



# Conserve O Gram

September 2001

Number 2/17

## Physical Properties And Health Effects of Pesticides Used On National Park Service Collections

At least 55 different chemical compounds and mixtures (including arsenic and mercury) may have been used to preserve National Park Service (NPS) museum collections (see *Conserve O Gram* 2/17, "Chronology of Pesticides Used on National Park Service Collections"). Virtually all are irritants, and many are harsh poisons and/or carcinogens. All objects that may have been treated with pesticides must be handled with caution. The charts on the following pages give a thumbnail sketch of pesticides suspected to have been used on NPS collections, including:

- physical properties
- health effects
- route of entry
- type of poison
- handling procedures
- synonyms and trade names

If there is any chance that your collections have been treated with any of these chemicals, be sure to obtain Material Safety Data Sheets (MSDS) to have more thorough descriptions and handling information available to collections personnel. The MSDS sheets are available either from the chemical manufacturer or from a number of on-line Internet sources.

### Sources for Material Safety Data Sheets

Agency for Toxic Substances and Disease Registry <<http://www.atsdr.cdc.gov/toxfaq.html>>

The EXtension TOXicology NETwork <<http://ace.ace.orst.edu/info/extonet/>>

National Toxicology Program <<http://ntp-server.niehs.nih.gov/>>

Pesticide Action Network Pesticide Database <<http://www.pesticideinfo.org>>

United States Environmental Protection Agency <<http://www.epa.gov/pesticides/>>

Occupational Safety and Health Administration <[http://www.osha-slc.gov/dts/chemicalsampling/toc/toc\\_chemsamp.html](http://www.osha-slc.gov/dts/chemicalsampling/toc/toc_chemsamp.html)>

MSDS Providers <<http://www.msdsprovider.net/Site/msdsprovider.nsf/about>>

Cornell University <<http://msds.pdc.cornell.edu/msdssrch.asp>>

Melanie Pereira, Intern  
Sara J. Wolf, Conservator  
Museum Management Program  
National Park Service  
Washington, DC 20240

---

The *Conserve O Gram* series is published as a reference on collections management and curatorial issues. Mention of a product, a manufacturer, or a supplier by name in this publication does not constitute an endorsement of that product or supplier by the National Park Service. Sources named are not all inclusive. It is suggested that readers also seek alternative product and vendor information in order to assess the full range of available supplies and equipment.

The series is distributed to all NPS units and is available to non-NPS institutions and interested individuals on the Internet at <<http://www.cr.nps.gov/museum/publications/conserveogram/>>. For further information and guidance concerning any of the topics or procedures addressed in the series, contact NPS Museum Management Program, 1849 C Street NW (NC 230), Washington, DC 20240; (202) 343-8142.

