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B F G T E C H N I C A L D O C U M E N T

M I N U T E S

VINYL CHLORIDE SAFETY ASSOCIATION MEETING

San Francisco, California

September 13-14, 1979

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General

The Vinyl Chloride Safety Association Meeting was held in San Francisco, September 13 and 14, 1979. There was a total of 87 people present representing PVC and VCM producers. Nineteen domestic and 12 foreign PVC producers were represented. In addition, 4 manufacturers of VCM with no PVC manufacture were at the meeting.

CIIT - IT'S CONTRIBUTION TO BUSINESS WHICH HANDLES TOXIC CHEMICALS - Dick Fleming, Executive V.P. of Air Products

CIIT was founded in 1974 and began operation in 1976 at its Raleigh-Durham, N.C. location. It has a membership of 25 chemically related companies who are allowed one representative each on the Board of Directors. The Director of Research is Dr. James Gibson, whose major concerns are proposing and critiquing research programs developed by the staff of biochemists, toxicologists, pathologists, genetic specialists and epidemiologists at the institutes.

The main objective at CIIT is to make available pertinent toxicological information to the industry, government and public sectors. This will be accomplished by:

- (1) Providing sound scientific and industry presence in the chemical realm.
- (2) Generating and interpreting data on chemicals.
- (3) Increasing efficiency for interpreting data on chemicals.
- (4) Encouraging extreme care in use of potentially hazardous chemicals.
- (5) Promoting and developing toxicologists.

Funded studies are one of the tools that will be used frequently. One that is presently being implemented deals with methyl chloride. Fourteen companies are jointly sponsoring this study at a shared cost of 1.2 million dollars.

Fleming stressed that although companies may sponsor a study, the Institute is in control of the study and will investigate all areas as objectively as possible regardless of final outcome. He added that CIIT is not a lobbying organization, an adversary to regulatory agencies, or a consultant to company members. This is necessary for the Institute to develop credibility with government, public and academic sectors.

RISK ANALYSIS - W. C. Wobser

With the trend in many phases of industry leaning toward developing larger and more complex process units, risk analysis has become a very important part of the overall decision analysis as related to general safety considerations. The goals of risk analysis are to determine (1) the number of ways a system can fail, and (2) what are the consequences when it does fail.

The team involved in the study includes (1) a safety engineer, (2) R & D representative, who has a good knowledge of the chemistry and/or physics of the process, (3) a process design engineer, (4) risk analysis coordinator, and (5) a manufacturing specialist.

The steps taken in the risk analysis are:

- (1) A preliminary analysis which provides the team with information such as equipment specifications, process chemistry, and an inventory of all possible energy sources.
- (2) A determination of the failure modes and effects analysis, which means reviewing all the possible things that can go wrong and estimating the seriousness of such failures.
- (3) Determine what changes are necessary to utilize the safest methods available. Projects can be simulated and computer run at minimal cost.

Risk analysis courses are offered at the following universities: Texas A & M, University of Tennessee, University of Washington, Washington University in D.C., and Carnegie Mellon.

A poll was taken to determine how many companies are using risk analysis. Three (3) companies use rigorous risk analysis while seven (7) companies use it in some other form.

TRAINING NEW PLANT FORCES FOR SAFETY - Roy Henderson, Plant Manager, (Diamond Shamrock) VCM Plant

The entire subject deals with the construction, staffing, and training involved with a grass roots VCM plant. Roy Henderson emphasized the importance of trained operating personnel during the plant startup. It is his belief that each individual must have a good understanding of the process equipment and its capabilities as well as limitations. In addition, his non-technical personnel must have an understanding of the chemicals that are being handled. This approach then generates an overall safety attitude within the organization.

PLACING EXPLOSIVE CHARGE ON A BURNING TANK CAR - Herm Waltemate, BFGoodrich

A presentation was given by H. Waltemate on the Claxton, Kentucky train derailment on October 17, 1978. The narrative is attached for details on this incident.

FOLLOW-UP TRAINING - Doug Frey, Diamond Shamrock

As a result of rapid plant expansion and transfer policies, Diamond Shamrock's experienced work force was decreasing. Before expansion the average experience for a 1st and 2nd class operator was 7-8 years and 10-12 years for a head operator. After expansion, years work experience change to 2 and 3 years respectively.

A follow-up training program was initiated to compensate for this problem. For the program to be effective, four (4) basic keys had to be observed by management:

- (1) Be committed (willingly absorb involved costs).
- (2) Management must participate enthusiastically.
- (3) Good, full time qualified trainer in charge.
- (4) Program must be directed toward positive operating attitude and individual development.

The five Gulf Coast Area plants (1,100 employees) pooled resources and set up several training programs:

- (1) A four week program for all new employees, (two weeks classroom, two weeks field experience).
- (2) One week program for all employees with one year experience.
- (3) Four days all classroom program for newly assigned PVC employees.

The training programs have, along with other possible factors, payed off by:

- (a) Increasing production.
- (b) Decreasing by 2/3 operator error related VCM releases.
- (c) Keeping OSHA recordable accidents at same rate.

Most of the plant personnel were recruited from within the corporation. Many hours were spent working the other plants in the organization in order to compile a process training manual. Seminars were conducted in areas such as ventilation, electricity, etc., to develop the necessary skills needed to operate the plant. Procedures were developed for spill prevention, leak detection, handling of hazardous materials, etc.

