

Date 27 September 1979

INTEROFFICE
MEMORANDUM

Subject Vinyl Chloride Safety Association

Meeting

Executive

To R. Fleming

(Location, Organization, or Department)

From J. T. Barr ✓

Reg. Response

(Location, Organization, or Department)

cc: A. R. Adams	J. D. Kramer
L. Allen	J. H. McMakin
J. Balliker	A. K. McMillan
J. H. Body	J. C. Novak
P. L. T. Brian	E. A. Primeau
A. F. Cantor	R. C. Sander
R. E. Duggan	R. H. Schenck
R. E. Gilbert	J. M. Scigliano/W. Silowka
A. E. Greene	J. H. Yaworski
B. Helm	

The annual meeting of the Vinyl Chloride Safety Association was held at San Francisco on 13-14 September 1979. More than 90 persons from 10 countries attended. Air Products was represented by Larry Allen, Earl Primeau, and the writer. A complete attendance list will be available later. The officers for the next year will be: Chairman, J. Gabbett (Georgia Pacific); Vice-Chairman, W. Clark (Dow); Program Chairman, R. Becker (Diamond-Shamrock). H. Olsen (Ethyl) and J. Hager (Stauffer) remain permanent Secretary and Treasurer, respectively. The next meeting will be held in Bermuda in October 1980.

Summary of Proceedings

Several of the subjects planned for the agenda were not presented because of problems getting input or leaders for the items selected in the summer survey, thus the original agenda was not followed exactly. See Attachment I.

CIIT R. Fleming

This presentation provoked considerable discussion at later breaks, and several persons have asked for further information.

Risk Analysis Don Wobser, Union Carbide

The Union Carbide procedure for process risk analysis was illustrated by application to their solvent polymerization reactor. Their overall procedure is as follows:

1. Fault identification, individual and in all possible combinations, is prepared for use in an effects analysis.

2. Preliminary hazards review is prepared from process information, equipment specifications, process chemistry, and total energy inventory. This normally takes 1-2 man days by an experienced analyst with adequate help.
3. Failure mode identification and effects analysis follows, performed by a team of about 5 persons (not necessarily including persons from manufacturing - this caused some comment) and takes 2+ days for the first review, followed by a "few weeks" work by the analyst. They review each part of the process, dissect the systems to identify hazards, and go through a "what-if" analysis to describe the scope of failures and their potential cause-effect relationships and to search for possible solutions. However, solutions are not the prime responsibility of this procedure, and are expected to be prepared by the process group.

A criticality scale is used to prioritize information needs and along with a probability estimate in a matrix presentation to establish action timing for existing processes. For example if there is a moderate or high probability for a strong or severe effect, immediate response is required. A goal of less than once per thousand years is established for a severe effect.

3. Fault free analysis is applied, using a systems approach to examine interactions of various failure modes. A team critique is used which takes about one day for the group, followed by two weeks work by the analyst. A response diagram is constructed and computer simulation used. Integration is by the Ruge-Kutta approach. This example had 34 variables, and took 25-30 man days to examine. It was stated that after programming, each final "run" cost about \$0.75.

Results of the study were:

1. There were no major hazards that had not been anticipated in design.
2. Many minor changes were made to reduce the effects of process upsets.
3. More rapid emergency response was obtained.
4. Response systems were directed to treat the causes, and not just the symptoms of upsets.
5. Quality was improved and costs reduced.

The completed program has been very useful in operator training and in research studies. They are convinced that paper studies can give a realistic and reliable picture of actual fault patterns. Their experience is that it normally requires 3 or more failure events to cause a major effect, and that about 90% of the time some type human failure is involved.

They have used a combination of formal training and special short courses to prepare their specialists. Schools which have programs in this area include Texas A&M, Carnegie-Mellon, University of Washington, University of Tennessee, and George Washington University. They also hired consultants at the beginning.

The analysis is used only on major projects, and because this group is a service activity, only at the request of Process.

A comment by ICI pointed out that they had used this procedure for more than 10 years, that it was mandatory in any high risk situation, and also before any process modification.

It is not used as the basis for cost/benefit decisions, but to provide advice and analysis.

A show of hands identified 10 companies which use some similar type of procedure, three with computer simulation.

Training for Safety Roy Henderson, Diamond-Shamrock

The employee training program at the new D.S. monomer plant was used to illustrate their procedures and methods.

Their principal effort is to give adequate information and guide in its interpretation. This includes a good understanding of the properties and hazards of the materials used, and also of the equipment and processes. In preparation of the second quarter 1978 startup they began personnel assignments in late 1976. By early 1977 they had their 10 key supervisors aboard, by mid-1977 all salaried technical and supervisory personnel were assigned, and by September 1977 all personnel had been located. Only 9 operators had prior chemical experience. The total work force is about 205.

The first steps were to write a process training manual, that was used later as the operating manual, and to attend training seminars by the suppliers of major units. All exempt persons attended a key-man safety seminar. Then the group prepared their safety manual, emergency manual, spill prevention and lead detection programs, and hazards handbook.

All potential operators were given a 4-week refresher course in basic math, physics, and chemistry, and fundamental manufacturing terminology.

The total plant force went to the 4-day, Texas A&M fire fighting school. This developed a strong sense of interdependence as well as needed skills.

During the latter construction period there was half-day schoolroom study and half-day field inspection and identification. There was also a 4-week school of half company procedures and half special skills. The operators then assisted in the final field checkout.

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The plant was completed by systems, not geographical areas. In January 1978 they started and operated the cooling water system, then air, then steam, and then purchased EDC and VC to operate portions of the distillation trains before the reactors were completed.

Finally, all hazard information was brought into the Material Safety Data Sheets, compliance and enforcement procedures were prepared by those to whom each would apply. Safety meetings are used as refresher training and for detailed discussion of problem areas.

