

**Tear Gas -  
Decontamination  
Procedures**

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## TEAR GAS - GENERAL INFORMATION

There are two primary types of tear gas - CN and CS. CN tear gas was first produced in America in 1918. Until the advent of CS gas, CN was probably the most widely used tear gas in the world. Today, due to it's strong lachrymating capacity, CN gas is used as a riot control agent, also under the name Chemical Mace. CS gas has also found it's place in industry and in structural decontamination. Both gasses have been improperly applied. CN gas, CN Smoke Bomb and CN gas with dye agents are usually riot type and primarily made for outdoor explosion.

The major users of CN and CS tear gas are: military; police forces for both interior structure and exterior riot use; industry, such as pest control companies; banks (for money packs); and security agencies.

Several modes of delivery of CN-CS gas are used. The canisters can be delivered from guns (12 guage to 38mm), via hand thrown grenades, rifle ejected grenades or aerial drop grenades.

There is normally 3 cc of liquid CS tear gas agent in one 12 gauge cartridge. Both CS and CN tear gas are used in 37-38mm rifles with approximately 25 cc of liquid. A gas powered

rifle is used. Grenades and canisters can hold 80 to 130 cc of liquid agent of CS and CN.

Riot control canisters can contain heavy smoke, high powder residue, high visibility staining, or minimal fast dispersing liquids or a combination of the above. Depending upon the manufacturer of the tear gas, the canisters have varying temperatures. They may be combustible upon discharge and they may burn anything from fabrics to buildings, or may explode leaving fragments, or may have a delay timer and are generally flammable.

If a dye additive is used, it probably will be red in color. The dye may stain clothes, buildings and skin. The dye and dust compound will produce a completely visible cloud. The dye is "non-toxic" and is used to mark rioters for later identification. Tear gas of this type can be very difficult for restorers since the dye can stain most fabrics and should be handled with care during cleaning.

Tear gas has a lachrymatory tear producing agent in which it also affects the nasal passages, upper respiratory system, nervous system and can cause skin irritation. The main symptoms of exposure to CN are tingling in the nose, rhinorrhea, burning of the throat and eyes with tearing. Irritation and burning of the skin is experienced especially if the skin is moist. More severe exposure produces pulmonary

congestion and edema. The onset of the edema is usually delayed, sometimes as long as 12 hours. An occasional individual may show hypersensitivity to CN but skin absorption is not believed to be a significant health concern.

No permanent effects have been found to occur from severe exposure to CN as far as has been determined from examination of hospital records and questioning of human volunteers. In a few susceptible persons, (3 of several hundred exposed), skin rash was severe, but this disappeared after a few days.

## CN & CS GAS CHARACTERISTICS

-- It is generally felt that CN tear gas is a more affective agent for exterior use. This is including military and police combat activity for riot control.

-- CN decontamination in structures is generally believed to be more difficult than CS decontamination. CS gas is an easier gas to use indoors for mop up and decontamination operation.

-- CN gas usually has a high powder residue where CS gas has more of a liquid displacement with minimal visible residue.

-- CN gas has a floral "apple blossom" type of smell and is grey in color. CS gas has no detectable odor but has been described as "earthy" and is grey/off-white in color.

-- Both CS and CN gas can contain dye additives but generally CN is more noted for having dye agents. CN and CS are found in bank money packs with a red dye that may be difficult, to almost impossible, to remove.

-- CN and CS is found in use by pest control operators for keeping un-wanted persons out of tented structures.

## CN & CS GAS DECONTAMINATION PROCEDURES

Both CN and CS can cause contamination difficulties, although the lower vaporization of CS gas results in a much more severe decontamination problem to building interiors. Outdoor air and weather conditions are usually sufficient to make exterior decontamination unnecessary under normal conditions.

A concern in the past has been of CS or CN riot tear gas, with or without dyes and smoke agents. This concern is that exterior air direction or air convection may move the gas into structures, introducing foreign tear gas agents causing additional damage.

CS and CN complete decontamination has proved to be extremely difficult. Major industrial and research corporations are presently attempting to develop techniques that will prove more satisfactory. There is indication that improved agent dissemination methods may reduce the severity of the contamination problem. In the meantime, the techniques recommended below have proven useful in reducing CS-CN contamination, especially on surfaces that are hard and non-absorbent. Commercial stocks of clothing and electronic equipment do not lend themselves to this type of treatment and may have to be discarded or, since they require cleaning, sold as

second hand merchandise.

STEP #1 - AREATION: The first step in the decontamination process is to remove all airborne particles of the chemical agent within the building. Doors and windows should be opened to create a draft. Smoke ejector type fans should be used to "exhaust" the air from the building. This is usually best accomplished by arranging the exhaust fans to provide a constant flow of air in a single direction through the building. These fans should remain in operation until the decontamination process is completed. Note - exterior wind direction may play a role in interior air movement. If possible, use exterior air to assist in ventilation. Do not exhaust directly into exterior air currents.

