9. Explosion

A **36-year-old** Hispanic boiler maker suffered fatal burns after an explosion occurred at a refinery where he was working. The victim and two injured co-workers were employed by a contractor at the facility. The three employees were hospitalized as a result of the explosion. The victim died four days later from burns over approximately 90% of his body. The events occurred in the area of the South Flare and Knock-Out Drum (KO Drum). A 36-inch pipe delivers hydrocarbons from the refinery production area and collects them in the KO Drum. Another 36-inch pipe exits the top of the KO Drum and delivers vapors to be burned at the South Flare to relieve pressure from the production area. The process leading up to the fatality began when, during a turnaround (shut down for maintenance), an environmental project was begun to capture flare gas and re-use it as fuel or feedstock rather than burn the gas in the flare. The 36-inch pipe between the KO Drum and the South Flare would be altered by installing a by-pass which would allow the South Flare to remain in service while work was performed at the KO Drum and the Flare Gas Recovery System. To begin the recovery project, the KO Drum and Flare Gas Recovery System had to be isolated from the South Flare and piping to the flare. Three employees of the contractor climbed onto the catwalk above the South Flare KO Drum at the 36-inch diameter outlet pipe. Their job was to open the pipe flange, insert a pipe blind, and close the flange. They opened the flange 1-2 inches to insert the blind. When the pipe was opened a fire blew out of the opened pipe flange onto all three workers. Their clothes caught fire; water cannons were activated to spray the workers and the refinery emergency response team was alerted. One worker who survived was burned over about 65% of his body and the other over 45%. The workers were provided supplied-air respirators for protection from the inhalation hazard of the hydrocarbon vapors, but fire protective gear was not provided.

Citations As Originally Issued

Citation 1

Item 1a 1910.132(a)	Protective equipment, including protective clothing, were not provided and used wherever it was necessary by reason of hazards of processes and chemical hazards encountered in a manner capable of causing injury or impairment of the function of any part of the body through physical contact.
Item 1b 1910.132(d)	The employer did not assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment.
Item 2 1910.147(c)(4)(i)	Procedures were not developed, documented, and utilized for the control of potentially hazardous energy.
Item 3 1910.147(c)(7)(i)	The employer did not provide training to ensure that the purpose and function of the energy control program was understood by employees and that the knowledge and skills required for the safe application and use of the energy controls was acquired by employees.
Item 4a 1910.147(d)(1)	Before authorized or affected employees turn off equipment, the authorized employee did not have the knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

Item 4b 1910.147(d)(2)	The equipment was not turned off or shut down using the procedures established for the equipment.
Item 4c 1910.147(d)(3)	All energy isolating devices needed to control the energy to equipment were not physically located and operated in such a manner as to isolate the equipment from the energy sources.
Item 5a 1910.147(d)(5)(i)	Following the application of lockout devices to energy isolating devices, all potentially hazardous stored or residual energy was not relieved, disconnected, restrained, and otherwise rendered safe.
Item 5b 1910.147(d)(5)(ii)	Where there was a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation was not continued until the servicing or maintenance was completed, or until the possibility of such accumulation no longer exists.
Item 6 1910.147(d)(6)	Prior to starting work on equipment that has been locked out, the authorized employee did not verify that isolation and deenergization of the equipment had not been accomplished.

See Photos on Next Page

DESCRIPTION	This photo shows the location of the South Flare KO Drum 36" pipe exiting the top of the drum as indicated by the blue arrow. The photo also shows the crane used to lift the blind to the platform & to help lift the 36" pipe so that the blind can be inserted into the flange as indicated by the red arrow.
CONFIDENTIAL MATERIAL	N/A