1. INTRODUCTION

Scope

This program sets forth accepted practices for respirator users, and provides information and guidance on proper selection, use and maintenance of respirators.

Purpose

The purpose of this program is to ensure that the Bureau of Forensic Services Respiratory Protection Program provides guidance to all employees using respiratory protection. This program applies to all job related respiratory hazards encountered both in the field and in the laboratory with the exception of clandestine drug labs. Respiratory Protection requirements for response to clandestine drug labs are found in the BFS/BNE Clandestine Laboratory Manual for Instruction and Procedure.

Permissible Practice

When working in an environment containing harmful dusts, fumes, sprays, mist, fogs, smokes, vapors or gases, the primary method of protection for employees will be engineering control. This is done by ventilating, covering or substituting with less toxic materials. If necessary, administrative controls, such as limiting exposure by limiting time on a job is another alternative. If neither engineering nor administrative controls are possible, then appropriate respirators will be used.

2. RESPONSIBILITIES

Employer

- The employer shall provide approved respirators and replacement supplies when such equipment is necessary to control harmful exposures.
- The employer shall provide the procedures for the employee to properly select the correct respirator based on the potential hazard.
- The employer shall be responsible for the establishment, maintenance and evaluation of the respiratory protection program.
- The employer shall educate and annually train employees on proper respirator use.

Employee

- The employee shall use the provided respiratory protection in accordance with the instruction and training received.
- The employee shall properly clean, maintain and store the respirator.
- The employee shall report any malfunction of the respirator to their supervisor and the Senior Industrial Hygienist.

Program Administration

Program Administration of the Respiratory Protection Program will be performed by the BFS Senior Industrial Hygienist and is hereafter called the "Program Administrator". The Program Administrator will be responsible for:

- Providing initial and annual fit testing and associated recordkeeping.
- Providing initial and annual respirator training and associated recordkeeping.
- Providing annual medical monitoring and records of physician's certification to wear respiratory protection.

- Implementing and retaining audit records and program evaluation reports including employee complaints, problems and suggestions.

- Revising and updating the Respiratory Protection Program as needed.

Laboratory Safety Officer

The Laboratory Safety Officer or designee is responsible for:

- Monthly SCBA inspection.

- Ensuring that the lab SCBAs have an appropriate regulator flow test and routine hydrostatic tests.

- Ensuring compressed air cylinders are kept filled and obtaining breathing air certification.

- Maintaining SCBA and cylinder inspection records and certifications, including regulator flow tests and hydrostatic tests.

3. DEFINITIONS

Aerosol: a system consisting of particles, solid or liquid, suspended in air.

Air hose: a tube through which air flows to the facepiece from the regulator or pump.

Approved: Respirators that have been tested and listed as satisfactory, meeting standards set by the National Institute for Occupational safety and Health.

Canister: A large sealed container holding a filter, absorbent material or both, which removes specific contaminants from the air drawn through it.

Cartridge: A small canister with the same purpose.

CBRN: Chemical, Biological, Radiological, Nuclear designation

Confined Space: An enclosure, such as a storage tank, silo, tank car, duct, tunnel, underground vault, cave or pit which has limited access, poor natural ventilation and which may contain a hazardous atmosphere.

Contaminant: A harmful, irritating or nuisance material that is foreign to the natural atmosphere.

Dust: A solid, mechanically produced particle with size varying from submicroscopic to visible.

End-of –Service-Life Indicator (ESLI): A device or label that warns the respirator user of the approach of the end of adequate respiratory protection, i.e. that the sorbent is approaching saturation or is no longer effective.

Escape-Only Respirator: A respirator intended to be used only for emergency exit.

Facepiece: The part of the respirator that covers the wear's eye, nose, and mouth (full facepiece). It is designed to make a gas-tight or particle-tight fit with the face and including the headbands, exhalation valve and connectors for an air purifying device (two cartridges or single canister) or air supplying source (self-contained breathing apparatus).

Filter: A device used in cartridges or canisters to remove solid or liquid aerosols from the air.

Fume: A solid particle that condenses from the air during welding or burning of metal.

Gas: A state of matter defined as a fluid with a vapor pressure exceeding 40 psia at 100^{o}F.

Immediately Dangerous to Life and Health (IDLH): An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Inhalation Valve: A device that allows respirable air to enter a respirator and prevents exhaled air from leaving the respirator through the valve.

Maximum Use Limit: The maximum concentration of a contaminant for which an air-purifying filter, cartridge or canister is approved for use.

N-100: Particulate filter (99.97% filter efficiency level equivalent to High Efficiency Particulate Air filters, aka HEPA) is effective against particulate aerosols free of oil.

Negative Pressure Respirator: A respirator in which the air pressure inside the mask is positive during exhalation and negative during inhalation in relation to the outside air pressure.

NIOSH: National Institute for Occupational Safety and Health.

OSHA: Occupational Safety and Health Administration.

P-100: Particulate filter (99.97% filter efficiency level) is effective against particulate and oily aerosols for multiple shifts.

Powered air-purifying Respirator (PAPR): An air purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Permissible Exposure Limit (PEL): The legally established time-weighted (TWA) concentrations or ceiling concentration of a contaminant that shall not be exceeded.

Positive Pressure Respirator: A respirator in which the air pressure inside the mask is always positive in relation to the outside air pressure during both inhalation and exhalation.

Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer. These values are assigned by NIOSH.

R-100: Particulate filer (99.97% filter efficiency level) is effective against particulate and oily aerosols for one work shift.