Startup resulted in two recordable accidents - one tripped over a pipe, another fell from an improperly extended ladder. There has been one recordable accident so far in calendar 1979.

They have one Safety and Loss Control Supervisor, primarily concerned with security, fire prevention and similar housekeeping chores, and one Environmental Engineer, responsible for industrial hygiene.

It is more difficult to train operator additions to an existing plant. All of their Houston area plants cooperate in maintaining a 4-week school for new hires (see a later discussion).

They have validated once, and are now revalidating their preentrance exam, so that they can require minimum scores before hiring. It demands 7th grade arithmetic and reasonable reading skills.

Their contract maintenance people are given the same training and safety programs as fulltime employees, despite the rapid turnover. Relief operators are used extensively for training when not actually relieving.

Monomer Peroxide Explosion B. Terwiesch, C. W. Huls

An explosion occurred 29 December 1978 in the monomer recovery and recycle section of the Huls 100 tpd PVC plant which was built in 1973. Their process used two screw compressors to condense vapor from a gasholder. The outlet pressure was 8 bars at 110°C, and the noncondensed gases were water scrubbed before return to a monomer plant (ammonia was added to control the pH at above 6) in a tower where water was added to maintain a desired level. This tower previously had contained Raschig rings, but they had earlier been found to have polymeric peroxides on them, and so had been removed.

Prior to the explosion a leak had been found in the tower, and it was bypassed and depressurized. Steam was applied to several pipe turns on the exterior to prevent freezing. The recovery section was destroyed with about 2 MM DM damage by the explosion.

The principle causes of the explosion appear to be the heat-induced decomposition of a significant quantity of peroxide formed in the tower. Primary contributors were the unusually high allowable oxygen content of the gases, 6% or half the explosive limit as compared to the below 0.5% that is acceptable

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here, the high temperature at the compressors, and the probable presence of liquid monomer in the scrub tower resulting from inadequate condensing capacity in the expanded condensing train. The prior finding of peroxide should have been adequate warning that the system was not being operated properly.

Subsequent laboratory work confirmed the literature (primarily Kolenin, et al. *Chem. Industrie*, 1 27-28 (1966)) that acetaldehyde, iron salts, acid and water catalyze the formation of the peroxides, which polymerize to a gummy mass. See also *ibid.*, 3 172 (1970). The laboratory-made polymer has a molecular weight of about 750-1400, averaging about 1000. The autodecomposition starts at about 40°C, raising temperatures at about 2.5°C/min, and releasing about 2 KJ/g. Formaldehyde and CO are decomposition products, along with CO₂, water and HCl.

They have since reduced the allowable oxygen content to 2%, and use 3% NaOH as the scrub liquid. Iodometric spot tests are used to check for peroxides, assisted by IR (-OH and -CO-bond absorption) and NMR.

They find that 300 ppm phenol is adequate to control - lower values were not tested. A pH 8 is safe, 5 is not. Temperature and organic impurities increase the rate of formation. Oxygen concentration is important, iron salts are not a major influence. Decomposition of the peroxide by aqueous caustic is sometimes slow if large masses are not properly contacted, and addition of methanol or other bridging solvents is useful.

They now use Topacol C, a substituted phenol (same as Ional??) at low concentrations in their system, and do not redistill before reuse. A written version of their discussion is not generally available at this time.

EIF stated that they had a similar explosion and now use caustic wash with no more difficulty. Others state that they assure quick reuse of the condensed material.

Transportation Accident H. Waltemate, BFG

The October 1979 derailment in Kentucky left two leaking and burning cars which persisted for several days and delayed repair and use of the track. The local fire marshall requested a squad from Ft. Campbell to place shaped charges on the cars to penetrate the shell and release the liquid for more rapid burning. The cars were diked to contain the spill, and secondary charges, placed to reignite the liquid. This was successful on the first try on one car, but the second had an ice layer on the heads, so another try was needed. Burnoff took less than 30 minutes. A copy of the video tape made by a local TV station is available on loan.

Three other VC cars also derailed. One had the full DOT retrofit package, and two were double insulated. These were not punctured and were replaced on the track for delivery.

Operator Training Programs D. Frey, Diamond-Shamrock

This discussion was an extension of the earlier presentation by R. Henderson on pre-commissioning training. There are five D-S installations in the Houston area with a total work force of about 1100, and they have a cooperative training program for employees. Prior to 1975 their average operator had 7 years

experience in their plant, and a head operator had 10-12 years. After the 1975 expansions the figures decreased to two and three years, respectively. Thus, they started a training program.

The Gulf Coast Area Program employs full-time two former supervisors that give two principal courses, a 4-week entry level program divided into equal parts of classroom and field study, and a 1-week "recycle" program given each employee yearly.

The Plastics Operations has one full-time training employee who gives all new employees a 4-day program on safety, company procedures, and process and quality assurance corrective action. He is developing a recycle program.

Their experience has been that about two-thirds of emissions and release incidents involve operator error to some degree, but this training program has reduced release frequencies to one-third of the prior 2 year average. As environmental violations have dropped, product quality has increased. There has been no change in the rate of recordable OSHA injuries, which already was low.

Their recommendations for a successful program included:

1. Go first class - provide adequate facilities and absorb the costs for overtime.
2. Employ a good trainer (rotate his duties).
3. Develop a positive attitude in the employees, which requires enthusiastic management participation.

Industry Emission Survey G. Schaaf, BFG

Only about 40% of the members responded to the survey sent out earlier, so this report was delayed pending further answers. A part of the data are covered by the report of R. Laudrie, later.

Monitoring Data Handling W. Clark, Dow

This report described some of the criteria used to decide if plant data are to be stored in original form, as microfilm, in computer memory banks, or some other form. They have several process computer systems in the plant areas that gather data. These cost about \$50 M, take 30 days or so to program, and have a 99.9%-on-line history since their earliest use in 1972. They have been in continuous use since 1974. Software has been the principal problem, and no back-up is provided.

