

Explosives Safety Initial Training



Course # 5.01
Rev. 08041-TO

Terminal Objective: Identify safe practices for work on or around explosives in accordance with the DOE Explosives Safety Manual, DOE M 440.1-1A, (Pantex Manual 240176).

Enabling Objectives:

- EO1: Describe basic explosives hazards.
- EO2: Identify UN Hazard Class 1/Division Placards used at Pantex
- EO3: Describe explosives labeling and marking used on containers at Pantex.
- EO4: Identify explosive safety Engineering and Administrative controls in use at Pantex.
- EO5: Describe the symbols for fire divisions associated with the explosives hazard at Pantex Plant.
- EO6: Identify the difference between explosives areas and non-explosive areas at Pantex.
- EO7: Describe the purpose and identification of exclusion areas at Pantex.
- EO8: Identify correct responses when encountering explosives moves.

Introduction

B&W Pantex performs a significant amount of work involving explosives. Explosives are located in many areas at plant site. While you are physically at plant site, you may either be indirectly or directly exposed to the hazard of explosives. In case of an inadvertent explosion, the risk of being injured or becoming a fatality does exist for each of us.

EO1: Describe basic explosives hazards.

There are two main hazards resulting from an explosion, heat and blast.



- **Heat** which is created by the chemical reaction. Heat precedes the blast effects. Heat may produce thermal burns.
- A rapid generation of high pressures from the released gas can create a shock wave which is commonly called **blast**.

Blast is broken down into three effects.

1. Primary effect is overpressure. Overpressure can cause damage to the eardrums, the sinuses, and the lungs.
2. Secondary effect is fragmentation. Fragments can cause “impact” damage or penetrate the body.
3. Tertiary effect is a physical displacement of a person.

EO2: Identify UN Hazard Class 1/Division Placards used at Pantex

The United Nations (UN) established a system, based on actual tests, of identifying hazardous materials or dangerous goods. The placard is a diamond shape with orange background and black lettering and/or numbering. It uses a Class/Division designator and is recognized Internationally. It is used by Department of Defense, Department of Transportation, and Department of Energy.

Hazardous materials/dangerous goods are divided into classes on the basis of the specific chemical characteristics producing the risk. The division is used as a descriptor of the effect or results. Class 1 identifies the hazard as explosives. It is then sub-divided into 6 Divisions. Simply stated, the smaller the number, the more dangerous the explosive hazard. (e.g. 1.6 used at Pantex, 1.5 is not used at Pantex) Also, a letter designator identifies the compatibility group assigned to help segregate items during transport or storage.

- **Class 1/Division 1 (1.1)** - mass explosion hazard. (e.g. at Pantex: LX-04, PBX-9404, and LX-10.)
- **Class 1/Division 2 (1.2)** - Non-mass explosion, but are fragment producing. (e.g at Pantex: Some Spin Rocket Motors, some Security Response Force Munitions.)
- **Class 1/Division 3 (1.3)** - Mass Fire, and may produce minor blast or fragments.(e.g. at Pantex: Gas generators and insensitive high explosives(IHE) LX-17, PBX-9502.)
- **Class 1/Division 4 (1.4)** - Moderate fire, with no significant blast or fragment hazard. (e.g. at Pantex: Squibs, Actuators, Valves, and some small detonators.)
- **Class 1/Division 6 (1.6)** - Minor fire hazard, with an insignificant mass explosion hazard. (e.g. at Pantex: IHE consolidated charges without boosters or detonators, IHE nuclear explosive assemblies and subassemblies with boosters, with or without detonators, and IHE articles with 1.4 items.)



EO3: Describe explosives labeling and marking used on containers at Pantex.

At Pantex, hundreds of containers, boxes, and shipping configurations are used. It is important to correctly and easily identify the content and hazardous potential. ***Labels are easily recognized and are a form of communication.*** (diamond shaped, orange background, with the class/division number, and a symbol-may/may not be exhibited on label. e.g. explosive.) Pantex is required to identify these using the ***UN Hazardous Material Classification/Division labels or placards.*** This allows everyone at Pantex to easily recognize the potential hazard the item poses.

Pantex marks containers with other specific information using a label identified as “PX-form” (e.g. PX-1234.) This PX-form will contain information which clearly identifies the contents of the package/container with information important to Pantex.



