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INTEROFFICE  
MEMORANDUM

Date 1 November 1978  
Subject Vinyl Chloride Safety Association  
Atlanta, 26-27 October 1978

To Distribution

From J. T. Barr

(Location, Organization, or Department)

Plastics R&D

(Location, Organization, or Department)

Distribution:

A. R. Adams  
L. Allen\*  
R. Arnett\*  
J. H. Body  
R. C. Burnham  
A. J. Diglio  
R. L. Duggan  
D. H. Francke  
R. E. Gilbert  
\*attended also

A. E. Greene  
C. A. Heiberger  
R. E. Jones  
J. D. Kramer  
R. McGinnis  
A. K. McMillian  
J. C. Novak  
E. A. Primeau  
F. L. Riddle

J. R. Russell  
R. C. Sander  
R. H. Schenck  
W. Mayo Smith  
G. B. H. Speed  
R. Stuben  
L. B. Tepper, M.D.  
J. T. Wharton

The ninth regular meeting of the Vinyl Chloride Safety Association met in Atlanta on 26-27 October 1978. Attending were 84 persons from 10 countries and 35 companies representing 34 polymer, 15 monomer and one intermediates plant and two consultant engineers. Officers elected for the next year were:

Chairman - Art Gellner, Certainteed  
Vice Chairman - Rod Becker, Diamond Shamrock  
Program - J. Gabbett, Georgia-Pacific

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Secretary and treasurer remained the same.

R. L. DUGGAN

San Francisco was selected as the meeting place for next year by a narrow margin over Bermuda.

The writer was appointed to a committee to review the by-laws of the association. After due consideration the recommendation was to make no changes at this time.

The agenda, a brief summary of the discussion, and some miscellaneous information are attached. A substantial amount of the material covered at this meeting regarding regulatory matters is common knowledge in our company, and is not reported here.

I. Medical Update - Dr. R. McBurney, Diamond-Shamrock

The speaker discussed the evidence leading to the conclusion of no epidemic of ASL cases. The world-wide case rate seemed to have peaked in 1976 at 12 cases. Only one new case is known thus far in 1978, with two more possibles. He believes this to be due to elimination of the genetically susceptible by now. He also emphasized the observed

## *Air Products*

cluster effect. He praised the industry-supported program at the University of Louisville as the only significant research underway at this time; and urged support of AIHC.

Diamond has devised a medical program that attempts to respond to the regulators perceived need for regulation in the absence of data, which always leads to the lowest detectable concept. They have spent well over a million dollars to computerize their health data along with exposures, job listings, etc., under the general groupings of people, places, and things. They now can call up in seconds, for example, a comparison of the vital capacity and FEV status of those exposed to PVC dust vs. all other workers (no difference seen) on a smoker/non-smoker basis, or a similar study for those who have had chlorine exposure. [This software is for sale at a package price of about \$250M, with an estimated annual maintenance cost of about \$200M.]

Diamond has placed all of its health and safety functions in one group, and has formed internally a Council on Political Affairs to establish better relations with regulatory agencies, elected officials, neighbors, employees, and the press. They have concentrated efforts in each of these areas to combat the lack of hard facts and to establish an industry presence.

### II. EPA Update - R. Laundrie, General Tire

The group was polled to determine the number of relief valve discharges reported in the past year. The average per company was about 3, with about half due to operator error, and most of the remainder due to equipment or instrument failure. The number varied considerably with the age and type of plant. Diamond spoke of 25, out of 50 thousand charges, or one out of each two thousand batches, in their small reactor plant.

There was a discussion as to whether a batch should be terminated if it is realized that there has been premature failure of the rupture disk. One regional office has opined that the plant would be in violation because there is no longer an RD ahead of the RV. Most opinion was in favor of completing the batch normally.

The recent series of exchanges with EPA on enforcement procedures emphasizes the need for detailed recordkeeping on operator-related materials. Training, retraining, reprimands, etc., must be well documented to avoid citations for preventable operator error.

The following reported extensions of the October 21 deadline.

