Safety and Health Review
Deer Park Refinery
October 25 - 29, 1976

The primary purpose of the Safety and Health Review is to assist the locations in evaluating the effectiveness of their safety and health program. The review team based their investigation on the premise that the goal of the program was to provide the environment, training, and incentive which permits the employees to perform their duties in an efficient manner without harm to themselves or damage to physical property.

The format of the review involved the evaluation of the safety aspects of the following ten categories: organization and administration, design practices, operations, maintenance, fire protection, industrial hygiene, employee participation and motivation, training, incident evaluation, and recordkeeping. The recommendations in the report are made as a result of observations or investigations made during the survey. However, it should be understood that, since time limitations did not permit in-depth studies in some cases, the recommendations are intended to focus management's attention to a situation which may merit further study.

SUMMARY

A. Organization and Administration

1. Safety Organization

The safety organization's responsibilities are understood to be as follows:

a. Consultation with line and staff personnel in the fields of fire, safety and health.

b. Participation in formal safety training programs for employees and supervisors.

c. Employee training in fire fighting techniques and the use of respirators.

d. Safety program review and evaluation.

e. Industrial hygiene monitoring.

f. Maintenance of fire equipment and respirators.

g. Administration of the fire and safety permit system.

It was evident that considerable effort has been put into the development of the formal safety program. Current safety and health emphasis seemed directed towards formal training and procedure development. These are essential, of course, but need to be balanced by a strong

emphasis on responsibility and awareness in the line departments. The refinery seems to be dedicated to developing strong line safety programs. The thrust appears to be that each employee is responsible for safe operating practices and procedures and for using good judgement in his efforts to prevent accidents. The team judged that the overwhelming majority of the employees was convinced that the refinery management was making a sincere effort to implement a good safety and health program for the employees. The team felt that the safety department could assume a stronger audit role in the management of the safety program, working with line management and senior staff to improve the effectiveness of the program at the foreman-employee level.

2. Plant Safety Rules

The complex is to be commended for instigating an extensive program to provide comprehensive procedures manuals. The new system will replace all existing safety, emergency, general and standing order manuals with an eight volume order system; however, some of the procedures developed for the manual seem to be too voluminous and technical for the intended audience. In addition, development time for critical safety seemed excessive. Every effort should be made to keep the procedures as brief as possible. Coordinated training of the writers of the procedures appears desirable.

The existing employee safety manual was printed in 1964 and has not been updated. It is our understanding that the manual may be re-issued in loose-leaf form as a quick summary of the more comprehensive and controlled safety orders.

B. Fire Protection

1. Fire Water System

The refinery fire water system is integrated with the fire water system at the Chemical Plant. Currently, the primary source of fire water is unclarified water from the Phillips Pumping Station (Source: Lake Houston). Adequate on-site storage is provided by TK W-38 and Cooling Tower No. 1 and No. 2 reservoir. Six 1500 gpm fire water pumps are available to maintain pressure on the fire water system.

Normally, Pump No. 1 (electric drive) at CT No. 1 and No. 2 reservoir maintains a system pressure of approximately 175 psi. When the fire alarm sounds, an operator at Power Plant No. 1 immediately starts Pump No. 2 (steam drive) and operators at the wharf start Pumps No. 3 and No. 4 (diesel drive). Pump No. 2 takes suction on the unclarified water system and Pumps No. 3 and No. 4 take suction on the

channel. Two other pumps are available at the Chemical Plant if required. With the completion of the Trinity River project, the primary source of fire water will be clarified water from the Phillips Pumping Station. A seventh pump (electric drive) is currently being installed at TK W-38. In addition, two connections are available on the ship channel for the use of fireboats which have 6000 gpm capability. The capacity of the system has recently been evaluated by computer program and found to satisfy Shell's requirements for pressure and capacity.

Fire water is used for utility stations, maintenance shutdowns, and process applications.

Recommendation

Procedures should be developed to assure that the fire water system is protected from possible contamination with flammable materials when used for process and maintenance applications.

2. Fire Control

A fire alarm is turned in by dialing 6555. The phone rings at the Main Gate and the Utilities Control Center. The main gate sounds the alarm and, during off-hours advises the telephone answering service to call Alert No. 1. The UCC reports the location of the fire over the operating and maintenance radio frequencies. The crews ride two foam trucks and one pumper truck to the fire. The first line fire crew consists of a fire chief, who is Manager - Safety or Supervisor - Safety (Refinery Supervisor - during the off-hours until safety representative arrives at the fire), two crew chiefs - operating foremen, and two crews - each consisting of six operators and one pipefitter. The second line fire crew consists primarily of the safety inspectors. The ambulance does not automatically respond to a fire alarm.