Many of the hourly people were completely inexperienced. A four (4) week course was implemented in order to instruct individuals on basic math, physics, and chemistry and to teach commonly used language relating to pumps and instruments. In addition to the above, a fire fighting school was conducted at Texas A & M University for all personnel including the plant manager. (Note to J. Corona - Consideration should be given for doing the same at the Convent plant.) Maintenance personnel completed a one (1) month training program which included a review of Diamond policies and specialized training.

A Plant Safety Information manual which was prepared by front line operating personnel was issued to each employee.

Two (2) pre-employment tests were given to all potential job candidates. These tests were validated and certified before being put into use. The plant employs 205 people in a non-union plant. The plant has developed a pool of individuals who train new employees and retrain present employees. In order to maintain an effective training program, Roy feels that management must be people oriented.

EXPLOSION IN VCM RECOVERY COMPRESSOR - B. Terrviesch, Chemische Werke Huls

Their plant experienced an explosion in a VCM gas washing tower on December 29, 1978. Recovered VCM is accumulated in a gas holder. A screw compressor is used to transfer from the gas holder to a condensor. Ammonia is added to reduce corrosion. The ammonia is washed out before the VCM is reused in polymerization. They were adding low pressure steam to the wash column to prepare it for entry. An explosion of great violence occurred in the wash tower which was caused by VCM peroxides. No injuries occurred but much damage was done to the recovery system. They were unable to determine exactly what caused the peroxide or what set it off. They are beginning more research on VCM peroxides.

They found that solid VCM peroxide will decompose under water. They have reduced the O_2 concentration in their system. The addition of 300ppm of phenol will suppress peroxide formation. Na OH will not destroy the peroxide once it is formed. Recycle VCM is reused quickly and not allowed to accumulate.

ICI reported that they use an additive (TOBONIL) to prevent peroxide formation. With this additive no distillation is required.

DATA REPORTING ON VCM MONITORING EQUIPMENT - W. Clark, Dow Chemical

Because of various State and Federal laws, a thorough, comprehensive program must be set up to monitor employees working with VCM. The Dow System uses a computer. Clark outlined the eleven basic program components that Dow Chemical utilizes:

- (1) Personal monitoring schedule.
- (2) Personal monitoring results.
- (3) Daily Environmental Reports and charts covering VCM.
- (4) Roster lists of employees.
- (5) Individual respirator list with cleaning dates posted.
- (6) Cleaning schedule for individual respirators reviewed and implemented.
- (7) Respirator fit lists.
- (8) Personal physicals for all employees.
- (9) Integrity checks: Thorough audit and continuous checking of program to uncover weaknesses.
- (10) Coordinated collection and recording of all pertinent information related to monitoring program.
- (11) VCM annual training required by OSHA.

The data is stored by month/day and operator. The process control computer costs about \$50,000 and has been on line 99.4% of the time since 1974.

SOLVENT ABSORPTION AS A FINAL CONTROL DEVICE - G. D. Schaaf - BFGoodrich

A presentation was made describing why BFGoodrich chose solvent absorption as the final control device.

Responses to questions of G. Schaaf:

- Five companies use a carbon bed system as a final control device.
- Three companies use a solvent absorber.
- Twenty-one companies use an incinerator as a final control device. Seventeen of these twenty-one have a neutralization for the HCL.

Question: How many companies have a backup control device or take a process shutdown?

- Pantasote holds noncondensables for eighteen hours then shutdown.
- Firestone has an agreement that they will not take a process shutdown if the incinerator can be put back in service within twenty-four hours.
- Stauffer burns their vented material on a continuous basis in their boilers.
- Dow has a backup incinerator and a backup absorber.
- Eleven companies have no backup. Of these eleven, six have plans for a future backup system.

Question: How do you assume a reactor is empty in the closed mode?

- Eight companies reported that they are operating in a closed mode.
- Air Products have sight glasses in their large polys.
- An European company reported that they do not have sight glasses in their reactor but use a level radiation gauge.
- Tenneco uses a level radiation gauge.
- BFG uses a sight glass on the discharge line from the large reactors.

CHLORIDE STRESS CRACKING - J. Wallace, Esso Canada

Mr. Wallace reviewed his update on the stress cracking of equipment used in the PVC industry. Attached is the summary of his conclusions.

UPDATE OF RECENT REGULATORY ACTIONS - J. T. Barr, Air Products -
R. Landrie, General Tire

See attached summary for information.

TRUE CONFESSIONS

Georgia Pacific reported on an accident in which an employee fell into a large reactor while the agitator was coasting to a stop. At the time there was shift competition for production records. The operator was to install a device in the manway for applying a clean wall additive. The employee failed to turn off the reactor vent fan and failed to attach his safety harness. The vacuum sucked the unit into the reactor and the employee did not release his hold. The employee was not missed for ten to fifteen minutes and steam inside the reactor made visibility very difficult. The employee slid down the side of the reactor and received serious burns and compound fractures of his legs and arms.

The only corrective action taken by Georgia Pacific is strict adherence to using the safety harness. BFG plants, with large polys, have been advised to install some permanent fixed device to prevent this type of accident.

Shell Chemical reported on an incident of a relief valve igniting on a tank car. They were filling seven tank cars simultaneously with two pumps at a 2,000 gallon per minute rate. The fifth car filled and failed to shut off and then became hydrostatically full. The fifth time the relief valve lifted an ignition occurred. The filling system was bonded, but the speaker could not describe the specific method of bonding used on the fill line or on the rails.

