

Science Education Collection

Guidelines In Case Of Emergency

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Overview

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The most common laboratory emergencies include chemical spills, fire or explosion, electric shock, and personnel injuries. Most laboratory accidents occur due to poor planning or lack of attention. Therefore, it's always better to prevent accidents (being *proactive*) than having to take any actions during an emergency (being *reactive*). For example, always wear proper personal protective equipment (PPE) in the laboratory. Regular laboratory inspection and equipment maintenance is beneficial to prevent laboratory accidents. However, once the emergency occurs, it's also essential to know what to do. Ensure your personal safety first and then call local emergency responders, when and if necessary. The extent of your response will depend on the seriousness of the incident and documented laboratory protocols for dealing with such incidents. Stay calm and take proper actions according to the type and level of emergency.

Principles

Be aware of possible laboratory accidents in advance before working in the lab and prevent accidents from happening by following safety regulations. Take precautions when dealing with hazardous chemicals and/or severe working conditions. Plan in advance what should be done in all kinds of accidents. In case of an emergency, keep calm and attend to your own safety first. Next, call local emergency responders for assistance and alert people in the vicinity of the emergency and its potential impact on them. Take proper actions to decrease damage or injuries.

Procedure

1. General Emergency

1. Depending on the type of the emergency, there are specific guidelines to follow; however, there are a few general principles to follow for any type of emergency:
2. Keep yourself safe first and remain calm.
3. Call local emergency responders or a safety department (*i.e.*, Environmental Health and Safety (EHS)), when possible, to report the emergency.
4. Inform people nearby of what happened and pull the emergency alarm, when and if necessary.

2. Chemical Spills

Chemical spills are the most common accidents when working in a laboratory requiring chemicals. Improper or careless opening, handling, or storage of chemicals might lead to chemical spills. Large-volume spills of a non-hazardous chemical or even a small-quantity spill of a hazardous chemical spill might threaten the lives of laboratory personnel. Therefore, caution needs to be taken when working with chemicals and always wear proper personal protective equipment (PPE) to prevent bodily exposure in the case of a spill.

1. Chemical spilling onto surroundings
 1. Identify the area of the chemical spill and inform your laboratory co-workers of the spill. Evacuate the location and areas surrounding the spill, when necessary.
 2. Identify the spilled chemicals and the amount of chemical that has spilled. Depending on the hazardous properties and quantities of the spilled chemicals, proper actions need to be taken. Refer to the chemical's safety data sheet (SDS) for hazard assessments.
 3. Minor spills refer to spills of less than 1 gallon of low-hazard chemicals or less than 20 mL of hazardous chemicals:
 1. Wear proper PPE first before taking any action. Care should be taken to avoid bodily exposure to chemicals.
 2. If possible, modify the spill source to avoid further issues.
 3. If possible, turn off any nearby heat or ignition source if the chemical is flammable.
 4. Avoid breathing any vapors from spilled chemicals. This applies especially to chemicals that are toxic and volatile.
 5. Locate the spill kit and use appropriate kit tools to confine and contain the spill area.
 6. Use suitable adsorbent to cover the spill and neutralize the spill, if the chemicals are acidic or basic in nature.
 7. Collect the residues and place them into in a suitable container.
 8. Report to EHS to dispose of any chemical spill waste.
 9. Refill the spill kit.
 4. Major spills refer to spills of larger than 1 gallon of low-hazard chemicals or larger than 20 mL of high-hazardous chemicals. If a major spill occurs:
 1. Secure and evacuate the spilled area immediately.
 2. Make sure all nearby personnel are aware that a major spill has occurred.
 3. Call emergency responders or EHS for help.
 4. Never attempt to clean up a major spill even when wearing PPE.

5. If possible, without exposure to the spill, shut down the power to any heat source if the spilled chemical is flammable.
6. Help the emergency personnel identify the spilled area when they arrive.

