared with the acute oral LD50, demeton appears to have a moderate degree of dermal hazard in mallards.

**Notes:** For a discussion of the comparative toxicity of demeton, see Tucker and Haegle (1971).

For a discussion of the effects of age on the sensitivity of mallards to demeton, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Demeton methyl: see oxydemetonmethyl

Demeton O + demeton S: see demeton

Demeton-S-methyl sulfoxide: see oxydemetonmethyl

Demos-L40: see dimethoate

Demox: see demeton

Derrin: see rotenone

Derris: see rotenone

Derris extractives: see rotenone

Derris resins: see rotenone

Des-I-Cate: see endothall

Dextrone: see diquat dibromide

Dextrone X: see paraquat dichloride

Dianisyltrichloroethane: see methoxychlor

Diazajet: see Diazinon

Diazide: see Diazinon

## DIAZINON

**Alternative Names:** AG-500, Alfa-tox, Basudin, Dazzel, Diazajet, Diazide, Diazol, ENT 19507, G-24480, Gardentox, Neocidol, Nucidol, Sarolex, Spectracide

**Chemical Name:** Phosphorothioic acid, O,O-diethyl O-[6-methyl-2-(1-methylethyl)-4-pyrimidinyl] ester (CAS 333-41-5)

**Primary Use:** Insecticide, nematocide



**Chemical Name:** 2,3-Dichloro-1,4-naphthalenedione (CAS 117-80-6)

**Primary Use:** Fungicide

**Sample Purity:** 90%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	7	M	3-4	>2,000

**Signs of Intoxication:** Regurgitation, ataxia, falling under stress. Signs lasted up to 19 days, and some birds lost weight.

Dichloran: see dicloran

Dichlorfenidim: see diuron

Dichloro diphenyl dichloroethane: see TDE

Dichlorodiphenyltrichloroethane: see DDT

Dichlorphos: see DDVP

Dichlorvos: see DDVP

### DICLORAN

**Alternative Names:** AL-50, Allisan, Botran, DCNA, Dichloran, ditranil, U-2069

**Chemical Name:** 2,6-Dichloro-4-nitrobenzenamine (CAS 99-30-9)

**Primary Use:** Fungicide

**Sample Purity:** 97%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	3-4	>2,000
Pheasant	6	F	3-4	500-1,000

**Signs of Intoxication:** Regurgitation (in mallards), hyporeactivity, ataxia, asthenia, imbalance, slowness, wing-drop, falling when walking, withdrawal, and ataraxia. Regurgitation occurred as soon as 20 min; other signs appeared as soon as 1.5 h after treatment in mallards. In pheasants, signs appeared the day after treatment, and mortalities occurred between 2 and 4 days after treatment. Remission took up to 5 weeks for both species.

### DICOFOL

**Alternative Names:** Acarin, DTMC, ENT 23648, FW-293, Kelthane, Mitigan, R and H FW-293

**Chemical Name:** 4-Chloro- $\alpha$ -(4-chlorophenyl)- $\alpha$ -(trichloromethyl)benzenemethanol (CAS 115-32-2)

**Primary Use:** Acaricide

**Sample Purity:** 87.8%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Pheasant	12	M	4	265 (211-334)

**Signs of Intoxication:** Imbalance, ptosis, ataraxia, fluffed feathers, low carriage, tremors, wing-beat convulsions, and emprosthotonos. Signs appeared on the day following treatment and mortalities usually occurred between 1 and 8 days after treatment. Remission took up to 1 week.

Dicophane: see DDT

### DICROTOPHOS

**Alternative Names:** Bidrin, Carbicron, CIBA 709, Ektafos ENT 24482, SD 3562

**Chemical Name:** (*E*)-Phosphoric acid, 3-(dimethylamino)-1-methyl-3-oxo-1-propenyl dimethyl ester (CAS 141-66-2)

**Primary Use:** Insecticide

**Sample Purity:** 98%  $\alpha$  Isomer<sup>1</sup> and 80%<sup>2</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	8	M	—	2,000 (602-6,640)
Canada goose <sup>1</sup>	12	M,F	—	2.28 (1.36-3.83)
Mallard <sup>1</sup>	12	M	3	4.24 (3.06-5.88)
Sharp-tailed grouse <sup>1</sup>	12	M	24-36	2.31 (1.78-3.00)
California quail <sup>2</sup>	12	M	18	1.89 (1.50-2.38)
Japanese quail <sup>1</sup>	12	M	2.5	4.32 (3.18-5.86)
Pheasant <sup>1</sup>	12	M	2	3.21 (2.45-4.21)
Chukar <sup>1</sup>	12	M,F	12-24	9.63 (7.35-12.9)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Rock dove <sup>1</sup>	16	M,F	—	2.00 (1.53-2.61)
House sparrow <sup>1</sup>	16	M	—	3.00 (1.59-5.64)
House finch <sup>1</sup>	8	M,F	—	2.83 (1.06-7.54)
Mule deer <sup>1</sup>	3	M	8-17	12.5-25.0

**Signs of Intoxication:** Goose-stepping ataxia, asthenia, miosis, salivation, lacrimation, tonic spasms, diarrhea, tachypnea, anorexia, prostration, tetany with wings outstretched, convulsions. As little as one-tenth of a lethal dose produced signs.

**Other Toxicity Data:** The 30-day EMLD<sup>1</sup> for mallards (n = 12) is about 0.25 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $4.24/\sim 0.25 = \sim 17$ , indicating moderately high cumulative toxicity.

One mule deer buck that received 0.75 mg/kg per day (80%) orally for 30 days displayed only tremors and salivation. Another buck received 3.00 mg/kg per day (80%) orally for 7 days and died.

The calculated percutaneous LD50<sup>2</sup> for 1-year-old mallard drakes (n = 12) after a 24-h dermal foot exposure is 14.2 (CL 4.56-43.8) mg/kg. Signs observed after percutaneous treatment included, in addition to several of the above, nasal exudate, mydriasis, ataxia, tremors, falling, using wings to aid pedestrian locomotion, and immobility. Mortalities occurred between 3 and 24 h after the initiation of treatment, and remission took up to 3 days after exposure ended. When the percutaneous LD50 is compared with the acute oral LD50, dicrotophos appears to have a moderate degree of dermal hazard in mallards.

**Notes:** For a discussion of the comparative toxicity of dicrotophos, see Tucker and Haegele (1971).

For a discussion of the effects of age on the sensitivity of mallards to dicrotophos, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

DID 764: see 6-aminonicotinamide

Didimac: see DDT

## DIELDRIN

**Alternative Names:** Alvit, Compound 497, Dieldrite, ENT 16225, HEOD, Octalox, Panoram D-31

**Chemical Name:** 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth[2,3-b]oxirene, (1a $\alpha$ ,2 $\beta$ ,2a $\alpha$ ,3 $\beta$ ,6 $\beta$ ,6a $\alpha$ ,7 $\beta$ ,7a $\alpha$ ) (CAS 60-57-1)

**Primary Use:** Insecticide

**Sample Purity:** 100% (85% HEOD)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Canada goose	14	M,F	A	< 141
Fulvous whistling duck	2	F	—	100-200
Mallard	12	F	6-7	381 (141-1,030)
California quail	12	M	7	8.78 (6.47-11.9)
Japanese quail	12	M	2	69.7 (40.0-121)
Pheasant	9	M	10-23 <sup>b</sup>	79.0 (21.6-289)
Chukar	9	M,F	8-11 <sup>b</sup>	25.3 (15.2-42.2)
Gray partridge	6	F	3-10	8.84 (1.24-62.8)
Rock dove	15	M,F	—	26.6 (19.2-36.9)
House sparrow	12	F	—	47.6 (34.3-66.0)
Mule deer	2	M	8-18	75-150
Domestic goat	3	M	6-8	100-200

<sup>a</sup>Except as noted.

<sup>b</sup>These birds may have been in active breeding condition.

**Signs of Intoxication:** Tail feathers spread and pointed either upward or downward, hyperexcitability, jerkiness in gait, ataxia, dyspnea, myasthenia, fluffed feathers, immobility, terminal wing-beat convulsions or opisthotonos. Mortalities usually occurred 1 to 9 days following treatment.

**Other Toxicity Data:** The 30-day EMLD for mallards (n = 6) is 5.0 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $381/5 = 76$  for mallards, indicating a high degree of cumulative action.

An approximation of the 30-day EMLD for fulvous whistling-ducks (n = 3) is about 2.5; for gray partridges (n = 2) it appears to be between 1.25 and 5.00 mg/kg per day.

In 60-day feeding tests, 2.5 ppm was not lethal to a male gray partridge nor a male fulvous whistling-duck.

The 8-day dietary LC50 for mallard ducklings (MM-15 days old at the start of treatment) is 91.0 (CL 70.3-118) ppm. The 8-day dietary LC50 for bobwhite chicks (HGF-11 to 13 days old) is 31.8 (CL 26.7-37.8) ppm. Consumption of the treated diets was less than normal, and weight gains in survivors were depressed.

Dieldrin did not cause eggshell thinning in studies with mallards and coturnix (Haegele and Tucker 1974).

**Note:** For a discussion of the comparative toxicity of dieldrin, see Tucker and Hægele (1971).

Dieldrite: see dieldrin

## DIESEL OIL #1

**Alternative Names:** None found

**Chemical Name:** A petroleum fraction

**Primary Use:** Adjuvant, pesticide carrier, fuel

**Sample Purity:** Technical grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mL/kg)
Mallard	5	M,F	>12	>20

**Signs of Intoxication:** Transient weakness, diarrhea, and regurgitation.

**Note:** The LD50 of 20 mL/kg is far more than any mallard is likely to encounter in normal pesticide applications.

Diethion: see ethion

Diethyl ethylthioethyl dithiophosphate: see disulfoton

Difenthos: see temephos

Diflubenuron: see difluron

## DIFLURON

**Alternative Names:** deflubenzon, diflubenuron, Dimilin, DU 112307, ENT 29054, Largon, OMS 1804, Pn 60-40, TH-6040

**Chemical Name:** *N*-[[4-(chlorophenyl)amino]carbonyl]-2,6-difluorobenzamide (CAS 35367-38-5)

**Primary Use:** Insecticide (interferes with cuticle development)

**Sample Purity:** 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (MM)	6	M	5	>2,000

**Signs of Intoxication:** Possible anorexia on the day after treatment.

Dimecron: see phosphamidon

## DIMETHOATE

**Alternative Names:** AC-12880, AC-18682, Cygon, Daphene, De-Fend, Demos-L40, Dimethogen, ENT 24650, Fostion MM, Le-Kuo, Perfekthion, Rebelate, Rogor, Roxion, Trimetion

**Chemical Name:** Phosphorodithioic acid, *O,O*-dimethyl *S*-[2-(methylamino)-2-oxoethyl] ester (CAS 60-51-5)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 99.8%<sup>1</sup> and 97%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>2</sup>	12	M	3-4	41.7 (30.1-57.8)
Mallard <sup>1</sup>	12	F	3-4	63.5 (45.8-88.1)
Pheasant <sup>2</sup>	12	F	3-4	20.0 (15.9-25.2)

**Signs of Intoxication:** Feathers drawn tightly to the body, mild tachypnea, ataxia, tenseness, fluffed feathers, imbalance, running and falling, tremors, clonic convulsions, immobility, myasthenia. Signs appeared as soon as 13 min and mortalities occurred overnight after treatment. Remission had occurred by 1 day after treatment.

**Other Toxicity Data:** The 30-day EMLD<sup>2</sup> for mallards of both sexes ( $n = 6$ ) is 6.0 mg/kg per day. The resulting cumulative toxicity index is  $41.7/6 = 7$ , indicating a moderate degree of cumulative action in mallards.

The 30-day EMLD<sup>2</sup> for 20- to 25-week-old pheasants of both sexes ( $n = 12$ ) appears to lie between 4.00 and 10.0 mg/kg per day. The resulting cumulative toxicity index is  $20.0/4.0-10.0 = 2.0-5.0$ , indicating a slight degree of cumulative action in pheasants.

**Notes:** Acetylcholinesterase measurements were made on the brains of the mortalities and the survivors of the pheasant 30-day EMLD test. When compared with their controls ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min} = 1.331$ ,  $s = 0.029$ , range = 1.299-1.366), survivors which were sacrificed on the day following the final treatment showed 71.7% inhibition ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min} = 0.377$ ,  $s = 0.080$ , range = 0.310-0.489). When compared with their controls ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min} = 1.097$ ,  $s = 0.068$ , range = 0.996-1.159), mortalities showed 88.0% inhibition ( $n = 6$ ,  $\Delta\text{pH}/45 \text{ min} = 0.131$ ,  $s = 0.085$ , range = 0.076-0.303).

Dimethogen: see dimethoate

Dimethoxy-DT: see methoxychlor

## DIMETHYLFORMAMIDE

**Alternative Names:** DMF, DMFO

**Chemical Name:** *N,N*-dimethylformamide (CAS 68-12-2)

**Primary Use:** Solvent, carrier for the lampricide TFM

**Sample Purity:** Reagent grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 (mg/kg)
Mallard (st)	4	M	12 <sup>b</sup>	> 2,000
Bobwhite (st) (HGF)	6	M	5	> 460
Ring-billed gull (st)	6	M,F	A	> 185

<sup>a</sup>Except as noted.

<sup>b</sup>These drakes may have been in breeding condition.

**Signs of Intoxication:** Jitteriness, slowness, ataxia, geotaxia, and falling. Signs appeared as soon as 10 min after treatment. Remission had occurred by the day after treatment.

Dimethyl parathion: see methyl parathion

Dimilin: see difluron

Dinaphthene + naphthene benzenes: see Panasol AN-2

Dinitro: see dinoseb

Dinitrobutylphenol: see dinoseb

Dinitrocresol: see DNOC

## DINOSEB

**Alternative Names:** Basanite, Chemox General, Chemox P.E., dinitro, dinitrobutylphenol, DN-289, DNBP, DNOSBP, DNSBP, Dow General Weed Killer, Elgetol 318, ENT 1122, Gebutox, Kiloseb, Nitropone C, Premerge, Sinox General, Subitex

**Chemical Name:** 2-(1-Methylpropyl)-4,6-dinitrophenyl (CAS 88-85-7)

**Primary Use:** Herbicide, has also been used as an insecticide

**Sample Purity:** 97.6%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	27.0 (21.4-34.0)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Pheasant	12	M	4	26.4 (21.0-33.3)

**Signs of Intoxication:** Slow reactions, tachypnea, ataxia, ataraxia, goose-stepping ataxia, reluctance to leave the swimming pond (in mallards), falling, and sitting. Signs appeared as soon as 20 min in mallards and 1 h in pheasants and mortalities occurred between 1 and 3 h in mallards and between 1 h and 1.5 days after treatment in pheasants. Remission took up to 1 day in mallards and 1 week in pheasants.

Di-on: see diuron

## DIOXATHION

**Alternative Names:** Delnav, ENT 22897, Hercules AC 528, Hercules 528, Navadel, Ruphos

**Chemical Name:** Phosphorodithioic acid, *S,S'*-1,4-dioxane-2,3-diyl *O,O,O',O'*-tetraethyl ester (CAS 78-34-2)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 72% (cis-47%, trans-25%)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	277 (172-443)
Pheasant	9	M	3-7	240 (190-302)

**Signs of Intoxication:** Ataxia, imbalance, weakness, slowness, immobility, wing-beat convulsions and tetany. Signs appeared as soon as 30 min and mortalities usually occurred between 1.5 and 4 h after treatment. Remission took up to 2 weeks.

Dipel: see *Bacillus thuringiensis* (Berliner)

Dipterex: see trichlorfon

Diptetes: see trichlorfon

## DIQUAT DIBROMIDE

**Alternative Names:** Aquacide, Dextrone, FB/2, Reglone

**Chemical Name:** 6,7-Dihydrodipyrido[1,2-a:2',1'-c] pyrazinediium dibromide (CAS 2764-72-9)

**Primary Use:** Herbicide

Sample Purity: 30%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	564 (324-982)

**Signs of Intoxication:** Ataxia (both rubbery-legged and tense-legged), nutation, wing-drop, wing shivers, immobility. Survivors took as long as 14 days to recover. Mortalities occurred 1 to 2 days after treatment.

Direz: see anilazine

**DISPARLURE****Alternative Names:** Disparnone, Pherocon GM**Chemical Name:** 2-Decyl-3-(5-methylhexyl)-cis-oxirane (CAS 29804-22-6)**Primary Use:** Male gypsy moth sex attractant (female-produced pheromone)**Sample Purity:** Technical grade**Acute Oral Toxicity Summary:** None**Signs of Intoxication:** No signs were observed in dietary tests on mallards and bobwhites.**Other Toxicity Data:** The 8-day dietary LC50 for 15-day-old mallard ducklings (n = 50) is >5,000 ppm. The 8-day dietary LC50 for 11- to 13-day-old bobwhite chicks (n = 40) is >5,000 ppm. Food consumption and body weight gains in the ducklings and the chicks in these studies appeared to be normal.

Disparnone: see disparlure

**DISULFOTON****Alternative Names:** BAY 19639, diethyl ethylthioethyl dithiophosphate, Di-Syston, Dithiodemeton, Dithiosystox, ENT 23437, Frumin AL or G, M-74, S 276, Solvirex, thiodemeton**Chemical Name:** Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester (CAS 298-04-4)**Primary Use:** Insecticide, acaricide**Sample Purity:** 97%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	6.54 (3.76-11.4)
Pheasant	12	M	3	11.9 (8.58-16.5)
Mule deer	3	F	10	2.50-5.00
Domestic goat	1	M	>60	<15.0

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, falling, wing-drop, tremors, slowness, hesitation in walking, immobility, nictitating membrane flicker, wing-beat convulsions, and tetany. One pheasant survivor was blind and several others may have had visual difficulty. Signs appeared as soon as 10 min and mortalities usually occurred between 1 and 3 h after treatment. Remission took up to 1 day in mallards and 10 days in pheasants.

**Other Toxicity Data:** The 30-day EMLD for 5- to 6-month old pheasants of both sexes (n = 12) is 3.00 mg/kg per day. The resulting cumulative toxicity index is 11.9/3.0 = 4.0, indicating a slight degree of cumulative action for disulfoton in pheasants.

The calculated percutaneous LD50 for 9- to 11-month-old mallard drakes (n = 8) after a 24-h dermal foot exposure is 192 (CL 96.0-384) mg/kg. Signs observed after percutaneous treatment included, in addition to several of the above, high carriage, dyspnea, using wings to aid pedestrian locomotion, wing shivers, and penile extrusion. Mortalities occurred between 5 and 24 h after the initiation of treatment. Remission took up to 2 days after the end of treatment. Mild dermal irritation was caused by exposure to disulfoton. When the percutaneous LD50 is compared with the acute oral LD50, disulfoton appears to have a relatively low order of dermal hazard in mallards.

**Notes:** Acetylcholinesterase activity measurements were made on the brains of pheasant mortalities and sacrificed survivors of the 30-day EMLD test. When compared with their controls (n = 6,  $\Delta$ pH/45 min = 1.331, s = 0.029, range = 1.299-1.366), survivors sacrificed on the day after the final dosage of 6.00 mg/kg per day for 30 days showed 53.6% inhibition (n = 3,  $\Delta$ pH/45 min = 0.617, s = 0.098, range = 0.530-0.724), whereas mortalities showed 91.7% inhibition (n = 3,  $\Delta$ pH/45 min = 0.110, s = 0.080, range = 0.029-0.188). When compared with their controls (n = 6,  $\Delta$ pH/45 min = 1.097, s = 0.068, range = 0.996-1.159), sacrificed survivors of the 3.00 mg/kg per day treatment level showed 31.7% inhibition (n = 5,  $\Delta$ pH/45 min = 0.749, s = 0.140, range = 0.573-0.903); the single mortality showed only 18.1% inhibition (n = 1,  $\Delta$ pH/45 min = 0.898).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Di-Syston: see disulfoton  
 Dithane D-14: see nabam  
 Dithane Z-78: see zineb  
 Dithiodemeton: see disulfoton  
 Dithiosystox: see disulfoton  
 Ditranyl: see dicloran  
 Diurex: see diuron

## DIURON

**Alternative Names:** DCMU, dichlorfenidim, Di-on, Di-urex, DMU, Karmex, Marmer, Vonduron

**Chemical Name:** *N'*-(3,4-Dichlorophenyl)-*N,N*-dimethyl urea (CAS 330-54-1)

**Primary Use:** Herbicide

**Sample Purity:** 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3	>2,000

**Signs of Intoxication:** Ataxia and frequent falling persisted for up to 11 days.

Divipan: see DDVP

## D.M. 7537

**Alternative Names:** M & T Chemicals RS150

**Chemical Name:** 5-(*p*-Chlorophenyl)silatrane

**Primary Use:** Experimental rodenticide

**Sample Purity:** ≥ 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog	6	M	—	467 (94.4-2,310)
Mallard	12	M	3-4	21.7 (12.5-37.9)
Mallard (st)	6	M	3-4	8.41 (5.00-14.1)
Pintail (st)	3	M	—	<2.50

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Pheasant	16	M	3-4	34.8 (25.5-47.4)
Chukar	8	M,F	3-4	3.54 (2.50-5.00)
House sparrow (st)	6	M,F	—	0.282 (0.0245-3.25)
Albino rat (st)	4	M	—	~45

**Signs of Intoxication:** Miosis, ataxia, tachypnea, dyspnea, phonation, circling, tenesmus, tremors, violent convulsions, terminal opisthotonos. This compound acts very quickly, producing signs in as few as 2 min and mortalities in 15 min. Remission usually took place by 2 h after treatment.

**Other Toxicity Data:** Secondary hazard appears to be minimal. Rats ingesting other albino rats that succumbed to about 5 times the lethal dose did not show signs of intoxication.

In a hulled-millet diet 80 ppm of DM 7537 was lethal to a single house sparrow after 3 days of treatment, whereas five sparrows survived a 40-ppm diet for 14 days of treatment. Three of five white-crowned sparrows died after receiving a hulled-millet diet containing 5 ppm for 17 days.

## D.M. 7597

**Alternative Names:** None found

**Chemical Name:** 5-(*p*-Chlorophenyl)-3,7,10-trimethyl silatrane

**Primary Use:** Experimental rodenticide

**Sample Purity:** Unknown

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Albino rat	2	M	—	> 500

**Signs of Intoxication:** None.

DMDT: see methoxychlor  
 DMF: see dimethylformamide  
 DMFO: see dimethylformamide  
 DMTP: see fenthion  
 DMU: see diuron  
 DN-289: see dinoseb  
 DNBP: see dinoseb



DNC: see DNOC

DND: see DDT

**DNOC**

**Alternative Names:** dinitrocresol, DNC, Elgetol 30, ENT 154, Nitrador, Selinon, Sinox, Trifocide

**Chemical Name:** 2-Methyl-4,6-dinitrophenol (CAS 534-52-1)

**Primary Use:** Herbicide

**Sample Purity:** 95%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	5-6	22.7 (18.0-28.5)
Pheasant	12	F	3-4	31.8 (22.9-44.0)

**Signs of Intoxication:** Ataxia, wings crossed high over the back, tail tremors or shivering, falling when walking, slowness, tachypnea, dyspnea, hyporeactivity, ptosis, ruffled or unkempt feathers, tetany, and opisthotonos. Signs appeared as soon as 15 min and mortalities usually occurred between 1 and 3 h after treatment in mallards and between 2 and 21 h in pheasants. Remission took up to 2 weeks.

DNOSBP: see dinoseb

DNSBP: see dinoseb

DNTP: see parathion

Dodecachloropentacyclodecane: see mirex

Dog button: see strychnine

Dol: see benzene hexachloride

Dolmix: see benzene hexachloride

Dormone: see 2,4-D

Dovip: see famphur

Dowco 132: see crufomate

Dowco 139: see mexacarbate

Dowco 179: see chlorpyrifos

**DOWCO 214**

**Alternative Names:** ENT 27520, OMS-1155

**Chemical Name:** Phosphorothioic acid, *O,O*-dimethyl *O*-(3,5,6-trichloro-2-pyridinyl) ester (CAS 5598-13-0)

**Primary Use:** Insecticide

**Sample Purity:** 99.3%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	7	M	3	>2,000
California quail	12	M	9-11	334 (265-421)
Pheasant	6	F	3	>2,000

**Signs of Intoxication:** Tenseness, ataxia, ataraxia, falling, ptosis, slowness, sitting, withdrawal, immobility, catatonias, bradypnea, and dyspnea. Signs appeared as soon as 1 day and mortalities occurred between 2 and 4 days after treatment in quail (no mortalities occurred in pheasants and mallards). Treatment levels as low as 500 mg/kg in pheasants and 250 mg/kg in mallards caused signs of intoxication. Remission took up to 7 days.

Dow ET-14: see ronnel

Dow ET-57: see ronnel

Dow General Weed Killer: see dinoseb

Dowicide 7: see PCP

Dowicide G: see PCP

Draza: see methiocarb

DRC-714: see Gophacide

DRC-736: see methiocarb

DRC-1339: see Starlicide

DRC-3492: see 6-aminonicotinamide

DRC-4575: see BAY 98663

Drinox H-34: see heptachlor

DSE: see nabam

DTMC: see dicofol

DU 112307: see difluron

**DUOMEEN T-E-9**

**Alternative Names:** None found

**Chemical Name:** *N*-tallow-trimethylene diamines

**Primary Use:** Mosquito control agent (pre-*imago* stage), wetting and dispersing adjuvant

**Sample Purity:** ~99%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	12 <sup>a</sup>	1,682 (1,030-2,746)
Pheasant	12	M	3	356 (185-685)

<sup>a</sup>These drakes were in active reproductive condition.



**Signs of Intoxication:** Polydipsia (in mallards), regurgitation, slowness, ataxia, fluffed feathers, goose-stepping ataxia, stumbling, imbalance, falling, sitting, hyporeactivity, ptosis, mydriasis, withdrawal, using wings to aid pedestrian locomotion, tremors, spasms, loss of righting reflex, mild tetanic seizures, ataraxia, myasthenia, asthenia, immobility, and emaciation. Polydipsia and regurgitation occurred in mallards as soon as 20 min after treatment. Other signs appeared on the day following treatment and mortalities usually occurred between 1 and 11 days after treatment. Remission took up to 18 days.

**Note:** Small spleens were observed on gross necropsies of the pheasant mortalities.

Duphar: see tetradifon  
 Dupont 4179: see methomyl  
 Dursban: see chlorpyrifos  
 Du-Sprex: see dichlobenil  
 DW 3418: see cyanazine  
 Dyfonate: see fonofos  
 Dylox: see trichlorfon  
 Dylox derivative: see C-12 trichlorfon  
 Dyrene: see anilazine  
 E-601: see methyl parathion  
 E-605: see parathion  
 E-1059: see demeton  
 E-3314: see heptachlor  
 Ectoral: see ronnel

## EDIFENPHOS

**Alternative Names:** BAY 78418, ediphenfos, Hinosan

**Chemical Name:** Phosphorodithioic acid, *O*-ethyl *S,S*-diphenyl ester (CAS 17109-49-8)

**Primary Use:** Fungicide

**Sample Purity:** 93.4%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	10	M	3	>2,715
Pheasant	6	M	3-4	500-1,000

**Signs of Intoxication:** Polydipsia, goose-stepping ataxia, geotaxia, ataxia, imbalance, wide stance, asthenia, falling, hypoactivity, poor reactions, ptosis, using wings to aid pedestrian locomotion. Signs appeared as soon as 30 min and mortalities occurred between 4 and 44 h after treatment. Remission took up to 8 days.

**Notes:** Signs of intoxication were induced in mallards at treatment levels as low as 60 mg/kg. This finding may in-

dicade that long-term exposure to this chemical could be more hazardous than the acute oral LD50 indicates.

Ediphenfos: see edifenfos

E.I. 47031: see Cyolane

E.I. 47300: see fenitrothion

Ektafos: see dicrotophos

EL-110: see Balan

Elancolan: see trifluralin

Elgetol 30: see DNOC

Elgetol 318: see dinoseb

Emmatoes: see malathion

Emmatoes Extra: see malathion

EN-18133: see thionazin

## ENDOSULFAN

**Alternative Names:** BIO-5462, Chlorthiepin, Cyclodan, ENT 23979, FMC-5462, HOE 2671, Insectophene, Kop-Thiodan, Malix, NIA 5462, Thifor, Thimul, Thiodan, Thionex

**Chemical Name:** 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin 3-oxide (CAS 115-29-7)

**Primary Use:** Insecticide

**Sample Purity:** 96%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	33.0 (23.8-45.8)
Mallard	20	M	12 <sup>a</sup>	45.0 (36.2-56.0)
Mallard	20	F	12 <sup>b</sup>	31.2 (20.8-46.6)
Pheasant	7	M	3-4	80-160
Pheasant	12	F	3-4	190 (137-263)
Pheasant	16	F	12 <sup>b</sup>	>320

<sup>a</sup>Most of these drakes were in active breeding condition or in the beginning stages of gonadal regression.

