ANNEX B

SELECTED MODEL PROCEDURES AND GUIDELINES

Several of the written operating procedures collected during the course of this study address not only when to use SCBA and other respiratory equipment, but also when to discontinue its use. The information provided in Annex B is intended to provide a diverse range of various approaches to serve as useful models for others who are attempting to address this issue.

In addition to the information included herein, various model procedures and guidelines are available on-line through the internet that provides useful examples for general fire department respiratory protection programs. For example, a comprehensive set of model procedures is available from the State of New Jersey Division of Fire Safety (citation as of 28 November 2007), and can be located at: http://www.nj.gov/dca/dfs/booklet6.pdf.

Annex B includes portions of applicable procedures and guidelines from five fire service organizations that provide helpful examples of several approaches for addressing this topic. These procedures and guidelines are re-used in this report with the permission from each organization, and anyone interested in re-using any portion of this material should do so in a manner respectful of intellectual property rights of the source organization. This information, like all procedures and guidelines, are under constant review and updating, and interested individuals should check with the source organization for the latest information. The following fire service organizations have information included in Annex B:

- Lacey Fire District 3, Lacey, Washington, USA;
- Tucson Fire Department, Tucson, Arizona, USA;
- Vancouver Fire & Rescue, Vancouver, Washington, USA;
- South King Fire & Rescue, Federal Way & Des Moines, Washington, USA;
- Queensland Fire & Rescue, Brisbane, New South Wales, Australia

APPENDIX 5.7 – Respiratory Hazards and Use (including voluntary use of respirators)

Part 1 – Voluntary Use of Respirators

1. If a respirator is not required to be used, a member may:
   - choose to voluntarily wear a respirator as long as the use of the respirator itself does not create a hazard
   - use a disposable filtering facepiece – N, P or R 95 or 100 – without having to conform to any of the requirements of the respiratory protection program

2. Members voluntarily choosing to wear any other type of respirator shall conform to all of the requirements of the Respiratory Protection Program (medical approval, fit testing, training, quarterly donning and annual evaluations).

3. Members choosing to voluntarily wear a respirator shall inform their supervisor.

4. Supervisors shall ensure that a member who is choosing to voluntarily wear a respirator receives the following information:

Respirators protect against airborne contaminants when properly selected and used. WISHA recommends voluntary use of respirators when exposure to substances is below the WISHA permissible exposure limits (PELs) because respirators can provide you an additional level of comfort and protection.

If you choose to voluntarily use a respirator – whether it is provided by you or the District – be aware that respirators can create hazards for you, the user. You can avoid these hazards if you know how to use your respirator properly AND how to keep it clean. Take these steps:

- Read and follow all instruction provided by the manufacturer about use, maintenance, cleaning and care, and warnings regarding the respirators limitations
- Choose respirators certified for use to protect against the contaminant of concern. National Institute for Occupational Safety and Health (NIOSH) , certifies respirators. If a respirator is not certified by NIOSH, you have no guarantee that it meets minimum design and performance standards for workplace use. A NIOSH label will appear on the respirator packaging. It will tell you what protection the respirator provides.
- Do not wear the respirator into atmospheres containing hazards that your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against solvent vapor or smoke (since smoke particles are much smaller that dust particles) or oxygen deficiency.
- Do not wear your respirator into situations where respirator use is required
- Keep track of your respirator so that you do not mistakenly use someone else's respirator

Part 2 – General

Figure B-1a Selected Model Procedures and Guidelines, page 1 of 5
(Used with permission of Lacey Fire District 3, Lacey, Washington, USA)

1. Respiratory hazards shall be evaluated to determine to type/level of respiratory protection necessary.

2. **SCBA shall be worn:**
   - in a contaminated atmosphere, including but not limited to:
     - interior structural firefighting
     - overhaul
   - in an atmosphere that is suspected of being contaminated or oxygen deficient, including but not limited to :
     - carbon monoxide alarm responses
   - in an atmosphere that may rapidly become hazardous or oxygen deficient
   - in an atmosphere that is oxygen deficient

3. An air purifying **N95 or N100 disposable respirator shall be worn**:
   - when entering an area or room occupied by, and/or when providing care for, and/or transporting individuals with suspected or confirmed TB or SARS
   - when working in an area where non-oil containing particulate is the hazard, such as dusty environments. Respiratory hazards must be evaluated before using an air-purifying respirator.

4. The **MSA Advantage 200LS with P100 cartridges shall be worn**:
   - only for particulate hazards, including those containing oil. An evaluation of the respiratory hazards is initially required, and further air monitoring may be required
   - when working in a building constructed pre-1980 that has had damage to thermal system insulation and/or surfacing materials. An evaluation of the respiratory hazards is initially required, and further air monitoring may be required

Part 3 – Respiratory hazards members may be exposed to during routine and emergency operations

1. Chemical Contamination

Fire fighters respond to a variety of incidents each presenting its own unique hazards. Traditionally, most firefighting activity has centered around structural fires. The combustion of wood releases several combustion products into the atmosphere, principally carbon monoxide and other simple hydrocarbons. Structural fires have changed over the past several years because building materials have changed. Polyvinylchloride, polychlorinated biphenyls, acrylics, phenol, polystyrene and urea-formaldehyde are components of household furniture, plastic pipes, roofing material, insulation materials, wall coverings, carpets, automobiles, paints and other construction materials; these chemicals all contribute to an increased diversity of chemical products found at fires. The increased use of plastics and other synthetic materials release different kinds of

Figure B-1a Selected Model Procedures and Guidelines, page 2 of 5
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combustion products, many of them highly toxic or carcinogenic. Additionally, even the normal household will contain cleaning supplies, pesticides, pool chlorine and other substances that will contribute to release of toxic substances at fires.

Smoke, in addition to creating a visually restricting work area, is now also recognized as containing toxic fire combustion products that include:

- Carbon monoxide and carbon dioxide
- Inorganic gases such as hydrogen sulfide, hydrogen cyanide, nitrogen oxides
- Acid gases such as hydrochloric acid, sulfuric acid, nitric acid
- Organic acids such as formic acid, acetic acid and chlorinated compounds such as carbon tetrachloride and vinyl chloride
- Hydrocarbons such as benzene, polyaromatic hydrorcarbons {PAH's}; and metals such as cadmium, and chromium
- Hydrogen Chloride
- Phosgene

In addition, chemicals at the site of a fire further contribute to hazardous contaminants in fire smoke. A classic example are polychlorinated biphenyls (PCBs) found in electrical transformers and other equipment which, when burned, may form dioxin, an acutely deadly substance.