2. Chemical spills onto the body

1. Wash off all chemicals spilled on a body immediately using a safety shower for at least 15 min. If clothes are saturated with spilled chemical, remove clothing immediately.
2. If the spill splashed into eyes, use an eyewash right away for at least 15 min. Open the eyes to allow complete washing. Only attempt to remove contact lenses after eye washing has commenced.
3. If the spilled chemical is a strong acid, wipe out the residues first before washing to avoid excessive or painful burning.
4. Remove contaminated clothing immediately to avoid further exposure to chemicals.
5. Call local responders or EHS for emergency assistance and alert people in the vicinity of the spill.

3. Fire or Explosion

1. Fire or explosion may occur from overheating, leakage, or spillage of flammable chemicals, or gases exposed to excessive heat, an open flame, or electric sparks in the laboratory. Be careful when working with flammable or explosive chemicals and avoid heat or electric sparks nearby. Safely operate electric equipment and any source of heat to prevent fire or explosion.
2. In case of a fire involving an individual's clothing, do not run since it might accelerate the fire. Stop, drop onto the ground with hands covering the face, and roll to extinguish the fire. If possible, use the safety shower to extinguish the fire.
3. In case of a lab fire or explosion, ensure your safety first and call emergency responders immediately for help.
4. Evacuate the building safely and pull fire alarms or notify nearby people, if possible.
5. Don't use elevators. Use stairs and locate the nearest exit.
6. If possible, shut down the electric power before evacuating.
7. Use a wet towel to cover the mouth and nose, if there is heavy smoke.
8. In case of a small fire, use a proper fire extinguisher and make sure an easy exit is available if you fail in extinguishing the fire. Here we listed the types of extinguisher and discussed the circumstances in which each extinguisher type should be used.
 1. Types of fire.
 - Class A: Ordinary combustible solids such as paper, wood, clothes.
 - Class B: Flammable liquids such as gasoline, petroleum oil and paint and flammable gases such propane, methane and butane.
 - Class C: Electrical equipment such as appliances, motors.
 - Class D: Combustible metals such as sodium, aluminum and potassium.
 - Class K: Cooking oil and greases such as animal or vegetable fats.
 2. Types of extinguisher.
 1. Water and Foam: for Class A fires only. Not suitable for class B or C fires. Water and foam extinguish fire by reducing the heat and the foam helps to separate oxygen from the objects.
 2. Carbon Dioxide: for Class B and C fires. Not effective for Class A fire. Carbon dioxide extinguishes fire by separating oxygen from the object and removing heat.
 3. Dry Chemical: multipurpose dry chemical works for Class A, B and C and ordinary dry chemicals works for Class B and C only. Dry chemical extinguishes fire by interrupting the chemical reaction.
 4. Wet Chemical: for Class K fire only. Wet chemical extinguishes fire by removing heat and separates oxygen from fuel elements.
 5. Clean agent: for Class B and C. Clean extinguishers used halon or halocarbon agents to interrupt the chemical reactions.
 6. Dry Power: for Class D only. Dry power takes away heat and separates oxygen to extinguish fire.
9. Be safe first and help others if possible.
10. Be aware of a second fire or explosion.

4. Personnel Injuries

1. Besides chemical spills, fire, or explosion, there are many other accidents that might happen in the lab, such as electric shock, heat burn, bleeding, or poisoning. Here are some general principles to follow for personnel injuries.
 1. Assess the situation before taking any actions.
 2. Ask the person what happened to them first, if they are conscious. Look for possible signs of injury if the person is unconscious and/or unresponsive.
 3. Call local emergency responders immediately if the person is in danger.
 4. Don't move the injured personnel unless imminent danger is present.
 5. If an individual has received an electrical shock, shut down the power first, if possible. Do not touch the person with bare hands. Use non-conductive material such as wood, glass, or rubber to pull the person away from the electric contact.
 6. If bleeding from minor cuts, flush with water to avoid contamination and treat with first aid supplies. If cuts are more serious, call for medical assistance.
 7. Initiate first aid to help, if possible.

Applications and Summary

Emergencies may happen in the laboratory no matter how detailed the safety regulations are. If an emergency arises, don't panic and ensure your safety first before attempting additional actions. Assess the situation and call local emergency agencies for assistance. For severe injuries,

wait until emergency responders come, and don't take any actions without appropriate knowledge. For minor injuries, use the first aid kit to help, when necessary.

References

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