<sup>b</sup>Most of these hens were in egg-laying condition or in the beginning stages of gonadal regression.

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, slowness, high carriage, jerkiness, wings crossed high over the back, dyspnea, tremors, wing shivers, and falling. Terminal signs were not observed. Signs appeared as soon as 10 min in mallards and 1 h in pheasants, and mortalities usually occurred between 0.5 and 2 h after treatment in mallards and between 2 and 4 days in pheasants. Remission took up to 1 month.

**Notes:** Endosulfan is a lipid-soluble compound; it could therefore follow the pattern shown for DDT of being eliminated from the body in the eggs of a laying hen. Since mortalities occur several days after treatment in pheasants, but occur rapidly in mallards, the egg elimination mechanism could serve to protect the individual laying hen pheasant by giving it an additional route of toxicant metabolism. Most of the survivors of the acute oral LD50 test on 1-year-old hen pheasants either were laying or had recently been laying. This could explain the apparently reduced sensitivity of 1-year-old hen pheasants to the toxic effects of endosulfan. However, another explanation could be that this apparent difference in hen pheasant sensitivity is due to some effect of maturation, perhaps an increased ability of the older pheasants to detoxify the chemical.

The above data provide no evidence of significant difference in the susceptibility of mature male and female mallards to the toxic effects of endosulfan. For further data and discussion of the effects of age on the sensitivity of mallards to this compound, see Hudson et al. (1972).

## ENDOTHALL

**Alternative Names:** Accelerate, Aquathol, Des-I-Cate, Herbicide 273, Herbicide 282, Herbicide 283, Hydout, Hydrothol 47, Hydrothol 191, Niagrathal, Tri-Endothol

**Chemical Name:** 7-Oxadicyclo[2.2.1 heptane 2,3-dicarboxylic acid] (CAS 145-73-3)

**Primary Use:** Herbicide, defoliant

**Sample Purity:** 83.6%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	16	F	3	229 (111-471)
Pheasant	10	F	6-7	< 198

**Signs of Intoxication:** Dyspnea, tachypnea, goose-stepping ataxia, ataxia, falling, regurgitation, sitting, jerkiness, tenseness, and lethargy. Signs appeared as soon as 1 h and mortalities occurred between 3 and 44 h. Remission took up to 9 days.

## ENDRIN

**Alternative Names:** Compound 269, ENT 17251, Experimental Insecticide 269 (J. Hyman & Co.), Hexadrin, Mendrin

**Chemical Name:** 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7,3,6-dimethanonaphth [2,3,-b] oxyrene (CAS 72-20-8)

**Primary Use:** Insecticide

**Sample Purity:** 96%<sup>1</sup> and 97%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	12	F	12 <sup>a</sup>	5.64 (2.71-11.7)
Sharp-tailed grouse <sup>1,2</sup>	12	F	—	1.06 (0.552-2.04)
California quail <sup>2</sup>	12	F	9-10 <sup>b</sup>	1.19 (0.857-1.65)
Pheasant <sup>2</sup>	12	M	3-4	1.78 (1.12-2.83)
Rock dove <sup>1</sup>	16	M,F	—	2.0-5.0
Mule deer <sup>1</sup>	3	F	10	6.25-12.5
Domestic goat <sup>1</sup>	2	F	12-24	25.0-50.0

<sup>a</sup>Most of these hens were in egg-laying condition.

<sup>b</sup>These hens were in the beginning stages of reproductive gonadal development.

**Signs of Intoxication:** Ataxia, slowness, drowsiness, tremors, tracheal congestion, prostration, convulsions, wing-beat convulsions, and opisthotonos. Signs appeared as soon as 1 h and mortalities usually occurred between 1 h and 5 days after treatment. Remission took up to 1 week.

**Other Toxicity Data:** The 30-day EMLD for mallards (n = 12) is 0.250 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $5.64/0.25 = 22$ , indicating a moderately high degree of cumulative action.

The percutaneous LD50 for 10-month-old mallard drakes (n = 2) after a 24-h dermal foot exposure to the 97% sample appears to be >140 mg/kg. Signs observed after percutaneous treatment included hyperexcitability, tenseness, shakiness, jerkiness, ataxia, goose-stepping ataxia, slowness, and stumbling. These signs appeared as soon as 3 h after the initiation of treatment. Remission took up to 4 days after the end of treatment. Mild dermal irritation was caused by exposure to endrin. When the percutaneous LD50 is compared with the acute oral LD50, endrin appears to have a relatively low order of dermal hazard in mallards.

**Notes:** For data and discussion on the effects of age on the sensitivity of mallards to endrin, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

- ENT 92: see Thanite  
 ENT 133: see rotenone  
 ENT 154: see DNOC  
 ENT 987: see thiram  
 ENT 1122: see dinoseb  
 ENT 1506: see DDT  
 ENT 1716: see methoxychlor  
 ENT 2435: see nicotine sulfate  
 ENT 3776: see dichlone  
 ENT 4225: see TDE  
 ENT 7796: see lindane  
 ENT 8601: see benzene hexachloride  
 ENT 9106: see nabam  
 ENT 9735: see toxaphene  
 ENT 9932: see chlordane  
 ENT 14874: see zineb  
 ENT 15108: see parathion  
 ENT 15152: see heptachlor  
 ENT 15541: see cycloheximide  
 ENT 15949: see aldrin  
 ENT 16225: see dieldrin  
 ENT 16391: see chlordecone  
 ENT 16634: see sulfoxide  
 ENT 17034: see malathion  
 ENT 17251: see endrin  
 ENT 17291: see schradan  
 ENT 17292: see methyl parathion  
 ENT 17295: see demeton  
 ENT 17510: see allethrin  
 ENT 17798: see EPN  
 ENT 17957: see coumaphos  
 ENT 18445: see Nemagon  
 ENT 18771: see TEPP  
 ENT 19507: see Diazinon  
 ENT 19763: see trichlorfon  
 ENT 20738: see DDVP  
 ENT 22374: see mevinphos  
 ENT 22897: see dioxathion  
 ENT 23233: see azinphos-methyl  
 ENT 23284: see ronnel  
 ENT 23437: see disulfoton  
 ENT 23648: see dicofol  
 ENT 23708: see carbophenothion  
 ENT 23737: see tetradifon  
 ENT 23969: see carbaryl  
 ENT 23979: see endosulfan  
 ENT 24042: see phorate  
 ENT 24105: see ethion  
 ENT 24482: see dicrotophos  
 ENT 24650: see dimethoate  
 ENT 24717: see crotoxyphos  
 ENT 24915: see tepa  
 ENT 24945: see fensulfothion  
 ENT 24964: see oxydemetonmethyl  
 ENT 24969: see chlorfenvinphos  
 ENT 24988: see naled  
 ENT 25445: see amitrole  
 ENT 25515: see phosphamidon  
 ENT 25540: see fenthion  
 ENT 25545-X: see isobenzan  
 ENT 25580: see thionazin  
 ENT 25602: see crufomate  
 ENT 25644: see famphur  
 ENT 25671: see Baygon  
 ENT 25705: see Imidan  
 ENT 25712: see trichloronat  
 ENT 25715: see fenitrothion  
 ENT 25719: see mirex  
 ENT 25726: see methiocarb  
 ENT 25734: see GC 6506  
 ENT 25766: see mexacarb  
 ENT 25784: see aminocarb  
 ENT 25796: see fonofos  
 ENT 25809: see Cyolane  
 ENT 25843: see Landrin  
 ENT 26538: see captan  
 ENT 26539: see folpet  
 ENT 26665: see dichlobenil  
 ENT 27041: see Mobam  
 ENT 27093: see aldicarb  
 ENT 27102: see Akton  
 ENT 27127: see bufencarb  
 ENT 27129: see monocrotophos  
 ENT 27164: see carbofuran  
 ENT 27165: see temephos  
 ENT 27311: see chlorpyrifos  
 ENT 27318: see ethoprop  
 ENT 27396: see methamidophos  
 ENT 27448: see phoxim  
 ENT 27520: see Dowco 214  
 ENT 27552: see bromopropylate  
 ENT 27572: see Nema-cur  
 ENT 27625: see C-2307  
 ENT 27738: see Vendex  
 ENT 27822: see acephate  
 ENT 27985B: see RU 11-679  
 ENT 28203: see trifluralin  
 ENT 28244: see atrazine  
 ENT 29054: see difluron  
 ENT 70460: see methoprene  
 Entex: see fenthion  
 Entocon growth regulant: see methoprene

## EPN

**Alternative Names:** ethyl p-nitrophenyl thionobenzene-phosphonate, EPN-300, ENT 17798

**Chemical Name:** Phenyl phosphonothioic acid, *O*-ethyl *O*-(4-nitrophenyl) ester (CAS 2104-64-5)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 91%,<sup>1</sup> 65.2%,<sup>2</sup> 87.7%<sup>3</sup>

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	12	F	3	3.08 (2.38-4.00)
Mallard (MM) <sup>2</sup>	20	M	4-5	7.09 (5.18-9.69)
California quail <sup>2</sup>	12	F	5-6	36.3 (28.0-47.1)
Japanese quail <sup>1</sup>	12	F	2	5.25 (3.79-7.28)
Pheasant <sup>1</sup>	12	F	3-5	53.4 (38.5-74.1)
Chukar <sup>1</sup>	12	F	3	14.3 (10.3-19.8)
Rock dove <sup>1</sup>	12	M,F	-	5.90 (4.25-8.17)
House sparrow <sup>1</sup>	16	F	-	12.6 (7.16-22.2)

**Signs of Intoxication:** Ataxia, imbalance, hyperexcitability, regurgitation, falling, sitting, goose-stepping ataxia, prostration, asthenia, myasthenia, salivation, lacrimation, tenesmus, diarrhea, loss of righting reflex, dyspnea, lethargy, tremors, wings spread, wing-drop, using wings for or to aid pedestrian locomotion, using wings to aid standing or balance, penile extrusion, tetany, and terminal wing-beat convulsions and opisthotonos. Signs appeared as soon as 1 h or as late as 2 days after treatment. Remission took up to 4 days.

**Other Toxicity Data:** The calculated percutaneous LD50 for the 65.2% sample in 1-year-old mallard hens (n = 8) after a 24-h dermal foot exposure is 480 (CL 240-960) mg/kg. The calculated percutaneous LD50 for the 87.7% sample in 4- to 5-month-old mallard (MM) drakes (n = 8) after a 24-h dermal foot exposure is 400 (CL 180-890) mg/kg. Signs were similar in these two tests and included, in addition to several of the above, phonation, slowness, exudate from nares, running and falling, and ataraxia. Signs appeared as soon as 5 h and mortalities usually occurred between 7 and 24 h after the initiation of treatment; one mortality, however, occurred between 1 and 4 days after the initiation of treatment. Remission took up to 4 days. When the percutaneous LD50 is compared with the acute oral LD50, EPN appears to have a relatively low order of dermal hazard in mallards.

**Notes:** Acetylcholinesterase activity measurements were made on the brains of the mortalities and survivors of the acute oral and percutaneous tests of the 87.7% formulation in mallards (MM). Survivors were sacrificed between 14 and 16 days after the initiation of treatment. At that time, when compared with their controls (n = 3,  $\Delta$ pH/

45 min = 0.813, s = 0.100, range = 0.732-0.925), survivors of the acute oral treatment had a mean of 14.6% inhibition (n = 10,  $\Delta$ pH/45 min = 0.694, s = 0.092, range = 0.535-0.846). When compared with their controls (n = 2,  $\Delta$ pH/45 min = 0.766, s = 0.053, range = 0.748-0.823), survivors of the percutaneous treatment had a mean of 23.0% inhibition (n = 7,  $\Delta$ pH/45 min = 0.605, s = 0.086, range = 0.426-0.701). Mortalities that occurred overnight after acute oral treatment showed only 8.8% inhibition (n = 3,  $\Delta$ pH/45 min = 0.741, s = 0.092, range = 0.684-0.847), whereas mortalities that occurred more rapidly (on the day of treatment) showed 60.8% inhibition (n = 17,  $\Delta$ pH/45 min = 0.319, s = 0.097, range = 0.169-0.513). Mortalities from the percutaneous treatment showed 49.1% inhibition (n = 2,  $\Delta$ pH/45 min = 0.400, s = 0.037, range = 0.374-0.427).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

For a discussion of the comparative toxicity of EPN, see Tucker and Haegele (1971).

EPN-300: see EPN

Equino-Aid: see trichlorfon

Esteron: see 2,4-D

Esteron 245: see 2,4,5-T

Estone: see 2,4-D

ET-14: see ronnel

ET-57: see ronnel

## ETHAMPHENPHION

**Alternative Names:** BAY 5505, BAY 69469, Muritan

**Chemical Name:** Phosphorothioic acid, *O,O*-diethyl *O*-(2-diethylaminomethyl-4-methylsulphonylphenyl) ester

**Primary Use:** Rodenticide

**Sample Purity:** Technical grade

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	8-11	10.4 (7.26-14.8)
Bobwhite	16	M	-	5.46 (4.19-7.11)

**Signs of Intoxication:** Polydipsia and regurgitation (in mallards), hyporeactivity, tenseness, slowness, ataxia, imbalance, running and falling, tremors, salivation, using wings for pedestrian locomotion, penile extrusion,

tonic convulsions of the legs, immobility, tetanic seizures, loss of righting reflex, and wing-beat convulsions. Signs appeared as soon as 6 min and mortalities usually occurred between 2 and 3 h after treatment. Remission took up to 10 days; however, the penis of one drake never retracted.

**Other Toxicity Data:** The calculated percutaneous LD50 for 1-year-old mallard drakes ( $n = 8$ ) after a 24-h dermal foot exposure is 56.6 [40.0-80.0] mg/kg. Signs observed after percutaneous treatment included, in addition to several of those reported above, wings spread, lacrimation, and nasal exudate. Mortalities occurred overnight after the initiation of treatment. When the percutaneous LD50 is compared with the acute oral LD50, it appears that ethamphenphion has a slight to moderate degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

## ETHION

**Alternative Names:** diethion, ENT 24105, NIA 1240, Niagara 1240, Nialate, phosphorodithioic acid, 8167 RP

**Chemical Name:** Phosphorodithioic acid, *S,S'*-methylene *O,O,O',O'*-tetraethyl ester (CAS 563-12-2)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	10	F	3	$\geq 2,560$
Pheasant	12	F	3-4	1,297 (745-2,257)

**Signs of Intoxication:** Ataxia, wing-drop, dyspnea, and falling. Signs appeared as soon as 1 h and mortalities occurred between 1.5 and 18 h after treatment. Remission took up to 2 days.

## ETHOPROP

**Alternative Names:** ENT 27318, ethoprophos, Jolt, Mocap, phosethoprop, prophos, V-C9-104

**Chemical Name:** Phosphorodithioic acid, *O*-ethyl *S,S*-di-propyl ester (CAS 13194-48-4)

**Primary Use:** Nematocide, soil insecticide

**Sample Purity:** 95.8%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3	12.6 [10.6-15.0]
Pheasant	12	M	3-4	4.21 (3.03-5.83)

**Signs of Intoxication:** Regurgitation, ataxia, ataraxia, violent wing-beat convulsions, salivation, lacrimation, ptosis, exudate from nares, dyspnea, and opisthotonos. Signs appeared as soon as 7 min and mortalities usually occurred between 15 and 60 min after treatment. Remission took up to 2 weeks.

**Other Toxicity Data:** The calculated percutaneous LD50 for 1-year-old mallard drakes ( $n = 8$ ) after a 24-h dermal foot exposure is 10.6 [7.50-15.0] mg/kg. Signs observed after dermal exposure included hyporeactivity, ataxia, slowness, stumbling, falling, using wings to aid pedestrian locomotion, wings spread, immobility, dyspnea, spasms, lacrimation, asthenia, myasthenia, and penile extrusion in the mortalities. Signs appeared as soon as 2.5 h and mortalities usually occurred between 4 and 18 h after the initiation of treatment. One drake, however, experienced prolonged intoxication from which debilitation developed and death occurred 29 days after treatment had ended. Remission typically took up to 1 week. When the percutaneous LD50 is compared with the acute oral LD50, ethoprop appears to have an extremely high degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Ethoprophos: see ethoprop

Ethyl *p*-nitrophenyl thionobenzenephosphonate: see EPN

Ethyl parathion: see parathion

Ethyl phosphates: see TEPP

Etilon: see parathion

Etolene: see ronnel

Experimental Insecticide 269: see endrin

Experimental Insecticide 3911: see phorate

Experimental Insecticide 52160: see temephos

Experimental Nematocide 18133: see thionazin

E-Z-Off D: see DEF

Famfos: see famphur

Famophos: see famphur

## FAMPHUR

**Alternative Names:** AC-38023, American Cyanimid 38023,



Bo-Ana, CL 38023, Dovip, ENT 25644, Famfos, Famophos, Warbex

**Chemical Name:** Phosphorothioic acid, *O*-[4-[(dimethylamino)sulfonyl],phenyl] *O,O*-dimethyl ester (CAS 52-85-7)

**Primary Use:** Systemic insecticide

**Sample Purity:** 35%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	9.87 (5.88-16.6)

**Signs of Intoxication:** Regurgitation, goose-stepping ataxia, wing-drop, tremors, tonic seizures.

FB/2: see diquat dibromide

FBHC: see benzene hexachloride

Fen-All: see TBA

Fenamiphos: see Nema-cur

Fence Rider: see 2,4,5-T

Fenchlorfos: see ronnel

Fenchlorphos: see ronnel

## FENITROTHION

**Alternative Names:** Accothion, Agrothion, BAY 41831, CP-47114, Cytel, E.I.-47300, ENT 25715, Folithion, MEP, Metathion E-50, methyl nitrophos, Monsanto CP-47114, Novathion, Nuvanol, OMS 43, S-1102A, S 5660, Sonar, Sumithion, Sumitomò

**Chemical Name:** Phosphorothioic acid, *O,O*-dimethyl *O*-(3-methyl-4-nitrophenyl) ester (CAS 122-14-5)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 95%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard (st)	12	M	3-4	1,190 (392-3,610)
Mallard	15	F	3	1,662 (185-14,958)
Sharp-tailed grouse	12	M	6-7	53.4 (42.4-67.3)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bobwhite	12	M	2-3	27.4 (19.0-39.5)
Bobwhite	9	M	5	32.0 (17.4-59.0)
Bobwhite	9	F	5	23.6 (12.8-43.5)
Pheasant (st)	12	M	3	55.6 (28.9-107)
Mule deer	1	M	13	>727

**Signs of Intoxication:** Regurgitation (in mallards), ataxia, high carriage, wing-drop, wing shivers, falling, salivation, tremors, loss of righting reflex, tetanic seizures, dyspnea, miosis, lacrimation, and wing-beat convulsions. Signs appeared as soon as 30 min and mortalities usually occurred between 1 h and 4.5 days after treatment; one mortality, however, occurred 17.5 days after treatment. Remission took up to 16 days.

**Other Toxicity Data:** The calculated percutaneous LD50 for 1-year-old mallard drakes ( $n = 8$ ) after a 24-h foot exposure is 504 (CL 370-686) mg/kg. Signs observed after dermal treatment were similar to those noted above. Mortalities occurred between 19 and 24.25 h after the initiation of treatment. Remission took up to 5 days. When the percutaneous LD50 is compared with the acute oral LD50, fenitrothion appears to have an extremely high degree of dermal hazard in mallards.

The 30-day EMLD for 4- to 5-month-old mallards of both sexes ( $n = 18$ ) appears to lie between 3.33 and 10.0 mg/kg per day. The resulting cumulative toxicity index is  $1,190/3.33-10.0 = 119-357$ , indicating an extremely high degree of cumulative action in mallards, particularly for an organophosphate. This finding may be accounted for in part by regurgitation of larger acute doses and better absorption of small subacute doses.

The 30-day EMLD for 5- to 6-month-old pheasants of both sexes ( $n = 12$ ) appears to lie between 6.00 and 15.0 mg/kg per day. The resulting cumulative toxicity index is  $55.6/6.00-15.0 = 3.56-9.27$ , indicating a moderate degree of cumulative action for fenitrothion in pheasants.

**Notes:** Gross necropsies of mortalities from the 30-day pheasant and mallard studies revealed many small spleens.

Acetylcholinesterase activity measurements were made on the brains of pheasant mortalities and survivors sacrificed on the day after the final dosage in the 30-day EMLD studies. When compared with their controls ( $n = 6$ ,  $\Delta pH/45 \text{ min} = 1.331$ ,  $s = 0.029$ , range = 1.299-1.366), survivors showed 68.3% inhibition ( $n = 6$ ,  $\Delta pH/45 \text{ min} = 0.422$ ,  $s = 0.093$ , range = 0.254-

0.531). When compared with their controls ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.097$ ,  $s = 0.068$ , range = 0.996–1.159), mortalities showed 88.3% inhibition ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.128$ ,  $s = 0.050$ , range = 0.051–0.184).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Fenophosphon: see trichloronat

Fenoprop: see silvex

## FENSULFOTHION

**Alternative Names:** BAY 25141, Dasanit, ENT 24945, S 767, Terracur P

**Chemical Name:** Phosphorothioic acid, *O,O*-diethyl *O*-[4-(methylsulfinyl)phenyl] ester (CAS 115-90-2)

**Primary Use:** Insecticide

**Sample Purity:** 90%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	5–7	0.749 (0.595–0.944)
Sharp-tailed grouse	3	M	—	0.500–1.00
California quail	20	M	9–10 <sup>a</sup>	1.68 (1.38–2.04)
California quail	20	F	9 <sup>b</sup>	1.19 (0.935–1.51)
Pheasant	12	M	3	1.34 (1.06–1.68)

<sup>a</sup>Most of these cocks had well-developed testes, indicating their active breeding condition.

<sup>b</sup>Most of these hens had slightly to well-developed ovaries, indicating either active breeding condition or the early stages of gonadal development.

**Signs of Intoxication:** Regurgitation, ataxia, wings crossed high over back, wing and tail tremors, masseter tenseness, dyspnea, opisthotonos. Signs appeared as soon as 20 min after treatment, and mortalities occurred in 34 min to 3 h. Survivors appeared normal the day after treatment.

**Other Toxicity Data:** The 30-day EMLD for 5- to 6-month-old mallards of both sexes ( $n = 12$ ) is 0.200 mg/kg per day. The resulting cumulative toxicity index is 0.749/0.200 = 3.7, indicating little cumulative toxic action in mallards.

The calculated percutaneous LD50 for 1-year-old mallard hens ( $n = 8$ ) after a 24-h dermal foot exposure is 2.86 (CL 2.10–3.89) mg/kg. Signs observed after dermal

treatment were similar to those reported above. Mortalities occurred between 2 and 18 h after the initiation of treatment. Mild dermal irritation occurred after dermal exposure to fensulfothion. Remission took up to 7 days. When the percutaneous LD50 is compared with the acute oral LD50, fensulfothion appears to have a moderate degree of dermal hazard in mallards.

**Notes:** For data and discussion on the effects of age on the sensitivity of mallards to fensulfothion, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

## FENTHION

**Alternative Names:** BAY 29493, Baytex, DMTP, ENT 25540, Entex, Lebaycid, Mercaptophos, Queletox, S 1752, Tiguvon

**Chemical Name:** Phosphorothioic acid, *O,O*-dimethyl *O*-[3-methyl-4-(methylthio)phenyl] ester (CAS 55-38-9)

**Primary Use:** Insecticide

**Sample Purity:** 90%<sup>1</sup> and 99%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Canada goose <sup>2</sup>	8	M,F	—	12.0 (8.48–17.0)
Mallard <sup>1</sup>	12	F	4	5.94 (4.28–8.23)
Bobwhite <sup>2</sup>	4	M	—	≤ 4.00
California quail <sup>2</sup>	12	M	6–7	15.0 (11.9–18.9)
Japanese quail <sup>2</sup>	12	F	2–3	10.6 (8.41–13.3)
Pheasant <sup>2</sup>	12	F	7–22 <sup>a</sup>	17.8 (9.33–34.0)
Chukar <sup>1</sup>	12	M,F	3	25.9 (15.8–42.7)
Rock dove <sup>2</sup>	12	M,F	—	4.63 (3.24–6.61)
Mourning dove (st) <sup>2</sup>	8	M,F	—	2.50 (1.25–5.00)
House sparrow (st) <sup>2</sup>	20	F	—	22.7 (14.6–35.1)
House finch (st) <sup>1</sup>	10	M,F	—	— 10

<sup>a</sup>These hens may have been in breeding condition.

**Signs of Intoxication:** Lacrimation, foamy salivation, tracheal congestion, goose-stepping ataxia, immobility, tonic



tremors, tachypnea, dyspnea, clonic convulsions or opisthotonos. Signs appeared as soon as 8 min and mortalities usually occurred between 30 min and 2 h after treatment. Remission took up to 2 days.

**Other Toxicity Data:** The calculated percutaneous LD50 for 10-month-old mallard drakes ( $n = 8$ ) after a 24-h dermal foot exposure<sup>2</sup> is 44.0 (CL 22.0-88.0) mg/kg. Signs observed after dermal treatment included, in addition to several of the above, wing-beat convulsions and penile extrusion. Mortalities usually occurred between 18 and 25 h after the initiation of treatment. When the percutaneous LD50 is compared with the acute oral LD50, fenthion appears to have a relatively low degree of dermal hazard in mallards.

The 30-day EMLD<sup>1</sup> for mallards ( $n = 12$ ) is 0.5 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $5.94/0.5 = 11.9$ , indicating moderate cumulative action. The fertility of eggs laid by survivors of the treatment level at 0.5 mg/kg per day was markedly reduced.

**Notes:** For a discussion of the comparative toxicity of fenthion, see Tucker and Haegele (1971).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Fermide 850: see thiram

Fernasan: see thiram

Fernesta: see 2,4-D

Fernimine: see 2,4-D

Fernoxone: see 2,4-D

Ferxone: see 2,4-D

Film extender: see Yuma Chemical "Spreader A"

## FLUOMETURON

**Alternative Names:** C-2059, Cotoran, Lanex

**Chemical Name:** *N,N*-dimethyl-*N'*-[3-(trifluoromethyl)phenyl]urea (CAS 2164-17-2)

**Primary Use:** Herbicide

**Sample Purity:** 80% Wettable powder

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	3-4	>2,000

**Signs of Intoxication:** Ataxia, wing-drop or wings crossed high over back, tail pointed upward, fluffed feathers, hyperexcitability, phonation, falling. Signs appeared 15 min after treatment and persisted for up to a week.

## FLUORODIFEN

**Alternative Names:** C-6989, Preforan, Soyex

**Chemical Name:** Benzene 2-nitro-1-(4-nitrophenoxy)-4-trifluoromethyl (CAS 15457-05-3)

**Primary Use:** Herbicide

**Sample Purity:** Technical grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Pheasant	3	F	3	>2,000

**Signs of Intoxication:** None.

FMC-5462: see endosulfan

FMC-10242: see carbofuran

FMC-17370: see resmethrin

Folidol: see parathion

Folidol M: see methyl parathion

Folithion: see fenitrothion

Folosan: see PCNB

Folpan: see folpet

## FOLPET

**Alternative Names:** ENT 26539, Folpan, Phaltan, thio-phal, trichloromethylthiophthalimide

**Chemical Name:** 2-[(Trichloromethyl)thio]-1*H*-isoindole-1,3(2*H*)-dione (CAS 133-07-3)

**Primary Use:** Fungicide

**Sample Purity:** 92.4%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3	>2,000

**Signs of Intoxication:** The only signs seen were mild ataxia and wings crossed high over back for up to 18 days. Slight weight losses occurred.