Respirator: A device designed to protect the wearer from the inhalation of harmful atmospheres.

Sanitized: To destroy organisms that cause disease or infection.

Smoke: The products of combustion, pyrolysis or chemical reaction of substances in the form of visible and invisible solid and liquid particles and gaseous products in air.

Spray: A liquid, mechanically produced particle with sizes varying from submicroscopic to visible.

Vapor: The gaseous state of a substance that is solid or liquid at ordinary temperatures and pressure.

4. CLASSIFICATION, DESCRIPTION AND LIMITATIONS OF RESPIRATORS

Air Purifying Respirators

Air Purifying Respirators (APRs) are a mask that uses either a canister or dual cartridges to remove contaminants from the atmosphere. These respirators do not protect against IDLH, oxygen deficiency or other atmospheres where contaminants are in unknown concentrations. The contaminants removed are limited by the type, efficiency and capacity of the cartridge or canister used. The SCOTT O-Vista, AV-2000 and AV-3000 full-face models are the primary APRs used by BFS personnel. The MSA Ultra-twin APR and MSA Advantage 1000 are alternative APRs used for personnel who cannot be fitted to wear SCOTT respirators. The SCOTT Model 66 half-face respirator or any NIOSH approved N-95 filtering facepiece may be used by Latent Print Examiners.

If a Powered Air-Purifying Respirator (PAPR) is proscribed by direction of the physician or operational needs dictate the need to use a PAPR (such as excessive wear time, performing exceptionally heavy work) then an equivalent SCOTT or MSA PAPR will be chosen with equivalent cartridges matching those described in the next section.

APR Cartridges/Canisters

The SCOTT #642-MPC-P100 (cartridge) filters out dust, organic vapors, ammonia and amines, chlorine and hydrochloric acid and provides escape for hydrogen sulfide. The GME P100 is the equivalent MSA Ultra-twin and Advantage 1000 cartridge. These canister/cartridges do not have ESLI's. Specific changeout schedules are listed in Appendix B.

The SCOTT #642-P100 or any NIOSH approved N-95 or N-100 filtering facepiece may be used is selected situations. The P-100 or N-95 may be used when the only contaminant is fingerprint powder or biological contaminants such as Tuberculosis. The P100 or N-100 are recommended for Hanta virus exposure. The cartridge may be reused until breathing becomes difficult. Filtering facepieces are to be disposed of after each use.

All cartridges are to be used within three years of their manufacture date (as indicated on the cartridge label) as long as they are still sealed with their original bag. [EXCEPTION: the SCOTT Enforcement Cartridge is good for 10 years] Cartridges removed from the original bag will be considered usable for up to 24 hours on exposure to air. Cartridges that are filtering material alone (P100) are useable indefinitely.

Both the SCOTT and MSA cartridges give very little protection against methanol. Any situation where the PEL (200 ppm) or STEL (250 ppm) of methanol may be exceeded would require the use of SCBA.

Atmosphere-Supplying Respirators

Self-contained Breathing Apparatus (SCBA) are respirators that provide uncontaminated air to the wearer. The primary limitations are weight (approximately 20 pounds), bulkiness, finite air source and training needed to maintain and use. Only SCBA's providing at least 30 minutes of breathing air, operated in the positive pressure mode will be used to enter unknown atmospheres and atmospheres containing known hazardous contaminants that requires the use of an SCBA.

SCOTT 4.5 SCBAs used and maintained by BFS. The MSA MMR is the alternative brand used for personnel who cannot be fitted to wear SCOTT respirators. Both SCBA brands operate at 4500 psig. SCBAs operating at 2215 psig and/or using steel cylinders are no longer used by BFS. All cylinders will be composite construction and rated for 45 minutes.

Emergency escape respirators are used in hazardous atmospheres for immediate escape only. If rescue of an employee is necessary, SCBA shall be used. Emergency escape respirators must be inspected monthly and hydrostatically tested according to DOT standards.

5. SELECTION OF RESPIRATORS

Approved Respirators

Only NIOSH approved respirators shall be selected. Surgical masks or unapproved dust filters shall not be substituted for approved respirators.

General Considerations

The selection of a respirator for any given situation shall require consideration of the following factors:

- The nature of the hazard
- The characteristics of the hazardous operation or process.
- The location of the hazardous area with respect to a safe area having respirable air.
- The period of time for which respiratory protection may be provided.
- The activity of the workers in the hazardous area.
- The physical characteristics, functional capabilities and limitations of various types of respirators.
- The respirator protection factor and respirator fit.

Processing for Fingerprints

- Processing closed containers in a well-ventilated area does not require the use of respiratory protection. Use of a NIOSH approved dust mask or full-face respirator with a P-100 filter is recommended to avoid inhalation of fingerprint powder.

Application of chemical agents at crime scenes

- Application of Leuco-Crystal Violet (LCV) indoors or application in poorly ventilated required the use of SCBA.

- Applications of LCV outdoors require the use of a full-face respirator with a standard cartridge. The purpose of respiratory protection is to avoid inhalation of LCV; hydrogen peroxide levels would be below the PEL (see experimental data). The cartridge must be changed after each scene or when it is difficult to breathe through.

- Applications of agents in methanol in poorly ventilated areas will require the use of SCBA due to the lack of an available APR cartridge for methanol.

- Applications of Fluoroscein dye in ethanol and glacial acetic acid in poorly ventilated areas will require the use of a full-face respirator with organic vapor and acid gas cartridges. Consult the Program Administrator concerning change-out schedule.