- Hooker - 30 days - strike delay
- PPG - 90 days - 54 day strike
- Shintech - 30 days - no reason given
- APCI - 70 days - labor shortage
- Certainfeed - uncertain status, but running

(We also believe Conoco has an extension at Lake Charles monomer plant.)

**AP00042492**

## *Air Products*

No plants were reported to be shut down or curtailed severely because of the EPA standard.

### Compliance Tests

Region V held a 2-day inspection at General Tire, they emphasized detailing the analytical procedures, observed recovery abatement, reactor opening, batch stripping, water stripping. Did not take duplicate samples.

Region VI spent 1 day in the lab at Borden's Geismar plant. One incinerator was tested at maximum operating rate, and they said that operating charts would be acceptable for the other. Four Regional officials plus a state man went to Goodyear for a preliminary visit. The regional people did not return for the scheduled test date, but relied on the state. The report was filed in June and Goodyear has had no response to date. Texas Air Control Board people made the inspection at Diamond and Shell (one plant, Region VI people at the other). An outside contractor was used at Vulcan. Ethyl had a wrangle about NBS-traceability of the standard.

Region IV relied heavily on Jefferson County people at BFG, Louisville, and on Florida State people at APCI, Pensacola.

Region III told Stauffer they would come back in the spring for final tests.

Region IX did not accompany the state and local people to Keysor-Century (who has not completed all tests) or to Stauffer.

No one has received "approval" or any other type comment on test reports, some of which were submitted as early as June.

The accepted definition of a leak varies from 1 ppm (Borden, Mass.) to 25 (Borden, Ill.). Most are in the 5-10 range at no specified location of the pick-up point.

Many companies have demonstrated an acceptable alternative procedure under paragraph 61.65 on reactor openings, so that measurements do not have to be taken each time.

### III. Spills and Solid Wastes - F. Hoy, Firestone

There was little new in this discussion, which was primarily a discussion of the Firestone Maryland problem which is proposed as a prototype for the future Federal regulation. Licensed landfill operations for Class B wastes require extensive recordkeeping, which inflates the cost. The Perryville plant (250-300 MM lb/yr) has estimated annual costs for solid waste disposal of \$50-60 M, with 10% being permit fees. The group present generally did not perceive solid wastes as a problem.

**AP00042493**

## *Air Products*

Liquid spills are handled with conventional systems modified for the flammable and volatile nature of VCM.

Three plants use deep wells for disposal of hydrocarbon-contaminated liquid streams. Most do not view this as a desirable procedure.

### IV. Dump Valve Leakage - W. Clark, Dow

Discussion of this subject seemed to be inhibited by a feeling of proprietary information. Twelve companies said that they used ball valves, and six said plug cocks. The others did not reply. Clark said that Dow found a short useful life for ball valves with glass-filled PTE seats, and turned to Jamesbury 8163 with stainless seats and stellite leading edge on the wafer. These last in excess of 150 batches before overall. The Masonieland Complex was not satisfactory.

### V. Incinerator Flames - G. Anderson, Diamond

This speaker gave in excruciating detail the start-up procedures and safety programs for their waste gas incineration. Items of interest were:

They use seal pots in the wet gas stream as auxillary flash-back preventers.

They put rupture disks between flash arrestors and the flare to protect the arrestor from possible physical damage.

They spare arrestors and filters.

They put a large rupture disk, at 1/4 the rating of the most vulnerable section, in their waste heat boiler.

They have severe overheating problems if the dilute streams are not feeding to the incinerator.

Nineteen polymer and 12 monomer companies use incineration as the principle abatement method. Ten of these do not have dual systems. A few use flares, but only as backup.

### VI. Transportation - R. Hopkins, Dow

Miscellaneous items of interest from this general discussion of recent DOT regulatory changes were:

If the 105A (insulated) cars are required to be upgraded there can be a major dislocation of supply. The present program is straining the fleets.

The head shields and shelf couplers have performed very well in the tests and accidents that have occurred since their installation. In the recent derailment at Princeton, Ky., two 105A and one head shield cars of vinyl survived, while two older types developed leaks and ignited.

**AP00042494**

## *Air Products*

Dow believes that J-M 76 compressed asbestos is the preferred gasket material.