The team understands that the fire procedures section of the emergency manual is being revised. Our discussions with employees confirmed the concern of management that the time to get to the fires is excessive and that there is considerable turnover in the membership of the first line fire crew.

Recommendations

a. Consideration should be given to a procedure to allow fire crew members and equipment to proceed directly to the site of the fire independently of each other. The necessity of routinely driving three fire trucks to the fire could be evaluated. Assigned personnel from the refinery lab could proceed immediately to the fire in the trucks.

b. A system to evaluate the overall experience level of the fire crew whenever a person leaves the crew would better insure continuity of quality and training.

c. The location ambulance should routinely respond to the fire alarm to assure that immediate transportation and medical assistance is available to any injured personnel.

d. The size of the second line fire crew should be evaluated to assure that adequate trained personnel are available during the off-hours to supplement the safety inspectors who may not all be available. An excellent nucleus for a volunteer fire crew exists in the area.

3. Primary Fire Fighting Equipment

The process areas have strategically spaced 1-1/2" hose reels, fixed monitors and 2-1/2" hose houses. Fire extinguishers and hydrants are adequately spaced throughout the refinery. Fixed sprinker and deluge systems are installed on most C_3 and C_4 storage. Some systems use drilled pipe horizontal sprinklers over light hydrocarbon storage. The team received the impression that some of thse systems are not tested routinely for effectiveness.

The permanently mounted tags on the portable fire extinguisher units do not include the date of the annual maintenance and the identity of the individual performing the maintenance as required by OSHA Standard 1910.157(d).

Recommendations

a. Sprinkler and deluge systems should be tested periodically for effectiveness. Further, since drilled pipe systems have traditionally shown a tendency to plug, we suggest these systems be reevaluated for adequacy. Spray nozzles may be desirable.

b. Information pertaining to the maintenance of fire extinguishers, including the date performed and the identity of the individual performing the maintenance, should be mounted on each unit.

C. Industrial Hygiene

1. Air Contamination

The refinery has monitored for benzene, toluene, xylene, MEK, CO, asbestos, silica, H_2S, SO_2 and hydrocarbon. Routine atmospheric monitoring is continuing on a quarterly basis for contaminants which are pertinent to their operation. Personal monitoring programs have been conducted for employees exposed to benzene, silica, MEK, toluene and asbestos. In general, there seemed to be little concern from the

employees about exposure to air contaminants. However, the publicity given to the concern and the subsequent epidemiologic studies at the Lube Plant prompted particular comments from employees in that area. Concern was expressed by operators in the Lube Plant about exposure to phenol vapors, from operators in the PXU about exposure to xylene vapors and from welders in the maintenance shop about exposure to welding fumes.

Recommendations

a. Continue with the current personal air monitoring program as scheduled. Consider the inclusion of phenol in the program for the lube plant.

b. Recommend that exposure of welders to fumes and gases be evaluated.

2. Physical Hazards

Noise contour maps were available in control rooms throughout the refinery. However, the maps in most locations had not been updated. The use of the noise contour maps to minimize employee exposure to high noise levels is limited, based on the observation of completed permits and discussion with the operators. Hearing protection devices were readily available to employees throughout the refinery. No personal monitoring for noise exposure has been accomplished. An audiometric testing program is on-going for new employees and operating and maintenance personnel.

Recommendations

a. Review noise contour maps at least annually for accuracy of information. Field maps should show date of the most recent review.

b. Emphasize the importance of proper administration of hearing protection program to insure that employee exposure to noise is within the limits designed on the contour maps.

3. Control of Hazards

Material Safety Data Sheets (MSDS) on major purchased materials and manufactured products were available in most, but not all, control rooms. However, information on some significant intermediate streams and some chemicals was not available. Information on the composition of welding rods and fluxes was not available to the welding craft. The Safety Bulletin Program initiated earlier in the year supplements the MSDS information. This information was available throughout the refinery and is being used as a training aid by some departments. Specific inquiries relating to CCU slurry oil and on chromates used for cooling water corrosion inhibitor were received from operators during the review.

