

FIELD INSPECTION REPORT
CONOCO, INCORPORATED
POLYVINYL CHLORIDE RESIN PLANT
ABERDEEN, MISSISSIPPI

by

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Contract No. 68-02-4147
Task Order No. 40
PN 3470-3-HH

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DIVISION OF STATIONARY SOURCE ENFORCEMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20466

August 31, 1979

DTH 000083529

DISCLAIMER

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PEDCO ENVIRONMENTAL

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September 26, 1979

Mr. Wayne Aronson
Air Enforcement Branch
U.S. Environmental Protection Agency
345 Courtland Avenue
Atlanta, Georgia

RE: Inspection of the CONOCO, Inc. Polyvinyl Chloride
Plant in Aberdeen, Mississippi
PN 3470-3-HH

Dear Mr. Aronson:

Enclosed is copy 1 of the Field Inspection Report concerning the CONOCO, Inc. PVC Plant in Aberdeen, Mississippi. We believe that the plant is in violation of Sections 61.65(a) and 61.65(b)(8) of the NESHAPS regulations. Specifically, we believe that the VCM discharge which occurred February 2, 1979 was preventable and that adequate measures may not have been employed to prevent future discharges. The other violation concerns fugitive VCM emissions in the rail car unloading area and in the Reactor 744 condensor lid.

When evaluating this case, we recommend that EPA consider that CONOCO, Inc. has demonstrated a good faith effort to achieve full compliance. Plant personnel were very cooperative during this inspection.

Specifics concerning this inspection are provided below:

Facility: CONOCO, Inc.
P. O. Box 91, New Highway 25
Aberdeen, Mississippi 39730

Source Description: Polyvinyl Chloride Resin Production

Inspection Scope: Compliance status with respect to NESHAPS -
vinyl chloride. Subjects emphasized: (1)
Relief Valve Discharge Prevention, (2)
Fugitive Losses, and (3) Recordkeeping



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Mr. Wayne Aronson
Page 2

Date of Inspection: August 21, 1979 (8:30am - 5:15pm)

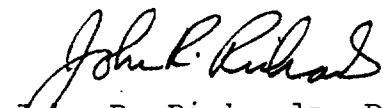
Attendees: Curry Miller, Plant Manager
Richard Frohreich, Chief Process Engineer
Charles Miller, Operations Superintendent
Veldon Messick, Process Engineer
Edward Kreschnick, Production Manager
Wayne Anderson, State of Mississippi
Wayne Aronson, EPA
Ronald Hawks, PEDCo
Herbert Belknap, Ph.D., PEDCo
John Richards, Ph.D., PEDCo

The report which follows is divided into 4 distinct sections: (1) confidentiality aspects, (2) plant description, (3) inspection procedures, and (4) findings and observations. Section 2 summarizes the descriptive data which is scattered throughout the rather extensive file for this case. Some new information obtained during this inspection has been added. Section 3 describes standard procedures used by PEDCo and the agenda adapted for this task. Section 4 is the largest portion as it includes the analyses of the discharges, a summary of the leak survey, and general observations. At the end of the report, we have listed all documents in our possession (locked file 3470-3-HH, RTP office) and which we used to prepare the report. We have also included a list of definitions used consistently throughout.

We believe that this is an important, fairly comprehensive evaluation of compliance. We hope the report is useful to EPA in preparing a rational and fair course of action. PEDCo Environmental appreciates the opportunity to assist you on this case. If you have further questions, please feel free to call.

Sincerely,

PEDCo ENVIRONMENTAL, INC.



John R. Richards, Ph.D.
Project Manager

JRR/dd

cc: File 3470-3-HH

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EXECUTIVE SUMMARY

The Aberdeen, Mississippi Polyvinyl Chloride Plant operated by CONOCO, Inc. is subject to National Emission Standards for Hazardous Air Pollutants - Vinyl Chloride. On August 21, 1979 PEDCo Environmental, Inc., under contract to the U.S. Environmental Protection Agency, conducted an announced inspection of the facility to evaluate compliance with applicable air pollution control regulations.

Concerning emergency vinyl chloride monomer (VCM) discharges, PEDCo Environmental believes that CONOCO, Inc. has adequately reported all incidents and that none has occurred since February 10, 1979. Discharges caused by level sensor failure in receiving vessel FA701 and by premature rupture disk failure in Reactor D-300 appear to be nonpreventable as defined in Section 61.65(a). Actions taken by CONOCO to reduce the potential for future incidents of these types are considered rational and effective. PEDCo Environmental considers the third discharge, that occurring on February 2, 1979, to be preventable and thus in violation of Section 61.65(a). Principle basis for this conclusion is the failure to test the nitric oxide emergency delivery system. Other factors which may have contributed to this incident include the temporary shut-off of necessary condensor water and the addition of excessive quantities of catalyst. Procedural changes and equipment modifications done in response to this accident are judged worthwhile but incomplete.

PEDCo Environmental is concerned that all control measures taken to reduce the potential of emergency discharges have been aimed specifically at the type of accidents which have already occurred. We suggest other modes of failure are equally plausible and that adequate measures may not have been taken to prevent such incidents and/or reduce the severity of the potential release.

As part of the on-site inspection, PEDCo Environmental conducted an independent assessment of compliance with the fugitive emission provisions of Section 61.65(b)(8). Using a portable gas chromatograph, PEDCo determined that all sources surveyed, with the exception of rail car domes and the Reactor 744 condensor lid, were in compliance.

CONOCO, Inc. appears to be in full compliance with record-keeping requirements (Section 61.71), the emission standards applicable to strippers (Section 61.64(e)), and the various requirements for equipment modifications to reduce fugitive emissions (Sections 61.65(b)). Furthermore, an adequate Leak Detection and Elimination Program has been implemented and a monitoring system has been operated. While the latter system complies with Section 61.65(b)(8)(i), we nevertheless, question certain features of the system.

PEDCo Environmental concludes that there are documented violations of Sections 61.65(a) and 61.65(b)(8). We further note that the company has made a good faith effort to achieve compliance and especially to reduce emergency discharges of the type which have occurred previously. CONOCO personnel were very cooperative and have provided whatever assistance requested by PEDCo Environmental.

1. CONFIDENTIALITY

During the facility inspection and the preliminary file review PEDCo Environmental received information which CONOCO, Inc. believes is proprietary. We have not attempted to make an independent judgment concerning the confidentiality of these documents. PEDCo Environmental has adhered strictly to the procedures for the handling of confidential information.

All information received from the EPA Regional Office files and from the CONOCO, Inc. Aberdeen plant records have been assigned a unique document number and have been labelled confidential if so requested by the plant representatives. These documents have been inventoried upon receipt, stored in a locked file when not being reviewed, released only to authorized PEDCo Environmental employees (on a sign in - sign out basis), and are not copied or transcribed except as necessary to prepare this report.

Whenever confidentially labelled data is introduced into this report, we have specified that it is claimed confidential by CONOCO, Inc. and we have listed the document number which is the source of the information. PEDCo Environmental suggests that reviewers of this report do not copy claimed confidential information or release this report without receiving the written approval of EPA counsel. The confidentiality agreement between CONOCO, Inc., and PEDCo Environmental, Inc., is Reference 83.

2. PLANT DESCRIPTION

The Aberdeen, Mississippi PVC plant is owned and operated by CONOCO, Inc. The plant, located in Monroe County, is in the northeast area of the State (see Figure 1). Specific coordinates are: latitude N 33° 48 minutes, 32 seconds; longitude W 88° 32 minutes, 33 seconds. CONOCO, Inc. has operated the PVC plant at this site since 1972. Previously, the plant was a family owned enterprise utilizing a large number of small reactors. The old reactors and associated equipment were retired during the period 1974-1975 due to economic considerations and regulatory pressures. The plant is subject to National Emission Standards for vinyl chloride (hereafter referred to as NESHAPS) which were promulgated in October 1976 (see Reference 87). These regulations require (1) periodic sampling of 3 major process streams, (2) operation procedures for three specific functions, and (3) physical modifications to a large number of process units.

Plant facilities include PVC resin production, dry blending and plasticizer operation. Only the resin production systems are subject to NESHAPS, therefore the inspection has been limited to these sources. CONOCO, Inc. demonstrated compliance in September 1978 with all applicable provisions of the NESHAPS with the exception of the Reactor Opening Loss provision which is the subject of an unresolved measurement technique issue. PEDCo has emphasized the time period from September 1978 to August 1979 in the review of the plant compliance status. The report adheres to the definitions presented in Appendix A.

