Odor Complaint

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This drill requires hazmat technicians to identify hazards present, evaluate meter readings, assess the chemical/physical properties of contaminants and communicate this information to higher authorities.

Cost of Drill: Depends on the availability of props	Time required: 30 minutes

Teaching Points

1. Identify meters that would be appropriate to use in this scenario.
2. Demonstrate the ability to properly use meters and interpret the meter readings.
3. State the limitations of meters used.
4. Recognize hazards present.
5. Identify and explain potential cross sensitivities of meter sensors.
6. Identify the chemical and physical properties of the substances involved and explain how they would affect meter use.
7. Demonstrate the ability to adequately communicate pertinent information to higher authorities.

Note

1. There is no "school solution" and there are no right answers (but there may be a few wrong ones).
2. If you want more information, ask for it (you may not get it but you can still ask!).

Materials List

1. Vintage refrigerator (if available, if not then use your imagination)
2. HazSim Pro3®
3. Role players (homeowner, environmental health department personnel and battalion chief)
4. Drill structure with (if possible) a basement

Setup Directions

Place a vintage refrigerator in the drill building so it's visible to responders.

Initiating the Drill

Give the drill participants the initial narrative (see below):

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Initial Narrative

The occupants of a residence woke up to an unpleasant odor in their house. They checked the the house and found the odor to be unbearable in the basement. They immediately called 911. A fire engine was dispatched to investigate a report of an odor in the basement. The engine arrived and the Captain and one Firefighter met with the owner.

Drill Participant Actions

Direct two drill participants to play the role of an engine company. They shall meet with the homeowner role player and ask him/her questions about the situation.

Drill Inject

The homeowner role player shall tell the first responders that he/she thought there might be a gas leak in the house. The homeowner told the Captain that the only gas appliances in the house were a furnace and a hot water heater. Both were in the basement. The homeowner also said there was a vintage refrigerator in the basement.

Drill Participant Actions

Direct the two drill participant to enter the basement.

Drill Inject

As the drill participants move down the stairway the drill facilitator shall tell the first responders that they detect a strong odor that is pungent and irritating. They detect this when they are halfway down the stairway.

Drill Participant Actions

Drill participants should exit the basement immediately and call for assistance from the hazmat team. (Note their decisions and discuss in the drill debrief.)

Drill Facilitator Actions

When the hazmat team arrives tell them to meet and confer with the first responders. The members of the hazmat team should recognize the significance of the behavior of the contaminants based on the descriptions of the first responders.

Drill Participant Actions

The hazmat team should enter the structure in PPE they feel is appropriate. (The drill facilitator shall note their selection of PPE and be prepared to discuss it in the drill debrief.) The entry team should use appropriate monitoring equipment when surveying the structure. (The drill facilitator shall note their selection of monitoring equipment and be prepared to discuss it in the drill debrief.)

Drill Inject

When the entry team goes down the stairs the drill facilitator shall cause the Hazsim to display increasing levels of CO and the H_2S. Readings on the Hazsim will peak at 80 ppm CO and 12 ppm H_2S. Oxygen readings shall be normal. The PID reading will be zero.

Drill Participant Actions

The entry team should exit the basement and meet with hazmat team personnel to discuss the meter readings.

Drill Inject

Direct one of the the hazmat team members to read the following: “Old refrigerators commonly used H_2S as a refrigerant. I suspect the refrigerant has leaked and that is where the odor came from. The high CO levels are caused by the interaction of H_2S with the CO sensor.” (They may paraphrase this as long as the team member passes the pertinent information.)

Drill Participant Actions

The hazmat team should discuss response options and select an appropriate course of action. (The drill facilitator shall note their selection of response options and be prepared to discuss it in the drill debrief.)

Drill Inject

If the drill participants decide to re-enter the basement the facilitator shall cause the Hazsim to display no measurable levels of CO or H_2S. Inform the drill participants that the H_2S odor persists.

As the hazmat team concludes their discussions, inform the drill participants that the environmental health personnel have arrived.

Role Player Actions

If using role-players for the environmental health personnel, direct them to tell the drill participants that vintage refrigerators used SO_2 as a refrigerant not H_2S. The role-players shall inform the drill participants that the homeowner arrived at this same conclusion by looking at the back of the refrigerator and seeing the words “sulfur dioxide” on the compressor.