- Use of iodine fuming in a poorly ventilated area will require the use of a full-face APR with organic vapor cartridges due to the presence of chloroform and petroleum ether. Consult the Program Administrator concerning change-out schedule.

- Luminol applications does not require respiratory protection.

Crime Scenes where Biological agents may be a concern

- Abandoned or little used rural facilities may have urine/feces from Deer mice, which are carriers of Hanta Virus. To prevent possible exposure in these circumstances, use of a N-100 filtering face piece is recommended.

- Crime scenes where the occupant had advanced stages of Tuberculosis, use of a N-95 filtering face piece is recommended.

Laboratory Spill Cleanup or Emergencies

- Small Spill Cleanup (1 gallon or less) by the Laboratory Spill Response Team will require either the use of a full-face respirator with at least a P100 filter for

dry materials. For liquid materials, all lab hoods will be turned on before cleanup is started. After testing the atmosphere with appropriate instrumentation (combustible gas indicator or colorimetric tubes) to verify that the contaminant levels are below the IDLH and less than 50 times the PEL, a full-face respirator with a standard cartridge will be used. Cartridges will be discarded after use. If the contaminant levels cannot be determined, then SCBA will be used. Exposure monitoring has determined that cleanup of a spill of 250 ml or more of phenol/chloroform/isoamyl alcohol will require a full-face respirator with an organic vapor cartridge.

- Escape-only Respirators will be used solely for the purposes of escape from a dangerous environment. A SCBA will be used if rescue is required.

Justification for choosing respirators and change-out schedules is found in Appendix A and B respectively.

6. USE OF RESPIRATORS

Training

Training requirements are listed in the Health and Safety Training Program Manual, section 9.0. Initial and annual training are required.

Respirator Fit Tests

A *Quantitative Fit Test* using a full-face negative pressure respirator shall be performed initially and annually thereafter to determine the ability of each individual respirator wearer to obtain a satisfactory fit with an APR. A satisfactory fit is defined as a fit factor averaging 500 or better for a full-face APR. Procedures required by 8 CCR 5144, Appendix A for the Portacount and the Controlled Negative Pressure protocol will be followed.

Respirator fit test will not be required for positive pressure SCBA. However, the individual must wear the same size and brand of APR mask to which they have been quantitatively fit tested.

A person shall be allowed to use only the specified make and model APR and SCBA for which the person has obtained a satisfactory quantitative fit. Under no circumstances shall a person be allowed to use any respirator if the results of the quantitative fit test indicate that the person is unable to obtain a satisfactory fit.

A Quantitative Fit Test shall be carried out for each wearer of a negative pressure full-face respirator prior to initial respirator use and at least annually. A current fit test is required for use of respiratory protection in the field or the laboratory.

Personnel who may wear a filtering face piece or half-face respirator will be fit tested with a *Qualitative Fit Test*. Procedures using irritant smoke specified in Appendix A of 8 CCR 5144 will be used.

Respirator Fit Test Records

Initial and Annual Fit Test records will be kept by the Program Administrator. The record will include:

- Employee's identification and work location.

- APR employee was fitted with.
- Whether spectacle inserts will be used.
- Whether contacts will be worn.
- Date and location of fit test.
- Type of fit test method, scores of individual tests and average fit factor.
- Identification and signature of person performing the fit test.

Facial Hair Requirements

To maintain compliance with 8 CCR 5144(g)(1) “facepiece seal protection”, all personnel who must wear a respirator to prevent exposures above the PEL or in a IDLH environment must comply with the Facial Hair Policy.

Facial hair that is in violation of this section is:

1. Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function; or
2. Any condition that interferes with face-to-facepiece seal or valve function.

Beards, goatees, Fu-manchus or any facial hair that can come between the sealing surface or interferes with the valve function is not permitted. Personnel who violate this policy will not be allowed to attend respirator training, will not be fit tested.

Respirator Inspection prior to Use

Each person issued a respirator for routine, non-routine, emergency or rescue shall inspect the respirator prior to its use to ensure that it is in good operational condition. Proper function will be evaluated using the manufacturer’s inspection procedures.

Air purifying respirator inspection shall include facepiece, face shield, straps, buckles, valves, cartridges/canisters and sealing gaskets. Silicone MSA Ultra-twin respirators should be inspected for small (0.25 inch or less) cuts in the mask near the speaking diaphragm clamp.

SCBA inspection shall include facepiece, face shield, straps, buckles, valves, breathing tubes, fittings, compressed air cylinder, air hoses, compression fitting o-ring, regulator and low pressure warning device.

Leaving a Hazardous Area

A respirator wearer shall be permitted to leave the hazardous area for any respirator-related cause. Reasons which require a respirator wearer to leave a hazardous area include, but are not limited to the following:

- Failure of the respirator to provide adequate protection;
- Malfunction of the respirator;
- Detection of leakage of an air contaminant into the respirator;
- Increase in resistance of the respirator to breathing
- Severe discomfort in wearing the respirator;
- Illness of the respirator wearer.

Voluntary Use of Respirators

Employees will be allowed to wear respirators in situations where no exposure above the PEL is anticipated. To wear an elastomeric respirator under these circumstances, the employee must agree to do the following:

1. Review Appendix D of 8 CCR 5144.
2. Wear only a NIOSH approved respirator.
3. Be medically evaluated concerning fitness to wear a respirator
4. Receive instruction in how to clean their respirator

For employees wearing only a filtering facepiece under voluntary conditions, only #1 and 2 apply.