### VII. OSHA Update - T. Moore, Hooker

Last year 20 companies said that they restricted employment of fertile females in regulated areas. This year 17 companies with 23 plant said that they do. Three forbid females in any part of a vinyl operation. A few forbid non-employees as well, but others only advise this group of the potential hazards.

Two companies, Firestone and Tenneco have received local (tacit) approval from EEOC. Five companies have some action pending. Diamond has had a complaint filed for forced transfer. Firestone has one suit pending. Another female who was hired after a tubal ligation dropped her suit. Stauffer has one formal complaint pending and a suit for deformation of character by a female who claimed she is not fertile because she is single. Two more were hired after tubal ligations.

Only a very few reported that females had asked for transfer out of regulated areas. Europe has no restrictions on females in this regard.

Goodrich had its respirator program cited in California because of bearded employees. The citation was dropped after they filed an abatement plan that did not require shaving (more than 2/3 of the employees were bearded). They train and test with smoke quarterly. Most can get satisfactory fits with full-face masks and some care. If not some trimming is done. Beards usually fit better than a 4-5 day stubble.

After our Denver meeting of 1976, at which we complained to the regional compliance officer of differences between regions (and he said that there was none) the officer called Region II to inquire why Great American was cited for a beard problem. Region II told him to mind his own business.

Rate retention is still a hot issue. Some unions continue to negotiate the matter. Companies such as Pantasote are concerned, because of no alternative jobs. Members were urged to follow the developments in the lead standard. Eight persons were transferred in the last year because of failure to meet physicals. Stauffer lost arbitration on two who were terminated. The arbitrator said the proper procedure would have been to put them on lay-off and hold them there so long as they could not meet the recall physical.

A poll on personnel monitoring showed that 28 companies said that they were not over 1 ppm more than 10% of the time, and all the others not more than 20%.

**AP00042495**

## *Air Products*

On deregulation, Shell regulates some plants only on start-up or shut-down, Dow has deregulated the Texas plants and never regulated the Plaquemine plant. Union Carbide wants to deregulate the solvent resin plants, but their hygiene group opposes. Stauffer was refused permission to deregulate the laboratory because the people enter regulated areas. They have not protested this ruling.

Inspection were held at 9 plants in response to reports filed with OSHA. There were 3 other inspections. A total of 4 citations were issued:

- 1) Liquid contact by a contractor employee led to an inspection and citation for the practice of employee notification of overexposure by bulletin board only.
- 2) Borden received a serious violation for a 1.53 ppm TWA without a respirator. Those who said that they had a respirator were not counted.
- 3) Great American for non-VC "nuts and bolts," e.g, pipes less than 7 ft off the floor.
- 4) Hooker was cited for not training the employees who do not work in the regulated area (contesting).

### VIII. Large Reactor - J. Barr, Air Products

The computer failures of December 1977 were described. Georgia-Pacific recently had an unexplained experience when all valves opened (twice) and all pumps started. Tenneco and Shintech also have had "impossible" things happen to their systems briefly. The disturbing factor is that no company had a convincing reason for the occurrence, and thus cannot be completely sure than they will not happen again.

Ten companies said that they had computer-controlled plants. Four of these have adequate analog backup to operate in the event of computer failure.

About 15 plants blind or otherwise block critical lines before preparing reactor for entry, only about 10 do so if the reactor is opened only, and no entry is planned. Thus the opportunity for accidental monomer release is substantial.

The use of blasting to clear setup reactors was described. Diamond asked if this could be used to get the lumps off the upper baffle support, which they said was their primary source of fouling in large reactors.

### IX. Stress Cracking - T. Allen, Stauffer and J. Wallace, Esso

Stauffer became the third company to report severe pitting and corrosion of stainless steel equipment (see my notes on 1975 and 1977 meetings).

**AP00042496**

## *Air Products*

They found severe pitting in nozzle areas which were not well cleaned regularly, and which were subject to warmer than average temperatures. They also found severe corrosion, from the outside in, on DM water lines in service at 170-180°F. As with the others, they believe that "high" chloride levels are responsible. The chloride can come from decomposition of polymer (fouling or in suspension, such as extra-severe stripping), contaminated insulation, or poor housekeeping.