ICI in the United Kingdom had an explosion in a VCM transfer pump. They have two pumps which are both computer controlled - one pump is used to spare the other. The first pump had not been operating properly and the second pump had just been put on stream. About 15 to 20 minutes later the first pump casing blew and sheared eight bolts on the flange. The pressure was generated by the VCM which was trapped in the first pump. There were several men in the area at the time of the failure but they were not injured.

BFG

E. Pancello gave a report on an accident where an employee fell in the strip tank.

H. Waltemate
E. Pancello
E. Clifford
G. Schaaf

/bn

G. E. Evens

Calvert City

DATE YOUR LETTER

K. C. Hardesty

Calvert City

DATE THE LETTER

November 2, 1978

CLAXTON, KENTUCKY TRAIN DERAILMENT - OCTOBER, 1978

At approximately 9:30 p.m. on October 17, 1978, an eastbound Illinois Central Gulf Railroad freight train derailed at Claxton, Kentucky a small community five miles southeast of Princeton, Kentucky. A total of eighteen cars were derailed of which sixteen were classified as hazardous materials. The BFGoodrich Vinyl Chloride cars involved were GATX 21973, GATX 25628, UTLX 82533, UTLX 98082 and UTLX 98103 enroute to Louisville. All were damaged with GATX 25628 and UTLX 82533 catching fire. GATX 25628 from a dome leak and UTLX 82533 from a 20 inch split in the side.

The initial concern was for a possible BLEVE on GATX 25628 and the overheating of three Pennwalt Chlorine cars positioned more or less in front of the leaking dome area. All people within a mile and a half of the derailment were evacuated immediately with later evacuations carried out downwind (northeast). No more than seventy families were affected plus a few bedridden patients in a convalescent home two and a half miles downwind of the scene.

The Environmental Protection Agency and the United States Coast Guard Strike Team monitored the surrounding area almost constantly but never obtained any measurable VC1 readings outside the immediate derailment scene. Readings up to 3 ppm occurred within 200 feet of UTLX 82533 occasionally but most of the time the readings were less than 0.2 ppm. The smell of ethyl acrylate from the ruptured Rohm and Haas tank car hung over the area during the entire time we were there and many people insisted on calling this odor vinyl chloride. We repeatedly corrected this but had little success.

The Kentucky Water Quality Control Team were present but because of the extremely dry fall, they felt they did not have a problem.

The initial plan was to wait till the VC1 cars burned out before clean-up operations could begin. But by Friday, October 20, everyone realized their time estimates had been optimistic and something had to be done. A decision was made to start clearing the derailment and Hulcher RR Emergency Services began operations on Saturday, October 21. The chlorine tank cars and the three other BFGoodrich vinyl chloride cars were removed first and by Monday, October 23, most of the derailed cars had been moved. This left only the burning UTLX 82533 blocking the track bed. A chute was built to permit the burning car to be dragged down the embankment without sloshing and by dark the ICGRR had the track back in service.

On Tuesday, October 24, a meeting was held and a decision to call in an Army Demolition Team to blow holes in the burning tank cars was made. The next day the Demolition Team blew holes in the lower and the upper ends of GATX 25628 and the car burned out in four hours.

The first explosive charge on the low end of UTLX 82533 did not penetrate completely due to an ice layer, so a second charge was applied and the desired results obtained.

NGC 23210

G. E. Evens
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November 2, 1978

It was estimated that 8000-10000 gallons of liquid VCl remained in GATX 25628 at the time of the explosions and approximately 2500 gallons in UTLX 82533. No VCl fall-out was measured as EPA monitored the downwind area during the entire operation. The only complaints received were for minor skin irritations caused by what might have been contaminated rain.

The empty cars were monitored on Thursday, October 26 and UTLX 82533 analyzed 1-2 ppm inside the tank itself. GATX 25628 analyzed 20 ppm with readings of 1-2 ppm obtained in the burning pits. The high reading inside GATX 25628 was probably due to the fact the liquid drain hole was not blasted clean and an opening of only 8 square inches resulted instead of the 64 square inches desired.

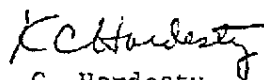
The dome valves on GATX 25628 was inspected and one liquid valve was bent and loose. The Midland gauge head assembly was also slightly bend and the entire dome cover was missing or melted. It appeared that some object had struck the Midland gauge and the one liquid valve causing the original leak under this valve. All other valves and the sample assembly were intact and tight.

ADDITIONAL COMMENTS

It is to be noted that the original Chemtrec call and most of the original information received was inaccurate in relation to commodities involved, car numbers and ownership. Some confusion and inaccuracies are almost always encountered but this was an extreme example.

There was considerable conflict of interests displayed between the ICGRR, the Fire Marshalls and the EPA. There were other agencies and other people consulted but the final decisions were made by one of these groups.

Deputy State Fire Marshall Rodney Raby is to be commended for his part in handling the incident after he arrived on Thursday, October 19.


