



INTER-OFFICE CORRESPONDENCE

TO: C. L. Strunk
FROM: Joe F. Gay
SUBJECT: Corpus Christi Refinery
Safety Audit

FORT WORTH, TEXAS

DATE: November 21, 1979

Attached are the results of the corporate safety department audit of the Corpus Christi Refinery. The results are broken down into three parts.

1. The firewater system tests, including recommendations that resulted from the tests and inspections of the plant firewater system.
2. Review of the firewater supply discrepancies (Unibon Unit Fire).
3. General refinery recommendations which deal with all other comments relative to our audit.

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Joe F. Gay

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FIREWATER SYSTEM TESTS

1. Tests were conducted to establish the flow rates and friction loss across the plant firewater system as well as to establish the general condition of the firewater system. Tests results indicated that significant improvement has resulted from the addition of the one new cross connect between the old and new systems. The installation of the additional cross connects previously recommended should serve to upgrade the system to acceptable performance levels.

The 10" connection from the new pumps on the west side was blocked in from the old system.

2. Flow tests conducted at the dock indicate that the single 8" line to the dock is inadequate to provide an acceptable level of protection. We can only provide approximately 3,000 gallons at 30 to 40 psi with all six pumps operating.
3. All pumps had been preset to operate at 1,250 rpm. Operating speeds for the east pumps and the old pumps on the west side should be 1,750 while the new pumps on the west side should be 1,900 rpm. Operating these pumps at 1,250 rpm reduces the pumping capacity by at least 35%.
4. External corrosion on west pumps is significant. Above ground piping at the old pumps is severely affected as well as portions of the pumps themselves. Gauges are not dependable to measure correctly. Jockey pump at old pump location is leaking badly. Tachometers on one of the old pumps and one of the new pumps were inoperative. The heaters on the new pumps were inoperative. Automatic features on old pumps are inoperative. Automatic features on new pumps had been circumvented by placing both battery circuits in the "off" position.
5. Maintenance and testing of pumps is being performed by outside contractor (Mundy) with employees who might be considered marginal. The safety department stated that maintenance was performed monthly but was unsure of what this entailed, if records were kept, if check lists were used, how long the pumps were run, etc. An attempt was made to establish these details but we were unable to find someone who accepted the responsibility for detailing the monthly tests.
6. The discharge manifold of the new west pumps has a back pressure controller (set @ 150 psi) that dumps back into TK 65. This valve and controller are fully insulated and apparently electrically heat traced. The heat tracing is fed by an extension cord that is plugged into a receptacle near the pump controller.
7. One of the dump valves on the new west pumps leaked continuously during the test.
8. The deluge systems throughout the plant all indicated some maintenance was needed.

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9. At the new splitter in the #4 Plat, risers have been provided for the deluge system installation on the fin fan and pumps, but so far no deluge system has been installed.
10. The oscillating monitors that protect SW's pipe rack near the sphere were improperly positioned and would have been useless had a fire occurred.
11. A number of service water connections, both permanent and temporary, to the fire system were noted during the inspection.
12. Severe external corrosion was noted on some of the above ground fire-water system, notably in the platformer area northwest of TK 1028, northwest of office building.
13. Many valves in firewater service were leaking.
14. Several PIV's were without visible indicators, view glasses properly positioned to indicate the direction of the line or seals.
15. Many valve caps were missing on hydrants and foam lines to tanks.
16. Some of the caps were galled and extremely difficult to remove.
17. Many hydrant wrenches were missing.
18. Some PIV's are not marked or numbered to indicate control function.
19. Many foam maker connections were laying flat on the ground.
20. Anyone can call the old boiler house and have a fire pump started without question.
21. Operating handles on many system control valves are inadequately located.
22. The two monitors between safety office and BTX unit have block valves open and water flow is being controlled by the nozzle.
23. Some hydrants and sectional block valves were extremely difficult to operate.
24. The most current (September 1979) plant firewater system print is inaccurate and inadequate. A check of this print in the new section of the plant and selected tank farm and dock areas pointed out a number of inaccuracies.