Overhaul and immediate post-overhaul environments are probably the most difficult to evaluate for respiratory hazards. Because of the unknown nature of respiratory hazards in these environments, SCBA is used until the air contaminants can be identified and quantified. Before decreasing the level of respiratory protection, the hazards must be known.

Responses to carbon monoxide alarms are now a more routine component of fire service activity. CO is a respiratory hazard, and members responding to CO monitor activations must assess the level of respiratory hazard while wearing full respiratory protection (SCBA).

Fire investigators

Fire investigators may also be at risk from the combustion products of fire to nearly the same extent as firefighters. Investigation activities may require entry into a structure before it is completely extinguished or during overhaul, and often times investigators work in a particulate-laden atmospheres for many hours or days after the fire is out. Each of these situations requires respiratory protection.

SCBA is required for overhaul, and may be required for post-overhaul atmospheres. Air purifying respirators may be worn in late post-overhaul conditions dictate, but when working inside a structure or vehicle, constant air monitoring for oxygen, carbon monoxide, hydrogen sulfide and explosive limits is generally required. Before any air purifying respirator is worn, the hazards must be known and certain monitoring conditions met.

Figure B-1a Selected Model Procedures and Guidelines, page 3 of 5
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Table 3 - Respiratory hazard evaluation summary

Work Activity	Contaminants	Exposures – TWA and monitoring	Respiratory Protection
Patient Care – suspected or confirmed TB, SARS or other pathogens	Bacteria, viruses	Initial and ongoing TB testing of personnel Monitoring of personnel potentially exposed to SARS or other pathogens	N95/N100 respirator
Firefighting	Variable	IDLH, no monitoring	SCBA
Overhaul	Variable	**Assume IDLH, no monitoring**	SCBA
Fire knocked down, overhaul complete, contents are NOT cool to the touch	Variable	**Assume IDLH, no monitoring**	SCBA
Fire knocked down, overhaul complete, contents ARE cool to the touch • Building constructed pre-1980, and fire damage has occurred to thermal system insulation and surfacing material.	PACM Particulate	• **Constant monitoring for CO, O2, LEL and H_2S** • Audible alarm for CO > 35 ppm • Audible alarm for O2 < 19.5%, > 20.9% (or 21%) • Asbestos = .1 fiber per cubic centimeter, 8 hr TWA • TWA CO > 35 ppm • H_2S < 10 ppm • LEL < 10%	A. ½ face cartridge respirator with P100 cartridges required B. SCBA if preferred
Fire knocked down, overhaul complete, contents ARE cool to the touch. • Building constructed post-1980 **OR** • Constructed pre-1980 and no fire damage has occurred to thermal system insulation and surfacing material.	Particulate	• **Constant monitoring for CO, O2, LEL and H_2S** • Audible alarm for CO > 35 ppm • Audible alarm for O2 < 19.5%, > 20.9% (or 21%) • Asbestos = .1 fiber per cubic centimeter, 8 hr TWA • TWA CO > 35 ppm • H_2S < 10 ppm • LEL < 10%	N95/100 respirator required ½ face cartridge respirator with P100 cartridges if preferred SCBA if preferred
ANY activity where particulate may be present or generated by the activity and is the only hazard	Particulate		N95/100 respirator required ½ face cartridge respirator with P100 cartridges if preferred SCBA if preferred

Figure B-1a Selected Model Procedures and Guidelines, page 4 of 5
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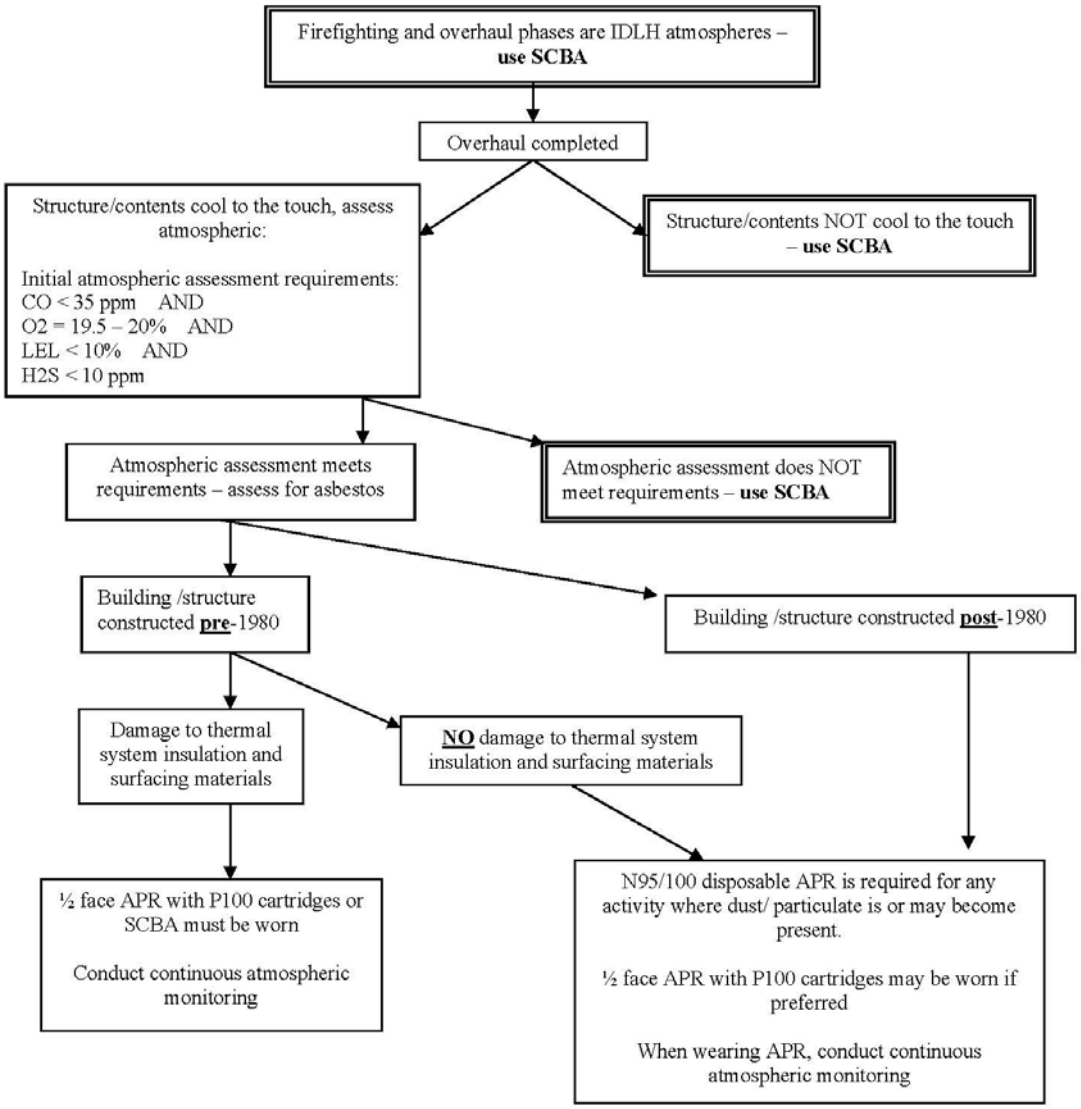
Respirator Decision Logic Sequence Following a Structure Fire

