

CHEMICALS



INTEROFFICE / LAKE CHARLES

TO Distribution

DATE August 21, 1981

FROM Roy E. Sanders

SUBJECT Loss Prevention Review of
TCE/Tetra Plant

A handwritten signature in dark ink, appearing to read 'Roy E. Sanders', with a stylized flourish at the end.

CONFIDENTIAL

Attached is a Loss Prevention Review report of the TCE/Tetra Plant. This study was initiated by a request from operations for a review of the reactor shutdown system.

Jim Wood consulted with various individuals to study the unit including E. M. Gorton, J. A. Hart, F. J. Kuntz, R. P. Lynch, W. F. Salter and B. J. Young. It would seem reasonable to have the Operations Review Committee meet in 4 to 6 weeks to discuss the points raised in this report.

aw

cc: E. M. Gorton
J. A. Hart
F. J. Kuntz
R. P. Lynch
J. H. Morgan/D. T. Rigler
J. G. Peck
T. G. Taylor
R. J. Whitaker
B. J. Young

SL 050560



TO R. E. Sanders

DATE August 13, 1981

FROM J. H. Wood *JHW*SUBJECT Loss Prevention Review of
TCE/Tetra Plant

TCE Operations requested Loss Prevention to look into the adequacy of the Tetra reactor shutdown system. A Loss Prevention Review of the entire Tetra Plant was conducted during parts of July and August with particular attention directed to the reactor shutdown system using the Hazards Review Manual as a guide. The Operations Manual was read and the process flowsheets were studied. Potential or past problems were discussed with the operations foreman. The more important questions addressed in the review are discussed below; some can be answered definitely while others cannot. These should be addressed in an ORC meeting at some future time.

RESOLVED QUESTIONS

- (1) Are adequate, positive facilities provided by the present shutdown system to stop and control a runaway reaction from occurring?

Ans: No, not automatically. The reactor shutdown system per se cannot provide this under all foreseeable conditions. The redundant Cl_2 temperature shutdowns, bypassed during startup, detect and protect against feeding liquid chlorine into the reactor. But vaporized chlorine when dissolved in reactor liquor can result in a runaway reaction if the reactor were heavily chlorinated.

- (2) What could happen if a runaway reaction occurred with only dissolved chlorine present in the reactor liquor?

Ans: We have not been able to find any old reports or detailed studies, but we know the situation depends upon reaction rates. Worst case would exhaust reactants present in just seconds if all reactants were thoroughly mixed and diffusion does not limit the reaction. The heat and gases produced could not be removed rapidly enough, and about 3-1/2 million BTU's would be generated. This is over four (4) times the energy which would be released if the reactor exploded due to a gas filled isothermal expansion at four times its design pressure.

- (3) Would the ΔP across the reactor pressure control valve safety system shut down the reactor before this condition can develop?

Ans: No, not necessarily. If the reactor pressure fell below the HCl system pressure, then it would. But when will this happen? The reactor PCV would close off if reaction stopped in order to maintain reactor pressure; and as long as this pressure was higher than the HCl system pressure, the shutdown system would not be activated. Addition of position switch on reactor PCV may be a better indication of loss of reaction.

- (4) Would a low reactor temperature shutdown feature provide necessary protection against loss of reaction and consequent chlorination problems?

Ans: A low reactor temperature shutdown would be advantageous in the cases where low temperature causes loss of reaction. Loss of reaction due to other causes such as loss of AIBN or the presence of impurities would not be detected soon enough to be of significant value.

- (5) Can the deviation alarm on the ratio of chlorine to HCl flow be tied into a shutdown system to indicate loss of reaction?

Ans: No, the deviation alarm has never been dependable because the ratio of Cl_2 feed to HCl flow varies with reactor rates. An engineering work order 49778 has been in Engineering since 1977 to install a flow deviation switch where the ratio would be kept the same. There is no progress on this job thus far. This work order should be given a higher priority; and if a deviation alarm could be installed which will be positively reliable, then consideration should be given to tying the switch into the shutdown system. A "fudge factor" for lights fed should be determined as safe.

- (6) Can the Cl_2 analyzer be tied into the shutdown system to provide protection against having too much unreacted Cl_2 in the reactor?

Ans: If the Cl_2 analyzer were dependable then it should be in the shutdown system, but it has not proven reliable enough. Both Operations and Laboratory would advise against putting the analyzer in the shutdown system until it is dependable. Obviously, much effort must be directed toward improving the analyzer's performance.

- (7) Should the shutdown system be bypassed during startups? For Maintenance?

Ans: Ideally a shutdown system should never be bypassed. It may be possible to devise a good shutdown system which would operate during startups (e.g., level switches on the surge drum). However, if a reactor temperature switch were tied into the shutdown system, this would have to be bypassed. The most critical item during startups is to be positively assured that no buildup of chlorine occurs in the reactor liquor or reactor vent. The analyzers and o-tolidine tests are critical for running the reactor.

If control valves are bypassed for maintenance, obviously this cuts down on the reliability of the shutdown system, since a demand may be placed on the shutdown system to operate. However, the situation is made a little better because there are two valves in series on the chlorine feed tied to the shutdown system. The frequency of this sort of maintenance is probably not often enough to cause undue concern.

- (8) The operations foreman feels a need for startup lights to evacuate the area for Tetra plant startup. Are these necessary?