The refinery has made extensive efforts to control exposure to vapors, gases and dusts. Special efforts have been made to reduce exposures to benzene, asbestos, silica, wood dust and slurry oil through the use of improved ventilation, closed-loop sampling systems and improved respiratory protection.

Laboratory hoods are used throughout the refinery to control personnel exposure to hazardous materials; however, exhaust hood ventilation rates are not checked on a periodic basis. No instructions could be found relating to procedures for use of the ventilation system installed at the tank truck loading rack to minimize employee exposure to benzene during the loading operation. It was our understanding that contract personnel perform this operation.

Recommendations

a. Review current availability of Material Safety Data Sheets to insure that pertinent hazard information on purchased materials, including welding rods and fluxes, manufactured products and critical intermediate streams is available in the control rooms, laboratories and maintenance facilities. Revew critical intermediate streams for the presence of potentially hazardous materials, such as benzene and polynuclear aromatics, to determine for which streams hazard information should be develcped.

b. Periodic inspections for performance of the laboratory ventilation hoods are recommended.

c. Establish program to evaluate the effectiveness of the exhaust hoods in the maintenance shops for maintaining an acceptable work place environment.

d. Review the effectiveness of the vapor collection system at the tank truck loading rack.

4. Respiratory Protection

In general, the assignment and location of the respirators is adequate. The source of air for air supplied respirators is normally purchased bottled breathing air. Scott Air Paks are used for emergencies. The self-contained respirators are inspected monthly by the operating departments. Air-purifying type respirators, both of the canister type and the cartridge type, are available at many of the control houses. In addition, dust respirators are used, primarily by maintenance personnel. It was noted that current procedures allow MSA Gasfoe cartridge and Type N canister air-purifying respirators to be used for H_2S service. MSA recommends only the super size GMC-55-1 canister for H_2S service.

Recommendations

a. Review the refinery recommendations for type of respirator to be used for H_2S exposure. Recommend that the pressure demand air supplied respirators be used wherever possible.

b. Review procedures for training employees on the use of respirators. Recommend that training become a line responsibility.

c. Review overall use and selection of respirators.

d. Review the possible need for self-contained respirators in the Refinery Quality Control Laboratory.

5. Skin Contamination

Skin contact with hydrocarbons and chemicals is normally avoided in the Refinery through the use of goggles and gloves. Personal hygiene procedures have not been established for materials which contain 4-6 ring PNA's such as slurry oil and DUTREXES®, although Material Safety Data Sheets contain some hygiene information. Protective equipment is provided as needed, based on current information. Gloves and goggles are readily available.

Recommendation

Work with Manufacturing Safety & Health to establish personal hygiene procedures for materials which contain 4-6 ring PNA's such as slurry oil and DUTREXES. The procedures should specify steps to minimize skin contact; insure prompt cleanup should skin contact occur; and to insure proper cleanup before eating, smoking and leaving work.

6. Eating Facilities

Employees in the Quality Control Laboratory eat lunch in the same room that effluent samples are handled.

Recommendations

a. Separate all food preparation and eating facilities from laboratory facilities.

b. Establish procedures for good hygiene practices to insure proper cleanup before eating, smoking, etc.

D. Supervisor/Employee Participation and Motivation

Current safety and health activity is primarily directed toward the formal training of both supervisors and employees. Most of these programs are either new or recently modified. The program is comprehensive, ambitious

and well conceived. It is well directed towards the defined goal of increasing employees' safety awareness and enthusiasm for safety. The effort is directed toward line responsibility for safety.

Safety meetings in operations are conducted monthly by the supervisors during the shift. Maintenance supervisors, with the help of the Safety Department, conduct safety meetings for Maintenance personnel twice monthly.

Employee morale was good. Some operators questioned had some pet project or projects that they felt should be accomplished to improve the safety of their working conditions. The impact of the PXU explosion was felt by operators in that unit, adjacent units and the other units which have a head medium system.

Most operators and craftsmen recognize and appreciate the increased safety effort instigated by the Refinery. They can see the results. They believe the company is sincere in their efforts. Some operators expressed concern that the foremen very seldom emphasize safety in their day-to-day activities. However, they admit that they are more knowledgeable and concerned about safety than in earlier years.

Recommendation

A continuing effort should be made to make safety an integral part of line responsibilities. Safety awareness needs to be a day-by-day effort in the routine communications between supervisors and employees.

E. Training

The training program for Refinery employees is comprehensive and well thought out.