K. C. Hardesty

KCH/pev

cc: C. L. Woods, W/Attachments
F. H. Sollman " "
Herm Waltmate ~~11/15/78~~
Chuck Carter " "
Rex Spurlock " "
Von Wyatt " "
G. T. Phillip " "
O. C. Johnston " "
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CLAXTON, KENTUCKY DERAILMENT - OCTOBER, 1978

The following cars were in the derailment:

<u>Car No.</u>	<u>Contents</u>	<u>Shipper</u>	<u>Condition</u>
UTLX 96302	VC1	U.S. Rubber	Undamaged
UTLX 98082	VC1	BFGoodrich	Damaged, no leaks
UTLX 98103	VC1	BFGoodrich	Damaged, no leaks
UTLX 82533	VC1	BFGoodrich	Ruptured & Burning
GATX 25628	VC1	BFGoodrich	Leaking & Burning
GATX 21973	VC1	BFGoodrich	Damaged, no leaks
UTLX 87808	Cl ₂	Pennwalt	Damaged, no leaks
GATX 76294	Cl ₂	Pennwalt	Damaged, no leaks
ACFX 86234	Cl ₂	Pennwalt	Damaged, no leaks
ACFX 86534	KOH	Pennwalt	Ruptured, leaking
DUPX 28015	HF	Dupont	Damaged, no leaks
DUPX 28016	HF	Dupont	Damaged, no leaks
UTLX 47659	EA	Rohm & Haas	Damaged, leaking
NATX 75079	EA	Rohm & Haas	Damaged, no leaks
SEMX 3424	Bn	Dupont	Undamaged
ACFX 44660	NAClO ₃	Pennwalt	Damaged, spilled
-----	Coal	-----	Damaged, spilled
-----	Coal	-----	Damaged, spilled

CLAXTON, KENTUCKY TRAIN DERAILMENT

CHRONOLOGICAL REPORT

Tuesday - October 17, 1978

10:12 p.m. - BFGoodrich guard office received a Chemtrec call on a derailment at Claxton, Kentucky located about five miles southeast of Princeton, Kentucky. Initial reports were confusing but they did report at least four BFGoodrich vinyl chloride cars were involved and that a butane tanker was burning on top of a VCl car. The time of the derailment was approximately 9:30 p.m. The use of the call-back numbers resulted in very little additional information.

Wednesday - October 18, 1978

12:05 a.m. - Frank Sollman and S. W. Stamper departed for the scene with Gene Evens acting as Home Coordinator.

12:55 a.m. - BFGoodrich Emergency Team arrived at Command Post set up approximately four miles from derailment. Reported to Eddie Clark, Deputy State Fire Marshall and Labe Hogan, ICGRR Superintendent who were in charge of the scene. There was still confusion as to what car or cars were burning. Dense fog with odors of ethyl acrylate and occasional whiffs of HCl prevented anyone from getting closer than one and one half miles to derailment. Fire Marshall first reported a BFGoodrich butane car was burning but after smelling the HCl, Frank Sollman concluded that probably at least one VCl car was burning. Fire Marshall kept insisting that he was smelling vinyl chloride whenever he got a whiff of the ethyl acrylate.

BFGoodrich Team travelled with Fire Marshalls, monitoring surrounding areas as reports started filtering in of "foul odors". No VCl readings were obtained.

4:00 a.m. - Fog lifted and S. W. Stamper and the Fire Marshall was able to reach derailment. Found BFGoodrich vinyl chloride tank car UTLX 82533 lying crossways of track with a 20 inch split above the centerline of the car near the high end. This was burning vapors at a good rate. BFGoodrich vinyl chloride car GATX 25628 had slid part way down the 80-100 feet embankment and was burning vapors and some liquid from a leak inside the dome area as it lay almost on its side. An ethyl acrylate tank car was leaking but had not caught fire and a sodium chlorate hopper car had rolled down the north side and spilled part of its contents. Three Pennwalt chlorine tank cars were near the burning VCl cars but were not leaking. Rescue Team evacuating one and one half mile radius.

8:00 a.m. - Much concern for the three chlorine cars overheating and releasing chlorine. Slight breeze from the southwest carried the smoke and fumes toward the Outwood Convalescent Center about two and one half miles away and Dawson Springs, a town of about 3000 people located about six miles away. Strong odors of ethyl acrylate and occasional traces of HCl continue. Nearly everyone is mistaking the EA odors for vinyl chloride as they did right up to the time the last car was removed from the scene.

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CLAXTON, KENTUCKY DERAILMENT - CONTINUED

- 11:50 p.m. - Jack Stonebraker, Assistant Chief and Jim Littel, Environmental Protection Agency, Region IV, arrived and started monitoring area with Draeger tubes. No VCl detected.

It was decided that a BFGoodrich representative would remain at the scene twenty four hours a day until the burning VCl tank cars burned out or were otherwise disposed of.

Van Wyatt, S. W. Stamper and Ken Hardesty were scheduled to handle this operation with Frank Sollman and Gene Evens acting as Home Coordinators.

- 6:00 p.m. - Art Profrock, Manager of Hulcher RR Emergency Services and Labe Hogan donned self-contained breathing apparatus and walked into the derailment. Both VCl cars were still burning and UTLX 82533 had a frost line indicating that approximately 30 percent (8000 gallons) of refrigerated liquid VCl remained in the lower end of the car as vapors burned from the gash in the upper end. No indication of the level on GATX 25628 as liquid and vapors burned inside the dome. Some burning liquid was running down the car into a small flaming puddle on the ground. This indicates that the car is over half full.