2.1 General Plant Information

The Aberdeen plant uses the suspension process for the production of four (4) types of PVC resin. Production capacity

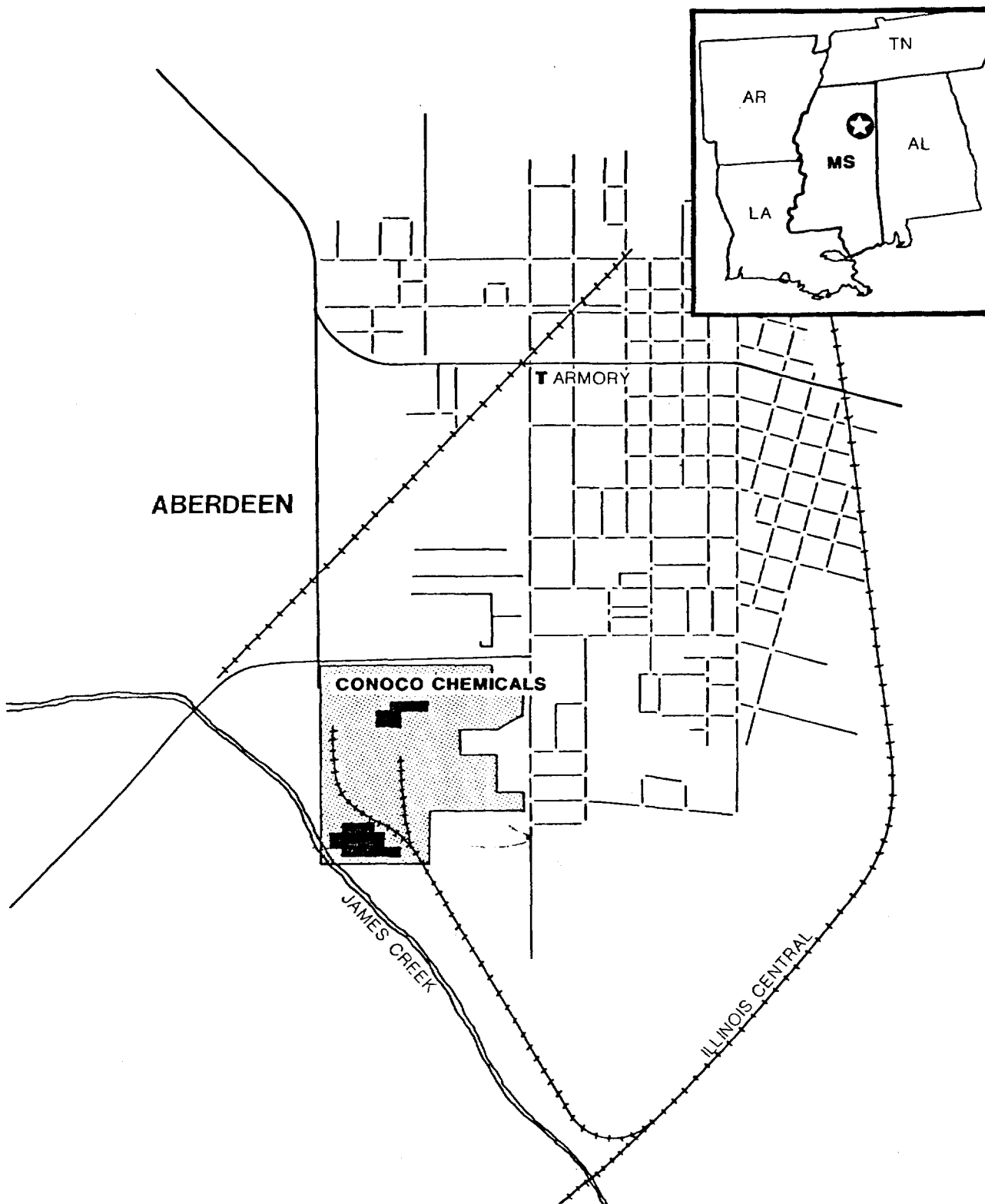


Figure 1. Plant Location.

is 3.5 million pounds of PVC resin per year (Claimed Confidential, Reference 84). Plant management personnel expect this level of demand to continue in the immediate future. Operation continue 365 days per year, 24 hours per day. There are two shifts per day with operators on duty for 4 days and off for 3 days.

A chronology of actions taken by the plant and interactions with regulatory agencies is presented in Appendix B. This is an abbreviated summary intended to include only those items pertinent to this inspection task. Please note that vinyl chloride monomer discharges were reported December 9, 1978, February 2, 1979, and February 10, 1979. Concern over such incidents has resulted in changes in plant equipment and operating procedures during the last year.

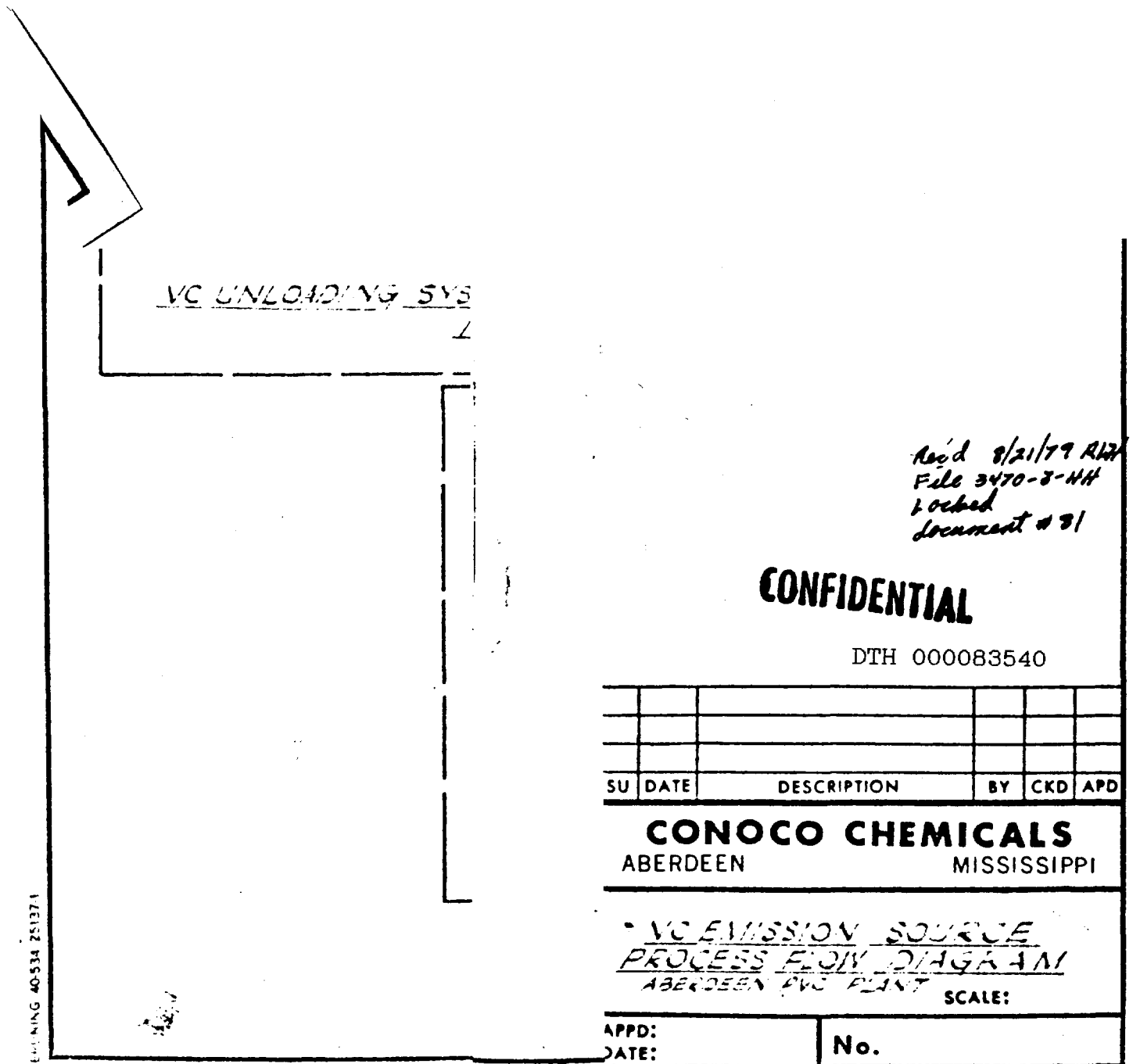
2.2 Equipment/Source Description

A simplified process flowsheet is presented in Figure 2 (Claimed Confidential, Document 81). As shown in this figure, there are seven basic steps in the processing of vinyl chloride monomer to produce polyvinyl chloride resin by the suspension process. These are as follows:

1. Monomer unloading and storage,
2. Monomer charging,
3. Polymerization,
4. Monomer recovery,
5. Emissions recovery,
6. Vent incineration, and
7. Water stripping.