This sequence covers firefighting and investigation activities in residential and some business or commercial structure fire incidents. There should be no expectation for any kind of unusual toxic contaminants.



Section 5 – RPP, Appendix 5.7A – Hazards and use
March 2004

Page 5.7A 5

Figure B-1a Selected Model Procedures and Guidelines, page 5 of 5
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DRAFT HazMat Field Operating Guidelines	Page 1 of 5
APPENDIX 12 [redacted] Monitoring Guidelines	Revised: August 2007

Operational Level – [redacted] MultiGas Monitoring Guidelines

Air Monitoring Guidelines for the [redacted] MultiGas Monitor are intended to cover Operations Level Response for air monitoring of three specific situations; air quality within structures during overhaul and fire cause operations, flammable atmospheres during natural gas line breaks and carbon monoxide levels in residential occupancies.

How to Monitor

The meter should be allowed 10 to 15 minutes to warm up. Keep the [redacted] meter in a location on the apparatus where it can be turned on enroute to a call. After the meter has warmed up insure it is working properly and zero, bump test or calibrate as needed.

The [redacted] MultiGas Monitor has three sensor tracks: Oxygen (O_2), Carbon Monoxide (CO) and Combustible Gas (LEL). Before you start to test, the meter should read 0% LEL, 20.8% O2 and 0ppm CO. The meter samples the air by diffusion and it takes time for sensors to collect an air sample. The O_2 and LEL sensor needs a minimum of 30 seconds to absorb the air and give a stable reading. The CO sensor needs a minimum of 60 seconds to absorb the air and give a stable reading. The meter should be held reasonably still for the 30 to 60 seconds needed to obtain a good reading.

When monitoring for oxygen, the air should be tested at several locations and the [redacted] monitor held still for a minimum of 30 seconds, at about head height. The meter should be testing air in the "breathing zone", the place where air is being breathed. The O_2 sensor measures the actual amount of oxygen in the air. Clean air has about 20.8% oxygen. As the amount of oxygen changes because of a fire or if other chemicals are present in the air, the meter reading should change. The reading changes in 0.1% increments. OSHA regulations require that any atmosphere below 19.5% oxygen be considered as Immediately Dangerous to Life or Health (IDLH) and SCBA must be used by employees entering those areas. Oxygen levels above 23.5% OSHA considers as oxygen enriched. Those areas should be ventilated before employees enter. If there is any **unexplained** drop in O_2 levels of more than 0.1%, (a reading of 20.6% or less) SCBA should be used by employee entering those areas. Once the nature of the hazard has been discovered other actions may be appropriate.

When monitoring for CO the [redacted] meter should be held still, for a minimum of 60 seconds, near the equipment of concern or in the breathing zone if you are monitoring air at a structure fire. CO gas is nearly the same weight as air and does not easily disperse without some natural or mechanical ventilation. The CO sensor reads in total parts-per-million (ppm) of carbon monoxide in air. The normal reading for CO is 0ppm and the meter reading is a whole number, which will change in 1-ppm increments. **During overhaul and fire cause operations, employees entering atmospheres which contain concentration of CO above 10ppm must use SCBA. Filter masks should be worn for detectable concentrations of CO below 10%.**

Figure B-1b Selected Model Procedures and Guidelines, page 1 of 5
(Used with permission of Tucson Fire Department, Tucson, Arizona, USA)

When monitoring for Natural Gas the [redacted] meter should be held still, for a minimum of 30 seconds in the area where you expect the gas to accumulate. The Combustible Gas sensor reads in percent of the Lower Explosive Limit (LEL). The normal reading for LEL is 0%. The LEL reading is a whole number that will change in 1% increments. Processed natural gas is not toxic to the human body, but is an asphyxiant and can kill if it displaces air to the point where the oxygen content will not support life. The flammability hazard of natural gas flammability is generally considered to be the more serious hazard because natural gas is explosive at 5% or 50,000 ppm in air but is not an asphyxiant hazard until it reaches concentrations above 28% or 280,000 ppm in air.

Natural gas is lighter than air, and tends to dissipate easily in air. When natural gas is confined, such as within a house, gas concentrations can reach explosive mixtures and, if ignited, result in blasts that could destroy buildings.

Indoor Air During Overhaul and Fire Cause at Structure Fire

Action Guides: Ventilate first and then test with ventilation off. O_2 reading of 20.7% or 20.8% and CO reading below 10ppm may indicate that the air in the structure is safe to breath and that SCBA may be removed.

The [redacted] MultiGas Monitor can be used to show that oxygen and carbon monoxide levels are safe for firefighters to remove the SCBA during the final phase of operation at a structure fire. High humidity will effect the oxygen (O_2) sensor and may effect the Carbon Monoxide (CO) sensor in the [redacted] MultiGas Detector. It is important to ventilate the structure before taking the meter into the building. Conduct the metering operation with the ventilation off.

Smoldering synthetic materials may produce high concentrations of Nitrate, Chlorate and Cyanate compounds in the general area of the source. It is possible that the concentration of these materials may exceed the concentrations of CO. The current TFD monitoring program uses CO as an indicator because CO is normally produced in larger quantities than other fire gases. If the CO concentration is in the safe range, then the concentration of all other toxic gases of concern should also be low enough to be considered safe to breathe. This may not be the case during overhaul, when smoldering synthetic materials are present. They may produce large quantities of other toxic gases and exceed the concentration of CO. Using the level of CO as an indicator that the air is safe to breath should not be used if synthetic materials are still smoldering. Some research suggests that the breathing the combination of CO and other synthetic compounds presents a much higher health risk than breathing the individual compounds by themselves. Employees should wear SCBA during all firefighting operations where there is a likely exposure to these compounds.

