



Fire Investigator Health and Safety Best Practices

June 15, 2018

Contents

Introduction.....	2
Current IAAI Health and Safety Committee Members	3
IAAI Health and Safety Committee Advisory Panel Members	3
Part 1 – Fire Investigator Health and Safety Best Practices	4
Employers	4
Vehicles.....	4
Individual Fire Investigators	4
Enroute to and Arriving at the Incident	5
During the Incident	6
After the Incident	7
Part II – Fire Scene Investigator Precautions and PPE Protection Categories	9
Appendix A – Respiratory Protection Guidelines	12
Appendix B – Decontamination Procedures.....	14

Introduction

Research regarding fire investigator health and safety, and the resulting practice changes, has not kept pace with that of fire fighters and, while some information can be brought from the fire fighter environment to that of the fire investigator, some cannot. In 2016 the International Association of Arson Investigators (IAAI) re-established its Health and Safety Committee with a mission “to promote health and safety knowledge, awareness, discussion, and action among members of the IAAI, its chapters, and the fire investigation community in general.” One of the first steps in this process was to conduct a benchmark survey to determine the current state of knowledge, awareness and practices.

The next step was to develop this best practices white paper that, based on the most current research and information available, identifies the practices that fire investigators and fire investigation companies and agencies/entities should be following, based on the latest research and information available, to ensure the health and safety of all who attend fire scenes. It can also serve as a training guide for companies and agencies/entities that wish to follow the latest fire investigator health and safety best practice guidelines. As new information becomes available, this document will be updated to provide a concise resource of the latest information regarding fire investigator health and safety. By necessity, this document includes many footnotes to further explain certain items. Please take the time to read and understand all the information in this paper.

This document represents almost two years of work by members of the IAAI Health and Safety Committee, assisted by a panel of subject matter experts. It also includes technical information provided by the staff of the U.S. National Institute for Occupational Safety and Health’s National Personal Protection Technology Laboratory.

Accomplishing the committee’s goal of improving the overall health and safety of fire investigators will require a fundamental culture change within the profession. It is understood and acknowledged that every fire scene is different, and no statement or recommendation herein is an absolute; these are all recommendations of how best to do things in most situations.

While this is a stand-alone document, it has a companion educational component. The committee has prepared an IAAI-approved PowerPoint® training presentation that provides in-depth background information regarding many of these recommendations and the hazards present at post-fire scenes. This will be developed into a series of webinars covering this important information and, hopefully, at some point in the future it will become a cfitrainer.net module. For information on this training, please contact the IAAI office.

This document references various U.S. regulations/standards, documents and agencies, as well as some U.K. and international regulations/standards and documents. Readers from other countries should refer to the appropriate similar items for their country or, if none exist, use the U.S. or U.K. ones for reference.

The committee is working on a separate report regarding recommendations for biological surveillance and health assessments for fire investigators. Once completed those recommendations will be published separately.

All listed website links were valid as of the publication date. The committee is not responsible for any broken links after this date.

Some references and citations are given within this document. Other relevant reference documents for this paper are listed on the Health and Safety Committee's resource page of the IAAI website at <https://www.firearson.com/Publications-Resources/Fire-Investigation-Resources/Health-Safety.aspx> In some cases, however, the material here is based on the recommendations of the experts who helped develop this document.

Current IAAI Health and Safety Committee Members

- Chairman: Jeff Pauley IAAI-CFI and FIT, Fire Investigator, Unified Investigations and Sciences, Inc./EFI Global, Inc.; retired Bedford County, Virginia Fire Marshal
- Co-Chair: Dr. Peter Mansi IAAI-CFI and ECT, Partner, Fire Investigations UK; retired London Fire Brigade Borough Commander and Group Manager of the Fire and Arson Investigation Unit; IAAI past president
- Tom Mooney IAAI-CFI and FIT, Deputy Fire Marshal II, Tualatin Valley Fire & Rescue, Oregon
- Captain Michael Brewer IAAI-FIT, Mesa, Arizona Fire Department
- Donald Brucker CFEI and CVFI, Chief Deputy Fire Marshal, Allegheny County, Pennsylvania Fire Marshal's Office
- Tommy Scott, Scott and Associates Investigative Services, Inc., Oklahoma City, Oklahoma
- Gary Hodson IAAI-CFI and ECT, IAAI Director; Senior Fire Investigator, Unified Investigations and Sciences, Inc./EFI Global, Inc.; retired Provo, Utah Police Department investigator

