

TE 3. UNIT 1.1. SMART SAFETY DEVICES. SURNAME NAME GROUP

Task 1. Match the terms with their correct definitions.

Term	Definition
1. sensor	A. A system that alerts operators when a dangerous condition is detected
2. alarm system	B. A device that detects changes in physical or environmental conditions and provides data
3. fail-safe mechanism	C. A mechanism that automatically stops equipment when a dangerous condition occurs
4. safety interlock	D. A mechanism designed to put or keep equipment in a safe state when a failure occurs
5. automatic shutdown	E. A mechanism that prevents equipment from operating unless certain safety conditions are met

Task 2. Choose the correct answer.

1. What is the main purpose of an Emergency Stop (E-stop) button?

- A. To start the machine automatically
- B. To instantly cut power to machinery in an emergency
- C. To monitor gas levels in the workshop
- D. To activate the fire suppression system

2. What is a "thermal hotspot"?

- A. A place where workers gather for safety training
- B. A section of the factory with good ventilation
- C. An area of abnormally high temperature indicating friction or overheating
- D. A location where fire extinguishers are stored

3. According to the reading, what caused the AI surveillance camera to fail in the workshop?

- A. A failure in the software logic
- B. Cutting fluid mist and ambient dust coated the camera lens
- C. The camera was turned off by a student
- D. A power outage occurred during the night shift

4. What is the primary function of a "safety interlock"?

- A. To automatically shut down equipment when gas is detected
- B. To provide early warning of potential mechanical faults
- C. To stream operational data to maintenance terminals
- D. To prevent equipment from operating unless certain safety conditions are met

5. In the chemical plant incident described in the reading, what three automated actions did the safety system take?

- A. Closed pneumatic valves, engaged ventilation fans, triggered visual beacons
- B. Sounded an alarm, called the fire department, evacuated the building
- C. Shut down the entire plant, notified the media, stopped production
- D. Activated sprinklers, closed all doors, turned off the lights

Task 3. Choose the correct word from the box below to complete each sentence.

• **threshold** • **inspection** • **telemetry** • **detector** • **emergency stop**

1. The safety officer suspended workshop operations after the quarterly routine _____ uncovered microscopic fatigue fractures in the gantry crane.
2. The optical flame _____ triggers an automated deluge valve within milliseconds of sensing ultraviolet radiation.
3. In high-precision CNC machining centers, the _____ must be hardwired directly to the master contactor to isolate drive power.
4. If ambient gas levels rise above the safety _____, the control software triggers an automated alarm.
5. Modern sensors stream operational data and vibration _____ directly to maintenance terminals in real time.

READING

The U.S. Steel Clairton Explosion: When Procedures Are Not Enough

On August 11, 2025, a deadly explosion at the U.S. Steel Clairton Coke Works in Pennsylvania killed two workers, injured eleven others, and caused over \$52 million in property damage. The incident occurred during a routine maintenance operation when a large cast-iron valve cracked, releasing highly flammable coke oven gas. Within minutes, the gas ignited and exploded.

What went wrong? Workers were attempting to clean a valve blocked with coke oven residue. To remove the blockage, they pumped high-pressure water into the valve – a practice the company had been using for at least three years, but one that had no formal written procedure.

The failed valve was over 70 years old and made of cast iron, a material widely recognized as brittle. When workers closed the valve's double gates while applying pressurized water, the water became trapped inside, creating extreme pressure that the old valve could not contain. The valve failed catastrophically.

The CSB investigation found that U.S. Steel's written procedures called for using steam to clean valves, yet the company had been using water informally for years. Worse still, none of the workers actually performing the task had attended the hazardous job meeting where the work plan was discussed.

The CSB Chairperson stated: "This deadly incident was the result of an ad hoc informal procedure, poor facility siting, and an ineffective process safety management system. It should never have happened."

Had the company conducted a proper hazard analysis and addressed the risks, the incident could have been prevented. The investigation serves as a stark reminder that technology alone cannot prevent disasters. Even the most sophisticated gas detectors and alarm systems are useless if companies ignore basic safety procedures and fail to train workers adequately.

Task 1: Read the statements and choose if they are TRUE or FALSE.

1. The explosion occurred because a gas detector failed to sound an alarm.
2. The valve that failed was over 70 years old and made of cast iron.
3. Workers were using high-pressure water to clean the valve, and this practice had a formal written procedure.
4. The CSB investigation concluded that the incident could have been prevented.
5. All workers who performed the task had attended the hazardous job meeting where the work was planned.

Task 2: Complete each sentence using words from the text.

investigation • catastrophically • procedures • residue • ad hoc

1. The valve failed _____ when pressure inside exceeded its limits.
2. Coke oven _____ had accumulated in the valve seat over time.
3. The company had been using water on an _____ basis for years.
4. The CSB _____ revealed serious safety management failures.
5. The company had no formal _____ for cleaning valves with water.

Task 3: Match the problem with its cause.

PROBLEM	CAUSE
1. The cast iron valve cracked	A. None of the workers attended the hazardous job meeting
2. Workers used water instead of steam	B. The valve was over 70 years old and made of brittle material
3. Workers were not trained on the correct procedure	C. The company had been using water informally for years

Task 4: Put the events in chronological order (1-4):

- A. The old cast iron valve cracked and released flammable gas.
- B. Workers pumped high-pressure water into a blocked valve.
- C. The valve had become blocked with coke oven residue.
- D. The released gas ignited and exploded, killing two workers.