## FONOFOS

**Alternative Names:** Dyfonate, ENT 25796, N-2788, N-2790

**Chemical Name:** Ethylphosphorodithioic acid, *O*-ethyl *S*-phenyl ester (CAS 994-22-9)

**Primary Use:** Soil insecticide

**GC-6506**

**Sample Purity:** 94.3%

**Alternative Names:** ENT 25734

**Acute Oral Toxicity Summary**

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	16.9 (13.4-21.3)

**Chemical Name:** Phosphoric acid, dimethyl 4-(methylthio) phenyl ester (CAS 3254-63-5)

**Primary Use:** Insecticide

**Sample Purity:** 95%

**Acute Oral Toxicity Summary**

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	1.12 (0.811-1.56)
Pheasant	12	M	3-4	0.668 (0.531-0.842)
Pheasant	5	F	4	0.500-1.00

**Signs of Intoxication:** Hyperexcitability, wide stance, reluctance to leave the swimming pond, ataxia, goose-stepping ataxia, falling, sitting, tremors, spasms, using wings to aid pedestrian locomotion, wing-drop, immobility, and terminal wing-beat convulsions. Signs appeared as soon as 25 min and mortalities usually occurred between 1 and 3 h after treatment. Remission took up to 4 days.

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, wing-drop, wing shivers, tremors, miosis, convulsions, running and falling, ataraxia, tachypnea, tetanic seizures, and terminal wing-beat convulsions. Signs appeared as soon as 4 min and mortalities usually occurred between 15 min and 2.5 h after treatment; however, one mallard died 9 days after treatment. Remission took up to 2 weeks.

Gearphos: see methyl parathion

Gebutox: see dinoseb

Genitox: see DDT

Gesapon: see DDT

Gesaprim: see atrazine

Gesarex: see DDT

Gesarol: see DDT

Forlin: see lindane

For-Mal: see malathion

Forron: see 2,4,5-T

Fos-Fall "A": see DEF

Fosferno M50: see methyl parathion

Fosfono 50: see parathion

Fostion MM: see dimethoate

Fratol: see sodium monofluoroacetate

French pyrethroid: see RU 11-679

Fruitone A: see 2,4,5-T

Fruitone T: see silvex

Frumin AL: see disulfoton

Frumin G: see disulfoton

Fumazone: see Nemagon

Furadan: see carbofuran

Furloe: see CIPC

FW-293: see dicofol

Fyfanon: see malathion

G-24480: see Diazinon

G-30027: see atrazine

Gallotox: see PMA

Gamaphex: see lindane

Gamma BHC: see lindane

Gamma isomer of benzene hexachloride: see lindane

Gammalin: see lindane

Gammex: see lindane

Gammexane: see lindane

Gammopaz: see lindane

Gardentox: see Diazinon

Gardona: see tetrachlorvinphos

Garlon: see silvex

Garrathion: see carbophenothion

GC-1189: see chlordecone

GC-1283: see mirex

**GOPHACIDE**

**Alternative Names:** BAY 38819, DRC-714, phosacetim, phosazetim

**Chemical Name:** Phosphoramidothioic acid, (1-iminoethyl)-O,O-bis(4-chlorophenyl) ester (CAS 4104-14-7)

**Primary Use:** Rodenticide

**Sample Purity:** 95%

**Acute Oral Toxicity Summary**

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog	2	M	-	>2,000

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	24.0 (19.0-30.9)
Golden eagle	3	M,F	< 36	2.5-5.0
Pheasant	16	F	3-5	161 (78.3-332)
Chukar	12	M,F	3	322 (168-620)

**Signs of Intoxication:** Myasthenia, arched back, anorexia, ataxia, wings crossed high over back, salivation, miosis, ptosis, dyspnea, diarrhea, tremors, loss of righting reflex, tetanic seizures, opisthotonos. Appearance of signs was sometimes delayed up to 4 days. Remission took up to 1 week.

Gramoxone: see paraquat dichloride

Grandamone: see grandlure

## GRANDLURE

**Alternative Names:** Grandamone

**Chemical Name:** (3,3-Dimethylcyclohexylidene)-acetaldehyde, mixture with (Z)-2-(3,3-dimethylcyclohexylidene) ethanol and (1R-cis)-1-methyl-2-(1-methylethenyl)cyclobutaneethanol (CAS 11104-05-5)

**Primary Use:** Female boll weevil sex attractant (pheromone produced by the male boll weevil)

**Sample Purity:** Technical grade

**Acute Oral Toxicity Summary:** None

**Signs of Intoxication:** No signs were observed in dietary tests on mallards or bobwhites.

**Other Toxicity Data:** The 8-day dietary LC50 for 15-day-old mallard ducklings (n = 50) is >5,000 ppm. The 8-day dietary LC50 for 11- to 13-day-old bobwhite chicks (n = 40) is >5,000 ppm. Food consumption and body weight gains in the ducklings and the chicks in these studies appeared to be normal.

Granosan: see Ceresan L, Ceresan M

Granutox: see phorate

GS-13005: see methidathion

GS-14260: see terbutryn

GS-19851: see bromopropylate

Guesapon: see DDT

Guesarol: see DDT

Gusathion: see azinphos-methyl

Gusathion M: see azinphos-methyl

Guthion: see azinphos-methyl

Gyron: see DDT

HC-1281: see TBA

HCCH: see benzene hexachloride

HCH: see benzene hexachloride

Hedonal: see 2,4-D

HEOD: see dieldrin

## HEPTACHLOR

**Alternative Names:** Drinox H-34, E-3314, ENT 15152, Heptamul, Velsicol 104

**Chemical Name:** 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene (CAS 76-44-8)

**Primary Use:** Insecticide

**Sample Purity:** 99.2%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	M	3	≥ 2,080

**Signs of Intoxication:** The only signs seen were ataxia, excessive swallowing, and nutation during the day of treatment. Mortalities occurred at night on the 6th and 8th days after administration.

**Other Toxicity Data:** For effects on mallard eggshell thickness, see Haegele and Tucker (1974).

Heptamul: see heptachlor

Herbicide 273: see endothall

Herbicide 282: see endothall

Herbicide 283: see endothall

Herbizole: see amitrole

Hercules 528: see dioxathion

Hercules 3956: see toxaphene

Hercules AC 528: see dioxathion

Herkol: see DDVP

HETP: see TEPP

Hexachlor: see benzene hexachloride

Hexachloran: see benzene hexachloride

Hexadrin: see endrin

Hexafor: see benzene hexachloride

## HEXAFLURATE

**Alternative Names:** Nopalmate, Nopalmitate, TD-480

**Chemical Name:** Potassium hexafluoroarsenate (CAS 17029-22-0)

**Primary Use:** Herbicide (primary target—prickly pear cactus)

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	193 (117-317)
California quail	12	M,F	12 <sup>a</sup>	229 (132-399)
Gray partridge	12	M	-	142 (112-178)

<sup>a</sup>These were in the early stages of gonadal regression at the end of the breeding season.

**Signs of Intoxication:** Regurgitation, circling, tremors, tenseness, spasms, dyspnea, tachypnea, polydipsia, opisthotonos, convulsions, and tetany. Signs appeared as soon as 10 min and mortalities occurred usually between 1 and 3 h after treatment. Remission took up to 1 week.

**Other Toxicity Data:** The 30-day EMLD for 4-month-old mallards of both sexes (n = 6) is 40.0 mg/kg per day. The resulting cumulative toxicity index is  $193/40.0 = 4.8$ , indicating little cumulative toxicity of hexaflurate for mallards.

Hexathane: see zineb

Hexathir: see thiram

Hexavin: see carbaryl

Hexyclan: see benzene hexachloride

HHDN: see aldrin

Hinosan: see edifenphos

HL 331: see PMA

HOE 2671: see endosulfan

Hong Nien: see PMA

Hydout: see endothall

Hydrothol 47: see endothall

Hydrothol 191: see endothall

IFK: see IPC-400

Igran: see terbutryn

Igran 50: see terbutryn

## IMIDAN

**Alternative Names:** ENT 25705, Phosmet, Phthalophos, Prolate, R-1504, Stauffer R-1504

**Chemical Name:** Phosphorodithioic acid, S-[1,3-dihydro-1,3-dioxo-2H-isoindole-2-yl,methyl]O,O-dimethyl ester (CAS 732-11-6)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 97.2%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	20	M	3-4	1,830 (1,270-2,630)
Pheasant	14	M	3	>250
Pheasant	12	F	3-4	237 (171-329)

**Signs of Intoxication:** Regurgitation and polydipsia (in mallards), ataxia, excessive preening, hyperactivity, falling, ptosis, salivation, prostration, dyspnea, tremors, wings spread, convulsions, tetanic seizures, and terminal wing-beat convulsions. Signs appeared as soon as 10 min and mortalities usually occurred between 0.5 and 17 h after treatment; two pheasants, however, died at 18 and 24 h after treatment. Remission took up to 2 weeks.

**Notes:** In mallards, treatment levels as low as 96 mg/kg produced signs of intoxication, and 768 mg/kg produced some mortalities.

INPC: see IPC-400

Insect Flowers: see pyrethrum

Insect growth regulator: see methoprene

Insecticidal extracts: see rotenone

Insecticide 1179: see methomyl

Insectophene: see endosulfan

Insect Powder: see pyrethrum

Inverton 245: see 2,4,5-T

IPC: see IPC-400

## IPC-400

**Alternative Names:** Chem-Hoe, IFK, INPC, IPC, Iso PPC, isopropyl carbanilate, propham, Triherbide-IPC, Tuberite

**Chemical Name:** Carbamic acid, phenyl-1-methylethyl ester

**Primary Use:** Herbicide

**Sample Purity:** 40% active formulation

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3	>2,000

**Signs of Intoxication:** Regurgitation, high carriage, goose-stepping ataxia, falling when walking, walking with the aid of the wings. Signs persisted 2 to 4 weeks after single oral administration.

## ISOBENZAN

**Alternative Names:** CP-14957, ENT 25545-X, SD 4402, Telodrin

**Chemical Name:** 1,3,4,5,6,7,8,8-Octachloro-1,3,3a,4,7,7a-hexahydro-4,7-methanoisobenzofuran (CAS 297-78-9)

**Primary Use:** Insecticide

**Sample Purity:** 99%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	5-7	4.15 (2.47-6.97)

**Signs of Intoxication:** Ataxia, fasciculation, tenseness, swimming backwards, tail high and fanned, loss of righting reflex, circling, opisthotonos. Signs appeared as soon as 30 min and mortalities occurred about 2 h after treatment. Survivors appeared normal by the next day, but lost moderate amounts of body weight by the end of the 14-day observation period.

Iso PPC: see IPC-400  
 Isopropyl carbanilate: see IPC-400  
 ISO-Systox: see demeton  
 Isotox: see benzene hexachloride  
 Ixodex: see DDT  
 Jolt: see ethoprop  
 Juvenile hormone mimic: see methoprene  
 Karbaspray: see carbaryl  
 Karbofos: see malathion  
 Karmex: see diuron  
 Kazide: see potassium azide  
 Kazoe: see potassium azide  
 Kelthane: see dicofol  
 Kemate: see anilazine  
 Kepone: see chlordecone  
 Kill-All: see sodium arsenite  
 Kilmite 40: see TEPP  
 Kiloseb: see dinoseb  
 Kilrat: see zinc phosphide  
 Kithiol: see malathion  
 Kobutol: see PCNB  
 Kopsol: see DDT  
 Kop-Thiodan: see endosulfan  
 Kop-Thion: see malathion  
 Korlan: see ronnel  
 Kuron: see silvex  
 Kurosals: see silvex  
 Kuton: see silvex

Kypchlor: see chlordane  
 Kypfos: see malathion  
 Kypzin: see zineb  
 L-11/6: see phorate  
 L-36352: see trifluralin  
 Lamprecid 2770: see TFM  
 Lamprecide: see TFM

## LANDRIN

**Alternative Names:** ENT 25843, OMS 597, SD 8530

**Chemical Name:** 2,3,5-Trimethylphenyl methylcarbamate; and 3,4,5-trimethylphenyl methylcarbamate(1:4) (CAS 12407-86-2)

**Primary Use:** Soil insecticide

**Sample Purity:** >95%<sup>1</sup> and 96%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>2</sup>	9	F	4	14.1 [10.0-20.0]
Mallard <sup>1</sup>	12	F	7-11 <sup>a</sup>	28.3 (14.7-54.4)
California quail <sup>2</sup>	12	F	5-6	195 (141-271)
Japanese quail <sup>2</sup>	24	M	2	70.8 (32.6-154)
Pheasant <sup>1</sup>	9	M	2-3	67.2 (25.2-179)
Chukar <sup>1</sup>	12	M,F	7-11 <sup>a</sup>	61.7 (43.2-88.1)
Rock dove <sup>1</sup>	12	M,F	-	168 (121-233)
House sparrow <sup>2</sup>	20	M	-	46.3 (37.4-57.3)
House sparrow <sup>2</sup>	12	F	-	55.0 (38.5-78.6)
Mule deer <sup>2</sup>	4	M	5-11	70.7 [50.0-100]
Domestic goat <sup>2</sup>	1	M	36-48	<210

<sup>a</sup>These birds may have been in breeding condition.

**Signs of Intoxication:** Birds—hyperactivity, ataxia, slowness, wing-drop, salivation, lacrimation, diarrhea, tachypnea, tonic spasms, immobility, tetany, violent convulsions. Mammals—ataxia, tremors, salivation, nutation, phonation, inability to stand, tachypnea, mucous-filled trachea, tachycardia, ataraxia. Signs and mortality occurred as soon as 15 min after treatment. Mortalities generally occurred by 2 h and complete recovery among survivors took 1 to 3 days.

**Note:** For a discussion of the comparative toxicity of Lannate, see Tucker and Haegel (1971).

Lanes: see fluometuron  
 Lannate: see methomyl  
 Largon: see difluron  
 Larvatrol: see *Bacillus thuringiensis* (Berliner)  
 Lasso: see alachlor  
 Lazo: see alachlor  
 Lead tetraethide: see tetraethyllead  
 Lead, tetraethyl: see tetraethyllead  
 Lebaycid: see fenthion  
 Le-Kuo: see dimethoate  
 Lepton: see leptophos

## LEPTOPHOS

**Alternative Names:** Abar, Lepton, Phosvel, VCS 506

**Chemical Name:** Phenyl phosphonothioic acid, *O*-(4-bromo-2,5-dichlorophenyl) *O*-methyl ester (CAS 21609-90-5)

**Primary Use:** Insecticide, experimental fungicide

**Sample Purity:** 90%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	9	F	4	1,333 (982-1,809)
Bobwhite	10	M	11	228 (184-283)
California quail	12	M	9-11	29.2 (20.4-41.6)
Pheasant	12	M	3-4	62.8 (15.9-248)

**Signs of Intoxication:** Ataxia, high carriage, jerkiness, running and falling, asthenia, unkemptness, sitting, hyporeactivity, hypoactivity, withdrawal, immobility, spasms, tremors, and ataraxia. Signs appeared as soon as 30 min after treatment. Mortalities appeared to fall into two classes: most occurred rapidly (between 1 and 5 h after treatment), but some were delayed (between 6 and 24 h after treatment).

**Notes:** Acetylcholinesterase activity measurements were made of the brains of bobwhite mortalities and sacrificed survivors (14-28 days after treatment). When compared with their controls ( $n = 5$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.101$ ,  $s = 0.100$ , range = 0.976-1.226), mortalities that occurred within 5 h after treatment showed 74.8% inhibition ( $n = 3$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.278$ ,  $s = 0.207$ , range = 0.046-

0.444). A single mortality that occurred overnight after treatment showed 7.7% inhibition ( $n = 1$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.016$ ); two mortalities that occurred overnight and one day after treatment showed no measurable inhibition ( $n = 2$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.246$ ,  $s = 0.056$ , range = 1.206-1.285). Sacrificed survivors showed only 0.6% inhibition ( $n = 8$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.094$ ,  $s = 0.152$ , range = 0.887-1.283).

One could speculate that two toxicological modes of action operate during intoxication with leptophos. One type of response could be attributed to depression of acetylcholinesterase activity by this pesticide. Mortalities associated with this response would be rapid and significant depression of cholinesterase activity would be found. The other type of response could be attributed to the chlorine content of this pesticide, which could cause it to act in the manner of a central nervous system stimulant. Mortalities associated with this type of response would occur over a longer period of time and would not be accompanied by depression of cholinesterase activity. Other similarly chlorinated and brominated organophosphate compounds (such as chlorpyrifos) may possess similar toxicological properties.

Lilly 36532: see trifluralin

Lindafor: see lindane

Lindagam: see lindane

## LINDANE

**Alternative Names:** ENT 7796, Forlin, Gamaphex, gamma BHC, gamma isomer of benzene hexachloride, Gamma-lin, Gammex, Gammexane, Gammopaz, Lindafor, Lindagam, Lintox, Novigam, Silvanol

**Chemical Name:** (1 $\alpha$ ,2 $\alpha$ ,3 $\beta$ ,4 $\alpha$ ,5 $\alpha$ ,6 $\beta$ )-1,2,3,4,5,6-Hexachlorocyclohexane (CAS 58-89-9)

**Primary Use:** Insecticide

**Sample Purity:** 25%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	12	M	3-4	>2,000

**Signs of Intoxication:** Regurgitation, polydipsia, tremors, circling, weakness, slowness of reflexes, opisthotonos.

**Other Toxicity Data:** The 30-day EMLD for mallards ( $n = 12$ ) is 30 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $>2,000/30 = >67$ , indicating a high degree of cumulative toxic action even for an organochlorine compound.



Line Rider: see 2,4,5-T  
 Lintox: see benzenehexachloride, lindane  
 Liquiphene: see PMA  
 Lonacol: see zineb  
 Lorsban: see chlorpyrifos  
 M-73: see clonitralid  
 M-74: see disulfoton  
 Mafu: see DDVP  
 Magnacide H: see acrolein  
 Malamar: see malathion  
 Malaspray: see malathion

## MALATHION

**Alternative Names:** AC 4049, carbofos, Chemathion, Compound 4049, Cythion, Emmatos, Emmatos Extra, ENT 17034, For-Mal, Fyfanon, Karbofos, Kithiol, Kop-Thion, Kypfos, Malamar, Malaspray, Malathon, mercaptothion, MLT, phosphothion

**Chemical Name:** [(Dimethoxyphosphinothioyl)thio]butanedioic acid, diethyl ester (CAS 121-75-5)

**Primary Use:** Insecticide

**Sample Purity:** 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	24	F	3	1,485 (1,020-2,150)
Pheasant	12	F	3	167 (120-231)
Horned lark	9	M,F	A	403 (247-658)

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Ataxia, walking high on toes, imbalance, hypoactivity, wing-drop, weakness, slowness, sitting, ptosis, falling with wings spread, tenesmus, salivation, swallowing, tremors, dyspnea, and convulsions. Signs appeared as soon as 25 min and mortalities usually occurred between 1 and 18 h after treatment. Remission took up to 7 days.

**Notes:** Acetylcholinesterase activity measurements were made of the brains of the horned larks. When compared with the controls ( $n = 7$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.868$ ,  $s = 0.059$ , range = 0.742-0.930), mortalities showed a mean inhibition of 86.9% ( $n = 3$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.114$ ,  $s = 0.090$ , range = 0.026-0.207), whereas sacrificed survivors (14 days after treatment) showed a mean inhibition of 21.4% ( $n = 8$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.682$ ,  $s = 0.130$ , range = 0.493-0.922).

Malathon: see malathion  
 Malix: see endosulfan  
 Marlate: see methoxychlor  
 Marmer: see diuron  
 Marvex: see DDVP  
 Matacil: see aminocarb  
 MCA-600: see Mobam  
 McNeil 1025: see norbormide  
 ME-1700: see TDE  
 Meldane: see coumaphos

## MEMA RM

**Alternative Names:** Mercuran

**Chemical Name:** (Acetato-*O*)(2-methoxyethyl)mercury (CAS 151-38-2)

**Primary Use:** Fungicide

**Sample Purity:** 11.4% (7.15% mercury)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard (st)	12	M	3-4	1,059 (764-1,470)
Mule deer (st)	1	M	16	>250

**Signs of Intoxication:** Mallards—ataxia, wings crossed high over back, tail down, wing shivers, salivation, collapse. Part of the dosage was regurgitated. Mortalities occurred as early as 1 h and as late as 6 days after treatment. Remission took as long as 2 weeks. Deer—piloerection, belching, bloody diarrhea, and anorexia. Remission took up to 2 weeks.

Mendrin: see endrin

Menite: see mevinphos

MEP: see fenitrothion

Mercaptodimethur: see methiocarb

Mercaptofos: see demeton

Mercaptophos: see fenthion, demeton

Mercaptothion: see malathion

Mercuram: see thiram

Mercuran: see Mema RM

Merpan: see captan

Mersolite: see PMA

## MESTRANOL

**Alternative Names:** None found

**Chemical Name:** 3-Methoxy-19-nor-pregna-1,3,5(10)-trien-20yn-17-ol (CAS 72-33-3)



**Primary Use:** Antifertility agent, repellent

**Sample Purity:** 95%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3-4	>2,000
Red-winged blackbird (st)	1	M	—	>913

**Signs of Intoxication:** Ataxia and imbalance. Signs appeared as soon as 2.5 h after treatment. Remission took up to 2 days.

**Other Toxicity Data:** The 15-day EMLD for chukars (n = 1M, 3F) is greater than 20 mg/kg per day for both sexes. The chukars treated at this level displayed some salivation and general weakness only. A subsequent reproduction study with these chukars revealed reduced egg fertility compared with that of a control group receiving empty gelatin capsules for a month.

Mesuroil: see methiocarb

Metacide 50: see methyl parathion

Metafos: see methyl parathion

Metalkamate: see bufencarb

Metaphos: see methyl parathion

Metasystemox: see oxydemetonmethyl

Meta-Systox-R: see oxydemetonmethyl

Metathion E-50: see fenitrothion

## METHAMIDOPHOS

**Alternative Names:** BAY 71628, ENT 27396, Monitor, Ortho 9006, RE-9006, SRA 5172, Tameron

**Chemical Name:** Phosphoramidothioic acid, *O,S*-dimethyl ester (CAS 10265-92-6)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 74.8%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard (st)	12	M	3	8.48 (6.73-10.7)

**Signs of Intoxication:** Ataxia, imbalance, falling, sitting, wing-drop, wings spread, tremors, nutation, immobility, and terminal wing-beat convulsions. Signs appeared as

soon as 10 min and mortalities usually occurred between 50 and 90 min after treatment. Remission normally took up to 3 days; however, it took 35 days in one bird.

## METHIDATHION

**Alternative Names:** GS-13005, Supracide, Ultracide, Ultracide Geigy

**Chemical Name:** Phosphorodithioic acid, *S*-[(5-methoxy-2-oxo-1,3,4-thiadiazol-3(2*H*))yl)methyl] *O,O*-dimethyl ester (CAS 950-37-8)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 98.2%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Canada goose	15	M,F	A <sup>b</sup>	8.41 (4.20-16.8)
Mallard	12	F	3-4	23.6 (16.5-33.8)
Pheasant	12	F	4	33.2 (17.3-63.5)
Chukar	12	M,F	12-24 <sup>b</sup>	225 (178-283)

<sup>a</sup>Except as noted.

<sup>b</sup>These adult birds may have been in reproductive condition — they were tested in the early part of the breeding season.

**Signs of Intoxication:** Goose-stepping ataxia, leg weakness, dyspnea, lacrimation, salivation, prostration, ataxia, seizures with wings spread, terminal opisthotonos. Signs appeared as soon as 10 min and mortalities usually occurred between 90 min and 5 h after treatment. Remission took up to 2 days.

**Note:** Treatment levels as low as 77.9 mg/kg have produced mortalities in chukars.

## METHIOCARB

**Alternative Names:** BAY 37344, BAY H-321, Draza, DRC-736, ENT 25726, Mesuroil, mercaptodimethur (proposed), Metmercaptopur

**Chemical Name:** 3,5-Dimethyl-4-(methylthio)phenyl methylcarbamate (CAS 3566-00-5)

**Primary Use:** Insecticide, stupefacient, avian repellent

**Sample Purity:** 98%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	12.8 (7.37-22.4)
Pheasant	11	F	3-6	~270
Horned lark	15	M,F	A	31.4 (20.4-48.4)

<sup>a</sup>Except as noted.

**Signs of Intoxication:** High carriage, tenseness, shakiness, ataxia, imbalance, backing, running and falling, disorientation, abnormal reactivity, sitting, withdrawal, ptosis, ataraxia, clonic convulsions, immobility, dyspnea, and opisthotonos. Signs appeared as soon as 5 min and mortalities usually occurred between 1 and 2 h after treatment; however, two pheasants died 6-20 h after treatment. Remission took up to 1 week.

**Notes:** Acetylcholinesterase activity measurements were made on the brains of the horned larks. When compared with controls ( $n = 7$ ,  $\Delta pH/45 \text{ min} = 0.868$ ,  $s = 0.059$ , range = 0.742-0.930), mortalities showed 59.9% inhibition ( $n = 7$ ,  $\Delta pH/45 \text{ min} = 0.348$ ,  $s = 0.059$ , range = 0.251-0.440), whereas survivors sacrificed 14-17 days after treatment showed only 6.6% inhibition ( $n = 9$ ,  $\Delta pH/45 \text{ min} = 0.811$ ,  $s = 0.070$ , range = 0.719-0.904).

## METHOMYL

**Alternative Names:** Dupont 4179, Insecticide 1179, Lanate, Nudrin

**Chemical Name:** *N*-[[(Methylamino)carbonyl]oxy]ethanimidothioic acid, methyl ester (CAS 16752-77-5)

**Primary Use:** Insecticide, nematocide

**Sample Purity:** 90%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	15	M	8-24	15.9 (11.4-22.0)
Pheasant	15	M	3-4	15.0 (10.0-22.3)
Mule deer	2	M	13	11.0-22.0

**Signs of Intoxication:** High carriage, ataxia, drowsiness, tachypnea, dyspnea, salivation, tenesmus, diarrhea, tremors, tetany or wing-beat convulsions.

**Other Toxicity Data:** The 30-day EMLD for 17- to 23-week-old mallards ( $n = 12$ ) is 7.5 mg/kg per day for both sexes. The resulting cumulative toxicity index is 15.9/7.5 = 2.1, indicating little or no cumulative toxic action.

## METHOPRENE

**Alternative Names:** Altosid, ENT 70460, Entocon growth regulant, ZR-515

**Chemical Name:** (*E,E*)-11-Methoxy-3,7,11-trimethyl-2,4-dodecadienoic acid, 1-methylethyl ester (CAS 40596-69-8)

**Primary Use:** Insect growth regulator acting as an insecticide, mimics the action of juvenile hormone

**Sample Purity:** 17% cis-, 68.9% trans-, technical grade

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	9	M	3-4	>2,000

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, slowness, reluctance to move, sitting, and withdrawal. Signs appeared as soon as 2 h and persisted for up to 2 days after treatment.

**Note:** Treatment levels as low as 500 mg/kg produced signs of intoxication in the mallards.

## METHOXYCHLOR

**Alternative Names:** dianisyltrichloroethane, Dimethoxy-DT, DMDT, ENT 1716, Marlate, methoxy DDT, Moxie

**Chemical Name:** 1,1'-(2,2,2-Trichloroethylidene)-bis [4-methoxybenzene] 88% and related compounds 12% (CAS 72-43-5)

**Primary Use:** Insecticide

**Sample Purity:** Technical grade

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 (mg/kg)
Mallard	3	M	3	>2,000
Sharp-tailed grouse	3	M	A <sup>b</sup>	>2,000
California quail	7	F	9-10 <sup>b</sup>	>2,000

<sup>a</sup>Except as noted.

<sup>b</sup>Most of these birds were in reproductive condition.

**Signs of Intoxication:** Slight asthenia in the legs of mallards, jitteriness, low stance, and wings spread. Signs appeared as soon as 1 h after treatment. Remission took up to 2 days.

**Notes:** One of six California quail treated at 2,000 mg/kg died 6 days after treatment. Signs of intoxication, however, were not observed.

Methoxy DDT: see methoxychlor

Methyl demeton-O-sulfoxide: see oxydemetonmethyl

Methyl Guthion: see azinphos-methyl

Methylmercuric cyanoguanidine: see Panogen

Methyl nitrophenos: see fenitrothion

## METHYL PARATHION

**Alternative Names:** Bayer E-601, Dalf, dimethyl parathion, E-601, ENT 17292, Folidol M, Fosferno M50, Gearphos, Metacide 50, metafos, metaphos, Metron, Nitrox, Nitrox 80, parathion-methyl, Partron M, Tekwaisa, Wofatox

**Chemical Name:** Phosphorothioic acid, *O,O*-dimethyl *O*-(4-nitrophenyl) ester (CAS 298-00-0)

**Primary Use:** Insecticide

**Sample Purity:** 80%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	16	M	3	10.0 (6.12-16.3)
Mallard	20	F	18	6.60 (4.42-9.88)
Mallard (MM)	15	F	4-5	60.5 (18.2-201)
Bobwhite	16	M	A	7.56 (5.70-10.0)
Pheasant	12	F	2	8.21 (5.69-11.9)
Red-winged blackbird	12	F	A <sup>b</sup>	23.7 (17.1-32.9)

<sup>a</sup>Except as noted.