---

| PESTICIDE  | PHYSICAL PROPERTIES                                | HEALTH EFFECTS   | ROUTE OF ENTRY                    | TYPE                                 | HANDLING   | SYNONYMS AND TRADE NAMES  |
|--|--|--|-----------------------------------|--------------------------------------|--|---|
| Arsenic<br>As  | silver-gray or white metallic solid                | carcinogen, skin, eye and respiratory irritation   | inhalation, ingestion, skin       | herbicide, insecticide, fungicide    | Nitrile gloves, dust-proof goggles   | arsenical soap, arsenic powder  |
| Baygon<br>C <sub>11</sub> H <sub>15</sub> NO <sub>3</sub>                  | colorless crystalline powder, with a faint odor    | no data  | inhalation, ingestion, skin       | insecticide                          | gloves, dust-proof goggles   | Propoxur, Aprocarb, Bifex, IMPC, Blattanex, Invisi-Gard, Suncide, Senchan |
| Benzethonium Chloride<br>C <sub>27</sub> H <sub>42</sub> ClNO <sub>2</sub> | colorless or white crystals or powder, odorless    | skin, eye, mucous membrane and upper respiratory tract irritant                                    | inhalation, ingestion, skin       | microbiocide                         | gloves, splash-proof goggles   | Hyamine1622, Solamine, BZTG, Phemithyn, Phemeride, Antiseptol             |
| Benzol<br>C <sub>6</sub> H <sub>6</sub>                                    | colorless liquid with aromatic odor, flammable     | carcinogen, damages central nervous system, blood, skin, bone marrow, eyes, and respiratory tract. | inhalation, ingestion, skin       |                                      | solvent resistant polyvinyl alcohol gloves, respirator, splash proof goggles, shield | benzene, carbon oil, cyclohexatriene, coal naptha, phenyl hydride         |
| Boric Acid<br>H <sub>3</sub> BO <sub>3</sub>                               | colorless odorless solid                           | may cause chest pain, coughing, breathing difficulty, skin, eye and gastrointestinal irritation    | inhalation, ingestion, skin       | insecticide, miticide                | gloves, safety glasses   | PermaDust, It Works, Drax Ant Kill, BoraCare, JECTA, Borid                |
| Camphor Gum<br>C <sub>10</sub> H <sub>16</sub> O                           | colorless or white solid with strong odor          | eye, skin and mucous membrane irritant, affects central nervous system and respiratory system      | inhalation, ingestion, skin, eyes | insecticide, fungicide, microbiocide | gloves, lab coat, safety glasses   | Camphor, 2-camphanone, 2-bornanone, Camphor Oil                           |
| Carbon disulfide<br>CS <sub>2</sub>  | colorless to yellow liquid, strong odor, flammable | affects respiratory, cardiac, central nervous, liver, kidney, and reproductive systems             | inhalation, ingestion, skin, eyes | fumigant                             | gloves, safety glasses   | carbon bisulfide, sulphocarbonic anhydride, dithiocarbonic anhydride      |
| Carbon tetrachloride<br>CCl <sub>4</sub>                                   | clear liquid, colorless gas with etheral odor      | suspected carcinogen, eye and skin irritant, affects liver, kidney and central nervous system      | inhalation, ingestion, skin, eyes | fumigant                             | safety glasses, polyvinyl gloves, and apron  | Benzinoform, Freon 10, Halon 104, Tetraform, Tetrasol, Carbona            |
| Chlordane<br>C <sub>10</sub> H <sub>6</sub> Cl <sub>8</sub>                | viscous amber to colorless liquid with a mild odor | suspected carcinogen, affects central nervous system, gastrointestinal tract, and liver            | inhalation, ingestion, skin, eye  | insecticide                          | goggles, chemical/solvent resistant gloves, apron                                    | Toxichlor, Niran, Octachlor, Orthoklor, Synklor, Corodane                 |

|   |             |  |                       |  |                                   |  |
|---|-------------|--|-----------------------|--|-----------------------------------|--|
| Chloretone<br>C <sub>4</sub> H <sub>4</sub> Cl <sub>3</sub> O | combustible | skin and eye irritant, may affect the liver and respiratory system | inhalation, ingestion |  | safety goggles, impervious gloves | chlorobutanol, acetone chloroform, Sedaform, Methaform |
|---|-------------|--|-----------------------|--|-----------------------------------|--|

