Monsanto

FROM (NAME & LOCATION) G. Chesnut

DATE March 3, 1983

cc H. Conrad
R. Hammann
M. Leidy

SUBJECT FEBRUARY SAFETY MEETING

REFERENCE

PLAINTIFF'S EXHIBIT
MON-1353

TO : K. E. Bretz

The subject of the February Safety Meeting was "Dept. 33 Flare Operations".

Accident Investigation Report No. 82-36 was reviewed.

Chief Operators reviewed Dept. 33 flare operation with each operator assigned to their shifts.

Attached are copies of the material used.

Procedure Bulletin P-0123 and P-0116 was reviewed at this time.

George Chesnut

Attended:

Townsend
Heer
Beal
Myers
Holcomb
Rains
Moore
Hayes
Tovrea
Prendergast
Boggess
Johnson
Lingenfelter
Lemons
Scott

TEXAS CITY PLANT

ACCIDENT INVESTIGATION REPORT NO. 82-36

I. INCIDENT

A pipefitter suffered a perforated ear drum when an explosion occurred as he was removing a large relief valve from the methanol plant flare header on Tuesday, December 7, 1982. A fellow worker was uninjured. There was no mechanical damage.

II. CAUSE AND CONTRIBUTING FACTORS

The cause of this incident was the failure of Manufacturing to communicate and Maintenance personnel to recognize the hazard of opening an active flare system containing a mixture of low molecular weight flammable gases. A possible contributing factor to the injury was the failure of the injured to wear ear protection as required in this area.

III. RECOMMENDATIONS

- Discontinue the practice of performing maintenance on an active flare header without positive isolation.

  Responsibility: R. A. Hernandez
  Timing : Immediately

- Manufacturing and Maintenance personnel should emphasize thorough planning and communication for all aspects of all shutdowns. Particular emphasis should be given to changes in job scope, or changes in timing.

  Responsibility: B. L. Johnson
  A. M. Berry
  Timing : Immediately

- Communicate to Operations and Maintenance personnel the requirements for wearing ear protection when portions of the unit are shut down.

  Responsibility: B. L. Johnson
  A. M. Berry
  Timing : Next safety meeting

- All units should be made aware of potential negative pressure in flare systems, and should review their flare system practice, operation, and input streams. Upgrade procedures to describe the above hazards, and communicate to appropriate personnel.

  Responsibility: SHAC
  Timing : June 20, 1983

LAM001248

IV. DETAILS OF REPORT

a. Description

Department 46 (cold box area) was shut down at 0500 hours on November 30 for maintenance. Department 44 (reformer area) and Department 45 (methanol synthesis area) continued to operate. The cold box area was isolated and decontaminated for maintenance. Maintenance work was initiated on December 6. Included in this maintenance was removal, inspection, and testing of fifty-two (52) relief valves. Two of these relief valves, RV603 and RV607, were on the residual gas compressor, 46C601. This machine was down. Both relief valves vented into the high pressure flare header. This flare header was still in service, and subject to receive process gas from relief valves or pressure control valves in the reformer area. The operating areas were functioning very well with stable operation.

On December 7, pipefitters Herb Guisti and Jim Butler began removing the first of the aforementioned relief valves. There were no block valves. Chief operator Ed Frazier told them to blind the flare opening, but did not emphasize why or how quickly the blind should be installed. RV603 was removed, and a blind was placed on the flare header opening without incident. The pipefitters recalled that the flare opening was "sucking like hell." The opening was uncovered for a period estimated to be 1/2 to 2 minutes. Removal of the second valve, RV607, was more difficult and required more time because its inlet side was connected to a long run of unsupported pipe. While in the process of removing this valve, the pipefitters again heard air rushing into the flare opening. Before the relief valve could be completely removed and the flare opening blinded, an explosion occurred inside the flare system. The estimated length of time that the flare was open was 2 to 5 minutes.

Pipefitter Guisti was stunned and momentarily disoriented by the explosion. He suffered a perforated eardrum in the left ear. He did not see any flame or smoke or feel any heat. Pipefitter Butler felt a concussion, but was uninjured. He saw black smoke or dust in the immediate area, but saw no flame and felt no heat. Both men left the area. Guisti reported to Medical and was taken to the Clinic of Eye, Ear, Nose, and Throat. He returned to work after treatment.