<sup>b</sup>These birds may have been in reproductive condition.

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, falling, dyspnea, salivation, withdrawal, using wings for pedestrian locomotion, nutation, lacrimation, asynergy, immobility, convulsions, wing-beat convulsions, and opisthotonos. Signs appeared as soon as 10 min and mortalities usually occurred between 15 min and 2 h after treatment. However, three bobwhites died between 4 and 20 h and one died 36 h after treatment. Remission usual-

ly took up to 2 days; however, one bobwhite showed prolonged signs, including ataraxia, bradypnea, ptosis, convulsions, tremors, erection of the feathers on the head, ataxia, sitting, hyperexcitability, and disorientation for up to 14 days after treatment.

**Other Toxicity Data:** The calculated percutaneous LD50 for 5-month-old mallard (MM) hens (n = 8) after a 24-h dermal foot exposure is 53.6 (CL 39.3-72.9) mg/kg. Signs appeared as soon as 4 h and mortalities usually occurred between 7 and 21 h after the initiation of treatment. Remission took up to 2 days. Mild dermal irritation was caused by exposure to methyl parathion. When the percutaneous LD50 is compared with the acute oral LD50, it appears that methyl parathion has an extremely high degree of dermal hazard in mallards.

**Notes:** Acetylcholinesterase activity measurements were made on the brains of the mallards (MM), bobwhites, and red-winged blackbirds from the above tests. Mallard mortalities from the acute oral treatment, when compared with controls (n = 2,  $\bar{\Delta}pH/45 \text{ min} = 0.768$ , s = 0.026, range = 0.750-0.787), showed 76.2% inhibition (n = 8,  $\bar{\Delta}pH/45 \text{ min} = 0.183$ , s = 0.161, range = 0.063-0.565); whereas mortalities from the percutaneous treatment, when compared with their controls (n = 2,  $\bar{\Delta}pH/45 \text{ min} = 0.823$ , s = 0.037, range = 0.797-0.849), showed 91.2% inhibition (n = 6,  $\bar{\Delta}pH/45 \text{ min} = 0.072$ , s = 0.020, range = 0.048-0.099). Mallard survivors of the acute oral treatment showed 12.8% inhibition (n = 17,  $\bar{\Delta}pH/45 \text{ min} = 0.670$ , s = 0.132, range = 0.455-0.929), whereas survivors of the percutaneous treatment showed 37.7% inhibition (n = 3,  $\bar{\Delta}pH/45 \text{ min} = 0.513$ , s = 0.132, range = 0.372-0.633) when they were sacrificed 14-15 days after treatment. Bobwhite mortalities, when compared with their controls (n = 12,  $\bar{\Delta}pH/45 \text{ min} = 1.450$ , s = 0.083, range = 1.346-1.604), showed 93.6% inhibition (n = 12,  $\bar{\Delta}pH/45 \text{ min} = 0.092$ , s = 0.069, range = 0.004-0.184), whereas survivors sacrificed 14-21 days after treatment showed 68.6% inhibition (n = 9,  $\bar{\Delta}pH/45 \text{ min} = 0.455$ , s = 0.407, range = 0.012-0.994). Red-winged blackbird mortalities, when compared with their controls (n = 3,  $\bar{\Delta}pH/45 \text{ min} = 1.747$ , s = 0.083, range = 1.667-1.833), showed 64% inhibition (n = 7,  $\bar{\Delta}pH/45 \text{ min} = 0.628$ , s = 0.215, range = 0.347-0.896), whereas survivors sacrificed 14 days after treatment showed 26.5% inhibition (n = 9,  $\bar{\Delta}pH/45 \text{ min} = 1.284$ , s = 0.118, range = 1.120-1.447).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Methyl systox: see oxydemetonmethyl

Metilmercaptosfosoksid: see oxydemetonmethyl

Metiltriaozion: see azinphos-methyl

Metmercaturon: see methiocarb

Metrifonate: see trichlorfon  
Metron: see methyl parathion

## MEVINPHOS

**Alternative Names:** ENT 22374, Menite, OS-2046, Phosdrin, Phosfene

**Chemical Name:** 3-[(Dimethoxyphosphinyloxy)-2-butenic acid, methyl ester (CAS 7786-34-7)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 100% analytical grade (60%  $\alpha$ , 40% other)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	12	F	5-7	4.63 (3.57-6.00)
Sharp-tailed grouse	12	M	A <sup>b</sup>	1.34 (0.695-2.57)
Pheasant	12	M	3-4	1.37 (0.951-1.98)

<sup>a</sup>Except as noted.

<sup>b</sup>Some of these grouse may have been in reproductive condition.

**Signs of Intoxication:** Ataxia, either low or high carriage, toes curled, tachypnea, dyspnea, salivation, diarrhea, tremors, phonation, tetany or violent terminal wing-beat convulsions. Signs appeared as soon as 2 min in mallards and 5 min in the other species; mortalities usually occurred between 4 and 34 min in mallards and between 5 and 20 min after treatment in the other species. Remission took up to 12 days.

**Other Toxicity Data:** The calculated percutaneous LD50 for 1-year-old mallard hens (n = 8) after a 24-h foot exposure is 11.1 (CL 4.98-24.7) mg/kg. Signs observed after dermal treatment included, in addition to several of the above, lacrimation, spasms, and wings spread. When the percutaneous LD50 is compared with the acute oral LD50, mevinphos appears to have a relatively high degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

## MEXACARBATE

**Alternative Names:** Dowco 139, ENT 25766, Zectran

**Chemical Name:** 4-(Dimethylamino)-3,5-dimethylphenol methylcarbamate (ester) (CAS 315-18-4)

**Primary Use:** Insecticide

**Sample Purity:**  $\geq$ 99% (recrystallized 3 times)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Bullfrog	8	M	-	566 (283-1,131)
Canada goose	6	M,F	-	2.64 (2.00-3.48)
Mallard	12	F	5-7	2.98 (2.50-3.50)
Mallard duckling (st)	9	M,F	15-19 d	4.20 (3.50-5.00)
Sharp-tailed grouse	12	M	A <sup>b</sup>	10.0 (6.50-15.6)
California quail	9	F	18	7.14 (2.68-19.0)
Japanese quail	12	F	2-3	3.21 (2.45-4.21)
Pheasant	12	F	A <sup>b</sup>	4.57 (3.42-6.09)
Chukar	12	M,F	4-5	5.24 (4.17-6.61)
Sandhill crane	4	M,F	-	1.00-4.50
Rock dove	12	M,F	-	6.47 (3.72-11.3)
Mourning dove (st)	6	M,F	3	2.83 (2.00-4.00)
House sparrow	16	F	A <sup>b</sup>	50.4 (21.9-116)
House finch (st)	12	M	A	4.76 (3.43-6.60)
Mule deer	5	M,F	5-30	12.5-25.0
Domestic goat	2	M	A	15.0-30.0

<sup>a</sup>Except as noted.

<sup>b</sup>Some of these birds may have been in breeding condition.

**Signs of Intoxication:** Ataxia, imbalance, neck tremors, nystagmus, miosis, hyporeactivity, sitting, reluctance to move, ataraxia, falling, convulsions, tachypnea, dyspnea, lacrimation, salivation, diarrhea, tachycardia, tracheal congestion, hyperthermia, terminal convulsions. The most typical sign is increased respiratory rate (up to 3 or 4 times the normal rate for a species). Death appears to occur by respiratory paralysis. Zectran poisoning and recovery are rapid. Usually peak signs or death occurred within 1 h and recovery was often complete by 3 h.

**Other Toxicity Data:** LD50's of Zectran to mallards of six ages between 48 h and 7 months were nearly identical, indicating little change in susceptibility with age; see Hudson et al (1972).

The 30-day EMLD is 2.33, 5-10, and 1.25 mg/kg per day, respectively, for chukars (n = 1M, 5F), deer (n = 4), and mallards (n = 12). For mallards, the resulting cumulative toxicity index is  $3.0/1.25 = 2.4$ , indicating little cumulative action.

No effects were seen on the fertility or hatchability of eggs produced by mallards surviving 2.66 mg/kg per day for 30 days.

A formulation of Zectran and Dowanol TPM was tested on 3- to 4-month-old female mallards (n = 9) and resulted in an acute oral LD50 of 35.0 mg/kg. This formulation contains 6% Zectran, which gives an LD50 of 2.1 mg/kg for the Zectran present. This level is close to the 2.98 mg/kg LD50 for recrystallized Zectran itself.

**Notes:** For a more detailed discussion of some of the above data, see Tucker and Crabtree (1969).

For a discussion of the comparative toxicity of mexacarbate, see Tucker and Haegele (1971).

### MEXACARBATE (ACYLATED)

**Alternative Names:** acetylated mexacarbate, acetylated Zectran, Zectran (acylated)

**Chemical Name:** *N*-acetyl-4-dimethylamino-3,5-dimethylphenyl methylcarbamate ester

**Primary Use:** Experimental insecticide

**Sample Purity:** ≥ 80%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Bullfrog	2	M	—	>2,000
Mallard	18	F	3-4	>2,000

**Signs of Intoxication:** None for bullfrogs. For mallards, moderate ataxia, masseter tenseness, excessive chewing motions during first 4 or 5 h only.

**Note:** For a more detailed discussion of the above data, see Tucker and Crabtree (1969).

**Microbial control agent:** see *Nosema locustae*

### MIREX

**Alternative Names:** Dechlorane, Dodecachloropentacyclopentane, ENT 25719, GC-1283

**Chemical Name:** 1,1a,2,2,3,3a,4,5,5,5a,5b,6-Dodecachlorooctahydro-1,3,4-metheno-1*H*-cyclobuta[cd]pentalene (CAS 2385-85-5)

**Primary Use:** Insecticide

**Sample Purity:** 98%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	7	M	3	>2,400
Pheasant	3	F	3	>2,000

**Signs of Intoxication:** Mild ataxia and withdrawal. Signs appeared as soon as 40 min after treatment. Remission usually took up to 2 days.

**Mitigan:** see dicofol

**ML-97:** see phosphamidon

**MLT:** see malathion

### MOBAM

**Alternative Names:** ENT 27041, MCA-600, OMS-708

**Chemical Name:** Benzo[b]thiophene-4-ol, methylcarbamate (CAS 1079-33-01)

**Primary Use:** Insecticide

**Sample Purity:** 98%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	9	M	12 <sup>b</sup>	952 (357-2,535)
Sharp-tailed grouse	8	M	—	173 (99.9-300)
California quail	12	M	5-6	463 (266-805)
Japanese quail	12	M	2 <sup>b</sup>	668 (530-842)
Pheasant	12	M	2-3	228 (136-383)
Chukar	16	M,F	9 <sup>b</sup>	237 (137-410)
Rock dove	12	M,F	—	273 (215-354)
House sparrow	12	M	A <sup>b</sup>	57.8 (33.2-101)

<sup>a</sup>Except as noted.

<sup>b</sup>Many of these birds may have been in breeding condition.

**Signs of Intoxication:** Asynergy, myasthenia, ataxia, imbalance, goose-stepping ataxia, stumbling or collapse,

tremors, lacrimation, foamy salivation, diarrhea, tachypnea, dyspnea, loss of righting reflex, ataxia, tetany, tonic convulsions, clonic convulsions, wing-beat convulsions, and phonation.

**Other Toxicity Data:** The 30-day EMLD for mallards (n = 3M, 3F) is 40 mg/kg per day. The resulting cumulative toxicity index is  $952/40 = 24$ , indicating a high degree of cumulative toxic action for a carbamate.

The fertility, hatchability, and chick survivability of eggs produced by pheasants (n = 3M, 3F) surviving 30 daily oral doses at a treatment level of 40 mg/kg per day were similar to those of a control group of pheasants treated 30 days with empty gelatin capsules.

**Notes:** For a discussion of the comparative toxicity of Mobam, see Tucker and Haegele (1971).

Mocap: see ethoprop

Molluscicide Bayer 73: see clonitralid

Monitor: see methamidophos

Monocron: see monocrotophos

## MONOCROTOPHOS

**Alternative Names:** Azodrin, CIBA 1414, ENT 27129, Monocron, Nuvacron, SD 9129

**Chemical Name:** (E)-Phosphoric acid, dimethyl [1-methyl-3-(methylamino)-3-oxo-1-propenyl] ester (CAS 919-44-8)

**Primary Use:** Insecticide

**Sample Purity:** >75%,<sup>1</sup> >80%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Canada goose <sup>1</sup>	12	M,F	—	1.58 (1.10-2.28)
Mallard <sup>2</sup>	12	M	4	4.76 (3.43-6.60)
Golden eagle <sup>1</sup>	6	—	1	0.188 (0.094-0.376)
Bobwhite <sup>1</sup>	12	M	12-24	0.944 (0.749-1.19)
California quail <sup>1</sup>	12	F	12	0.763 (0.438-1.33)
Japanese quail <sup>1</sup>	12	M	2-3	3.71 (2.73-5.03)
Pheasant <sup>2</sup>	12	F	7-8	2.83 (2.00-4.00)
Chukar <sup>2</sup>	12	F	4	6.49 (5.01-8.42)
Gray partridge <sup>1</sup>	7	F	A	6.40-12.8
Turkey <sup>1</sup>	13	M,F	6-18	2.00-3.16

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Rock dove <sup>1</sup>	24	M,F	A	2.83 (1.39-5.75)
House sparrow <sup>1</sup>	10	M	A <sup>b</sup>	1.48 (1.07-2.04)
House finch <sup>2</sup>	5	M	A	8.10-24.3
Mule deer <sup>1,2</sup>	6	F	8-28	25.0-50.0
Domestic goat <sup>1</sup>	2	F	8-12	20.0-50.0

<sup>a</sup>Except as noted.

<sup>b</sup>Some of these birds may have been in breeding condition.

**Signs of Intoxication:** Birds—fluffed feathers, eyes closed, ataxia, lacrimation, salivation, polydipsia, dyspnea, tracheal congestion, defecation, mydriasis, hyperactive nictitating membrane, tremors, wing-beat convulsions, tetany or opisthotonos. Mammals—ataxia, miosis, hypo-reactivity, constant quivering, immobility, tracheal congestion, tachypnea, dyspnea, phonation. Mortalities usually occurred 1 to 60 h after treatment. Remission usually took up to 4 days; however, some mortalities occurred after this time.

**Other Toxicity Data:** The 30-day EMLD<sup>1</sup> for mallards (n = 6M, 6F) is about 0.25 mg/kg per day. The resulting cumulative toxicity index is  $4.76/-0.25 = -19.4$ , indicating a high degree of cumulative action for an organophosphate.

The calculated percutaneous LD50 for the 75% sample for 1-year-old mallard drakes (n = 8) after a 24-h dermal foot exposure is 30.0 (CL 13.5-66.8) mg/kg. In general, signs were similar to those reported above. Mortalities usually occurred between 3 and 19 h after the initiation of treatment. Remission took up to 3 days after treatment had ended. When the percutaneous LD50 is compared with the acute oral LD50, it appears that monocrotophos has a moderate degree of percutaneous hazard in mallards.

**Notes:** Gross necropsies often revealed endocardial and gastrointestinal hemorrhaging.

For a discussion of the comparative toxicity of monocrotophos, see Tucker and Haegele (1971).

For data and discussion on the effects of age on the sensitivity of mallards to monocrotophos, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Monosodium fluoroacetate: see sodium monofluoroacetate  
Monsanto CP-47114: see fenitrothion

Morsodren: see Panogen

Motox: see toxaphene

Mous-con: see zinc phosphide



Moxie: see methoxychlor

M & T Chemicals RS150: see D.M. 7537

Muritan: see ethamphenphion

Muscatox: see coumaphos

N-2788: see fonofos

N-2790: see fonofos

## NABAM

**Alternative Names:** Chem Bam, Dithane D-14, DSE, ENT 9106, Parzate, Spring-Bak

**Chemical Name:** 1,2-Ethanedithiolbiscarbamodithioic acid, disodium salt (CAS 142-59-6)

**Primary Use:** Fungicide

**Sample Purity:** 93%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog	6	F	—	420 [250-707]
Mallard	4	M	3-4	>2,560
Japanese quail	12	M	2	2,120 (1,680-2,670)
Pheasant	9	M	3-5	707 [500-1,000]
Rock dove	5	M,F	—	>2,000
Domestic goat	2	M	11	>800

**Signs of Intoxication:** Ataxia, tremors, tachypnea, myasthenia, salivation, miosis, tenesmus, diarrhea, pilorection.

## NALED

**Alternative Names:** bromchlophos, Bromex, Dibrom, ENT 24988, RE-4355

**Chemical Name:** Phosphoric acid, 1,2-dibromo-2,2-dichloroethyl dimethyl ester (CAS 300-76-5)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 93%,<sup>1</sup> 92%<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months) <sup>a</sup>	LD50 95%CL (mg/kg)
Canada goose <sup>1</sup>	9	M,F	—	49.9 (31.7-78.6)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	12	M	—	52.2 (37.8-72.3)
Sharp-tailed grouse <sup>1</sup>	12	M	A	64.9 (37.3-113)
Pheasant <sup>2</sup>	16	M	3-4	120 (30.0-480)
Mule deer <sup>1</sup>	2	M,F	—	~200

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, tachypnea, salivation, tremors, loss of righting reflex, violent wing-beat convulsions, and opisthotonos. Signs appeared as soon as 5 min and mortalities usually occurred between 15 min and 3.5 h after treatment; however, one pheasant died between 2 and 3 days after treatment. Remission took up to 2 weeks.

**Note:** A treatment level as low as 22.2 mg/kg caused a mortality in Canada geese.

Nankor: see ronnel

Naphthalenes: see Panasol AN-2

Naphthene + dinaphthene benzenes: see Panasol AN-2

Naramycin A: see cycloheximide

Navadel: see dioxathion

Neguvon: see trichlorfon

## NEMACUR

**Alternative Names:** BAY 68138, ENT 27572, fenamiphos (proposed), phenamiphos (proposed)

**Chemical Name:** Phosphoroid acid, ethyl 3-methyl-4-(methylthio) phenyl(1-methylethyl) ester (CAS 2224-92-6)

**Primary Use:** Nematocide

**Sample Purity:** 81%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	1.68 [1.41-2.00]
California quail	12	F	11 <sup>a</sup>	1.83 (1.12-3.01)
Pheasant	7	M	3-4	0.500-1.00

<sup>a</sup>Most of these hens were in breeding condition.

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, slow-



ness, withdrawal, hyporeactivity, wing-drop, regurgitation, tachypnea, rapid swallowing, using wings for pedestrian locomotion, immobility, ataxia, lacrimation, salivation, dyspnea, tetanic seizures, wing tremors, opisthotonos, and terminal wing-beat convulsions. Signs appeared as soon as 10 min and mortalities usually occurred between 0.5 and 2 h after treatment. Remission took up to 14 days.

**Other Toxicity Data:** The calculated percutaneous LD50 for 1-year-old mallard drakes ( $n = 8$ ) after a 24-h dermal foot exposure is 23.8 (CL 17.5-32.4) mg/kg. Signs observed were similar to those reported above, and appeared as soon as 4 h after the initiation of treatment. Mortalities usually occurred between 19 and 24 h after the initiation of treatment. When the percutaneous LD50 is compared with the acute oral LD50, Nema-cur appears to have a relatively low degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Nemafos: see thionazin  
Nemafume: see Nemagon

## NEMAGON

**Alternative Names:** BBC 12, DBCP, dibromochloropropane, ENT 18445, Fumazone, Nema-fume, OS 1897

**Chemical Name:** 1,2-Dibromo-3-chloropropane (CAS 96-12-8)

**Primary Use:** Nematocide

**Sample Purity:** 95% active ingredient and 5% other halogenated C<sub>3</sub> compounds

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-5	66.8 (48.2-92.6)
Pheasant	12	F	3-4	156 (89.3-271)

**Signs of Intoxication:** Ataxia, hyporeactivity, slowness, falling, ptosis, tremors, lethargy, asthenia, myasthenia, backing, withdrawal, ataxia, somersaulting onto the back or side, and immobility. Signs appeared as soon as 15 min and mortalities usually occurred between 1 and 9 days after treatment. Remission took up to 2 weeks.

**Notes:** A treatment level as low as 60.0 mg/kg caused a mortality in pheasants.

Nemaphos: see thionazin  
Neocid: see DDT  
Neocidol: see Diazinon  
Neoron: see bromopropylate  
Neostanox: see Vendex  
NIA 1240: see ethion  
NIA 5462: see endosulfan  
NIA 5488: see tetradifon  
NIA 5996: see dichlobenil  
NIA 10242: see carbofuran  
NIA 17370: see resmethrin  
NIA 24110: see RU 11-679  
Niagara 1240: see ethion  
Niagrathal: see endothall  
Nialate: see ethion

## NICOTINE SULFATE

**Alternative Names:** Black Leaf 40, ENT 2435

**Chemical Name:** (S)-3-(1-methyl-2-pyrrolidinyl) pyridine sulfate,(2:1) (CAS 65-30-5)

**Primary Use:** Insecticide

**Sample Purity:** 40%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	4	587 (397-869)
Japanese quail	12	M	2	530 (383-735)
Pheasant	8	F	3-4	1,200-2,000
Rock dove	5	M	—	>2,000
Mule deer	3	F	12	100-200

**Signs of Intoxication:** Wing shivers or fasciculation, ataxia, excessive swallowing and chewing motions, masseter tenseness, mild narcosis, strong whole-body tremors, miosis, terminal wing-beat convulsions or opisthotonos. Levels as low as 6.0 mg/kg produced some signs in mallards. In most species mortalities occurred as soon as 6 min or as late as 2 days following treatment.

Nicouline: see rotenone  
Nifos T: see TEPP  
Nimitox: see temephos  
Niran: see chlordane, parathion  
Nitrador: see DNOC  
Nitralin: see Planavin  
Nitropone C: see dinoseb  
Nitrostigmine: see parathion  
Nitrox: see methyl parathion  
Nitrox 80: see methyl parathion

Nogos: see DDVP  
 Nomersam: see thiram  
 Nopalmate: see hexaflurate  
 Nopalmitate: see hexaflurate  
 No-Pest: see DDVP  
 Norex: see chloroxuron

## NORBORMIDE

**Alternative Names:** McNeil 1025, Raticate, Shoxin

**Chemical Name:** 3a,4,7,7a-Tetrahydro-5-(hydroxyphenyl-2-pyridinylmethyl)-7-(phenyl-2-pyridinylmethylene)-4,7-methano-1*H*-isindole-1,3(2*H*)-dione (CAS 991-42-4)

**Primary Use:** Experimental rodenticide

**Sample Purity:** 20%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	9-10	>3,000

**Signs of Intoxication:** Regurgitation, dyspnea, polydipsia, slight loss of balance, excessive preening. No significant changes in body weight had occurred by the end of the 14-day observation period.

## NOSEMA LOCUSTAE

**Alternative Names:** None found

**Chemical Name:** *Nosema locustae* Canning (Microsporida: Nosematidae), a microsporidian protozoan

**Primary Use:** An experimental microbial control agent for grasshoppers and Mormon crickets, commonly applied at the rate of  $2.47 \times 10^9$  spores per hectare.

**Sample Purity:**  $1.72 \times 10^9$  spores/mL water,<sup>1</sup>  $5 \times 10^8$  spores/mL water<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 (spores/bird)
Mallard (MM; st) <sup>1</sup>	10	M,F	1	$\geq 5 \times 10^9$
Pheasant (HGF; st) <sup>2</sup>	10	M	A	$\geq 5 \times 10^9$

<sup>a</sup>Except as noted.

**Signs of Intoxication:** None.

**Notes:** One mallard died 2 months after treatment, but 9 other mallards and 10 controls survived and appeared normal throughout the 7-month observation period before sacrifice. We have no explanation for the single mallard mortality; however, it was probably not related to treatment with *Nosema locustae*.

Novathion: see fenitrothion

Novigam: see lindane

NRDC 104: see resmethrin

Nucidol: see Diazinon

## NUCLEOPOLYHEDRAL VIRUS

**Alternative Names:** *Hemerocampa pseudotsugata*, polyhedral virus, viral pesticide

**Chemical Name:** A preparation of the nucleopolyhedrosis virus *Hemerocampa pseudotsugata*

**Primary Use:** Experimental insecticide

**Sample Purity:**  $30.01 \times 10^6$  polyhedra per milligram

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	2	M,F	4	>404
Pheasant	1	F	4	>384
House sparrow (st)	1	F	—	>1,969
Mule deer	1	M	—	>52.9

**Signs of Intoxication:** No signs, or minor temporary weakness only.

**Other Toxicity Data:** The percutaneous LD50 for a male albino rabbit (n = 1) after a 28-h exposure appears to be greater than 241 mg/kg.

Three hen mallards survived repeated daily dosages of 5 mg/kg per day for 5 days, at which time treatment was terminated.

**Notes:** In terms of the proposed field application rates, these doses are quite large, equaling 1.5 times the  $50 \times 10^9$  polyhedra applied per hectare. It should be kept in mind, however, that each infected target insect larva can produce 2 to 20% of this original treatment rate.

Minor primary dermal irritation was noted on the rabbit tested (equal to +1 on the FDA scale for erythema and edema).

The mule deer displayed moderate transient neutrophilia and eosinophilia after oral administration. This response could be interpreted as initial metabolic intoxication and allergic response to the foreign protein of the virus preparation.

Nudrin: see methomyl  
 Nuvacron: see monocrotophos  
 Nuvan: see DDVP  
 Nuvanol: see fenitrothion  
 Nux vomica: see strychnine  
 Nylmerate: see PMA  
 Octachlor: see chlordane  
 Octachlorocamphene: see toxaphene  
 Octa-Klor: see chlordane  
 Octalene: see aldrin  
 Octalox: see dieldrin  
 Octamethylpyrophosphoramidate: see schradan  
 n-Octyl sulfoxide of isosafrole: see sulfoxide

## OIL HERDER

**Alternative Names:** Shell Oil Herder

**Chemical Name:** 60% of an active material which is described as a linear primary alcohol of C<sub>12</sub> to C<sub>15</sub> range, 40% ethylene glycol monobutyl ether

**Primary Use:** Oil-spill clean-up agent

**Sample Purity:** 100%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (st)	6	F	4	>2,000

**Signs of Intoxication:** Low carriage, ataxia, imbalance, stumbling, falling, wing-drop, polydipsia, hyperexcitability, unkemptness, and hypoactivity. Signs were extreme as soon as 15 min after treatment. Remission took up to 2 days.

## OIL HERDER #2

**Alternative Name:** Shell Oil Herder #2

**Chemical Name:** 60% of an active material which is described as a linear primary alcohol of C<sub>12</sub> to C<sub>15</sub> range, 40% butyl alcohol

**Primary Use:** Oil-spill clean-up agent

**Sample Purity:** 100%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (MM; st)	19	M	4-5	>2,000

**Signs of Intoxication:** Regurgitation, ataxia, stumbling, ptosis, loss of righting reflex, using wings to aid pedestrian locomotion, tremors, intermittent opisthotonos or emprosthotonos, immobility, dyspnea, wing-beat convulsions, and occasional hyperexcitability or hyperactivity upon remission. Signs appeared as soon as 15 min, and except for prolonged asthenia and slowness in some birds, remission had occurred by the day following treatment.

