Emergency and Rescue Manual

HiZJU-CHINA iGEM 2025

Introduction

Beyond biological experiments, we also need to possess certain emergency response capabilities and self-rescue skills in daily life, work, and study to ensure personal safety. To this end, we have compiled several common emergency scenarios and provided corresponding emergency plans, helping everyone master essential emergency rescue knowledge to deal with unexpected situations.

1. Fire Emergency Rescue

(1) Fighting incipient fires: Immediately call for help loudly, organize personnel to extinguish the fire with appropriate methods (selecting suitable fire extinguishers such as dry powder and carbon dioxide types), and dial the fire emergency number simultaneously (standard number in China is 119).

(2) Key points for emergency calls: Clearly state the fire location including building and room number, type of combustible materials, fire scale, presence of flammable, explosive, or toxic substances, whether people are trapped, and the caller's detailed information (name, institution, department, contact number), ensuring all information is as detailed as possible.

(3) Fire extinguisher operation: Follow the steps of "lift (the extinguisher), pull (the safety pin), hold (the nozzle), squeeze (the handle)" and ensure the extinguishing agent is aimed at the base of the flame.

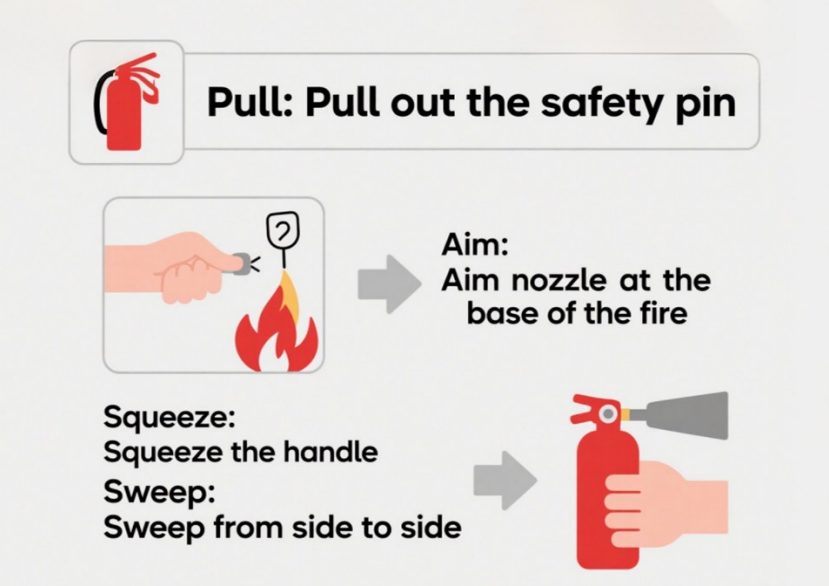

Figure 1. Usage of fire extinguishers

2. Self-rescue in Fire Scenarios

(1) Evacuation principle: Stay calm, identify the direction, and evacuate quickly to the lower floors. Do not crowd or flee in panic.

(2) Smoke prevention: Cover the mouth and nose with a wet towel or mask, and evacuate in a bent-over, low posture to avoid inhaling thick smoke.

(3) Escape routes: Never use elevators. If staircases are burned or passages blocked, move away from the fire and smoke, and escape via the roof terrace, balcony, or downspout. Alternatively, fix a rope to a stable object or use connected bed sheet strips if no rope is available, then slide down slowly while holding it.

(4) Response when evacuation is impossible: Retreat to a closed room, close doors and windows connecting to the fire, and pour water on the doors and windows to slow fire spread, then wave conspicuous clothes out of the window, tap the window to create loud noise, or shout to call for rescue.

(5) Treatment for clothing on fire: Do not run or pat the fire. Immediately remove the clothing, or extinguish the flames by pouring water,

rolling on the ground, or covering with heavy clothing. Afterward, carefully remove any clothing stuck to the skin, rinse the burned area with cold water, and then disinfect the wound with medical iodine or other disinfectants to prevent infection.

(6) Core principles: Prioritize life over property. Never re-enter the fire site without confirming safety.

3. Electric Shock Emergency Rescue

(1) Separate from the power source: Immediately turn off the main power switch or unplug the power cord. If the power source cannot be located or disconnected immediately, use dry insulating materials such as wooden sticks or bamboo poles to lift away the electric wire. Never touch live electrical objects or the electrocuted person directly.

(2) First aid and medical treatment: Quickly and gently move the victim to a well-ventilated, dry area and place them in a supine position. If the person has no breathing or pulse, first ensure their airway is clear, then alternately perform artificial respiration and external chest compressions. Meanwhile, dial the emergency number “120” and transport the person to the hospital as soon as possible, continuing cardiopulmonary resuscitation (CPR) during transport.