Records concerning these requirements will be kept for voluntary users by the LSO, with the exception of the medical approval, which will be kept by the Program Administrator.

7. MAINTENANCE OF RESPIRATORS

SCBA Maintenance and Inspection

All SCBAs will be inspected monthly by the Laboratory Safety Officer or designee and noted on the inspection form found in Appendix C.

SCBA regulators must be flow tested as specified by the manufacturer (annually for MSA, and biannually for SCOTT). Repairs will be made by a certified testing company. The Lab Safety Officer will keep records of flow tests and repairs.

SCBA Cylinders:

- Must be kept at least 90% full.

- Must be filled with Grade D breathing air, which contains:
  - 19.5-23.5% oxygen
  - <1000 ppm CO_2
  - <10 ppm CO
  - < 5 mg/m^3 oil mist
  - < moisture

Grade D breathing air certification must be provided when filling tanks. A copy of the certification must be obtained for documentation.

Composite cylinders shall be hydrostatically tested initially after three years and every five years thereafter. Composite SCBA cylinders will only be used 15 years from the date of manufacture.

Any SCBA cylinder that has come in direct contact with strong acids or bases in use will be immediately decontaminated and removed from service. The cylinder shall be inspected by a manufacturer's representative to determine the integrity of the composite coating and future use. Documentation of the inspection and recommendation will be kept with the SCBA records.

Cleaning and sanitizing

Each respirator should be cleaned and sanitized after each use. Use warm water (110^{o}F maximum) and mild soap to clean the respirator. Rinse with clean, warm water and allow

to air dry. Sanitizing is accomplished by immersing the mask for at least two minutes in one of the following solutions:

- 50 ppm bleach solution (1 ml household bleach in 1 liter of water)
- 50 ppm iodine solution (1 ml tincture of iodine to 1 liter or water) or
- a commercially prepared disinfectant recommended by the manufacturer.

Then rinse all components in fresh warm water (110^{o}F maximum) and allow to air dry.

Repair and Replacement

Replacement of parts or repairs shall only be done by persons trained in proper respirator assembly and correction of possible malfunctions or defects.

Replacement parts shall be only those designed for the specific respirator being repaired.

All records of SCBA repair will be maintained by the Lab Safety Officer.

Storage

Employees are responsible to store their respirators in a manner that will protect them against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. SCBAs, APRs and cartridges will not be operated or stored in environments below 0^{o}F or above 120^{o}F. Respirators shall be stored to prevent distortion of the elastomeric parts.

8. SPECIAL ISSUES

Corrective Vision

Employees who wear corrective lenses may either:

- Use a spectacle insert kit for the respirator. The employer will provide the kit and the prescription lenses to the employee initially and as needed.
- Use contact lenses.

No modification of the face piece is allowed.

Immediately Dangerous to Life or Health atmospheres

When an atmosphere has been characterized as IDLH due to oxygen deficiency (<19.5 % oxygen) or toxicity, then a SCBA must be used. Atmospheres containing flammable vapors may not be entered until ventilation has reduced the flammability levels to less than 10% of the LEL as measured on a combustible gas meter. Hazardous atmospheres that cannot be characterized shall be considered IDLH.

When entry into IDLH atmospheres is required, at least one standby person shall have positive pressure SCBA and appropriate retrieval equipment for removing the employee(s) who have entered the IDLH atmosphere in case of emergency. Communications (visual, voice or other suitable means) shall be maintained between the standby person and the respirator wearers. The employee(s) outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue.

Confined Spaces

All confined spaces shall be considered IDLH unless proven otherwise. Before a person is allowed to enter a confined space, all requirements of 8 CCR 5157 must be carried out, including preparation of a permit, continuous air monitoring, stationing of attendants, provision of retrieval equipment and communications equipment.

9. MEDICAL EVALUATION

No employee shall be assigned work requiring the use of a respirator, including standby-mode, or may volunteer to wear a respirator where it is not required unless it has been determined by an occupational health physician that the person is physically able to perform the work while using a respirator.

The physician's determination that an employee is certified to wear/use a respirator shall be based on medical tests and findings, including:

- Medical history.
- Pulmonary function tests
- Treadmill (when required by the physician)
- Chest X-ray (when required by the physician)

The physician's determination shall be made before the time of assignment to respirator use and updated every 24 months unless the physician, supervisor or program manager determine a more frequent exam is necessary. The physician' determination shall be documented on the "Physician's Certification of Employee Respirator Use" letter or similar document, signed by the examining physician and provided to the Program Administrator for each employee.

The medical records are confidential and will be provided to the employee. BFS uses UC Davis Medical Group to provide medical evaluations, which also stores copies of employee medical records for BFS for up to 30 years. The Program Administrator will only receive a letter indicating whether an employee has medical approval to wear a respirator.

In the event that the Physician finds that an employee has a medical condition that would prevent the use of a negative pressure APR, the Physician will be required to evaluate whether a PAPR will mitigate the medical condition. If the physician determines that the PAPR is a satisfactory substitute, the employer shall provide a PAPR to the employee is if appropriate cartridges are available.

When the employee ceases to work in applying impression evidence sprays in field applications or participating as a member of a laboratory spill cleanup team, a final evaluation will be conducted and future annual evaluations will cease.