Oil-soaked bird clean-up agent: see Shell Sol 70

Oko: see DDVP

OM 2424: see Terrazole

OMPA: see schradan

OMS-33: see Baygon

OMS-43: see fenitrothion

OMS-597: see Landrin

OMS-708: see Mobam

OMS-771: see aldicarb

OMS-1155: see Dowco 214

OMS-1804: see difluron

Ontrack WE-1: see PCP

OR-1911: see phosphamidon

Orthene: see acephate

Ortho 5353: see bufencarb

Ortho 9006: see methamidophos

Ortho 12420: see acephate

Orthocide: see captan

Orthocide 406: see captan

Ortho-Klor: see chlordane

Ortho Paraquat: see paraquat dichloride

Orthophos: see parathion

Ortho Phosphate Defoliant: see DEF

Ortran: see acephate

OS-1897: see Nemagon

OS-2046: see mevinphos

## OXYDEMETONMETHYL

**Alternative Names:** BAY 21097, BAY 21116, demeton methyl, demeton-S-methyl-sulfoxide, ENT 24964, metasystemox, Metasystox R, Meta-Systox-R, methyl demeton-O-sulfoxide, methyl systox, metilmercaptosoksid, R-2170

**Chemical Name:** Phosphorothioic acid, S-[2-(ethylsulfinyl) ethyl] O,O-dimethyl ester (CAS 301-12-2)

**Primary Use:** Insecticide

**Sample Purity:** 50%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	4	53.9 (38.9-74.8)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
California quail	12	M	6	47.6 (34.3-66.0)
Japanese quail	12	F	2 <sup>a</sup>	84.1 (60.6-117)
Pheasant	12	F	3-4	42.4 (30.6-58.8)
Chukar	15	M,F	3-4	120 (81.4-177)
Rock dove	9	M,F	-	14.0 (8.84-22.3)
House sparrow	16	M	-	70.8 (43.4-116)

<sup>a</sup>Some of these hens were in egg-laying condition.

**Signs of Intoxication:** Ataxia, salivation, lacrimation, nutation, dyspnea, masseter tenseness, severe miosis, tenesmus, prostration or immobility in a prone position, tremors, tetany, terminal wing-beat convulsions or opisthotonos. Signs appeared as soon as 8 min and mortalities usually occurred between 10 min and 2 h after treatment. Remission took up to 14 days.

**Note:** For a discussion of the comparative toxicity of oxydemetonmethyl, see Tucker and Haegele (1971).

Pallethrine: see allethrin

PAM: see PMA

Pamosol 2 Forte: see zineb

## PANASOL AN-2

**Alternative Names:** None found

**Chemical Name:** An aromatic solvent composed of 23.7% C<sub>9</sub> to C<sub>15</sub> alkylbenzenes, 17.7% naphthalene, 46.3% C<sub>11</sub> to C<sub>15</sub> substituted naphthalenes, 11.2% C<sub>9</sub> to C<sub>14</sub> naphthene + dinaphthene benzenes, and 1.1% C<sub>12</sub> to C<sub>16</sub> acenaphthenes (percent by volume)

**Primary Use:** Insecticide and herbicide solvent

**Sample Purity:** Technical grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (MM; st)	9	M	4	>2,000

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, sitting, and slowness. Signs appeared as soon as 2 min after treatment; however, no mortalities occurred. Remission had occurred by the day following treatment.

## PANOGEN

**Alternative Names:** methylmercuric cyanoguanidine, Mor-sodren, Panogen 42

**Chemical Name:** Mercury, (cyanoguanidinato-*N'*)(methyl) (CAS 502-39-6)

**Primary Use:** Seed disinfectant, fungicide

**Sample Purity:** 100%<sup>1</sup> and 6.3% formulation<sup>2</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	6	M	4	53.0 (31.5-89.1)
Mallard <sup>2</sup>	12	M	3-4	561 (303-1,039)
Pheasant <sup>2</sup>	9	M	3	566 (400-800)
House sparrow (st) <sup>2</sup>	2	M,F	-	300-900

**Signs of Intoxication:** Regurgitation, polydipsia, general weakness, slowness of reactions, fluffed feathers, tetany when disturbed, coma. Remission took up to 1 week.

**Note:** See "Notes" for PMA

Panogen 42: see Panogen

Panoram D-31: see dieldrin

Panthion: see parathion

Paramer: see parathion

Paraphos: see parathion

Paraquat CL: see paraquat dichloride

## PARAQUAT DICHLORIDE

**Alternative Names:** Dextrone X, Gramoxone, Ortho Paraquat, paraquat CL, PP-148, PP-910, Weedol

**Chemical Name:** 1,1'-Dimethyl-4,4'-bipyridinium dichloride (CAS 1910-42-5)

**Primary Use:** Herbicide

**Sample Purity:** 21%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard (st)	12	M	3-4	199 (144-276)

**Signs of Intoxication:** Polydipsia, regurgitation, swallowing, ataxia, imbalance, wing-drop, hyporeactivity, slowness, asthenia, sitting, running and falling, and possible miosis. Polydipsia and regurgitation appeared as soon as 9 min and other signs of intoxication appeared 3 h after treatment. Mortalities usually occurred between 3 and 20 h after treatment; however, one bird died between 1 and 2 days after treatment. Remission took up to 12 days.

**Other Toxicity Data:** The calculated percutaneous LD50 for 10- to 11-month-old mallard drakes (n = 8) after a 24-h dermal foot exposure is 600 (CL 424-848) mg/kg. Signs observed after dermal treatment included, in addition to several of those reported above, lacrimation, wings spread, using wings to aid pedestrian locomotion, and wing shivers. Mortalities occurred between 5.5 and 21.5 h after the initiation of treatment. Remission took up to 5 days. When the percutaneous LD50 is compared with the acute oral LD50, paraquat dichloride appears to have a moderate degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Parasporal bodies: see *Bacillus thuringiensis* (Berliner)

Parathene: see Parathion

## PARATHION

**Alternative Names:** AAT, AC-3422, Alkron, Alleron, American Cyanamid 3422, Aphamite, BAY E-605, Bladan, Corothion, DNTP, E-605, ENT 15108, ethyl parathion, Etilon, Folidol, Fosfono 50, Niran, Nitrostigmine, Orthophos, Panthion, Paramar, Paraphos, Parathene, Parawet, Phoskil, Rhodiatox, SNP, Soprathion, Stathion, Thiophos

**Chemical Name:** Phosphorothioic acid, *O,O*-diethyl *O*-(4-nitrophenyl) ester (CAS 56-38-2)

**Primary Use:** Insecticide

**Sample Purity:** 98.76%,<sup>1</sup> 98.6%,<sup>2</sup> and 99.5%<sup>3</sup>

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Fulvous whistling-duck <sup>1</sup>	4	M,F	—	0.125-0.250
Mallard <sup>1</sup>	24	M	3-4	2.40 (1.67-4.01)
Mallard <sup>1</sup>	12	F	2-3	1.90 (1.37-2.64)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	20	M	12 <sup>b</sup>	2.34 (1.88-2.92)
Mallard <sup>1</sup>	20	F	12 <sup>b</sup>	1.44 (1.13-1.83)
Mallard <sup>1</sup>	20	F	15	1.44 (1.16-1.80)
Mallard duckling (MM) <sup>1</sup>	8	—	1 wk	0.898 (0.770-1.05)
Sharp-tailed grouse <sup>2,3</sup>	8	F	12-36	5.66 (3.46-9.24)
California quail <sup>1</sup>	12	M	5-6	16.9 (12.2-23.5)
Japanese quail <sup>1</sup>	16	F	2 <sup>b</sup>	5.95 (3.38-10.5)
Pheasant <sup>1</sup>	12	M	2-3	12.4 [10.1-15.2]
Pheasant <sup>1</sup>	22	F	12 <sup>b</sup>	>24.0
Chukar <sup>1</sup>	24	M,F	3-24	24.0 (16.8-34.2)
Gray partridge <sup>1</sup>	8	M	3-10	16.0 (4.00-64.0)
Rock dove <sup>1</sup>	12	M,F	—	2.52 (1.82-3.50)
House sparrow <sup>1</sup>	12	M	— <sup>b</sup>	3.36 (2.43-4.66)
Mule deer <sup>1</sup>	2	M	9-10	22.0-44.0
Domestic goat <sup>1</sup>	2	F	12-72	28.0-56.0

<sup>a</sup>Except as noted.

<sup>b</sup>These birds were in active breeding condition.

**Signs of Intoxication:** Lacrimation, tachypnea, dyspnea, asynergy, tenesmus, diarrhea, paresis, tremors, prostration, convulsions, opisthotonos. Mortalities occurred as soon as 30 min or as late as 13 days after single oral administration.

**Other Toxicity Data:** An estimation of the 30-day EMLD for gray partridges (n = 2) appears to be about 3.0-6.0 mg/kg per day, and that for fulvous whistling-ducks (n = 2) is about 0.01-0.02 mg/kg per day.

In 60-day feeding studies, 1.5 ppm parathion in the diet was not lethal to fulvous whistling-ducks (n = 2), but 8.0 ppm was lethal to one of the two gray partridges tested.

The calculated percutaneous LD50 for 10-month-old mallard drakes (n = 8) after a 24-h dermal foot exposure is 28.3 [20.0-40.0] mg/kg. Signs observed after dermal treatment included, in addition to several of the above, penile extrusion in two of the dead birds. Mortalities occurred 3-21.5 h or 43-50 h after the initiation of treatment. When the percutaneous LD50 is compared with the acute oral LD50 for mallard drakes of similar age,

parathion appears to have a relatively low degree of percutaneous hazard in mallards.

**Notes:** For a discussion of the comparative toxicity of parathion, see Tucker and Haegele (1971).

For additional data and a discussion of the effects of age on the sensitivity of mallards to parathion, see Hudson et al. (1972).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

For data and discussion on the effects of parathion on eggshell thickness in mallards and coturnix, see Haegele and Tucker (1974).

Parathion-methyl: see methyl parathion

Parawet: see parathion

Partron M: see methyl parathion

Parzate: see nabam, zineb

Parzate C: see zineb

Parzate zineb: see zineb

Payze: see cyanazine

PCB's: see polychlorinated biphenyls

## PCNB

**Alternative Names:** Avicol, Botrilex, Brassicol, Folosan, Kobutol, PKhNB, quintozone, terrachlor, Terraclor, Terra-Coat LT-2, Terra-Coat L-205, Tilcarex, Tri-PCNB, Tritisan

**Chemical Name:** Pentachloronitrobenzene (CAS 82-68-8)

**Primary Use:** Soil fungicide, seed dressing fungicide

**Sample Purity:** 99%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	3	>2,000
Pheasant	3	F	3	>2,000

**Signs of Intoxication:** Ataxia, tenseness, jerkiness, jitteriness, hyperexcitability, slow and disoriented reactions, goose-stepping ataxia, and sitting. After treatment, signs appeared as soon as 1 h in mallards and as soon as 3 days in pheasants. Remission took up to 15 days in mallards and 7 days in pheasants.

## PCP

**Alternative Names:** Chlorophen, Dowicide G, Dowicide 7, Ontrack WE-1, penchlorol, penta, Pentacon, Penta

General Weed Killer, Penwar, Santobrite, Santophen, Sinituho, sodium pentachlorophenolate, Weedone

**Chemical Name:** Pentachlorophenol (CAS 87-86-5)

**Primary Use:** Insecticide, fungicide, molluscicide, defoliant, herbicide, wood preservative

**Sample Purity:** 99.6%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	16	F	3	380 (205-704)
Pheasant	9	F	3-6	504 (343-743)

**Signs of Intoxication:** Polydipsia and regurgitation (in mallards), tachypnea, wing shivers or twitching, jerkiness, shakiness, ataxia, imbalance, tremors, and spasms. Signs appeared as soon as 10 min and mortalities in mallards usually occurred between 2 and 24 h after treatment and in pheasants between 3 and 5 days after treatment. However, one pheasant died after about 3 h and one died between 10 and 12 days after treatment. Remission took up to 2 weeks.

Penchlorol: see PCP

Penite: see sodium arsenite

Pennamine D: see 2,4-D

Penta: see PCP

Pentachlorin: see DDT

Pentacon: see PCP

Penta General Weed Killer: see PCP

Penwar: see PCP

Perfekthion: see dimethoate

Pestox 3: see schradan

Pestox III: see schradan

PH 60-40: see difluron

Phaltan: see folpet

Phenacide: see toxaphene

Phenamiphos: see Nema-cur

Phenatox: see toxaphene

Phenmad: see PMA

Pherocon GM: see disparlure

Pheromone: see disparlure, grandlure

Phix: see PMA

## PHORATE

**Alternative Names:** 3911, AC-3911, American Cyanamid 3911, ENT 24042, Experimental Insecticide 3911, Granutox, L-11/6, Rampart, Thimet, timet



**Chemical Name:** Phosphorodithioic acid, *O,O*-diethyl *S*-[(ethylthio) methyl] ester (CAS 298-02-2)

**Primary Use:** Insecticide

**Sample Purity:** 98.8%<sup>1</sup> and 88%<sup>2</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	16	F	—	85.2 (59.3-122)
Mallard <sup>1</sup>	12	F	3-4	0.616 (0.367-1.03)
Mallard <sup>2</sup>	12	F	12	2.55 (2.02-3.21)
Pheasant <sup>1</sup>	12	F	3	7.12 (4.94-10.3)
Chukar <sup>1</sup>	8	F	3	12.8 (3.20-51.2)

**Signs of Intoxication:** Ataxia, diarrhea, beak-sharpening reflex, polydipsia, lacrimation, loss of righting reflex, immobility, irregular heart and respiratory rates, tremors, wing-beat convulsions or opisthotonos. Levels as low as 0.09 mg/kg produced signs in mallards. This was an extremely fast-acting compound on all species tested. Signs occurred in pheasants as soon as 3 min after treatment. Mortalities usually occurred between 10 min and 4 h after treatment. Remission took up to 2 days.

**Other Toxicity Data:** The 30-day EMLD for the 98.8% sample for 5- to 6-month-old pheasants of both sexes ( $n = 12$ ) appears to lie between 3.50 and 7.00 mg/kg per day. The resulting cumulative toxicity index is  $7.12/3.50-7.00 = 1.0-2.3$ , indicating little or no cumulative action for phorate in pheasants.

The calculated percutaneous LD50 for the 88% sample for 1-year-old mallard hens ( $n = 8$ ) after a 24-h dermal foot exposure is 203 (CL 149-276) mg/kg. Mortalities occurred between 19.5 and 24 h after the initiation of treatment. When the percutaneous LD50 is compared with the acute oral LD50 for mallards of the same age, phorate appears to have a very low degree of dermal hazard in mallards.

**Notes:** Acetylcholinesterase activity measurements were made on the brains of pheasant mortalities and survivors sacrificed on the day following the final dosage in the 30-day EMLD studies. When compared with their controls ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.331$ ,  $s = 0.029$ , range = 1.299-1.366), survivors showed 58.7% inhibition ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.550$ ,  $s = 0.119$ , range = 0.422-0.741). When compared with their controls ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 1.097$ ,  $s = 0.068$ , range = 0.996-1.159), mortalities

showed 96.3% inhibition ( $n = 6$ ,  $\bar{\Delta}pH/45 \text{ min} = 0.041$ ,  $s = 0.020$ , range = 0.023-0.080).

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Phosacetim: see Gophacide  
Phosazetim: see Gophacide  
Phosdrin: see mevinphos  
Phosethoprop: see ethoprop  
Phosfene: see mevinphos  
Phosfolan: see Cyolane  
Phoskil: see parathion  
Phosmet: see Imidan

## PHOSPHAMIDON

**Alternative Names:** C-570, Dimecron, ENT 25515, ML-97, OR-1911

**Chemical Name:** Phosphoric acid, 2-chloro-3-(dimethylamino)-1-methyl-3-oxo-1-propenyl dimethyl ester (CAS 297-99-4)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 80%,<sup>1</sup> 85%<sup>2</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard (st) <sup>1</sup>	12	F	3	3.81 (2.91-5.00)
Sharp-tailed grouse <sup>2</sup>	4	M	12-24 <sup>b</sup>	1.50-3.00
Japanese quail (st) <sup>2</sup>	8	F	A <sup>b</sup>	3.60 (1.80-7.20)
Pheasant (st) <sup>2</sup>	12	F	4	4.24 (3.37-5.34)
Chukar <sup>1</sup>	9	M,F	3-5	11.8 (10.1-13.8)
Rock dove <sup>1</sup>	3	M,F	—	2.11-3.66
White-winged dove (st) <sup>1</sup>	8	M,F	A	2.93 (2.44-3.66)
Albino rat (st) <sup>1</sup>	8	M	—	11.0 (9.39-12.8)
Mule deer (st) <sup>2</sup>	3	M,F	24-36	44.0-88.0

<sup>a</sup>Except as noted.

<sup>b</sup>These birds may have been in breeding condition.

**Signs of Intoxication:** Lacrimation, foamy salivation, miosis, wing-drop, tachypnea, dyspnea, ataxia, immobility, convulsions, tetany, and opisthotonos. Signs appeared as soon as 6 min and mortalities usually occurred

between 8 and 30 min after treatment. Remission took up to 1 day.

**Other Toxicity Data:** Phosphamidon applied to the scales of the legs or to the eyes of birds was rapidly toxic, but phosphamidon sprayed on dry feathers did not produce substantial intoxication.

The calculated percutaneous LD50 for the 85% sample for 1-year-old mallard hens ( $n = 8$ ) after a 24-h dermal foot exposure is 26.0 (CL 5.25-129) mg/kg. Signs observed after dermal treatment included, in addition to several of those reported above, high carriage, hyporeactivity, using wings to aid pedestrian locomotion, nasal exudate, wings spread, spasms, tremors, and ataraxia. Mortalities usually occurred between 5 and 24 h after the initiation of treatment; however, one hen died overnight after the end of the 24-h exposure. Remission took up to 4 days after treatment ended. When the percutaneous LD50 is compared with the acute oral LD50, phosphamidon appears to have a slight to moderate degree of dermal hazard in mallards.

A female bullfrog placed in aqueous solutions up to 250 ppm survived a 17-day exposure at the highest treatment level (250 ppm). (By way of comparison, a few nanoliters are lethal to certain crustaceans and 5 to 10 ppm are lethal to several types of fish.)

Repeated acute oral LD50 determinations with rats, using a stock 1:400 aqueous solution of phosphamidon containing 1,000 mg/L Yuma Chemical "Spreader A," showed that the potency of the solution after 41 days was about half that of the fresh solution.

**Notes:** The early appearance of signs and the steepness of the acute dose-response curves (increasing dosage levels produced disproportionately large increases in the response) indicate that phosphamidon is rapidly and thoroughly taken up from the gastrointestinal tracts of birds.

For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Phosphorodithioic acid: see ethion

Phosphothion: see malathion

Phosvel: see leptophos

Phosvit: see DDVP

## PHOXIM

**Alternative Names:** BAY 77488, Baythion, ENT 27448, phoxime, Valexon, Volaton

**Chemical Name:** 4-Ethoxy-7-phenyl-3,5-dioxo-6-aza-4-phosphaoct-6-ene-8-nitrile, 4-sulfide (CAS 14816-18-3)

**Primary Use:** Insecticide

**Sample Purity:** 73%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	546 (314-950)
Sharp-tailed grouse	12	F	6	35.7 (25.7-49.4)
Pheasant	12	M	3	46.9 (33.8-65.0)

**Signs of Intoxication:** Polydipsia and regurgitation (in mallards), ataxia, hyperexcitability, goose-stepping ataxia, running and falling, phonation, high carriage, slowness, asthenia, wing-drop, tremors, tachypnea, dyspnea, falling, wing-beat convulsions, immobility, wings spread, tetany, and opisthotonos. Treatment levels as low as 15.6 mg/kg produced toxic signs in mallards. Signs appeared as soon as 5 min and mortalities usually occurred between 30 min and 4 h after treatment; however, one mallard died 13 days after treatment. Remission took up to 20 days.

**Other Toxicity Data:** The 30-day EMLD for 5- to 6-month-old mallards of both sexes ( $n = 12$ ) appears to be less than 2.50 mg/kg per day. The resulting cumulative toxicity index is  $546 / <2.50 = >218$ , indicating an extremely high degree of cumulative action for phoxim in mallards, even when regurgitation of acute dosages is taken into account.

**Note:** Gross necropsies of mortalities and sacrificed survivors of the 30-day pheasant study revealed small spleens.

Phoxime: see phoxim

Phthalophos: see Imidan

Phygon: see dichlone

Phygon XL: see dichlone

Phygon Seed Protectant: see dichlone

Phytar 560: see Silvisar-510

Phytosol: see trichloronat

## PICLORAM

**Alternative Names:** Borolin, Tordon

**Chemical Name:** 4-Amino-3,5,6-trichloro-2-pyridinecarboxylic acid (CAS 1918-02-1)

**Primary Use:** Herbicide

**Sample Purity:** 90.5%<sup>1</sup> and Tordon 22K formulation<sup>2</sup>

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard <sup>1</sup>	3	M	3	>2,000
Mallard (st) <sup>2</sup>	1	M	7	>2,000
Pheasant <sup>1</sup>	3	M	3	>2,000

**Signs of Intoxication:** Regurgitation occurred soon after treatment in the mallards. Pheasants showed only mild ataxia and fasciculation following treatment.

**Other Toxicity Data:** Combinations of 1,000 mg/kg picloram<sup>2</sup> and 1,000 mg/kg 2,4-D amine or 2,000 mg/kg of each administered by stomach tube were not lethal to two mallard drakes.

PKhNB: see PCNB

## PLANAVIN

**Alternative Names:** nitralin (proposed), SD 11831

**Chemical Name:** 4-(Methylsulfonyl)-2,6-dinitro-*N,N*-di-propyl benzenamine (CAS 4726-14-1)

**Primary Use:** Herbicide

**Sample Purity:** Technical grade

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	4	M,F	~4	>2,000
Chukar	2	M,F	2-3	>2,000

**Signs of Intoxication:** None

**Other Toxicity Data:** A single 5-month-old mallard drake survived 31 repeated oral dosages of 100 mg/kg per day, given over a 36-day period. Two mallards given 100 ppm in their diets for 30 days showed no gross effects other than slightly reduced feed intake.

## PMA

**Alternative Names:** Agrosan, Gallotox, HL 331, Hong Nien, Liquiphene, Mersolite, Nylmerate, PAM, Phenmad, Phix, PMAC, PMAS, Riogen, SC-110, Scutl, Shimmerex, Tag Fungicide, Tag HL 331

**Chemical Name:** (Acetato-*O*)phenylmercury (CAS 62-38-4)

**Primary Use:** Eradicant fungicide, herbicide

**Sample Purity:** 100%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	878 (169-4,558)
Pheasant	12	F	3-4	169 (101-283)

**Signs of Intoxication:** Ataxia, fluffed feathers, goose-stepping ataxia, imbalance, tenseness, slowness, ataraxia, falling, withdrawal, hyporeactivity, hypoactivity, and ptosis. Signs appeared as soon as 20 min in mallards and 2.5 h in pheasants and mortalities usually occurred between 4-20 h and 2 days in mallards and between 2 and 6 days after treatment in pheasants. Remission took up to 7 days.

**Other Toxicity Data:** The 30-day EMLD for 5- to 6-month-old pheasants of both sexes (n = 12) appears to be greater than 18.0 mg/kg per day. The resulting cumulative toxicity index is  $169 / >18.0 = <9.4$ , indicating a relatively slight degree of cumulative action for PMA in pheasants, in comparison with other mercurial pesticides.

**Notes:** Several interesting comparisons of mercurial toxicity are made possible by conversions of the toxicity values of mercurial compounds to toxicity figures for actual metallic mercury (Hg) in those compounds. The ethyl and methyl mercurial pesticides, when converted in this manner, show surprising similarity of toxicity. For instance, the acute oral LD50 for Ceresan L in ring-necked pheasant cocks is 1,190 mg/kg, which is equivalent to 26.8 mg/kg Hg. The acute oral LD50 for Ceresan M in pheasant hens is 360 mg/kg, which is equivalent to 11.5 mg/kg Hg. The acute oral LD50 for Panogen in pheasant cocks is 566 mg/kg, which is equivalent to 23.8 mg/kg Hg. The acute oral toxicity of Ceresan L in mallards is high because of regurgitation; however, when dosed sub-acute, the total accumulation of metallic mercury that killed half of the test group was equivalent to 22.5 mg/kg Hg, which is very close to the median lethal acute dosage for pheasants. This finding indicates a high degree of cumulative action for Ceresan L (an ethyl mercury pesticide) in mallards.

A phenyl mercury compound, PMA, appears to be much less toxic, on the basis of metallic mercury, than the ethyl or methyl mercury compounds. As shown in the summary, the acute oral LD50 for PMA in pheasant hens is 169 mg/kg, which is equivalent to 101 mg/kg Hg. The group of pheasants treated with 18.0 mg/kg per day survived a total administration of 540 mg/kg PMA, which is

equivalent to 321 mg/kg Hg. This finding indicates that PMA not only is less toxic, on the basis of metallic mercury, than ethyl or methyl mercury pesticides, but also appears to have less cumulative action.

PMAC: see PMA

PMAS: see PMA

Poison nut: see strychnine

## POLYCHLORINATED BIPHENYLS

**Alternative Names:** Aroclor (several products), chlorinated biphenyls, PCB's

**Chemical Name:** Various polychlorinated biphenyl mixtures

**Primary Use:** Industrial, such as plasticizers, heat-exchange agents; have become widespread environmental contaminants

**Sample Purity:** Four mixtures designated Aroclor 1242,<sup>1</sup> 1254,<sup>2</sup> 1260,<sup>3</sup> and 1268<sup>4</sup> (the last two digits of each number indicate percent chlorine in the sample)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	3	M	8-9 <sup>a</sup>	> 2,000
Mallard <sup>2</sup>	3	M	8-9 <sup>a</sup>	> 2,000
Mallard <sup>3</sup>	3	M	8-9 <sup>a</sup>	> 2,000
Mallard <sup>4</sup>	3	M	8-9 <sup>a</sup>	> 2,000
Bobwhite <sup>4</sup>	3	M	12	> 2,000
Albino rat (st) <sup>2</sup>	6	M	—	841
				(500-1,410)
Albino rat (st) <sup>4</sup>	10	M	—	2,000-4,000

<sup>a</sup>These drakes may have been in breeding condition.

**Signs of Intoxication:** Mallards showed no signs. Bobwhites showed jitteriness and ataxia. Rats treated with Aroclor 1254 showed ataxia, blanched retinas, ptosis, serous nasal exudate that appeared porphyrin-like, withdrawal, lack of preening. Rats treated with Aroclor 1268 showed reddish exudate on eyelids, ataraxia, ptosis, possible blindness, withdrawal. Rat mortalities occurred between 4 h and 4 days after treatment. Some survivors showed signs for as long as 8 days. Treatment levels as low as 100 mg/kg Aroclor 1254 produced one rat mortality.

**Other Toxicity Data:** Two male albino rats received 75 mg/kg per day of Aroclor 1268 in corn oil administered by stomach tube for 6 days; one died on the 7th day. Two male rats were similarly treated with Aroclor 1254 and both survived. In a feeding study, Aroclor 1254 at 1,000

ppm was lethal to none of six male rats by 14 days, one of five by 28 days, three of four by 43 days, and four of four by 53 days. Food consumption was reduced by 21%. A treatment level of 10 ppm produced one death in six male rats at 29 days (possibly not caused by Aroclor intake) but no further mortalities by 45 days. These feeding studies suggest that a total intake of about 500 to 2,000 mg/kg of Aroclor 1254 is the lethal level for dietary exposures of 1 to 7 weeks in rats.

**Notes:** Gross necropsies in bobwhites revealed gastrointestinal purpura in one bird and gastrointestinal hyperemia in another.

For effects on eggshell thickness, see Haegele and Tucker (1974).

Polychlorocamphene: see toxaphene

Polyhedral virus: see nucleopolyhedral virus

Polyram-Ultra: see thiram

Polyram Z: see zineb

Pomarsol: see thiram

Pomazol: see thiram

## POTASSIUM AZIDE

**Alternative Names:** Azide, Kazide, Kazoe, PPG-101, Smite

**Chemical Name:** Potassium azide (CAS 12136-44-6)

**Primary Use:** Herbicide, fungicide, nematocide, insecticide, bactericide, growth regulator

**Sample Purity:** ≥ 98%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3	22.8
				(13.6-38.3)
California quail	15	M	9-10	20.8
				(16.5-26.1)
Pheasant	12	F	3-4	15.1
				(12.0-19.0)

**Signs of Intoxication:** Ataxia, stumbling, fluffed feathers, falling, sitting, polydipsia, and attempted regurgitation (in mallards), ptosis, ataraxia, myasthenia, using wings to aid in and for pedestrian locomotion, nutation, spasms, tremors, immobility, wings spread, phonation, opisthotonos, bradypnea, dyspnea, and terminal wing-beat convulsions. Signs appeared as soon as 5 min and mortalities usually occurred between 15 min and 17 h after treatment. Remission took up to 9 days.