Tell the drill participants the battalion chief is enroute and would like a briefing immediately upon arrival. The BC will arrive in 10 minutes.

Drill Participant Actions

The hazmat team should prepare to deliver a suitable briefing. They will deliver this briefing when the battalion chief role-player arrives. (The drill facilitator shall tell the drill participants to be prepared to discuss the contents of their briefing in the drill debrief.)

Drill Role Player (BC) Actions

The person playing the role of the battalion chief shall express a general sense of skepticism with the actions of the hazmat team and the fire arriving engine company. He/she shall ask pointed questions and if the hazmat team members can't answer those questions the drill facilitator shall not that for follow-up in the drill debrief.

Suggested questions for the BC role player to ask

Will the PID detect H_2S? Why or why not?

How do you reconcile the normal oxygen level with the increase in CO and H_2S?

Are these monitoring results what you would expect from malfunctioning gas-fired appliances? Is a CO sensor also sensitive to H_2S?

If the hazmat team members mention the possibility of interaction the BC shall press them on this issue to explain their reasoning.

Why did the CO and H_2S levels increase as the entry team went farther down the stairs into the basement?

Are there reference source(s) would have told you that SO_2 was once commonly used as a refrigerant? Did the hazmat team use them?

Do SO_2 and H_2S have similar odors? Why is in unlikely that the responders would continue to smell the gas if it was H_2S?

Is an SO_2 sensor cross-sensitive to H_2S? Could this explain why the meters said they detected H_2S?

Suggested answers to questions the BC role player asks

Will the PID detect H_2S? Why or why not?

Yes. The ionization energy (formerly called ionization potential) of hydrogen sulfide is 10.46 so a 10.6 lamp will detect it.

How do you reconcile the normal oxygen level with the increase in CO and H_2S?

The increased levels of CO and H_2S will displace oxygen but it may not be enough for it to show up on an O_2 sensor. An O_2 sensor is simply not sensitive enough to show a change in the O_2 concentration that small.

Are these monitoring results what you would expect from malfunctioning gas-fired appliances? Is a CO sensor also sensitive to H_2S?

A malfunctioning gas-fired appliance will often give off CO. The likelihood of such a situation generating H_2S is remote. A CO sensor is somewhat cross sensitive to H_2S. Depending upon the sensor used, the instrument would understate the levels of H_2S.

If the hazmat team members mention the possibility of "interaction" the BC shall press them on this issue to explain their reasoning.

An "interaction" between the sensors in a 4-gas monitor is remote.

Why did the CO and H_2S levels increase as the entry team went farther down the stairs into the basement?

The vapor density of H_2S is 1.19. The vapor density of CO is 0.97. The H_2S would tend to sink to the lowest level in the structure, which is the basement. The CO is almost neutrally buoyant. If the

ventilation in the basement was poor then the CO would tend to linger there and not disperse to the rest of the building.

Are there reference source(s) would have told you that SO_2 was once commonly used as a refrigerant? Did the hazmat team use them?

None of the standard reference sources that hazmat teams use would likely have helped to fill in this piece of the puzzle. In this case you could find someone who knows about old refrigerators or you could search the internet. (Note: a Google search would provide the answer in a matter of minutes. The usual caveats about information found on the internet apply.)

If the hazmat team says they would consult the SDS remind them that this incident occurred at a residence. SDSs are required in the workplace, not in private residences.

Do SO_2 and H_2S have similar odors? Why is in unlikely that the responders would continue to smell the gas if it was H_2S?

Both gases have pungent and irritating odors, however, H_2S has a unique rotten egg smell. H_2S causes olfactory fatigue at high concentrations and at continuous low concentrations. It's not likely that responders would have continued to smell H_2S as the incident progressed. The fact that the responders continued to smell a sulfur-like odor should have told them they aren't dealing with H_2S.

Is an SO_2 sensor cross-sensitive to H_2S? Could this explain why the meters said they detected H_2S?

SO_2 sensors are cross-sensitive to H_2S. It's possible a reading of one particular gas may actually be something else. In this incident the H_2S concentration reported was most likely SO_2.