None of their nozzles failed, which by attribute to relatively low stress service, but they have found some attack in the vessel itself in areas where welding pads are used. These pads do impart some stress in light-walled vessels. They also have seen problems in stub shafts, bolts, centrifuge flights, etc. These units have had 5-13 years of service, and are of 304 SS, except some bolts, which were of 316. In general, there is much less evidence of 316 attack than of 304, except in highly stressed material such as threaded bolts.

Recommendations were:

- 1) Protect surfaces from extended service under a polymer coat.
- 2) Reduce high temperature service as much as possible.
- 3) Protect from dirt, especially chlorides, by plugging up holes on weld pads, using clean, impervious insulation, or paint.
- 4) Reduce stress by relieving, or by good design.

Esso followed up their report of last year by attempting to estimate quantitatively some factors causing corrosion. A temperature of 160°F seems to be borderline for extended service life in the presence of substantial chloride and traces of oxygen. He passed out a questionnaire to accumulate field data for a better understanding. Time at elevated temperature is additive, in his opinion, and he passed out the attached sheets. He believes that buffering and chelates will help reduce attack. A poll showed that 10 plant buffer at 5-8 pH, none above, and 7 do not. Presumably the rest did not know.

### X. Pot and Drinking - J. Mercer, Great American

John told of the very satisfactory experience they have had in enlisting the aid of local social service groups to help their employees who have family or personal problems. These social services have improved both attendance and performance in employees who have been sent to them, and the accident rate is down. They have a very high proportion of employees aged 18-23, and thus many such problems.

### XI. Closed Reactor Technology - H. Waltemate, BFG

Eleven suspension plants and four bulk plants indicated that they had "closed reactor" technology at the present. Of these, four indicated that they had adequate methods to determine externally the extent of fueling. Eleven more planned to go to closed mode.

**AP00042497**

## ***Air Products***

About half of those who responded stated that they used two or more levels of control in the charging of critical materials, with weight and volume being the usual primary variables.

For removal of wall fouling seven still hand clean, 4 use manual high pressure water, 1 has automatic high pressure water, and 4 use solvents. When asked how it was determined if a reactor was empty, eleven said that they still use sight glasses. Of these, 9 are Pressure Product type, and one has a valve between it and the vessel.

One company uses a water spray on the rupture disk to help keep it clear of buildup.

### **XII. Open-Air Plants - B. Kinnamon, BFG**

Bob discussed the worker exposure at the new Louisville installation. He described the plant as six 16,000 gallon reactors designed in 1973 for total outside installation. It was started up in 1976, suffered badly from the winter of 1977 and 1978, but now is being partially enclosed. He presented the average of all 8-hr TWA measurements from their plants during the first three quarters of 1978. They are in an attached table. The Louisville results are biased up by the fact that one maintenance man wears a monitor daily as a part of a test program. Their operators are said to average 0.2-0.4 ppm. He had trend charts that showed a steady decrease over the past few years in the plants, and a tendency to increase in the winter and decrease in the summer as ventilation changed. They expressed the opinion that open plants were not practical when the temperature drops below 20°F for any substantial period.

They claim that their personnel measurements are 95% below 1 ppm at present. Twenty-three companies said that theirs were similar. Seven of these were monomer plants, and 8 were indoor PVC plants.

The most common alarm levels are at 1 and 5 ppm. BFG uses 3 ppm, and a few others were 2 ppm. New Jersey OSHA has accepted the Pantasote Eocom measurements in lieu of personal measurement, but West Virginia has not.

Eight companies had reported emergency releases to OSHA. The most general rule for an OSHA report, as compared to EPA, is that there be a substantial release by accident and that there had been personal exposure without a proper respirator.

### **XIII. European Summary - J. Wilson, ICI**

The European rule on food packaging limits RVCM in the package to 1 ppm and 10 ppb in the food. In practice the package wall needs to be below 0.5 ppm. They have difficulties meeting this in copolymers.