(3) Key points for artificial respiration:
(i) Tilt the casualty’s head back and lift their chin, remove any foreign objects from their mouth, and ensure airway patency;
(ii) Pinch their nostrils shut, give mouth-to-mouth breaths (ensuring no air leaks), with each breath lasting 1~1.5 seconds and at a rate of 12~16 breaths per minute;
(iii) If the casualty has a clenched jaw, switch to mouth-to-nose breaths, taking care to avoid air leakage from the mouth.

(4) Key points for external chest compressions:
(i) Locate the compression site: The rescuer slides the index and middle fingers of their right hand upward along the right costal arch margin of the electrocuted person until reaching the sternal angle (the midpoint

where the ribs meet the sternum). Keep the two fingers together, place the middle finger on the midpoint of the substernal notch (base of the xiphoid process), and rest the index finger flat on the lower part of the sternum, then place the heel of the other hand tightly against the upper edge of the index finger, onto the sternum, and that is the correct compression site.

Note: Ensure the heel of the hand is fully attached to the sternum to avoid pressing the ribs.

(ii) Perform standardized compression movements: Keep both arms straight and elbows fixed without bending, overlap the heels of the two hands (lift the palm of the top hand to avoid touching the chest wall), press vertically downward to depress the adult sternum by 5-6 centimeters each time, then fully release to ensure the sternum rebounds to its original position.

(iii) Compression rate: Perform compressions at a steady pace, 100-120 compressions per minute.

4. Chemical Accident Emergency Rescue

In the event of a chemical safety accident, immediately report to the laboratory supervisor, then take targeted emergency response measures based on the accident type, and arrange for medical treatment promptly after initial disposal.

(1) Chemical Burns

Immediately remove clothing contaminated with chemicals, and rinse the burned area thoroughly with running water for 15-30 minutes to ensure sufficient water volume to prevent the burn from spreading.

- For small-area minor burns: First rinse with running cold water for 30 minutes, then apply specialized burn ointment.
- For large-area extensive burns: Gently apply clean clothing soaked in cold water to the wound to avoid friction, then seek medical attention immediately.

Notes: Keep blister membranes intact. Do not peel off damaged skin. Never apply colored substances like mercurochrome, gentian violet, soy sauce, toothpaste or non-specialized drugs, as they may interfere with medical staff's judgment of wound depth and subsequent treatment.

(2) Chemical Corrosion

Quickly remove contaminated clothing, rinse the corroded area with copious amounts of running water for 15-20 minutes. If the chemical's properties are known, use a compatible solvent/solution (for instance, weakly alkaline solution for acidic corrosion, weakly acidic solution for alkaline corrosion) for further cleaning. Keep the wound clean and wait for medical personnel.

If chemicals splash into the eyes, immediately rinse with running water gently for 15-20 minutes, tilt the head toward the injured eye to prevent water from flowing into the uninjured eye to avoid cross-contamination.

(3) Chemical Frostbite

Quickly move the frostbitten person to a warm environment and away from cold objects. Rewarm the frostbitten area by soaking it in warm water around 40°C (not exceeding 42°C). Once the frost thaws, gently remove or cut off frostbitten clothing. Seek medical help immediately while continuing rewarming.

If the frostbitten person has cardiac or respiratory arrest, perform chest compressions and artificial respiration, and continue first aid until vital signs recover or medical personnel arrive.

Notes: Never use fire heating, snow rubbing, cold water soaking, or forceful beating on the frostbitten area which may worsen tissue damage.

(4) Inhalation Chemical Poisoning

(i) Cut off the toxic source: Immediately close valves of toxic chemical pipelines and seal leaking equipment to stop further toxin release.

(ii) Reduce concentration: Open doors, windows, and exhaust equipment to maintain ventilation and dilute airborne toxin levels.

(iii) Safe rescue: Rescuers must wear a protective mask like activated carbon mask and chemical protective clothing to ensure adequate protection before entering the toxic are.

(iv) Evacuation and help: Quickly move the poisoned person to a well-ventilated area upwind to prevent further toxin inhalation. Provide on-site first aid and call the emergency number "120" for transportation.

(5) Ingestion Chemical Poisoning

(i) Ingestion of General Chemicals

To reduce the concentration of chemicals in the stomach, slow down their absorption, and protect the gastric mucosa, immediately take milk, eggs, flour, starch, mashed potato puree, or drinking an adequate volume of water. Alternatively, take water containing activated carbon (typically 10-15 grams of activated carbon can adsorb 1 gram of toxin) in divided doses to induce vomiting or diarrhea. Meanwhile, immediately send the victim to a hospital for emergency medical treatment.

