



In-Station Training

TM 24-39 Chemical Incompatibility



Author

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Purpose

Incidents involving multiple incompatible chemicals present significant complexity where responders must deal with not only the characteristics of the individual chemicals, but also of their reaction products.

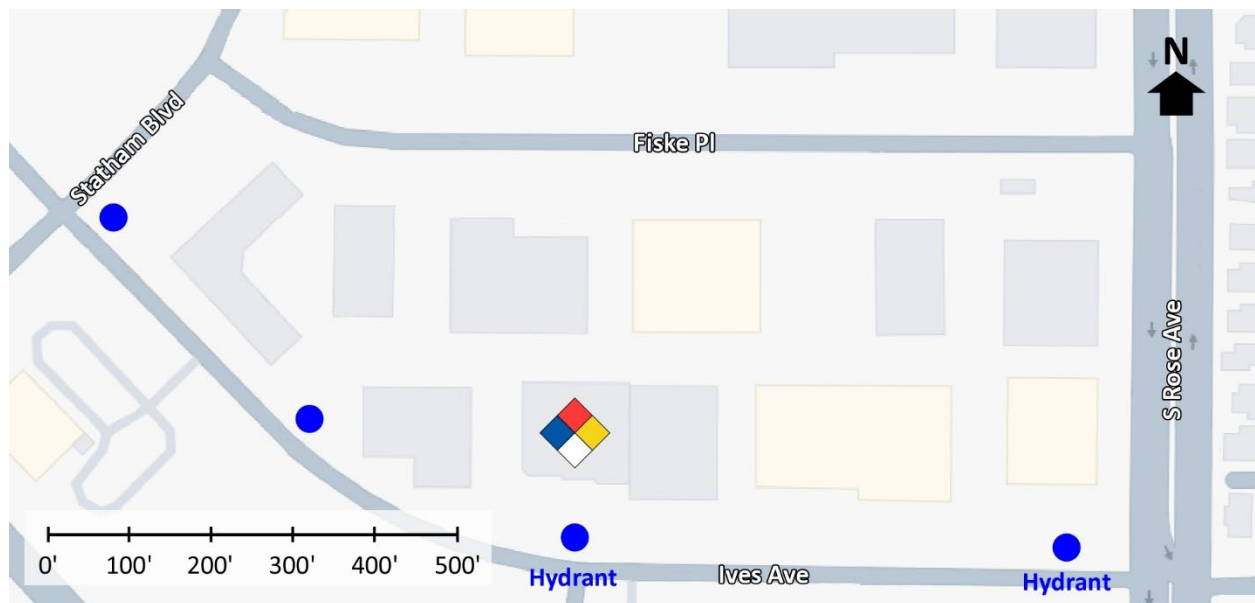
Learning Outcomes

Firefighters and officers perform an effective size-up, select an appropriate strategy, and implement tactics based on the strategic decision-making model in response to hazardous materials incidents.