1. Operations

A five-phase operator development program is currently in effect to train new operators. The duration of the program is approximately 12 months. The program includes a three-week classroom session, supervised on-unit training, job assignments and experience training, self-development, and a one-week classroom retraining session. Success of program depends upon the effectiveness of the training coordinator. Currently, the training coordinators are used for other than training activities. Most operators felt the operator development program was good, but thought that the training coordinators and/or foremen should increase their training role during Phase II and the early parts of Phase III. In evaluating the effectiveness of the program, the team felt that formal training efforts should extend beyond the entry position--at least through the early stages of the second job assignment; training manuals should be concise and easily understood; serious evaluation of qualifications of new operators should take place during the probationary period; and more time should be devoted to industrial hygiene.

Simulated emergency drills were well received by the operators. There is a variation in the quality and frequency of these drills in the various units. This is a very effective training tool and should be encouraged and observed by the process manager.

2. Engineering

All of the Engineering technical staff could benefit from more training on safety and, particularly, health problems. The more senior engineers have been exposed to most safety problems, but are not sufficiently oriented to health problems. Continuity of safety and health expertise to assure maximum safety in design and operation is important. A responsible individual or team should take an active role in providing safety and health input to projects and procedures.

New metallurgical and pressure equipment inspectors are currently attending a comprehensive, recently instituted (16-session) training course which includes one session on safety, but no indicated industrial hygiene training. To our knowledge, the electrical, instrument and mechanical equipment inspectors receive no continuing safety training.

New foremen receive some safety training during their orientation, but get limited industrial hygiene information. Craft trainees who come from operations receive the formal safety training from the Operator Development program. This training is supplemented during the formal craft training when the safety aspects of a particular craft are discussed by an experienced craft foreman. New employees who are hired directly as craftsmen receive only the short orientation given all new employees. If general helpers are brought into maintenance in greater numbers for longer tenures, consideration will be given to providing craft related safety and health training.

3. Fire

Each member of the fire crew receives fire training approximately once a month. The drill usually lasts two to three hours. Emphasis is placed on creating simulated fire situations to provide opportunities for fire crews to become more familiar with fire fighting equipment, techniques and the areas where fires may occur. The related Operating Department also takes part in the drill. Members of the crew also have the opportunity to attend a Complex sponsored fire training school at Texas A&M. In addition, Refinery management, staff emergency fire crew backup, training coordinators and hourly relief foremen are also invited to attend.

Currently, a one-time fire fighting training program is being offered to shift foremen and the hourly operating personnel not associated with the fire crews. A comprehensive one-day classroom/field program,

including live fire fighting experiences, is designed to familiarize all operating personnel with the basics of fire fighting techniques. Many operators expressed their enthusiasm for the training program. New operators should have equivalent training.

Recommendations

a. Recommend that all employee training course curriculums be reviewed for adequate coverage of health considerations.

b. The Refinery may want to consider the assignment of an individual or team who would assume the responsibility for the continuity of safety and health expertise at this location and would take an active role in providing safety and health input to projects and procedures.

c. Training coordinators could benefit from some additional guidance in writing concise training manuals and in developing effective training techniques. Consideration should be given expanding their role in training operators beyond the entry job.

d. Operating units should be encouraged to increase the frequency of the simulated emergency drills and add to their effectiveness as a training tool.

e. Supervisors would benefit from a comprehensive training program which would assist them in integrating safety responsibilities into their line responsibilities. An effective program could emphasize the importance of continued safety awareness with one-on-one safety training, safety permit writing and simulated drills.

f. Craftsmen hired off the street should be given comprehensive safety and health training at least equivalent to the training received by the operators.

F. Design Practices

1. Atmospheric Vents

Recent experience with H_2S exposure from compressor atmospheric vents at Deer Park has emphasized the importance of proper location for the discharge of these vents. Generally, in the areas surveyed, reciprocating compressor distance pieces are vented to the flare and other light hydrocarbon vents in the process units are vented to the flare or to the fuel gas system.

Recommendation

As all areas were not inspected, the Refinery should be assured that no compressor or other vents discharge to atmosphere within a sheltered

area. Vents should be connected to the flare if possible, but, at a minimum, could be discharged to the atmosphere above the shelter, assuming there would be minimum possible H_2S and hydrocarbon exposure.