Management computers are used to process, sort, store, and report the data received from the field computers. These cost about \$150 M, require 90 days to program, and have about 98% reliability. They are scheduled down 6 hr/month to create back-up storage files on floppy disks.

Data which are to be reused in the original form, or which is kept only to meet a regulations is kept in the most convenient form - usually original or microfilm. If it is to be computer-processed it usually winds up on a floppy disk.

Solvent Absorption as Final Control Device G. Schaaf, BFG

Goodrich is offering to license their solvent absorption system for final control of vent streams. However, they were forced to admit that they are installing incinerators as stand-by backups at several of their plants, and Great American, the other solvent user, relies on its boiler for back-up.

Their claim for the most economical process is based on the following table using the EPA standard 150 MM lb plant emissions of 0.48/100 lb of product:

	<u>Solvent</u>	<u>Incinerator</u>	<u>C. Bed</u>
Capital, \$M	475	425	600
Cost/hr, \$			
Utilities	6.01	2.91	13.94
Solvent	0.50	-	-
Caustic	-	2.34	-
Credit, RVC			
@ 17¢	13.96	-	13.97
Net cost/hr \$	(7.46)	5.25	(0.03)

It is apparent that a change in the basic assumptions will affect the net cost strongly.

The advantages are given as:

- Safe
- Low operator attention
- Best economics (?)
- Low pollution
- Some impurity selectivity

Disadvantages are:

- Releases some solvent
- Cannot be used on copolymer
- Some impurity build-up

They have obtained 96% on-line time for the last 6 months, and expect 98% in the future, but are installing back-up incinerators.

No precise figure on the VC content of the off-gas was given, but it was said to be well within the proposed 5 ppm. It was admitted that it was not as good as an incinerator.

There was extensive discussion as to the fate of methyl chloride. John Floros sees a build-up at Great American, and burns off a purge when necessary. Schaff claimed not to have seen it at BFG. However, a 4% downtime could well be the reason.

A show of hands revealed:

- 3 companies have solvent systems (BFG, Great American, and Wacker)
- 5 have carbon beds (see 1978 report)
- 21 have incinerators
 - 17 neutralize HCl
 - (2 use it elsewhere)
 - 11 have back-up, 6 more planning.

There is a great variety of response to loss of the primary abatement device. Several have a "few days gentlemen's agreement," some go to gasholders, boilers, storage bullets, etc., others do nothing.

Those with carbon beds that do produce copolymer have added a stripping column before the beds to remove vinyl acetate. Some use a small (disposable) carbon bed as a standby disposal system for their single incinerator.

General Discussion

Five companies have specific leak detection program approval, mostly in Region IV. Others have it indirectly through their permits.

Several companies are concerned about assurance that the reactor is empty before recharging. A few, such as Tenneco and Huls have radioactive level devices. BFG has a sight glass in the dropheader. Only 8 claim to be in full closed-reactor mode as we are. For reactor opening 11 use the specified EPA instrument test to show compliance, 4 use bags, and many have approved equivalent methods, usually random tests and record retention of a demonstrated procedure. For reactor purging 11 use steam, 3 water, and 2 nitrogen sweep to an incinerator.

Stress Cracking J. Wallace, Esso Canada - Attachment II

Seventeen companies, 7 of them foreign, participated in the survey for stress cracking of stainless vessels. See the attached handout for a summary of results, which seem to support his preliminary theory (see 1978 report). Temperature, pH, oxygen and chloride concentration appear to be the key variables.

His survey included reports on 8 strippers, 4 reactor strippers, 5 reactors, 2 stripping towers, 3 centrifuges and several process pipe sections that have

failed. Type 316 is somewhat better than 304 or 321, and confinement of acid by fouling or insulation is important. In general all failures have been within 0.4-3.0 service lives per his predictions.

Microphotos show the failure to be intergranular, changing to transgranular, and originating in heat-sensitized areas near welds.

Regulatory Activities J. Barr and R. Laundrie, General Tire

The writer and Bob Laundrie used the attached outline (Attachment III) to discuss regulatory activities of the past year. In addition, Bob reviewed the SPI survey on emergency discharges which, among other facts, showed that operator error was the single largest cause at about 30%, followed by "process upset." He also presented the attached emission and compliance data without the identifying company names from EPA semiannual reports which he obtained by FOI requests. This shows a spotty and incomplete reporting and compliance history. (Attachment IV)

Discussion revealed 13 OSHA inspections during the last year. Only two citations of any consequence were given: Hooker was cited for not giving hazard training to workers in non-regulated work areas, and the citation was withdrawn at the Review Commission level; Pantasote was cited for not doing personnel monitoring in their Region II plant which is equipped with the EOCOM area monitor. This was despite a letter from OSHA approving this step. The citation is being challenged.

Four companies in the northeast have received the "cease and desist" administrative orders from EPA on emergency releases for which SPI recently voted to join in the judicial review. We and Conoco received show cause orders from Region IV, and Goodrich had an informal conference on the same subject. Region VI has not acted on this, except for one general letter earlier this year.

True Confessions

There were no major accidents reported again this year. Several companies discussed near-misses and minor accidents.

Georgia-Pacific had established a very competitive situation between shifts during a production push. All men were on 12 hour turns and management encouraged trying to outdo the previous record. In trying to rush the application of an antifouling spray through their 36" center head nozzle an operator who was working alone forgot to turn off the ventilation fan and the partial vacuum pulled the temporary rig into the reactor. The man also fell in, while the agitator was on slow speed. He suffered a compound fracture of one leg and severe burns from the hot (185°F) reactor walls. Management attitude was given as the primary cause.