The vinyl chloride monomer is received and stored as a liquid under pressure. It is pumped into a charge receiver which is essentially just a holding vessel. When a reactor is ready, the monomer in the charge receiver is pumped out through a filter to the reactor. Polymerization initiators and suspension agents are added to the monomer as necessary to produce the desired resin type. The batch reactor is operated at

Figure 2. Simplified process flow sheet.



elevated temperature and pressure for approximately 6 hours. At this point most of the monomer has polymerized to form polyvinyl chloride. The polymerization reaction is stopped using a chemical agent. Steam stripping of the PVC-water suspension is then done to recover any monomer which is not reacted. This monomer is collected in the recovery system for eventual recycle to the charge receiver. Uncondensed vapors and gases then pass to the incinerator. The product PVC from the reactor is dried and stored. More detailed information on each step is contained in the following paragraphs.

Vinyl chloride monomer is received by rail. Liquid VCM is pumped from the rail cars by compressed vapors from the storage sphere. After all possible liquid has been removed (as determined by a sight glass in the unloading lines) the reciprocating compressor lines are reversed so that VCM vapors remaining in the rail car can be evacuated. After the pressure drops to 10 psig (approximately 1.7 atmospheres) the rail car is isolated, the unloading lines are evacuated to the emission recovery system and the lines are disconnected (Claimed Confidential, Document 15). Liquid VCM stored in the sphere is transferred to the VCM charge receivers using centrifugal pumps.

A total of eight (8) large polymerization reactors are used to produce the PVC resin slurries. There are two modules each containing 4 interconnected batch reactors. Module 1, sometimes referred to as the "old module", has reactor volumes of 2,523 cubic feet each with VCM batch charge quantities of 49,500 pounds (Claimed Confidential, Document 18). The set of reactors became operational in 1974. Module 2, the "new module", has reactor volumes of 2,975 cubic feet and batch charge quantities of 60,000 pounds (Claimed Confidential, Document 15). There is a slight difference in reactor design, however, this does not appear relevant to the objectives of the inspection. All of the polymerization reactors are fabricated of stainless steel. These vessels are designed for a pressure

of 200 psig at a temperature of 200°F (Claimed Confidential, Document 17). Each reactor is protected with pressure relief valves in accordance with various regulatory requirements including 61.65(a). The reactor has a primary system composed of a rupture disk (RD) and safety relief valve (SRV) in series, each set to 185 psig. A secondary SRV is set at 200 psig.

Three VCM recovery systems are used to collect unreacted monomer vapors for recycle back into the process (Claimed Confidential, Document 17). These include the Module 1 system, the Module 2 system, and the Emission Recovery system. All three utilize a knockout/scrubber step for removal of entrained resin particles followed by condensers and vacuum pumps. Approximately 10-30% of the liquid VCM charged to the polymerization reactors is recycled material from these process systems (Claimed Confidential, Document 17).

Unremoved VCM vapors and other organic compounds (if present) are sent to a refrigeration system and then vented to the direct fired incinerator, which operates at 2600°F and has a residence time of 1.5 seconds (Claimed Confidential, Document 86). Emissions are quenched using process water and scrubbed in a packed bed, again using process water. The inlet concentration of VCM in this quench and scrub water is low. Note that as there is no backup system for the incinerator if a malfunction occurred, the plant would not be able to maintain compliance with NESHAPS for more than several days (Claimed Confidential, Reference 84).

The PVC slurry is stripped in the reactors down to a VCM concentration less than 400 ppm as required by 61.64(e)(1)(ii). Filtering is done in Sweco strainers and the resin is pumped to slurry blend tanks. The final PVC resin product is achieved by drying in a set of centrifuges and concurrent rotary driers. All centrifugal pumps, centrifugal compressors, and agitators are equipped with double mechanical seals and operated at seal water pressures well above vessel operating pressures. The reciprocating compressors are equipped with oil seals.

The overall PVC resin production area includes the following equipment (Claimed Confidential, Documents 17, 18, and 19):

- 8 Polymerization reactors
- 8 Agitators
- 13 Centrifugal compressors
- 4 Reciprocating compressors
- 15 Centrifugal pumps
- 59 Rupture disks
- 59 Safety valves
- 1 Incinerator

Section 4 of this report contains a complete inventory of these sources, as reported in CONOCO, Inc. "Compliance Manual", (Claimed Confidential, Documents 17 and 18). This includes the equipment numbers assigned by CONOCO.

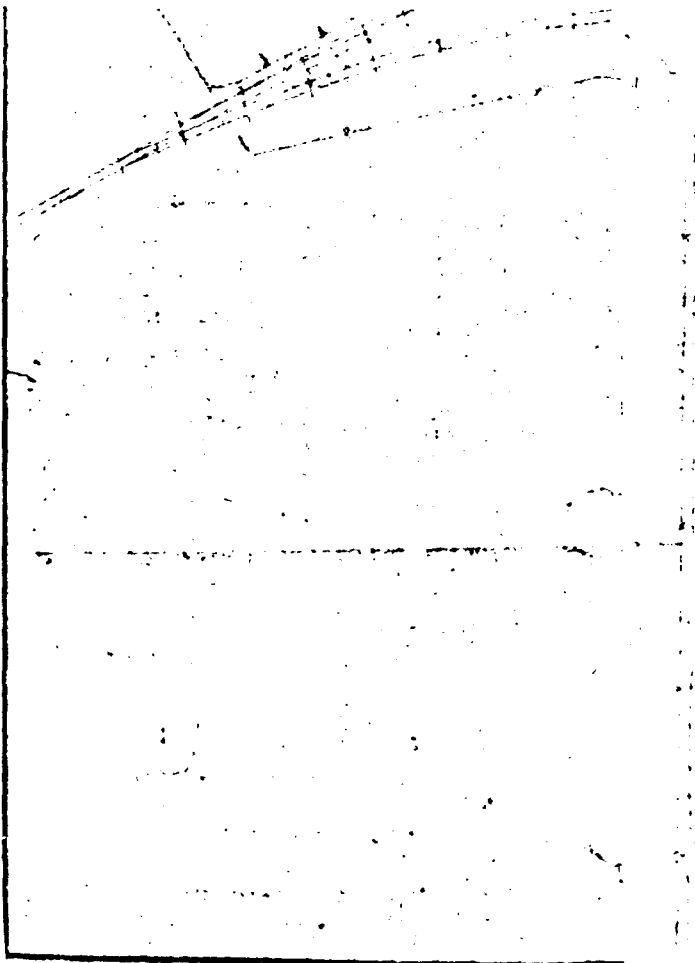
A set of four (4) Honeywell 1000 Process Gas Chromatographs are located in the plant to identify VCM leaks as required in NESHAPS, Rule 61.65. Each chromatograph monitors 10 locations (air is withdrawn continuous along PVC $\frac{1}{4}$ " O.D. lines from potential fugitive VCM release sites to the fixed location GC). The GC cycles between these lines are at a frequency of 1 every 10 minutes. Figure 3 illustrates a plot plan showing the locations of the monitoring points (Claimed Confidential, Document 80), while an inventory of these sites is presented in Section 4 of this report.

2.3 Plant Operation

Four types of PVC resin are produced at the Aberdeen plant (Claimed Confidential, Document 84). Module 1 is used to produce only Type 5385, while Module 2 is used to produce Types 5305, 5425, 5465, and 5385. During the 15 days preceeding this inspection, Reactor 741 produced Type 5425 exclusively, Reactor 744 produced Type 5305 in a large majority of the batches and Reactors 742 and 743 primarily produced Type 5335 (Claimed Confidential, Document 84). Plant management personnel do not anticipate a near term shift in product distribution (Claimed Confidential, Document 84).

Each type of resin requires a different operating temperature and pressure. Desirable operating conditions and maximum acceptable pressures are listed in Table 1.

Figure 3. Plot plan.