10. PROGRAM EVALUATION

The Program Administrator will annually assess implementation of the Respiratory Protection Program. Assessment will include:

- Respirator fit
- Appropriate selection based on hazard
- Proper use
- Proper maintenance

Periodic assessment of actual exposure by quantitative personal air monitoring will be conducted to verify respirator selection criteria.

APPENDIX A

Decision Logic for Respirator Selection

Justification for respirator selection is provided for the following situations:

Processing for Fingerprints

- Processing closed containers in a well-ventilated area does not require the use of respiratory protection. Use of a NIOSH approved dust mask or full-face respirator with a P-100 filter is recommended to avoid inhalation of fingerprint powder.

No exposure to chemicals is anticipated if the container is kept closed and good ventilation is present. Respiratory protection is recommended, not required to reduce inhalation of fingerprint powder. Exposures to fingerprint powder are not anticipated to exceed the PEL of 5 mg/m^3 (see NIOSH Health Hazard Evaluation Report 92-0147-2456, Federal Bureau of Investigation, September, 1994).

Examination of chemical agents at crime scenes

- Application of Leuco-Crystal Violet (LCV) indoors or application in poorly ventilated required the use of SCBA.

Due to the use of hydrogen peroxide as the carrier material, indoor application or application in poorly ventilated areas may potentially expose employees to levels exceeding the PEL. The ability of the SCOTT cartridge to absorb hydrogen peroxide has not been provided by the manufacturer, therefore SCBA is required.

- Applications of LCV outdoors require the use of a full-face respirator with a standard cartridge. The purpose of respiratory protection is to avoid inhalation of LCV; hydrogen peroxide levels would be below the PEL (see experimental data). The cartridge must be changed after each scene or when it is difficult to breathe through.

Exposure to hydrogen peroxide volatilizing from a 3 % solution in a well-ventilated area would be below the PEL. See experimental data in Appendix B.

- Applications of chemical agents in methanol in poorly ventilated areas will require the use of SCBA due to the lack of an available APR cartridge for methanol.

Methanol levels could exceed the PEL in poorly ventilated areas. The APR cartridges used by BFS do not absorb methanol satisfactorily. Therefore, any exposure above the PEL will require the use of SCBA unless the concentration of methanol can be measured at the scene.

- Applications of Fluoroscein dye in ethanol and glacial acetic acid in poorly ventilated areas will require the use of a full-face respirator with organic vapor and acid gas cartridges. Consult the Program Administrator concerning change-out schedule.

It would be anticipated that the PEL for both ethanol and glacial acetic acid could be exceeded in a poorly ventilated environment. Air monitoring with colorimetric tubes should be performed to verify concentrations. Cartridge change-out schedules will need to be worked out on a situation specific basis by the Program Administrator.

- Use of iodine fuming in a poorly ventilated area will require the use of a full-face APR with organic vapor cartridges due to the presence of chloroform and petroleum ether. Consult the Program Administrator concerning change-out schedule.

It would be anticipated that the PEL for chloroform and petroleum ether could be exceeded in a poorly ventilated environment. Air monitoring with colorimetric tubes should be performed to verify concentrations. Cartridge change-out schedules will need to be worked out on a situation specific basis by the Program Administrator.

<u>Crime Scenes where Biological agents may be a concern</u>

- Abandoned or little used rural facilities may have urine/feces from deer mice, which are carriers of Hanta Virus. To prevent possible exposure in these circumstances, use of a N-100 dust mask is recommended.

The Centers for Disease Control recommends the use of N-100 dust masks where hanta virus may be present. Since dust may be stirred up when performing activities at a crime scene, rural crime scenes should be evaluated with hanta virus in mind.

- Crime scenes where the occupant had advanced stages of Tuberculosis, use of a N-95 filtering face piece is recommended.

Persons in the advanced stage of Tuberculosis are expelling the agent, which remain viable for a short period of time. Health Care workers who are exposed to such persons

wear N-95 filtering face-pieces. The crime scene responder who is concerned about possible exposure may elect to wear a N-95 filtering face piece.

Laboratory Spill Cleanup or Emergencies

- Small Spill Cleanup (1 gallon or less) by the Laboratory Spill Response Team will require either the use of a full-face respirator with at least a P100 filter for dry materials. For liquid materials, all lab hoods will be turned on before cleanup is started. After testing the atmosphere with appropriate instrumentation (combustible gas indicator or colorimetric tubes) to verify that the contaminant levels are below the IDLH and less than 50 times the PEL, a full-face respirator with a standard cartridge will be used. Cartridges will be discarded after use. If the contaminant levels cannot be determined, then SCBA will be used.

Particulate filters will adequately protect employees. The use of monitoring equipment is necessary to determine that the APR is appropriate. If this cannot be determined, then SCBA must be used.

- Escape-only Respirators will be used solely for the purposes of escape from a dangerous environment. A SCBA will be used if rescue is required.

Escape-only respirators are designed for the wearer to place them on and leave the area; the unit does not supply enough air to permit personnel to perform rescue. If rescue is required, then SCBA must be used.

APPENDIX B

Respirator Change-out Schedules

1. Rule of Thumb

If the chemical's boiling point is >70°C and the concentration is less than 200 ppm, you can expect a service life of 8 hours at a normal work rate. Service life is inversely proportional to work rate. Reducing concentration by a factor of 10 will increase service life by a factor of five. Humidity above 85% will reduce service life by 50%.

Examples: toluene, trichloroethylene. However, even though ethyl alcohol fits the rule of thumb, experimental data indicates that the effectiveness of activated carbon in absorbing ethyl alcohol is not very efficient and maximum wear times are considerably less than that predicted by the "Rule of Thumb".

