HEALTH RELATED INFORMATION ON CHEMICALS COMMONLY USED BY ENTOMOLOGISTS AND ADJUNCT METHODS OF PEST CONTROL IN STORED ENTOMOLOGICAL COLLECTIONS: A BRIEF REVIEW. VERNON A. BROU

HYDROGEN CYANIDE: A gas and one of the fastest acting human toxins, which affects the central nervous system and respiratory system. It causes weakness, confusion, respiratory failure, unconsciousness and death. Lethal doses vary greatly with the individual. Following inhalation, death usually occurs within minutes.

CYANIDE, SODIUM OR POTASSIUM: A solid, usually available in beads, granules, or powder. Human death can occur with the ingestion of as little as 200 mg. Unlike the gas, ingestion of the solid may not cause immediate death, but it may be delayed several hours. Mixing on contact with water and especially acids liberates hydrogen cyanide gas.

Cyanides are commonly used in fumigation products, photographic solutions, electroplating, metal polishes, metal hardening, rodenticides and the processing of mined gold. Currently there is a world wide shortage of cyanide salts, due to the tremendous need for this chemical to process gold. There is only one U.S. manufacturer of cyanide presently and their current attitude is to sell product only to certain big industrial customers. Industrial grade cyanide is still available here in the U.S. from European suppliers, e.g. in 200 lb. drums. Laboratory / reagent grade is available in 1 lb. to 25 lb. amounts at a much higher cost. Medical treatment for cyanide poisoning includes inhalation of amyl nitrite followed by intravenous sodium nitrite and sodium thiosulfate. Commercial cyanide treatment kits are available. Transfusion or infusion of whole blood may be required also.

VAPOR PEST STRIPS: Polyvinylchloride strips with the insecticide Vapona is no longer manufactured by Shell Chemical Co. However, other brands have appeared on the market. The chemical will corrode metal in specimen cases (e.g. insect pins). The strips form and bleed acid liquid onto anything they come in contact with and will permanently discolor specimens and storage cases.

This chemical affects the human central nervous system, eyes, respiratory system, and cardiovascular system. Symptoms can be mild to severe, including headaches, blurred vision, unconsciousness, seizures, memory and thinking defects.
CARBON TETRACHLORIDE: This well-known chemical "spot remover" which causes liver cancer in animals is still used by entomologists. It is easily absorbed through the skin or inhaled. Over exposure causes toxic hepatitis, coma, and death usually due to acute kidney failure. It decomposes in the presence of moisture, heat and ultraviolet light and forms phosgene gas, the vapors soften various materials and surface coating. In the liquid form it will corrode metal. Acute exposure in combination with drinking alcohol has resulted in many deaths.

NAPHTHALENE: (moth balls): A common household and industrial disinfectant/deodorizer and supposed "moth repellent". It is easily absorbed through the skin and lungs. Toxicity can be mild: nausea, vomiting and diarrhea, or more serious: kidney failure, convulsions and coma. Contact with the eyes produces irritation and cataracts. Some individuals may develop severe hemolytic anemia even at low exposure levels.

This chemical is a very poor repellent and the vapors re-crystallize on specimens in storage cases. Once infestation of book lice or dermestid beetles has occurred, introduction of this chemical into closed storage cases, even in large amounts is useless. Interestingly, this is the only chemical recommended for use in museum collections as a repellent in storage cases and is registered as such with the Environmental Protection Agency.

PARADICHLOROBENZENE: A general use chemical solid insect repellent. It reacts with some plastics (e.g. polyethylene, styrofoam, styrene), as found in the foam pinning bottom of specimen cases. It discolors objects that it comes in contact with. It causes the leaching of body fats on the surface of insect specimens, causing them to become "greasy". This chemical also breaks down and forms chlorine gas which may bleach specimens in storage cases. Use of this chemical in storage cases in strong enough concentrations will kill adult and larval stages of dermestid beetles and booklice. It apparently does not destroy the egg and pupal stages of those pests.

Acute effects to humans include dizziness, headaches, nausea, loss of concentration, irritation to skin, eyes, and respiratory system. Chronic exposure can cause liver and kidney damage including liver cirrhosis.

FREEZING: Experiments in Europe with herbarium specimens, resulted in the killing of insect pests in all stages of life when held at -0.4 degrees F. for 48 hours.

LOW HEAT: I have used the following method in processing well over 400,000 insect specimens with good results. The majority were of the orders Lepidoptera, Coleoptera, Hymenoptera, Heteroptera, Diptera and Orthoptera.

Freshly collected material (or papered and relaxed) are pinned and prepared according to the type of insect. Lepidoptera would be pinned with the wings spread on a pinning board. At least 2/3 of the wing area should be held down with light card-stock or heavy paper. All of the outer wing edges must be held down to prevent curling. The wing area is a large surface and the thinnest area is the wing edge and at this edge is where the drying process begins. If the wings edges are not held they will curl.

Specimens on pinning boards should remain at ambient room temperature for 48 hours prior to exposure to the heat. The boards can then be placed in a thermostatically controlled drying oven at 110 degree F. ± 5 degrees, for 48 hours. The boards can be removed and the specimens can be transferred directly to permanent storage cases without fear of pest contamination.

Freshly collected insects should not be placed directly into a drying oven. All or part of the exoskeleton are too soft and collapse as the specimen rapidly dehydrates, causing malformation and damage. The 48 hours of drying time at room temperature allows the exoskeleton to dry and become hard. Deviations from these parameters may be required for large specimens of Lepidoptera, Coleoptera, and Orthoptera. They may require 3 to 4 days at
ambient temperature prior to drying in an oven. Some orders with extremely soft exoskeleton may require further ambient drying time.

Extending the drying time is unnecessary, as prolonged low temperatures of 100 - 110 degrees F. can accelerate leaching of body fats to the outer surface of the specimens. This is a problem commonly encountered with certain groups of Lepidoptera using standard methods of preparing/drying specimens. Temperature in excess of 115 - 120 degrees F. should be avoided altogether.

Psociods (booklice) are the most commonly encountered pest of stored insect collections. The low heat drying process completely destroys this pest. Also, no dermestid beetle infestations were ever noted. Psociods and dermestids usually begin their journey into storage cases while attacking specimens while they are on pinning boards. Careful inspection of pinning boards reveals numerous psociods which move from one pin hole in the pinning surfaces of the board to another. The booklice are often found on empty boards feeding on scales and insect debris that results from pinning specimens.