IAAI Health and Safety Committee Advisory Panel Members

- Peter Berger, Captain/Paramedic, Hallandale Beach, Florida Fire and Rescue; National Education Coordinator, Fire Fighter Cancer Foundation, Inc.
- Dr. Jeff Burgess, Associate Dean for Research and Professor, Mel and Enid Zuckerman College of Public Health, University of Arizona
- Dr. Alberto Caban-Martinez, Assistant Professor, Division of Environment & Public Health, Univ. of Miami, Miller School of Medicine
- Cindy Ell, Executive Director, Fire Fighter Cancer Foundation, Inc.
- Kenny Fent Ph.D., Research Industrial Hygienist, CDC/NIOSH/Division of Surveillance, Hazard Evaluations, and Field Studies
- Dr. Sander Orent, Occupational Medicine Specialist, Broomfield, Colorado

Part 1 – Fire Investigator Health and Safety Best Practices

Employers *should*:

- Have written policies covering all aspects of fire investigator health and safety, including but not limited to:
 - Conducting a site safety survey before starting every fire scene investigation, and at the start of each day it continues.
 - Specifically addressing environmental, biologic and chemical/toxic hazards.
 - Personal protective equipment (PPE) ensemble definition, requirements, and use.
 - A respiratory protection program that addresses (U.S.) 29 CFR 1910.134.
 - See Appendix A for additional information regarding respiratory protection.
 - When to use respiratory protection equipment¹.
 - Identifying the support mechanisms necessary to have on site whenever SCBA use is required.
 - The transportation of contaminated tools/equipment and PPE.
 - Decontamination procedures.
 - See Appendix B for additional information regarding decontamination.
 - Cleaning of contaminated clothing.
 - Regular/annual physicals/health checks.
- Provide employees with an annual physical.
- Provide employees with annual skin screening.
- Have a program for employee mental health awareness and support.

Vehicles

- Containers of collected evidence, and soiled/dirty tools and clothing *should* all be stored in an area other than the vehicle's passenger compartment or trunk/boot.
 - If this is not possible, use tight-sealing tubs/containers for anything that could be contaminated.

Individual Fire Investigators *should*:

- Maintain a healthy lifestyle.
- Be physically fit and able to perform the job, to include being fit tested on assigned respirators and being able to safely wear and doff an open circuit pressure demand SCBA when necessary.
- Have an annual physical.

¹ While respiratory protection equipment is a part of the full PPE ensemble, because of its importance it is listed separately in this document. What is proper is defined by the situation as found by the fire investigator, using the guidelines established by your employer's competent decision maker or, if self-employed, using the information and resources identified herein.

- Because the fire investigation profession could present an increased risk of skin cancer, have an annual skin check, preferably by a dermatologist.
 - If there is or has been a prior positive skin exam, these may need to be done more frequently.
- Immediately clean and bandage any skin area that gets a cut or abrasion.
 - Any existing cut or abrasion should be bandaged before starting the scene examination.
- Maintain a written log of every scene examination that includes at a minimum:
 - Date, location and nature of each incident.
 - The number of hours spent at the scene.
 - Notations of the presence of any hazardous condition, or any injury or unprotected exposure possibility.

Enroute to and Arriving at the Incident

- While it's important to know where you are going, the best route of travel and the weather conditions that may be encountered, it is also important to drive safely so that you can arrive at the incident scene in a timely fashion and do your job in a more relaxed and positive state of mind.
- Know about and understand the type of scene you are responding to before you go.
 - Ask any necessary questions to gain a full understanding.
- If this is still an active fire scene, check in with the incident commander first.
 - Ask about any known safety concerns/issues.
- Conduct a site safety survey of the entire scene before beginning any work and at the start of each subsequent day there.
 - Include checking for the presence of hazardous materials, including asbestos, and physical and biological hazards.
- Verify the status of all utilities prior to entering any structure.
 - Use a lock out/tag out system and procedures for electrical systems as necessary.
- Ensure that you are wearing proper PPE² for the incident before approaching the scene for any reason, including an appropriately selected respirator that is approved by the regulatory authorities of your country for fire scene entry.

² Defined as PPE manufactured and evaluated to a known scientific standard of performance (i.e. ANSI, ASTM, ASSE, NFPA, NIOSH, EN, etc.). Specific information regarding respirator selection is found elsewhere in this document.

