HAZMAT HQ™ Digital Magazine

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CHATROOM

A Year in Review: Gratitude from the Editors of Hazmat HQ Digital Magazine

As we close another successful year, we—Bob Coschignano, Mike Bloski, and Derek Schaumann—would like to take a moment to reflect on the incredible journey we've shared with you, our valued contributors and readers, through *Hazmat HQ Digital Magazine*. Your unwavering support, dedication, and engagement have been the driving force behind our success.

To our contributors, thank you for your expertise, creativity, and commitment. Your articles, insights, and ideas have enriched our publication and helped us elevate the hazmat community to new heights. Whether you shared the latest trends, innovative practices, or lessons learned in the field, your contributions have been vital in fostering a culture of learning and collaboration.

To our readers, your enthusiasm fuels our mission. Your feedback, questions, and discussions inspire us to continue delivering content that informs, educates, and connects. Seeing our community grow and thrive has been the greatest reward for all the work we put into this magazine.

As we enter the holiday season, we want to wish you all a joyous, healthy, and safe time with your loved ones. Let this be a season of gratitude, reflection, and renewal.

Thank you for making Hazmat HQ Digital Magazine a trusted resource and community.

With heartfelt thanks and warm wishes,
Bob Coschignano, Mike Bloski, and Derek Schaumann
Editors, *Hazmat HQ Digital Magazine*


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HAZMAT CONFERENCE
The Southern Most HazMat Conference
FEB 3 - 5, 2026
KEY WEST, FL
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Simulation Training

By: Armando "Toby" Bevelacqua

District Chief Retired (SOC) City of Orlando Fire Department

This month's article on virtual simulations comes from a friend of mine that asked about the validity of its use in the classroom, my very general answer was absolutely. With a few caveats! So, I would like to tackle this issue from several angles.

First is the how. How are we going to use this technology and the concepts of learning in the classroom. Second is the variety of what can be called simulations and third is cost value

Now we can't get into very deep specifics here as each one of the bullet points below have a

plethora of information from which I could write. Several chapters could be written, and in actuality I and my co-author did write a book on computer simulations and how to use them, along with six actually computer simulations that can be used effectively within the classroom (https://www.redhatpub.com/copy-of-tss). But what we are going to do here is just skim over the salient points of simulations in general.

I have been using simulations in the classroom for over 30 years, some have been as simple as giving the student a problem and as they are developing a strategy to address the problem I throw in an additional issue through the use of hyperlinked PowerPoints, cards, or any other descriptive reference. Others have been as complex as building and developing virtual reality simulations with oculus head gear and everything in between.

So, here we are going to define simulations for this article as this:

1. Tabletop or basic equipment simulations. This would include, iPad or other mechanical device displaying some sort of actionable information, A PowerPoint slide deck with hyperlinks that introduce problems, or QR Codes that the student has to engage with.

2. Game board activities which may include cards dice or functional directions for an educational outcome. Here the activity may be a product of a direction that a QR code gives, or a question from PowerPoint. Or even a board game style decision making activity.
    These are computer programs, virtual reality or augmented reality. Where the interaction is highly visual dependent with injects at the appropriate time frames.

Whichever one you use one thing is constant you must have educational objectives. What I have been seeing lately are companies that come up with some really great stuff and have a lot of glitz and glamour trying to sell the product but upon questioning them about objectives it's the deer in the headlights look

and a comment of what do you mean, why would I need that?

Learning comes in a variety of packages and each package must be acquired in a very specific order. We as humans learn best by watching, doing and repeating. Take an EMS procedure, or a Fire activity. The first thing I must display to you is the didactic, the facts, the reason for the procedure. It could be, in our example as simple as opening a patient's airway, or on the fire ground laddering a building when there are openings already there! So, in each There is a why. Why do I need to maintain an airway, well so the patient can breathe or so you can breathe for the patient. Why do I need to ladder a building during fire conditions? So that the inside crews always have a means of egress even when they

can’t get to the front door. These are the whys. Everything we learn has the whys.

The next step is for me to demonstrate the activity, or the procedure. Identifying the correct way to carry out the process, and then for you to perform the procedure correctly and repetitively so that you have proficiency in the skill. This is how we learn in a nutshell!

So where do simulations come into play. Take air monitoring, or wet chemistry. In both I have to tell you how things work and what to look for. I can do this by showing you slides in PowerPoint and move on. Or I can say let’s play a game, I am going to give you a chemical and you use pH paper on it. Now I am engaging you in the lecture. You take the pH paper, and you see that it turns a bright red. Now I can start discussing acids, and vapor migration as two

examples. We move onto bases, oxidizers, and each step of the way I explain what you are seeing. Now I will give you different chemicals and I ask you to characterize these chemicals. You have already performed all the wet chemistry tests so now you are repeating what I have already shown you and what you have already done.