RECOMMENDATIONS - FIREWATER SYSTEM TESTS

1. In order to assure the most efficient and effective performance of the firewater system as designed, the 10" valve in the cross connection between the old and new systems should be maintained in the open position.
2. Due to the excessive flow and pressure loss experienced during those tests it is recommended that the 8" firewater line to the dock be extended to make a loop system back into the new (west side) fire grid.
3. A system of both written instructions and documented compliance should be initiated to assure that all variable speed fire pump drivers are preset and continuously operated at designed speeds.
4. An assessment of the corrosion associated with the west firewater pumps and its related equipment should be initiated on a priority basis followed by actions indicated to provide system integrity. The west firewater pumps should be revamped to the extent necessary to comply with minimum requirements of the NFPA recommendations for firewater pump installations.

Serious consideration should be given to requesting the manufacturer's representative to review the pump and motor installations in light of refurbishing to acceptable standards including the required automatic starting system, the external water jacket heaters, and the pressure relief valves.

Strong consideration should be given to providing enclosed shelters for all firewater pumps and drivers. These shelters should be heated to maintain a minimum temperature of 70° F as recommended by the NFPA.

Audible and visual alarms should be provided at the appropriate control point to indicate any malfunction, shutdown, failure to start, or change in automatic starting mode for each firewater pump driver.

5. All fire pumps should be run weekly for 30 minutes. The maintenance and testing of these pumps should be done by qualified pump mechanics (preferably Champlin employees) and records kept. Check list should be developed to detail the items that are to be checked on the engine, pump and automatic controllers.
6. This temporary wiring should be replaced with adequate wiring in fixed conduit. The back pressure controller should be set to 10% above the working pressure.
7. The dump valves should be checked and reset to 10% above the working pressure of the pumps.

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9. In order to provide the necessary fire protection for the fin fans and pumps at the new splitter in the #4 Platformer the installation of the intended deluge system should be installed.
10. These oscillating monitors should be preset and locked in the proper position so that overlapping streams will provide exposure protection for SW's pipe rack. The monitors should be included on a monthly inspection check list.
11. The use of firewater for other than emergency situations (fires, spills, etc.) should be restricted. All permanent connections to service water and cooling water services should be eliminated. The use of firewater for purposes other than emergency situations should be controlled by written permits issued by the safety department.
12. Priority should be given to inspecting all above ground firewater piping and setting up a corrosion control program.
13. All firewater equipment should be repaired and a monthly inspection program established.
14. All post indicator valves should have indicators positioned so that the open and shut positions are correct and the directional flow of controlled piping is designated. All PIV's should be sealed in the correct position with small lead and wire seals. This equipment should be included on a monthly inspection check list and a yearly maintenance schedule that includes lubricating and exercising.
15. Valve caps (thread protectors) should be provided for this equipment and attached to the equipment with chains to insure their availability. This equipment should be placed on a monthly inspection check list.
16. Threads on this equipment should be cleaned and lubricated to insure that the connections can be utilized easily during emergencies.
17. Wrenches should be provided for each hydrant and this item should be made part of the monthly inspection check lists.
18. All PIV's should be numbered, color coded or otherwise identified to indicate their control function, i.e., solid red for section block valves, red with white caps to indicate controls for individual pieces of equipment.
19. An ongoing program should be initiated that will assure the relocation/ repositioning of foam maker line connections so as to be readily accessible and properly supported approximately three feet above ground.

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20. All four firewater pumps located near the old boiler house are equipped with automatic controls. These controls should be repaired and set up to provide a staggered start for all four pumps. One of the new pumps should be set up as the primary pump with the other new pump secondary. The two old pumps would follow in succession. The boiler house could be used to shut down the pumps on authority from the safety department or other designated management official. They could also start pumps selectively when firewater permits have been issued by the safety department. This would allow wear and tear on pumps to be controlled. Boiler house personnel could be assigned to monitor pump performance and firewater storage level during emergencies.
21. All valves should be provided with extensions that will allow operation of the valve from approximately waist high.
22. All control valves for the firewater system should be maintained in proper operating condition with repair and/or replacement of fixed protection operating valves maintained on a priority basis. The use of fire nozzles as replacements for water control valves should be strongly discouraged.
23. All hydrants and firewater control valves should be placed on a yearly maintenance program that includes both lubricating and exercising. Exercising these valves could best be accomplished by using an engine driven hydraulically operated wrench that has an adjustable torque for the various size valves. This would allow valves at offsites such as tank farms and docks to be maintained easily and expediently.
24. An updated, as built, print of the complete firewater system should be developed and field verified in order to provide a document for reliable reference and future planning relative to firewater needs. This print should be made to include all aspects of the fixed firewater system including sprinkler, deluge and weir systems, any fixed attachments or ties and all visible related fire line equipment, such as city fire hydrants, fire truck connections, outside water supplies, etc. Upon completion, the appropriate sections of print should be posted in each operating area.