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ISO DATE	DESCRIPTION	BY	CKD	APD
CONOCO CHEMICALS ABERDEEN MISSISSIPPI				
FIGURE I PLOT PLAN EPA MONITORING POINT LOCATION SCALE: 1" = 100'				
APPD: RAF DATE: 4-5-79		No. SD-1046-42-1-D		

Table 1. REACTOR OPERATING CONDITIONS^a

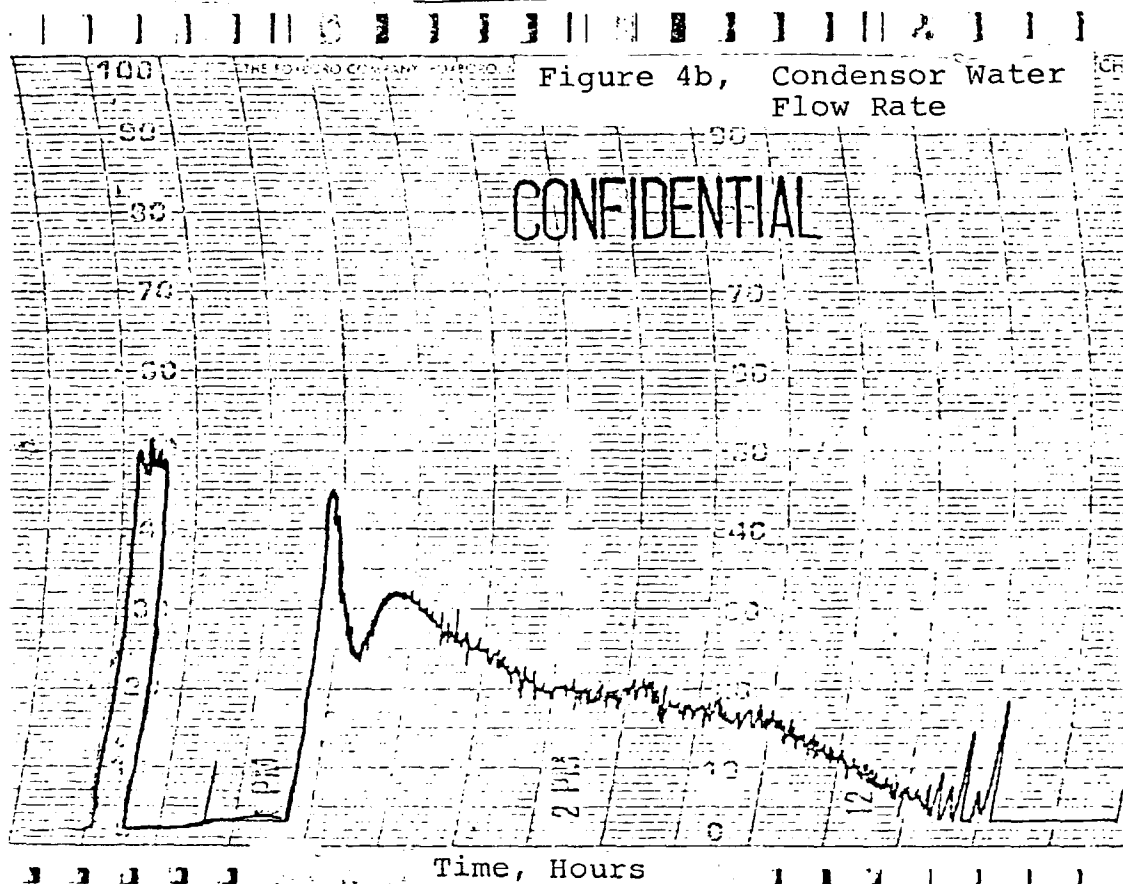
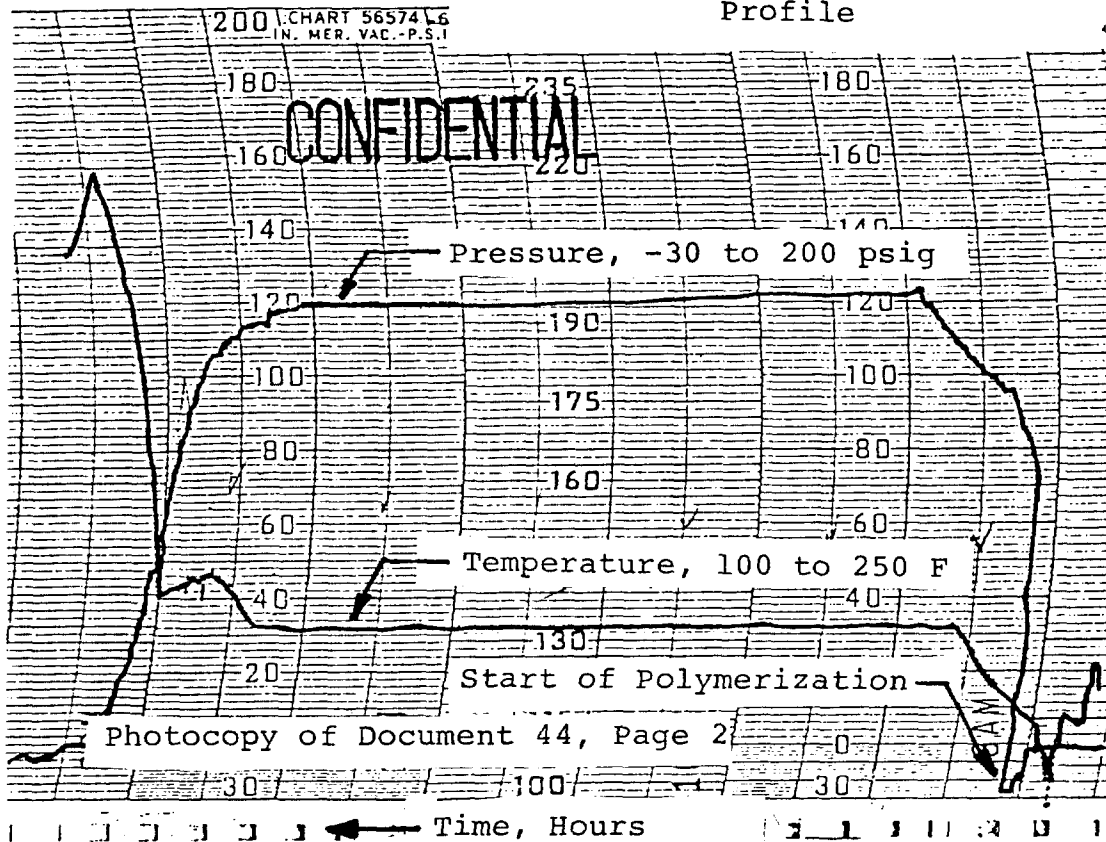
Resin Type	Normal Conditions		Maximum Pressure (psig)
	Temperature °F	Pressure (psig)	
5305	unknown	~160	170
5385	~125	~120	145
5425	~122	~105	145
5465	unknown	unknown	145

^aClaimed Confidential, Documents 79 and 84).

Reactor Operating Procedures - The batch reactor is initially charged with vinyl chloride monomer, water, suspension agent (Polyvinyl alcohol (PVA)), and catalyst (benzoyl peroxide) according to the specific formula for the type of resin desired (Claimed Confidential, Document 89). Additions of decoloring agents such as butyl hydroxy toluene are made to improve quality (Claimed Confidential, Document 89). Indirect steam heating of the reactor is started to raise the mixture to the desired operating polymerization temperature and pressure. As these conditions are approached, the cooling water flowing to the reflux condensor is started so that the exothermic reactions will not get out of control, thereby yielding undesirable product characteristics. After 6 hours a free radical type scavenger is added to "kill" the polymerization reactions. Steam is then injected into the reactor to strip the remaining unreacted VCM which comprises 10-20% of the initial VCM charge (Claimed Confidential, Document 84). Vapors are collected and condensed in the vapor recovery system. Steam stripping is performed until the concentration of VCM in the slurry is below 400 ppm as required by 61.64(e)(1)(ii).

The reactor profile from an actual batch run in Reactor D-400 on August 10, 1979 is depicted in Figure 4. The top set of curves are the reactor temperature and pressures and the bottom curve is the condensor cooling water flow rate, during approximately the same time. It is difficult to match the two curves exactly since plant operators make no effort to match the time scales on the strip chart recorder paper. The initial

Figure 4a, "Typical" Reactor Profile



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rise in reactor temperature and pressure (Figure 4) is due to the steam jacket heating at the beginning of the run. In this run, temperature and pressure were well controlled using the condensor water flow rate. The drop in pressure is due to the addition of the kill agent at the end of the run. The temperature increase at the end of the run results from the injection of steam directly into the reactor for stripping of the monomer.

CONOCO, Inc. uses α -methyl styrene (AMS) for purpose of temporarily slowing the polymerization reaction (bumping), for quality control, and for emergency suppression in the event of reaction "runaway" (Claimed Confidential, Document 84). Amounts used for bumping or quality control rarely exceed several pints of AMS, however, emergency suppression can require up to 5 gallons. Figure 5 illustrates the reactor profiles for a case in which AMS was used to bump the polymerization reaction. AMS was used on two occasions three hours apart during the run. The presumed injection times are indicated with arrows on the top curve. Both injections resulted in a temporary drop in the reactor temperature and pressure. Other variations apparent in the profiles are probably due to the highly variable condensor water flow rate. Data presented in Figure 5 is from Reactor D-500 on February 6, 1979 when Type 5385 was being produced (Claimed Confidential, Document 45).