The EEC proposal for personal exposure for a 3 ppm annual average exposure which may not be exceeded, and 95% compliance with work area



concentration of 8 ppm for 1 hr, 7 ppm for 8 hrs, 6 ppm for 1 week, or 5 ppm for a month. Alarms are to be set at 30 ppm for 2 minutes (hard to do with present systems), 20 ppm for 20 minutes or 15 ppm for 1 hr. This is expected to be adopted. Present rules are:

Germany, existing plants 5 ppm/yr with a maximum of 12, new plants 2 ppm/yr, with a maximum of 5.

France, Belgium, 5 ppm/week.

Britain, Netherlands, 10 ppm/day.

Switzerland, 10/week

Sweden, 1/day.

Their typical older plants are at 2-3 ppm 8-hr averages, and they wonder how we report below!.

The environmental requirements are:

West Germany: presently limited to 3 Kg/hr emissions at maximum of 55 ppm concentration, to be reduced to 0.1 Kg/hr at 8 ppm, to be met 99% of half-hour periods. The concentration shall be no greater than 0.1 ppm at the nearest house, 0.25 ppm at the plant boundary, or 0.01 ppm at 1.5 Km.

France and Netherlands provide for negotiated local restrictions. Great Britain calls for negotiated best practical means, with the following guidelines:

|                      | New  | Old | Plants          |
|----------------------|------|-----|-----------------|
| VCM Recovery         | 0.1  | 0.4 | Kg/tonne PVC    |
| Reactor Opening      | 0.2  | 0.2 | (daily average) |
| Stripping-Suspension | 0.25 | 0.5 |                 |
| Emulsion             | 2.0  | 2.0 |                 |

There will be automatic notification of any emergency release or emergency use of short stop.

Dust is becoming something of a political problem in England, but not so much so in the other countries. The pneumoconiosis case in Italy has been discounted, but one in France appears more real. A review of the English retinees indicates more problems than first thought. The cause, actually PVC<sub>3</sub> or dust, or the emulsifier, is still in doubt. Limits are 115 mg/m<sup>3</sup> in the stack outlet in England. Germany has now classed PVC dust as a Class I hazard. Breathable dusts below 10 are limited to 0.1 mg/m<sup>3</sup>, with a 0.35 g/m<sup>3</sup> deposition limit. Considerable emphasis is being put on containment procedures.

**AP00042499**



No particular water limitations are in effect relating to vinyl chloride. Germany limits EDC and other chlorinated materials to 0.3 ppm average with 1 ppm maximum.

#### XIV. True Confessions

Goodrich described a fatality resulting from a ribbon blender accident. Two summer students cleaning a large blender were instructed by the foreman to get out and rotate the ribbon 180°. One worker went to the breaker, removed the lock and energized the circuit. The motor started, crushing the other worker who had not gotten out. Errors were:

- 1) Using only one lock.
- 2) Limit switch on lid not functioning properly.
- 3) Auto start on level in feed funnel energized.
- 4) No start-stop switch - only timer.

They received 3 general duty citations.

Union Carbide followed up on the Texas City bulk plant explosion of September 1977. It has been established that failure in an instrument line allowed the initiator measuring orifice to be bypassed and some 30 fold initiator excess charged.

They now use the BS and DS-90 rupture disk, reverse bulking without a knife. It tends to open all the way better than does the knife version. Care is needed in proper installation to avoid premature failure.

#### XV. General

The question was raised as to a fail-proof method of preventing opening or disconnecting the wrong valve or line on the bottom of reactors. Borden has had to drop the mechanical linkage between the manway and the bottom valve. No help was offered beyond proper labeling of all lines and reactors and careful instructions.

Of those who replied to a question on how much productivity has been lost because of EPA, the most common answer was about 10%.

The question of action if the abatement device is lost was discussed. SPI Counsel was quoted as recommending a "most reasonable" action, e.g., do that which will cause the lowest overall emissions. Crash shutdowns are not necessarily the best action. Good documentation for the reasons behind the action taken was recommended.

Diamond remains the only company convinced that catalytic converters are potential source of ignition in a plant.

**Air Products**

All companies still label bagged PVC as required by OSHA except Union Carbide, who has an exemption for solution copolymers at less than 1 ppm.