2. Small Piping and Nipples

A cursory review was made to determine if there were unnecessary or potentially hazardous small piping connections at pumps and other equipment which could fail and release hydrocarbon vapors to the atmosphere. No significant problems were noticed.

Recommendation

Shutdown schedules should provide for the inspection of the small piping, particularly the nipples connecting the small piping to the larger process lines or equipment, inflammable liquid or vapor service, or where the liquid is close to or above its flash or auto-ignition temperature.

3. Tankage

In general, tank spacing and firewall capacity appear to be adequate. Mechanical and electrical equipment inside the tank levees have been kept to a minimum.

4. Volatile Liquid Storage

Most C_3/C_4 storage vessels inspected had either a sprinkler or deluge system installed permanently at the vessel. Some C_3/C_4 storage vessels in the Alkylation and Paraxylene units do not have fixed fire protection. At some locations, the actuating valves were not identified. The valves to actuate the deluge system to the 16 vertical propane storage tanks in the East Property could not be located.

No facilities were available to waterflood these and other large volume C_3/C_4 storage vessels with water so that they could preferentially leak water in case of a failure at the vessel or in unprotected piping.

Time did not allow complete evaluation of water draw installations from C_3/C_4 vessels. Experience has shown that the potential for incidents during this operation is significant. Water draws on storage vessels should contain two valves adequately spaced to minimize the potential for freezing during the draining operation.

Recommendations

a. Review the location of the operating valves for deluge and sprinkler systems and provide identification as required.

b. Connection on piping manifolds away from the C_3/C_4 storage area should be considered to permit the emergency injection of water into the piping and vessels for the purpose of controlling a leak by preferential displacement of hydrocarbon with water. (A permanent water connection should not be installed.)

c. C_3/C_4 storage vessels in the Alky and PXU areas which do not have fixed fire protection should be evaluated for adequacy of protection.

5. Heat Exchangers

An investigation was made into the potential for light hydrocarbon leakage into the cooling water system. The heat exchanger applications involving cooling water in the systems that serve most cooling towers are such that in case of leaks, light hydrocarbon entry into the CW return system is a possibility. Only the newer cooling water towers have vents on the return risers. The team understands that an AFE is circulating to convert the older CW towers.

6. Fired Heaters

Time did not permit a thorough review of all fired heaters; however, based on spot observations and discussions, it appears that several mechanisms for flame-out protection are in use in the plant. For instance, some fuel supply systems used low fuel gas pressure devices to trigger shutdown controls which did not shut down pilot-gas flow, some had mechanical limit stops on the TRC control valves to prevent closure, or globe valve by-passes. Spot checks also indicated that some operating personnel are not familiar with the position the heater damper will assume in case the actuating device fails.

Fuel gas shutoff valves and smothering steam valves appear to be located far enough away from the heaters to be operable in an emergency and these valves are well identified. An exception is the valves at the CR-3 stabilizer heater.

Recommendations

a. A specific audit of fired heaters and heater control may be worthwhile to provide a thorough review of design, practices and procedures. Particular consideration should be given to the use of low pressure fuel gas shutdown valves which also shut down pilot-gas flow.

b. Damper position in the event of actuating device failure should be verified and communicated to all operating people.

c. The location of heater fuel shutoff and steam smothering valves should be reviewed to assure that they are well identified and are accessible in case of fire.

7. Buildings and Structures

Modifications to the ventilation system at the Refinery control houses were in progress at the time of the survey. Modifications to the PXU control house were being made following the recent explosion and fire. To minimize exposure to flying glass, the window area was being reduced by bricking-in part of the area.

Recommendation

Evaluate the effect of an explosion on the bricked-in area of the PXU control house to determine if flying bricks would be a problem.

8. Electrical System

A tour of the Refinery was made at night to determine the adequacy of the area lighting. Except for some of the older units, i.e., DU-3, LOFU and Alkylation, lighting appeared adequate for normal unit operations. Low lighting intensity in some peripheral areas made the location of chain barricades at the following locations somewhat hazardous, particularly if a quick egress is required.

a. West side of CCU adjacent 12th Street.
b. East side of CFH adjacent heater.

Not all control houses have emergency power systems. Some units have had to operate/shut down in the dark when the power failed.

The Refinery is currently using both 12-volt and 32-volt lighting systems in confined spaces. The 32-volt system is being phased out.

A significant number of violations of electrical installations in classified locations resulted from a cursory inspection of the process areas.