For comparison purposes, a set of profiles have also been included for a case when AMS was used for emergency suppression. Figure 6 data is from Reactor 744 on August 11, 1979 when Type 5385 resin was being produced (Claimed Confidential, Document 74). AMS was added in two stages approximately 30 minutes apart as indicated by the arrows. In this case the problem occurred due to a plugging of the reflux condensor. The large quantities of AMS have a significant impact on the reactor temperature and pressure.

Reactor Opening Procedures - After reactor recovery, the PVC slurry is transferred to the PVC blend tanks and the reactor is prepared for the next batch. This involves water rinse

Figure 5a, Reactor Profiles with AMS Bumps

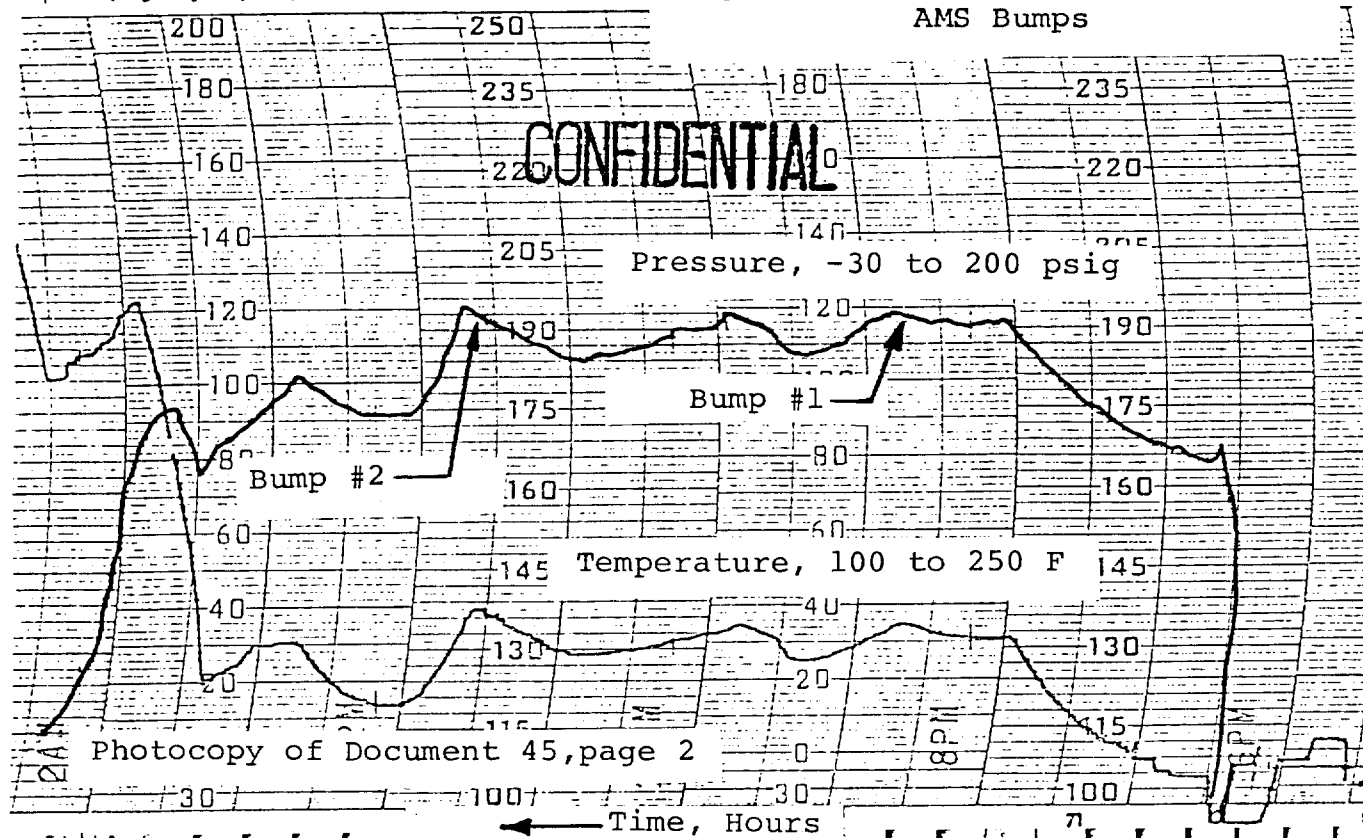
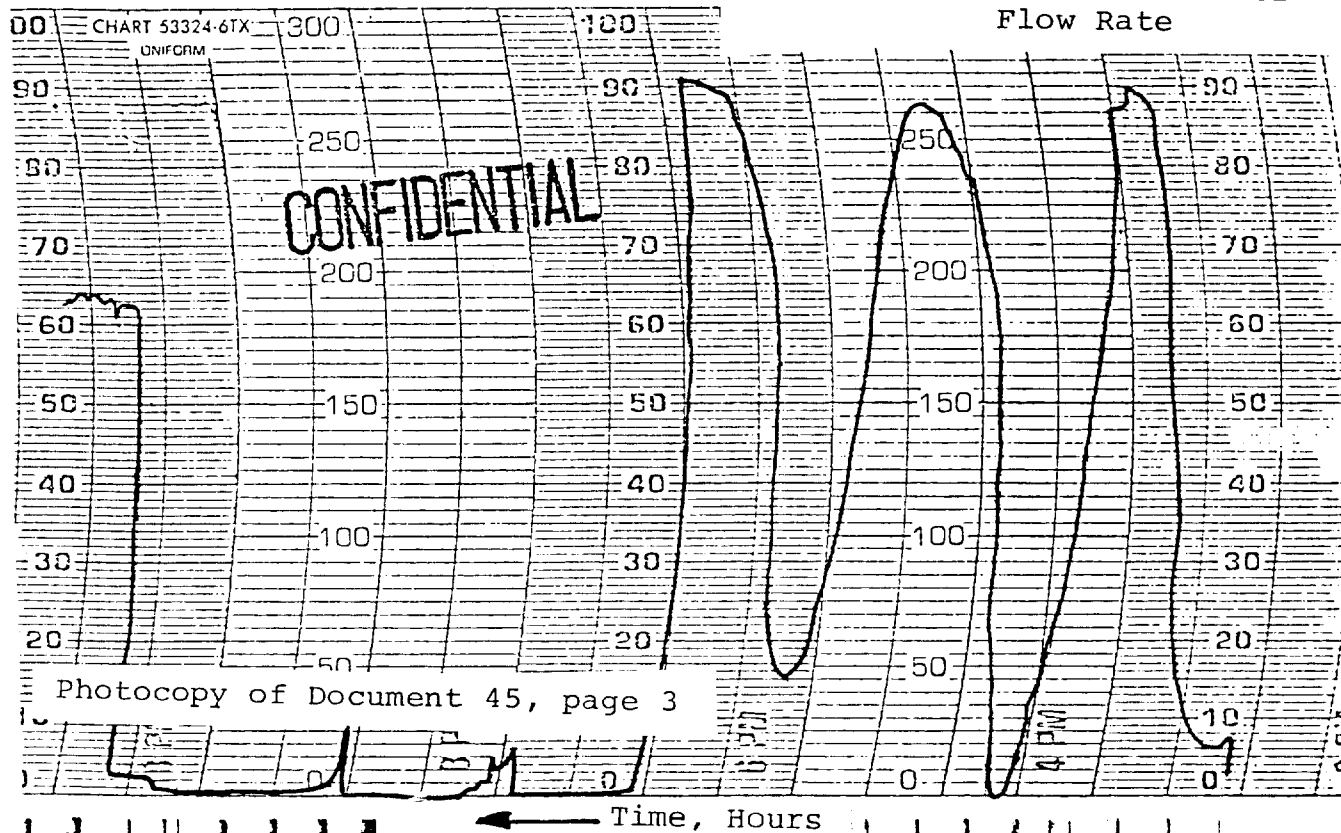
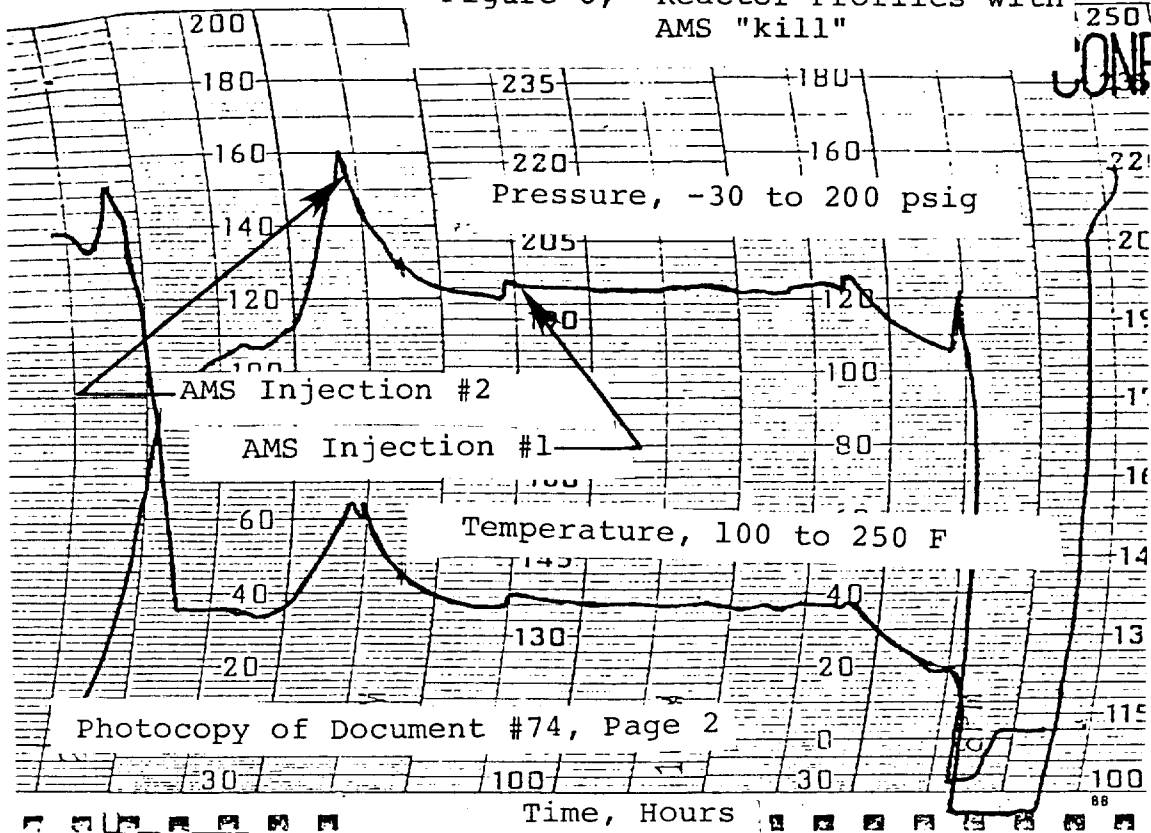