Manufacturing foreman Craig Johnson placed a slip blind over the open hole approximately one minute following the explosion. A nitrogen purge was started to the flare header through a nitrogen hose. There were no further incidents.

b. Findings

1. The initial shutdown was scheduled from November 22 to December 13. All work was to be done on straight days. The shutdown schedule was changed as the result of increased production demands. The actual shutdown started November 30 and ended December 15. Work was still performed on a straight day basis with judicious use of overtime authorized. There was no change in the shutdown worklist as a result of the shutdown being shortened by three to four days.

2. Prior to the shutdown, several memos and checklists were written, and planning meetings and a unit safety meeting were held on the upcoming shutdown. These memos and meetings were focused on the cold box isolation, decontamination, entry, and repair. There was no detailed description of the non-cold box area shutdown, decontamination, safety hazards, or special work precautions on specific jobs. There was a memo issued listing shutdown jobs without elaboration.

3. On November 30 (the initial day of the shutdown), the regular maintenance foreman was transferred from Department 44, 45, 46 to fill the position of the retired W.P.O. On November 22, a foreman from the Department 31 area was transferred to Department 44, 45, 46 as a replacement. (There was a 1-week overlap.) The replacement foreman has worked on a temporary basis in Department 44, 45, 46 for about seven years. He had not participated in pre-shutdown planning. During the one-week overlap coverage, the replacement foreman's orientation was devoted heavily to the cold box.

4. Operations personnel who were checking lines prior to relief valves being removed were "having a hard time staying in front of the pipefitters." Thus, they were rushed, and the quality of their work perhaps suffered.

5. Earlier in the shutdown, four relief valves being removed for inspection were under static N_2 pressure. One flange which was being opened for isolation blinding was under N_2 pressure. The source of this pressure was an open nitrogen purge into the line.

6. There was an unusually large number of relief valves (52) scheduled for inspection. Normally, only 10-12 relief valves are inspected in a shutdown of this size and duration. Several of the relief valves were beyond the one-year inspection date. Because of increasing run time between shutdowns, this effort was made to "catch up."

7. Some of the large relief valves are pilot operated valves, and in the past only the pilots were removed for testing. RV607 was a pilot operated valve. Manufacturing assumed that only the pilot would be removed in this case. Instead, the entire valve was removed. There were no communications regarding the removal of only the pilot.

8. Analyses of flare system gases following the explosion (see Appendix I) show the presence of H_2, CO, CO_2, CH_4, N_2 and O_2. The large concentration of N_2 (about 50% mol) was caused by a nitrogen purge which was not present at the time of the incident. The calculated molecular weight of the analyzed gas was approximately 20. A literature reference on flares (see Appendix II) gives an equation for calculating the condition of draft at the base of a flare as a function of stack height and gas molecular weight. This flare with this gas would generate a draft condition of approximately three inches of water. Further, the reference offers an equation for determining whether the pressure at the stack base will be greater or less than atmospheric, depending on temperature and molecular weight of the gas. Calculations show that a pressure less than atmospheric would be expected. By actual measurement on the day following the incident, the pressure was one inch of water, vacuum.