Shell was loading 7 cars from a header using two pumps with a combined flow of about 2000 gpm. The relief on one car lifted several times, with the release igniting on the third lift. The fire went out when the pump was stopped. The

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automatic meter shutoff on that car had failed, while the meters on 4 other cars had activated. The cars were grounded. One suggestion as to the ignition source was static developed in the liquid spray.

Goodrich had one employee badly burned when he fell into a tank of 200°F tempering water at a compound plant. He had climbed on the edge of the tank to reach the plastic ribbon. They added a safety bar to reduce clearance to 12".

ICI reported that the casing on a Durco monomer pump shattered while being checked in a blocked-in situation. They surmise that the housing bulged, reducing the internal clearances, which increased the pump pressure to over 1000 psi, which caused the casing to bulge further, etc., etc., and parts were scattered more than 20 feet. All 8 casing bolts failed by tensile failure. This happened within 2-3 minutes of pump startup. Borden and Air Products commented on similar but less catastrophic events, and Premex reported hydraulic hammer damage in monomer lines.

A Mexican company discussed a sudden unexplained pressure surge in a charged reactor, which they thought might be due to excessive light ends in the charge. No one else had had a similar experience.

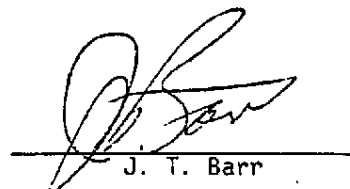
Goodrich asked if anyone had experience with surge accumulator in incinerator fuel lines that might operate in the explosive range. There was no constructive response.

Miscellany

Stauffer paid Kema Nobel for a look-see at their antifouling technology. They got a maximum of 15 batches between cleanings even after extensive electro-polishing, and found it too time consuming. They realize that EDC will be declared a carcinogen and thus must develop a new reactor cleaning process.

The question of personal tape recorders came up again, and again it was the wish of the majority that they not be used. This brought up the question of the "official" recorder that was instituted originally to protect against potential anti-trust problems. It was decided for each company to ask its law department for counsel on this subject, for a vote at the next meeting. I have since discussed this with Ray Schenck, and he advises that, so long as we do not have an independent observer such as a staff member or lawyer, that we continue the practice.

Kema Nobel has tried the Diamond-Shamrock technology for low-gel resins (types 35 and 40) in their laboratory reactors, and find it to be low gel, but of undesirable PSD. They do not have adequate small test equipment to evaluate the system properly.



J. T. Barr

sjs
Attach.

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ATTACHMENT I

VINYL CHLORIDE SAFETY ASSOCIATION MEETING AGENDA

SEPTEMBER 13 & 14, 1979

HYATT ON UNION SQUARE, SAN FRANCISCO, CALIFORNIA 94108

September 13, 1979

	<u>Time</u>	<u>Subject</u>	<u>Discussion Leader</u>
A.M.	8:00 - 9:00	Registration & Coffee Social Hour	
	9:00 - 9:30	Chairman's Welcome Official Business	Art Gellner CertainTeed
	9:30 - 10:15	CIIT - Its contribution to business which handles toxic chemicals.	Dick Fleming Ex. Vice President Air Products
	10:15 - 10:30	Coffee Break	
	10:30 - 11:15	Risk Analysis of Runaway Reaction Occurring in a Solvent Autoclave	D. C. Wobser Union Carbide
	11:15 - 12:00	Training New Plant Forces for Safety	Roy Henderson Diamond Shamrock
P.M.	12:00 - 1:30	Lunch	
	1:30 - 2:15	Explosion in VCM Recovery Compressor	B. Terwiesch Chemische Werke Hüls
	2:15 - 2:45	Placing Explosive Charge on a Burning Tank Car	H. Waltemate B. F. Goodrich
	2:45 - 3:00	Coffee Break	
	3:00 - 3:45	Major VCM Excursions & How They are Handled	Doug Frey Diamond Shamrock
	3:45 - 4:15	Data Reporting on VCM Monitoring Equipment	W. Clark
	4:15 - 4:45	Solvent Absorption as a Final Control Device	G. Schaaf B. F. Goodrich
	4:45	Adjourn	

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(2)

September 14, 1979

<u>Time</u>	<u>Subject</u>	<u>Discussion Leader</u>
A.M. 8:00 - 8:30	Chloride Stress Cracking (Update)	J. Wallace Esso
8:30 - 10:15	An Update of Regulatory Agencies Activity & Their Effect on Our Industry. Including: New Regulations Present Reporting Required Present Reporting Results Other Agencies, etc.	J. T. Barr Air Products & R. Laundrie General Tire
10:15 - 10:30	Coffee Break	
10:30 - 12:00	True Confessions	
12:00	Adjourn Meeting	

AP00050515

WORKING HYPOTHESIS

THE MAJORITY OF THE DATA COLLECTED OR REASONABLY ASSUMED, PLUS THE OBSERVATION OF STRESS CRACKS ORIGINATING AS INTERGRANULAR CRACKS IN HEAT AFFECTED ZONES, LEAD TO THE FOLLOWING HYPOTHESES.

- AT pH <4 A REASONABLE GUIDE TO LIFE EXPECTANCE MAY BE OBTAINED FROM THE COMPUTATIONS PRESENTED AT THE LAST MEETING.
- AT pH >4 LIFE EXPECTANCY IS GREATLY INCREASED.
- IN THE CASE OF STRIPPING TOWERS, OPERATION ABOVE ATMOSPHERIC PRESSURE MAY ALSO EXTEND THE LIFE EXPECTANCY BY PREVENTING OXYGEN ENTRY.
- FOULING WAS USUALLY PRESENT, BUT ITS EFFECT WAS NOT CLEARLY RESOLVED.

THE IMPLICATIONS OF THESE HYPOTHESES ARE IMPORTANT AND VERIFICATION OR CORRECTION IS EAGERLY SOUGHT.