EO4: Identify explosive safety Engineering and Administrative controls in use at Pantex.

Hazardous events associated with operational activities involving nuclear material and explosives are evaluated to determine consequences according to the type of material, source of insult, and effect to workers at Pantex, the public, and environment. Controls are selected and used to help protect the employee, the item or weapon system. Controls may be either engineering or administrative.

Engineering controls. There are two kinds of engineering controls. There are design features and limiting conditions of operation (LCO).

- **A design feature is a structure, system or component (SSC) where the properties of the material provide the safety function.** It only relies on its material. (e.g. Reinforced concrete construction; interlocking gates, doors, and electrical circuits in remote operations; design of special tooling and equipment; fire suppression system.)
- **LCOs describe the lowest functional capability or performance level of Critical Safety structures, systems, component and their support systems required for normal safe operation of the facility.** (e.g. High Pressure Fire Loop, Lightning Protection System)



Administrative controls are the **provision relating to organization and management, procedures, record keeping, reviews, and audits** necessary to ensure safe operation of the facility and maintain the underlying assumptions in the Technical Safety Bases. The requirements of these programs are identified as either Administrative Control Programmatic Requirements or Administrative Control Specific Requirements. It requires action by an individual. **Administrative controls must be followed for Engineering controls to be effective.** (e.g. Approved operational procedures, training, posted Limit Placards)

- **Approved operational procedures** – According to the Level of Use, the procedures direct operations.
- **Training** – designed to provide employees the knowledge, skills, and attitudes necessary to perform job functions.

LIMITS PLACARD

Location: _____
 Operations Description: _____

MATERIAL	LIMIT	INVENTORY
Explosives (lb)		
Pu ²³⁹ (kg)		
Tritium (g)		
U ²³⁵ (kg)		
U ²³⁸ (kg)		
Th ²³² (kg)		
Pu ²³⁸ (g)		
Personnel		

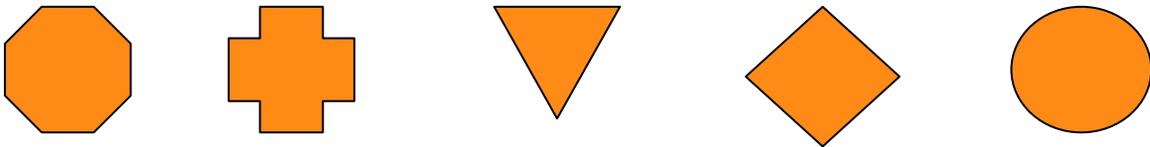
PR - Process Requirements - Material restricted to that amount required to support process flow.
 QL - Configuration Limited - No specific limit when configured as part of a higher assembly.
 UL - Unlimited - If Explosive material is not restricted to a specific compatibility group or quantity (max).

Facility Sign: _____ Badge #: _____ Date: _____
 Validation: _____ Badge #: _____ Date: _____

COMMENTS: _____

- **Nuclear Material and Explosive Inventory Program - Posted Limit Placards** (PX-100-35) – designates the maximum amount or quantity of radioactive material, explosives, and personnel allowed in each work location or storage facility.

EO5: Describe the symbols for fire divisions associated with the explosives hazard at Pantex Plant.



All buildings or storage sites containing explosive materials, flammable or combustible liquids, or gases are marked with a symbol to identify the most severe hazard associated with the materials in a building or storage site. (e.g. Octagon, cross, inverted triangle, diamond, or circle) The numerical designator is assigned according to the UN Hazard Class/Division (e.g. UN Hazard 1.4, the fire symbol will have a “4” as the designator.) These symbols alert emergency responders of the expected hazard. These are easily visible to approaching fire fighting forces from the maximum practical distances on the exterior of the facility. For building of long dimensions or where access to the building is from several directions, more than one symbol may be necessary. **All explosive fire symbols are orange background with black numbers/symbol and the shape determines the potential result of the hazard involved.**



EO6: Identify the difference between explosives areas and non-explosive areas at Pantex.

As you have learned, we perform a great deal of explosives work at Pantex. We perform work with explosives in many different areas at plant site. While these explosives activities impact every location at Pantex, there are some areas that are more hazardous than others.