Figure 5b, Condensor Water Flow Rate



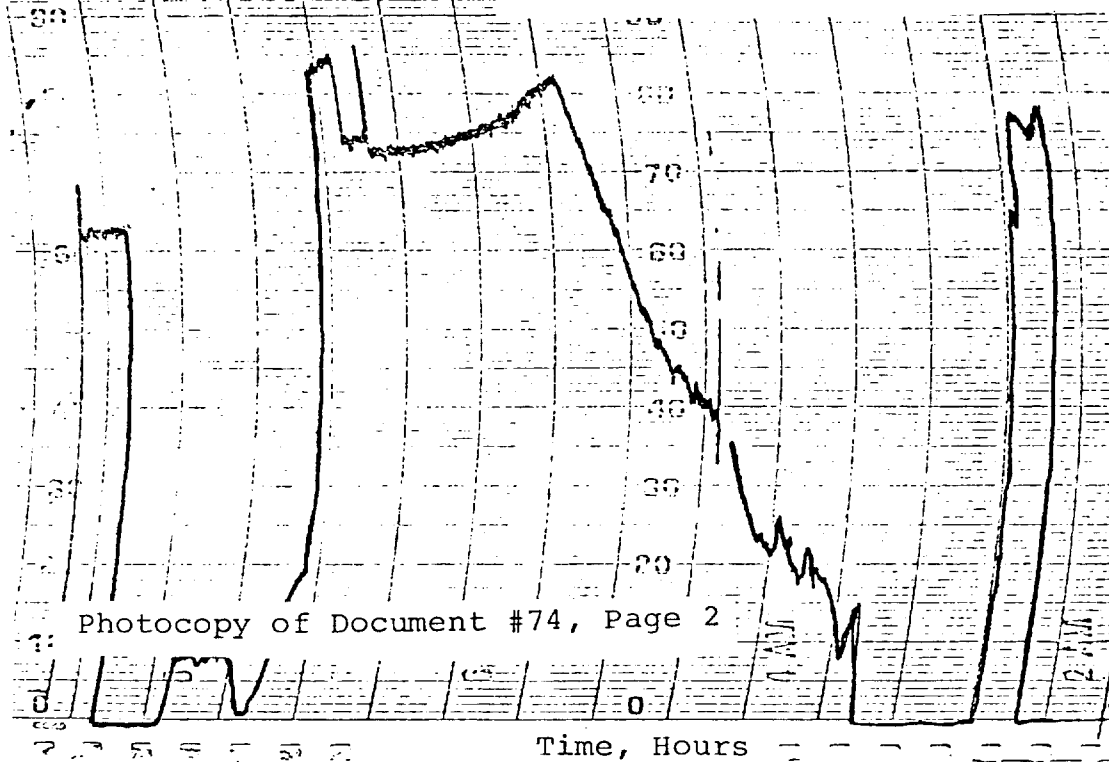
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Figure 6, Reactor Profiles with AMS "kill"



THE FOXBORO COMPANY, FOXBORO, MASS., U.S.A.

Figure 6b, Condensor Water Flow Rate



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followed by steam evacuation of the VCM contaminated air in the reactor. All VCM in the reactor after water rinse is ultimately released to the atmosphere via the steam jet evacuation. The concentration of VCM is minimized by use of more steam during the stripping process than is calculated to be necessary. The reactor opening procedures are required under Section 61.65(b)(6)(i).

Unloading Line Disconnect Procedures - Following completion of the rail car unloading, the rail car is isolated and the lines are evacuated to the emission recovery system. CONOCO calculates that compliance is achieved if the final pressure in the unloading lines is ≤ 5.6 psig. The line disconnect procedures are required under Section 68.65(b)(1)(i).

Leak Detection and Elimination Procedures - CONOCO, Inc. has submitted a comprehensive Leak Detection and Elimination Program (LDEP) to EPA in accordance with 61.65(b)(8). This has been approved by EPA on July 6, 1979. Details concerning this program will not be addressed since most of the information is conveniently available to the persons reviewing this report. It should be pointed out that this program is primarily corrective in nature in that it does not include comprehensive preventive maintenance procedures.

3. INSPECTION PROCEDURES

The inspection was conducted in accordance with the PEDCo Environmental-Standard Inspection Procedures as described in Reference 85. Due to the nature of the source, procedures concerning fan performance evaluation and internal control equipment inspection were not applicable. A leak detection survey, not described in Reference 85, was conducted at the request of the EPA Task Manager. The Inspection was announced by EPA approximately 1 week in advance.

During the preinspection meeting with plant management personnel, PEDCo presented a preferred agenda (Appendix C, Reference 82) for the plant inspection and records review. The purpose of the detailed agenda was to ensure that (1) PEDCo Environmental acquired all the information necessary to accomplish the task objectives and (2) the on-site time could be minimized so as not to unduly disrupt operation. CONOCO, Inc. personnel agreed with the preferred agenda. The inspection proceeded almost exactly according to this schedule. The EPA Task Manager, Mr. Wayne Aronson, devoted part of his time to the general plant survey and part to the review of the records. In this manner he could monitor PEDCo efforts in both major work areas.

As information was received from CONOCO, Inc. it was given a unique Document Number and stamped confidential if requested by the plant representatives. At the end of the inspection, CONOCO personnel were given a second opportunity to review information PEDCo has received from the EPA Regional Office files and from the CONOCO plant to determine if any material was claimed confidential.

At the post-inspection meeting, CONOCO was advised as to the next phase of the PEDCo review. Plant personnel did not ask and PEDCo personnel did not volunteer a statement concerning the compliance status of the plant. Mr. Richard Frohreich was identified as the person PEDCo should contact for further questions.