Conducting the Drill

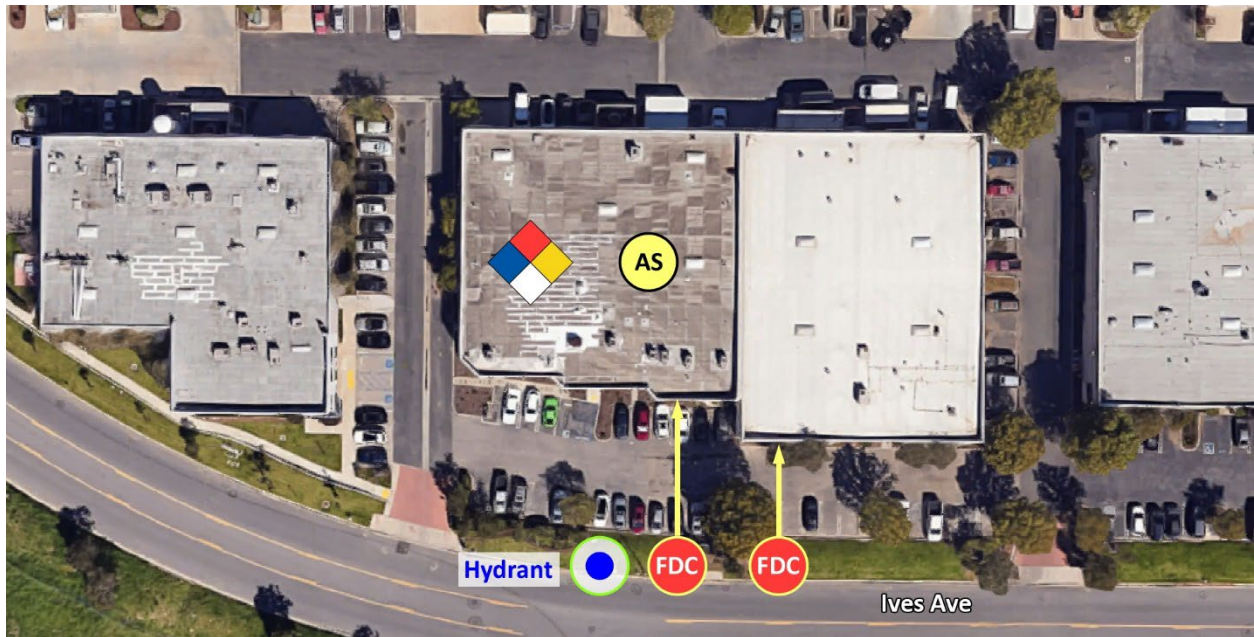
This incident involved a hazmat response to Alliance Finishing & Manufacturing, 1721 Ives Avenue in Oxnard, California on August 15, 2019, at 10:24 (Diskin, 2019 & Michael M Films, 2019). Review the map and photos (Figures 1-8) to gain an understanding of the area and building involved.

Figure 1. Map of the Incident Area



Note: Adapted from Google. (2024a). [Map, 1721 Ives Avenue in Oxnard, CA]. <https://bit.ly/3Ade0B8>.

Figure 2. Aerial View



Note: Adapted from Google. (2024b). [Aerial view 1721 Ives Avenue in Oxnard, CA].
<https://bit.ly/3WJ3LgP>.

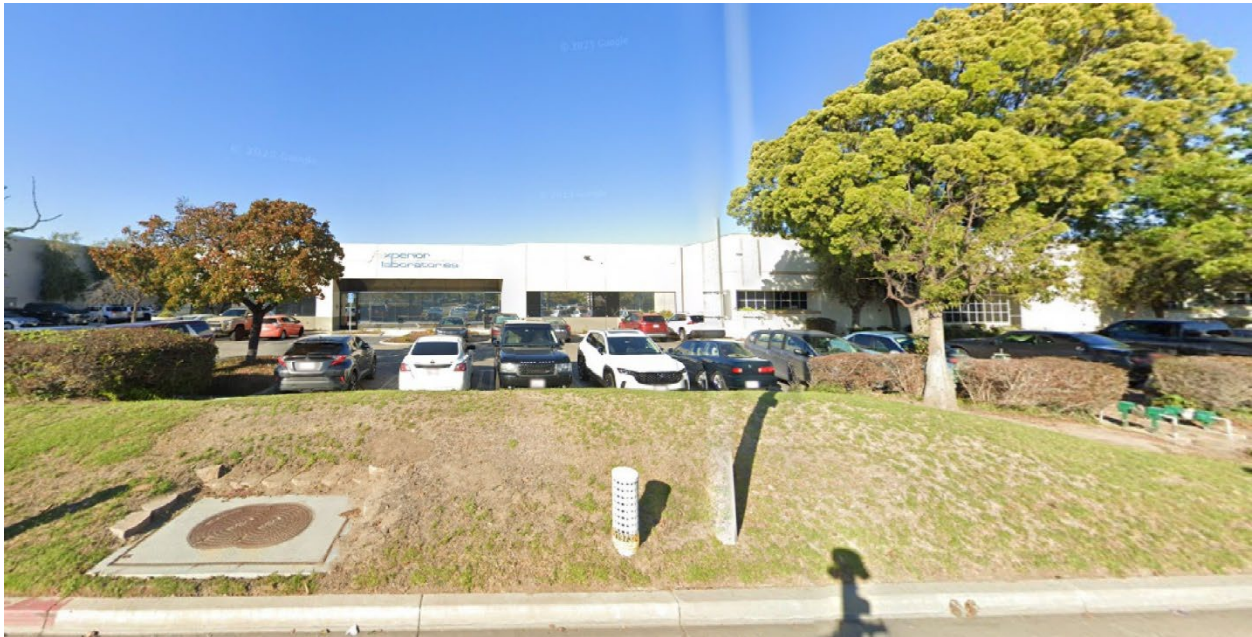
There are multiple hydrants on Ives Avenue as illustrated in Figures 1 and 2.