2. Experimental Evidence

A. Organic solvents

The following is data collected by BFS when opening chemical containers with screw top lids 2.25 inches in diameter. Fifty milliliters of each substance was used. After 10 seconds of swirling, the cap was opened and samples were collected at 1 foot directly above the container. Real-time analysis was obtained with a Foxboro MIRAN 1BX. The 70 and 100°F columns indicate actual chemical concentrations recorded at those temperatures. All values are in "PPM". Except for chloroform, respiratory protection would not be required when sampling these substances. Time in minutes refers to cartridge change-out time if a respirator is elected to be worn.

Chemical	PEL PPM	70°F PPM	Time-min	100°F PPM	Time-min
Acetone	750	40	43	184	32
Chloroform	2	32	445	114	218
Ethyl Alcohol	1000	62	47	44(114*)	35
Ethyl Ether	100	26	285	34(58*)	117
Methyl Alcohol	200	150	0	146(279*)	0

Toluene	50	9	>8 hr	48	>8hr
Trichloroethylene	25	37	>8hr	20	>8hr

* = level measured when lid opened first time after heating without swirling.

B. Hydrogen Peroxide

Using Draeger colorimetric tubes, exposure to hydrogen peroxide was measured in the following situations after a one square foot section of concrete was saturated by a handsprayer:

1. Outdoors, in full sun, temperature 90^{o}F, measured 2 inches off concrete = 0.3 ppm
2. Outdoors, in full sun, temperature 90^{o}F, measured 12 inches off concrete = 0.5 ppm
3. Outdoors, in full shade, temperature 90^{o}F, measured 12 inches off concrete = 0.1 ppm
4. Enclosed garage, temperature 85^{o}F, measured 12 inches off concrete = 0.5 ppm
5. Inside a bucket, inside a room, temperature 85^{o}F, measured 12 inches off surface = 6 ppm.

The Permissible Exposure Limit for hydrogen peroxide is 1 ppm.

C. Hydrogen Chloride

Using Draeger colorimetric tubes, exposure to hydrogen chloride was measured at a height of 1 foot above the lip:

Conditions	Concentration measured @70^{o}F	Concentration measured @95^{o}F
Laboratory grade HCl: 37-39% 1 inch opening	10 ppm	Not tested
Consumer grade drain cleaner HCl 10%, 90% inert Screw-top container, 2.25 inch dia.	0 ppm	0 ppm

This data shows that if any laboratory grade HCl is suspected which must be sampled, then a respirator must be used. Based on MSA data for an exposure to 10 ppm, the change-out schedule would be 1440 minutes. Therefore, BFS will require change-out after use at each site.

3. Manufacturer's Experimental Data

Change-out schedules for the SCOTT 642-MPC respirator cartridges are listed on the following pages.

ESTIMATED CARTRIDGE BREAKTHROUGH TIME FOR THE SCOTT 642-MPC MULTI-PURPOSE TWIN CARTRIDGE

MEDIUM WORK RATE, 22 ^{o}C AND LESS THAN 65 % RH

CHEMICAL	ESTIMATED CARTRIDGE SERVICE LIFE IN HOURS AT					
	CAS NO.	10 ppm	50 ppm	100 ppm	500 ppm	1000 ppm
Acetic anhydride	108-24-7	98.4	33.5	21.0	7.2	4.5
Acetone	67-64-1	27.9	9.5	6.0	2.0	1.3
Acrylonitrile	107-13-1	36.9	12.6	7.9	2.7	1.7
Allyl acetate	591-87-7	60.3	20.5	12.9	4.4	2.8
Allyl alcohol	107-18-6	52.4	17.8	11.2	3.8	2.4
Allyl chloride	107-05-1	24.6	8.4	5.3	1.8	1.1
Benzene	71-43-2	57.9	19.7	12.4	4.2	2.6
Bromobenzene	108-86-1	106.9	36.4	22.9	7.8	4.9
Butanol	71-36-3	91.3	31.0	19.5	6.6	4.2
Butanol, 2-	78-92-2	76.2	25.9	16.3	5.5	3.5
Butanone, 2-	78-93-3	61.8	21.0	13.2	4.5	2.8
Butyl acetate	123-86-4	61.1	20.8	13.1	4.4	2.8
Butyl acetate, sec-	105-46-4	65.9	22.4	14.1	4.8	3.0
Butylamine	109-73-9	82.8	28.2	17.7	6.0	3.8
Carbon tetrachloride	56-32-5	61.1	20.8	13.1	4.4	2.8
Chlorobenzene	108-90-7	84.9	28.9	18.2	6.2	3.9
Chlorobutane, 1-	109-69-3	57.1	19.4	12.2	4.2	2.6
Chlorocyclopentane	930-28-9	61.9	21.1	13.2	4.5	2.8
Chloroform	67-66-3	26.2	8.9	5.6	1.9	1.2
Chloroheptane, 1-	629-06-1	65.1	22.1	13.9	4.7	3.0
Chlorohexane, 1-	544-10-5	61.1	20.8	13.1	4.4	2.8
Chloromethyl heptane, 3-	123-04-6	50.0	17.0	10.7	3.6	2.3
Chloropentane, 1-	543-59-9	59.5	20.2	12.7	4.3	2.7
Chloropropane, 1-	540-54-5	19.8	6.7	4.2	1.4	0.9
Chloropropane, 2-	75-29-6	20.6	7.0	4.4	1.5	0.9
Chlorotoluene, o-	95-49-8	80.9	27.5	17.3	5.9	3.7
Chloro-2-methylbutane, 2-	594-36-5	46.8	15.9	10.0	3.4	2.1
Chloro-2-methylpropane, 2-	507-20-0	29.4	10.0	6.3	2.1	1.3
Cumene	98-82-8	64.3	21.9	13.7	4.7	2.9
Cycloheptatriene, 1,3,5-	544-25-2	91.1	31.0	19.5	6.6	4.2
Cyclohexane	110-82-7	52.0	17.7	11.1	3.8	2.4
Cyclohexanone	108-94-1	94.9	32.3	20.3	6.9	4.3
Cyclohexene	110-83-8	64.8	22.0	13.8	4.7	3.0