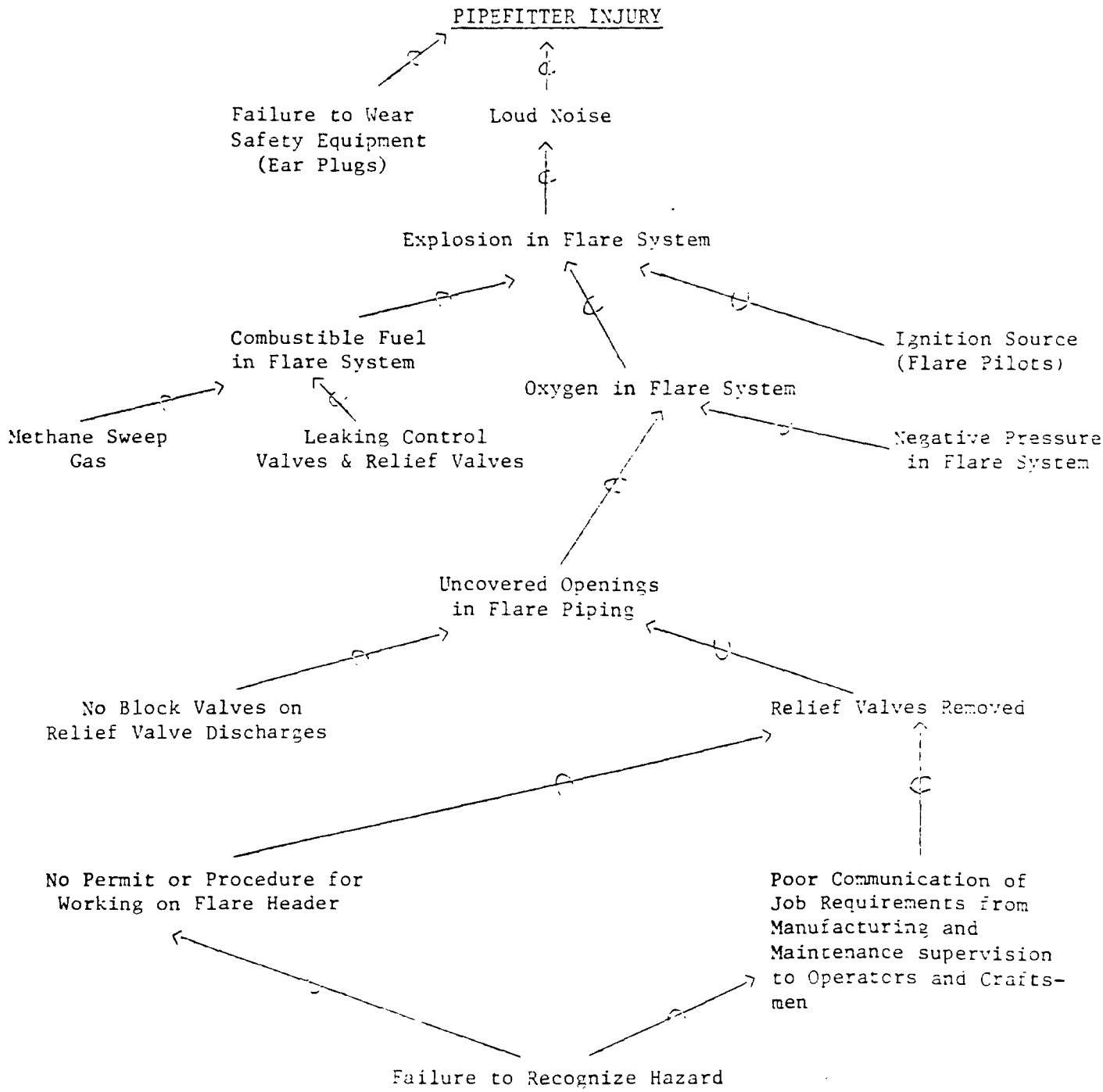
9. Four 1" relief valves had been removed from the flare header on the day preceding this incident. An apprentice operator accompanied the pipefitters during the removal. The valve openings were not blinded until after the incident.

10. There is disagreement as to whether removal of large relief valves from an active flare header has taken place before. Craftsmen contend that they have done it before, while both Maintenance and Operations supervision contend that it has not been done before. Both agree that small (1") relief valves have been removed from an active flare header without incident.

11. Removal of the two large relief valves was performed without any permit procedure. The chief operator told the pipefitters to blind the flare opening, but did not emphasize why or how quickly.

12. With the cold box being isolated from the flare header, the usual large volume N_2 sweep into the flare header was absent. A purge of natural gas to the flare sump was started to provide adequate flare stack sweep.

13. Two observers saw a large bright red "ball" of flame above the flare tip immediately after hearing a loud explosion. Immediately preceding the explosion, these observers and one additional individual heard a series of loud, sharp reports similar to a high-powered rifle.