Figure 3. West Entrance to the Commercial Complex (Alpha/Bravo Corner)



Note: Adapted from Google. (2022a). [Street view, 1721 Ives Avenue in Oxnard, CA].
<https://bit.ly/3WynPS2>.

Figure 4. Side Alpha



Note: Adapted from Google. (2022b). [Street view, 1721 Ives Avenue in Oxnard, CA].
<https://bit.ly/4d5GBaq>.

Figure 5. East Entrance to the Commercial Complex (Alpha/Delta Corner)



Note: Adapted from Google. (2022c). [Street view, 1721 Ives Avenue in Oxnard, CA].
<https://bit.ly/4c09vqY>.

Figure 6. Alpha/Bravo Corner



Note: Adapted from Google. (2024c). [3d view, 1721 Ives Avenue in Oxnard, CA]. <https://bit.ly/4c4eQh6>.

Figure 7. Bravo/Charlie Corner



Note: Adapted from Google. (2024d). [3d view, 1721 Ives Avenue in Oxnard, CA]. <https://bit.ly/3LMB7Fg>.

Figure 8. Aerial View of the Commercial Complex



Note: Adapted from Google. (2024e). [Aerial view, 1721 Ives Avenue in Oxnard, CA].

<https://bit.ly/3XkZlry>.

The temperature is currently 64° F with wind from the north at 5 mph (Weather Underground, 2024). You have been dispatched to Alliance Finishing & Manufacturing at 1721 Ives Avenue for a hazmat incident. Initial dispatch information reports a container of ammonium bifluoride off-gassing. You are the company officer or AIC of the first arriving engine and have your company's typical staffing. Reference materials include the [Emergency Response Guidebook](#) (US DOT, 2024) and [Pocket Guide to Hazardous Chemical Hazards](#) (NIOSH, 2020).

1. What critical factors would you consider when dispatched and during response and what conversations would you have with your crew while responding?

You hear four engines, an advanced life support ambulance, and command officer go enroute. You will arrive from the west on Ives Avenue. The second engine and the paramedic unit will arrive approximately five minutes after you from the same direction. Dispatch provides an update that three workers may have been exposed to the vapor coming from the container.

Examine Figure 9 illustrating conditions on arrival on Ives Avenue at the intersection with the unnamed alley providing access to Side Charlie of the incident occupancy. If you choose to position at this

location, go to question 3. If you would go to Side Alpha of the incident occupancy, examine Figure 10, and then go to question 3.

Figure 9. Conditions on Arrival-Exposure Bravo 1



Note: Adapted from Google. (2022d). [Street view, 1721 Ives Avenue in Oxnard, CA]. <https://bit.ly/3XkgYNY>.

Figure 10. Conditions on Arrival-Side Alpha



Note: Adapted from Google. (2022e). [Street view, 1721 Ives Avenue in Oxnard, CA]. <https://bit.ly/3StlKFC>.

2. State your initial radio report (IRR) exactly as you would transmit it to dispatch.

3. What specific actions would you take (as the company officer) immediately upon arrival and exiting the apparatus and what task orders would you give your crew?

After making contact, the reporting party (facility manager) advises that workers were mixing ammonium bifluoride and water in an intermediate bulk container (IBC) to make a 10% solution when the container began off gassing. The IBC is located a short distance inside a roll up door on the back side of the building (Side Charlie). The manager provides a safety data sheet for [Ammonium Bifluoride, Flake](#) (Spectrum, 2022). The potentially exposed workers evacuated and are now located on Side Alpha of the incident occupancy. The manager believes that all other workers have evacuated but has not yet been able to account for everyone.

4. What additional information would you request from the facility manager?
5. Would you change the action you are taking or modify the assignments given to your crew? If so, what task orders would you provide?
6. State your update report exactly as you would transmit it to dispatch.
7. What action will you take at this point?
8. Engine 2 and Medic 2 arrive and reports they are Level 1 Stratham Boulevard and Fiske Place. State the tactical assignment you would give them exactly as you would transmit it.
9. Based on the anticipated effectiveness of your tactical operations, state your conditions, actions, and needs (CAN) report that you would provide to the first arriving command officer as part of command transfer to IC #2.