Cyclohexylamine	108-91-8	84.3	28.7	18.0	6.1	3.9
Cyclooctane	292-64-8	73.0	24.8	15.6	5.3	3.3
Cyclopentanone	120-92-3	106.2	36.1	22.7	7.7	4.9
Cymene, p-	99-87-6	60.3	20.5	12.9	4.4	2.8
Decane	124-18-5	53.5	18.2	11.4	3.9	2.4
Dibromoethane, 1,2-	106-93-4	106.2	36.1	22.7	7.7	4.9
Dibromomethane	74-95-3	61.8	21.0	13.2	4.5	2.8
Dibutylamine	111-92-2	57.2	19.5	12.2	4.2	2.6
Dichlorobenzene, 1,2-	95-50-1	86.5	29.4	18.5	6.3	4.0
Dichlorobutane, 1,4-	110-56-5	85.7	29.2	18.3	6.2	3.9
Dichloroethane, 1,1-	75-35-4	18.3	6.2	3.9	1.3	0.8
Dichloroethane, 1,2-	107-06-2	42.9	14.6	9.2	3.1	2.0
Dichloroethylene, 1,2-*cis*-	156-59-2	23.8	8.1	5.1	1.7	1.1
Dichloroethylene, 1,2-*trans*-	156-60-5	26.2	8.9	5.6	1.9	1.2
Dichloromethane	75-09-2	7.9	2.7	1.7	0.6	0.4
Dichloropropane, 1,2-	78-87-5	51.6	17.5	11.0	3.8	2.4
Dichloropropene, 1,3-	542-75-6	68.2	23.2	14.6	5.0	3.1
Diethylamine	109-89-7	66.3	22.5	14.2	4.8	3.0
Diisobutyl ketone	108-83-8	53.5	18.2	11.4	3.9	2.4
Diisopropylamine	108-18-9	58.0	19.7	12.4	4.2	2.7
Dimethylamine	124-40-3	12.8	4.4	2.7	0.9	0.6
Dimethylbutane, 2,3-	79-29-8	54.2	18.4	11.6	3.9	2.5
Dipropylamine	142-84-7	70.0	23.8	15.0	5.1	3.2
Epichlorohydrin	106-89-8	68.2	23.2	14.6	5.0	3.1
Ethanol	64-17-5	22.2	7.6	4.8	1.6	1.0
Ethoxyethanol, 2-	110-80-5	61.1	20.8	13.1	4.4	2.8
Ethoxyethlyacetate, 2-	111-15-9	63.5	21.6	13.6	4.6	2.9
Ethyl acetate	141-78-6	53.2	18.1	11.4	3.9	2.4
Ethyl benzene	100-41-4	66.7	22.7	14.3	4.8	3.0
Ethyl chloride	75-00-3	4.8	1.6	1.0	0.3	0.2
Ethylamine	75-04-7	30.9	10.5	6.6	2.2	1.4
Ethylidene-5-norbornene, 2-	16219-75-3	65.5	22.3	14.0	4.8	3.0
Ethyl-1-butanol, 2-	97-95-0	61.1	20.8	13.1	4.4	2.8
Heptane	142-82-5	58.7	20.0	12.6	4.3	2.7
Heptanone, 2-	110-43-0	76.1	25.9	16.3	5.5	3.5
Heptanone, 3-	106-35-4	68.5	23.3	14.7	5.0	3.1
Hexane	110-54-3	39.2	13.3	8.4	2.8	1.8
Hexyl acetate	142-92-7	53.2	18.1	11.4	3.9	2.4
Isopentyl acetate	123-92-2	56.3	19.2	12.0	4.1	2.6
Isopropanol	67-63-0	42.9	14.6	9.2	3.1	2.0
Isopropenyl acetate	108-22-5	64.3	21.9	13.7	4.7	2.9
Isopropyl acetate	108-21-4	51.6	17.5	11.0	3.8	2.4
Isopropylamine	75-31-0	49.7	16.9	10.6	3.6	2.3
Mesityl oxide	141-79-7	91.9	31.3	19.6	6.7	4.2
Mesitylene	108-67-8	68.2	23.2	14.6	5.0	3.1
Methanol	67-56-1	0.16	0.05	0.034	0.012	0.007
Methoxyethanol, 2-	109-86-4	92.1	31.3	19.7	6.7	4.2
Methoxyethylacetate, 2-	110-49-6	73.8	25.1	15.8	5.4	3.4
Methyl acetate	79-20-9	26.2	8.9	5.6	1.9	1.2
Methyl chloride	74-87-3	0.04	0.01	0.008	0.003	0.002
Methyl chloroform	71-55-6	31.7	10.8	6.8	2.3	1.5
Methyl iodide	74-88-4	9.0	3.1	1.9	0.7	0.4
Methylamine	74-89-5	9.0	3.1	1.9	0.7	0.4