The accident data for 1976 and 1977 supplied by 23 plants that included VC/PVC operations showed a rate and severity of accidents 50-100% higher than the MCA average. There was a general lack of interest in continuing the study and it was dropped.

XVI. Other Matters

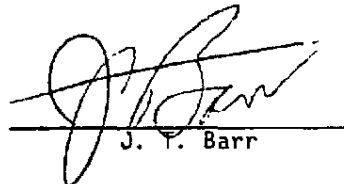
Norsk Hydro/KemaNobel have abandoned the Denmark project, and Norsk Hydro bought the Conoco interests in England as an alternative outlet for their monomer.

The European market is suffering badly from barter PVC coming in from the East Europe countries.

Electro Chemical Industries is in the midst of start-up of their new plant. This is the first plant using Chemineer Bottom - entering agitation. So far, they have had no problems. They feel isolated, being the only Israeli producer, and could be a candidate for a correspondent company.

Chris Sjolín has been assigned to a non-PVC job, and the Steunesung plant manager with has taken his place.

The Diamond bulk plant in Alberta is a year late and costs have risen to over \$90 MM. J-M is expected to be their prime customer.



J. T. Barr

sjd  
Attach.

**AP00042501**

# VINYL CHLORIDE SAFETY ASSOCIATION MEETING AGENDA

OCTOBER 26 & 27, 1978

HYATT REGENCY ATLANTA, ATLANTA, GEORGIA 30303

October 26, 1978

| <u>Time</u>     | <u>Subject</u>                                                                                                                        | <u>Discussion Leader</u>                      |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| AM 8:00 - 9:00  | Registration and Coffee Social Hour                                                                                                   |                                               |
| 9:00 - 9:45     | Chairman's Welcome<br>Official Business<br>Update on Association By-Laws                                                              | Herm Waltemate<br>B. F. Goodrich              |
| 9:45 - 10:15    | Update on Medical                                                                                                                     | Dr. McBurney<br>Diamond Shamrock              |
| 10:15 - 10:30   | Coffee Break                                                                                                                          |                                               |
| 10:30 - 11:30   | Update on EPA<br>(Zero Emission and 100 % On-Line)                                                                                    | Robert Landrie<br>General Tire                |
| 11:30 - 12:00   | Handling of Spills and Solid<br>Waste Disposal                                                                                        | <del>C. W. Engstrom</del> F. May<br>Firestone |
| PM 12:00 - 1:00 | Lunch                                                                                                                                 |                                               |
| 1:00 - 1:30     | Dump Valve Leakage Problems                                                                                                           | Warren Clark<br>Dow Chemical                  |
| 1:30 - 2:00     | Safety Problems Associated With<br>Incinerators and Flares                                                                            | Gregory S. Ondencin<br>Diamond Shamrock       |
| 2:00 - 2:30     | Transportation of VCM in General<br>(Rail Car Safety)                                                                                 | Richard Hopkins<br>Dow Chemical               |
| 2:30 - 3:00     | OSHA Update (Female Employees<br>Status in Regulated Areas)                                                                           | Thomas Moore<br>Tenneco Chemicals             |
| 3:00 - 3:15     | Coffee Break                                                                                                                          |                                               |
| 3:15 - 4:00     | Major Accidents, Near Misses,<br>and Special Precautions in Large<br>Reactors and Computerized Plants<br>and Blasting Inside Reactors | John Barr<br>Air Products                     |
| 4:00 - 5:00     | Stress Cracking on Stainless Steel<br>Equipment                                                                                       | Tom Allen JimWallac<br>Stauffer Esso          |
| 5:00 - 5:15     | Adjourn                                                                                                                               |                                               |