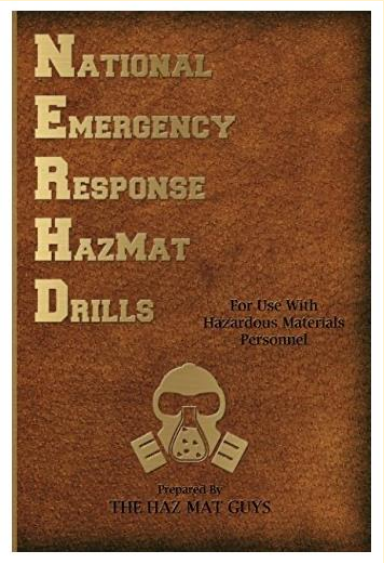
This style of teaching takes time to develop and from the instructor's perspective they must know the material hands down. This is not for the new instructor that reads portions of PowerPoint. This is a creative way to share information in a dynamic style. A style that will get the student involved. The book that I spoke about earlier "Tactical Skull Sessions" does just that it gives the instructor a platform by which

the instructor can engage the student into case study scenarios focused on air monitoring.

Basically, simulations are scenarios that you can set up in the classroom to explain a concept, procedure or activity in a repeatable fashion. If we had to perform an air monitoring procedure at the training ground, it would take time and when learning the new skill not repeatable quick enough to learn the process. Using simulation, you learn over a short period of time the ins and outs of the procedure so when you are at the training ground and the training department is evaluating you, you now have performed the procedure often enough for levels of proficiency.

The second part of our question is the simulation itself. Here it is truly up to the instructor to give the time to come up with activities that strengthen the procedure that was just learned. You can do your own activities based upon the materials that you are teaching. QR codes are very effective. The ability to have a video, PDF, or small slide show in the cloud and the QR code is the access point, is an engaging way to deliver information such as SDS during a simulated incident. A hyper linked scenario with pictures also can be quite effective. Within the power point you have meter readings that change as the scene unfolds.

The HazMat Guys have a book on HazMat drills, 50 easy to perform skills that can enhance your lecture delivery



Now let's talk about cost. Obviously the QR codes, the PowerPoint slide decks, the hyperlinked simulations all are very inexpensive to complete. It is only a time investment that you as the instructor is willing to make. And I can tell you are very effective in the classroom. I have created games, board games, and card games these also have a time investment, and depending if you print these things out on your own or find a printer to make your idea impressive (the cleaner the game of presentation looks the better the buy in from your students) can range in the neighborhood

of $35 – $250 dollars. There are many good printers that you can find on the internet that can do some remarkable work. The only downside is you have got to deliver the product camera ready which means a good background in photoshop, InDesign, illustrator would be very helpful.

If you are looking at iPad, mechanized platforms, these can range from about $350 for an iPad to $17,000 for a simulator that mimics an air monitor. I have an iPad that I use in many of my classes. On these devices I have downloaded PDF's specific to the class. Each group has an iPad and must come up with the solutions to the problems that I project onto a screen. What I have in QR code I have also placed in these iPads for those areas that have weak or no internet.

Now the Coup de grâce, computer programs. Let me say this, these are fancy and have A LOT of eye candy, but buyer beware these typically come with a multitude of issues. Not to mention the learning objectives which for the most part you would have to develop around the simulation that comes with the program. These hover in the neighborhood of $150,000 – $1.5 million dollars depending on the level of sophistication within each simulation and how many simulations you purchase. So, the question is, can you make these on your own? The quick answer is yes. But if you are going to do it the time commitment is extremely high and the learning curve even higher. I have built augmented reality simulations, and virtual reality simulations along with straight computer game style simulations. Do they

work in the classroom, absolutely, but you better have your objectives lined up and the understanding of what you want to deliver as you can get off track very easily. https://drive.google.com/file/d/10WinAsgN3RBszYqhM45udhYczTsUsgnH/view?usp=share_link

So, the answer is yes, simulations work incredibly well in the classroom. However, you must spend the time to create these masterpieces of learning. They are not easy and can be a time warp, losing hours for every simulation you prepare. But you must start somewhere and why not make it now. I hope that this article, if nothing else, has given you inspiration on the development of your own

simulations for your teaching style and topic. Have fun with it.