PP-148: see paraquat dichloride

PP-910: see paraquat dichloride

PPG-101: see potassium azide  
 Prebane: see terbutryn  
 Preforan: see fluorodifen  
 Premerge: see dinoseb  
 Preseed: see CHE 1843  
 Primatol A: see atrazine

## PROCESS OIL 492

**Alternative Names:** None found

**Chemical Name:** Unknown

**Primary Use:** Carrier; ingredient in 492 Mosquito Larvicide Oil

**Sample Purity:** Technical grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	18	> 2,000

**Signs of Intoxication:** Ataxia, stumbling. Signs appeared on the day following treatment. Remission took up to 2 days.

Prolate: see Imidan  
 Propham: see IPC-400  
 Prophos: see ethoprop  
 Propoxur: see Baygon  
 Protex: see rotenone  
 Proxol: see trichlorfon  
 Pynamin: see allethrin

## PYRETHRUM

**Alternative Names:** Dalmation Insect Flowers, Insect Flowers, Insect Powder, Trieste Flowers

**Chemical Name:** A complex of components of the flowers of *Chrysanthemum cinerifolium*, including compounds known as pyrethrins I (CAS 121-21-7) and II (CAS 121-21-9) and cinerins I (CAS 25402-06-6) and II (CAS 121-21-0)

**Primary Use:** Insecticide

**Sample Purity:** 20%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard (st)	6	F	3-4	> 10,000

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Japanese quail (st)	6	M	5	7,070 (996-50,200)

**Signs of Intoxication:** Regurgitation, asthenia, tremors, wing-beat convulsions, slowness, and hyperexcitability. Signs appeared as soon as 7 min and mortalities occurred 1 day and 14 days after treatment in Japanese quail. Remission took up to 5 days, except for a single mortality after 14 days.

Quaker button: see strychnine

Queletox: see fenthion

Quilan: see Balan

Quintozene: see PCNB

R-1303: see carbophenothion

R-1504: see Imidan

R-1582: see azinphos-methyl

R-1910: see butylate

R-2170: see oxydemetonmethyl

Rabon: see tetrachlorvinphos

Rad-E-Cate 35: see Silvisar-510

Rampart: see phorate

Raticate: see norbormide

Ravyon: see carbaryl

RE-4355: see naled

RE-5353: see bufencarb

RE-9006: see methamidophos

## RE-11775

**Alternative Names:** None found

**Chemical Name:** Carbamic acid, methyl(phenylthio-3-(1-methylpropyl)phenyl ester (CAS 25474-41-3)

**Primary Use:** Experimental mosquito larvicide and adulticide

**Sample Purity:** 60% Active isomer, 40% other isomers

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	7-9	12.8 (7.37-22.4)
California quail	12	F	6-7	103 (79.2-133)

**Signs of Intoxication:** Ataxia, falling, using wings to aid pedestrian locomotion, penile extrusion (in mallards), immobility, tremors, dyspnea, salivation, wing-beat con-

vulsions, and tetany. Signs appeared as soon as 5 min; mortalities usually occurred between 0.5 and 2 h after treatment. Remission took up to 2 days.

Rebelate: see dimethoate

Reddon: see 2,4,5-T

Reglone: see diquat dibromide

Resistox: see coumaphos

Resitox: see coumaphos

## RESMETHRIN

**Alternative Names:** benzofurolone, Chryson, cismethrin, d trans isomer = bioresmethrin, FMC-17370, NIA 17370, NRDC 104, SBP-1382, Synthrin

**Chemical Name:** 2,2-Dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylic acid, [5-(phenylmethyl)-3-furanyl] methyl ester (CAS 10453-86-8)

**Primary Use:** Insecticide (synthetic pyrethroid)

**Sample Purity:** ~100% ( $\leq 30\%$  cis,  $\geq 70\%$  trans)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
California quail	3	M	5-6	$\geq 2,000$

**Signs of Intoxication:** None.

R and H FW-293: see dicofol

Rhodiatox: see parathion

Riothane D-3: see TDE

Riogen: see PMA

Roccal: see Airkem A-33 Dry

Rogor: see dimethoate

## RONNEL

**Alternative Names:** Dow ET-14, Dow ET-57, Ectoral, ENT 23284, ET-14, ET-57, Etrolene, fenclorfos, fenclorphos, Korlan, Nankor, Trolene, Viozene

**Chemical Name:** Phosphorothioic acid, *O,O*-dimethyl *O*-(2,4,5-trichlorophenyl) ester (CAS 299-84-3)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 92.5%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	3	M	3	$\geq 2,000$

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Pheasant	12	M	3-4	611 (351-1,063)

**Signs of Intoxication:** Ataxia, slowness, running and falling on side, tenseness, tremors, ptosis, and tetanic seizures. Signs appeared as soon as 1 day and mortalities usually occurred between 1 and 6 days after treatment. Remission took up to 1 week.

## ROTENONE

**Alternative Names:** barbasco, cubé, cubé extractives, cubé resins, Derrin, Derris, derris extractives, derris resins, ENT 133, nicouline, Protex, tuba, tubatoxin

**Chemical Name:** 1,2,12,12a-Tetrahydro-8,9-dimethoxy-2-(1-methylethenyl)-[1]benzopyrano[3,4-b]furo[2,3-h][1]benzopyran-6[6aH]-one (CAS 83-79-4)

**Primary Use:** Insecticide, piscicide

**Sample Purity:** 32.38% Cubé resins

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3	$\geq 2,200$
Pheasant	9	F	3	1,680 [1,410-2,000]

**Signs of Intoxication:** Ataxia, nutation, dyspnea, polyuria, feathers fluffed or held tightly to body, wing-drop, neck pulled in, immobility. Regurgitation occurred at levels above 1,500 mg/kg. Signs were observed less than 1 h after single oral administration and mortalities occurred up to 5 days after treatment. Remission took up to 1 week.

Roxion: see dimethoate

## RU 11-679

**Alternative Names:** bioethanomethrin, ENT 27985B, French pyrethroid, NIA 24110

**Chemical Name:** 3-(Cyclopentylidenemethyl)-2,2-dimethyl-(1R-trans)-cyclopropanecarboxylic acid, [5-(phenylmethyl)-3-furanyl]methyl ester (CAS 22431-62-5)

**Primary Use:** Insecticide (synthetic pyrethroid)

**Sample Purity:** 96%,<sup>1</sup> 36% in DOPC (2,6-dioctadecyl-p-cresol)<sup>2</sup>



## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	33	F	18	>1,600
Mallard <sup>2</sup>	11	F	18	>1,600
California quail <sup>1</sup>	16	F	9-11	139 (117-165)

**Signs of Intoxication:** Ataxia, polydipsia, regurgitation, tremors, wide stance, phonation, circling, spasms, tenseness, falling, sitting, using wings for pedestrian locomotion, loss of righting reflex, and immobility. Signs appeared as soon as 20 min and mortalities often occurred between 1.5 and 5 h after treatment.

**Other Toxicity Data:** Although the LD50 for the pure material in mallards is reported as >1,600 mg/kg, mortalities occurred at dosage levels as low as 200 mg/kg.

**Notes:** Addition of DOPC, an antioxidant, does not appear to enhance the toxicity of RU 11-679 in mallards and California quail.

Gross visual examination of the internal organs of sacrificed mallards revealed small spleens in several birds.

Ruelene: see crufomate

Rukseam: see DDT

Rumetan: see zinc phosphide

Ruphos: see dioxathion

S 276: see disulfoton

S 767: see fensulfothion

S-1102A: see fenitrothion

S 1752: see fenthion

S 4400: see trichloronat

S 5660: see fenitrothion

Salvo: see 2,4-D

Santobrite: see PCP

Santophen: see PCP

Sapcron: see chlorfenvinphos

Sarolex: see Diazinon

SBP-1382: see resmethrin

SC-110: see PMA

## SCHRADAN

**Alternative Names:** ENT 17291, octamethylpyrophosphoramide, OMPA, Pestox III, Pestox 3, System

**Chemical Name:** Octamethyldiphosphoramidate (CAS 152-16-9)

**Primary Use:** Systemic insecticide

**Sample Purity:** ≥90%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	36.3 (20.9-63.2)
Pheasant	12	M	3-4	19.0 (13.7-26.4)

**Signs of Intoxication:** Ataxia, falling, high carriage, wing-drop, loss of righting reflex, slowness, fluffed feathers, tetany, ptosis, apnea, immobility, wing-beat convulsions, and opisthotonos. Signs appeared as soon as 17 min and mortalities occurred between 35 and 86 min in mallards and between 27 min and 4.5 days after treatment in pheasants. Remission took up to 1 week.

Scuttl: see PMA

SD 3562: see dicrotophos

SD 4294: see crotoxyphos

SD 4402: see isobenzan

## SD 7727

**Alternative Names:** None found

**Chemical Name:** 2,4-Dichlorophenol methanesulfonate (CAS 3687-13-6)

**Primary Use:** Experimental nematocide

**Sample Purity:** >95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	3-4	>2,000

**Signs of Intoxication:** Ataxia, high carriage, nutation, falling when walking, wings crossed high over back, tail pointed upward. Signs appeared in 9 min and regurgitation occurred in 10 min. Signs persisted for 8 to 13 days. Weight losses occurred.

SD 7859: see chlorfenvinphos

SD 8447: see tetrachlorvinphos

SD 8530: see Landrin

SD 9098: see Akton

SD 9129: see monocrotophos

SD 11831: see Planavin

SD 14114: see Vendex

SD 15418: see cyanazine

**SD 16898****Alternative Names:** None found**Chemical Name:** Acetic acid, thio-, S-cyanomethyl ester, methylcarbamoyloxime**Primary Use:** Experimental insecticide, miticide**Sample Purity:** Technical grade**Acute Oral Toxicity Summary**

Test animal	No.	Sex	Age (months*)	LD50 95%CL (mg/kg)
Mallard	12	M	9-11	7.55 (5.99-9.51)
Bobwhite	3	F	12-24	6.00-12.0
Pheasant	3	M	8-10	3.00-6.00
Chukar	12	M,F	12	5.99 (4.32-8.31)

\*Some birds of each species were in breeding condition.

**Signs of Intoxication:** Ataxia, imbalance, hyporeactivity, sitting, penile extrusion (in mallards), tremors, falling, wing-drop, wings spread, excessive swallowing, ptosis, immobility, tetany, emprosthotonos, and violent wing-beat convulsions. Signs appeared as soon as 2 min and mortalities usually occurred between 20 and 60 min after treatment. Remission had occurred by 1 day after treatment.

**SD 17250****Alternative Name:** thiocarboxime (proposed)**Chemical Name:** (Z)-N-[[[(methylamino)carbonyl]oxy]ethanimidothioic acid, 2-cyanoethyl ester (CAS 29118-87-4)**Primary Use:** Experimental insecticide, miticide**Sample Purity:** Technical grade**Acute Oral Toxicity Summary**

Test animal	No.	Sex	Age (months*)	LD50 95%CL (mg/kg)
Canada goose	12	M,F	A	8.99 (6.49-12.5)
Mallard	12	M	9-11	12.0 (9.51-15.1)
Bobwhite	3	F	24	15.0-37.9
California quail	31	M,F	12	-26
Pheasant	3	M	8-10	4.00-8.00

\*Except as noted. Some birds of each species were in the early stages of gonadal reproductive development.

**Signs of Intoxication:** Ataxia, imbalance, tremors, falling, immobility, penile extrusion, dyspnea, possible lacrimation, and terminal wing-beat convulsions. Signs appeared as soon as 15 min and mortalities usually occurred between 0.5 and 1 h after treatment. Remission took up to 2 days.

**Other Toxicity Data:** The 30-day EMLD for 5- to 6-month-old mallards of both sexes (n = 12) is 8.00 mg/kg per day. The resulting cumulative toxicity index is 12.0/8.00 = 1.5, indicating little cumulative action for SD 17250 in mallards.

**Notes:** The dose-response slope for California quail was extremely low; treatment levels as low as 12.0 mg/kg produced some mortalities, whereas levels as high as 67.8 mg/kg did not produce 100% mortality.

**SD 30053****Alternative Names:** None found**Chemical Name:** Ethyl 2-(N-benzoyl-3,4-dichloroanilino)-propionate**Primary Use:** Experimental herbicide**Sample Purity:** 95%**Acute Oral Toxicity Summary**

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	7	M	3	>2,000

**Signs of Intoxication:** Ataxia, regurgitation, imbalance, and slowness. Signs appeared as soon as 20 min and remission took up to 1 day for most birds, but one bird showed signs for up to 10 days.

Seedrin: see aldrin

Selinon: see DNOC

Sendran: see Baygon

Septene: see carbaryl

Sevin: see carbaryl

Sevin-4-Oil: see carbaryl

Shell Oil Herder: see Oil Herder

Shell Oil Herder #2: see Oil Herder #2

**SHELL SOL 70****Alternative Names:** None found**Chemical Name:** A solvent composed of 98.2% paraffins and 0.9% naphthenes**Primary Use:** Industrial solvent, cleansing agent for oil-soaked birds

**Sample Purity:** Technical grade

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (MM; st)	10	M	4-5	>2,000

**Signs of Intoxication:** Slowness. Signs appeared as soon as 1.5 h after treatment, and remission took up to 2 days.

**Other Toxicity Data:** No mortality occurred in a group of six 5-month-old mallard (MM) drakes exposed to the compound by immersion of the whole body, so the feathers were completely wetted. This manner of exposure was designed to simulate the use of the chemical for removing oil from an oil-soaked bird. Approximately 4 L of the solvent were placed in a pail; each bird was immersed, except for the head, in the solvent and the feathers were rubbed vigorously. After the bird was removed from the pail, hand pressure was applied to the feathers in an attempt to remove as much solvent from the soaked feathers as possible. Three of the six birds were then placed in an indoor pen and the other three were placed in an outdoor pen. Weather conditions in the outdoor pen during the initial period of the test were relatively severe: on the 1st and 2nd days of the test, low ambient temperature was 3.5° C; ambient temperature dropped to -1° C on the 3rd day and for the next 3 days the temperature did not rise above the freezing point—about 7-10 cm of snow was on the ground and the low ambient temperature dropped to -10° C.

Although no mortalities occurred, clinical signs of intoxication were severe. Signs included ataxia, goose-stepping ataxia, falling, sitting, backing, falling on tails, regurgitation, ptosis, alternating lethargy and alertness, hyporeactivity, ataraxia, possible exophthalmia, and unkemptness. Signs appeared as soon as 20 min after treatment and ataxia persisted for up to 1 day after treatment in several birds. Although the feathers were completely soaked with the solvent, there appeared to be no tendency for the feathers to become water-soaked, and before clinical signs appeared, the birds were able to swim normally and at the proper level in the water. On the day following treatment, the feathers of all birds appeared to be normal (except for a slight degree of unkemptness) and there still appeared to be no tendency for them to become water-soaked. However, 8 days after treatment it was noticed that the birds had been losing feathers, and on examination it was noted that the feathers of all birds could be plucked much more easily than normal. Breast feathers and those on the sides of the body, covering the pectoralis muscles, seemed to be the most susceptible to plucking. The epidermal surface showed moderate irritation with mild erythema and eschar formation. Three days later (11 days after treatment) there was scab forma-

tion over the irritated areas, and the feathers seemed to pluck less easily. In areas where the skin irritation was less severe, there was still eschar formation but no scab formation. Reforeathering of the bare areas had progressed well by 22 days after treatment.

The three indoor birds were placed outdoors with the other three birds on the 22nd day after treatment and observation of these birds was continued for 1 year to check for signs of abnormalities that might occur during the molting period. Except for one bird, which died from causes probably not related to chemical exposure about 6 months later, the birds appeared normal throughout the observation period, and all went through the spring and fall molts successfully. All were in good plumage and all had gained about 200 g body weight when the study ended.

Shimmerex: see PMA  
Short-stop E: see terbutryn  
Shoxin: see norbormide  
Silvanol: see lindane

### SILVEX

**Alternative Names:** Aqua-Vex; Ded-Weed; fenoprop; Fruitone T; Garlon; Kuron; Kurosol; Kuton; 2,4,5-TP

**Chemical Name:** 2-(2,4,5-Trichlorophenoxy)-propanoic acid (CAS 93-72-1)

**Primary Use:** Herbicide

**Sample Purity:** Analytical grade

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	3	>2,000
Mule deer	1	F	42	<400

**Signs of Intoxication:** Mallards—ataxia, imbalance and tremors; deer—tenseness, jitteriness, and anorexia. Signs appeared in mallards as soon as 45 min and remission took up to 4 days. The doe died during the night after treatment.

**Notes:** Gross necropsy of the dead deer revealed severely hemorrhagic small intestine, hemorrhagic abomasum, hydropericardium, coronary band petechiation, endocardial petechiation, lungs with interstitial emphysema, and trachea and bronchi filled with fluid from the rumen.

### SILVISAR-510

**Alternative Names:** Arsan, Phytar 560, Rad-E-Cate 35

**Chemical Name:** Mixture of cacodylic acid (dimethylarsinic acid) and triethanolamine cacodylate (CAS 75-60-5)

**Primary Use:** Herbicide, silvicide (tree killer)

**Sample Purity:** 54.3%, total As = 27.14% (cacodylic acid 46.0%, triethanolamine cacodylate 8.3%)

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (st)	9	F	3-4	>2,400
Chukar (st)	6	M,F	4	≥2,000
Mule deer (st)	1	F	15	>320

**Signs of Intoxication:** Regurgitation and polydipsia (in mallards), ataxia, falling, using the wings to aid pedestrian locomotion, asthenia, and anorexia (in deer). Signs appeared as soon as 10 min and mortalities occurred between 1 and 2 days after treatment. Remission took up to 1 month.

Sinituho: see PCP

Sinox: see DNOc

Sinox General: see dinoseb

Smite: see potassium azide

SNP: see parathion

## SODIUM ARSENITE

**Alternative Names:** Atlas "A," Chem Pels C, Chem-sen, Kill-All, Penite

**Chemical Name:** Arsenenous acid, sodium salt (CAS 7784-46-5)

**Primary Use:** Herbicide, insecticide

**Sample Purity:** 97%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3	323 (149-699)
California quail	12	M	9-12*	47.6 (34.3-66.0)
Pheasant	12	M	3-4	386 (221-671)

\*These cocks were in good breeding condition.

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, asthe-

nia, slowness, jerkiness, falling, hyporeactivity, fluffed feathers, ptosis, huddled position, unkempt, loss of righting reflex, immobility, and tetanic seizures. Signs appeared as soon as 1 h and mortalities usually occurred between 1 and 6 days after treatment. Remission took up to 1 month.

**Note:** For data and discussion on the effects of sodium arsenite on eggshell thickness in mallards, see Haegele and Tucker (1974).

Sodium fluoroacetate: see sodium monofluoroacetate

## SODIUM MONOFLUOROACETATE

**Alternative Names:** 1080, Compound 1080, fratol, monosodium fluoroacetate, sodium fluoroacetate, ten-eighty

**Chemical Name:** Sodium monofluoroacetate

**Primary Use:** Mammal control agent, rodenticide

**Sample Purity:** ≥90%,<sup>1</sup> 95.5-98.6%<sup>2</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months*)	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	12	M	-	54.4 (25.6-115)
Mallard (st) <sup>1</sup>	20	M	3	9.11 (5.60-14.6)
Mallard duckling (st) <sup>1</sup>	20	-	1 wk	5.97 (4.25-8.39)
Golden eagle <sup>1</sup>	6	M,F	-	3.54 (0.498-25.1)
California quail (st) <sup>2</sup>	12	F	18	4.63 (2.66-8.05)
Japanese quail (st) <sup>1</sup>	20	M,F	3 <sup>b</sup>	12.8 (7.23-22.8)
Pheasant (st) <sup>1</sup>	12	M	2-3	6.46 (3.85-10.8)
Chukar (st) <sup>1</sup>	20	M,F	3	3.51 (2.58-4.78)
Turkey <sup>1</sup>	10	F	<6	4.76 (1.19-19.0)
Rock dove (st) <sup>1</sup>	12	M,F	-	4.24 (3.36-5.34)
Mourning dove (st) <sup>1</sup>	13	M,F	-	8.55-14.6
House sparrow (st) <sup>1</sup>	12	M	A <sup>b</sup>	3.00 (2.38-3.78)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Domestic ferret (st) <sup>1</sup>	8	M	~12	1.41 [1.00-2.00]
Mule deer <sup>1</sup>	6	M	8-11	0.33-1.00

<sup>1</sup>Except as noted.

<sup>2</sup>These birds may have been in breeding condition.

**Signs of Intoxication:** Respiratory, central nervous system, and muscle effects such as dyspnea, ataxia, weakness, tremors, convulsions. Ferrets additionally displayed muscarinic and cardiac effects, (i.e., signs indicative of stimulation of the parasympathetic nervous system, including increased salivation, urination, and defecation, with eventual cardiac failure). The time between treatment and death was relatively constant in all species, from 1 h to 1 day, with few exceptions.

**Other Toxicity Data:** The 30-day EMLD for mallards (n = 3 M, 3 F) is 0.5 mg/kg per day. The resulting cumulative toxicity index is  $9.11/0.5 = 18.2$ , indicating a moderate to high degree of cumulative action for this species.

To determine the secondary hazard of 1080, ferrets (n = 5) were fed one white-footed mouse per ferret. The mice had been treated with sodium monofluoroacetate at dosage levels based on the body weight of the ferret to which it was to be fed (i.e., the mice received toxicant at 1, 2, 4, or 8 mg/kg of ferret body weight). In this way, if all of the offered mouse were eaten by the ferret, the ferret would receive a dosage of 1, 2, 4, or 8 mg/kg. The ferrets had been fasted 1-3 days, and were given the mice either dead or alive between 1 and 2 h after the mice had been dosed. The mice were completely consumed within 10-15 min. The only ferret that survived this treatment had received one of the two mice dosed at 2 mg/kg. Thus, it appears that sodium monofluoroacetate has a high degree of secondary toxicity in mammals.

**Notes:** For a discussion of the comparative toxicity of sodium monofluoroacetate, see Tucker and Haegle (1971).

For data and discussion on the effects of age on the sensitivity of mallards to sodium monofluoroacetate, see Hudson et al. (1972).

Sodium pentachlorophenate: see PCP

Solvirex: see disulfoton

Sonar: see fenitrothion

Soprathion: see parathion

Soprocide: see benzene hexachloride

Soyex: see fluorodifen

Spectracide: see Diazinon

Spotrete: see thiram

Spreader: see Yuma Chemical "Spreader A"

Spring-Bak: see nabam

Sprout Nip: see CIPC

Spud-Nic: see CIPC

SR 73: see clonitralid

SR 406: see captan

SRA 5172: see methamidophos

## STARLICIDE

**Alternative Names:** CL 47676, DRC-1339

**Chemical Name:** 3-Chloro-4-methylbenzenamine hydrochloride (CAS 7745-89-3)

**Primary Use:** Avicide, avi-repellent

**Sample Purity:** 97%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	128 (102-161)
Mallard (st H <sub>2</sub> O)	6	M	3-4	96-192
Mallard (st corn oil)	5	M	3-4	48-96
Mallard (st propylene glycol)	4	M	3	48-96

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, imbalance, tremors, tail fanning, ataraxia, slowness, falling, ptosis, loss of righting reflex, tachypnea, sitting, dyspnea, using wings to aid pedestrian locomotion, and immobility. Signs appeared as soon as 10 min and mortalities usually occurred between 2 and 3 days after treatment. Remission took up to 1 month. Strong and persistent signs were produced by treatment levels as low as 6.0 mg/kg.

Stathion: see parathion

Stauffer R-1303: see carbophenothion

Stauffer R-1504: see Imidan

Stirifos: see tetrachlorvinphos

Strobane-T: see toxaphene

## STRYCHNINE

**Alternative Names:** dog button, Nux vomica, poison nut, Quaker button, strychnine alkaloid, strychnine sulfate, *Strychnos nux-vomica*, strychnos

**Chemical Name:** An alkaloid extract of the seeds of *Strychnos nux vomica*; strychnidin-10-one (CAS 57-24-0)<sup>1</sup>; strychnidin-10-one, sulfate (2:1) (CAS 64-41-3)<sup>2</sup>

**Primary Use:** Bird and mammal control agent, rodenticide

**Sample Purity:** 98% N.F./strychnine alkaloid,<sup>1</sup> and U.S.P. strychnine sulfate<sup>2</sup>

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months*)	LD50 95%CL (mg/kg)
Bullfrog <sup>1</sup>	4	M	—	2.21 [1.56-3.12]
Mallard duckling <sup>1</sup>	20	—	36 h	2.62 (1.94-3.55)
Mallard duckling <sup>1</sup>	20	—	1 wk	2.00 (1.51-2.65)
Mallard <sup>1</sup>	15	—	1	5.88 (3.23-10.7)
Mallard <sup>1</sup>	16	M,F	6	2.83 [2.00-4.00]
Mallard <sup>1</sup>	20	M,F	6	2.27 (1.26-4.11)
Golden eagle <sup>1</sup>	3	M	—	4.80-8.10
Golden eagle <sup>2</sup>	2	—	—	5.00-10.0
California quail <sup>1</sup>	9	M	5-6	112 (51.6-243)
Japanese quail <sup>1</sup>	24	F	2 <sup>b</sup>	22.6 (11.9-42.9)
Pheasant <sup>1</sup>	12	M	12-24 <sup>c</sup>	24.7 (14.4-42.2)
Pheasant (st) <sup>2</sup>	12	M	2	8.48 (4.41-16.3)
Chukar <sup>1</sup>	8	M,F	5-7	16.0 (8.0-32.0)
Rock dove <sup>1</sup>	12	M,F	—	21.3 (16.9-26.9)
Mourning dove (st) <sup>2</sup>	9	M,F	J	>5.12
House sparrow <sup>1</sup>	20	M	— <sup>d</sup>	4.18 (3.18-5.50)
House sparrow (st) <sup>2</sup>	6	F	—	4.00-8.00
Mule deer <sup>1</sup>	5	F	8-11	17.0-24.0

\*Except as noted.

<sup>b</sup>Some of these hens were laying eggs.

<sup>c</sup>These cocks were in breeding condition.

<sup>d</sup>These sparrows may have been in breeding condition.

**Signs of Intoxication:** Feathers fluffed or held tightly against body, low or high carriage, ataxia or asynergy, fasciculation, wing-drop, tails pointed down, salivation, tremors, hyperacusis, muscle tenseness, recurring convulsions or tetanic seizures, anorexia, tachycardia, immobility, violent convulsions or opisthotonos. During the early and middle stages of intoxication, slight touch, light, or sound stimuli produced exaggerated responses and often seizures. Signs appeared as soon as 10 min and mortalities usually occurred between 1 and 5 h after

treatment; however, deer mortalities occurred as late as 4 days and California quail mortalities as late as 7 days after treatment. Except in cases of delayed mortality, remission had usually occurred by several hours after treatment.

**Notes:** To convert strychnine alkaloid figures to strychnine sulfate figures, multiply the alkaloid figures by 1.28 (molecular weight of the sulfate + 2 + molecular weight of the alkaloid = 1.2813). If the toxicity of strychnine were proportional to the amount of alkaloid present, this factor would predict the toxicity of the sulfate from that of the alkaloid. This relation apparently does not always hold true, as can be seen by comparing the LD50's for pheasants with the two formulations.

For a discussion of the comparative toxicity of strychnine, see Tucker and Haeghele (1971).

Strychnine alkaloid: see strychnine

Strychnine sulfate: see strychnine

Strychnos: see strychnine

*Strychnos nux-vomica*: see strychnine

Subitex: see dinoseb

Substituted naphthalenes: see Panasol AN-2

Sulfox-Cide: see sulfoxide

## SULFOXIDE

**Alternative Names:** ENT 16634, n-octyl sulfoxide of isosafrole, Sulfox-Cide, sulfoxyl

**Chemical Name:** 5-[2-(octylsulfinyl)propyl]-1,3-benzodioxole (CAS 120-62-7)

**Primary Use:** Pesticide synergist

**Sample Purity:** 88%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	3-4	>2,000

**Signs of Intoxication:** Weakness, goose-stepping ataxia, ataxia, occasional stumbling or falling, wings held very high on body. Signs were seen as soon as 25 min after treatment and persisted for up to 14 days.