Oxygen (O_2) Readings: The normal reading for O_2 on the [redacted] Monitor is 20.8%. Because a reduction of any amount in O_2 reading may indicate the presence of a large amount of an unknown contaminate, it is prudent to continue to use SCBA until the O_2 reading inside the

Figure B-1b Selected Model Procedures and Guidelines, page 2 of 5
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structure is above 20.6%. Humidity will effect the O_2 sensor and cause the meter reading for O_2 to drop. The building needs to be ventilated before the [redacted] is taken into the building. Test the air with the ventilation off.

If after ventilating the structure the O_2 reading in the building stays below 20.7% then consider the following:

- Insure that the ventilation is not causing the contamination.
- Insure that overhaul has fully extinguished the fire.
- Check for gas leaks.
- Remove the meter to clean air and see if the O_2 reading returns to 20.8%. If it does then there may be a serious source of contamination inside the building and you may want to have a HazMat Unit respond to do more air monitoring.
- If the meter reading does not return to 20.8% within 3 minutes of exiting the building then the meter may not be working properly. Try monitoring with a different meter.

Carbon Monoxide (CO) Readings: The normal reading on the [redacted] Monitor for CO is 0ppm. OSHA permissible exposure limit for CO is 25ppm. Tests conducted at structure fires indicate that some of the CO produced may be absorbed into water vapor present because of firefighting operations. Meter reading may be lower then the actual amount of CO present. Most direct reading meters are not able to detect the presents gases that have be dissolved into water vapor. Gases dissolved into water vapor still present a health hazard to firefighters. Current wisdom is to continue to use SCBA until a reading of less then 10ppm is achieved on the [redacted] Monitor. As with O_2 it is important to ventilate the structure before bringing the [redacted] Monitor into the building and then take readings with the ventilation off.

Natural Gas Leaks

Action Guides: Readings in structures from 1 % LEL to 9% LEL ventilate the structure. If reading are 10% or higher consider the following:

- Evacuate the structure or the affected part of the facility for large facilities.
- Secure ignition sources.
- Use positive pressure ventilation to clear the natural gas from the structure.
- Have HazMat units dispatched to aid in monitoring.
- Lay hose lines and secure water supply.
- Assess the need for additional recourses if a large-scale evacuation could be necessary.
- Position equipment for quick retreat.

The [redacted] Monitor can be used to detect Natural Gas in concentrations as low as 350 ppm. This is well below the minimum flammable concentration of 50,000 ppm (100% LEL) or the toxic concentration of 280,000 ppm (28% total gas in air). The meter reads in percent of LEL

Figure B-1b Selected Model Procedures and Guidelines, page 3 of 5
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from 0% to 100% of the LEL. Normally, flammable atmospheres below 100% of the LEL are too lean to burn and ignition will not occur. Natural gas will collect under structures, in building, under eves and in non-vented attics. Natural gas may also collect in soil, storm drains and sewers. When sub surface monitoring is necessary you should consider having a HazMat unit dispatched.

The [redacted] monitor will give true readings for natural gas but may not be accurate for other flammable atmospheres. When testing for flammable liquids like most alcohols a reading of any amount of the LEL may indicate that there is an explosive atmosphere present. If you are using the [redacted] monitor to test flammable atmospheres other than natural gas you may need to correct the reading. In some cases there is no way to correct the reading. When dealing with flammable atmospheres other than natural gas, additional training is needed.

Carbon Monoxide Leaks in Residents

Action Guide: CO readings below 25 ppm: turn off appliance and use natural or mechanical ventilation to clear the building. CO readings from 25 ppm to 199 ppm evacuate the building, turn off appliance and use natural or mechanical ventilation to clear the building. CO reading above 200 ppm: evacuate the building and do not reenter without SCBA, turn off appliance and use mechanical ventilation to clear the building. Consider having a Medic Unit respond to assess the occupants. Occupants may reenter the building after the appliance has been secured and the building ventilated and there is no indication of any further CO leaks.

CO leaks in residents do not present the same health risks as those present at structure fires. Currently OSHA, NIOSH and the ACGIH all consider an occupational exposure to CO alone, of below 25 ppm to produce no adverse health effects. The [redacted] monitor can be used to detect carbon monoxide in concentration as low as 1 ppm. Concentrations above 200ppm are dangerous and the IDLH for CO is 1200ppm. Concentrations above 5000 ppm have been fatal within five minutes. When measuring CO test at each location for a minimum of 60 seconds. Many factors are involved in the production and release of CO into a residence. Do not assume that a low reading means that the leak is safe. Appliance leaks are rarely constant and CO levels may change considerably.

Figure B-1b Selected Model Procedures and Guidelines, page 4 of 5
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Summary of Actions		
Indoor Air During Overhaul of Fire Cause		
Procedures	Meter Reading	Actions
Monitor for O_2 and CO. Testing time is 60 seconds. Ventilate and ensure that there are no smoldering synthetic materials. Ventilate the area before bringing the monitor into the building.	O_2 20.6% or less CO 10 ppm or more Smoldering synthetic materials CO below 10%	Wear SCBA Wear filter mask
Natural Gas Leak		
Procedures	Meter Reading	Actions
Monitor for LEL. Testing time is 30 seconds.	1% LEL to 9% LEL 10% LEL or higher	Ventilate the Structure Consider: • Evacuation • Secure ignition sources • Use PPV • Call HazMat • Lay Hose • Additional assistance • Equipment retreat
Carbon Monoxide Leaks in Residents		
Monitor for CO. Test time is 60 seconds. Test near suspect appliances.	CO 25ppm or less CO 25ppm to 199ppm CO 200ppm or more	Turn off appliance and clear using natural of mechanical ventilation. Evacuate residence, turn off appliance and use natural or mechanical ventilation. Evacuate building and do not reenter with out SCBA. Turn off appliance and use mechanical ventilation to clear building. Consider having Medics evaluate residents.