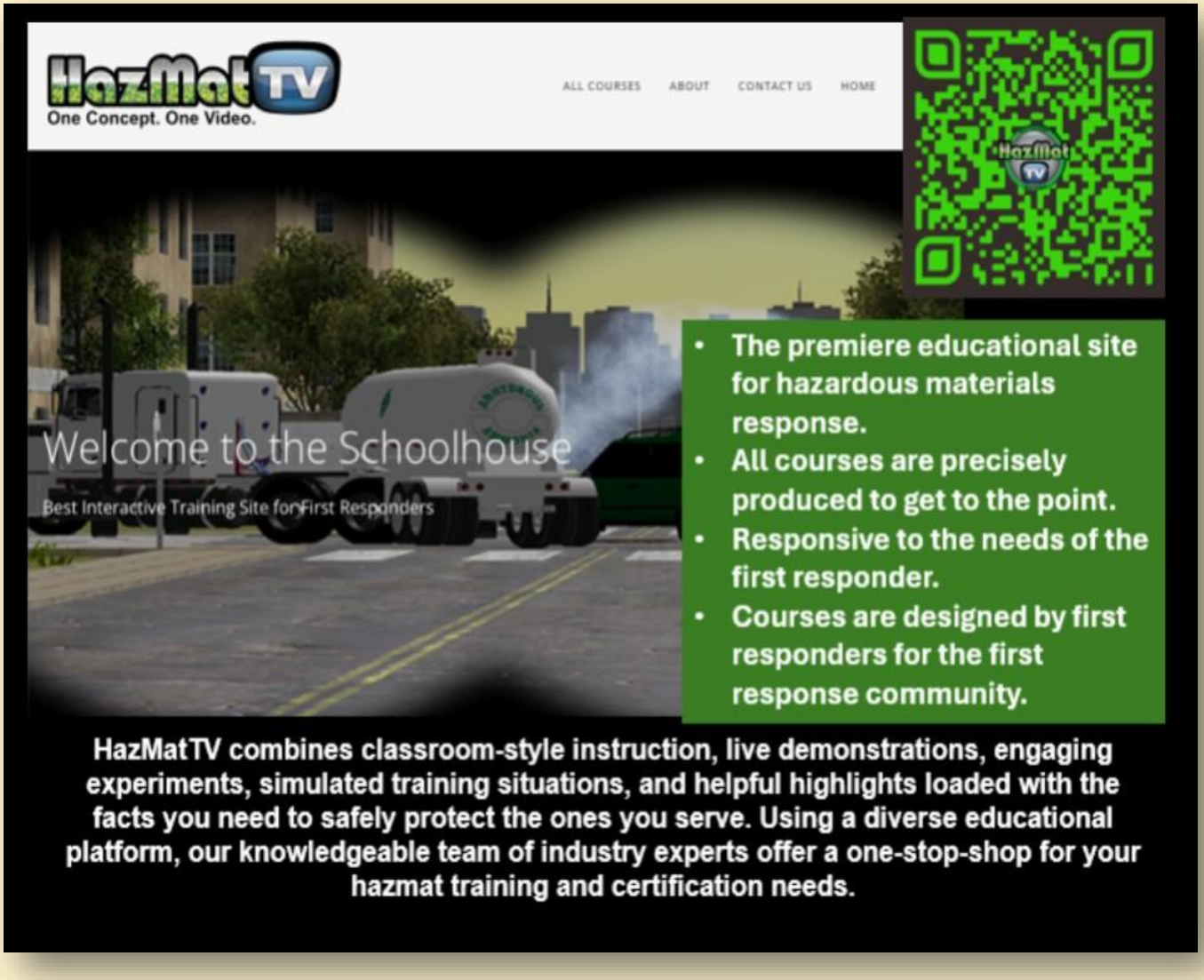
Armando S. Bevelacqua is 37 plus year veteran of the fire service. Retired from the City of Orlando Fire Department, Orlando Florida where he served as Chief of Special Operations, Homeland Security and Emergency Medical Services Transport.

Armando also teaches at local colleges, instructing Fire and EMS Classes. Armando lectures to fire departments throughout North America, Canada and Europe. He is an adjunct instructor through the Department of Defense as well as with several federal agencies involved with forced protection.

Chief Bevelacqua serves on several federal, state and local committees. He held membership to the Inter-Agency Board (IAB) for Training and Exercise development. Technical Consultant and member to the NFPA 470 (472, 1072, 473), and 475 Technical Committees along with representation on the ASTM standards development committee for emergency response. Chief Bevelacqua has assisted in the development of standards and protocols such as with Rocky Mountain Poison Control for the

development of standardized Medical Protocol for the WMD event and for the State Department for WMD training of embassy delegates.

His latest endeavor is to create educational videos and comics for the first response community. Educating new and seasoned responders to the ever-advancing technologies that are entering the first response arena.



Engaging the Next Generation of Hazmat Responders: Leveraging Social Media and Modern Tools

By Bob Coschignano,
President HazMat 101 Consultants

Recruiting and educating the next generation of hazardous materials (hazmat) responders is more critical than ever. As seasoned professionals retire, it's essential to attract young people to careers in hazmat and equip them with the skills needed to manage complex incidents. To do this, we must adapt our strategies, embracing modern technology and educational techniques to meet the expectations and preferences of today's learners.

- Here, we'll explore practical ways to engage the younger demographic of hazmat

responders using innovative tools like podcasts, social media, interactive training, and revamped conferences.

Podcasts: A Modern Approach to Knowledge Sharing

- Podcasts have become a powerful educational tool, offering flexibility for listeners to learn on their own schedule. They provide an excellent platform to discuss hazmat topics in an approachable and relatable way, making them ideal for reaching younger audiences who value on-demand content.

- Take, for example, my podcast, *HazChat*. It covers everything from chemical safety to

incident management, blending technical information with real-world experiences. Episodes such as ***"Aug 2024 - Clifton NJ Fire and Explosion of a semi"*** **or** ***"Dec 2024 - Not your average propane leak"*** break down complex subjects into conversational and easy-to-follow narratives.