| PESTICIDE   | PHYSICAL PROPERTIES                                  | HEALTH EFFECTS  | ROUTE OF ENTRY                   | TYPE                    | HANDLING                                       | SYNONYMS AND TRADE NAMES   |
|---|--|---|----------------------------------|-------------------------|--|--|
| Chloroform<br>CHCl <sub>3</sub>   | Clear, colorless liquid with sweet odor              | suspected carcinogen, affects liver, kidney and central nervous system                      | inhalation, ingestion, skin, eye | fumigant                | goggles and shield, lab coat and apron, gloves | methyl trichloride, trichloromethane, trichloroform  |
| Chlorpyrifos<br>C <sub>9</sub> H <sub>11</sub> Cl <sub>3</sub> NO <sub>3</sub>        | white or colorless granular crystals, gas-like odor  | may affect the central nervous system and the liver   | inhalation, ingestion, skin      | insecticide             | gloves, dust proof goggles                     | Dowco 179, Dursban, Lorsban, Pyrinex, Eradex, Killmaster, Brodan, O,O-diethyl O-3m5m6-trichloro-2 pyridyl phosphorothioate |
| Combat  |  |   |                                  | insecticide             |  |  |
| Contrac Rat and Mouse Bait<br>C <sub>30</sub> H <sub>23</sub> BrO <sub>4</sub>        | blue meal with sweet grain-like odor                 | bleeding gums, nose bleeds, bruises, stomach pain   | inhalation, ingestion, skin      | rodenticide             | rubber gloves                                  | Bromadiolone, Boldo, Ratimus, Maki, Super-Caid, Bromatrol, Tamogan   |
| Copper-8-quinolate<br>C <sub>18</sub> H <sub>12</sub> CuN <sub>2</sub> O <sub>2</sub> | green to yellow crystalline powder                   | may cause asthmatic symptoms, diarrhea, vomiting  | inhalation, ingestion            | fungicide, microbiocide | safety glasses, gloves                         | oxine-copper, Culinat, Dokrin, Frutido, Milmer, Bioquin, Dodivin, Chapman, Q-san, Cupracide                                |
| Cuprinol Clear #20  | clear amber liquid with mineral spirits odor         | eye, skin, respiratory, and gastrointestinal irritant                                       | inhalation, ingestion, skin      | fungicide               | respirator, gloves, safety glasses             | Napthenic acid, zinc salt, CNC, Troysan, WILTZ 65, Wittox-C, Copper Nap-All  |
| Cyanide<br>CHN  | colorless gas, or white solid with faint almond odor | can cause weakness, headache, nausea, eye and skin irritation, thyroid disorders, and death | inhalation, ingestion, skin      | fumigant                | respirator, gloves, goggles with face shield   | prussic acid, formonitrile, Cyclon, hydrocyanic acid, isocyanide   |

|   |   |   |                             |             |   |  |
|---|---|---|-----------------------------|-------------|---|--|
| DDT<br>C <sub>14</sub> H <sub>9</sub> Cl <sub>5</sub> | colorless solid, or white to slightly off-white powder, with faint odor | probable carcinogen; reproductive, liver, and kidney problems; eye, nose, skin, throat irritant | inhalation, ingestion, skin | insecticide | respirator, gloves, goggles and face shield | Dicophane, Agritan, Gesapon, Gesapex, Citox, Detox, Anofex, Gearrol, Neocid, Flit, Bug-a-boo |
|---|---|---|-----------------------------|-------------|---|--|

| PESTICIDE   | PHYSICAL PROPERTIES   | HEALTH EFFECTS   | ROUTE OF ENTRY              | TYPE                  | HANDLING  | SYNONYMS AND TRADE NAMES  |
|---|---|--|-----------------------------|-----------------------|---|---|
| Diazinon<br>C <sub>12</sub> H <sub>21</sub> N <sub>2</sub> O <sub>3</sub> PS          | oily colorless liquid                                       | eye and skin irritant; may cause gastrointestinal symptoms                               | inhalation, ingestion, skin | insecticide           | gloves, long pants and sleeves, face shield, goggles                    | Basudin, Dazzel, Gardentox, Royazol, Knox Out, Nucidol, Spectracide, Alfatox, DropDead, phosphorothioic acid          |
| Dichlorvos<br>C <sub>4</sub> H <sub>7</sub> Cl <sub>2</sub> O <sub>4</sub> P          | clear, slightly yellow liquid with a mild odor; combustible | suspected carcinogen, can affect the central nervous system                              | inhalation, ingestion, skin | insecticide           | Nitrile gloves, Tyvek clothes (if possible), respirator, safety glasses | Unitox, Lindan, DDVP, Vapona, Shell No-Pest Strips, Flie Die, Nuvan, Astrobot, Cypona                                 |
| Dowfume 75 (75% EDC, 25% carbon tetrachloride)  |   |  |                             | fumigant              |   | Dichloroethane mixed with tetrachloromethane;   |
| Dri-die   | white odorless powder                                       | eye irritant   | inhalation                  | insecticide           | dust mask, rubber gloves  | silica aerogel with ammonium flucosilicate  |
| Drione  | off white to white dry powder with slight odor              | eye irritant   | inhalation, ingestion       | insecticide, miticide | dust mask, gloves, safety glasses                                       | piperonyl butoxide with silica and pyrethrins, Staffels Ant and Roach Killer, D-Con Crawling Bug Killer, Viper Drione |
| Ethion<br>C <sub>9</sub> H <sub>22</sub> O <sub>4</sub> P <sub>2</sub> S <sub>4</sub> | colorless or light brown to pale yellow liquid or dust      | affects central nervous system, and gastrointestinal system; chest tightness; runny nose | inhalation, ingestion, skin | insecticide           | dust mask, gloves, safety glasses                                       | Ethanox, Hylmox, Nialate, Rhodocide   |