YOUR INPUT IS AGAIN REQUESTED, ESPECIALLY TO FIND:

- HAVE YOU EXPERIENCED ANY CRACKING AT pH >4 OR AT DISSOLVED OXYGEN CONTENTS <0.5 PPM (NOT TO BE CONFUSED WITH OXYGEN IN THE CHARGE, WHICH IS CONVERTED TO HCl)?
- CONVERSELY, HAS THE LIFE OF A GROUP OF VESSELS GREATLY EXCEEDED THE PREDICTED LIFE EXPECTANCY UNDER THESE CONDITIONS?
- HAVE YOU ANY OTHER DATA RELEVANT TO THE LIFE EXPECTANCY?

COPIES OF THE ORIGINAL HANDOUT AND QUESTIONNAIRE ARE AVAILABLE FOR GATHERING RESPONSES. ANONYMOUS RESPONSES ARE BETTER THAN NONE.

JRW/cdr
79 09 13

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Handwritten signature and initials in a circle.

- 1) NUMERICAL ESTIMATES OF PROBABLE C.S.C.C. FAILURE DATES ARE ESSENTIAL FOR DECISION MAKING.
- 2) FROM DATA IN A REVIEW BY E. HOXIE^(a) THE "WICKING TEST" 50% FAILURE TIME $t_{0.5}$ IS ESTIMATED AS

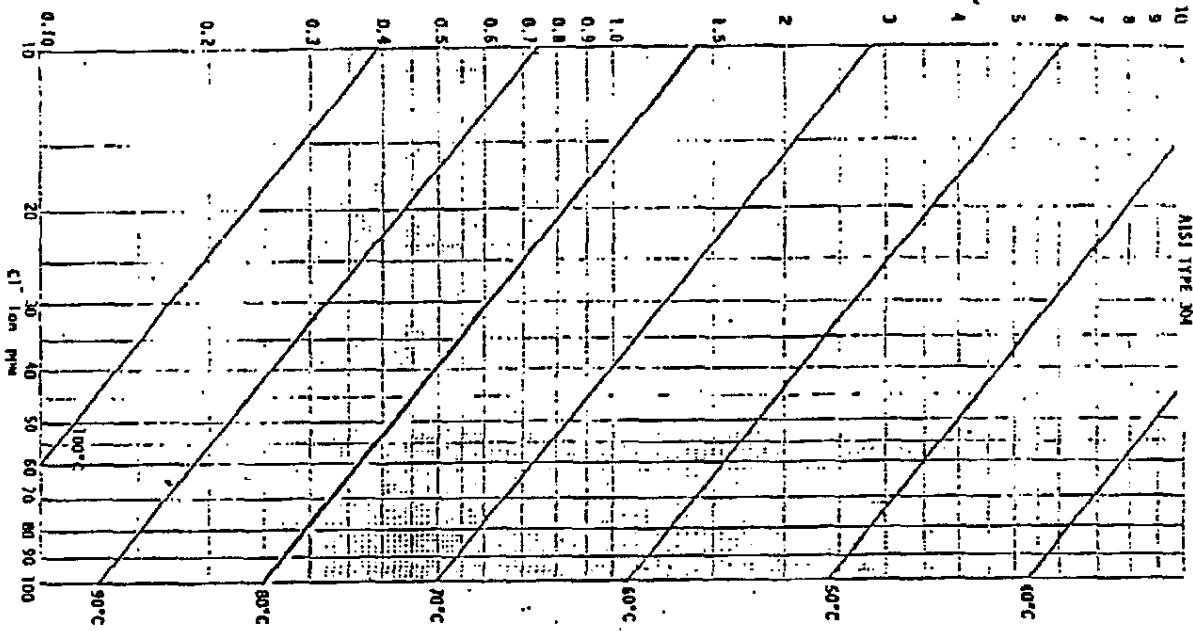
$$t_{0.5} = \text{ANTILOG}_{10} \left(\frac{3679}{T^{\circ}\text{C} + 273} - 0.7586 \log_{10} [\text{Cl}^- \text{ ppm}] - 6.045 \right) \text{ HOURS FOR AISI 304.}$$
- 3) ACTUAL STRIP DRUMS AND MIX TANKS OF AISI 304 BADLY FAILED IN 5 TO 7 TIMES $t_{0.5}$.
- 4) MOST PROBABLE FAILURE TIME t_{f304} ESTIMATED AS $3 \times t_{0.5}$ FOR AISI 304
 i.e. $t_{f304} = \text{ANTILOG}_{10} \left(\frac{3679}{T^{\circ}\text{C} + 273} - 0.7586 \log_{10} [\text{Cl}^- \text{ ppm}] - 9.5105 \right) \text{ YEARS}$
- 5) NOTE (a) FIGURE 13 SUGGESTS FOR AISI 316, $t_{f316} = 4 \times t_{f304}$. NO ACTUAL FAILURE FOUND OR PREDICTED.
- 6) RESULTING PROBABLE FAILURE ESTIMATES ARE PLOTTED IN THE ATTACHMENT.
- 7) FOR REGULAR EXPOSURE OF DIFFERING SEVERITY, E.G. P_a, P_b, P_c % OF TIME AT TEMPERATURES, T_a, T_b, T_c -----ETC.

$$\frac{100}{t_f} = \frac{P_a}{t_{fa}} + \frac{P_b}{t_{fb}} + \frac{P_c}{t_{fc}} \dots \text{ETC.}$$
- 8) FAILURES WERE AT PH 3-4: EFFECT OF PH UNDER INVESTIGATION. ZERO OXYGEN INHIBITS, BUT LOW LEVEL HAS NO EFFECT.
- 9) CORRELATION WITH ONE OTHER PLANT HAS BEEN GOOD. MORE CORRELATIONS NEEDED FOR GOOD RISK MANAGEMENT. YOUR INPUT IS REQUESTED WHERE EQUIPMENT HAS GREATLY EXCEEDED THE PREDICTED FAILURE TIME.