4. FINDINGS AND OBSERVATIONS

Results of the PEDCo Environmental inspection to determine compliance status of the CONOCO PVC plant in Aberdeen, Mississippi are presented in the following section. Two principal subject areas are addressed: Relief Valve Discharges and Fugitive VCM Emissions. In addition, PEDCo surveyed plant equipment to confirm that all sources are controlled as required by NESHAPS, and that all required records were being kept. A preliminary compliance evaluation is presented, however, the reader is advised that decisions concerning compliance are ultimately reserved for EPA who will base their decision partially on this report and partially on other sources of information.

4.1 Relief Valve Discharges

Section 61.65(a) of the NESHAPS regulation prohibits "preventable" relief valve discharges. PEDCo Environmental has reviewed the available records on the three reported incidents to evaluate if in fact these were emergency conditions which could not have been anticipated and avoided. We have also evaluated modifications made by CONOCO to plant equipment and operating procedures to prevent future discharges. Such plans are required by Section 61.65(a).

4.1.1 Reported Incidents

The three reported VCM releases are reviewed based on information in the EPA Regional Office files and on the interview of plant personnel during this inspection.

Incident Number 1 - Release of VCM from Receiving Vessel FA701.

As reported in document 9, VCM was released from the receiving vessel due to the failure of the level sensing device. Failure of the sensor was believed to be caused by freezing of liquid on the sensor, thereby giving false low readings. Duration of the relief valve discharge was 5-10 seconds. Presumably the short duration of the

release was due to the quick notification of the operator on-site and on the immediate shutdown of the transfer pumps being used to fill the vessel. Total estimated VCM emissions was calculated to be 522 pounds. The release occurred at 4:00 a.m. on December 9, 1978.

Plant personnel were not aware of any similar incident at this plant or at similar facilities (Reference 84). This mode of failure was considered very improbable due to the mild climate and the low moisture levels thought to persist in the receiving vessel.

CONOCO, Inc. has reported (Document 2) that a redundant high level sensor have been installed on the monomer receivers. This new unit is not like the differential pressure sensor and should not be prone to freezing (Reference 88). We also understand that the old sensor now has heat tracing and insulation to preclude freezing (Reference 84). No attempt was made to verify these modifications since the units were in service during the period of the inspection. PEDCO Environmental considers the modifications adequate to prevent an incident identical to the one which occurred.

We have concluded that there is sufficient data presently available to classify this incident as a nonpreventable emergency. Nevertheless, there is the unresolved question concerning the source of moisture in Vessel FA701.

Incident Number 2 - Release of VCM from Reactor D-300 due to uncontrolled polymerization reaction.

A major atmospheric discharge of VCM occurred beginning at 4:00 p.m. on February 2, 1979. The duration of the event was approximately 30 minutes during which up to 25,500 pounds of VCM were emitted. The problem was initiated by the pluggage of the reflux condensor which lead to high temperature excursions in the reactor. AMS was injected several times with no apparent effect. Subsequently the backup suppression system, nitric oxide gas, was attempted however the delivery line burst. Reactor D-300 was equalized into an empty reactor nevertheless the SRV on D-300 failed to reset after the pressure decreased below the set point. This remarkable incident was the combined results of 4 separate "malfunctions", namely:

1. Condensor pluggage,
2. AMS ineffectiveness,
3. NO delivery line failure, and
4. Relief valve failure.

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This incident is described in more detail in Documents 5, 6, 7, and 20. The reactor profiles and condensor water flow are presented in Figures 7a and 7b. Please note that, unlike previous reactor data shown, the condensor water flow did not have an impact on the reactor temperature and pressure. This indirectly confirms plant personnel conclusions that the problem was initiated by reflux condensor pluggage. It has been reported (Documents 20 and 84) that the previous batch in this reactor was "coarse" and due to the undesirable physical properties considerable buildup occurred in the condensor.

Referring again to Figure 7a, note that the "runaway" situation developed late in the batch polymerization. We presume that at this stage the chain length of PVC molecules is relatively long and that the overall slurry viscosity has increased. There is a logical question as to whether the AMS could be dispersed rapidly enough in this slurry to effectively suppress the reactions. Plant officials, nevertheless, felt addition of AMS was timely and that dispersion was not the problem (Reference 84). If so there is the unresolved question concerning the unexpected feebleness of AMS. Prior to Incident #2 and since February 1979 AMS has been successfully used for very similar circumstances. As recently as August 11, 1979 a reflux condensor pluggage resulted in "runaway" conditions. Addition of AMS controlled this problem well before release levels were reached (refer to Figures 6a and 6b).

It is our opinion that the discharge should be classified as preventable. This is based on the fact that the NO delivery line was not checked. As an emergency system, this should have been pressure checked on a regular basis. We also note that the condensor water flow rate was temporarily shut off during the runaway and this may have had a slight impact on the rate of the pressure increase even though the condensor was partially plugged.

Since Incident #2, CONOCO has made a number of modifications to the operating procedure and to the equipment itself.

Figure 7a, Reactor Profiles
Incident #2

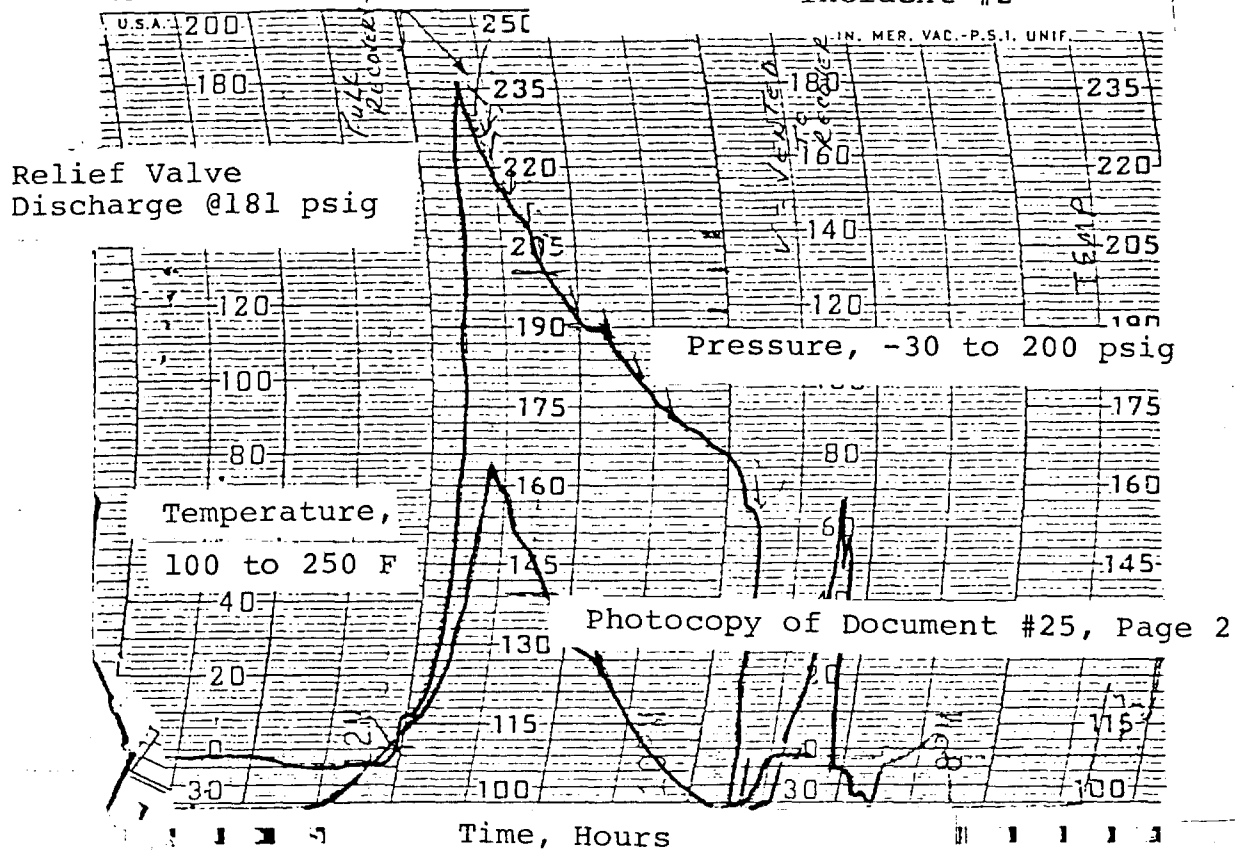
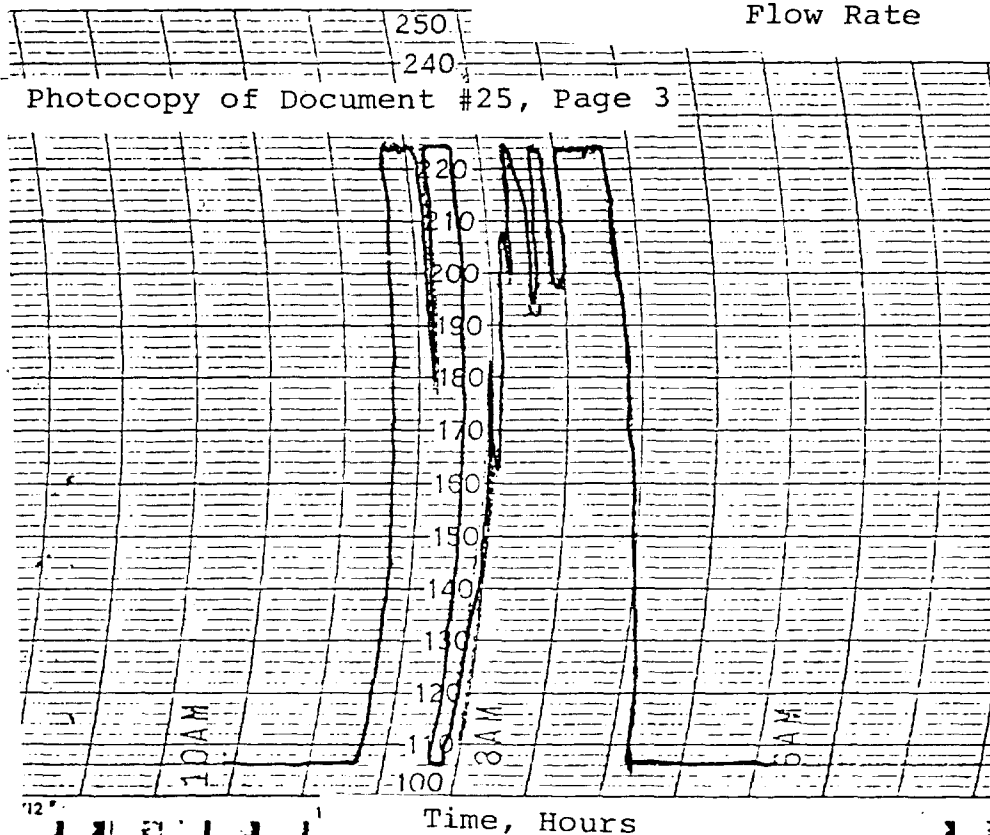