|  |   |  |                             |          |   |  |
|--|---|--|-----------------------------|----------|---|--|
| Ethylene dichloride<br>C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub> | colorless oily liquid with chloroform odor; flammable | irritant, dizziness, headache, nausea, rash, coma                                  | inhalation, ingestion, skin | fumigant | respirator, PVA gloves, safety glasses with side shields                      | EDC, dichloroethane, dichloroethylene, Dutch liquid        |
| Ethylene oxide<br>C <sub>2</sub> H <sub>4</sub> O                    | colorless gas with ether-like odor                    | carcinogen; skin and eye irritant; affects central nervous and circulatory systems | inhalation, ingestion, skin | fumigant | respirator, impervious gloves (not rubber), flame resistant clothing, goggles | oxirane, dimethylene oxide, ETO, Ethox, Oxyfume, Anprolene |

| PESTICIDE   | PHYSICAL PROPERTIES  | HEALTH EFFECTS   | ROUTE OF ENTRY                   | TYPE                     | HANDLING   | SYNONYMS AND TRADE NAMES   |
|---|--|--|----------------------------------|--------------------------|--|--|
| Formalin<br>CH <sub>2</sub> O   | colorless liquid with pungent odor, combustible              | suspected carcinogen; eye, skin, respiratory irritant  | inhalation, ingestion, skin      | fungicide                | respirator, Nitrile gloves, goggles  | methylene glycol, formaldehyde, Morbicid, Formol, BFV, Fanoform, Lysoform, methanal                              |
| Hydrocyanic acid gas<br>CHN   | colorless or pale blue gas or liquid with bitter almond odor | very poisonous; affects central nervous system, thyroid; skin, eye irritant; headache; death | inhalation, ingestion, skin, eye | fumigant                 | respirator, gloves, goggles  | prussic acid, formonitrile, Cyclon, hydrogen cyanide   |
| Lexol Neats Foot Formula  | translucent yellowish to brownish oily liquid                | non-toxic  |                                  | microbiocide, protectant |  |  |
| Lindane<br>C <sub>6</sub> H <sub>6</sub> Cl <sub>6</sub>                    | white or colorless crystalline solid with slight musty odor  | suspected carcinogen, affects central nervous, respiratory, reproductive systems, and liver  | inhalation, ingestion, skin      | insecticide              | goggles, gloves, respirator  | Aficide, Agrocide, benzene hexachloride, Bexol, Celanex, Entomoxan, Gamacid, Kewell, Lindafor, Novigan, Hexicide |
| Malathion<br>C <sub>10</sub> H <sub>19</sub> O <sub>6</sub> PS <sub>2</sub> | clear brown to colorless liquid with mild skunk-like odor    | skin, eye, nose irritant; affects respiratory and central nervous systems                    | inhalation, ingestion, skin      | insecticide              | Nitrile gloves, Tyvek clothing (if possible), respirator, splash-proof goggles | Chemathion, Malacide, Karbofos, Detmol, Cythion, Malaspray, Lice Rid, o,o-dimethyl thiophosphate                 |
| Mercuric chloride<br>Cl <sub>2</sub> Hg                                     | white crystalline powder                                     | corrosive to tissues; kidney and gastrointestinal disfunction                                | inhalation, ingestion, skin      | fungicide                | Tyvek clothing, NIOSH approved SCBA, rubber gloves, goggles                    | mercury bichloride, corrosive sublimate, mercury perchloride, Fungchex, TL 898, dichloro mercury                 |
| Methyl bromide<br>CH <sub>3</sub> Br  | colorless liquid or gas with fruity odor                     | skin and eye irritant; affects central nervous and cardiac systems                           | inhalation, ingestion, skin      | fumigant                 | protective glasses, work in a fume hood, gloves                                | bromomethane, monobromothane, Embafume, Terabol, methyl fume   |