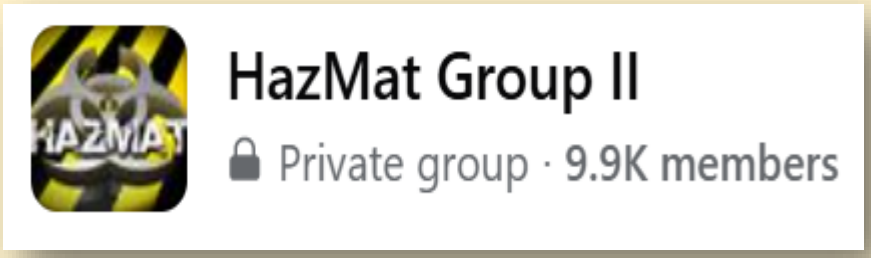
- Podcasts can also spotlight experts in the field, providing mentorship and inspiration to new responders. They create a sense of community and offer a gateway for young professionals to explore hazmat careers.

Social Media: Connecting Through Digital Platforms

- Younger generations spend significant time on social media, making it an essential tool for outreach and education. Platforms like Instagram, TikTok, and YouTube can deliver concise, visually engaging content that

aligns with their preferred way of consuming information.

- For instance:
- Instagram: Share infographics on PPE selection, hazardous material classifications, or response protocols.
- TikTok: Create short, engaging videos demonstrating decontamination procedures or showcasing detection tools in action.
- YouTube: Host longer-form tutorials and case studies on incidents, offering in-depth insights into hazmat operations.
- The key is to provide clear, visually appealing content that simplifies technical concepts without sacrificing accuracy. Social media also encourages interaction, fostering



discussion and allowing young responders to ask questions or share experiences.

Gamification and Virtual Reality: Modernizing Training

- Traditional classroom training can feel disconnected for a generation accustomed to interactive and technology-driven learning. Gamification and virtual reality (VR) can make training more immersive and engaging.
- For example, a VR-based simulation could immerse responders in a virtual incident where they must identify hazards, select appropriate PPE, and perform containment measures. These scenarios allow learners to practice decision-making in a controlled environment while gaining hands-on experience.

- Gamified elements, such as earning points or badges for completing tasks, can increase motivation and retention. Training modules might include interactive quizzes on the Emergency Response Guidebook (ERG) or hazard recognition exercises, making learning both educational and enjoyable.

Revitalizing Conferences: From Traditional to Transformational

- Hazmat conferences are valuable networking and learning opportunities, but they need to evolve to appeal to younger audiences. Interactive and hands-on sessions can replace traditional lecture-style presentations, fostering engagement and collaboration.
- Consider incorporating:
- Workshops: Practical, scenario-based training sessions that allow attendees to

practice skills like air monitoring or containment.

- Panel Discussions: Young professionals can participate in discussions on topics like career development or innovations in hazmat response.
- Networking Events: Casual meetups and mentorship opportunities that connect new responders with experienced professionals.
- Incorporating technology, such as live polling or app-based event guides, can enhance the experience and provide attendees with real-time access to resources.

Storytelling and Purpose: Highlighting the Impact of Hazmat Work

- One of the most effective ways to engage younger responders is to demonstrate the real-world impact of hazmat work. Highlight stories where responders have made a difference, whether by preventing a disaster, saving lives, or protecting the environment.
- Gen Z, in particular, seeks meaningful careers that contribute to the greater good. By showcasing the purpose and importance of hazmat response, we can inspire them to see it not just as a job, but as a vital and rewarding profession.

Mentorship and Community Building

- Building relationships with experienced responders is invaluable for younger hazmat professionals. Mentorship programs,

whether formal or informal, provide guidance, encouragement, and a sense of belonging.

- Platforms like *HazChat* and other professional forums can serve as virtual spaces where responders at all levels can share insights, ask questions, and support one another. Creating a community where young responders feel welcomed and valued is key to retaining them in the field.

Conclusion: Preparing for the Future of Hazmat Response

- Engaging the next generation of hazmat responders requires a shift in how we educate, train, and connect with them. By leveraging podcasts, social media, interactive training, and modernized conferences, we can make hazmat careers more appealing and accessible.

- Ultimately, we need to meet young responders where they are, using innovative tools and techniques to inspire and prepare them for the challenges of hazardous materials response. With these efforts, we can ensure the future of our profession remains strong, capable, and ready for whatever comes next.

Bob Coschignano

Mr. Coschignano has been in the fire service for over 30 years, most of which have been in Special Operations. Mr. Coschignano has served on both state and local hazardous materials related committees. Mr. Coschignano is an instructor and evaluator for several local and state competencies and has lectured around the country. He was the program manager for the Hazardous Materials Technician program at Valencia College. Mr. Coschignano is also DEA certified in Clandestine Labs. Mr. Coschignano is a

Chief Editor for HazMat HQ Digital Magazine, Co-Author of Chemical Card Guide and Risk Based Response Quick Chemical Access Cards published by RedHat publications and has been featured in both Fire Engineering and Firehouse magazines. Contributor for National Emergency Response Drills by The HazMat Guys on Amazon. Mr. Coschignano is the Co-host of HazChat. Mr Coschignano is also President of HazMat 101 Consultants and 2022 recipient of the International Association of Fire Chief's Hazardous Materials Level A award for instruction. Mr Coschignano holds an A.S. degree in Fire Science and is a retired Hazardous Materials Team Lieutenant from the City of Orlando Fire Department.