During the Incident

- Use air quality monitoring during all interior and exterior examinations³.
 - Understand monitoring limitations, detection ranges, interferences, maintenance and sustainment requirements.
 - Monitor CO (carbon monoxide) and HCN (hydrogen cyanide) at a minimum.
 - H₂S (hydrogen sulfide) and LEL (lower explosive limit) are also good.
- Use powered ventilation fans to physically move ambient air and propel contaminants downwind from the investigation scene. For gases and vapors, ventilation is your friend.
- Wear appropriate PPE for the incident you are attending; every scene is somewhat different. This includes:
 - Steel-toed leather or rubber boots/shoes⁴ with a puncture-resistant sole, understanding the limitations of each type.
 - Disposable Tyvek® suit with hood⁵.
 - If these are not available, wear fire retardant coveralls or long pants and a long sleeve shirt.
 - The goal here is to prevent the skin absorption of hazardous chemicals.
 - Protective safety helmet that meets or exceeds ANSI Z89.1-2014 for industrial use, with a chin strap.
 - Hearing protection that meets or exceeds ANSI A10.46-2013
 - Proper respiratory protection equipment for the situation as found.
 - See Appendix A for additional respiratory protection information.
 - Vented goggles if wearing a half-mask respirator.
 - Disposable outer gloves and nitrile inner gloves.
 - Ensure that all PPE technologies in use can be pre-determined as being compliant to existing standards development organization published technical standards.
- Have a process where someone knows where you are and what you are doing.
- Conduct all scene examinations with at least two persons⁶ unless the status or nature of the scene indicates that it is safe for one person.
 - Whenever a single investigator is present, have a plan in place where you are checked on regularly but no less frequently than every half hour.

³ At present it is unknown how long gas, vapor and particulate hazards persist post-fire, however, disturbing the scene in any way and at any time post-incident can stir up and make particulates airborne and/or release trapped gases and vapors, thus requiring the use of proper PPE including certified respiratory protection.

⁴ Rubber boots can pick up static electricity that will attract particulates but are easier to clean. Leather boots may absorb certain chemicals and can be harder to clean. It would be best to have a pair of each and determine appropriate use based on the scene circumstances found.

⁵ Users should recognize that these are not fire retardant and therefore should not be worn at any scene where fire re-ignition could occur.

⁶ While having two or more persons at a scene is desirable, it is recognized that this is not always possible. However, it is also not necessary that this second person be a fire investigator. It could be a fire fighter, neighbor, the property's owner or tenant, or anyone who could alert others should the fire investigator become injured or incapacitated.

- Take regular breaks as needed, well away from the fire scene.
 - If you are going to eat or drink anything, remove all PPE and wash hands and face with soap and water, cleansing wipes or a waterless cleaner⁷.
 - All nitrile gloves and leather/canvas gloves and similar are one use and done. In addition to any evidence collection requirements, these need to be replaced each time they are removed.
 - The use of SCBA, high temperatures and/or humidity, and/or extensive digging may necessitate more frequent and/or longer breaks and hydration.

After the Incident

- Following proper doffing/de-robing procedures (see Appendix B), immediately remove all PPE:
 - Place all disposable items in a minimum 4 mil thick plastic bag, seal it with duct tape or similar and dispose of it properly.
 - Do not leave this bag at the scene unless you know that it will be properly disposed of by a remediation company.
 - Place all to-be-cleaned clothing items in a minimum 4 mil thick plastic bag and seal it with duct tape or similar.
 - When this bag is reopened you should be wearing gloves and proper respiratory protection.
 - It is best to open this bag in a well-ventilated area or outdoors to allow any volatile substances to evaporate before handling the contaminated items.
 - These items should be decontaminated and washed as soon as possible (see below for additional information).
 - Close and seal the empty bag to prevent any further exposure or contamination.
- Using soap and water or cleaning wipes, clean all skin areas that may have been exposed to soot contamination (see also footnote 7).
- Clean tools and respirator assembly⁸ immediately after use with an approved cleaning agent⁹ and water and before returning them to your vehicle.
 - If this is not possible, store them out of the vehicle's passenger compartment and trunk/boot.
- Do not transport dirty tools and/or contaminated clothing or PPE, or evidence containers containing samples in your vehicle's passenger compartment or automobile trunk/boot.
 - Remove all outer clothing using proper methodology (see Appendix B).
 - Replace contaminated footwear with clean before entering vehicle, or
 - Thoroughly clean footwear before entering vehicle (see Appendix B).
 - If this is not possible, place all items in a sealed container.