|  |   |  |                                  |                     |   |   |
|--|---|--|----------------------------------|---------------------|---|---|
| Naphthalene<br>C <sub>10</sub> H <sub>8</sub>                                | white crystals with moth ball odor; flammable; combustible                | skin and eye irritant; affects liver and kidney  | inhalation, ingestion, skin      | fumigant            | gloves, safety glasses, respirator                        | Naphthalene, Coal Tar Camphor, Naphthalin, Naphthalinium, moth balls                |
| PESTICIDE  | PHYSICAL PROPERTIES   | HEALTH EFFECTS   | ROUTE OF ENTRY                   | TYPE                | HANDLING  | SYNONYMS AND TRADE NAMES  |
| Orkin Aid 4E (see diazinon)  |   |  |                                  |                     |   |   |
| Ortho-dichlorobenzene<br>C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub>       | clear liquid with mild aromatic odor                                      | skin and eye irritant; affects central nervous, respiratory systems, liver, kidney     | inhalation, ingestion, skin, eye | insecticide         | respirator, gloves, safety goggles                        | dichlorobenzene, DCB, Chloroben, Dilantin DB, Dowtherm E, Termitkil, dichlorobenzol |
| Para-dichlorobenzene<br>C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub>        | colorless or white, volatile crystals with strong odor; combustible       | suspected carcinogen, affects respiratory, circulatory, central nervous, renal systems | inhalation, ingestion, skin      | fumigant            | gloves, full face respirator or dust or gas-proof goggles | PDB, Evola, Globol, Paracide, Parazene, Paradow, Paramoth, Paranuggets              |
| Paranitrophenol<br>C <sub>6</sub> H <sub>6</sub> NO <sub>3</sub>             | colorless to slightly yellow crystals or powder, odorless                 | skin, eye, nose, throat irritant; headache, liver and kidney damage                    | inhalation, ingestion, skin      | fungicide           | chemical resistant glasses, gloves, respirator            | PNP, NIPHEN, mononitrophenol, 4-hydroxynitrobenzene                                 |
| Pentachlorophenol<br>C <sub>6</sub> Cl <sub>5</sub> OH                       | colorless to white crystalline solid with benzene-like odor               | possible carcinogen; eye, skin, nose, throat irritant; liver and kidney damage         | inhalation, ingestion, skin, eye | fungicide           | gloves, safety glasses                                    | PCP, Dowcide 7, Permicide, Thompsons Wood fix, Fungol, Permagard, PentaKil, Mystox  |
| Permethrin<br>C <sub>21</sub> H <sub>20</sub> Cl <sub>2</sub> O <sub>3</sub> | odorless, colorless crystalline solid or pale brown viscous liquid        | eye, skin, respiratory irritant; affects central nervous system                        | inhalation, ingestion, skin      | insecticide         | gloves, face shield                                       | Ambush, Ectiban, Pounce, Nix Dragnet, Spartan                                       |
| Phenol<br>C <sub>6</sub> H <sub>6</sub> O                                    | syrupe clear to pinkish liquid or colorless to pink solid with sweet odor | corrosive to eyes, mucous membranes, and skin  | inhalation, skin                 | microbiocide        | respirator, impervious gloves, chemical goggles           | carbolic acid, phenic acid, Oxybenzene  |
| Potassium cyanide<br>CKN   | white lumps or crystals with bitter almond odor                           | SUPER TOXIC; corrosive to eyes, skin, respiratory tract; death                         | inhalation, ingestion, skin      | poison, rodenticide | rubber gloves, chemical goggles, lab coat, work in hood   | hydrocyanic acid, potassium salt  |

|   |  |                       |                                |             |  |                                      |
|---|--|-----------------------|--------------------------------|-------------|--|--------------------------------------|
| Premise 75<br>(imadacloprid)<br>$C_9H_{10}ClN_3O_2$ | wettable powder or<br>colorless crystals with<br>weak odor | skin and eye irritant | inhalation,<br>ingestion, skin | insecticide |  | Admire, Merit, Gaucho,<br>Confidor 2 |
|---|--|-----------------------|--------------------------------|-------------|--|--------------------------------------|