No leaks on the three chlorine cars, four other VCl cars, two anhydrous hydrofluoric acid cars, one butadiene car and a second ethyl acrylate. Leakers are one potassium hydroxide car and the first ethyl acrylate. The sodium chlorate hopper car has spilled out plus two treated anthracite coal cars are lodged between the burning VCl car UTLX 82533 and a 55 ton chlorine car. Some coal has spilled from the covered hopper cars but has not caught fire.

Quite a bit of indecision all day today. It is hoped the VCl cars will burn themselves out within seventy-two hours or Hulcher can enter area and clear the track so traffic can be resumed.

- 9:30 p.m. - Fire Marshalls closed off scene for the night. State Police road block instructed not to let anyone past.

Thursday - October 19, 1978

- 12:15 a.m. - United States Coast Guard Gulf Strike Team arrived to monitor area for contaminated ground water. EPA requested their presence. Lt. Commander Jim Paskewich in charge.
- 12:30 a.m. - State Police road block on northeast side of perimeter reported derailment fire had intensified. Fire Marshalls went out to monitor area from the other side.
- 1:05 a.m. - Fire Marshalls returned with report that the dome fire on GATX 25628 had increased (probably more gaskets burned out) and that a "BLEVE" was a distinct possibility. They put out a call for the entire Caldwell County Emergency Squad of fifty people to report to the scene with the possibility of evacuating a much larger perimeter including Dawson Springs.

CLAXTON, KENTUCKY DERAILMENT - CONTINUED

They also placed calls for the EPA people, Dave Williams of the AAR Bureau of Explosives and anyone else in the area.

- 1. - EPA reported no VC1 readings around the perimeter and returned to their motel.
- 1. - Horizon illuminated over derailment for 15-20 minutes.
- 1. - Horizon illuminated again. Assume it was relief valve on GATX 25628 relieving.
- 1. - Most of County Emergency Squad released as no fall-out found.
- 1. - No further flare-ups from derailment vicinity during night. Local radio station reporting two more tank cars blew up about 3:00 a.m. Assume this report was due to someone observing the relief valve discharges.
- 1. - Kentucky National Guard helicopter arrived after special request of Jerry Mansfield of the Department of Disaster and Emergency Services of Kentucky. Helicopter started flying inspection tours over scene. Some confusion as smoke was obscuring scene. Decision was made to go in on foot to check over-night changes.
- m. Art Profrock, Hulcher; Carl Bossard, ICGRR Superintendent of Hazardous Materials, Eddie Clark, Deputy Fire Marshall and Ken Hardesty, BFGoodrich walked to scene wearing self-contained breathing apparatus. Burned area in front of dome of GATX 25628 has enlarged which supported the relief valve release theory. Slightly more fire in dome and burning liquid is still running down the car onto the ground. This means GATX 25628 is still over half full of liquid and frost line on UTLX 82533 indicates about 25 percent left in it. All other cars still intact to disprove radio reports of two additional cars blowing up.
- . - Six different TV camera crews working scene. Also, two representatives of the National Transportation Safety Board arrived to investigate accident.
- . - Art Profrock and the Pennwalt Emergency Team went in to check the three Pennwalt chlorine cars. No leaks found.
- . - Chuck Carter, BFGoodrich Public Relations Department arrived and toured the scene. No actions planned for the night. Just standing by waiting for the VC1 cars to burn out. Most estimates seem optimistic at this time.

October 20, 1978

- . - Art Profrock reports that the burning liquid had stopped from GATX 25628 which means it is slightly less than half full.

CLAXTON, KENTUCKY DERAILMENT - CONTINUED

- 9:30 a.m. - Big press conference. EPA and Fire Marshalls announce they are moving perimeter of evacuation into one mile and permitting some people to return to their homes. Opened up the derailment scene to authorized personnel and passes issued. Also, allowed TV crews to proceed to gravel road alongside scene (800 ft) and film the burning VC1 tank cars.
- 10:00 a.m. - Dave Williams, Bureau of Explosive; Chuck Carter and Ken Hardesty entered derailment area and inspected and monitored all BFGoodrich cars. No leaks on the damaged cars UTLX 98082, 98103, and GATX 21973. UTLX 82533 and GATX 25628 continue to burn. Determined level on 25628 was approximately one half full by temperature differential of tank.
- 12:00 a.m. - Rohm and Haas team moved in two tank trailers on flat cars and started transferring the remaining ethyl acrylate from their leaking tank car.
- 1:00 p.m. - Plans are to cut a road in the southside of RR embankment so damaged cars can be moved up this road and placed on trucks or flat cars in area where gravel road crosses tracks (500 ft east of wreck). Hulcher heavy equipment due in tonight.
- 2:00 p.m. - Most of evacuated people returned to their homes this afternoon.
- Rodney Raby, Supervising Deputy Fire Marshall now in charge of scene. Three other Deputy Fire Marshalls assisting.

Saturday - October 21, 1978

- 8:00 a.m. - Hulcher moving in heavy equipment and starting to cut road along side southside of RR embankment.
- 8:30 a.m. - VC1 cars still burning. Fire in dome of GATX 25628 has diminished some. Calling UTLX 82533 20 percent now.
- 1:00 p.m. - Hulcher finished road and started removing cars. Moved ruptured KOH car into field and using four side-winders to carry chlorine cars ACFX 86234 and GATX 79294 up the road to RR track and re-truck both.
- 5:00 p.m. - Moved BFGoodrich VC1 car UTLX 98082 to temporary road and then drug the ruptured EA car clear of wreck.