The more hazardous areas are called explosives areas. Personnel physically present in explosives areas are exposed to a greater risk factor. *Explosives areas must offer personnel a greater protective factor because of the inherent risk.* Characteristics of explosive areas and facilities:



- **Constructed with reinforced concrete or steel armor plate.**
- **Identified with a Fire Symbol (Orange) on exterior**
- **Reinforced concrete structures with Steel Barriers or earthen shielding.**
- **Warning signs, lights, and audible horns.**
- **Warning barriers or gates to prohibit entry during operations.**

The *less hazardous areas are called non-explosives areas.* These areas are intermixed and border each other all over plant site. Characteristics of non-explosive areas and facilities:



- **Buildings built without concrete reinforcement.**
- **Buildings constructed with metal siding and roofs. (e.g. Morgan™ buildings)**
- **Buildings with windows.**

EO7: Describe the purpose and identification of exclusion areas at Pantex.

Exclusion Areas are specific physical locations where the required protection from explosives blast and debris is not provided through suppression or containment for personnel, the public, and environment.

Exclusion areas are only active during explosive operations. Personnel are not allowed in Exclusion Areas during Explosives Operations. If in the exclusion area when the visual/audible warnings begin, personnel have 4 minutes to make their way into a safe area outside the exclusion area. **DO NOT ENTER** active Exclusion Areas and **DO NOT ALLOW** others to enter active exclusion areas. Should you observe someone in an active Exclusion Area, advise them to leave the Exclusion Area immediately and immediately notify the Operations Center at ext.5000.

Identified by a combination of physical barriers and visual/audible warnings.

- **Physical barriers**
 - Gates
 - Chained corridors, ramps, or hallways
 - Roadblock – Railroad type barrier
- **Visual/audible warnings**
 - Flashing/blinking lights
 - Audible – warnings sounding like horns/sirens
 - Posted “Danger/Warning” signs

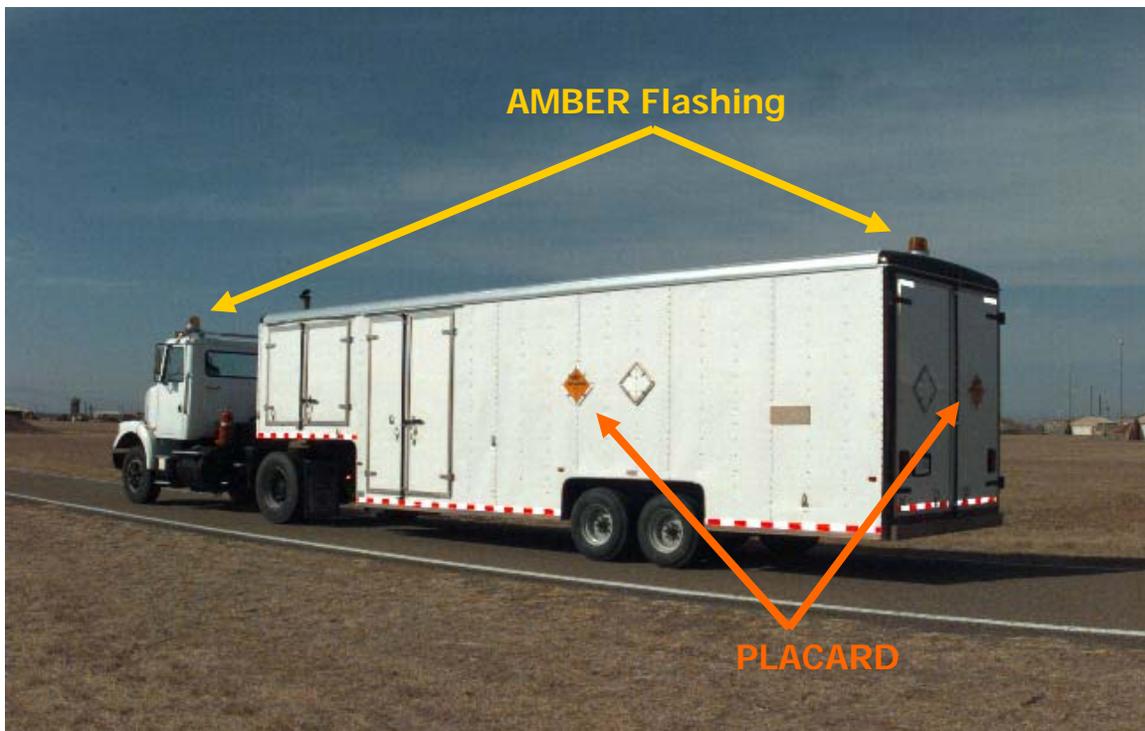


EO8: Identify correct responses when encountering explosives moves.