5 QUESTIONS TO SOLVE THE PROBLEM

By Kevin Ryan

One of the main tenets I have always stuck to when approached with a hazmat problem is to keep it simple. Emergency response in any field is always a dynamic, challenging and changing environment. Your focus in bringing the incident under control should be on solving the problem. The solution to problem solving lies in keeping a simple yet efficient approach. Complex plans can break down when put under pressure. Command will set strategic objectives on a broader scale allowing Group Supervisors to be more focused on tactics. Specific tactical objectives will have a direct

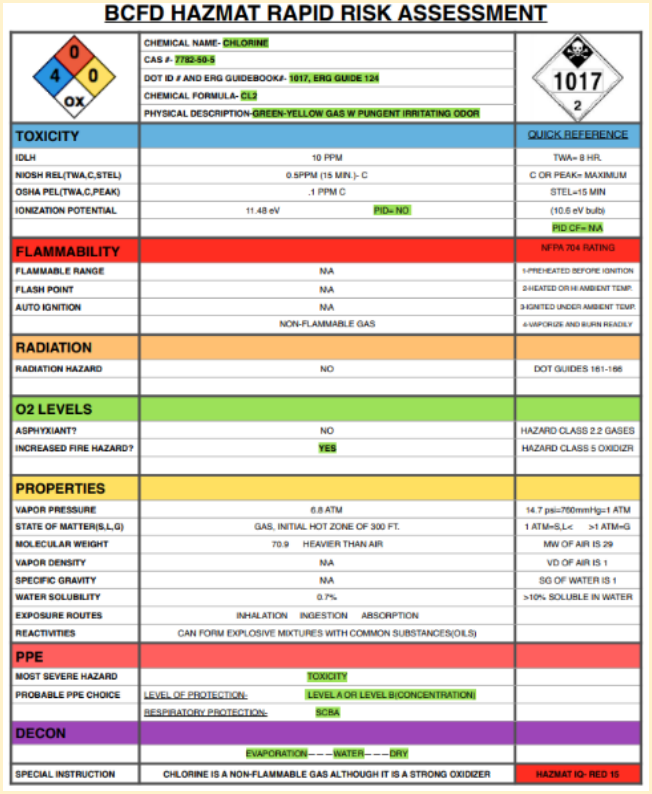
impact on the outcome of the incident. A Group Supervisor can ask themselves (5) simple questions to develop these objectives. Here are the (5) questions in order:

1. What is the product?
2. How does it hurt me?
3. How do I protect myself?
4. How do I remove it?
5. How do I solve the problem?

Let's look at each question individually.

1. <u>What is the product?</u> Identifying the product is typically done in several ways. Placards, markings, labels, reference material and SDS's are a valuable tool in

answering question #1. A research team is tasked with providing all relevant information to the Group Supervisor. A rapid risk cheat sheet is a great way to eliminate the clutter of information overload. The BCFD (Baltimore City FD) has created its own that allows for clear choices when making decisions under incident stress. The top 50 known chemicals are already pre-filled out to save time at incidents.



BCFD HAZMAT RAPID RISK ASSESSMENT

0 / 4 / 0 / OX	CHEMICAL NAME- CHLORINE CAS #- 7782-50-5 DOT ID # AND ERG GUIDEBOOK#- 1017, ERG GUIDE 124 CHEMICAL FORMULA- CL2 PHYSICAL DESCRIPTION-GREEN-YELLOW GAS W PUNGENT IRRITATING ODOR	1017 / 2
TOXICITY		QUICK REFERENCE
IDLH	10 PPM	TWA= 8 HR.
NIOSH REL(TWA,C,STEL)	0.5PPM (15 MIN.)- C	C OR PEAK= MAXIMUM
OSHA PEL(TWA,C,PEAK)	.1 PPM C	STEL=15 MIN
IONIZATION POTENTIAL	11.48 eV PID= NO	(10.6 eV bulb) PID CF= NA
FLAMMABILITY		NFPA 704 RATING
FLAMMABLE RANGE	NA	1-PREHEATED BEFORE IGNITION
FLASH POINT	NA	2-HEATED OR HI AMBIENT TEMP.
AUTO IGNITION	NA	3-IGNITED UNDER AMBIENT TEMP.
	NON-FLAMMABLE GAS	4-VAPORIZE AND BURN READILY
RADIATION		
RADIATION HAZARD	NO	DOT GUIDES 161-166
O2 LEVELS		
ASPHYXIANT?	NO	HAZARD CLASS 2.2 GASES
INCREASED FIRE HAZARD?	YES	HAZARD CLASS 5 OXIDIZR
PROPERTIES		
VAPOR PRESSURE	6.8 ATM	14.7 psi=760mmHg=1 ATM
STATE OF MATTER(S,L,G)	GAS, INITIAL HOT ZONE OF 300 FT.	1 ATM=S,L,< >1 ATM=G
MOLECULAR WEIGHT	70.9 HEAVIER THAN AIR	MW OF AIR IS 29
VAPOR DENSITY	NA	VD OF AIR IS 1
SPECIFIC GRAVITY	NA	SG OF WATER IS 1
WATER SOLUBILITY	0.7%	>10% SOLUBLE IN WATER
EXPOSURE ROUTES	INHALATION INGESTION ABSORPTION	
REACTIVITIES	CAN FORM EXPLOSIVE MIXTURES WITH COMMON SUBSTANCES(OILS)	
PPE		
MOST SEVERE HAZARD	TOXICITY	
PROBABLE PPE CHOICE	LEVEL OF PROTECTION- LEVEL A OR LEVEL B(CONCENTRATION) RESPIRATORY PROTECTION- SCBA	
DECON		
	EVAPORATION - - - WATER - - - DRY	
SPECIAL INSTRUCTION	CHLORINE IS A NON-FLAMMABLE GAS ALTHOUGH IT IS A STRONG OXIDIZER	HAZMAT IQ- RED 15