STEP #2- REVIEW OF BUILDING & CONTENTS: Severity of contamination is usually proportional to kind of projectile, gas type, volume of gas and air space. This is important to understand since many structures as well as contents, may need special attention.

STEP #3 - VACUUMING & DISPOSAL: The contaminated area should be vacuumed in its entirety!! This includes structure and contents. Light porous material such as contaminated newspapers

and other inexpensive items easily replaceable should be considered for immediate removal. Also open foods, food containers and un-lined food items, i.e. bar soap, tooth brushes etc. should be discarded or carefully reviewed.

Disposal should be in trash containers that are double bagged or lined, then tied prior to disposal. A list of all contents disposed of should be supplied for the customers inventory. Make a record of all activity.

A HEPA filtered vacuum, if professionally used, will remove more ppm (parts per million) and reduce re-exposure to environment. Normal household vacuums should not be used, but suctioning through a light to commercial wet/dry vacuum is possible. Use several inches of water in the wet/dry vac with a new filter, and if possible, bag the exhaust with lightly dampened cotton material. This will assist in not allowing fine particles to re-enter the atmosphere.

An alternative for vacuums that have long hoses is to keep the vacuum chamber outside and have only the hose in the structure. This also keeps airborne particles down inside the structure and any dust will dissipate into the outside air.

#### STEP #4 - REMOVAL OF OTHER CONTAMINATED GOODS:

-- a. RESIDENTIAL: A staging area such as a garage, separate rooms, temporary storage facility is a must when structure also



has to be decontaminated. Small contents should be inventoried at the point where they are found. At that time, they should be boxed with a triplicate work order for each box. One for the customer, one for the box, one for inventory control log and possibly a fourth copy for the master control file.

-- b. PRIVATE BUSINESS: Immediately walk through the structure with the owner. Determine what is important for him/her to continue business with. Acquire permission for emergency vacuuming, contents removal and monitor reduction of loss after general clean up. It may be necessary to do a comprehensive cleaning once lower irritant levels have been established.

-- c. RESALE BUSINESS: Clothiers, bars, drug stores, restaurants and merchandising companies can suffer the saleability of their goods. Their insurance company should be immediately contacted prior to retail sales of any goods coming near contaminated source. The Health Department should be consulted immediately where food is sold, made or processed. Vacuuming these types of businesses without proper equipment and monitoring may cause further damage. Fresh air ventilating should be the only remedial action until a qualified decontamination company is involved.

STEP #5 - HEATING: CN & CS gas vaporize more with heat.

Depending on each situation, heat off-gassing may or may not be

applicable. Residential heat that can only go up to 90 degrees Fahrenheit may be good for assisting to off-gas the heat/air conditioning systems, but is of little use for indoor environmental activity.

Proper heat for off-gassing should be done with propane type heaters with temperature controls on them. Those most often recommended will heat between 110 and 130 degrees Fahrenheit. Also one should off-gas down wind with large airmovers - "minimum 6000 to 8000 CFM.". The principle is to activate CN-CS residue by heat then explode contaminated air outside the structure. This process should be carefully monitored and done hourly until maximum effectiveness has been accomplished.

#### STEP #6 - CHEMICAL DECONTAMINATION:

-- a. STRUCTURE: CN & CS tear gasses are not water soluble. Therefore, chemical aids are needed to release most nonstaining residues from walls, floors and ceilings. These are Mono-ethanolamine, Triton X-100 and Igepal CO-630. These chemicals are supplied by most chemical houses. Proportioning chemicals will vary due to surface type, or amount of contaminate involved or type of CS or CN gas used. Ventilation systems should be heated continually, causing agent to off-gas and burn itself off.

One useful way to clean contaminated walls and ceilings is

to put cleaning solvent chemicals in a sprayer and thoroughly wash down effected areas. Then, squeegee chemicals and residue off. Next, wet-vac up the excess residue around the perimeter. Then solution wash walls and ceiling with detergent.

Attic insulation, if contaminated, should be heated and off-gassed as much as possible. If insulation is rockwool or cellulosic, a dilution of MEA Triton X-100 and distilled water should be sprayed directly on insulation. This then must be raked into porous fibers, then reapplied. Areas burnt by any type of combustion must be removed. Excessive heavy contamination will call for complete removal of insulation.

Contaminated earth either under houses or on exterior surfaces should be mulched with no additives for best environmental protection to ground. If odor still persists from soil under a house, it probably is due to the porous wood framing and not the ground. The wood area can be sealed then re-evaluated prior to determining additional source contamination under homes.

Carpets in structures can be saved in some cases with light residue and light contamination. Caution: sub-floor and carpet pad must always be checked. Heavy contamination will call for pad disposal and chemical wash down. Sometimes carpets that have been cleaned several times will still have trace odors emanating from the carpet fibers. Vacuuming after

carpet drying may still show presence of fugitive tear gas.

Interior fabric wallpaper and wall coverings should be vacuumed and dry cleaned on premise. Also, solvent waste should be disposed of properly. Wood, sheet vinyl, tile, ceramic and concrete surfaces should be washed then, if necessary, a protective finish applied.

