



Conserve O Gram

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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>

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

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

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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 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 C ₁₁ H ₁₅ NO ₃	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 C ₂₇ H ₄₂ ClNO ₂	colorless or white crystals or powder, odorless	skin, eye, mucous membrane and upper respiratory tract irritant	inhalation, ingestion, skin	microbio-cide	gloves, splash-proof goggles	Hyamine1622, Solamine, BZTG, Phemithyn, Phemeride, Antiseptol
Benzol C ₆ H ₆	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 H ₃ BO ₃	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 C ₁₀ H ₁₆ 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, microbio-cide	gloves, lab coat, safety glasses	Camphor, 2-camphanone, 2-bornanone, Camphor Oil
Carbon disulfide CS ₂	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 CCl ₄	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 C ₁₀ H ₆ Cl ₈	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

Chloreto $C_4H_4Cl_3O$	combustible	skin and eye irritant, may affect the liver and respiratory system	inhalation, ingestion		safety goggles, impervious gloves	chlorobutanol, acetone chloroform, Sedaform, Methaform
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PESTICIDE	PHYSICAL PROPERTIES	HEALTH EFFECTS	ROUTE OF ENTRY	TYPE	HANDLING	SYNONYMS AND TRADE NAMES
Chloroform $CHCl_3$	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 $C_9H_{11}Cl_3NO_3$	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 $C_{30}H_{23}BrO_4$	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 $C_{18}H_{12}CuN_2O_2$	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 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 C ₁₄ H ₉ Cl ₅	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
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PESTICIDE	PHYSICAL PROPERTIES	HEALTH EFFECTS	ROUTE OF ENTRY	TYPE	HANDLING	SYNONYMS AND TRADE NAMES
Diazinon C ₁₂ H ₂₁ N ₂ O ₃ 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 C ₄ H ₇ Cl ₂ O ₄ 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 C ₉ H ₂₂ O ₄ P ₂ S ₄	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 C ₂ H ₄ Cl ₂	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 C ₂ H ₄ 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 CH ₂ O	colorless liquid with pungent odor, combustible	suspected carcinogen; eye, skin, respiratory irritant	inhalation, ingestion, skin	fungicide	respirator, Nitrile gloves, goggles	methylene glycol, formaldehyde, Morbucid, Formol, BFV, Fanoform, Lysoform, methanal
Hydrocyanic acid gas 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 C ₆ H ₆ Cl ₆	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, Agroicide, benzene hexachloride, Bexol, Celanex, Entomoxan, Gamacid, Kewell, Lindafor, Novigan, Hexicide
Malathion C ₁₀ H ₁₉ O ₆ PS ₂	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 Cl ₂ 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 CH ₃ 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 C ₁₀ H ₈	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 C ₆ H ₄ Cl ₂	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 C ₆ H ₄ Cl ₂	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 C ₆ H ₆ NO ₃	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 C ₆ Cl ₅ 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 C ₂₁ H ₂₀ Cl ₂ O ₃	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 C ₆ H ₆ 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 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 (imadacloprid) $C_9H_{10}ClN_3O_2$	wettable powder or colorless crystals with weak odor	skin and eye irritant	inhalation, ingestion, skin	insecticide		Admire, Merit, Gaucho, Confidor 2
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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 C ₂₀₋₂₂ H ₂₈₋₃₀ O ₃₋₅	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 (colecalfiferol) C ₂₇ H ₄₄ 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 (hexaflumuron) C ₁₆ H ₈ C ₁₂ F ₆ N ₂ O ₃	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 (chlorophacinone) C ₂₃ H ₁₅ ClO ₃	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 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 C ₁₀ H ₁₄ 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 F ₂ O ₂ S	colorless odorless gas	affects central nervous system, kidney, liver; death	inhalation	fumigant	respirator, chemical goggles	sulfuryl fluoride, Termafume
Warfarin C ₁₉ H ₁₆ O ₄	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 Cl_2Zn						zinc butter, zinc dichloride
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