2. <u>How does it hurt me?</u>

3. How do I protect myself?
4. How do I remove it? Questions 2,3,4 can all pretty much be answered simultaneously. These 3 questions are dependent on focused and efficient research. One of the most vital decisions that needs to be made is what PPE

(Personal Protective Equipment) will be worn. Proper PPE at incidents cannot be understated. PPE is what allows the members to perform their tactics, minimizing the chances of injury or worse. The choice to be made is based on the

hazards present. The research team will determine these dangers. Most hazmat teams that I am aware of choose between fire or chemical protection. The BCFD is no different. The initial determination is between fire or chemical gear. If chemical gear is chosen, then you must select Level A or B. The choice between A or B comes down to vapor (Level A) or splash (Level B) hazard as determined by research. Meter selection is also an integral part of protecting members. Identifying and quantifying goes a long way in how to manage an incident. Higher concentrations detected can lead to the source of the problem. Once the source is known, control of the incident should

come relatively quickly. Question 4 refers to what type of decon will be performed. Once again, research will provide the answer. Multiple options for decon exist including traditional and emerging methods. A mix of these new and old styles will provide you with plenty of options. The BCFD approaches decision-making by looking at the state of matter involved. A solid can typically be removed by brushing or some mechanical means while standing in a containment area. Water probably makes a bigger mess than needed for solids unless in an extreme circumstance. Decision making for liquids needs a little bit deeper assessment. The biggest question is vapor or splash hazard

(this will be inline with your PPE choice). A splash liquid (ex. Sulfuric Acid) can simply be neutralized with the commercially available mixtures or wiped with specific activated carbon pads. A liquid with vapor hazard (ex. Hydrochloric Acid) can be handled by using fans to speed the evaporation process. Any remaining liquid can be neutralized or collected by pads. High vapor hazard products like Ammonia or Chlorine can take advantage of the chemicals ability to vaporize. Fans can be set up to remove the high vapor hazard product. This process takes

advantage of the gas\vapor's ability to vaporize. Using the chemical state of matter is a good starting point for decision making although we will always have exceptions to the above. Experience, excess concentrations, lack of capabilities and other unforeseen factors can always affect decisions to be made.

5. <u>How do I Solve the Problem?</u> All decision making to this point needs to be focused on solving the problem. Efficient research, product identification, hazards presented and decon needed all

contribute to effective problem solving. Tactics used to solve the problem need to tip the scales in our favor for incident outcome. Avoid the rabbit holes, Solve the Problem!!!! (April 2024 edition).

Kevin Ryan leads the Baltimore City FD Hazmat Operations Office. A 31-year veteran of the fire service with 26 years of experience in the world of hazmat response. He is a Level III instructor and adjunct at the BCFD Fire Academy.

Household Chemicals: A cheat sheet

By The HazMat Guys

Hey everyone! We're super excited to be back writing for this awesome magazine. It lines up perfectly with some of the stuff we've been doing lately in show prep and class planning. Lately, we've been getting a lot of emails asking about household chemicals—what happens when people start mixing them in ways they shouldn't, or just use them improperly. We actually started a podcast about it, but it kind of went on the back burner. But now that I'm writing this, I'm thinking it's time to pick that back up again!

Anyway, we thought we'd share some of our research here. Hopefully, this will be a handy little guide for when you're out there responding to calls that involve everyday household products. Now,

I’m not going to dive into the PPE side—that’s a whole other dozen pages right there—but think of this as a "print it out and leave it on the rig" kind of reference.

The Basics: Single Household Chemicals

Alright, first up, we’re talking straight chemicals—no fancy mixtures yet. Just your average household stuff you’ll find in the cleaning cupboard. Let’s jump in.