Methylcyclohexane	108-87-2	52.0	17.7	11.1	3.8	2.4
Methylcyclohexanone, 4-	589-92-4	83.6	28.4	17.9	6.1	3.8
Methylcyclopentane	96-37-7	46.7	15.9	10.0	3.4	2.1
Methyl-3-cyclohexanone	591-24-2	76.1	25.9	16.3	5.5	3.5
Methyl-3-butanol, 1-	123-41-3	77.0	26.2	16.5	5.6	3.5
Methyl-4-pentanone, 2-	108-10-1	72.3	24.6	15.5	5.3	3.3
Methyl-4 pentanol, 2-	108-11-2	59.5	20.2	12.7	4.3	2.7
Methyl-5-heptanone, 3-	541-85-5	64.8	22.0	13.8	4.7	3.0
Nitropropane, 1-	108-03-2	107.7	36.6	23.0	7.8	4.9
Nonane	111-84-2	57.2	19.5	12.2	4.2	2.6
Pentachloroethane	76-01-7	73.8	25.1	15.8	5.4	3.4
Pentane	109-66-0	45.9	15.6	9.8	3.3	2.1
Pentanedione, 2,4-	123-54-6	97.9	33.3	20.9	7.1	4.5
Pentanol	71-41-0	80.9	27.5	17.3	5.9	3.7
Pentanol, 2-	6032-29-7	69.0	23.5	14.8	5.0	3.2
Pentanone, 2-	107-87-9	78.3	26.6	16.7	5.7	3.6
Pentanone, 3-	96-22-0	70.8	24.1	15.1	5.1	3.2
Pentyl acetate	628-63-7	57.9	19.7	12.4	4.2	2.6
Perchloroethylene	127-18-4	84.9	28.9	18.2	6.2	3.9
Propanol	71-23-8	55.6	18.9	11.9	4.0	2.5
Propyl acetate	109-60-4	62.7	21.3	13.4	4.6	2.9
Propylamine	107-10-8	67.8	23.1	14.5	4.9	3.1
Pyridine	110-86-1	89.6	30.5	19.2	6.5	4.1
Tetrachloroethane, 1,1,2,2-	79-34-5	82.5	28.1	17.6	6.0	3.8
Toluene	108-88-3	74.6	25.4	15.9	5.4	3.4
Trichloroethane, 1,1,2-	79-00-5	57.1	19.4	12.2	4.2	2.6
Trichloroethylene	79-01-6	43.6	14.8	9.3	3.2	2.0
Trichloropropane, 1,2,3-	96-18-4	88.1	30.0	18.8	6.4	4.0
Triethylamine	121-44-8	61.0	20.8	13.0	4.4	2.8
Trimethlypentane, 2,2,4-	540-84-1	51.2	17.4	10.9	3.7	2.3
Trimethylhexane, 2,2,5-	35-94-9	51.2	17.4	10.9	3.7	2.3
Vinyl acetate	108-05-4	43.6	14.8	9.3	3.2	2.0
Vinyl chloride	75-01-4	3.2	1.1	0.7	0.2	0.1
Xylene, m-	108-38-3	78.6	26.7	16.8	5.7	3.6

Cartridge lives at 1000 ppm represent experimental 1% breakthrough data points obtained in the 1970's adjusted for a medium work rate and the increased carbon volume and capacity of current cartridge technology. This data is applicable for ambient conditions at 22 °C, relative humidities from 0 to 65% and a medium work rate (25 LPM). The other breakthrough times were calculated from Equation 2 taken from Nelson, G. O. and A. N. Correia, "Respirator Cartridge Efficiency Studies: VIII Summary and Conclusions" Am. Ind. Hyg. Assoc. J. 37: 514 (1976). These tests and calculations assume no safety factor.

For temperatures at 32 ^{o}C, multiply breakthrough times by 0.8.
For temperatures at 12 ^{o}C, multiply breakthrough times by 1.2.

For relative humidities between 65 and 80 %, multiply breakthrough times by 0.9.
For relative humidities between 80 and 95 %, multiply breakthrough times by 0.8.

These tests were performed under laboratory conditions and not under actual use conditions. Miller-Nelson Research Inc makes no warranties Miller-Nelson Research Inc makes no warranties concerning protection by these air purifying respirator devices.
These cartridge lives are estimates and the user should determine the suitability of the devices under actual field conditions

Compiled by Miller-Nelson Research Inc, 8 Harris Ct., Suite C-6, Monterey, CA 93940

Appendix C

SCBA MONTHLY CHECKOUT

YEAR:	**SCBA HARNESS #**	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
CYLINDER INSPECTION Hydro test date: must be <3 yrs composite, <5 yrs steel. Exterior of cylinder, Threads, valve knob													
CYLINDER PRESSURE (Full-ok; Partial <90% **–DO NOT USE UNTIL REFILLED**)													
HARNESS ASSEMBLY													
FACE PIECE ASSEMBLY (MSA MMR only)													
REGULATOR ASSEMBLY (demand lever screws, high pressure o-ring, hoses)													
FUNCTION CHECK-REGULATOR & ALARM													
DISCREPANCIES NOTED:													
DATE DISCREPANCIES RESOLVED													
INITIAL:													

Appendix D

MANUFACTURER'S SAFETY NOTICES