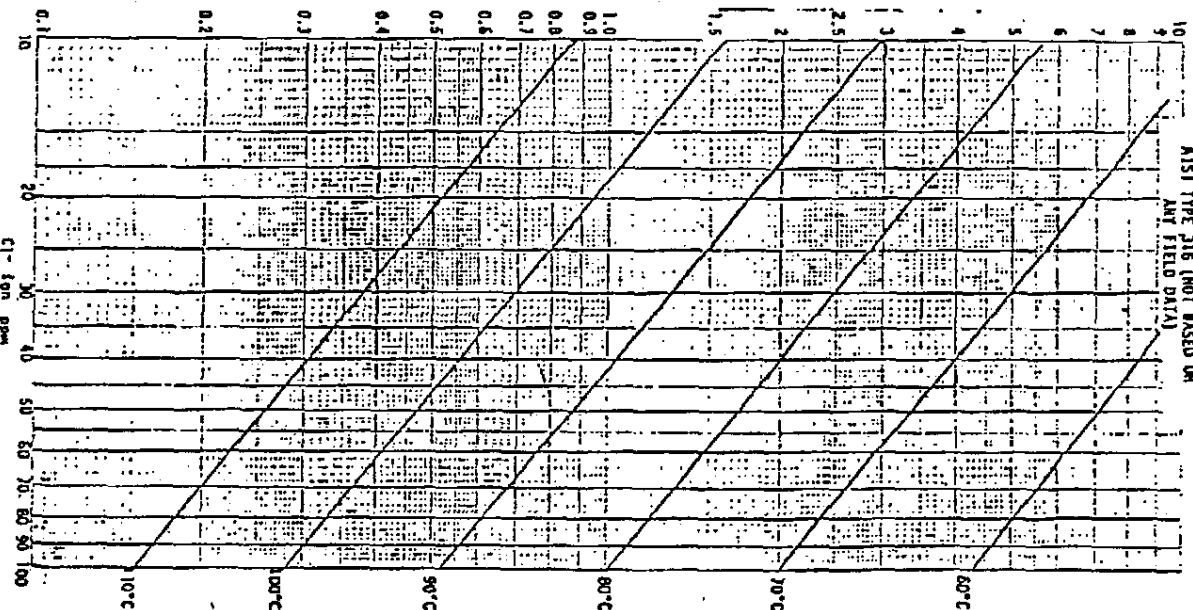
(a) E.C. Hoxie - Some Considerations in the Selection of Stainless Steel for Pressure Vessels and Piping
 A.S.M.E. Talk 1975 copies from International Nickel Corp., 1 New York Plaza, New York, N.Y. 10004.

J.R. WALLACE:caw
 ESSO CHEMICAL CANADA
 PLASTICS TECHNOLOGY LABORATORY
 P.O. BOX 69, SARNIA, ONTARIO N7T 7H8
 OCTOBER 25, 1978 TEL.(519)339-2284

LIFE EXPECTED - TOTAL YEARS
OF ACTUAL EXPOSURE



LIFE EXPECTED - TOTAL YEARS
ACTUAL EXPOSURE



These predictions are the best we can make, based largely on the laboratory results of others, plus our field experience with Type 304 stainless steel. No guarantee can be given of performance in any specific circumstances, due to the effect of other variables, as yet not quantified.

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CHLORIDE STRESS CORROSION RISK MANAGEMENT FAILURE QUESTIONNAIRE

HAVE YOU EXPERIENCED CHLORIDE STRESS CORROSION CRACKING IN ANY OF THESE MATERIALS -

STAINLESS STEEL TYPE 304 ☐ 304L ☐ 316 ☐ 316L ☐ OTHER

IF SO, PLEASE INDICATE THE CONDITIONS, AS FAR AS THEY ARE KNOWN TO YOU.

TYPE OF EQUIPMENT _____

STEEL TYPE	304	304L	316	316L	OTHER
1. MAXIMUM TEMPERATURE USED					
2. % OF TIME AT THIS TEMPERATURE					
3. YEARS OF SERVICE					
4. IONIC CHLORIDE CONTENT PPM					
5. pH					
6. OXYGEN CONTENT					
7. WERE CONCENTRATING CONDITIONS PRESENT					
8. EXTERNAL OR INTERNAL (MARK E OR I)					
9. IF INTERNAL, LIQUID OR VAPOUR (L OR V)					
10. WAS FOULING PRESENT					
11. SPECIAL CONDITIONS*					

*SPECIAL CONDITIONS INCLUDE STRESSES FROM GRINDING OR WELDING, TEMP. CYCLING, PRESENCE OF CHELATOR.

PLEASE RETURN TO: J.R. WALLACE
ESSO CHEMICAL CANADA
PLASTICS TECHNOLOGY LABORATORY
P.O. BOX 69, S. CHRISTINA STREET
SARNIA, ONTARIO N7T 7H8

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RECENT REGULATORY ACTIONS

OSHA

Enforcement - New Manual 4 June (unlawful?)

- Relies more heavily on General Duty Clause, including criminal charges.
- Will enforce ACGIH guidelines, NIH, etc.
- Employee representatives must be included.
- More difficulty with blank warrants - exparte.

Rate Retention - Included in Lead Standard

- Part of standard remanded, but not rate retention.
- Limited term, depends on suitability for employment.

Carcinogen Policy - In Draft

- Said to issue this fall but perhaps not until after benzene case is settled.
- Fifth District has said that incremental cost/benefit must be considered. Appealed.

Fire Brigades - Now Proposed

- Would allow employee to refuse hazardous jobs

EPA

Carcinogen Policy - Draft Released

- Possibly to appear in FR soon.
- Requires generic leak reduction program at once, BAT as a minimum later, with decreasing goals based on residual risk. One test of one species adequate to list, if pollutant.