Sunday - October 22, 1978

- 8:00 a.m. - Fires on both VC1 cars appear to have diminished a little more. Still calling UTLX 82533 about 20 percent. Hulcher starting to cut road to wreck along northside of tracks. Due to rocky terrain they are having difficulty getting enough dirt to build road to desired elevation. Monitored trace amounts of VC1 downwind of UTLX 82533. A little windy today.
- 8:35 a.m. - ICGRR moved in 100 ton crane and with Hulcher's assistance retracked the U.S. Rubber VC1 car, UTLX 96302 and the Dupont BN car, SEMX 3424. Both these cars were upright but with wheels off the tracks as they were the last two cars of the derailment.

CLAXTON, KENTUCKY DERAILMENT - CONTINUED

- 12:50 p.m. - BFGoodrich VC1 car UTLX 98103 pulled clear of wreck.
- 3:00 p.m. - GATX 21973 drug clear of scene. Also, removed one coal car, the full ethyl acrylate car and the third chlorine car. Only cars left on scene are the two burning VC1 cars, two anhydrous hydrofluoric acid cars and the sodium chlorate hopper car. Quite a bit of discussion on how to handle the sodium chlorate. Pennwalt wants to wet it down but EPA experts insist we do it dry.

DAMAGE SUMMARY OF BFGOODRICH CARS GATX 21973, UTLX 98082 and UTLX 98103

- GATX 21973 - Indentations on both sides under dome plus a three foot crease on top section near A end of car. Nothing serious except running gear damage.
- UTLX 98082 - Outer skin badly beat up on one side and both ends. May have small dent in pressure tank at bottom of one end. Nothing serious.
- UTLX 98103 - One side in good shape - other side scraped bare during dragging out operation. Ends pushed in a little but pressure vessel may have escaped undamaged.
- 3:30 p.m. - Plans are to dig chute down northside of embankment and drag UTLX 82533 down and away from track area while monitoring some angle to prevent sloshing.

There has been talk of blowing GATX 25628 and UTLX 82533 with explosives but latest thinking is that it is too dangerous.

Monday - October 23, 1978

- 8:00 a.m. - Hulcher drug VC1 car UTLX 82533 halfway down the north embankment. Some sloshing with increased fire and smoke but everything under control.
- 9:30 a.m. - RR crew laying new track.
- 10:00 a.m. - Hulcher retruckng or placing wrecked cars on flat beds. Moved sodium chlorate car and retrucked without incident.

Railroad track returned to service before dark.

Tuesday - October 24, 1978

- 8:00 a.m. - Dense fog in area but lifting by 8:00 a.m.
- 8:30 a.m. - Monitored all wrecked cars with HNU meter. No leaks. Fires on both VC1 cars has diminished further.
- 12.:30 p.m. - Hulcher working at removing wrecked cars from area. Moving the two HF cars up the north road so they can be retrucked tomorrow a.m.

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CLAXTON, KENTUCKY DERAILMENT - CONTINUED

Meeting at Command Post. Charlie Woods, BFGoodrich Plant Manager attended. Decision was made to call in Army Demolition Team to place shaped charges of explosives at lower ends and high points of cars to release the liquid VCl and then ventilate the vapors from both cars.

2:00 p.m. - Hulcher building burning pits below GATX 25628 and UTLX 82533 to contain liquid VCl after explosions. GATX 25628 is still lying halfway down south bank and UTLX 82533 is now two-thirds down north bank.

3:30 p.m. - Demolition Team arrived to check scene.

Shot one charge on a scrap piece of steel for test purposes. Cut steel like a cutting torch.

8:00 p.m. - Rod Raby, Deputy State Fire Marshall, requested two BFGoodrich people to monitor the scene during Wednesday's activities. Van Wyatt and Ken Hardesty will man HNU meters during the entire operation.

Wednesday - October 24, 1978

7:10 a.m. - Monitored scene. No change. Estimate 8000-10000 gallons left in GATX 25628 and 2500 gallons remaining in UTLX 82533.

10:30 a.m. - Army Demolition Team arrived. Hulcher setting the two hydrofluoric acid tank cars on trucks. The two burning VCl cars are the only cars remaining at derailment area.

12:15 p.m. - Demolition Team completed briefing and survey of scene.

2:00 p.m. - Monitored scene for Demolition Team. Trace amounts up to 0.2 ppm VCl analyzed north of UTLX 82533. Demolition Team proceeded to place their explosive charges. One charge at low point of south end of GATX 25628 and one near top of north end. On UTLX 82533, one charge was placed low on north end (low end) of car and the other charge was located on the west side, opposite the original rupture. A drum of diesel oil was placed above the sodium chlorate spill with a small explosive charge placed on it on the assumption there would be combustion when the oil came into contact with the oxidizing agent, sodium chlorate. There were also several plastic jugs of gasoline placed around area to insure combustion. All charges were wired to detonate simultaneously.

Burning pits had been formed below the low end of each VCl car to contain the burning liquid VCl as it escaped from the cars.

There was considerable delay during this period as the Demolition Team had trouble placing their charges and getting them to stick to the tank cars.

A light rain started to fall.