**AP00042502**

October 27, 1978

| <u>Time</u>    | <u>Subject</u>                                                                                        | <u>Discussion<br/>Leader</u>       |
|----------------|-------------------------------------------------------------------------------------------------------|------------------------------------|
| AM 8:00 - 8:30 | Safety Problems Associated With<br>Pot Smoking and Alcohol                                            | Russell Mercier<br>Great American  |
| 8:30 - 9:00    | Safety Problems Associated With<br>Closed Reactor Technology                                          |                                    |
| 9:00 - 9:30    | Indoor Vs. Outdoor PVC Plants -<br>Their Safety Problems and Relative<br>Personnel Monitoring Figures | R. S. Kinnamon<br>B. F. Goodrich   |
| 9:30 - 10:15   | Update on European Regulatory<br>Matters                                                              | Dr. John H. Wilson<br>ICI, England |
| 10:15 - 10:30  | Coffee Break                                                                                          |                                    |
| 10:30 - 12:00  | True Confessions                                                                                      |                                    |
| PM 12:00       | Adjourn Meeting                                                                                       |                                    |

**AP00042503**

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.

| 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.

AP00042504

- 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<sup>(a)</sup> THE "WICKING TEST" 50% FAILURE TIME  $t_{0.5}$  IS ESTIMATED AS  

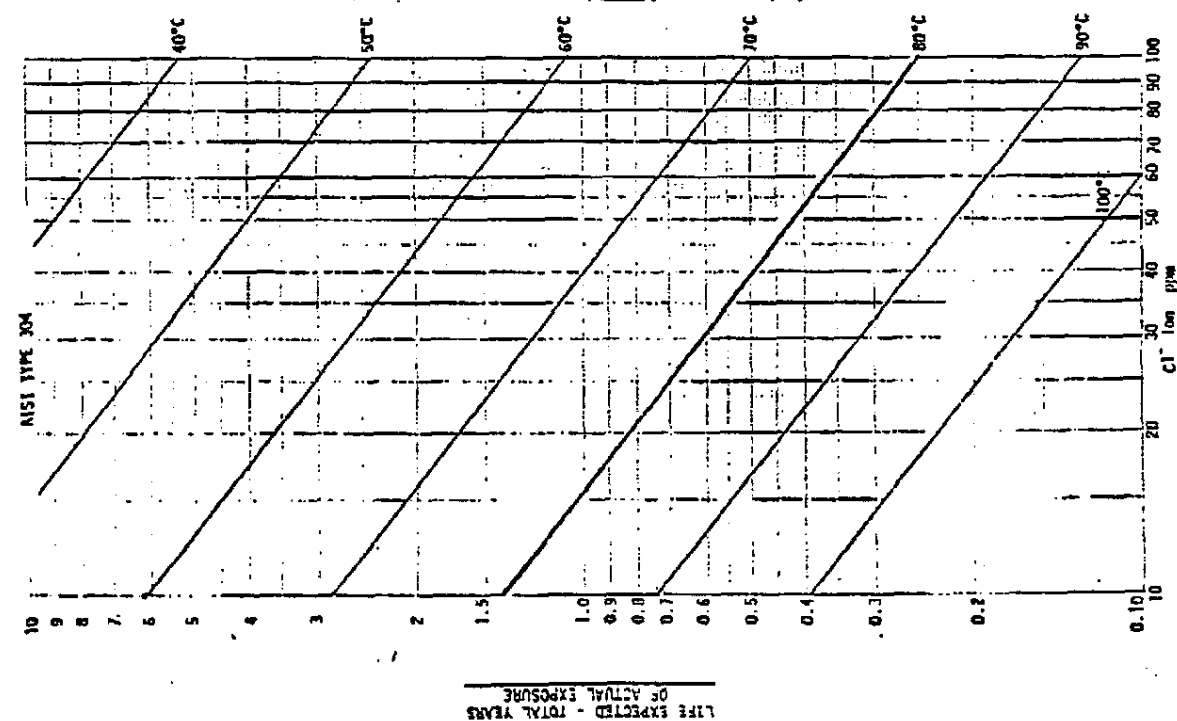
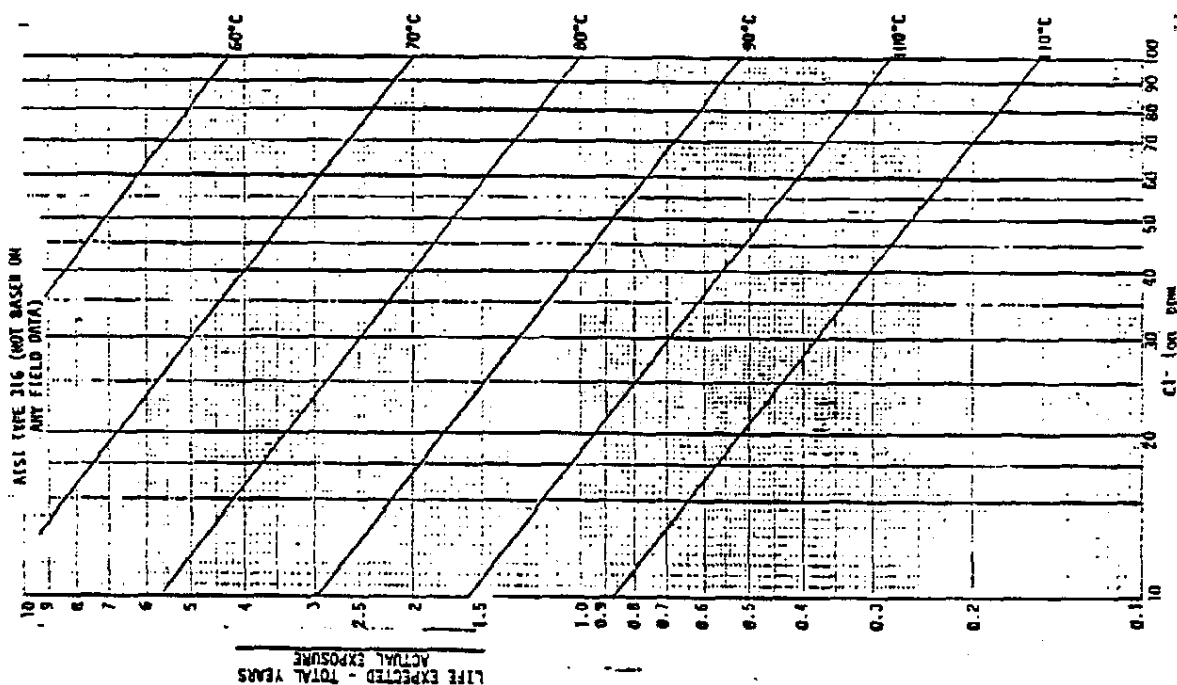
$$t_{0.5} = \text{ANTILOG}_{10} \left( \frac{3679}{T^{\circ}\text{C}+273} - 0.7586 \log_{10} [\text{Cl}^- \text{ ppm}] - 6.045 \right) \text{ HOURS FOR AISI 304.}$$
- 3) ACTUAL STRIP DRUMS AND MIX TANKS OF AISI 304 BADLY FAILED IN 5 TO 7 TIMES  $t_{0.5}$ .
- 4) MOST PROBABLE FAILURE TIME  $t_{f304}$  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.