REVIEW OF THE FIREWATER SUPPLY DISCREPANCIES
(UNIBON UNIT FIRE)

The following comments are offered relative to the Unibon fire.

The fire began at approximately 7:00 p.m. and according to the log in the new boiler house the raw water feed pumps to the demineralizer were shut down sometime after midnight. The boiler feed water tank (17,000) barrels will last approximately 16 hours under normal usage. This assumes that the tank is near full when the demineralizer is shut down completely. It should be pointed out that a 6" tie in directly from the city main will allow partial operation of the demineralizer (according to the operator) when the raw water pumps are shut down.

During the fire approximately 5,500 gallons per minute were used. According to the safety department, the lowest level reached in the tank was about 50%. At 2:30 a.m. (after pumping 7½ hours) the level in Tank 65 was 70%. However, one pump was inoperative and we cannot be sure what the second pump was pumping because the throttle setting had been changed.

Normally firewater supplies for refineries and chemical plants are based on a minimum of 150% of the rated capacity of the pumps for four hours. This supply must be from a reliable source and can be supplemented by makeup water, provided the source is also considered reliable. The city of Corpus Christi is considered a reliable source.

The pumping capacity of the two pumps taking suction from TK 65 is 6,000 gallons a minute at 150% of the rated capacity of the pumps. Hence, normal storage capacity should be 1,440,000 gallons. Tank 65 is a 40,000 barrel (1,680,000 gallon) tank with a 76% (1,275,800 gallon) dedicated to firewater usage. Disregarding makeup this leaves us 164,200 gallons short of having a full four hour supply. If makeup water is provided at a rate of 685 gallons per minute we can fully satisfy the four hour supply requirement. This system was originally designed to provide 3,000 gpm from the 16" city water main that runs from west to east on Dempsey Street. Assuming that we can maintain this 3,000 gallons per minute makeup rate to Tank 65, this would provide us with a seven hour supply.

It is our recommendation that engineering determine what makeup rate is actually available to TK 65. If the full 3,000 gallons per minute is not being provided then they should determine the most feasible means to establish this rate. It should be pointed out that while the makeup line to the tank is a 12" line that comes from the 16" city main, that the flow is actually routed through an eight inch meter that is bypassed around a 16" block valve (normally closed). The 16" block valve is provided with an orifice that I assume restricts the maximum water flow rate to Champlin because of obligations to other customers on this section of city main. We should establish what flow rate can be established through this eight inch meter with the 16" block valve closed. If the required rate cannot be maintained, then we should determine what rates can be established by opening the 16" city block valve and establishing flows through both the orificed valve and the meter. If adequate flows can then be maintained we should get permission to open this valve during emergencies. Obviously if this is acceptable, then someone will have to be assigned the responsibility of opening this valve immediately when an emergency occurs.

The following services are currently being provided through the 8 inch meter.

<u>Service</u>	<u>Capacity Needed During Emergencies</u>
1. Old west side fire pumps	4,500 gallons/minute
2. 6" emergency supply to demineralizer	?
3. Cooling tower makeup	?
4. Service water	?
5. City fire hydrants	?
6. Other (dock, etc.)	?
7. Tank 65 makeup	3,000 gallons/minute

All city water departments require provisions in the water systems to provide integrity to the city system where water may be used for other than domestic purposes. The city requirements should be determined and rigidly adhered to for all Champlin connections.

GENERAL REFINERY RECOMMENDATIONS

1. Fire Equipment

Many fire extinguishers were noted as being in need of painting, having broken seals and/or being out of place. Equipment is not numbered and the inspection tags attached to the extinguishers are not being initialed monthly. Yearly maintenance was being recorded on the inspection tags.