CLAXTON, KENTUCKY DERAILMENT - CONTINUED

- 5:15 p.m. - Detonation. Charges on GATX 25628 went off as planned resulting in a large liquid fire in the pit below the car and a blowtorch type flame from the high end. No increase in fire from UTLX 82533. First assumption was that the charge on the north side of the track did not detonate.
- 5:25 p.m. - Vapor fire on UTLX 82533 went out. Probably caused by burning vapor blast from GATX 25628 blowing over UTLX 82533.
- 6:00 p.m. - Fires on GATX 25628 diminishing slowly. Army Demolition Team reported that charges did go off but lower charge did not cut all the way through the tank shell. The Demolition Team thinks the ice layer on the car was responsible for this. The charge on the vapor end did cut an eight inch hole as planned.
- 7:00 p.m. - The Army wanted to return to UTLX 82533 and place a second charge to finish the job but it was explained to them the dangers of explosive mixtures in the area after the fires on the car had gone out. It was agreed that the Team would attempt to ignite the vapors in the area with parachute flares shot from a tear gas gun since a Very pistol could not be located. They would then proceed into the area monitoring the atmosphere as they went with the BFGoodrich HNU meter and the ICGRR explosion meter. There was an hour and one half delay while the State Police brought in a tear gas gun and the flares from Madisonville, Kentucky.
- 9:00 p.m. - Army Demolition Team proceeded to derailment. They kept reporting no readings on the HNU meter or the explosion meter and walked right up to the leaking car. Nobody could explain this and the Team was warned again of the explosive mixtures. They insisted their meters were working and proceeded to place the second charge.
- 9:30 p.m. - Detonation. UTLX 82533 burning much like GATX 25628 did. Flames 75-100 ft in the air with considerable black smoke.
- Fires on GATX 25628 diminished to practically nothing. Small fire at lower end of the car and a couple of small fires in burning pit.
- EPA reports no VC1 readings in surrounding areas. Some complaints of skin irritations in areas downwind of fires.
- 9:50 p.m. - "Back-blow" on UTLX 82533 with the accompanying long whistle and boom. Sodium chlorate did not ignite at all.
- It was decided to let the cars burn down for an hour or two more before sending in the railroad people to inspect and repair the tracks.

All groups were satisfied with the operation.

NGC 23219

Thursday - October 26, 1978

- 9:00 a.m. - Fires out. Monitored both cars. UTLX 82533 very clean with only 1-2 ppm VC1 remaining inside the car. GATX 25628 still contained 20 ppm VC1 but discovered the bottom charge had only cut around the eight inch square with the inside section still in place.

CLAXTON, KENTUCKY DERAILEMENT - CONTINUED

Instead of a sixty four square inch opening for the liquid we had only eight-ten square inch. Monitored burning pits and obtained several readings of 1-2 ppm VC1.