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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.



AVERAGE 8-HOUR TWA EXPOSURES  
IN BFG PLANTS, JANUARY - SEPTEMBER 1978  
(Without Regard to Respirator)

| <u>Plant Location</u> | <u>Product</u> | <u>Indoor</u> | <u>August ppm</u> |
|-----------------------|----------------|---------------|-------------------|
| Calvert City          | Vinyl chloride | no            | 0.16              |
| Long Beach            | Suspension     | No            | 0.43              |
| Avon Lake             | Latex          | Yes           | 0.43              |
| Pedricktown           | Emulsion       | Yes           | 0.52              |
| Avon Lake             | Suspension     | Yes           | 0.84              |
| Pedricktown           | Suspension     | Yes           | 0.86              |
| Avon Lake             | Suspension     | Yes           | 0.86              |
| Louisville            | Large reactor  | No            | 0.96              |
| Louisville            | Old suspension | Yes           | 1.12              |
| Louisville            | Recovery area  | Yes           | 1.16              |
| Louisville            | Emulsion       | Yes           | 1.21              |
| Avon Lake             | Old suspension | Yes           | 1.37              |
| Henry                 | Suspension     | Yes           | 1.40              |
| AVERAGE 4,281 tests   |                |               | 1.05              |

JTB/sjw

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