Light fixtures, wall fixtures, built-in appliances, vent plates to wall outlets should be cleaned with contact cleaners and electrical protective contact coatings. Recommended manufacturers are CRC and LPS. Tear gas will assume the total airspace, therefore, all appliances, electronics and contents must be dismantled and chemically treated.

Rubber parts, door and window moldings should be cleaned and a protective silicone coating applied.

Walls and ceilings with water base paint should be cleaned, sealed and painted. In moderate to severe cases, walls, cabinets, doors, tile grout and acoustic ceilings should be cleaned and rinsed twice prior to a sealer or base prep, then painted. Acoustic ceilings and decorative wall coverings that are porous may need to be scraped and reapplied. Marble walls or any other porous surface need to be carefully cleaned, deodorized and finished by a professional restorer.

Wall paneling that has any airspace whatsoever between it and the sheetrock or plaster may need to be carefully removed

"if nailed on" to clean and deodorize dead airspace. This is necessary in more extreme cases, but should be thoroughly vacuumed and sealed in most cases.

Projectiles hitting walls and breaking sheetrock or plaster are candidates for future contamination. An exact count of projectiles or ferrets should be made from police agency and accounted for. Missing projectiles may be hiding inside walls causing possible future contamination to interior structure when high heat days occur.

Ceiling tiles or drop ceilings should be carefully checked since room heating vent ducts and air handling systems may trap dead air. Drop T-bar ceilings should be fogged and sealed from above as well as below.

-- b. SOFT GOOD CONTENTS: Childrens dolls and toys should be drycleaned. If process for medium to heavy contamination is not 100% successful, items should then be replaced.

Pillows, either duck down, feather or foam, can be cleaned if not over exposed to contaminates in light residual environments.

Clothes should be preferably dry cleaned including towels, underwear and generally all normally wet cleaned clothes. If clothes are water base cleaned, they should be laundered twice before fluff and fold or ironed. Caution: please let cleaner be aware of your tear gas contents so that they can keep them

separate from other customer's uncontaminated clothing.

Couches, mattresses and fabric furniture should be vacuumed and dry cleaned. If odor persists, it is possibly coming from the foam or bottom of exposed framing.

-- c. HARD GOODS: Dishes, pots and other utensils should be detergent washed twice. Rinse in a separate cycle, sanitize and wipe with clean cloth towels.

Furniture should be solvent washed inside and outside and a sealer applied, if necessary, to all open, rough, unfinished surfaces (furniture backs, bottom of drawers, interior of credenzas and desks etc.) Apply sealer then finish and wax or wood oil if required.

Books, paintings, records, pictures and valuables must be treated on a case by case basis.

Electrical appliances, electronic equipment and musical instruments should be monitored carefully. General contaminated airspace consumes airspace around electronic equipment. These pieces should be carefully solvent cleaned and lubricated to not void warranties and provide proper restoration.

## CAUTIONS - WHAT NOT TO DO!

- DO NOT mask odors with perfumes or carpet deodorants.
- DO NOT fumigate structure with a pesticide.
- DO NOT allow children, elderly or animals to enter contaminated property.
- DO NOT allow any person into moderate or highly contaminated building without proper face and respiratory protection. All persons coming into contact with contaminates should wear outer clothing, disposable gloves, a mask rated for "toxic gas and vapor particulants" and protective eye wear.
- DO NOT decontaminate structure without customer's written permission or consent by their insurance company. Advise them of your qualifications and be sure they understand your plan of operation and restoration.
- DO NOT remove contaminated contents that can spread chemical agent. Example: clothes, valuables, stereo equipment etc. If put in a car they can cause anxiety or respiratory distress to occupants and driver.
- DO NOT touch your face or body with your hands.
- DO NOT turn heating system or air conditioning system on if it is contaminated. The system will spread contamination causing additional problems. Service properly.

-- DO NOT seal contaminants into paint or other finishes.

Remove them.

-- DO NOT put on contaminated clothing without first dry cleaning or double washing.

-- DO NOT eat opened foods from kitchen.

-- DO NOT sit on the toilet seat without protective paper liner or properly decontaminating seat.

-- DO NOT use open sanitary napkins, toilet tissue, kleenex, napkins, paper towels etc.

-- DO NOT keep old tooth brushes or disposable personal items.



REMEMBER - THINGS TO DO!

- DO board up all windows from the projectiles.
- DO protect valuables in a store or home - even if you have to hire a temporary security company.
- DO allow building to breath as much as possible with the use of fresh air and large fans.
- DO wear disposable plastic gloves when touching merchandise or contents.
- DO wear outer garments like a raincoat or some other protective material to keep contamination from touching your clothes. (especially when you must move contents.)
- DO wear protective eye wear.
- DO wear proper respiratory "toxic vapor/gas mask".
- DO apply baking soda on and around soft skin tissue.
- DO rinse hands with rubbing alcohol first, then water and soap can be applied.
- DO flush eyes with a continuous flow of water. If irritant has come into contact with your tear ducts, do not flush with any other chemical but large amounts of running tap water.