⁷ Ensure that the use of wipes and cleaners is in accordance with the manufacturer's specified surface contact times.

⁸ Follow the respirator manufacturer's user instructions for cleaning and maintenance of the respirator. For example, alcohol wipes should not be used as they can degrade the facepiece material over time.

⁹ See "An Examination of Decontamination Procedures," Fire and Arson Investigator, July 2017 for additional information.

- Do not enter, or allow others to enter, your vehicle's passenger compartment unless ALL potentially contaminated clothing has been removed and all exposed skin areas have been cleaned.
- While disposable coveralls are preferred, do not wash contaminated clothing in your personal washing machine if possible.
 - Use an extractor-type washing machine (found in many fire stations), or
 - Use a commercial laundry/dry cleaner and tell them that the items are contaminated.
 - Do not use local laundromat machines.
 - If a personal/home washing machine must be used, wash fire-contaminated clothing articles by themselves. When finished, run an empty complete wash cycle with soap.
- Follow industry-established decontamination procedures for tools, PPE and other contaminated items.
 - See Appendix B for additional information regarding decontamination.
- As soon as possible, take a shower to clean any particulates from your hair and skin.

Part II – Fire Scene Investigator Precautions and PPE Protection Categories

All fire scenes have the potential for being unsafe in many ways and the proper use of PPE and safety procedures can mitigate these risks. However, many fire investigators do not fully understand and appreciate the health risks associated with fire investigations. To help fire investigators understand the precautions that should be taken at the various types of fire scenes, a hazardous materials-style, time-based scene classification system is offered to denote the various stages of fire scenes, from an investigative perspective, to help fire investigators know the PPE safety measures needed.

It is understood and acknowledged that every fire scene is somewhat different, and it is difficult to make across-the-board recommendations or requirements. However, the health risks associated with fires are broad-based and apply to almost every fire situation¹⁰. Likely one of the most misunderstood concepts has to do with particulates. Some investigators believe that if they don't see any particulates in the air then things are OK. However, very small particulates (< 5 micrometers in size) are invisible to the naked eye, and these particles can penetrate deep into the lungs where clearance mechanisms are less effective and where inflammation and systemic absorption can occur. Repeated exposure to these small particles could lead to chronic health conditions down the road.

THE PPE listed here is more fully described in Part I above. Additional respiratory protection equipment information is found in Appendix A.

HOT SCENE A – *A fire scene where the fire has been extinguished but overhaul has not yet commenced or is in progress.*

In this situation fire investigators sometimes need to enter the structure or scene after consultation with the incident commander to identify those areas that can be overhauled and those areas, usually the probable area of fire origin, where overhaul should either be limited or not done at all.

While it is strongly recommended that fire investigators not enter fire scenes during this period, the fire investigator is usually only entering to make a quick, initial determination and possibly take some initial photos, and should be wearing the following PPE.

- Turnout gear, including bunker pants and coat, structural fire fighter helmet, structural fire fighter boots and structural fire fighter gloves.
- Proper respiratory protection equipment offering the below NIOSH (or similar in other countries) awarded protection:
 - SCBA as a primary technology with the ability to downgrade to APR, PAPR or ½ mask after site characterization and determination of an accurate maximum hazard ratio, and with tight fitting full face mask with a minimum of P100/OV/FM/CL (multi-gas/vapor) canisters or serviceable CBRN Cap 1 canisters.

¹⁰ See International Agency for Research on Cancer, Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 98 (2010) <http://monographs.iarc.fr/ENG/Monographs/vol98/mono98-7.pdf>

- Work duty coveralls or similar underneath turnout gear to aid in self decontamination.

Note 1: In virtually every instance of this type, the fire investigator is working for a public fire agency. Private fire investigators are typically not at a fire scene during this period.

Note 2: Fire investigators should only enter scenes that have not yet been fully extinguished under the most extenuating circumstances, and then only when wearing full structural fire fighter PPE and SCBA.

HOT SCENE B – *A fire scene that has been fully extinguished less than two hours*¹¹.