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

NGC 23221

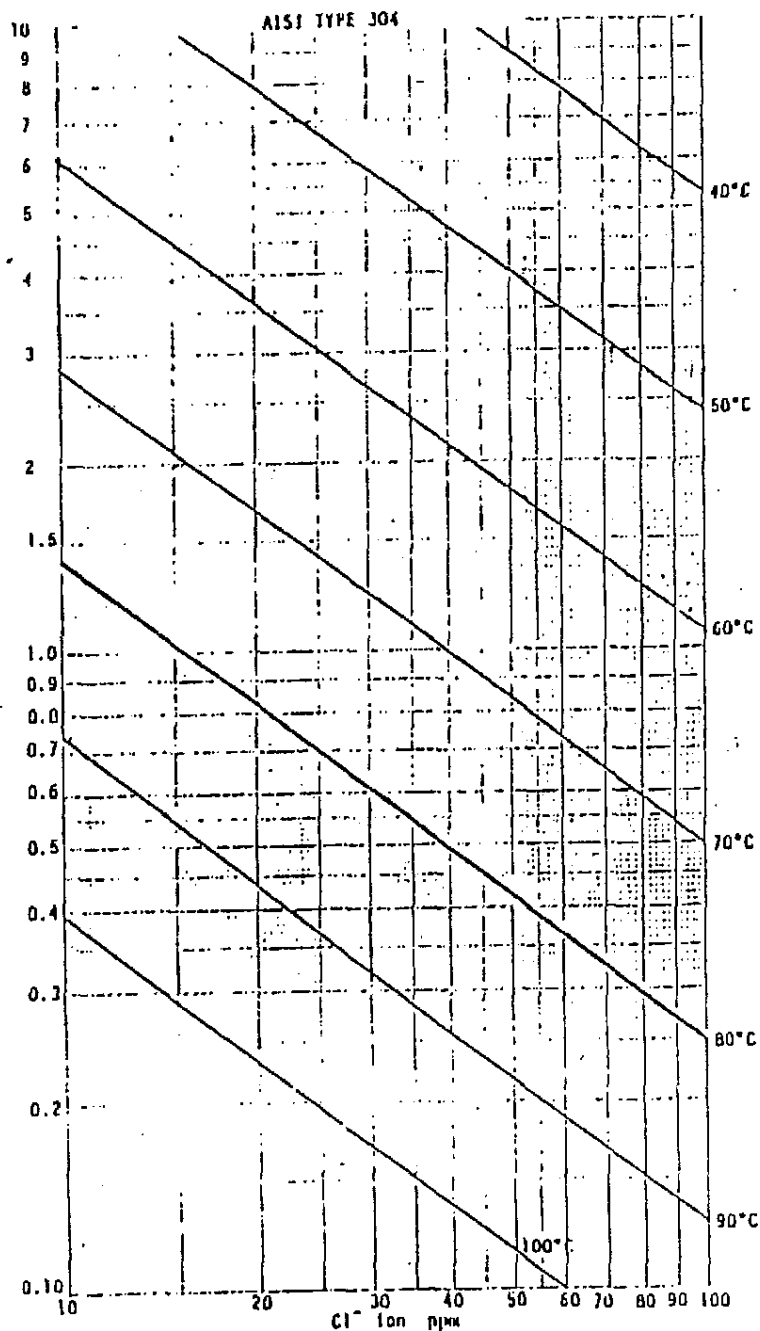
CHLORIDE STRESS CORROSION CRACKING (C.S.C.C.) TEST RESULTS

- 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
$$t_{0.5} = \text{ANTILOG}_{10} \left(\frac{3679}{T_C + 273} - 0.7586 \log_{10} [\text{Cl}^- \text{ ppm}] - 6.045 \right) \text{ HOURS FOR AISI 304.}$$
- 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 $t_{f_{304}}$ ESTIMATED AS $3 \times t_{0.5}$ FOR AISI 304
i.e. $t_{f_{304}} = \text{ANTILOG}_{10} \left(\frac{3679}{T_C + 273} - 0.7586 \log_{10} [\text{Cl}^- \text{ ppm}] - 9.5105 \right) \text{ YEARS}$
- 5) NOTE (a) FIGURE 13 SUGGESTS FOR AISI 316, $t_{f_{316}} = 4 \times t_{f_{304}}$. 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.

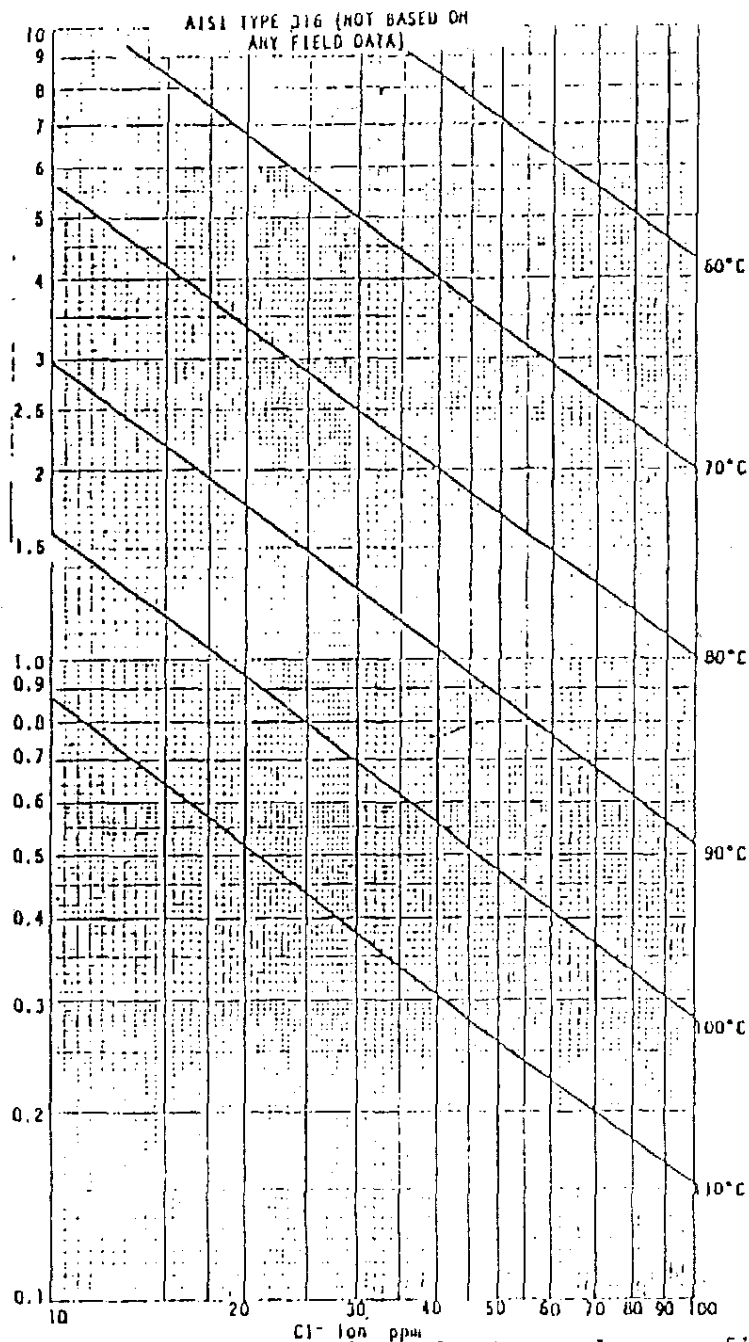
- (a) E.C. Hoxie - Some Considerations in the Selection of Stainless Steel for Pressure Vessels and Piping
A.S.M.E. Talk 1975 copies from International Nickel Corp., 1 New York Plaza, New York, N.Y. 10004.

J.R. WALLACE:caw
ESSO CHEMICAL CANADA
PLASTICS TECHNOLOGY LABORATORY
P.O. BOX 69, SARNIA, ONTARIO N7T 7H8

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.



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.