Figure B-1b Selected Model Procedures and Guidelines, page 5 of 5
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VANCOUVER FIRE DEPARTMENT

RESPIRATORY PROTECTION PROGRAM

September 22, 2004

This program is provided by the Vancouver Fire Department to comply with the Washington Industrial Safety and Health Administration's (WISHA) *General Occupational Health Standards, Chapter 296-62 WAC, Part E, Respiratory Protection.* Much of the information provided in this program was derived from the *OSHA Technical Manual, Section VIII: Chapter 2, Respiratory Protection* and *OSHA's Small Entity Compliance Guide, Appendix IV, Sample Respiratory Protection Program.*

SEE ALSO: *WAC 296-800 Safety and Health Core Rules*
WAC 296-841 Respiratory Hazards
WAC 296-842 Respirators

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TABLE OF CONTENTS

Figure B-1c Selected Model Procedures and Guidelines, page 2 of 11
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VANCOUVER FIRE DEPARTMENT
ADMINISTRATIVE GUIDE

AG # 200.5

SUBJECT: **Fire Investigator Safety Guidelines**
PURPOSE: **Maintain the safety of Fire Investigators during the investigation of a fire.**
APPROVED: **August 20, 2002**
REVISED: **September 7, 2004**
SEE ALSO: **Vancouver Fire Department Respiratory Protection Program**
PAGE: **1 of 4**

ATTACHED **Investigator Respiratory Protection/Safety Chart**
Phase 3 Decision Logic Chart
Respirator-Selection-Decision Flow Chart
Post-fire site safety hazard evaluation worksheet 200.5.1

Fire Investigators shall adhere to all safety standards as required by the Vancouver Fire Department and the State of Washington, Department of Labor and Industries. This includes the respirator requirements for medical clearance, proper fit testing, and training.

GENERAL REQUIREMENTS FOR ALL FIRES

1) At a minimum, the listed equipment must be worn and used whenever the Fire Investigator is in a hazardous area or hazardous atmosphere:
   - **Coveralls (cotton or fire-resistant) or Brush Gear**
   - **Approved fire suppression foot wear**
   - Approved hand protection
   - Hard hat or firefighting helmet
   - **Eye protection**
   - **Respiratory protection provided by the employer and selected following the decision chart as found in Appendix A for this document**
   - **800 MHz Radio**

2) Upon arrival at the scene, Fire Investigators must report to the Incident Commander (IC) and enter into the Passport Accountability System. If working independently, the Fire Investigator must notify the 911 center (CRESA) of their presence and structure entry time.

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3) When deemed necessary by the IC or Lead Fire Investigator, the Fire Investigator may request additional investigative resources be brought to the scene, and remain on scene until the investigation is completed.

4) Fire Investigators must calibrate all personal air monitoring instruments prior to each use.

5) Fire Investigators must ensure that while operating in all hazardous areas or hazardous atmospheres, personal air monitoring instruments must be turned on, worn on their person and functioning.

STRUCTURE FIRES

1) While in the *hazardous area*, the Fire Investigator shall wear a respirator appropriate for the hazardous atmosphere at all times. The respirator may be in the standby mode.

2) Upon entering a *hazardous atmosphere*, the respirator shall be donned and operating.

3) Phase 1 environments: full turnouts, SCBA (or SAR with a PASS device), shall be worn in all IDLH environments, and the Fire Investigator must be under the direction and control of the I.C. A RIT Team complying with AG #300.9 shall be in place.

4) Phase 2 environments: After the atmosphere has been well-characterized, Phase 2 may be declared and investigators may enter the hazardous area via a 1 IN—1 OUT rule. Fire Investigators must obtain an on-scene, standby employee partner before entering a hazardous area or hazardous atmosphere and shall maintain voice, visual, or touch communication with that partner at all times. The standby employee shall be situated outside the hazardous area and be trained, ready, and equipped to initiate rescue procedures as outlined in WAC 296-842-19005.

A. the Lead Investigator shall ensure the scene is evaluated and documented on the Site Safety Hazard Evaluation Worksheet before investigator entry. Much of this information may come from interior suppression crews and ISO, but a consultation with the IC shall be made by the Investigator.

B. Vancouver Fire Department recommends investigators wear SCBA whenever there is doubt regarding the contamination of the atmosphere at a fire scene. The level of respiratory protection worn by the Fire Investigator must be predicated on the ability to quantify the

45

Figure B-1c Selected Model Procedures and Guidelines, page 4 of 11
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presence of:

- **Oxygen deficient environments (below 19.5% by volume)**
- **Flammable & combustible gases LEL**
- **Carbon Monoxide above TLV/TWA**
- **Other toxic gases, i.e., hydrogen sulphide**

C. Fire Investigator shall use air-monitoring equipment appropriate for the hazardous atmosphere at all times. Any time this equipment alarms, the Fire Investigator must immediately re-evaluate their situation and report the condition to the IC.

- **Wearing SCBA**: The Investigator may remain in the hazard area with slightly elevated levels of CO, if all other indicators remain unchanged AND they report this to the standby employee. For all other monitored increases, the Investigator must vacate the hazardous area immediately and report to the IC or designee.
- **Wearing APR**: the Investigator shall vacate the hazardous area immediately and notify standby employees, or CRESA as the case may be, anytime their air-monitoring equipment alarms.
- Fire Investigators may re-enter the hazardous atmosphere using SCBA or SAR after the atmosphere has once again been deemed safe by the IC. Fire investigators working alone must not re-enter after an air alarm activation until the atmosphere has again been well characterized and all applicable safety procedures followed.

5) Phase 3 environments: Phase-3 entry may occur after a two-party decision process has determined the fire is definitely extinguished and the hazardous atmosphere poses only particulate risk. At a minimum, the Fire Investigator shall don an approved APR and notify CRESA of their address and describe their task. Code-4 checks shall be done periodically at the discretion of the Investigator.

EXTENDED FIRE INVESTIGATIONS

1) Before transferring command to the Investigation Team, the IC will confer with the Lead Fire Investigator on-scene to relate any safety concerns during the continuing investigation; including minimum level of personal protective equipment is worn during the course of the fire investigation.

2) The lead Fire Investigator must assume command.

3) Security and support should be provided to investigators who may remain at the scene after fire crews have returned to quarters.

- Care must be exercised to be aware of weak floors, holes burned in floors, and even the combustible portions of floor assemblies destroyed.