Bleach (Sodium Hypochlorite) • **Flammable Meter:** No response (not flammable). • **PID:** May give a weak or no response (depends on concentration and calibration).	**Ammonia** • **Flammable Meter:** May give a response if in sufficient concentration in air (flammable at high concentrations). • **PID:** Weak to moderate response (low ionization energy). • **pH:** Strongly basic in solution (pH 11-12).

• **pH:** Strongly basic (usually around pH 11-13). • **FTIR/Raman:** Detectable on both; produces characteristic peaks. • **Oxidizer Paper:** Yes (bleach is an oxidizer).	• **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** No response.
Vinegar (Acetic Acid) • **Flammable Meter:** No response (not flammable in aqueous solution; glacial acetic acid is flammable). • **PID:** Yes, moderate response. • **pH:** Acidic (typically pH 2-3).	**Hydrogen Peroxide** • **Flammable Meter:** No response (not flammable). • **PID:** Weak or no response (depends on concentration). • **pH:** Slightly acidic to neutral (typically pH 4-6). • **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** Yes (strong oxidizer).

• **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** No response.	
Rubbing Alcohol (Isopropyl Alcohol) • **Flammable Meter:** Yes, strong response (flammable vapors). • **PID:** Yes, strong response. • **pH:** Neutral (around pH 7). • **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** No response.	**Drain Cleaners (Sodium Hydroxide or Sulfuric Acid)** • **Flammable Meter:** No response (not flammable). • **PID:** No response for sodium hydroxide; sulfuric acid may give a weak response. • **pH:** Strongly basic (sodium hydroxide, pH >12) or strongly acidic (sulfuric acid, pH <1). • **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** Sulfuric acid: No; Sodium hydroxide: No.
Oven Cleaners (Sodium Hydroxide)	**Glass Cleaners (Ammonia or Vinegar)**

• **Flammable Meter:** No response (not flammable).
• **PID:** No response.
• **pH:** Strongly basic (pH >12).
• **FTIR/Raman:** Detectable on both.
• **Oxidizer Paper:** No response.
	• **Flammable Meter:** No response (not flammable in typical concentrations).
	• **PID:**
	  ◦ Ammonia: Weak to moderate response.
	  ◦ Vinegar: Moderate response.
	• **pH:**
	  ◦ Ammonia: Basic (pH ~11).
	  ◦ Vinegar: Acidic (pH 2-3).
	• **FTIR/Raman:** Detectable on both.
	• **Oxidizer Paper:**
	  ◦ Ammonia: No.
	  ◦ Vinegar: No.

Toilet Bowl Cleaners (Hydrochloric Acid or Sodium Bisulfate)	**Pool Chemicals (Chlorine)** • **Flammable Meter:** No response (not flammable).

• **Flammable Meter:** No response (not flammable). • **PID:** Weak response (depends on formulation). • **pH:** Strongly acidic (typically pH <1-2). • **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** No response.	• **PID:** No response (chlorine does not ionize in UV light). • **pH:** Varies; generally, slightly acidic to neutral (pH 6-7). • **FTIR/Raman:** Detectable on both. • **Oxidizer Paper:** Yes (chlorine is an oxidizer).

Binary Reactions: When Two's a Crowd

Now let's talk about **binary reactions**—two things mixing together to make something new. Sometimes it's the reaction itself that's the real problem, not necessarily the chemicals before or after. Here are a few classic household combos that can turn dangerous real fast:

Bleach + Ammonia = Chloramine Gas	Bleach + Vinegar = Chlorine Gas
• **Flammable Meter:** No response (chloramine is not flammable). • **PID:** Weak response (chloramine has high ionization energy). • **pH:** Basic before reaction (bleach), but mixed pH depending on proportions. • **FTIR/Raman:** Detectable as chloramine has characteristic peaks. • **Oxidizer Paper:** Yes, if residual bleach remains.	• **Flammable Meter:** No response (chlorine gas is not flammable). • **PID:** No response (chlorine gas is not detectable with PID). • **pH:** Acidic (chlorine gas and vinegar are acidic). • **FTIR/Raman:** Detectable as chlorine gas has distinct peaks. • **Oxidizer Paper:** Yes (chlorine is a strong oxidizer).

Bleach + Rubbing Alcohol = Chloroform	**Hydrogen Peroxide + Vinegar = Peracetic Acid**
• **Flammable Meter:** Yes, if isopropyl alcohol vapors remain; chloroform itself is not flammable. • **PID:** Strong response (chloroform ionizes well). • **pH:** Neutral to slightly basic (bleach influence depends on reaction completeness). • **FTIR/Raman:** Detectable (chloroform has distinct spectral peaks).	• **Flammable Meter:** No response (not flammable). • **PID:** Yes, strong response (peracetic acid is volatile and ionizes well). • **pH:** Acidic (peracetic acid is highly acidic, pH ~1-3). • **FTIR/Raman:** Detectable as peracetic acid has distinct peaks. • **Oxidizer Paper:** Yes (peracetic acid is an oxidizer).