| PESTICIDE  | PHYSICAL PROPERTIES                            | HEALTH EFFECTS   | ROUTE OF ENTRY                   | TYPE                     | HANDLING   | SYNONYMS AND TRADE NAMES  |
|--|--|--|----------------------------------|--------------------------|--|---|
| Pyrethrins   | light amber liquid or oil                      | skin, eye irritant, may affect central nervous and respiratory systems         | inhalation, ingestion, skin      | insecticide              | neoprene gloves, splash resistant goggles  | pyrethrum, Buhach, Chrysanthemum, Ofirmotox, Firmotox, Dalmation insect flowers,  |
| Pyrethrum<br>C <sub>20-22</sub> H <sub>28-30</sub> O <sub>3-5</sub>  | viscous brown resin or oil; combustible        | skin, eye irritant, may affect central nervous and respiratory systems         | inhalation, ingestion, skin      | insecticide              | gloves, goggles, respirator  | Pyrethrins, Cinerin I or II, Jasmolin, Tri-Die PT230  |
| Quintox Mouse Seed<br>(colecalfiferol)<br>C <sub>27</sub> H <sub>44</sub> O  | blue meal                                      | hypercalcemia, anorexia, nausea  | inhalation, ingestion, skin, eye | rodenticide              | rubber gloves  | 9,10-Secocholest-5,7,10(19)-trien-3-ol, Vitamin D, dehydrocholesterol, Deparal, Delsterol, Ricketon, Tiritan, Vigantol        |
| Recruit<br>(hexaflumuron)<br>C <sub>16</sub> H <sub>8</sub> C <sub>12</sub> F <sub>6</sub> N <sub>2</sub> O <sub>3</sub> | white solid odorless                           | eye irritant, liver and kidney damage  | inhalation, ingestion, skin      | termiticide, insecticide | gloves, dust proof mask and glasses  | 1-(3,5-Dichloro-4-(1,1,2,2-tetrafluoroethoxy) phenyl)-3-(2,6-difluorobenzoyl)urea   |
| Roach Rid (Boric Acid)   |  |  |                                  | insecticide              |  | see boric acid  |
| Rozol<br>(chlorophacinone)<br>C <sub>23</sub> H <sub>15</sub> ClO <sub>3</sub>   | bluish green solid, odorless                   | skin, eye irritant; may affect liver   | ingestion                        | rodenticide              | gloves   | Robert's Rat and Mouse Killer, Vam-O Formula No. 3, Amvac, Crown, Enforce4r Rat and Mouse Killer, Romix Special, Mouse Seed ® |
| Sodium Fluoride<br>FNa   | clear white or blue crystals, odorless         | eye, skin irritant; affects central nervous system, kidney, respiratory system | inhalation, ingestion, skin, eye | insecticide, fungicide   | PVA gloves, respirator, lab coat, safety glasses                                   | Floridine, sodium monofluoride  |
| Thymol<br>C <sub>10</sub> H <sub>14</sub> O  | white crystal, aromatic odor, combustible      | skin and eye irritant  | inhalation, ingestion, skin      | fumigant                 | dust mask (at room temp) respirator (elevated temp), rubber gloves, safety glasses | 6-isopropyl-m-cresol  |
| Vikane<br>F <sub>2</sub> O <sub>2</sub> S  | colorless odorless gas                         | affects central nervous system, kidney, liver; death                           | inhalation                       | fumigant                 | respirator, chemical goggles   | sulfuryl fluoride, Termafume  |
| Warfarin<br>C <sub>19</sub> H <sub>16</sub> O <sub>4</sub>   | colorless odorless solid or crystalline powder | hematuria, back pain, affects blood and cardiovascular system,                 | inhalation, ingestion, skin, eye | rodenticide              | gloves, dust proof goggles   | Coumadin, D-Con, Ratox, Arab Rat Death, Solfarin, Marevan   |

|   |  |  |  |  |  |                              |
|---|--|--|--|--|--|------------------------------|
| Zinc Chloride<br>$\text{Cl}_2\text{Zn}$ |  |  |  |  |  | zinc butter, zinc dichloride |
|---|--|--|--|--|--|------------------------------|