Vinyl Chloride Revisions - After Policy

- No change in agency attitude that overall policy will be established before any further action on amendments. If present draft stands, June 77 proposal will be consistent.
- Office of Enforcement also wants changes.
- EDF may not accept delay.
- Companies in Northeast have filed for Judicial Review.

Water Quality Criteria - Used Old Risk Analysis

- Proposes 52 ppb for lifetime 10^{-6} risk.
- No aquatic life criteria proposed.
- Very bad job.

Waste Disposal - RCRA likely to impact PVC

- Waste streams from VC, PVC operations listed as hazardous.

FDA

PVC Packaging Sanction - No further action

- Awaits results of SOM policy, that will use acceptable risk calculations to establish residuals.
- Memo of understanding with EPA on potable water finally written.

DOT

Identification System - HM - 171

- Proposes 4-digit international identification system on all containers of hazardous materials.

IRLG

Identification of Carcinogens - For Comment

- First step toward uniform governmental policy.
- Uses risk assessment as tool.
- Many good features, but generally too pessimistic in approach.

IRLG/TSCA

Extensive and detailed test methods, Protocols.

FDA/HEW/TSCA

Good laboratory practices, etc.

AP00050521

SUSPENSION
STRIPPED SLURRY DATA
(March - 1979 Reports)

(ATTACHMENT)
IV

Company and Location	Area	No. Reported	% Over 400	PPM Average				
				Oct.	Nov.	Dec.	Jan.	Feb.
Borden Leominster, Mass.	I	124	.8%	94	129	84	116	98
Great American Chemical Fitchburg, Mass.	I	160	8.7%	266	106	334	236	218
Goodrich Pedricktown, N.J.	II	181	.5%	28.1	1.3	8.6	4.0	2.8
Pantasote Passaic, N.J.	II	172	2.3%	119	155	125	164	117
Tenneco Burlington, N.J.	II	124	8.8%	136	189	144	147	188
Tenneco Flemington, N.J.	II	83	12%	301	156	137	229	288
Goodyear Niagara Falls, N.Y.	II	Did not submit report to EPA						
Hooker Burlington, N.J.	II	Did not submit report to EPA						
Stauffer Delaware City, Del.	III	181	2.7%	259	215	234	183	197
Diamond Shamrock Delaware City, Del.	III	181	6%	52	70	101	128	387
Pantasote Point Pleasant, W.Va.	III	156	10.8%	227	255	267	218	236
Union Carbide S. Charleston, W.Va.	III	142	19.7%	491	59	112	64	59
Firestone Perryville, Md.	III	Not reported		--	553	240	268	150
Firesonte Pottstown, Pa.	III	Not reported		--	273	254	247	306

AP00050522

SUSPENSION
STRIPPED SLURRY DATA
(March - 1979 Reports)

Company and Location	Area	No. Reported	%	PPM Average				
				Oct.	Nov.	Dec.	Jan.	Feb.
Goodrich Louisville, Ky.	IV	90	0	--	--	95	72	55
Air Products Pensacola, Fla.	IV	181	18.8%	342	655	93	210	190
Conoco Aberdeen, Miss.	IV	181	20.4%	326	215	332	344	506
Air Products Calvert City, Ky.	IV	Closed old plant - new plant not started till after 3/1/79						
Borden Illioopolis, Ill.	V	173	1.1%	84	55	44	164	25
B. F. Goodrich Avon Lake, Ohio	V	151	2.6%	119	185	44	20	30
B. F. Goodrich Henry, Ill.	V	131	3.8%	86	79	78	52	134
General Tire Ashtabula, Ohio	V	151	9.9%	240	326	311	248	223
Diamond Shamrock Deer Park, Texas	VI	164	5.5%	141	154	234	134	91
Union Carbide Texas City, Texas	VI	168	3.6%	24	42	75	76	6.8
Ethyl Baton Rouge, La.	VI	Did not receive from EPA						
Georgia Pacific Plaquemine, La.	VI	Confidential						
Conoco Oklahoma City, Okla.	VI	Claimed confidential						
Certaanteed Lake Charles, La.	VI	Did not submit report to EPA						
B. F. Goodrich (Goodyear) Plaquemine, La.	VI	Did not submit report to EPA						
Tenneco Pasadena, Tex.	VI	Did not receive from EPA						
Shintech Freeport, Tex.	VI	Did not receive from EPA						

AP00050523

SUSPENSION
STRIPPED SLURRY DATA
(March - 1979 Reports)

<u>Company and Location</u>	<u>Area</u>	<u>No.</u> <u>Reported</u>	<u>%</u> <u>Over 400</u>	<u>PPM Average</u>				
				<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Jan.</u>	<u>Feb.</u>
Goodrich Long Beach, Cal.	IX	179	0%	3.4	5.6	4.5	6.0	--
Keyser Saugus, Cal.	IX	173	0%	227	179	161	161	197
Stauffer Long Beach, Cal.	IX	151	.6%	166	149	168	134	94
Union Carbide Torrance, Cal.	IX	None reported						

G. E. Brumbaugh:sm
8/30/79

AP00050524

PVC PLANTS ONLY
 VENT GAS DATA
 (March - 1979 EPA Reports)

