SMOKES.TXT

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.... SMOKE FORMULAS ....

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Smokes are used mainly for screening purposes, so with this in mind this file will concern itself mainly with white smoke. Smokes are mists or particles suspended in the air. They remain suspended there until through enviromental conditions or static charge, they begin to attract each other or are dispersed.

There are three ways to produce smokes: 1) Vaporizing oil, 2) Spraying a reactive chemical in the air, 3) Burning a pyrotechnic mixture that releases a smoke forming chemical.

1) When oil is used to make smoke the oil is sprayed into a device that heats it up in a flash. The resulting oil vapor is exhausted to the air and when it cools down it condenses into a mist. Remember the kerosene or propane fueled insect fogger? This works on the same principal.

2) Certain chemicals react with the water in the air to produce a fog. As an example there are Titanium Tetrachloride, Tin Tetrachloride, Chlorosulfonic Acid, and Silicon Tetrachloride.

Perhaps the easiest to secure of these is titanium tetrachloride. If these chemicals are used, keep in mind that they are corrosive so any spraying equipment must be constructed of stainless steel or suitable material. You can use titanium tet. by simply taping a small explosive charge onto a bottle of the stuff. Just watch out for the glass fragments. Titanium tet. usually comes in a sealed bottle that if opened cannot be sealed again.

3) Pyrotechnic formulas are made that either through a chemical reaction form a smoke producing chemical or the heat released from burning the mixture vaporizes a smoke producing chemical.

The first type of mixture forms chemicals such as aluminum chloride, zinc chloride, zinc oxide, or sulfur dioxide. The second type of mixture uses chemicals such as ammonium chloride, napthalene, or anthracene which are vaporized without decomposition. When using mixtures containing a hydrocarbon such as napthalene, care must be taken that the hot vapor does not catch fire

when it hits the open air. This will cause the amount of smoke to decrease or cease alltogether. For this reason a chemical that produces carbon dioxide when heated is added to the mixture. Following are some formulas of both type 1 and 2. Also volatile chemicals such as napthalene oe hexachloroethane can sublimate from these mixtures so they must be sealed airtight.

ALL FORMULAS BY WEIGHT

Type 1 formulas: Potassium Chlorate 20 - 30%
Ammonium Chloride 50%
Napthalene 20%
Charcoal 0 - 10%

Usually it is not safe to use an ammonium salt and a chlorate together in a mixture but in this case this mixture is usually pretty stable with a storage life of about 10 years if kept dry. If there is a problem with flaming when this formula is used, decrease the ammonium chloride by about 5% and add 5% sodium bicarbonate.

Potassium Chlorate 60%
Lactose 20%
Ammonium Chloride 20%

This is a fairly good formula but may not give as much as smoke as the first.

Potassium Nitrate 60%
Sugar 40%

Combine these 2 chemicals in a small amount of boiling water. Pour the mix out onto a sheet of plastic and while it dries, start breaking it into small pieces. When it is dry, grind it into a powder in a non-sparking mortar and pestle. Add to it 80% by weight of ammonium chloride. I have had some success with this mix. You can decrease the amount of chloride for better burning.

Type 2 formulas: Sulfur 55%
Potassium Nitrate 40%
Fine Charcoal 5%

Mix these chemicals together well and be sure the mixture is free of sulfur chunks. This is slow burning and the smoke consists of sulfur trioxide, sulfur dioxide and vaporized sulfur.

Hexachloroethane 45%
Zinc Oxide 45%
Fine Aluminum 10%

This mixture was used in the american armed forces and is known as HC. A charge with a weight of about 8 oz. can produce over 100,000 cu. ft. of a dense gray white smoke. If the aluminum is not a fine powder it will be almost impossible to ignite.

Hexachloroethane	53%
Zinc Dust	44%
Magnesium Oxide	3%

This formula is similar to HC. The smoke consists of zinc chloride.

Hexachloroethane	45%
Zinc Oxide	45%
Calcium Silicide	10%

This is an interesting formula. In addition to producing a zinc chloride smoke, it also forms silicon tetrachloride which reacts with moisture in the air to produce silicic acid which is a smoke agent in itself.

Hexachloroethane	40 - 45%
Zinc Oxide	20 - 40%
Ammonium Perchlorate	35 - 10%
Powdered Charcoal	5%

This is a newer formula and is mixed after being dampened with a 5% PVC solution (use PVC pipe primer as a solvent). The rate of burning depends on the amount of ammonium perchlorate. The smoke consists of ammonium chloride, and zinc chloride.

Magnesium Powder	8%
Red Phosphorous	51%
Manganese Dioxide	35%
Zinc Oxide	3%
Linseed Oil	3%

This formula which contains red phosphorous is very good as phosphorous is the best masking smoke agent. Red phosphorous is very easily ignited so mix this chemical when dampened with a small amount of alcohol. It produces a complex smoke of phosphorous anhydride which reacts with moisture in the air.

These formulas are usually contained in a stout cardboard cylinder which has a number of vent holes. A tube with a 1" I.D. 5" long and 1/4'walls is a good starting point for any of these formulas. Holes can be drilled in the sides of the tube then covered over with tape. A smoke pot is a large can that contains at least 2 lbs. of a smoke mixture. These can put out over 500,000 cu. ft. of smoke.
Although the above mixtures are not outright poisonous, do not breathe in too much of the smoke if possible. Do not use these indoors and be careful of accidental fires the smoke bombs can cause.

*** Kilroy was here ***