(ii) Ingestion of Strong Acids

Immediately drink adequate volume of 0.17% calcium hydroxide solution, magnesium oxide suspension, or 3-4% aluminum hydroxide gel. Milk, vegetable oil, or water can also be used to dilute the toxin quickly. Subsequently, take beaten egg yolks as a demulcent, and immediately send the victim to the hospital.

Notes: Never induce vomiting or perform gastric lavage without professional guidance. Do not take sodium carbonate or sodium bicarbonate solutions. They will react with acids to produce large amounts of carbon dioxide, which may cause gastric distension or even gastric rupture.

(iii) Ingestion of Strong Bases

Immediately drink adequate volume of five-fold diluted edible vinegar or fresh orange juice to dilute the toxin. Then take olive oil, egg white, or milk to protect the gastric mucosa, and immediately send the victim to the hospital.

Notes: Never induce vomiting or perform gastric lavage without professional guidance.

(iv) Ingestion of Pesticides

- Organochlorine poisoning: Immediately induce vomiting and perform gastric lavage. Use 1-5% sodium bicarbonate solution or warm water for gastric lavage, then instill adequate 50% magnesium sulfate solution. Send the victim to the hospital immediately.

  Notes: Oil-based laxatives are prohibited.

- Organophosphorus poisoning: Generally, 1% salt water or 1-2% sodium bicarbonate solution can be used for gastric lavage. If trichlorfon is ingested, use normal saline or clean water for gastric lavage. Send the victim to the hospital immediately.

  Notes: Sodium bicarbonate solution is strictly prohibited since trichlorfon converts to more toxic dichlorvos when exposed to alkali.

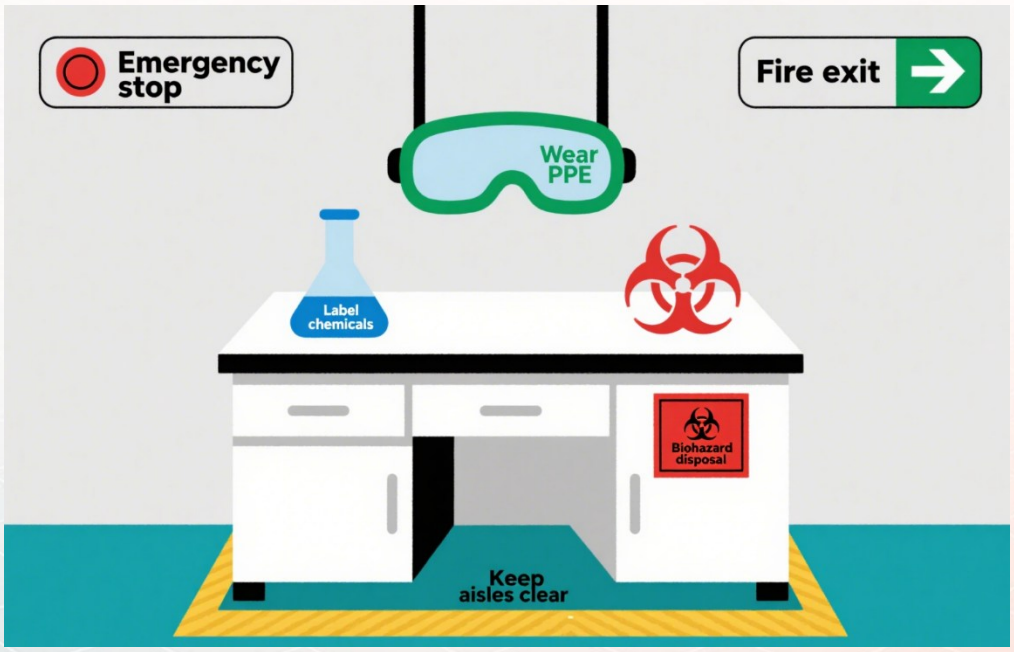

Figure 2. Laboratory safety protection and emergency response

(6) Gas Explosions

Immediately cut off the on-site power and gas supply, guide personnel to evacuate along safe routes to an upwind outdoor area. Move other explosive items on-site to prevent secondary explosions. Call the fire emergency number 119 and wait for rescue.

Conclusions

Safety is no trivial matter. We hope every student will proactively learn emergency protection measures, master emergency escape and self-protection skills, continuously enhance their personal safety awareness, and thereby effectively prevent potential safety hazards from evolving into safety accidents.