Recommendation - Fire Equipment

It is recommended that a much more vigorous inspection and maintenance program be established for all fire extinguishers.

All units should be numbered (on the attached inspection tag) and a corresponding number be painted on the designated spot for the extinguisher. When units are removed for maintenance or recharge the replacement extinguisher can be assigned the number on the inspection tag. Each unit including wheel units should have inspection tags that indicate the month and year of inspection. Each operating area including off-sites should be assigned to someone who is held accountable for inspecting the equipment monthly and initialing the inspection tag. Safety personnel should spot check all operating areas at least monthly to insure that inspections are being performed.

2. Fire Brigades

There appeared to be some confusion about the organization of the fire brigades especially on the off shifts.

Recommendation - Fire Brigades

Agreeing to serve as a member of the "Emergency Response Team" should be a condition of employment. The term "Emergency Response Team" should be used in lieu of "Fire Brigade" to indicate a multifunction unit that can handle all emergency situations, i.e., fires, spills, evacuations, first aid, rescue, etc. These individuals should be well trained and equipped. They should be recognized by management for serving in this capacity and we should make every attempt to build an esprit de corps in the organization. Providing special hard hats, jackets, coveralls, patches, etc. might be considered. Sufficient numbers of personnel should be trained to insure that a minimum of ten qualified team members are available on each shift.

3. Vehicle Traffic Control

Vehicle traffic control within the plant is very inadequate. The large number of vehicles traversing the plant is a long standing problem that has not improved. Roadways are not well defined and acceptable parking areas have not been established. Some roadways cross over tank farm walls into the diked areas. Motorized equipment is being left inside

3. Vehicle Traffic Control (continued)

the tank farm overnight. Controlled access roadways into operating areas are not blocked off to prevent vehicles from inadvertently entering. There were reported incidents of material being off loaded into the wrong receiving tanks. Vehicle entry permits (written) are not being issued to control vehicles entering controlled access areas.

Recommendation - Vehicle Traffic Control

Management should review the necessity of having the present number of vehicles inside the refinery. Personal cars that are not used in the conduct of business should be parked outside the refinery. Roadways that can be traversed safely during normal operations should be defined and some type of barricade (chains, etc.) should be provided for those roadways that might need to be closed rapidly should a spill or other hazardous condition arise. For those roadways determined to be controlled access, barricades should be provided that can be easily removed and replaced when vehicles are allowed to enter. All barricades (chains, pipe gates, etc.) should be made visible by adequate lighting, reflectors, etc. Parking areas should be determined and defined. Unattended parking along roadways should be prohibited where emergency equipment could be blocked. Motorized equipment working inside tank farm walls should be removed on the dark shifts. Written vehicle entry permits should be written for vehicles entering controlled access areas. These permits should define the exact area where the vehicle is allowed and specify the time allowed. Blanket permits should be limited to only those situations where it is the only practical solution (such as shutdowns). When vehicles hauling hazardous materials enter the plant the guard should check and initial the bill of lading to verify the exact product. He should then notify the appropriate receiving department that the shipment has arrived. The supervisor of that department should designate someone to meet the driver at the gate and to accompany him to the area where the material is to be off loaded. The safest and most direct route should be followed, i.e., loads of chlorine should be routed down wind of the major concentrations of people when possible. The supervisor should be held responsible for insuring that the bill of lading is verified and initialed prior to the product being off loaded.

4. Safety Meetings

The chief complaints about safety meetings was inappropriate subject material, many employees not attending, supervisors not attending, and the safety department holding all the meetings.

Recommendation - Safety Meetings

It should be recognized that the employer is held responsible for providing training to all employees regarding hazards that they might encounter in the work place. Unfortunately, many subjects must be

4. Safety Meetings

Recommendation (continued)

covered that will seem boring and appear only vaguely related to some individuals. Many subjects have to be covered repetitively to reinforce thinking and to insure that new or transferred employees have been reached.

Continuing effort is required to upgrade the scope and content of these meetings. The new training room offers an opportunity to diversify these meetings and receive maximum benefit. Content of some meetings should be developed by line personnel with help from the safety department. The use of supervisors as well as hourly personnel (both qualified) to present these meetings is highly recommended.