Regardless of the amount of ventilation, these scenes are very dangerous for fire investigators because of the potential for high levels of gases and particulates (e.g., smoldering items). It is strongly recommended that fire investigators not enter fire scenes to undertake any investigative actions during this period. If there is a need to enter, fire investigators should limit their actions and time in the scene while following a vetted respirator selection logic (i.e. (U.S.) NIOSH Respirator Selection Logic 2004: <https://www.cdc.gov/niosh/docs/2005-100/pdfs/2005-100.pdf>) and wearing the below PPE.

- Turnout gear, including bunker pants and coat, structural fire fighter helmet, structural firefighter boots, or
 - Coveralls (preferably disposable with hood) that completely cover the arms and legs. As noted in Part I, these should not be worn if there is a chance of fire re-ignition.
 - Helmet with chin strap.
 - Boots with steel toe and puncture-resistant sole (see footnote above)
- Respiratory protection
 - SCBA (see U.S. OSHA <https://osha.gov/Publications/3352-APF-respirators.pdf>) or
 - Other proper respiratory protection equipment as identified in Appendix A.
- Structural fire fighter gloves, or disposable leather gloves with nitrile gloves underneath

WARM SCENE – *A fire scene that has been fully extinguished at least two hours but less than 72 hours.*

This is the typical time period when many public investigator fire scene examinations are conducted. But it is also the time when a significant particulate and gas/vapor exposure hazard exists. All fire investigators conducting any type of examination within the fire scene during this period should wear the below PPE and be aware of or have immediate access to environmental monitoring data stay times, escape times and time weighted averages of toxic industrial chemicals (TIC) while on scene.

- Coveralls (preferably disposable with hood) that completely cover the arms and legs.
- Helmet with chin strap.
- Boots with steel toe and puncture-resistant sole.

¹¹ The 2011 Tualatin Valley Fire & Rescue study by Weiss and Miller indicates that ventilation is typically a hazard mitigator with a one-hour minimum post extinguishment. Because definitive post-fire toxic hazard testing has not been conducted, a two-hour minimum is recommended.

- Proper respiratory protection equipment as identified in Appendix A.
- Disposable leather gloves with nitrile gloves underneath.

Note 4: The 72-hour threshold is used here because the Tualatin Valley study cited in footnote 11, and the Nelson study have shown that some gas residue can be present at some fire scenes for as long as 72 hours. Should future research amend this number then this may be changed accordingly.

COLD SCENE – *A fire scene that has been fully extinguished for at least 72 hours and not generating detectable or visible dust, fumes, mists, particulates, gases, vapors or aerosols.* Current research indicates that particulate and gas hazards are greatly reduced after 72 hours, when debris is not disturbed. However, when moving fire debris or digging of the scene occurs, particulates are introduced into the localized air and gas pockets can be released, thus creating a health hazard for the fire investigator. Even the mere act of walking through a scene post-fire can create this hazard. While certain situations may warrant a cursory, unprotected look at a scene, fire investigators conducting any type of examination within the fire scene during this period should wear the following PPE and address the rehabilitation/recovery needs of fire investigators.

- Coveralls (preferably disposable with hood) that completely cover the arms and legs.
- Helmet with chin strap.
- Boots with steel toe and puncture-resistant sole.
- Proper respiratory protection equipment as identified in Appendix A.
- Disposable leather gloves with nitrile gloves underneath.

Appendix A – Respiratory Protection Guidelines

The United States Department of Labor, Occupational Safety and Health Administration, has a tool on their website to assist with proper respirator selection and related information at <https://www.osha.gov/SLTC/etools/respiratory/index.html>. One of the information subsets provided discusses the employer’s responsibility to conduct an exposure assessment. “Employers must make a ‘reasonable estimate’ of the employee exposures anticipated to occur as a result of those hazards, including those likely to be encountered in reasonably foreseeable emergency situations, and must also identify the physical state and chemical form of such contaminant(s).” This includes an identification of the respiratory hazards that could be present.