• **Oxidizer Paper:** No response.	
Ammonia + Vinegar = Ammonium Acetate • **Flammable Meter:** No response (not flammable). • **PID:** No response (ammonium acetate is not volatile). • **pH:** Neutral to slightly acidic (ammonium acetate is a neutral salt in solution, but slight acidity depends on the vinegar concentration). • **FTIR/Raman:** Detectable as ammonium acetate has distinct peaks.	**Bleach + Toilet Bowl Cleaner (Hydrochloric Acid) = Chlorine Gas** • **Flammable Meter:** No response (chlorine gas is not flammable). • **PID:** No response (chlorine gas is not ionizable). • **pH:** Acidic (due to hydrochloric acid). • **FTIR/Raman:** Detectable as chlorine gas has distinct peaks. **Oxidizer Paper:** Yes (chlorine gas is a strong oxidizer).

• **Oxidizer Paper:** No response.	
Drain Cleaner (Sodium Hydroxide) + Drain Cleaner (Sulfuric Acid) = Violent Exothermic Reaction • **Flammable Meter:** No response (no flammable products generated; the reaction is primarily heat and water). • **PID:** No response (products are not volatile organic compounds). • **pH:** Highly variable; initially basic (sodium hydroxide) and acidic (sulfuric acid), neutralizing	

depending on proportions and reaction completion. • **FTIR/Raman:** Detectable if residual reactants remain. • **Oxidizer Paper:** No response unless trace sulfuric acid remains.	

Multi-Mixture Madness: Because Three's a Crowd

Sometimes the problem isn't just mixing two things together—it's when folks decide that if two chemicals are good, then three are *even better*. Spoiler: they're usually not.

Bleach + Ammonia + Vinegar = Chlorine Gas + Chloramine Gas	**Bleach + Rubbing Alcohol + Ammonia = Chloroform + Chloramine Gas**

• **Products:** Chlorine gas (bleach + vinegar), chloramine gas (bleach + ammonia). • **Flammable Meter:** No response. • **PID:** Weak response (chloramine); no response (chlorine gas). • **pH:** Acidic (vinegar influence dominates). • **FTIR/Raman:** Detectable for both gases. • **Oxidizer Paper:** Yes (due to chlorine gas and residual bleach).	• **Products:** Chloroform (bleach + alcohol), chloramine gas (bleach + ammonia). • **Flammable Meter:** Possible response if residual alcohol vapors remain. • **PID:** Strong response (chloroform), weak response (chloramine). • **pH:** Neutral to slightly basic. • **FTIR/Raman:** Detectable for both products. • **Oxidizer Paper:** No response (unless residual bleach is present).
Hydrogen Peroxide + Vinegar + Ammonia =	

Peracetic Acid + Ammonium Acetate

- **Products:** Peracetic acid (hydrogen peroxide + vinegar), ammonium acetate (ammonia + vinegar).
- **Flammable Meter:** No response.
- **PID:** Strong response (peracetic acid), no response (ammonium acetate).
- **pH:** Acidic (peracetic acid dominates).
- **FTIR/Raman:** Detectable for both.

• **Oxidizer Paper:** Yes (peracetic acid is a strong oxidizer).	

Print It and Share It

At the end of the day, this guide isn't so much a deep dive into chemistry—it's more about starting the conversation and giving you a quick reference to toss on the firehouse table. Over the years, we've seen most of these scenarios pop up at least once. On every one of those calls, I wish I had something like this to double-check on the spot.

Stay safe out there, and don't be afraid to print this out, laminate it, and leave it on the rig. You never know when a simple household call might turn into a hazmat situation that'll keep you guessing.

Bobby Salvesen

Co-Host, Co-Founder, & CEO

Bobby Salvesen, serving as a firefighter since 1994, quickly climbed the ranks to become Chief in 2014 at the East Meadow Volunteer Fire Department. With a relentless pursuit of knowledge, he studied Chemistry at the New York Institute of Technology and is furthering his education at SUNY Old Westbury.

His career path took him from EMS to FDNY's Fire Department in 2000, and following 9/11, to a specialist role in Squad 288 within FDNY's Special Operations Command, focusing on Special Rescue and HazMat. In 2013, he joined Hazardous Materials Company 1, continuously expanding his expertise.

Bobby also passionately teaches at both the New York State and Nassau County Fire Service Academies, covering HazMat and Confined Space Rescue.

Alongside his professional achievements, he is a dedicated husband and father of two.

Mike Monaco

Co-Host, Co-Founder, & COO

Since 1998, Michael Monaco has progressed from firefighting and specialized rescue to a key role in FDNY's Hazmat Company One in 2005, showcasing his knack for simplifying hazmat concepts. By 2008, he began teaching, shaping Hazmat education across various platforms. With a degree in Neurological Physiology from SUNY Stonybrook, Monaco's knowledge spans beyond firefighting. Engaged and a dad to three, his two decades focus on safety and education in hazardous materials.

CONFERENCE DATES

Florida Hazmat Symposium

Jan 14 – 17 2025

Oklahoma Hazardous Materials Conference

Mar 5 – 8 2025

2025 New England Hazmat Conference

March 25th – 27th

2025 Michigan First Responder Hazmat Conference April 22nd - 24th