Typical violations are as follows:

a. Substandard installation - Ranarex gas density analyzer at CCU.

b. Temporary general purpose switchgear installed in Class 1, Division 2 area of PXU.

c. Bent conduit, open wiring and bolts removed from Class 1, Division 2 equipment in manifold are at propane storage - East Property.

d. Pigtail installed at Class 1, Division 2 electrical outlet at hydrocracker to facilitate temporary installation of electrical installation.

e. Portable 440-volt/110-volt power supply is designed with both general purpose and explosion-proof equipment. Unit provides multiple outlets for 110-volt power. No instructions were found relating to the limitations of use of the equipment.

Recommendations

a. The DU-3, Alkylation and LOFU units should be reviewed for adequate area lighting.

b. Electrical systems in all classified areas should be inspected for conformance to the National Electric Code. Employees should be informed of the importance of maintaining the integrity of the system.

c. Review need for lighting and instrumentation at process units. Establish routine testing procedures to assure reliability of system.

G. Operating Procedures

1. Operator Experience Level

It was observed that the experience level of operating personnel is quite low. New units now being constructed will, of course, compound this problem. This problem appears to be well recognized by the management as evidenced by:

a. Increased/improved job training at all levels.

b. Well considered craft training sessions planned to keep turnover in the operating jobs to a tolerable level, while still providing the necessary craft skills.

c. Attention to hiring experienced craftsmen to reduce the operating turnover.

2. Operating Manuals

Trained and informed operators are a prerequisite for a safe operating plant. A manual of operating information is a requirement for informed and effective operators. Some written information available to the operators is not current. It is evident that operators do use the information that is available to them. It is important that operators know what to do in case of an emergency, what the safety rules and regulations are, the design considerations of their equipment and the precautions that are necessary to prevent downgrading incidents which could lead to injury, property damage or plant downtime. There was a

noticeable lack of recently updated emergency procedures and up-to-date mechanical flow diagrams. Majority of standing orders had not been recently reviewed or updated. The Refinery has started a comprehensive program to upgrade all procedures manuals. Start-up and shutdown instructions are normally modified for each planned turnaround.

3. Safety Inspections

Currently, safety inspections of operating equipment are conducted routinely by operating personnel. These inspections involve fire extinguishers, hose reels, fixed monitors, respirators, safety showers, car-sealed valves, equipment lubrication and some alarms and shutdown devices. Emergency shutdown equipment is not checked uniformly. All systems cannot be completely checked. The Refinery has recognized this and are modifying some systems so that they can be checked.

Safety audits of operating units were reportedly conducted by safety inspectors in conjunction with the process managers, as well as by the Health and Safety Committee, on a routine basis. No records of the audit by the safety inspectors and process managers were found. With a few exceptions, area housekeeping was good.

Recommendations

a. A formal in-house safety review program should be considered by the Refinery. The program should be comprehensive, including all aspects of safety. All operating units should be included. The review should be conducted at least annually. Records should be maintained of the inspections.

b. Emergency alarms and shutdown systems should be reviewed to assure that they are being checked periodically. Modifications should be made, as required, to assure maximum reliability of critical systems.

4. Safety Permits

Deer Park uses the two safety permit system. Operations has the responsibility for the administration of the Departmental Work Permit which is required before any work is performed in an operating area by outside personnel, except work covered by the Fire and Safety Permit. Operations writes and signs the permit which is countersigned by personnel responsible for performing the work. The Safety Group has the responsibility for writing the Fire and Safety Permit. Safety writes the permit which is countersigned by representatives of Operations and the personnel responsible for performing the work. A new Departmental Work Permit procedure was being initiated concurrently

with the safety review. A review of the system indicates tht the work permits are little more than a second job ticket. The permit is well conceived. However, use of the permit in many cases does not communicate to the craftsman the critical information needed to alert him to potential hazards. This observation was reinforced with discussions with craftsmen. It was felt that Operations depends heavily on the Safety Group to control the safety aspects of the job. In some areas, copies of the Fire and Safety Permit were not available in the control house. In addition, permits were signed by Operating personnel without visiting the site.

Recommendation

Operating departments should routinely audit the administration of the safety permit system. Permits should include information on hazards, preparatory work required, safety precautions and personnel protective equipment required. A training program might be considered to prepare foremen and operators for this responsibility. In line with the Refinery's commitment to line responsibility for safety, the location may want to consider having Operations prepare the Fire and Safety Permit, with the Safety Group reviewing the permit before work could start.