46

Figure B-1c Selected Model Procedures and Guidelines, page 5 of 11
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- Floors may have been weakened so they will not support live loads.
- Unprotected openings may exist in floors, some common to occupancies, some related to overhaul or fire damage.
- If the investigation takes the investigator into areas of the community where dangerous social situations may arise and exist, the Incident Commander must ensure that in these circumstances the fire investigator has access to additional security measures. These measures may include:

  a) Supplementary lighting
  b) Standby fire suppression companies
  c) Law enforcement personnel
  d) Private security officers

DECONTAMINATION AFTER FIRE INVESTIGATIONS

1) Fire investigation personnel exposed to fire product contamination at the fire scene, during the course of investigation activities, should have their PPE lightly sprayed with water with the respirator in place in order to remove contamination.

2) **Secondary decontamination must be performed prior to returning to service: clean helmets, boots, gloves, masks, and all other equipment exposed to contaminants during the course of the fire investigation.**

3) Personnel exposed to fire product contamination must take a shower upon return to quarters.

47

Figure B-1c Selected Model Procedures and Guidelines, page 6 of 11
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Investigator Respiratory Protection/Safety Chart*

Investigator Respiratory Protection/Safety Chart shall be used to evaluate environmental hazards and select the appropriate level of respiratory protection and standby personnel.

48

Figure B-1c Selected Model Procedures and Guidelines, page 7 of 11
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* ***The levels of protection discussed in this table are minimum requirements. The IC or Lead Investigator may assign or request higher levels of protection at any time.***

	PHASE 1 FIREFIGHTING ACTIVE CHEMICAL ENGINE	PHASE 2 FIRE IS OUT TRANSITION STAGE	PHASE 3 CLEARLY STOPPED CHEMICAL GENERATION
Respiratory Hazards	Heat, Toxic Gases, Particulates	Possible Toxic Gases, Particulates	Particulates
Fire	YES	NO	NO
IDLH	YES	NO	NO
Smoke	YES	NO	NO
Ventilation	Start	Yes Continuous	Yes – Establish 6 Air Changes
Air Monitor	NO	YES	YES
Atmosphere is Well-Characterized	NO	YES No LDL O_2 = Exterior CO ≤ 35 ppm Debris <200° F	YES - Continue Monitoring
Respiratory Minimum	SCBA	SCBA or APR	SCBA or APR
Standby Employees	2 - In / 2 Out Implements Immediate Rescue	1 - In / 1 Out Initiates Rescue Procedures	1 – In / 0 – Out 2 – In / 0 – Out

Notes:

8. Carbon Monoxide levels should be similar to ambient air, e.g. ½ the PEL for CO (35 ppm). CO levels much higher than ambient air may indicate the presence of other air contaminates.
9. Air monitoring equipment can detect only a few of many heat decomposition products.
10. Minimize exposure in environments where contents are hot to the touch or steaming. This may indicate the continued release of toxic products.
11. Investigators shall when possible avoid disturbing any materials that might release dust or fibers. Only MSA GME P100® cartridges are approved for use.
12. The characterization survey should attempt to rule out unusual toxic contaminants, however VFD personnel should remember this is always a

Figure B-1c Selected Model Procedures and Guidelines, page 8 of 11
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potential hazard and should abide by the "buddy system" whenever they have doubts.

13. Air purifying respirator cartridges should be replaced after each use, no single use exceeding 4 hours.

CRITERIA	PRESENCE	PHASE 3 POSSIBLE
Occupancy Class	Assembly/Business/Educational Factory/High Hazard Institutional/Mercantile/Storage Miscellaneous Group U	Evaluate
Fire Extinguished, Atmosphere Free of Smoke & Visible Vapors	YES	YES
Smoke--Vigorous	YES	NO
Smoke—Tiny Embers	YES	Evaluate
Visible Vapors	YES	YES if steam, otherwise re-evaluate
Hazardous Process	YES	NO, unless Hazmat fire involvement ruled out
Drug Lab	YES	NO
Identified Containers of Hazardous Substances	YES	Evaluate, NO if involved in fire, container breached
Unidentifiable Materials or Containers	YES	NO
Sealed Structure Recently Opened	YES	Ventilation—6 Air Changes, Re-establish atmosphere is "well-characterized"
Structure Has Been Open & Used by Others	YES	Re-evaluate
CRESA NOTIFIED ADDRESS/TASK	YES	YES

14. Entrant shall exit hazardous atmosphere immediately if any odor is detected inside the respirator face piece.

Phase 3 Decision Logic Chart

50

Figure B-1c Selected Model Procedures and Guidelines, page 9 of 11
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Respirator Selection Decision Flow Chart

51

Figure B-1c Selected Model Procedures and Guidelines, page 10 of 11
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Information under revision; contact source for current updates.)