While you are going about your business on the Plant, you may encounter Explosives Moves either on roadways or inside the ramps, corridors, hallways or loading/unloading docks of Pantex Plant. It is important to the safety of both the transport material and personnel encountering the move to know how to react and respond.

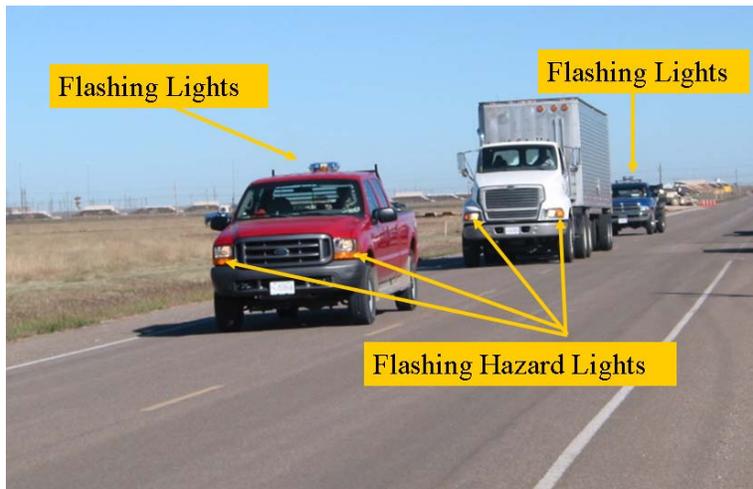
Recognition of **Transportation Explosive Truck** on Pantex roadways: Several types of vehicles are used.

- **Amber flashing lights** on vehicle, or the vehicles hazard lights flashing.
- **Orange Placarded** for explosives.



Recognition of *Nuclear Explosive (NE), Nuclear Material (NM) or Nuclear Explosive Like Assembly (NELA) transport on Pantex roadways*(Pantex Dr., S. 13th St., Lafayette Dr., to Z12 MAA):

- **Convoy Escorts: 2 vehicles with flashing AMBER lights.**
Approximately 300 feet to the front and rear of NE transport vehicle.
- NE/NM transport vehicle - Tractor with trailer (**no placards**)
- Convoys travel only on approved routes (Zone 4 Material Access Area(MAA) to Zone 12 MAA, Protected and Limited Area, or vice-versa.)
- Traveling speed – 20 mph.



CAUTION

SPEED LIMIT FOR ALL VEHICLES ON CONVOY ROUTE is posted at 20 MPH AT ALL TIMES.

Exception: Emergency Response & Security personnel who are responding to alarms, security incidents, or emergency incidents

Vehicle traffic on site roadways approaching a NE, NM, or NELA Move: (from front, rear, or either side.) Exception: Emergency Response & Security personnel who are responding to alarms, security incidents, or emergency incidents.

- **Do not approach, stay approx. 300 feet from transport.**
- **Pull to side of roadway**
- **Stop**
- **Remain stopped until the Convoy has passed and a separation distance of approx. 300 feet has been accomplished.**

NOTE:
Walker/spotter requirements for Hazard Class 1.1 or 1.2 explosives or IHE with detonators apply only to the Zone 12 MAA.
CAUTION
Vehicles must never come from behind and pass material in transit unless given direction by the walker/spotter.

Vehicular, bicycle and/or pedicycle, or pedestrian traffic in Zone 12 MAA approaching an Explosive Move escorted by walker/spotter who is wearing a red/orange fluorescent vest. (from front, rear, or either side):

- **Separation distance of 25 feet from all forklifts regardless of load.**
- **Follow directions of walker/spotter.**
- **Pull to side of ramp, corridor, or hallway.**
- **Stop and allow transport items to pass.** (25 ft. separation distance.)



If transport item is stopped:

- **Follow directions of walker/spotter.**
- **Stop**
- **Await permission to pass.**