5. Equipment Lock-Out Procedures

The Refinery has recently instigated an effective equipment lock-out procedure. This program is well conceived, and with proper administration, will function to minimize the potential for injury to personnel.

6. Safety Showers

A review should be made of the safety shower design used at the Refinery to assure that water distribution from the shower head is adequate.

7. General

Recognizing that unit safety audits are performed regularly by the Safety Committee, the following areas are highlighted for their attention in regular walk-throughs:

a. Line Labeling - With the low level of operator experience, proper line labels (particularly lines containing hazardous materials) are very important.

b. Protective Equipment - Existence, condition and proper location for storage of protective equipment.

c. DOT Gas Cylinders - Cylinders should be chained to minimize the potential for damage from falling.

d. Combustible Gas Analyzers - Process operators should be encouraged to use these devices for monitoring their area.

e. Containment of Light Hydrocarbon Vapors - Alkylation unit should review procedures to minimize the potential for light hydrocarbons to back up into the spent acid tank.

f. Steam Leaks - Attention to steam leaks is important both from a noise (Hydrocracker) and an energy-waste standpoint.

g. Heater safety - A fuel gas low pressure shutdown device was wired open at DU-1 and DU-3. Also, the fuel gas low pressure shutdown at the CCU Gas Plant does not shut off waste gas flow to heater.

h. Access to Poorly Ventilated Areas - For instance, the flare KO drum adjacent the propane storage vessels on the East Property is located below grade. A sign should be installed requiring an entry permit before entering the pit area.

i. Combustible Material - For instance, wood platform to pumps at west end of blending area in West Tank Farm has a substandard stairway. Refinery may want to consider the use of steel for this installation.

j. Analytical Instruments - For instance, the staticon conductivity analyzer at Refinery jet fuel loading facility was reported to have been inoperative for some time. This instrument measures the effectiveness of the anti-static additive, ASA-3, injection system.

k. Walking/Working Surfaces - For instance, the uncontrolled use of water in the PXU area resulted in many slippery walking surfaces throughout the unit.

l. Flammable Materials - For instance, operating problems had necessitated the use of open load lugger buckets to control the disposal of Xylene rich waste. We understand that active projects were being developed to solve these problems.

H. Maintenance Procedures

1. Personnel

Discussions with foremen and supervisors lead the team to believe that safety is being stressed by management. These people appear to be knowledgeable regarding plant safety orders and procedures and

give the impression that safety considerations are a necessary part of their job. Nevertheless, the team observed numerous violations of safety rules due to lack of individual awareness. Thus, we strongly support the existing and proposed programs for improving in this area.

Shell craftsmen appear to understand safety rules and regulations, but their recognition of the importance of adhering to the rules needs emphasis. Experienced craftsmen seem to have a strong sense of responsibility to train younger men in safety matters.

2. Procedures Manual

The maintenance procedures manual has not been kept current. The presence of such a manual appears to be in order to assure consistent maintenance procedures and continuity of safety information.

Recommendation

The procedures manual for the Maintenance Group should be updated.

3. Preventive Maintenance Records

The procedures and records for pressure containing equipment appeared adequate and in order.

A recent inspection of major pipe rack piping resulted in an extensive program to add reinforcement at the contact points. Proper priority was assigned to allow this effort to proceed continuously and effectively.

There seems to be a dedicated effort to maintain the integrity of the electrical distribution system. The infrared inspection program is active. The program, to periodically check protective relays, has received good priority. These efforts reduce unscheduled electrical outages with the potential exposures to downgrading incidents during emergency shutdowns and the subsequent start-up.

There is no evidence of a routine program for checking the overspeed trips on the steam turbines.

Recommendation

Inspection procedures should be implemented to check all turbine overspeed trips at least annually.

4. Contractor Relationship

Contract craftsmen are used extensively to augment Shell maintenance forces. Contract supervision is repsonsible for their safety training. The Shell Safety Group periodically audits the training effort and frequently is asked to contribute.

Shell has a safety review meeting with capital construction contractors prior to the start of construction. Job safety is monitored by Shell personnel.

Recommendation

Effort should be made to assure that contractor maintenance personnel are knowledgeable in their field and in our safety procedures, particularly those people who work closely with our foremen.

D. P. Atwood

R. B. McAulay

J. E. Nicholson

H. H. Williams