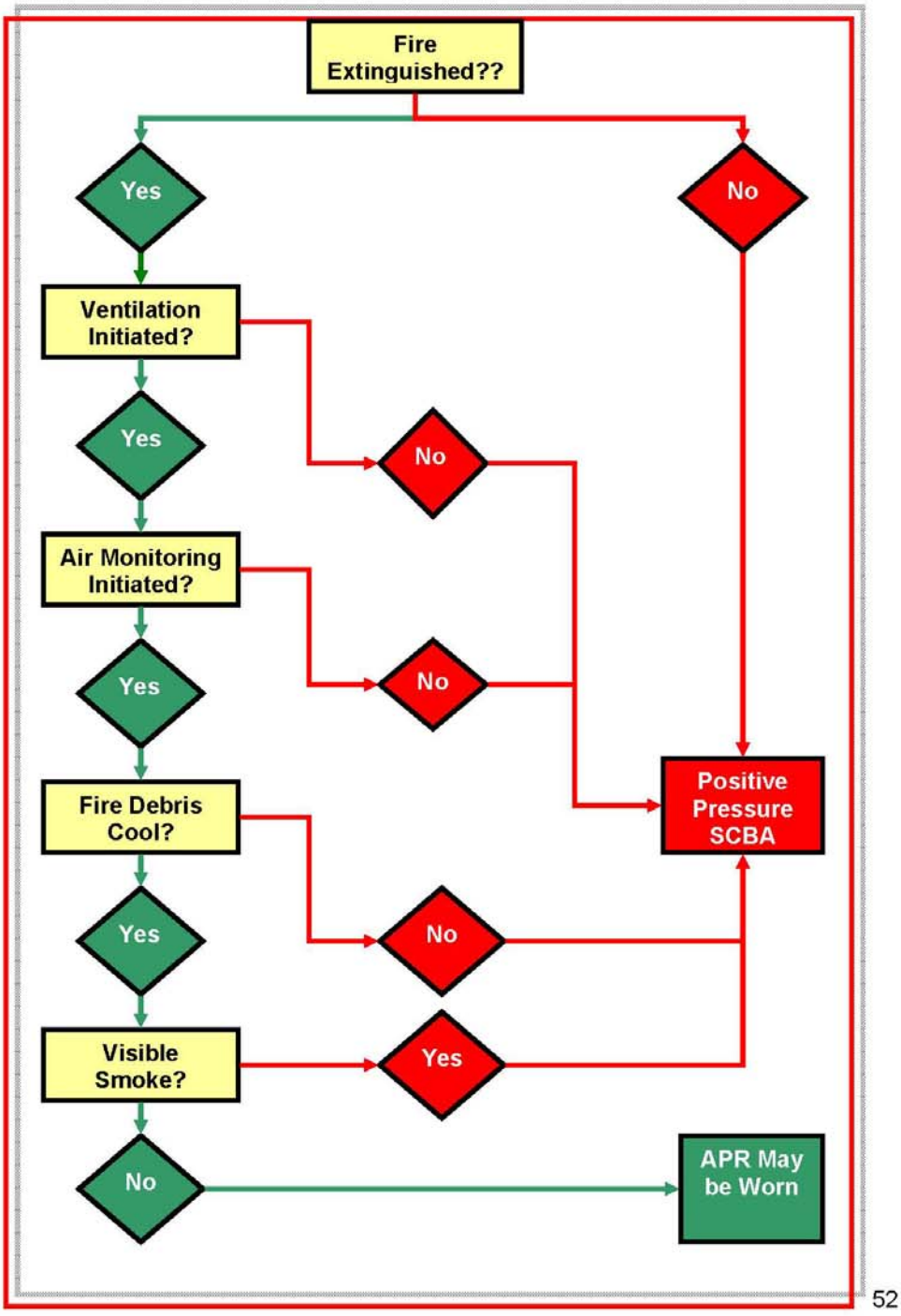

Figure B-1c Selected Model Procedures and Guidelines, page 11 of 11
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Policy F-2
Revised 10/01/05

F-2: Fire Investigator Respiratory Standard

A. The purpose of this standard is to outline the respiratory protection procedures for fire investigators. Since a fire investigation is not an emergency, the investigators respiratory needs are different than those required for firefighting. In reflection of those differing needs, a separate standard is adopted for fire investigations. For any incidents where an investigator needs to be in an atmosphere that has been established as Immediately Dangerous to Life and Health (IDLH) normal firefighter protective gear, including Self Contained Breathing Apparatus (SCBA) shall be used.

B. The normal process for an investigation is as follows. Once the fire is extinguished and overhauled to the point that there are no smoldering fires detected by firefighters, the air quality must be sampled. The purpose of this is to determine the level of protection required for the fire investigators to conduct their investigation. Once the level of hazard is identified, the proper level of respiratory protection can be determined. After donning proper respiratory protection, the investigators may enter the structure and conduct the investigation.

C. Air sampling shall be conducted on any compartment type fire with significant structural and or contents damage. This includes any fires where the products of combustion are held within a space and may accumulate, posing a respiratory hazard to our personnel.

D. While conducting the initial air sampling in the structure, the investigator shall also conduct a general safety survey. This shall include but is not limited to structural stability, holes in floors, sharp objects, electrical hazards, etc. The results of this survey shall be shared with the other investigators working at the scene.

Atmosphere Characterization Instructions

A. The lead fire investigator shall be responsible for ensuring that air monitoring is completed for each investigation. In most cases it shall be the fire investigators conducting the sampling, not the firefighters.

B. Utilizing structural firefighting PPE, including SCBA, survey the building or area to be investigated. Care must be taken to assure that there are no chemical constituents involved in the fire. This would include but is not limited to chemical storage areas, pesticides, large quantities of wool products, paints, enamels, coatings etc. Evaluate area for asbestos containing materials (ACMs) and presumed asbestos containing materials (PACMs). Determine if the fire has been completely extinguished or if overhaul is still in progress. The use of an infrared thermal device will assist in this process. If areas of elevated temperature (greater than 200 F) are present, do not continue any further with this procedure. Use of an SCBA is still required.

Figure B-1d Selected Model Procedures and Guidelines, page 1 of 2
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C. Measure the concentration of oxygen in percent, carbon monoxide and hydrogen sulfide in ppm, and hydrocarbons as % LEL in an open and uncontaminated location - preferably outdoors or in a clean environment for calibration purposes. Document the time and the results. With firefighting PPE and SCBA, proceed to the area where the air purifying respirator (APR) use is desired. Document the atmospheric readings in the air-monitoring log for later comparison.

D. Establish Positive Pressure Ventilation (PPV) to provide 6 complete exchanges of air.

E. After the calculated time required for ventilation has elapsed, re-enter the area with SCBA and PPE and measure for oxygen concentration in percent, carbon monoxide and hydrogen sulfide in ppm, and hydrocarbons measured in % LEL.

F. The following are the requirements to switch from SCBA to APR:

   a. Post PPV oxygen concentration equal to outdoor (calibration) sample.

   b. Post PPV carbon monoxide concentration less than or equal to 35 ppm.

   c. Post PPV hydrogen sulfide concentration less than or equal to 10ppm.

   d. Post PPV lower explosive limit (LEL) reading zero.

   e. Polytec IV tube all clear in the 7 regions.

   f. Once all these conditions are met it is permissible to conduct the investigation using APR's.

G. Approved APR filters are the "dual cartridge" for organic vapors/acid gases/formaldehyde with a clip on hepa filter attached.

H. Work time shall be limited to 6 hours per day when utilizing an APR as your respiratory protection.

I. Any detectable odors inside the respirator will be immediately reported to the safety officer and requires re-evaluation of the atmosphere and/or change out of the cartridges.

J. Cartridges shall be replaced every 3 hours or at the completion of the days work, whichever comes first.

K. Completed Fire Investigation Air Monitoring Logs (Form 369) are to be included with the fire incident report.

L. It is the intent of this policy that fire investigators are properly protected during all fire investigations. The tools and equipment have been provided to the investigation staff for their safety. When in doubt, use caution and select the best protection available.