PIPEFITTER INJURY
Failure to Wear Safety Equipment (Ear Plugs)
Loud Noise
Explosion in Flare System
Combustible Fuel in Flare System
Oxygen in Flare System
Ignition Source (Flare Pilots)
Methane Sweep Gas
Leaking Control Valves & Relief Valves
Negative Pressure in Flare System
Uncovered Openings in Flare Piping
No Block Valves on Relief Valve Discharges
Relief Valves Removed
No Permit or Procedure for Working on Flare Header
Poor Communication of Job Requirements from Manufacturing and Maintenance supervision to Operators and Crafts-men
Failure to Recognize Hazard

c. Discussion

- The committee concluded that a flashback explosion occurred in the flare system as the result of the ignition of a mixture of flare gases and air. Obviously, the air was admitted when the relief valves were removed. The source of ignition was the flare pilot flames. The series of sharp rifle-like reports was the shock wave changing directions in the flare system piping. This is a well-known phenomenon.

- It is quite unlikely that a flammable or explosive mixture existed inside the flare piping near the open relief valve flange. The inward rush of air (dilution) discouraged a rich mixture. The absence of heat or flame from the flange opening also suggests that the explosion was farther downstream.

- The injured was not wearing the required ear protection because of an apparent misunderstanding of the requirements when part of the complex is down. While ear protection would not have prevented the incident, the committee feels that the injury might have been avoided. A fellow worker in close proximity was wearing ear protection (E-A-R expandable foam) and he was not injured.

- The committee shares some concern regarding the replacement of experienced maintenance supervisory personnel in an area immediately preceding a shutdown. (There is no evidence that the incident was related to the change in maintenance personnel, however.) When this is absolutely necessary, more orientation and familiarization time should be given the replacement.

- The shutdown mentioned in this report involved work primarily in the cold box. This area is recognized by both Manufacturing and Maintenance personnel as a very hazardous area in which to work. Much planning and communication had taken place regarding decontamination, isolation, and permitting procedures for entry into and work in the cold box. The concern for safety in this hazardous area was so great that safety in other parts of the shutdown, i.e., the simple parts, was overlooked. This is not atypical; we do good jobs of overcoming difficult problems, but we sometimes let the simple problems bite us.

- The relief valves mentioned previously (RV603, RV607) were reinstalled without incident with the flare header in service. This was accomplished by careful planning and thorough, effective communication.

- This incident is not the first flare incident in this plant. J. H. Swain related an incident involving the Department 18 flare system in "about 1954." A contractor removed a relief valve from an active flare line before the line was blocked in. An explosion occurred, resulting in shock and burns to the pipefitter.

PROCEDURE BULLETIN—TEXAS CITY PLANT P-0123

BYPASSING AND TESTING PROTECTIVE DEVICES

PURPOSE

Define the control measures necessary to reduce losses due to bypassed or malfunctioning protective devices.

POLICY

No protective devices will be intentionally bypassed or made inoperative without providing adequate alternate protection, continuing communication that the device is bypassed, and approval from authorized supervision.

All protective devices will be routinely tested to assure operability.

SCOPE

This procedure applies to any department (operating unit, laboratory or facility) which must use protective devices to minimize loss or control conditions that affect the safety of personnel and equipment. Examples of protective devices are: shutdown devices, interlocks, critical alarms, relief valves, vents, backflow preventers, etc. (This procedure supersedes P-0123.)

RESPONSIBILITY

The responsibility for control of protective device bypassing and the routine testing of protective devices rests with the owning department at the level of Manufacturing Superintendent or PT Group Supervisors as the case may be.

Each department will be responsible for providing the necessary internal procedure to implement the control of bypassing and testing protective devices along the guidelines established in this procedure. The departmental procedure shall clearly indicate the level of authority needed to allow the bypass, but no case should exclude the Chief Operator. The department's procedure should be reviewed by the General Superintendent and Loss Prevention and Safety Department when originally written or revised.

PROCEDURE

SC 000057

A. Bypassing Protective Devices

In the event that a protective device must be taken out of service, it will be the responsibility of authorized supervision to approve its removal from service.

LAM001254

The Supervisor/Chief Operator authorizing removal from service will define and implement alternate means of providing the protection afforded by the device before the device is removed from service. Alternate protective means will be immediately defined and implemented on those devices which were not deliberately removed from service but discovered to be inoperable. Alternate protection will be maintained until the primary protective device is returned to service.

When a protective device is out of service, a tag will be placed on a status board conspicuously located in the unit control room (or equivalent location).