Sulfoxyl: see sulfoxide

Sumithion: see fenitrothion

Sumitomo: see fenitrothion

Suncide: see Baygon

Supona: see chlorfenvinphos

Supracide: see methidathion

Su Seguro Carpidor: see trifluralin



Sutan: see butylate  
 Synklor: see chlordan  
 Synthetic 3956: see toxaphene  
 Synthrin: see resmethrin  
 System: see schradan  
 Systemox: see demeton  
 Systox: see demeton

## 2,4,5-T

**Alternative Names:** Brush Killer, Brush-Rhap, Dacamine, Ded-Weed Brush Killer, Esteron 245, Fence Rider, Forron, Fruitone A, Inverton 245, Line Rider, Reddon, Tormona, Tributon, Trinoxol, Trioxone, Weedar, Weedone

**Chemical Name:** 2,4,5-Trichlorophenoxyacetic acid (CAS 93-76-5)

**Primary Use:** Herbicide

**Sample Purity:** Assumed technical grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	M	3	>2,000
Pheasant	3	M	3	500-1,000

**Signs of Intoxication:** Ataxia, polydipsia and regurgitation (in mallards), goose-stepping ataxia, geotaxia, hypoactivity, withdrawal, and slowness. Signs appeared as soon as 20 min in mallards and 1 day in pheasants and mortalities occurred between 3 and 24 h after treatment. Remission took up to 3 days.

T-2: see TBA

Tag Fungicide: see PMA

Tag HL 331: see PMA

Tamaron: see methamidophos

Taterpex: see CIPC

## TBA

**Alternative Names:** Benzabor, Benzac, Benzac 1281, Fen-All, HC-1281, T-2, TCB, Tribac, trichlorobenzoic acid, Trysben 200, Zobar

**Chemical Name:** 2,3,6-Trichlorobenzoic acid (CAS 50-31-7)

**Primary Use:** Herbicide

**Sample Purity:** 98.9% [2,3,6-TBA(60.7%); 2,3,4-TBA (9.3%); 2,4,5-TBA(26.3%); 2,4,6-TBA(2.6%); tetrachlorobenzoic acids (0.8%); and dichlorobenzoic acids (0.3%)]

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3	2,000 (1,467-2,725)
Pheasant	4	F	3	500-1,000
Pheasant	6	F	7	>1,000

**Signs of Intoxication:** Regurgitation (in mallards), ataxia, imbalance, falling, sitting, using wings for pedestrian locomotion, phonation, wings spread, spasms, tetanic seizures, hyporeactivity, asthenia, myasthenia, bradypnea, and immobility. Signs appeared as soon as 20 min and mortalities usually occurred between 1 and 3 days after treatment. Remission took up to 36 days.

TCB: see TBA

## TCDD

**Alternative Names:** None found

**Chemical Name:** 2,3,7,8-Tetrachlorodibenzo[b,e][1,4]dioxin (CAS 1746-01-6)

**Primary Use:** Undesirable contaminant of 2,4,5-T and trichlorophenol (any compound in which technical trichlorophenol is a starting material could be contaminated with TCDD)

**Sample Purity:** Analytical grade dissolved in corn oil

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard (st)	20	M,F	1 wk	>0.108
Bobwhite (HGF; st)	16	M	7	0.0150 (0.00919-0.0245)
Ringed turtle-dove (st)	30	M	A	>0.810

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Regurgitation, polydipsia, anorexia, hypoactivity, slowness, emaciation, asthenia, ataxia, imbalance, sitting, fluffed feathers, hyperexcitability, jitteriness, huddled position, unkempt, falling, hyporeactivity, tremors, spasms, convulsions, and immobility. Regurgitation appeared as soon as a few minutes after treatment, but other signs of intoxication did not appear until 7 days after treatment. Mortalities occurred

between 13 and 37 days after treatment. Remission in survivors had apparently occurred by 30 days after treatment.

**Notes:** Gross necropsies of the sacrificed ringed turtle-dove survivors revealed enlarged livers; livers from the dosage level of 0.108 mg/kg were twice the size of those from control birds. Necropsies of the dead bobwhite revealed severe emaciation, visceral uration, and accumulation of fluids in the pericardium and abdominal cavity.

TCDS: see tetradifon

TD-480: see hexaflurate

## TDE

**Alternative Names:** DDD, dichloro diphenyl dichloroethane, ENT 4225, ME-1700, Rhothane D-3, tetrachlorodiphenylethane

**Chemical Name:** 1,1'-(2,2-Dichloroethylidene)bis[4-chlorobenzene] (CAS 72-54-8)

**Primary Use:** Insecticide, mosquito larvicide and adulticide

**Sample Purity:**  $\geq 95\%$

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	3	F	3	>2,000
California quail	4	F	6	>760
Pheasant	12	F	3-4	386 (270-551)

**Signs of Intoxication:** Ataxia, imbalance, hyperexcitability, tenseness, jerkiness, shakiness, slowness, hypoactivity, huddled position, ptosis, tremors, and ataraxia. Signs appeared as soon as 2 h and mortalities usually occurred between 1 and 5 days after treatment. Remission took up to 11 days.

Tedion: see tetradifon

Tedion V-18: see tetradifon

Tekwaisa: see methyl parathion

TEL: see tetraethyllead

Telodrin: see isobenzan

## TEMEPHOS

**Alternative Names:** abaphos, Abate, Abathion, AC-52160, Biothion, Difenthos, ENT 27165, Experimental Insecticide 52160, Nimitox, tetrafenphos

**Chemical Name:** Phosphorothioic acid *O,O'*-(thiodi-4,1-

phenylene) *O,O,O',O'*-tetramethyl ester (CAS 3383-96-8)

**Primary Use:** Insecticide

**Sample Purity:** 92%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Bullfrog	3	F	—	>2,000
Mallard	16	M	4-7	79.4 (38.5-163)
California quail	12	F	6	18.9 (15.0-23.8)
Japanese quail	12	M	2 <sup>b</sup>	84.1 (60.6-116)
Pheasant	10	F	3-4	35.4 (25.5-49.0)
Chukar	9	M,F	2-3	240 (110-521)
Rock dove	16	M,F	— <sup>b</sup>	50.1 (16.7-150)
House sparrow	16	F	A <sup>b</sup>	35.4 (8.85-141)

<sup>a</sup>Except as noted.

<sup>b</sup>Some of these birds may have been in breeding condition.

**Signs of Intoxication:** Asthenia, ataxia, low carriage, fluffed feathers, fasciculation, tremors, salivation, lacrimation, tracheal congestion, miosis, muscular weakness, tachycardia, tachypnea, tetany, immobility. Penile extrusion occurred in one mallard. Signs appeared as soon as 5 min and mortalities usually occurred between 1 and 24 h after treatment; however, one mallard died 15 days after treatment. Remission in survivors took up to 2 weeks. Treatment levels as low as 10 mg/kg produced signs and 12.5 mg/kg produced deaths.

**Other Toxicity Data:** The 30-day EMLD for mallards ( $n = 22$ ) is 2.5 mg/kg per day for both sexes. The resulting cumulative toxicity index is  $79.4/2.5 = 32$ , indicating a high degree of cumulative action for an organophosphate.

**Notes:** Dose-response slopes in acute oral tests were low (increasing dosage levels did not produce proportional increases in the response), which may indicate poor absorption of single doses.

For a discussion of the comparative toxicity of temephos, see Tucker and Haegel (1971).

Temik: see aldicarb

Tendex: see Baygon

Ten-eighty: see sodium monofluoroacetate

Tenoran: see chloroxuron  
TEP: see TEPP

## TEPA

**Alternative Names:** aphoxide, APO, ENT 24915

**Chemical Name:** 1,1',1''-Phosphinylidynetrisaziridine (CAS 545-55-1)

**Primary Use:** Chemosterilant, insecticide

**Sample Purity:** 72.5%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog	8	M	—	500 (250-1,000)
Canada goose	12	M,F	—	13.0 (9.08-18.6)
Mallard	12	M	3-4	8.54 (6.16-11.8)
Japanese quail	16	F	2 <sup>a</sup>	>20.0
Pheasant	6	F	3-4	29.9 (22.0-40.5)
Chukar	12	M,F	2-4	63.9 (48.8-83.8)
Rock dove	12	M,F	— <sup>b</sup>	~30.0
Red-winged blackbird	8	M	—	13.5 (10.0-18.2)
House finch	16	M	— <sup>b</sup>	~100

<sup>a</sup>These hens were all laying eggs.

<sup>b</sup>These birds may have been in breeding condition.

**Signs of Intoxication:** Ataxia, wing-drop, tachypnea, dyspnea, nutation, tremors (the house finches raised their wings slowly above their head when disturbed), ataraxia or prostration, repeated wing-beat convulsions. Signs appeared as soon as 25 min and mortalities occurred 4 h to 10 days after treatment. Remission took up to 12 days.

**Other Toxicity Data:** The 15-day EMLD for 9-month-old chukars (n = 1M, 3F) is >1.0 mg/kg per day, but the eggs later produced by survivors of this level were markedly less fertile than those of a control group that received empty gelatin capsules for the 15-day dosage period.

## TEPP

**Alternative Names:** Bladan, ENT 18771, HETP, Klimite 40, Nifos T, TEP, tetraethyl pyrophosphate, Tetron-100, Vapotone

**Chemical Name:** Diphosphoric acid, tetraethyl ester (CAS 107-49-3)

**Primary Use:** Insecticide

**Sample Purity:** 40% TEPP, 60% other ethyl phosphates

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Bullfrog	9	F	—	112 (70.7-178)
Mallard	12	M	3-4	3.56 (2.70-4.68)
Pheasant	12	M	3-4	4.22 (2.93-6.09)
Chukar	12	M,F	3-4	10.1 (7.28-14.0)

**Signs of Intoxication:** Birds—goose-stepping ataxia, miosis, salivation, lacrimation, tenesmus, diarrhea, wings crossed over back, tetanic seizures, wing-beat convulsions or opisthotonos. Mortalities usually occurred in the first 25 min after treatment. Bullfrogs—levels as low as 17.7, 25.0, and 35.4 mg/kg produced one mortality of the three frogs tested at each level.

**Other Toxicity Data:** The calculated percutaneous LD50 for 1-year-old mallard drakes (n = 8) after a 24-h foot exposure is 64.0 (CL 28.7-142) mg/kg. In addition to many of the above, signs observed after percutaneous exposure to TEPP included ataxia, imbalance, slowness, fluid exuding from nares, spasms, wings spread, and immobility. Mortalities occurred between 2.5 and 25.5 h after initiation of treatment. When the percutaneous LD50 is compared with the acute oral LD50, TEPP appears to have a low degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

## TERBUTRYN

**Alternative Names:** GS-14260, Igran, Igran 50, prebane, Short-stop E

**Chemical Name:** N-(1,1-dimethylethyl)-N'-ethyl-6-(methylthio)-1,3,5-triazine-2,4-diamine (CAS 886-50-0)

**Primary Use:** Herbicide

**Sample Purity:** 97.8%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	4	F	3-4	>2,000
Pheasant	3	F	3	>2,000

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, imbalance, sitting, and tremors. Signs were observed only in mallards and appeared as soon as 19 min after treatment. Remission took up to 10 days. No mortalities occurred.

**TERGITOL 12-P-6**

**Alternative Names:** None found

**Chemical Name:** Unknown

**Primary Use:** Emulsifier, ingredient in 492 Mosquito Larvicide Oil

**Sample Purity:** Technical grade

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	F	18	>2,000

**Signs of Intoxication:** Ataxia and imbalance. Signs appeared as soon as 2 h after treatment. Remission had occurred by 1 day after treatment.

**Terpenes:** see Thanite

**Terpinyl thiocanoacetate:** see Thanite

**Terrachlor:** see PCNB

**Terrachlor-Super X:** see Terrazole

**Terraclor:** see PCNB

**Terra-Coat L-205:** see PCNB, Terrazole

**Terra-Coat LT-2:** see PCNB

**Terracur P:** see fensulfothion

**TERRAZOLE**

**Alternative Names:** OM 2424, Terrachlor-Super X, Terra-Coat L-205, Truban

**Chemical Name:** 5-Ethoxy-3-(trichloromethyl)-1,2,4-thiadiazole (CAS 2593-15-9)

**Primary Use:** Fungicide

**Sample Purity:** 95%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard (MM; st)	8	M	4-5	>2,000

**Signs of Intoxication:** Sitting, polydipsia, ataxia, slowness, hyporeactivity, stumbling, asthenia, and myasthenia. Signs appeared as soon as 25 min and the single mortality occurred between 3 and 7 days after treatment. Remission took up to 16 days.

**Tersan 75:** see thiram

**Tetrachlorodiphenylethane:** see TDE

**TETRACHLORVINPHOS**

**Alternative Names:** Appex, Gardona, Rabon, SD 8447, stirifos

**Chemical Name:** Phosphoric acid, 2-chloro-1-(2,4,5-trichlorophenyl)ethenyl dimethyl ester (CAS 961-11-5)

**Primary Use:** Insecticide

**Sample Purity:** Technical grade

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M,F	3-5	>2,000
Pheasant	6	M,F	2-4	≥2,000
Chukar	2	M	2-3	>2,000

**Signs of Intoxication:** No signs occurred in the mallards and chukars. The pheasants showed convulsions, tremors, and prostration during the second and third days after treatment.

**TETRADIFON**

**Alternative Names:** ENT 23737, Duphar, NIA 5488, TCDS, tedion, Tedion V-18, V-18

**Chemical Name:** 1,2,4-Trichloro-5-[(4-chlorophenyl)sulfonyl]benzene (CAS 116-29-0)

**Primary Use:** Insecticide, acaricide

**Sample Purity:** 99.4%

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	3	M	4	>2,000

**Signs of Intoxication:** Ataxia, wing twitching, imbalance, and slowness. Signs appeared as soon as 1 h after treatment. Remission had occurred by the day following treatment.

**TETRAETHYLLEAD**

**Alternative Names:** lead, tetraethyl; lead tetraethide; TEL

**Chemical Name:** Tetraethyl-plumbane (CAS 78-00-2)

**Primary Use:** Gasoline additive

**Sample Purity:** Commercially pure

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3-4	107 (44.5-258)
Japanese quail	12	M	3-4 <sup>a</sup>	24.6 (14.7-41.3)

<sup>a</sup>These cocks may have been in breeding condition.

**Signs of Intoxication:** Polydipsia, regurgitation, reluctance to leave the swimming pond (in mallards), shakiness, hypoactivity, wing-drop, wings spread, ataxia, imbalance, geotaxia, slowness, running and falling, sitting, reluctance to move, fluffed feathers, ptosis, ataraxia, asthenia, mydriasis, tremors, and anorexia. Regurgitation in mallards occurred as soon as 7 min, other signs appeared as soon as 20 min, and mortalities usually occurred between 1 and 4 days after treatment. Remission took up to 8 days.

**Note:** For data and discussion on the effects of tetraethyllead on eggshell thickness in mallards and Japanese quail, see Haegele and Tucker (1974).

Tetraethylpyrophosphate: see TEPP

Tetrafenphos: see temephos

Tetrasodium ethylene diamine tetraacetate: see Airkem A-33 Dry

Tetron-100: see TEPP

**TFM**

**Alternative Names:** Lampricide, Lampracid 2770, TFM-A

(TFM recrystallized by Aldrich Chemical Co.), TFM-FG (field grade TFM)

**Chemical Name:** 4-Nitro-3-(trifluoromethyl)phenol (CAS 88-30-2)

**Primary Use:** Lampricide

**Sample Purity:** >96% (TFM-A),<sup>1</sup> 35% in dimethyl formamide (TFM-FG)<sup>2</sup>

## Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard <sup>1</sup>	24	M	12	458 (324-649)
Mallard (st) <sup>2</sup>	24	M	12 <sup>b</sup>	308 (237-400)
California quail (st) <sup>2</sup>	12	F	12 <sup>b</sup>	546 (313-950)
Ring-billed gull (st) <sup>2</sup>	9	M,F	I	250 (170-368)

<sup>a</sup>Except as noted.

<sup>b</sup>These birds may have been in breeding condition.

**Signs of Intoxication:** Polydipsia, regurgitation, stumbling, tachypnea, sitting, ataraxia, ataxia, imbalance, myasthenia, running and falling, withdrawal, dyspnea, wing-drop, wings spread, tonic convulsions, tetanic seizures, and terminal wing-beat convulsions and opisthotonos. The timing of the appearance of signs and mortalities was different for the two formulations. With TFM-A signs appeared as soon as 13 min and mortalities usually occurred between 20 and 50 min after treatment. Remission took up to 7 or 8 days. With TFM-FG signs appeared as soon as 1 min and mortalities usually occurred between 4 and 20 min after treatment. Remission took up to 4 h.

**Other Toxicity Data:** Mallards 8 weeks old (5 M and 5 F per treatment group) were exposed to TFM-A in their drinking and swimming water at concentrations of 5.0, 15.8, 50.0, and 500 mg/L for 48 h. No mortalities occurred but clinical signs were apparently induced at the 50.0-mg/L level and the 500 mg/L level caused rejection of the treated water.

Mallards 1 year old (n = 5 M and 5 F per treatment group) were exposed to TFM-FG in their drinking and swimming water at concentrations of 57.1 and 285.7 mg/L (20.0 and 100 mg/L active TFM) for 48 h. No mortalities occurred and clinical signs of intoxication were slight.

A combination of TFM-FG and clonitralid was administered to mallard drakes (n = 24), bobwhite cocks (n = 24), and male and female ring-billed gulls (n = 24). Results were similar to those after administration of TFM-FG alone. Mallards 4 months old (n = 15 M and 15 F) were exposed to the mixture in their drinking and swimming water with results similar to the studies of TFM-FG alone. In these combination studies, the ratio of TFM to clonitralid was 98:2; the mixture thus contained 34.3% active TFM and 0.7% active clonitralid.

**Notes:** On the basis of active ingredients, it appears that TFM-FG is more toxic to mallards than TFM-A. This finding can be explained as a synergistic effect contributed by the dimethylformamide carrier, which probably speeds up the absorption of TFM in the gastrointestinal tract either by affecting the membranes lining the tract or by acting as a solvent for the TFM.

For further discussion of these data, see Hudson (1979).

TFM-A: see TFM

TFM-FG: see TFM

TH-6040: see difluron

## THALLIUM SULFATE

**Alternative Names:** Zelio

**Chemical Name:** Thallous sulfate (CAS 7446-18-6)

**Primary Uses:** Rodenticide, insecticide bait ingredient, mammal control agent

**Sample Purity:** 99% (80.2% Thallium)

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	12	M	3	36.7 (28.3-47.5)
Golden eagle	4	—	I	60.0-120
Pheasant	12	M	3-4	23.7 (17.1-32.9)

<sup>a</sup>Except as noted.

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, imbalance, high carriage, slowness, goose-stepping ataxia, myasthenia, asthenia, hypoactivity, hopping and falling, wing-drop, immobility, and loss of righting reflex. Signs appeared as soon as 15 min and mortalities usually occurred between 1 and 7 days after treatment. Remission took up to 20 days.

**Notes:** For a more complete presentation of the toxicologi-

cal data for the eagle studies, and results of residue analyses performed on the eagle mortalities, see Bean and Hudson (1976).

Gross necropsies of mallard and pheasant mortalities revealed consistent incidence of extreme visceral uration (especially of the Glisson's capsule and the pericardium), pericardium adhering to the heart, hyperemia and purpura of the gastrointestinal tract, sloughing of the lining of the gastrointestinal tract, coronary band petechiation, and small spleens.

## THANITE

**Alternative Names:** ENT 92, terpinyl thiocynoacetate

**Chemical Name:** 82% Exo-acetic acid, thiocyanato-, 1,7,7-trimethylbicyclo[2.2.1] hept-2-yl ester and 18% related terpenes (CAS 115-31-1)

**Primary Use:** Insecticide, experimental piscicide

**Sample Purity:** 100%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	9	M	12 <sup>a</sup>	>2,000
Pheasant	6	M	3	>2,000

<sup>a</sup>These drakes may have been in breeding condition.

**Signs of Intoxication:** Polydipsia, regurgitation, ataxia, goose-stepping ataxia, jerkiness, reluctance to rise and move, falling, unkemptness, using wings to aid pedestrian locomotion, emaciation, and asthenia. Signs appeared 1 day after treatment in mallards and 7 days after treatment in pheasants. No mortalities occurred. Remission took up to 20 days.

Thifor: see endosulfan

Thimer: see thiram

Thimet: see phorate

Thimul: see endosulfan

Thiocarbonyl: see SD 17250

Thiodan: see endosulfan

Thiodemeton: see disulfoton

## THIONAZIN

**Alternative Names:** AC-18133, American Cyanamid 18133, Cynem, EN-18133, ENT 25580, Experimental Nematocide 18133, Nemafof, Nemaphos, Zenophos

**Chemical Name:** Phosphorothioic acid, *O,O*-diethyl *O*-pyrazinyl ester (CAS 297-97-2)



**Primary Use:** Nematocide, soil insecticide, fungicide

**Sample Purity:** 95.6%

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	M	3	1.68 (1.21-2.33)
Pheasant	12	M	3-4	2.11 (1.68-2.66)

**Signs of Intoxication:** Regurgitation and polydipsia (in mallards), ataxia, imbalance, running and falling, sitting, miosis, masseter tenseness, lacrimation, using wings for pedestrian locomotion, dyspnea, wings spread, tremors, asthenia, tonic convulsions, tetanic seizures, wing-beat convulsions and opisthotonos. Signs appeared as soon as 5 min and mortalities usually occurred between 10 and 80 min after treatment. Remission had usually occurred by 2 days after treatment.

**Other Toxicity Data:** The calculated percutaneous LD50 for 10-month-old mallard drakes (n = 8) after a 24-h dermal foot exposure is 7.07 [CL5.00-10.0] mg/kg. Penile extrusion was noted in mortalities; otherwise, signs after dermal treatment were similar to those reported above. Mortalities usually occurred between 1 and 19 h after the initiation of treatment; however, one drake died 4 days after the initiation of treatment. Remission took up to 5 days. When the percutaneous LD50 is compared with the acute oral LD50, thionazin appears to have a moderate degree of dermal hazard in mallards.

**Note:** For further discussion of the percutaneous toxicity data, see Hudson et al. (1979).

Thionex: see endosulfan

Thiophal: see folpet

Thiophos: see parathion

Thiosan: see thiram

Thiotex: see thiram

## THIRAM

**Alternative Names:** Arasan, Chipco Thiram 75, Delsan, ENT 987, Fermide 850, Fernasan, Hexathir, Mercuram, Nomersam, Polyram-Ultra, Pomarsol, Pomasol, Spotrete, Tersan 75, Thimer, Thiosan, Thiotex, Thiramad, Thirasan, Thylate, Tirampa, TMTD, TMTDS, Tramatant, Tripomol, Tuads, Vancide TM-95, Vancide TM-Flowable

**Chemical Name:** Thioperoxydicarbonic diamide ( $[(H_2N)(S)]_2S_2$ ), tetramethyl (CAS 137-26-8)

**Primary Use:** Fungicide

**Sample Purity:**  $\geq 99\%$

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	7	F	3	>2,800
Pheasant	12	M	3-4	673 (485-932)

**Signs of Intoxication:** Mallards showed transient ataxia only. Pheasants showed tachypnea, wing-drop, reluctance to move, fluffed feathers, ptosis, diarrhea, tremors like those produced by chlorinated organic compounds, immobility.

Thiramad: see thiram

Thirasan: see thiram

Thuricide: see *Bacillus thuringiensis* (Berliner)

Thylate: see thiram

Tiezene: see zineb

Tiguvon: see fenthion

Tilcarex: see PCNB

Timet: see phorate

Tirampa: see thiram

TMTD: see thiram

TMTDS: see thiram

Tordon: see picloram

Tormona: see 2,4,5-T

Torque: see Vendex

Toxakil: see toxaphene

## TOXAPHENE

**Alternative Names:** Alltex, camphechlor, chlorinated camphene, Clor Chem T-590, Compound 3956, ENT 9735, Hercules 3956, Motox, octachlorocamphene, Phenacide, Phenatox, polychlorocamphene, Strobane-T, Synthetic 3956, Toxakil

**Chemical Name:** Chlorinated camphenes (CAS 8001-35-2)

**Primary Use:** Insecticide

**Sample Purity:** 90%<sup>1</sup> and 100%<sup>2</sup> (100% = 67-69% total chlorine content)

#### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months*)	LD50 95%CL (mg/kg)
Fulvous whistling-duck <sup>1</sup>	8	M	3-6	99.0 (37.2-264)

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard duckling <sup>1</sup>	20	—	1 wk	30.8 (23.3–40.6)
Mallard <sup>2</sup>	16	F	3–5	70.7 (37.6–133)
Sharp-tailed grouse <sup>1,2</sup>	8	M	12–48	19.9 (14.1–28.2)
Bobwhite <sup>1</sup>	15	M	3	85.5 (59.3–123)
California quail <sup>1</sup>	15	M	9–11 <sup>b</sup>	23.7 (11.9–47.4)
Pheasant <sup>1</sup>	8	F	2–3	40.0 (20.0–80.0)
Gray partridge <sup>1</sup>	12	M	A	23.7 [20.0–28.3]
Sandhill crane <sup>2</sup>	3	F	—	100–316
Horned lark <sup>1</sup>	6	M,F	A	581 (425–794)
Mule deer <sup>1</sup>	3	M	18	139–240
Domestic goat <sup>1</sup>	1	M	>60	>160

<sup>1</sup>Except as noted.

<sup>2</sup>Some of these birds may have been in breeding condition.

**Signs of Intoxication:** Ataxia, goose-stepping ataxia, circling, low or high carriage, neck pulled in, ptosis, constant tremors that appeared like shivering, phonation, reluctance to move, tenesmus, hyperthermia, wing-beat convulsions or opisthotonos. This is a fairly slow-acting chemical. Although signs were seen as soon as 20 min in some species, mortalities usually occurred between 2 and 14 days after treatment.

**Other Toxicity Data:** Toxaphene did not cause eggshell thinning in tests on Japanese quail (Haegele and Tucker 1974).

**Note:** For data and discussion on the effects of age on the sensitivity of mallards to toxaphene, see Hudson et al. (1972).

2,4,5-TP: see silvex

Trametan: see thiram

Trefanocide: see trifluralin

Treficon: see trifluralin

Treflan: see trifluralin

Triasyn: see anilazine

Tribac: see TBA

Tribactur: see *Bacillus thuringiensis* (Berliner)

Tributon: see 2,4-D; 2,4,5-T

Tributyl phosphorothioate: see DEF

Tricarnam: see carbaryl

## TRICHLORFON

**Alternative Names:** Anthon, BAY 13/59, BAY L-13/59,

Bovinox, Cekufon, chlorofos, chlorphos, Chlorophos, Danex, dipterox, Dipterox, Diptetes, Dylox, ENT 19763, Equino-Aid, metrifonate, Neguvon, Proxol, trichlorofon, trichlorophon, trichlorophon, Trinex, Tugon

**Chemical Name:** Phosphonic acid, (2,2,2-Trichloro-1-hydroxyethyl)-dimethyl ester (CAS 52-68-6)

**Primary Use:** Insecticide

**Sample Purity:** 98%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	12	M	3–4	36.8 (26.6–51.1)
Bobwhite	6	M	10 <sup>b</sup>	22.4 (13.3–37.6)
California quail	12	F	9–11 <sup>b</sup>	59.3 (47.1–74.7)
Pheasant	12	M	4	95.9 (76.1–121)
Rock dove	9	M,F	A	123 [78.1–195]
Ringed turtle-dove	8	F	A	32.0 [26.9–38.0]

<sup>a</sup>Except as noted.

<sup>b</sup>Many of these birds were in the early stages of gonadal development for the breeding season.

**Signs of Intoxication:** Regurgitation, imbalance, ataxia, tremors, falling, sitting, hyporeactivity, hypoactivity, slowness, running and falling, ataraxia, foamy salivation, asthenia, dyspnea, immobility, wing-beat convulsions, and tetany or opisthotonos. Signs appeared as soon as 10 min and mortalities occurred usually between 30 min and 3 h after treatment; however, one bobwhite died 11 days after treatment. Remission in survivors took up to 1 week.

**Note:** For a discussion of comparative data for a derivative of trichlorfon, which differs by having the hydroxyethyl group replaced with a long carbon chain, see C-12 trichlorfon.

Trichlorfon, C-12 derivative: see C-12 trichlorfon

Trichlorofon: see trichlorfon

## TRICHLORONAT

**Alternative Names:** Agrisil, Agritox, BAY 37289, ENT 25712, fenophospon, Phytosol, S 4400, trichloronate

**Chemical Name:** Ethyl phosphonothioic acid, *O*-ethyl *O*-(2,4,5-trichlorophenyl) ester (CAS 327-98-0)

**Primary Use:** Insecticide

**Sample Purity:** 98%

Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	12.0 (8.65-16.6)

**Signs of Intoxication:** High carriage, neck tremors, goose-stepping ataxia, salivation, nutation, dyspnea, prostration with wings spread, tetany. Signs appeared as soon as 20 min and recovery among survivors took as long as 28 days. Mortalities usually occurred between 2 and 4 h after treatment. Levels as low as 5.66 mg/kg produced some mortality. Weight losses occurred among survivors.