Figure B-1d Selected Model Procedures and Guidelines, page 2 of 2
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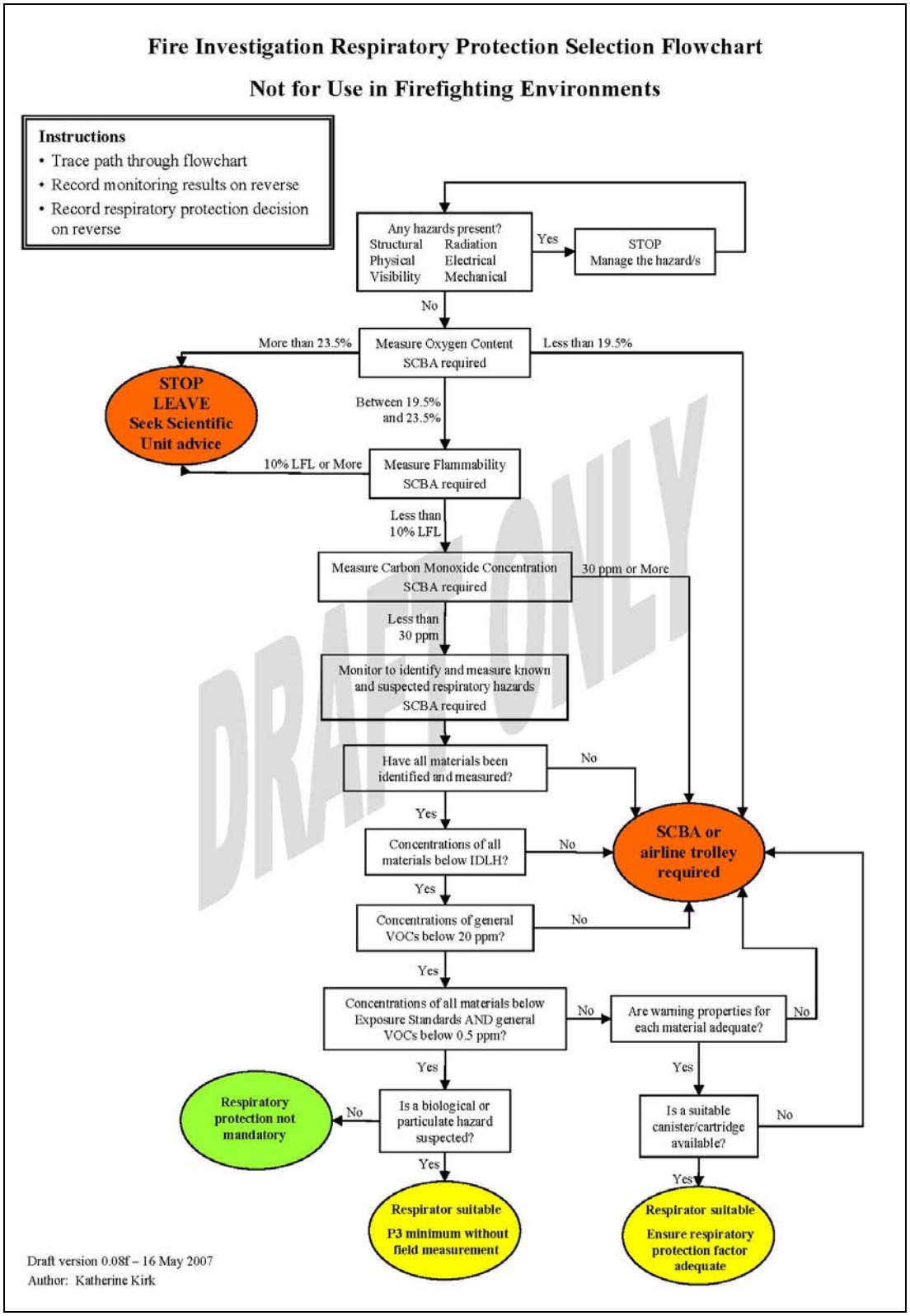

Figure B-1e Selected Model Procedures and Guidelines, page 1 of 2
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Fire Investigation Respiratory Protection Selection Worksheet

DEFINITIONS

Breakthrough: Permeation of a chemical through respiratory protection canisters/cartridges when they reach their capacity.

Breathing zone value: Concentration of a chemical which will be inhaled (e.g. by a person wearing respiratory protection). Must be less than or equal to the **Exposure Standard** for that chemical.

End of Service Life Indicator (ESLI): A feature (e.g. colour change indicator) of some respiratory protection canisters/cartridges that alerts the user to canisters/cartridges nearing their capacity and the need to replace them.

Exposure standard: Airborne concentration which should not cause adverse health effects nor cause undue discomfort to nearly all workers. Time weighted average (TWA) exposure standards refer to an 8-hour working day for a 5-day working week, at normal physical exertion levels.

IDLH: Immediately dangerous to life and health. Airborne concentration that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

Protection factor (PF): Factor by which the airborne concentration of a chemical is reduced when wearing respiratory protection. This value is dependent on the type of respiratory protection and type of canister/cartridge, if applicable.

P2 filter with half facepiece:	PF = up to 10 (particulates only, not gases and vapours)
PAPR-3 filter with full facepiece PAPR:	PF = up to 100
SCBA positive pressure demand:	PF = 100 +

VOCs: Volatile organic compounds. A specific volatile organic compound (e.g. acrolein or benzene) may be present as a chemical hazard, or a mix of VOCs may be present as a result of processes such as combustion.

Warning properties: Properties of the material (odour, taste or irritation) that could warn the user that canister/cartridge breakthrough has occurred. **Adequate** warning properties are those that alert the user **before** inhaled air exceeds the exposure standard.

	Minimum	Maximum	Measurement
Oxygen content (%)	19.5 %	23.5 %	……
Flammability (% LFL)	--	10% LFL	……

Material	Exposure Standard	IDLH	Measurement	Protection Factor (PF)	Breathing Zone Value (Measurement ÷ PF)
Carbon monoxide	30 ppm	1200 ppm	……	……	……
VOCs	0.5 ppm	—	……	……	……
Acid gases (as HCl)	5 ppm	50 ppm	……	……	……
Hydrogen cyanide	10 ppm	50 ppm	……	……	……
Formaldehyde	1 ppm	20 ppm	……	……	……
……	……	……	……	……	……
……	……	……	……	……	……

Type of respiratory protection selected: ……

If respirator selected:

- Does the canister/cartridge have an end-of-service-life indicator (ESLI)? Yes / No
- Has the canister/cartridge service life been calculated for this environment? Yes / No Duration: ……
- If "No" to both of the above questions, the user will be dependent on the warning properties of the material(s) to detect breakthrough.

Warning properties of materials should NEVER be ignored – return to fresh air or replace canister/cartridge IMMEDIATELY

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Author: Katherine Kirk

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