While it is known that some hazards, such as particulates, will be present at virtually every post-fire scene, we don’t know their precise make-up and typically don’t know exactly what gas and/or vapor hazards might be present unless extensive sampling is done. While sampling is the “gold standard” of hazard detection, it is often not practical in these situations. There are other alternatives:

- *“You can use data on the physical and chemical properties of air contaminants, combined with information on room dimensions, air exchange rates, contaminant release rates, and other pertinent data, including exposure patterns and work practices, to estimate the maximum exposure that could be anticipated in the workplace.*
- *Data from industry-wide surveys by trade associations for use by their members, as well as from stewardship programs operated by manufacturers for their customers, are often useful in assisting employers, particularly small-business owners, to obtain information on employee exposures in their workplaces.”*

From https://www.osha.gov/SLTC/etools/respiratory/change_schedule_exposure.html

Although there is ample information that identifies the many harmful gases and vapors that could be present at a post-fire scene, very little research data exists today regarding the actual composition and amounts, and there are so many scene variables that definitive numbers may be very hard to come by. The IAAI Health and Safety committee is working to conduct studies that will help identify the presence and levels of gases and vapors in the post-fire environment and at some point in the future this information will help with respirator selection. Until then the OSHA website says that, *“you should account for potential variation in exposure by using exposure data collected with a strategy that recognizes exposure variability, or by using worst-case assumptions and estimation techniques to evaluate the highest foreseeable employee exposure levels. The use of safety factors may be necessary to account for uneven dispersion of the contaminant in the air and the proximity of the worker to the emission source.”*

Even with this information, deciding on the best respirator solution for fire investigators can be challenging. To use the OSHA respirator selection advisor genius software, you must know the several workplace parameters, two of them being the OSHA permissible exposure limit (PEL) and the maximum exposure level (TWA) in the workplace of a single contaminant and its physical state: gases, vapors and particulates.

(See https://www.osha.gov/SLTC/etools/respiratory/advisor_genius_nrdl/work_categories.html)

This of course requires the identification of specific items which, as discussed above, is very challenging in the post-fire environment.

In the U.S., OSHA regulations require that a competent decision maker determine the best respirator for employees to use based on recognized hazards. Based on the best information presently available regarding the potential hazards to fire investigators, the IAAI-recommended minimum respirator assembly to be used is either a half or full facepiece with P100/OV/AG^{12,13} filters at a minimum¹⁴. NIOSH rated CBRN Cap 1 canisters can also be used for fire scene examinations when specified by policy, the incident commander or lead fire investigator and used as subcomponents of industrial respirators. In the U.K., based on the information in Health and Safety Executive Guidance 53 the recommendation is the P3 filter and appropriate gas filter. SCBA (an open circuit, pressure demand, self-contained breathing apparatus respirator) is required by the U.S. and U.K. if it is necessary to enter an IDLH (immediately dangerous to life or health) environment, which includes the post-fire overhaul phase.

Respirator users and competent decision makers should read the relevant literature and information available at the website of the NIOSH National Personal Protective Technology Laboratory (<https://www.cdc.gov/niosh/nppt/>) regarding respirator approval standards, respirator recognition, and access to the NIOSH certified equipment list when developing procedures to validate a written respiratory protection program based on U.S. Department of Labor, OSHA requirements.

Workplace administrators charged with writing and managing written respiratory protection programs play a vital role in working with management personnel on the use of engineering controls to eliminate the airborne respiratory hazards, and if not able to eliminate them, control them by implementing feasible engineering controls, workplace environmental sampling and monitors, administrative signage/area restrictions and as necessary introducing workplace specific personal protective technologies and equipment designed to lower the potential or actual exposure of assigned workers.

A field sample of a written industrial respiratory protection program can be found at the following link:
<http://www.radford.edu/content/dam/departments/administrative/ehs/Respiratory%20Protection%20Program.pdf>. This is an evolving document that is tailored to a specific workplace and demonstrates a concerted effort to address all the known and implied variables present. It also shows how perishable the information is/can be if the document responsibilities are not revisited, reevaluated, improved, and republished over a known period.

¹² P100/OV/AG is a respiratory protection filter that removes 100% of particulates down to .3 microns (also known as HEPA or high efficiency particulate air filter) in combination with protection for organic vapors (OV) and acid gases (AG). Organic vapors typically refer to liquids that evaporate quickly (hence giving off vapors) and are petroleum based. Examples include solvents in paint, nail polish remover and gasoline. An acid gas is any gas that contains significant amounts of acidic gases such as carbon dioxide or hydrogen sulfide.

¹³ There have been adverse respiratory effects while wearing P100/OV/AG cartridges during overhaul (Burgess et al., 2001), with a likely cause being formaldehyde breakthrough (Anthony et al., 2007). SCBA should be used by fire investigators who must enter a fire scene during the overhaul phase.