The use of outside speakers to present programs periodically should serve to stimulate interest as well as upgrade presentations.

Attendance at these meetings is a condition of employment and failure to do so should be treated as an unexcused absence. Again we might point out that we are required by law to provide training. Supervisors should attend these meetings unless it is absolutely essential that they be elsewhere. It is also important that management personnel actively participate in these meetings both to become informed on certain subjects and to emphasize management support.

5. Safety Warehouse

Much of the material currently stocked and issued at the safety warehouse appears to be more suited for general stores issue and control.

Recommendation - Safety Warehouse

A review should be made of the current safety warehouse stock to determine if those items, such as slicker suits, coveralls, work gloves, rubber boots, safety shoes, hard hats, liners, goggles, safety belts, etc. could not best be handled by the tool room or stores. The handling of this equipment by the Safety Manager and the Engineers is very time consuming and it is felt this time could be better utilized in surveillance of other plant activities.

6. Smoking Control

There was evidence that smoking is occurring in unauthorized areas. The present plant policy restricts smoking to only authorized areas and prohibits the carrying of strike anywhere matches or lighters without protected flint wheel. However, the guard does not question persons entering the plant nor is a sign apparent at plant entrances that prohibits these items.

6. Recommendation - Smoking Control

A concerted effort to control smoking must be instituted by all employees. Beginning with contract personnel, but obviously including Champlin personnel, disciplinary action (termination) should be taken against any person found smoking in undesignated areas. The carrying of matches or lighters inside the plant should be expressly prohibited. Security guards should be responsible for controlling this at the time of entry. Lighters (electric tilt or zippo types chained to fixed objects) should be provided at each designated smoking area. Adequate butt containers should be provided in each designated area. All designated smoking areas should be specifically defined and posted with signs. A readily visible sign should be displayed at the entrances to the plant that specifies the Smoking and Dematching Policy. The "No Smoking" signs currently displayed in certain areas of the plant should be removed or replaced with signs that state "Smoking Permitted Only in Designated Areas."

7. General

A number of contract personnel were observed in all areas of the plant with what appeared to be limited, if any, Champlin surveillance or supervision.

Recommendation - General

Due to the number of contract personnel observed in all areas of the refinery with a lack of apparent supervision or surveillance it would appear appropriate that management conduct a review of current manpower requirements/utilization relative to assuring that adequate supervision is being provided for both contract and company personnel.

8. Safety Department Organization

The level of activity at the refinery has increased to the point where contract safety personnel are being used to supplement our safety personnel. While it is recognized that we cannot staff for peak levels of plant activity we do recommend that management review the current manpower requirements. The review should take into consideration the level of activity that we have experienced since the startup of the new facility, the logistics problems created by the new docks and off-site tank farms, the projected levels of activity created by future expansions, and the level of surveillance and responsibility the refinery deserves from its safety personnel.

Recommendation - Safety Department Organization

It is our recommendation that each safety engineer be assigned to a specific area of the plant with responsibility for providing full safety engineering services for their assigned area. This responsibility would include but not be limited to the following:

8. Recommendation - Safety Department Organization (Continued)

- a. Daily routine surveillance of all work site and construction activities within the assigned area;
- b. Evaluation of the effectiveness of routine and preventative maintenance programs established for the area fire and safety equipment and systems;
- c. Assistance to supervisory personnel involved in the development of safety training and education programs applicable to the area;
- d. Provision of assistance deemed necessary in developing compliance with all safety permit procedures;
- e. Provision of daily advice and consultation to the respective area supervisory personnel relative to occupational safety compliance;
- f. Development of industrial health and hygiene monitoring programs, such as sound pressure surveys, ambient air contamination surveys, heat stress analysis, etc.;
- g. Performance of routine audits of both safe practices and conditions within the assigned area;
- h. Monitoring effectiveness of repair, installation and/or modification of fire and safety systems;
- i. Providing supervisory personnel the necessary assistance in establishing effective self-audit programs.

This type of general area responsibility assignment should produce, as a spin-off benefit, safety engineers with broad based experience capable of promotion within the corporation.