The tag *(available from Stores) will contain the following information:

1. Description and/or function of the device out of service.
2. Reason for removal.
3. Alternate protection established.
4. Name of the operator and foreman responsible for initially removing the protective device from service or finding the device to be malfunctioning.
5. Date and time protective device was removed from service or found to be malfunctioning.
6. Supervisor authorizing removal from service.

The board will be checked at least each shift by the Chief Operator on duty to ensure that the protective devices are returned to service as soon as possible. The Operating Foreman will monitor the status on a daily basis.

Whenever protective devices on operating equipment are out of service due to malfunction or maintenance, the job will be worked on a continuous basis until completed and the device has been returned to service unless the authorizing Supervisor, based on his judgement of loss potential exposure and adequacy of alternate protective means, reduces the priority to a regular work basis.

△ Bypassing of safety shower/eyebath alarms is not permitted. Exceptions to this rule will require explicit approval of the responsible General Superintendent.

B. Routine Checking of Protective Devices SC 000058

In order to minimize the loss potential resulting from inoperable protective devices, each department (operating

*See Attachment #1

PROCEDURE BULLETIN—TEXAS CITY PLANT P-0116

AREA SAFETY INSPECTIONS

I. PURPOSE

The purpose of this bulletin is to define a procedure for inspection of area safety equipment that will accomplish the following:

A. Insure equipment is ready for use.

B. Train personnel in location of equipment.

C. Improve area safety consciousness.

II. POLICY

The safety facilities of every area are to be inspected at predetermined intervals.

III. RESPONSIBILITY

A. The Plant Manager's Safety Board has the over-all responsibility for setting the minimum requirements of the Safety Inspection Program for the entire plant.

B. The Manufacturing Superintendent/Supervisor or equivalent has the responsibility for setting the requirements for his area: equipment to be inspected, frequency of inspections, methods of testing, limits of delegation, and amount of feedback. The minimum requirements set by the Plant Manager's Safety Board must be met in each case.

C. The Manufacturing Foreman or equivalent is responsible for carrying out the program as defined for his area.

D. The Loss Prevention and Safety Department is responsible for an annual review of the over-all plant program, with feedback of the results going to the Plant Manager's Safety Board.

IV. SCOPE

This bulletin covers all operating and non-operating areas at the Texas City plant: manufacturing departments, office buildings, laboratories, warehouses, shops, storerooms, etc.

V. PROCEDURE

This procedure defines the minimum requirements for the Area Safety Inspections as outlined in the LP&S Procedure Bulletins. It also recommends inspection frequencies for items not specifically covered in these Procedure Bulletins.

AREA SAFETY INSPECTIONS

The inspections are to be made using check lists of safety equipment developed specifically for that area. The purpose of these lists is to insure complete and repetitive inspection of the equipment plus serve as a record of these inspections. The actual inspecting, testing, etc., may be accomplished by the methods or individuals that will be most expedient for that area, but check lists must be dated and initialed by individual doing the inspecting.

Two equipment inspection frequency lists are included in this procedure. The first list covers items specifically mentioned in other Procedure Bulletins with their required inspection frequency. The second list includes other safety equipment and a recommended inspection frequency. In no way should this be considered an all inclusive list. Other items should be included as needed to maintain area safety awareness.

A. Required Safety Equipment Inspections

1. Weekly

a. Car sealed or locked valves (includes valves under relief valves) - P-0123.
b. CO_2 extinguishers - P-0124.
c. Dry chemical extinguishers - P-0124.
d. Wet pipe sprinkler systems - P-0124.
e. Deluge sprinkler systems - P-0124.
f. Nitrogen back flow preventers - P-0126.
g. Eyebath and safety showers - ANSI Z358.1-1981 (Include flushing, alarm testing, and condition of light and signs.)
h. Blind flanges on tank valves (applies to tank bottom valves located on large storage tanks where there is little surveillance and where leak or valve failure could cause a hazardous condition or serious environmental exposure).

2. Monthly

a. Deluge sprinkler systems--drain test - P-0124.
b. Breathing air pipe lines - P-0130.
c. Respiratory equipment - P-0130.

3. Semiannually

a. Utility hoses - P-0121.
b. Breathing air hoses - P-0121.

4. Annually

SC 000060

a. Ladders - P-0114.
b. Steam hoses--hydrostatic - P-0121.
c. Marine & chemical hoses--hydrostatic - P-0121.

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