

# Preparation of Nerve Agent Simulant Aerosol

## Standard Operating Procedure

Lab: 3724 Beckman Institute

Department: Beckman Institute for Advanced Science and Technology

PI: Paul V. Braun

Written By: Mohammad Amdad Ali

### Section 1: Overview

Type of SOP:  Process  Hazardous Material  Hazardous Class of Materials  Equipment

#### Synopsis:

Nerve agents are a class of phosphorus-containing organic chemicals, i.e. organophosphates. This SOP is written to standardize the operating procedure of organophosphate aerosol and protect the users from potential hazards. Aerosol deposited organophosphate is used to study transportation of organophosphate molecules by chemical gradient in gel.

### Section 2: Risk Assessment Summary (Hazards and control measures)

#### Materials:

Material (name, CAS #, other ID)	Hazards
Diethyl chlorophosphite, 589-57-1	Acute toxicity in case of skin, eye contact, inhalation, ingestion.
Diisopropyl fluorophosphates, 55-91-4	Skin corrosion, serious eye damage, specific target organ toxicity - single exposure, respiratory system.

#### Hazardous Conditions:

- **Heating:** Heating the solution can produce organophosphate vapor.
- **Inhaled:** Hold breath until respiratory protective mask is donned. If severe signs of agent exposure appear (chest tightens, pupil constriction, incoordination, etc.). Administer an intramuscular injection with the MARK I Kit injectors only if local sweating and muscular twitching symptoms are observed. If breathing has stopped, move victim to a safe area and give artificial respiration. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. Do not use mouth-to-mouth resuscitation when facial contamination exists. If breathing is difficult, administer oxygen. SEEK MEDICAL ATTENTION IMMEDIATELY.
- **In case of skin contact:** Don respiratory protective mask and remove contaminated clothing. Immediately wash contaminated skin with copious amounts of soap and water, 10% sodium carbonate solution, or 5% liquid household bleach. Rinse well with water for 15 minutes to remove decontaminant.

Administer an intramuscular injection with the MARK I Kit injectors only if local sweating and muscular twitching symptoms are observed. SEEK MEDICAL ATTENTION IMMEDIATELY.

- **In case of eye contact:** Immediately flush eyes with water for 10-15 minutes, then don respiratory protective mask. Although miosis (pinpointing of the pupils) may be an early sign of agent exposure, an injection will not be administered when miosis is the only sign present. Instead, the individual will be taken IMMEDIATELY to the medical treatment facility for observation.
- **If swallowed:** Do not induce vomiting. First symptoms are likely to be gastrointestinal. Immediately administer an intramuscular injection of the MARK I kit auto-injectors. SEEK MEDICAL ATTENTION IMMEDIATELY.

#### Technique Hazards:

- **No protected aluminum chamber:** can contaminate fume hood.

#### Personal Protective Equipment

- Nitrile gloves, Safety glasses, Lab coat, Close-toe shoes, Respirator mask
- Contact lenses should not be worn when working with this chemical.
- Contaminated gloves or clothing must be removed as soon as possible.
- Second person must be present while experiment is conducting. NEVER ALONE!

#### Engineering Controls

- All of the processes must be in the fume hood only, pull the sash down when the cleaning is ongoing!

### **Section 3: Procedures**

#### Storage

1. Nerve agent stimulant bottle should be keep in an airtight unbreakable container.
2. Diisopropyl fluorophosphates must be stored in refrigerator.
3. Other stimulants are keep in organophosphate cabinet in flammable liquid cabinet.

#### Aerosol Spray

1. **Contact and get approval from Paul Braun before starting experiment.**
2. Second person must present during the experiment.
3. Note time, date, name of the chemical, amount and dissolving solvent in the notebook.
4. Prepare nerve agent neutralizing agent. For example, prepare aqueous sodium hydroxide solution (~10 pH) for fluoride containing G-series nerve agent simulant.
5. Calculate the amount require to prepare simulant solution using volumetric method.
6. Add required amount of solvent to a container.

7. Find the nerve agent simulant from the organophosphate cabinet (except DFP, it is in the refrigerator), add desired amount to the container, put it back safely. Dispose the used capillary micropipette in a waste bottle. Cover the container.
8. Make a cylindrical chamber (height ~30 cm, radius ~10 cm) using aluminum foil. Place the sample (which is going to be dosed with organophosphate) bottom of the chamber. Make a small window on top of the chamber to insert atomizer head. Place the chamber on an aluminum foil sheet inside the fume hood.
9. Once everything is set, draw stimulant solution into an atomizer and spray carefully through the window of the chamber.
10. Allow 15 minutes to settle down the aerogels. Carefully remove the sample and dispose aluminum foil in a waste bottle.
11. Dispose the atomizer, gloves, respirator mask and other contaminated stuffs in a waste bottle.

#### Section 4: Waste Disposal/Cleanup

- NEVER smell or touch nerve agent stimulant solution with a bare hand.
- If there is any small spill, pour neutralizing solution and evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area .
- Leave the fume hood for 24 h. In case of large spillage, contact lab manager immediately.

#### Section 5: Emergency Response

1. In case of emergency, the victim should be removed from the contaminated area, placed under a safety shower while emergency personal is contacted (911).
2. All contaminated clothing should be removed immediately with appropriate gloves and safely discarded.
3. In case of contact with the skin, the affected area must be immediately rinsed with large amounts of water for at least 15 mins.
4. In case of inhalation, it may irritate the respiratory tract. Conscious persons should be assisted to an area with fresh, uncontaminated area. Seek medical attention in the event of respiratory irritation, cough or tightness in the chest. Symptoms may be delayed.
5. Spill – Assess the extent of danger. Assist contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).
6. In case of contact with the eye, irrigate the eye for at least 30 mins, keeping the eyelids apart and away from eyeballs during irrigation. If discomfort persists, proceed to the Emergency Department.

#### Section 6: Additional Information

##### Advice:

1. Use the smallest amount of organophosphate possible.
2. Never do it off hours.

3. In case of large spillage, contact lab manager immediately.

Checklist:

- Read (Material) Safety Data Sheets.
- Reserve a fume hood for 24 h and make sure the fume hood is empty.
- Another researcher is nearby and knows the hazards present.
- All calculations are done prior to beginning the procedure.
- The required glassware is of the proper size to accommodate all steps of the procedure.

***References***