<u>Company and Location</u>	<u>Area</u>	<u>Hours over 10 ppm</u>	<u>Type of Control Device</u>
Great American Chemical Fitchburg, Mass.	I	72 hours	Some type of incinerator May be dryer
Borden Leominster, Mass.	I	5-1/2 hours	Incinerator
Tenneco Burlington, N.J.	II	29-1/4 hours	One incinerator Installing second unit
Goodyear Niagara Falls, N.Y.	II	Did not submit a report to EPA	
Pantasote Passaic, N.J.	II	None mentioned	No mention of control device
Tenneco Flemington, N.J.	II	None mentioned	Two incinerators
Hooker Burlington, N.J.	II	Did not submit a report to EPA	
B. F. Goodrich Pedricktown, N.J.	II	125 hours	Vent gas absorber
Firestone Perryville, Md.	III	None mentioned	Carbon adsorption
Firestone Pottstown, Pa.	III	None mentioned	Incinerator
Union Carbide S. Charleston, W.Va.	III	None mentioned	Incinerator
Pantasote Pt. Pleasant, W.Va.	III	None mentioned	Incinerator
Stauffer Delaware City, Del.	III	No mention of vent gas	--
Diamond Shamrock Morristown, N.J.	III	-0-	--
B. F. Goodrich Louisville, Ky.	IV	14 hours	--
Conoco Aberdeen, Miss.	IV	1 hour	Incinerator
Air Products Calvert City, Ky.	IV	-0-	Incinerator
Air Products Pensacola, Fla.	IV	-0-	Incinerator

AP00050525

PVC PLANTS ONLY
VENT GAS DATA
(March - 1979 EPA Reports)

<u>Company and Location</u>	<u>Area</u>	<u>Hours over 10 ppm</u>	<u>Type of Control Device</u>
B. F. Goodrich Avon Lake, Ohio	V	724 hours plus 80 hours bypassed	Vent absorber
B. F. Goodrich Henry, Ill.	V	87 hours	Vent absorber
General Tire Ashtabula, Ohio	V	2 hours	Incinerator
Borden Illioopolis, Ill.	V	No data sent to us "Confidential?"	Incinerator
Georgia Pacific Plaquemine, La.	VI	1/2 hour	Carbon adsorption unit vented to gas fired steam generator
Ethyl Baton Rouge, La.	VI	2 hours	Incinerator
Certainteed Lake Charles, La.	VI	Did not submit a report to EPA <i>12/20/78 (21)</i>	
Conoco Oklahoma City, Okla.	VI	Claimed confidential	
Goodyear Plaquemine, La.	VI	Did not submit report to EPA	
Diamond Shamrock Deer Park, Texas	VI	-0-	Incinerator
Tenneco, Pasadena, Tex.	VI	Did not receive from EPA	
Union Carbide Texas City, Texas	VI	Tests made in March 1978 below 1 ppm; no other mention of vent gas stream	Solvent absorption
Shintech Freeport, Texas	VI	Did not receive from EPA	
B. F. Goodrich Long Beach, Cal.	IX	41 hours	Incinerator
Keyser Saugus, Cal.	IX	2 hours	--
Union Carbide Torrance, Cal.	IX	None reported	--
Stauffer Long Beach, Cal.	IX	No mention of vent gas stream	Incinerator

AP00050526

REACTOR OPENING LOSS
(March - 1979 Reports)

<u>Company and Location</u>	<u>Area</u>	<u>Number Reported</u>	<u>Number Over Limit</u>	<u>% Over Limit</u>
Great American Chemical Fitchburg, Mass.	I	377	10	2.7%
Borden Leominster, Mass.	I	556	556	100%
Tenneco Burlington, N.J.	II	89	1	1.1%
B. F. Goodrich Pedricktown, N.J.	II	296	17	5.7%
Goodyear Niagara Falls, N.Y.	II	Did not submit a report to EPA		
Tenneco Flemington, N.J.	II	54	6	11%
Hooker Burlington, N.J.	II	Did not submit a report to EPA		
Pantasote Passaic, N.J.	II	No mention of reactor losses in report		
Diamond Shamrock Delaware City, Del.	III	195	110	56%
Firestone Perryville, Md.	III	Have approved alternate method of steam purging -- did not report individual reactor openings		
Firestone Pottstown, Pa.	III	Have approved alternate method of steam purging -- did not report individual reactor openings		
Union Carbide S. Charleston, W.Va.	III	No mention of reactor opening losses in the report		
Pantasote Point Pleasant, W.Va.	III	Operating under an alternate method of testing		
Stauffer Delaware City, Del.	III	Reported results in PFM -- cannot tell if out of compliance		
B. F. Goodrich Louisville, Ky.	IV	10,802	332	3.0% (9.5% of large reactors were over standard)
Air Products Pensacola, Fla.	IV	Closed reactor technology -- no data reported		
Union Carbide Tucker, Ga.	IV	Run other products before opening -- no data reported		
Air Products Calvert City, Ky.	IV	Closed old plant - new plant not started till after 3/1/79		

AP00050527

REACTOR OPENING LOSS
(March - 1979 Reports)

<u>Company and Location</u>	<u>Area</u>	<u>Number Reported</u>	<u>Number Over Limit</u>	<u>% Over Limit</u>
B. F. Goodrich Avon Lake, Ohio	V	232	7	0.3%
B. F. Goodrich Henry, Ill.	V	1402	110	7.8%
General Tire Ashtabula, Ohio	V	101	12	11.8%
Borden Illioopolis, Ill.	V	479	479	100%
Diamond Shamrock Deer Park, Texas	VI	122	47 (Use statistical reactor sampling program)	38.5%
Conoco Oklahoma City, Okla.	VI	No March 1979 report		
Certainteed Lake Charles, La.	VI	Did not submit a report to EPA		
Goodyear (B.F. Goodrich) Plaquemine, La.	VI	Did not submit a report to EPA		
Ethyl Baton Rouge, La.	VI	No data sent with this report		
Tennaco Pasadena, Texas	VI	Did not receive from EPA		
Georgia Pacific Plaquemine, La.	VI	All data labeled as confidential		
Shintech Freeport, Texas	VI	Did not receive from EPA		
Union Carbide Texas City, Texas	VI	Used a calculated procedure -- no data		
Stauffer Long Beach, Cal.	IX	10	0	0%
Keyser Saugus, Cal.	IX	302	1	0.3%
B. F. Goodrich Long Beach, Cal.	IX	978	25	2.55%
Union Carbide Torrance, Cal.	IX	No data reported		

AP00050528