¹⁴ 29 CFR 1910.134 (OSHA) and 42 CFR 84 (NIOSH)

Appendix B – Decontamination Procedures

In addition to cleaning and decontaminating tools after every scene exam use, it is also sometimes necessary to decontaminate (decon) investigative personnel at fire scenes. There are two types of decon situations that fire investigators must be aware of:

1. Persons entering the scene who may contaminate it (IN)
2. Persons leaving the scene and are contaminated from the scene contents (OUT)

These recommended procedures or similar should be implemented for the investigation of all fatal fires, arson fires and any other fire scene where dictated by the circumstances of the post-fire scene. The incident commander or lead fire investigator should determine when these procedures are necessary and implement them accordingly.

IN Procedures

Each person entering each fire scene hot zone¹⁵ must wear new gloves, disposable coveralls or other approved clean outerwear, and any other necessary pristine PPE. In those instances where the possibility of scene contamination exists, all persons entering the scene should clean their boots, using the below procedures, immediately prior to entering. The lead investigator/scene manager is responsible for determining if this procedure is necessary and, if so, ensuring that the decon station is in place and properly used prior to anyone entering to ensure that all items are either new or fully cleaned to prevent any cross contamination. (If this procedure is used it is to be documented in the investigation report and photographed.)

- If the ground is dry, set up two buckets or similar containers filled with water. To the first bucket add the recommended amount of cleaning solution¹⁶. Using a poly fiber, long-handle brush or similar, each person cleans their boots in the first bucket, rinses them in the second one, and then enters the scene.
 - It will likely be necessary to regularly rinse and refresh one or both buckets.
- If the ground is wet, it may be necessary to place a tarp under these buckets and to add a pre-rinse bucket in the first position. If used, the wet tarp will be slippery, and users need to exercise caution.

OUT Procedures

The decon procedures to be used after exiting a fire scene vary depending on the situation.

At crime scenes, including all fatal fires, it is strongly recommended that a decon station be established at the hot zone exit point. This process requires the assistance of additional people. While there are specific methodologies for this process in HazMat literature, a detailed discussion of this process is outside the scope of this document.

¹⁵ For the purposes of Appendix B, a fire scene hot zone is defined as that portion of the scene that includes the structure or similar burned area and any adjacent debris field/area, and to which access is restricted to only those required to enter. It should be visually defined/outlined with red scene tape. The fire scene warm zone includes that area immediately outside the hot zone of sufficient size and shape to limit exposure to contaminants and shall contain the necessary decon areas. Access to this area is limited to decon personnel and those accessing the hot zone. It should be defined/outlined with yellow scene tape. The cold zone includes all areas of the scene outside the warm zone.

¹⁶ See Evans, M. and S. Trimber, “An Examination of Decontamination Procedures,” Fire and Arson Investigator, July 2017, pp 10-15 for additional information regarding effective cleaning products.

For all other fire scenes, decon, which includes doffing/de-robing should be done away from the immediate scene and away from your vehicle, in this order:

1. Tools:
 - a. Wash tools using a bucket of clean water containing the recommended amount of cleaning solution, scrubbing with a poly fiber or similar brush for at least 30 seconds and then rinsing in a bucket of clean water or with a hose, or
 - b. Wipe them down with a damp cloth* or allow them to air dry; see step 13
 - c. Properly dispose of the dirty water
2. Remove outer gloves and place in trash bag
3. Take off helmet and wipe it off with a damp cloth*
4. Gently remove hood portion of Tyvek® suit**
5. Gently unzip the suit and pull out arms. Roll down the suit with the inside out, to the top of boots
6. Remove boots
7. Remove suit and outer gloves and place in a trash bag
8. Clean boots using the same procedures as for tools; see step 13
9. Remove goggles and then respirator, taking care not to cross contaminate facial areas in the removal, and wipe them off with a damp cloth*
10. Remove inner gloves and place in trash bag
11. Close and seal the trash bag
12. Put on any clothing necessary to travel
13. Place tools, boots and trash bag in vehicle's utility area

* If you are going to dispose of these used cloths they go in the trash bag before step 10. If you are going to wash and reuse them, place them in a separate bag that goes in your vehicle's utility area. Follow the best practices cleaning information.

** If wearing something else, such as coveralls, a structural firefighting ensemble, or long pants and a long-sleeved shirt, substitute as appropriate following the same steps.