

#5: Flash Fire – Inspection #317804722

A **41 year old male** employee was exposed to a flash fire. An employee in a mix room was exposed to a fire and explosion when an energetic material ignited. Much of the mixing process was conducted remotely with operators separated by concrete walls from the large quantities of material. A process step required an operator to enter the mix room and clean a small amount of residual material from mixer equipment. While cleaning the mixing equipment the material ignited and a flash fire and explosion occurred. The severity of the event was increased by inadequate and poorly implemented procedures. The employee was not wearing the required personal protective clothing. The employee did not record the shoe conductivity test on the log, suggesting the test may not have been conducted. The quantity of material in the mix room (basis of controls incorporated into employer procedure) exceeded the amount the employer anticipated to be present when conducting the specific cleaning task. The daily safety checklist was not initialed by the supervisor, indicating poor management oversight. The employee later died of his injuries.

Citation(s) as Originally Issued

A complete inspection was conducted at the accident scene. Some of the items cited may not directly relate to the fatality.

Citation 1

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| Item 1a 1910106(e)(6)(i) | Adequate precautions against the ignition of flammable vapors were not taken: Adequate precautions were not taken to prevent electrostatic discharge from igniting flammable solvent vapors during the use of acetone and binder solutions in mix processes: a) containers of acetone were not electrically interconnected to mix bowls during transfer; b) containers of flammable binder solutions were not electrically interconnected to mix bowls during transfer; c) conductive tools were not always used during mixer cleaning operations; and d) adequate precautions were not taken to ensure daily contamination of conductive shoes soles did not prevent the shoes from remaining conductive through the 12-hour workday. |
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| Item 1b 1910.106(e)(6)(ii) | Class 1 flammable liquid(s) were dispensed into containers without electrically interconnecting the nozzle and container: Electrostatic discharge sources were not controlled during mix processes: a) containers of acetone were not electrically interconnected to mix bowls during transfer; b) containers of binder solutions were not electrically interconnected to mix bowls during transfer. |
| Item 2a 1910.119(d)(2)(i)(C) | Process safety information pertaining to the technology of the process did not include the maximum intended inventory: The written process safety information did not include documentation defining the maximum intended inventory of energetic material (wet and dry states) existing in the Mix Room at the time of the cleaning between batches and at end of batch cycles. |
| Item 2b 1910.119(d)(2)(i)(D) | Process safety information pertaining to the technology of the process did not include the safe upper and lower limits: The written process safety information did not define in written documentation the upper limit of the quantity of energetic material existing as residual material (wet and dry states) in mixer bowl and on mixer surfaces at the time of cleaning between batches, in which an operator can safely perform mixer cleaning processes. |
| Item 3a 1910.119(e)(1) | The process hazard analysis did not identify, evaluate, and control the hazards involved in the process: The employer's process hazard analysis did not identify, evaluate, and control the following hazards involved in processes a) The hazard of solvent-wet composition permitted to dry while stored for multiple batches in a catch tray in the Mix Room. b) The hazard of reducing the protection provided by pyro-suit through excessive use of acetone on aluminized outer coverings. c) The hazard of daily contamination of conductive shoes soles preventing the shoes from remaining conductive throughout the 12-hour day. |
| Item 3b 1910.119(e)(3)(vi) | The process hazard analysis did not address human factors: a) Employee failing to use personal protective equipment required by specific process specification. b) Employee failing to always transfer residual composition from catch tray to mix bowl. c) Employee failing to use conductive scraper for Mix Room cleaning processes. d) Employee failing to wet- dried composition with acetone during mix bowl cleaning processes. e) Employee failing to thoroughly clean mixer after each batch. f) Employee entering Mix Room while mixer was in operation. |

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| Item 3c 1910.119(e)(6) | The employer did not ensure after the initial process hazard analysis that the process hazard analysis was updated and revalidated at least every five (5) years by a team meeting that requirements of 29 CFR 1910.119(e)(4). Most current PHA report for mixing had not been updated and revalidate within 5 years. |
| Item 4a 1910.119(f)(1)(i)(B) | The employer did not develop and implement written operating procedures that provided clear instructions for safely conducting activities in each covered process consistent with the process safety information and which covered the steps for reach operating phase including normal operations; a) multiple procedural steps contained in the written operating procedures, or process were not implemented; b) written procedures were not developed and implement to provide clear instructions for transferring waste energetic material from process buildings to waste storage areas. |
| Item 4b 1910.119(f)(1)(ii)(B) | The employer did not develop and implement written operating procedures that provided clear instructions for safety conducting activities in each covered process consistent with the process safety information and which address operating limits including the steps required to correct or avoid deviation beyond such operating limits; a) the process did not clearly detail the operating limits for conducting specific cleaning processes in the mix room and did not provide clear instructions that limited the amount of energetic composition existing in the mix room from safely conducting the process; b) the process did not clearly detail the operating limits for manually handling raw flare grains. The process specification did not provide clear instructions that limited the number of grains contained in ammo can when an employee was required to open the ammo can from manual transfer to waste drums; c) the process specification did not clearly detail the operating limits for manually handling ventilation socks containing energetic material waste. The process specification did not provide clear instructions that limited the quantity of energetic material waste when changing bag filters and when cleaning the wet collector. |

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| Item 5 1910.132(a) | Protective equipment was not maintained in a sanitary and reliable condition: Pyro-suits with PAPR provided to employees for entering the mix room to conduct cleaning processes involving energetic decomposition were not maintained in a sanitary and reliable condition; a) Pyro-suit surfaces were contaminated; b) loose/damaged stitching of pyro-suit aluminized outer coverings caused open seams; c) physically damaged pyro-suite aluminized outer coverings caused openings d) pyro-suit hood leans were overused. |
| Item 6 1910.132(d)(1) | 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 (PPE): An adequate hazard assessment was not conducted to determine appropriate personal protective equipment (PPE) needed to protect employees from thermal/fire hazards when performing specific tasks in the transfer of waste energetic composition from production buildings to scrap areas, including: a) manual handling of ventilation/filter socks containing energetic material waste when not soaked in waste or diesel; b) manual handling of raw flare grains when not contained in closed ammo boxes. |
| Item 7a 1910.132(d)(1)(i) | When the employer had assessed the workplace hazard(s) and determined that hazard(s) were present, the employer did not select and/or use the types of personal protective equipment that would protect the affected employee from the hazard(s) identified: The employer did not ensure employees used the pyro-suit with PAPR when entering the mix room to conduct cleaning processes involving energetic composition. The pyro-suit was required to protect employees from identified fire and thermal hazards. |
| Item 7b 1910.119(f)(1)(iii)(B) | The employer did not develop and implement written operating procedures that provided clear instructions for safely conducting activities in each covered process consistent with the process safety information and which addressed safety and health considerations including the precautions necessary to prevent exposure, including engineering controls, administrative controls, and personal protective equipment: Personal protective equipment provisions detailed in the written operating procedure for conducting the process of cleaning residual energetic composition from the mixer were not implemented. Employees did not use full pyro-suit w/PAPR when entering the mix bay to clean mixers as required by the process specification. |

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Photo 1 of 1: Building that contained a process to manufacture energetic composition via batch mixing.