Ans: This is probably a good idea; although no immediate danger is present, the potential for sudden overpressure is there if the reactor became badly chlorinated prior to initiation of the free radical reaction. Then it may be too late to evacuate. Because startup procedures are followed closely, this should not happen. Even so, the presence of startup lights provide an extra safety feature to minimize personnel exposure.

- (9) Tetra reactor startup requires operators posted at the chlorine PCV and FCV to operate the bypass valves. Would it be more reliable and safer to use the control valves for startup which could be operated inside the control room?

Ans: Yes. As long as the shutdown system is bypassed anyway, a control room operated switch could allow operation of the control valves during startup. A control board manual trip of the reactor shutdown system would be beneficial to assure rapid shutdown if conditions arose which required immediate response and/or fast evacuation such as sudden uncontrollable reaction or other possible dangers.

- (10). Several vessels in the Tetra plant having rupture disc-SRV combinations do not have a pressure gauge between them. The ASME Code requires that the pressure be monitored in the space between the disc and the SRV. What are the plans?

Ans: Operations now understands the importance of this item and is taking steps to correct.

- (11) Are the process flowsheets up to date?

Ans: Sheet 63F-10001 should be updated to show the AIBN addition lines and the flow orifice on the chlorine feed. Sheet 63F-10002 should show the bottoms product preheater. Sheet 63F-10003 should show the reflux dryer and filter.

UNRESOLVED QUESTIONS

- (1) Should the loss of AIBN alarm be provided with a time delay and tied into the shutdown system? AIBN is fed to the reactor from two possible locations---the suction of the absorber bottoms pumps or the suction of the recycle pumps. It is possible to maintain AIBN flow to the suction of the pumps, but not have the AIBN fed to the reactor (e.g., pump cavitation). Other conditions such as plugging of the AIBN feed line can occur which would result in loss of AIBN flow, and it is these conditions which can be protected against by shutdown on time delay.
- (2) If a time delay were provided on loss of AIBN, how long should the delay be? This depends on the Cl_2 feed rate. At maximum rates, the reactor liquor would become completely saturated in eight (8) minutes, but a dangerous condition would exist much sooner than that. A couple of minutes may even be too long to wait at high rates before regaining reaction. The half life of AIBN at 240°F . is 75 seconds, and it is considered that after 10 half lives there is none left. This is longer than anyone should wait before shutting down the reactor if AIBN flow cannot be reestablished. Those experienced in operating the reactor recall that about five (5) minutes has elapsed in the past prior to reestablishing AIBN flow. It would be safest to shut off chlorine flow upon loss of AIBN, and reintroduce chlorine feed once AIBN flow has been reestablished. The time delay necessary must be a judgmental decision. Positive indication could be provided by an analyzer on reactor liquor.

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TCE/Tetra Plant
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- (3) The rupture discs on the Tetra reactor have a burst pressure rating of 240 psig, whereas the reactor is rated at 128 psig and was hydrostatically tested at 192 psig. It is true that the SRV is set at 117 psig to protect the condenser, but shouldn't the rupture discs have a burst pressure at or below the hydrostatic test pressure?

dls



PPG INDUSTRIES

INDUSTRIES

TO	Roy Sanders	DATE	July 21, 1981
FROM	F. J. Kuntz	SUBJECT	Tetra Reactor Shutdown System

On July 14, a meeting was held with Bob Lynch, Jack Young, and Fred Kuntz to discuss several questions concerning the Tetra reactor shutdown system. This was a preliminary inquiry to determine if there was sufficient justification to warrant a complete review of the shutdown system by the Loss Prevention group. The results of this meeting indicate that such a review is needed and could reveal the need for several changes or additions to the present shutdown system.

Would you initiate whatever actions are necessary to start the review of this system? If you have any questions, you can contact Jack Young or me.

cg

cc: T. G. Taylor
J. A. Hart
G. deJesus
R. P. Lynch
R. P. Byars
B. J. Young
L. W. Carter
W. F. Salter

SL 050566



TO Roy Sanders

DATE July 21, 1981

FROM F. J. Kuntz

SUBJECT Tetra Reactor Shutdown System

On July 14, a meeting was held with Bob Lynch, Jack Young, and Fred Kuntz to discuss several questions concerning the Tetra reactor shutdown system. This was a preliminary inquiry to determine if there was sufficient justification to warrant a complete review of the shutdown system by the Loss Prevention group. The results of this meeting indicate that such a review is needed and could reveal the need for several changes or additions to the present shutdown system.

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W. F. Salter

FRED,
YOUR REQUEST IS
WELL TIMED! BOB LYNCH
& I HAVE BRIEFLY DISCUSSED
AND WE AGREE TO GIVING
THIS A HIGH PRIORITY.
LOSS PREVENTION WILL
EXPAND YOUR REQUEST TO A
COMPLETE LOSS PREVENTION
REVIEW OF THE ENTIRE
TETRA UNIT. JIM WOOD IS
ALREADY REVIEWING MECH.
FLUW SHEETS, THE TETRA
ACCIDENT REPORT ETC.
YOUR HELP WILL BE
NEEDED TO COMPLETE
THE STUDY.

J.A. HART
F.J. KUNTZ
R.P. LYNCH
J.H. MORGAN
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