Trichloronate: see trichloronat

Trichlorophon: see trichlorfon

Trichlorphon: see trichlorfon

Trichlorpyrphos: see chlorpyrifos

Tri-Endothal: see endothall

Trieste Flowers: see pyrethrum

## TRIFLURALIN

**Alternative Names:** Elancolan, ENT 28203, L-36352, Lilly 36352, Su Seguro Carpidor, Trefanocide, Treficon, Treflan, Triflurex, Trim

**Chemical Name:** 2,6-Dinitro-*N,N*-dipropyl-4-(trifluoromethyl) benzenamine (CAS 1582-09-8)

**Primary Use:** Herbicide

**Sample Purity:** 96.7%

Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	3-4	>2,000
Pheasant	3	F	3	>2,000

**Signs of Intoxication:** Very mild ataxia only.

Triflurex: see trifluralin

Trifocide: see DNOC

Triherbicide-CIPC: see CIPC

Triherbicide-IPC: see IPC-400

Trim: see trifluralin

Trimetion: see dimethoate

Trinex: see trichlorfon

Trinoxol: see 2,4,5-T

Trioxone: see 2,4,5-T

Tri-PCNB: see PCNB

Tripomol: see thiram

Trithion: see carbophenothion

Tritisan: see PCNB

Tritoftorol: see zineb

Trolene: see ronnel

Truban: see Terrazole

Trysben 200: see TBA

Tuads: see thiram

Tuba: see rotenone

Tubatoxin: see rotenone

Tuberite: see IPC-400

Tugon: see trichlorfon

U-2069: see dicloran

UC 7744: see carbaryl

UC 21149: see aldicarb

Ultracide: see methidathion

Ultracide Geigy: see methidathion

Uden: see Baygon

V-18: see tetradifon

Valexon: see phoxim

Vancide 95RE: see captan

Vancide PA: see CHE 1843

Vancide TM-95: see thiram

Vancide TM-Flowable: see thiram

Vapona: see DDVP

Vapotone: see TEPP

V-C9-104: see ethoprop

VCS 506: see leptophos

Vegaben: see chloramben

Vegiben: see chloramben

Velsicol 104: see heptachlor

Velsicol 1068: see chlordane

## VENDEX

**Alternative Names:** ENT 27738, neostanox (proposed), SD 14114, Torque

**Chemical Name:** Hexakis(2-methyl-2-phenylpropyl)distanoxane (CAS 13356-08-6)

**Primary Use:** Miticide

**Sample Purity:** >95%

Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	7	F	3	>2,000
Pheasant	3	M	3	▶2,000

**Signs of Intoxication:** Mallards - ataxia, stumbling, phona-

tion, imbalance, geotaxia, slowness, asthenia, and myasthenia. Signs appeared as soon as 25 min after treatment, and remission took up to 21 days. No mortalities occurred. No signs were observed in pheasants.

Verbigen: see chloramben  
 Vergemaster: see 2,4-D  
 Vertron 2D: see 2,4-D  
 Viozene: see ronnel  
 Viral pesticide: see nucleopolyhedral virus  
 Visko-Rhap Low Volatile 4L: see 2,4-D  
 Volaton: see phoxim  
 Vondcaptan: see captan  
 Vonduron: see diuron  
 Warbex: see famphur  
 Weed-Ag-Bar: see 2,4-D  
 Weedar: see 2,4,5-T  
 Weedar 64: see 2,4-D  
 Weedazol: see amitrol  
 Weed-B-Gon: see 2,4-D  
 Weedez Wonder Bar: see 2,4-D  
 Weedol: see paraquat dichloride  
 Weedone: see 2,4-D; PCP; 2,4,5-T  
 WHO OMS-771: see aldicarb  
 WL 19805: see cyanazine  
 Wofatox: see methyl parathion  
 Y-2: see IPC-400  
 Y-3: see CIPC  
 Yomesan: see clonitralid

## YUMA CHEMICAL "SPREADER A"

**Alternative Names:** film extender, spreader

**Chemical Name:** Unknown

**Primary Use:** As substance which increases the area that a given volume of liquid will cover on a solid or on another liquid, used in pesticide applications

**Sample Purity:** Assumed technical grade

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Chukar (st)	2	—	3-4	1,000-10,000

**Signs of Intoxication:** None observed. The only mortality occurred between 23 and 43 h after treatment.

Z-78: see zineb  
 Zebtox: see zineb  
 Zectran: see mexacarbate  
 Zectran (acylated): see mexacarbate (acylated)  
 Zelio: see thallium sulfate

Zenophos: see thionazin  
 Zephiran chloride: see Airkem A-33 Dry  
 Zerdane: see DDT  
 Zidan: see zineb

## ZINC PHOSPHIDE

**Alternative Names:** Kilrat, Mous-con, Rumetan

**Chemical Name:** Zinc phosphide (CAS 1314-84-7)

**Primary Use:** Rodenticide

**Sample Purity:** 94%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months <sup>a</sup> )	LD50 95%CL (mg/kg)
Mallard	12	F	3-4	35.7 (11.8-108)
Golden eagle	2	—	12	>20.0
Pheasant	12	M	3	16.4 (11.4-23.7)
Horned lark (st)	9	M,F	A <sup>b</sup>	47.2 (13.0-172)

<sup>a</sup>Except as noted.

<sup>b</sup>These birds may have been in breeding condition.

**Signs of Intoxication:** Polydipsia and regurgitation (in mallards), ataxia, imbalance, anorexia, tenseness, hyporeactivity, hyporeactivity, tachypnea, dyspnea, ptosis, and immobility. Signs appeared as soon as 15 min and mortalities usually occurred between 2 and 21 h after treatment. Remission took up to 1 month.

## ZINEB

**Alternative Names:** Aspor, Chem Zineb, Dithane Z-78, ENT 14874, Hexathane, Kypzin, Lonacol, Pamosol 2 Forte, Parzate, Parzate C, Parzate zineb, Polyram Z, Tiezene, Tritoforol, Z-78, Zebtox, Zidan, Zinosan

**Chemical Name:** [[1,2-Ethanediy]bis(carbamodithioate)] (2-)]zinc (CAS 12122-67-7)

**Primary Use:** Fungicide

**Sample Purity:** 95%

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	M	11-12 <sup>a</sup>	>2,000
Pheasant	3	F	3-4	>2,000

<sup>a</sup>These drakes may have been in breeding condition.

**Signs of Intoxication:** Goose-stepping ataxia, wings crossed over back, general myasthenia from 1 h up to 1 or 2 days.

Zinophos: see thionazin

Zinosan: see zineb

Zobar: see TBA

ZR-515: see methoprene

17/147: see azinphos-methyl

## 492 MOSQUITO LARVICIDE OIL

**Alternative Names:** None found

**Chemical Name:** Mixture of Armeen OD, Tergitol 12-P-6, and Process Oil 492

**Primary Use:** Mosquito control (pre-imago stage)

**Sample Purity:** 100%—1% Tergitol 12-P-6 and 0.5% Armeen OD in Process Oil 492

### Acute Oral Toxicity Summary

Test animal	No.	Sex	Age (months)	LD50 (mg/kg)
Mallard	6	F	18	>2,000

**Signs of Intoxication:** None.

666: see benzene hexachloride

1080: see sodium monofluoroacetate

3911: see phorate

8167 RP: see ethion

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## Glossary

- Aggressiveness**—Loss of fear of the investigator, abnormal belligerence toward the investigator or other individuals in the test group
- Anorexia**—Loss of appetite, not eating feed
- Apnea**—Cessation of breathing
- Asthenia**—Weakness, debility
- Asynergy**—Lack of coordination between muscle groups; movements are in serial order instead of being made together
- Ataraxia**—Imperturbability, calmness
- Ataxia**—Muscular incoordination, especially when voluntary muscular movements are attempted
- Bradycardia**—Slow heart beat
- Bradypnea**—Slow breathing
- Catatonía**—Stupor, tendency for an animal to assume and remain in a fixed posture, characterized by extreme unresponsiveness and inactivity
- Clonic convulsions**—Alternate relaxation and involuntary contractions of muscles
- Coma**—Abnormal deep stupor; the animal cannot be roused by stimulation
- Convulsions**—Massive involuntary muscle contractions
- Debility**—Weakness of tonicity in functions or organs of the body
- Diarrhea**—Discharge of more or less fluid feces
- Dyspnea**—Shortness of breath, labored breathing
- Edema**—Swelling
- Emaciation**—Wasting of the flesh, state of being extremely lean
- Emprosthotonos**—Lying with the body incurved, arching of the neck toward the belly
- Eosinophilia**—Excessive eosinophiles in differential white blood cell counts
- Epistaxis**—Nose bleed
- Erythema**—Redness of the skin due to dilation of blood vessels
- Eschar**—A slough, especially following a burn
- Excessive phonation**—Making abnormally loud or frequent vocal sounds
- Exophthalmia**—Protruding eyeballs
- Exudate**—Secretion of fluid
- Fasciculation**—Skin or superficial tremors
- Flaccid**—Defective or flabby muscle tone
- Geotaxia**—Heavy-footed walking due to muscular incoordination in the legs and feet
- Goose-stepping ataxia**—A type of incoordination where the feet are raised unnecessarily high in each step
- Hemorrhage**—Abnormal discharge of blood from vessels into tissues or from the body
- Hyperacusis**—Increased reaction to sound
- Hyperemia**—Congestion, an unusual amount of blood in a part of the body
- Hyperexcitability**—Increased reaction to stimuli
- Hyperthermia**—Elevated body temperature
- Hypoesthesia**—Dulled sensitivity to touch
- Hyporeactivity**—Lethargy, diminished reaction to stimuli



- Ischemia**—Local paling of the skin (often due to constriction of the blood vessels)
- Lacrimation**—Production of tears
- Lethargy**—Stupor, torpor, sluggishness
- Loss of righting reflex**—No attempt to regain normal body position
- Masseter tenseness**—Tightness of the jaw muscle
- Miosis**—Constriction of the pupil
- Muscarinic syndrome**—Stimulation of smooth muscle, often resulting in secretions
- Myasthenia**—Muscular weakness
- Mydriasis**—Dilation of the pupil
- Neutrophilia**—Excessive neutrophils in differential white blood cell counts
- Nictitating membrane flicker**—Abnormally frequent activation of the nictitating membrane of the eye
- Nutation**—Nodding of the head
- Nystagmus**—Involuntary eyeball movement
- Opacity**—Loss of lens or corneal transparency
- Opisthotonos**—Arching of the back and arching of the neck over the back
- Paralysis**—Temporary suspension or permanent loss of function
- Paraplegia**—Paralysis of the lower body and both legs
- Paresis**—Partial or incomplete paralysis
- Penile extrusion**—Forcing or pushing out of the penis
- Petechia**—Small pin-point hemorrhage spots
- Phonation**—Utterance of vocal sounds
- Pica**—A perversion of appetite with a craving for substances not fit for feed
- Pilorection**—Hairs more erect than usual
- Polydipsia**—Excessive drinking
- Polyuria**—Excessive urination
- Prostration**—Absolute exhaustion
- Ptosis**—Drooping of the eyelid
- Purpura**—Hemorrhages into the skin, mucous membranes, internal organs, and other tissues; does not disappear under pressure
- Righting reflex**—Ability to assume upright normal body position
- Remission**—Lessening of severity, or abatement of signs of intoxication
- Running or hopping and falling**—Animal runs or hops for a short distance and then falls, sometimes going into a tonic spasm or tetanic seizure
- Salivation**—Excessive secretion of saliva
- Spasm**—An involuntary, sudden movement or convulsive muscular contraction
- Sternal recumbancy**—Resting or reclining on the chest or breast
- Tachycardia**—Rapid heart beat
- Tachypnea**—Rapid breathing
- Tenesmus**—Spasmodic contractions of anal sphincter
- Tetanic seizures**—Temporary whole-body rigidity
- Tetany**—Intermittent tonic convulsions
- Tonic convulsions**—Continuous, unremitting muscular contractions
- Torpor**—State of being dormant or inactive; temporary loss of all or part of the power of sensation or motion
- Tracheal congestion**—Congestion resulting from constriction of tracheal cartilages, mucous accumulation in the trachea, or both
- Tremors**—Twitching of muscles
- Unkemptness**—Disorderly fur or feathers, from lack of grooming or preening
- Uration**—Excessive deposition of uric acid salts in connective tissue
- Using wings for or to aid pedestrian locomotion**—A condition in birds where ataxia is so severe that walking or flying is not possible, but the wings can still be used for movement on the floor or ground
- Wing-beat convulsions**—Convulsions associated with non-functional wing flapping
- Wing-drop**—Wings carried in abnormally low position
- Wings crossed over back**—Condition resulting from very high wing position
- Wing shivers**—Constant rapid wing twitching
- Withdrawal**—Diminished interaction with other animals in cage or with observer

## Index to Species Tested

- Agelaius phoeniceus*: see Red-winged blackbird
- Albino rat—*Rattus norvegicus*: chlorpyrifos, D.M. 7537, D.M. 7597, nucleopolyhedral virus, phosphamidon, polychlorinated biphenyls
- Alectoris chukar*: see Chukar
- Anas acuta*: see Northern pintail
- Anas platyrhynchos*: see Mallard
- Aquila chrysaetos*: see Golden eagle
- Bobwhite: see Northern bobwhite
- Branta canadensis*: see Canada goose
- Bullfrog—*Rana catesbeiana*: Baygon, carbaryl, chlorpyrifos, DDT, demeton, Diazinon, dicotophos, D.M. 7537, Gophacide, mexacarbate, mexacarbate (acylated), nabam, phorate, phosphamidon, sodium monofluoroacetate, strychnine, temephos, TEPA, TEPP
- California quail—*Callipepla californica*: aldicarb, Baygon, C-12 trichlorfon, carbaryl, CHE 1843, chlordane, chlorpyrifos, DDT, demeton, dicotophos, dieldrin, Dowco 214, endrin, EPN, fensulfothion, fenthion, hexaflurate, Landrin, leptophos, methoxychlor, mexacarbate, Mobam, monocrotophos, Namacur, oxydemetonmethyl, parathion, potassium azide, RE-11775, resmethrin, RU 11-679, SD 17250, sodium arsenite, sodium monofluoroacetate, strychnine, TDE, temephos, TFM, toxaphene, trichlorfon
- Callipepla californica*: see California quail

- Canada goose—*Branta canadensis*: Baygon, carbaryl, chlorpyrifos, dicotophos, dieldrin, fenthion, methidathion, mexacarbate, monocrotophos, naled, SD 17250, TEPA
- Capra hircus*: see Domestic goat
- Carpodacus mexicanus*: see House finch
- Chukar—*Alectoris chukar*: azinphos-methyl, Baygon, carbaryl, Ceresan M, chlorpyrifos, 2,4-D, demeton, dicotophos, dieldrin, D.M. 7537, EPN, fenthion, Gophacide, Landrin, mestranol, methidathion, mexacarbate, Mobam, monocrotophos, oxydemetonmethyl, parathion, phorate, phosphamidon, Planavin, SD 16898, Silvisar-510, sodium monofluoroacetate, strychnine, temephos, TEPA, TEPP, tetrachlorvinphos, Yuma Chemical "Spreader A"
- Colinus virginianus*: see Northern bobwhite
- Columba livia*: see Rock dove
- Coturnix japonica*: see Japanese quail
- Dark-eyed junco—*Junco hyemalis*: Baygon
- Dendrocygna bicolor*: see Fulvous whistling-duck
- Domestic ferret (European polecat)—*Mustela putorius*: sodium monofluoroacetate
- Domestic goat—*Capra hircus*: Baygon, chlorpyrifos, demeton, dieldrin, disulfoton, endrin, Landrin, mexacarbate, monocrotophos, nabam, parathion, toxaphene
- Domestic pigeon: see Rock dove
- Eremophila alpestris*: see Horned lark
- European polecat: see Domestic ferret
- Ferret: see Domestic ferret
- Fulvous whistling-duck—*Dendrocygna bicolor*: aldrin, carbofuran, Ceresan L, dieldrin, parathion, toxaphene
- Goat: see Domestic goat
- Golden eagle—*Aquila chrysaetos*: Gophacide, monocrotophos, sodium monofluoroacetate, strychnine, thallium sulfate, zinc phosphide
- Gray partridge—*Perdix perdix*: aldrin, Ceresan M, dieldrin, hexaflurate, monocrotophos, parathion, toxaphene
- Greater prairie chicken—*Tympanuchus cupido*: Ceresan M
- Grus canadensis*: see Sandhill crane
- Horned lark—*Eremophila alpestris*: malathion, methiocarb, toxaphene, zinc phosphide
- House finch—*Carpodacus mexicanus*: Baygon, demeton, dicotophos, fenthion, mexacarbate, monocrotophos, TEPA
- House sparrow—*Passer domesticus*: Baygon, chlorpyrifos, demeton, dicotophos, dieldrin, D.M. 7537, EPN, fenthion, Landrin, mexacarbate, Mobam, monocrotophos, nucleopolyhedral virus, oxydemetonmethyl, Panogen, parathion, sodium monofluoroacetate, strychnine, temephos
- Japanese quail—*Coturnix japonica*: Baygon, carbaryl, Ceresan L, Ceresan M, chlorpyrifos, 2,4-D, DDT, demeton, dicotophos, dieldrin, EPN, fenthion, Landrin, mexacarbate, Mobam, monocrotophos, nabam, nicotine sulfate, oxydemetonmethyl, parathion, phosphamidon, pyrethrum, sodium monofluoroacetate, strychnine, temephos, TEPA, tetraethyllead, toxaphene
- Junco hyemalis*: see Dark-eyed junco
- Larus delawarensis*: see Ring-billed gull
- Mallard—*Anas platyrhynchos*: acephate, acrolein, Agrox, Airkem A-33 Dry, Akton,alachlor, aldicarb, aldrin, allethrin, aminocarb, 6-aminonicotinamide, amitrole, anilazine, Armeen OD, atrazine, Avitrol 200, azinphos-methyl, *Bacillus thuringiensis* (Berliner), Balan, BAY 93820, BAY 98663, Baygon, benzene hexachloride, bordeaux mixture, bromopropylate, bufencarb, butylate, C-12 trichlorfon, C-2307, capsule wall material, captan, carbaryl, carbofuran, carbophenothion, Ceresan L, Ceresan M, CHE 1843, chlordane, chlordecone, chlorfenvinphos, chlormequat chloride, chloroxuron, chlorpyrifos, CIPC, clonitralid, coumaphos, crotoxyphos, crufomate, cyanazine, cycloheximide, Cyolane, 2,4-D, DDT, DDVP, DEF, demeton, Diazinon, dichlobenil, dichlone, dicloran, dicotophos, dieldrin, diesel oil #1, difluron, dimethoate, dimethylformamide, dinoseb, dioxathion, diquat dibromide, disparlure, disulfoton, diuron, D.M. 7537, DNOC, Dowco 214, Duomeen T-E-9, edifenphos, endosulfan, endothall, endrin, EPN, ethamphenphion, ethion, ethoprop, famphur, fenitrothion, fensulfathion, fenthion, fluometuron, folpet, fonofos, GC-6506, Gophacide, grandlure, heptachlor, hexaflurate, Imidan, IPC-400, isobenzan, Landrin, leptophos, lindane, malathion, Mema RM, mestranol, methamidophos, methidathion, methiocarb, methomyl, methoprene, methoxychlor, methyl parathion, mevinphos, mexacarbate, mexacarbate (acylated), mirex, Mobam, monocrotophos, nabam, naled, Nemacur, Nemagon, nicotine sulfate, norbormide, *Nosema locustae*, nucleopolyhedral virus, Oil Herder, Oil Herder #2, oxydemetonmethyl, Panasol AN-2, Panogen, paraquat dichloride, parathion, PCNB, PCP, phorate, phosphamidon, phoxim, picloram, Planavin, PMA, polychlorinated biphenyls, potassium azide, Process Oil 492, pyrethrum, RE-11775, ronnel, rotenone, RU 11-679, schradan, SD 7727, SD 16898, SD 17250, SD 30053, Shell Sol 70, silvex, Silvisar-510, sodium arsenite, sodium monofluoroacetate, Starlicide, strychnine, sulfoxide, 2,4,5-T, TBA, TCDD, TDE, temephos, TEPA, TEPP, terbutryn, Tergitol 12-P-6, Terrazole, tetrachlorvinphos, tetradifon, tetraethyllead, TFM, thallium sulfate, Thanite, thionazin, thiram, toxaphene, trichlorfon, trichloronat, trifluralin, Vendex, zinc phosphide, zineb, 492 Mosquito Larvicide Oil
- Meleagris gallopavo*: see Wild turkey
- Mourning dove—*Zenaida macroura*: Baygon, fenthion, mexacarbate, sodium monofluoroacetate, strychnine
- Mule deer—*Odocoileus hemionus hemionus*: aldrin, aminocarb, azinphos-methyl, Baygon, carbaryl, 2,4-D, demeton, dicotophos, dieldrin, disulfoton, endrin, fenitrothion, Landrin, Mema RM, methomyl, mexacarbate, monocrotophos, naled, nicotine sulfate, nucleopolyhedral virus, parathion, phosphamidon, silvex, Silvisar-510, sodium monofluoroacetate, strychnine, toxaphene

*Mustela putorius*: see Domestic ferret

Northern bobwhite—*Colinus virginianus*: aldrin, azinphos-methyl, C-12 trichlorfon, carbofuran, Ceresan L, chlorfenvinphos, clonitralid, cyanazine, DDT, dimethylformamide, disparlure, ethamphenphion, fenitrothion, fenthion, grandlure, leptophos, methyl parathion, monocrotophos, polychlorinated biphenyls, SD 16898, SD 17250, TCDD, TFM, toxaphene, trichlorfon

Northern pintail—*Anas acuta*: D.M. 7537

*Odocoileus hemionus hemionus*: see Mule deer

Oregon junco: see Dark-eyed junco

*Passer domesticus*: see House sparrow

*Perdix perdix*: see Gray partridge

*Phasianus colchicus*: see Ring-necked pheasant

Pheasant: see Ring-necked pheasant

Pigeon: see Rock dove

*Rana catesbeiana*: see Bullfrog

Rat: see Albino rat

*Rattus norvegicus*: see Albino rat

Red-winged blackbird—*Agelaius phoeniceus*: mestranol, methyl parathion, TEPA

Ring-billed gull—*Larus delawarensis*: clonitralid, dimethylformamide, TFM

Ringed turtle-dove—*Streptopelia risoria*: TCDD, trichlorfon

Ring-necked pheasant—*Phasianus colchicus*: aldicarb, aldrin, aminocarb, atrazine, azinphos-methyl, BAY 93820, Baygon, benzene hexachloride, bordeaux mixture, bufencarb, C-12 trichlorfon, C-2307, carbaryl, carbofuran, carbophenothion, Ceresan L, Ceresan M, chloramben, chlordane, chlorfenvinphos, chlorpyrifos, coumaphos, cycloheximide, 2,4-D, DDT, DDVP, DEF, demeton, Diazinon, dichlobenil, dicloran, dicofol, dicrotophos, dieldrin, dimethoate, dinoseb, dioxathion, disulfoton, D.M. 7537, DNOC, Dowco 214, Duomeen T-E-9, edifenphos, endosulfan, endothall, endrin, EPN, ethion, ethoprop, fenitrothion, fensulfothion, fenthion, fluorodifen, GC-6506, Gophacide, Imidan, Landrin, leptophos,

malathion, methidathion, methiocarb, methomyl, methyl parathion, mevinphos, mexacarbate, mirex, Mobam, monocrotophos, nabam, naled, Namacur, Nemagon, nicotine sulfate, *Nosema locustae*, nucleopolyhedral virus, oxydemetonmethyl, Panogen, parathion, PCNB, PCP, phorate, phosphamidon, phoxim, picloram, PMA, potassium azide, ronnel, rotenone, schradan, SD 16898, SD 17250, sodium arsenite, sodium monofluoroacetate, strychnine, 2,4,5-T, TBA, TDE, temephos, TEPA, TEPP, terbutryn, tetrachlorvinphos, thallium sulfate, Thanite, thionazin, thiram, toxaphene, trichlorfon, trifluralin, Vendex, zinc phosphide, zineb

Rock dove (domestic pigeon)—*Columba livia*: Baygon, carbaryl, Ceresan M, chlorpyrifos, 2,4-D, DDT, demeton, dicrotophos, dieldrin, endrin, EPN, fenthion, Landrin, mexacarbate, Mobam, monocrotophos, nabam, nicotine sulfate, oxydemetonmethyl, parathion, phosphamidon, sodium monofluoroacetate, strychnine, temephos, TEPA, trichlorfon

Sandhill crane—*Grus canadensis*: Baygon, chlorpyrifos, DDT, mexacarbate, toxaphene

Sharp-tailed grouse—*Tympanuchus phasianellus*: Baygon, carbaryl, carbophenothion, demeton, dicrotophos, endrin, fenitrothion, fensulfothion, methoxychlor, mevinphos, mexacarbate, Mobam, naled, parathion, phosphamidon, phoxim, toxaphene

*Streptopelia risoria*: see Ringed turtle-dove

Turkey: see Wild turkey

*Tympanuchus cupido*: see Greater prairie chicken

*Tympanuchus phasianellus*: see Sharp-tailed grouse

White-crowned sparrow—*Zonotrichia leucophrys*: D.M. 7537

White-winged dove—*Zenaida asiatica*: phosphamidon

Wild turkey—*Meleagris gallopavo*: monocrotophos, sodium monofluoroacetate

*Zenaida asiatica*: see White-winged dove

*Zenaida macroura*: see Mourning dove

*Zonotrichia leucophrys*: see White-crowned sparrow

A list of current *Resource Publications* follows.

133. A Handbook for Terrestrial Habitat Evaluation in Central Missouri, edited and compiled by Thomas S. Bassett, Deretha A. Darrow, Diana L. Hallett, Michael J. Armbruster, Jonathan A. Ellis, Bettina Flood Sparrowe, and Paul A. Korte. 1980. 155 pp.
134. Conservation of the Amphibia of the United States: A Review, by R. Bruce Bury, C. Kenneth Dodd, Jr., and Gary M. Fellers. 1980. 34 pp.
135. Annotated Bibliography for Aquatic Resource Management of the Upper Colorado River Ecosystem, by Richard S. Wydoski, Kim Gilbert, Karl Seethaler, Charles W. McAda, and Joy A. Wydoski. 1980. 186 pp.
136. Blackbirds and Corn in Ohio, by Richard A. Dolbeer. 1980. 18 pp.
137. Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates, by Waynon W. Johnson and Mack T. Finley. 1980. 98 pp.
138. Waterfowl and their Wintering Grounds in Mexico, 1937-64, by George B. Saunders and Dorothy Chapman Saunders. 1981. 151 pp.
139. Native Names of Mexican Birds, researched and compiled by Lillian R. Birkenstein and Roy E. Tomlinson. 1981. 159 pp.
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146. Effects of the 1976 Seney National Wildlife Refuge Wildfire on Wildlife and Wildlife Habitats, compiled by Stanley H. Anderson. 1982. 28 pp.
147. Population Ecology of the Mallard. VII. Distribution and Derivation of the Harvest, by Robert E. Munro and Charles F. Kimball. 1982. 126 pp.
148. Management of Seasonally Flooded Impoundments for Wildlife, by Leigh H. Fredrickson and T. Scott Taylor. 1982. 29 pp.
149. Mitigation and Enhancement Techniques for the Upper Mississippi River System and Other Large River Systems, by Rosalie A. Schnick, John M. Morton, Jeffrey C. Mochalski, and Jonathan T. Beall. 1982. 714 pp.
150. Microscopic Anatomy of Salmonids: An Atlas, by William T. Yasutake and Joseph H. Wales. 1983.
151. Avian Use of Forest Habitats in the Pembina Hills of Northeastern North Dakota, by Craig A. Faanes and Jonathan M. Andrew. 1983. 24 pp.
152. National Pesticide Monitoring Program: Organochlorine Residues in Freshwater Fish, 1976-79, by Christopher J. Schmitt, Michael A. Ribick, J. Larry Ludke, and Thomas W. May. 1983. 62 pp.

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