Reflect on your strategic decision-making and responses to questions 1 through 9 before answering the next six questions (these questions usually apply to structure fires but consider how they apply to a hazmat incident such as encountered in this 10-Minute Training).

10. What was the problem?

11. What was getting in the way of achieving your tactical priorities?

12. Was there anything in this incident that could have hurt or killed you (right now)?

13. Was it reasonable to believe that the building was occupied?

14. Was there searchable space?

15. If you believed it was reasonable that the building was occupied and there was searchable space, what could you do about it?

Command has tasked your company to perform reconnaissance from the exterior on Side Charlie and provide a conditions, actions, and needs (CAN) report.

16. Based on the characteristics of the chemical(s) potentially involved in this incident, would the atmospheric monitoring equipment carried on your apparatus be useful in identifying or quantifying the hazards presented? Why or why not?

Wearing structural firefighting clothing and self-contained breathing apparatus you make your way to Side Charlie and observe the conditions illustrated in Figure 11.

Figure 11. Conditions on Side Charlie



Note: Adapted from Michael M Films. (2019). *Oxnard hazmat incident*. Retrieved August 27, 2024, from <https://bit.ly/3StlKFC>.

17. State the CAN report provided to IC #2 based on conditions observed from Side Charlie?



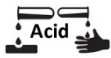







Additional Learning: The conditions encountered in this incident would not have resulted from mixing ammonium bifluoride flake with water (the normal process for producing an ammonium bifluoride solution used in metal finishing). The container used in this process had likely been used for some other chemical that is incompatible with ammonium bifluoride.

Review Section 10 Stability and Reactivity on the Ammonium Bifluoride Safety Data Sheet and identify what types of chemicals ammonium bifluoride is incompatible with.

First responders at the operational level should be able to identify potential chemical incompatibilities based on data in the [Emergency Response Guidebook](#) (US DOT, 2024), [NIOSH Pocket Guide to Chemical Hazards](#) (NIOSH, 2020), and Safety Data Sheets. Identifying the outcome of mixing incompatible chemicals is likely outside the skill set for a first responder at the operational level. However, there are tools that can be used to assess and predict the consequences of mixing different chemicals. One readily accessible tool is the [CAMEO Chemicals Reactivity Tool](#) (NOAA, 2024).

Examine Table 1 which lists chemicals commonly used in metal finishing. While you might not have this information readily available, you could ask the facility manager what acids, bases, and oxidizers are used in the facility and what materials could have previously been in the intermediate bulk container.

Table 1. Chemicals Commonly Used in Metal Finishing.

Chemical	Acid	Base	Oxidizer
Nitric Acid			
Chromic Acid			
Hydrochloric Acid			
Ammonia			
Sulfuric Acid			
Hydrofluoric Acid			
Sodium Hydroxide			
Phosphoric Acid			

Note: Adapted from KCH Engineered Systems. (n.d.). *Surface and metal finishing applications*. <https://bit.ly/4e60b6t>.

The presence of a reddish vapor cloud provides a hint that can help narrow down the potential chemicals involved in this incident. Using the AI prompt which of the following chemicals would release a reddish vapor when mixed with ammonium bifluoride? Returned the following response:

When Nitric Acid is mixed with Ammonium Bifluoride, it can release a reddish-brown vapor. This vapor is primarily composed of nitrogen dioxide (NO₂), which is a characteristic reddish-brown gas. None of the other acids or chemicals listed would typically produce a reddish vapor when mixed with ammonium bifluoride. The reddish vapor is specifically associated with the formation of nitrogen dioxide, which occurs when nitric acid decomposes or reacts with certain compounds (ChatGPT 4o, personal communication, August 29, 2024).

Important! Don't simply rely on AI as answers to prompts can be wrong (with significant consequences when working on a hazmat incident). However, as with any other reference, the information may be useful if it is validated from other sources such as the [NIOSH Pocket Guide to Chemical Hazards](#) which provides the following physical description on nitrogen dioxide "Yellowish-brown liquid or reddish-brown gas (above 70°F) with a pungent, acrid odor. [Note: In solid form (below 15°F)]" (NIOSH, 2020).

If you would like to explore the [CAMEO Chemicals Reactivity Tool](#) (NOAA, 2024) click on the link and add ammonium bifluoride and nitric acid other than red fuming to "my chemicals" and then click on "predict reactivity".

References

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