Figure 7b, Condensor Water
Flow Rate



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As reported in Documents 2 and 84, the following changes have been made to prevent future incidents of this type:

1. The emergency NO suppression system will be pressure checked every six months using N₂.
2. Operators will be required to use self-contained breathing apparatus before starting NO injection so that they will not have to abandon the area if a NO delivery line breaks.
3. After each "coarse" run, the condensor is to be inspected and cleaned if necessary.
4. Less catalyst will be used in batches immediately following a "coarse" run.

We are not convinced that these modifications are adequate to prevent future discharges similar to Incident #2. There are too many unresolved questions concerning the causes of the discharges and the effectiveness of the control measures.

Items 1 and 2 relate to the secondary suppression control system which is used when AMS is ineffective. We believe both changes are useful but may not be comprehensive enough. NO is subject to gradual oxidation to NO₂ in storage. Periodic sampling should be done to ensure that the NO supply remains stable. Secondly, the reason for the line burst during the February 2, 1979 incident is not clear. If it was simply an installation problem then the 6 month pressure checks are adequate. However, if the problem was caused by corrosion of the line, the mode of failure needs to be determined in order to be confident that the problem cannot develop in less than 6 months. The data of February 2nd and 9th demonstrate the need for the NO backup system since AMS proved ineffective. Therefore it is critical to ensure that this system is always operational.

Item 3 appears to be a logical and effective course of action to prevent one of the major causes of "runaway" conditions at the Aberdeen facility.

Item 4 is particularly interesting; it suggests that batches with high catalyst are prone to runaway conditions. A

review of the limited data obtained during the inspection (Documents 76, 25, 46, 47, 45, 24, 72, 22, 23, 43, 29, 67, 30, 73, 44, 21, 26, 27, and 28) seems to confirm that every time the batch formula for Type 5385 resin includes more than 5 gallons of Type 223 catalyst, there are operating problems which require the use of AMS. One batch prepared with only 4.5 gallons of Type 223 catalyst was controlled extremely well (Reactor D-400, Batch 5102, Type 5385 resin, Document 44). Both emergency discharge incidents which have been reported due to reactor operating problems have involved batches with 6 gallons of Type 223 catalyst with Type 5385 resin. This quantity of catalyst is higher than all other similar batches for which we presently have data. We believe that there is a need to review the large reactor batch sheets for the period of January 1, 1979 to August 18, 1979 to confirm or disprove the importance of catalyst quantities in causing a runaway situation. If confirmed the operating procedures should be modified to reduce the frequency of runaway conditions. A plant representative stated that the main reason for the increased catalyst use was to offset lower condensor inlet water temperatures (Document 88).

During the review of selected periods, we noticed that the period of February 1, 1979 to March 11, 1979 was characterized by numerous operating periods. Some of the problems are summarized in Table 2. The frequency of problems is substantially greater than other periods reviewed, namely, March 12 - March 31, May 1 - May 31, and July 30 - August 15, 1979. All of the abnormal conditions involved production of Type 5385 resin and all but one occurred in Module 1. Based on the review of the EPA files and the interviews with plant representatives, there does not appear to be any explanation for the frequency of problems during this period. We must speculate that there are underlying problems which have not yet been recognized.

Incident Number 3 - Release of VCM from Reactor D-300 due to premature rupture disk failure.

A major atmospheric discharge of VCM occurred December 10, 1978 beginning at approximately 7:15 a.m. and

TABLE 2. ABNORMAL OPERATING PROBLEMS, FEBRUARY-MARCH 1979

Date	Reactor Batch	Type Resin	Document Number	Comments
2-1-79	D-300/3489	5385	76	VC pump plugged; coarse batch produced
2-2-79	D-300/3490	5385	25	Condensor plugged; major discharge. AMS was ineffective
2-5-79	D-500/5542	5385	46	Apparent runaway conditions; AMS required on two occasions to maintain control
2-5-79	D-33/3496	5385	47	Apparent runaway conditions; AMS required to main control
2-6-79	D-500/5544	5385	45	AMS used twice to "bump" reactors
2-7-79	D-500/5545	5385	24	AMS used once to "bump" reactors
2-9-79	D-300/3506	5385	72	Runaway conditions; AMS ineffective; premature relief valve discharge resulting in major VCM release
2-13-79	D-600/6323	5385	22	Very abnormal pressure; temperature profile, no operator notes of explanation
2-14-79	D-600/6325	5385	23	Very abnormal pressure, temperature profiles, no operator notes of explanation
2-16-79	D-300/3527	5385	29	Very abnormal pressure, temperature profiles, no operator notes of explanation
3-10-79	741/870	5385	30	Apparent runaway conditions; AMS used to kill system
3-11-79	D-300/3574	5385	67	AMS used twice in futile attempt to control reactors; system ultimately killed with AMS

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continuing for a period of 5 minutes. VCM loss was estimated at 7,100 pounds. The discharge was minimized by the equalization of pressure with two other reactors in Module 1. Type 5385 resin was being prepared when runaway conditions developed early in the batch processing. AMS was injected in an attempt to "bump" the reactions however, this had little effect. Manual vents to the recovery system also did not alleviate the increasing pressure. Finally, the operator attempted to "kill" the batch using 5 gallons of AMS and this effort was again unsuccessful. Before the NO could be injected, the rupture disk on the reactor blew out at a pressure of 148 psig, well below the set point. CONOCO speculates that a pressure wave caused by the disk also caused the safety release valve to open, ultimately causing the VCM release.

The reactor temperature and pressure profiles for this batch are presented in Figure 8. Please note that the operator was never able to stabilize conditions from the beginning of the run. The approximate times of AMS injections are marked with arrows.

We consider this incident a non-preventable accident since there was no reason to suspect failure of the rupture disk at the low pressure. Plant personnel confirmed that the pressure readings were reasonably accurate and this conclusion was confirmed by checking data from the same reactor before and after this event. There is no evidence to suspect failure of the pressure sensors.

Concerning the rupture disks, plant personnel reported (Reference 84) that these are generally subject to extensive quality control checks. Furthermore, the reactors are pressurized after installation of new disks to ensure that the pressure can be maintained.

Since the incident, plant personnel have made several modifications to prevent future occurrences (Reference 2). This include replacement of the relief valve which released upon the disk rupture and use of a new disk holder which is pretorqued prior to installation. These appear to be adequate to prevent future problems of this type.

Figure 8a, Reactor Profiles
Incident #3

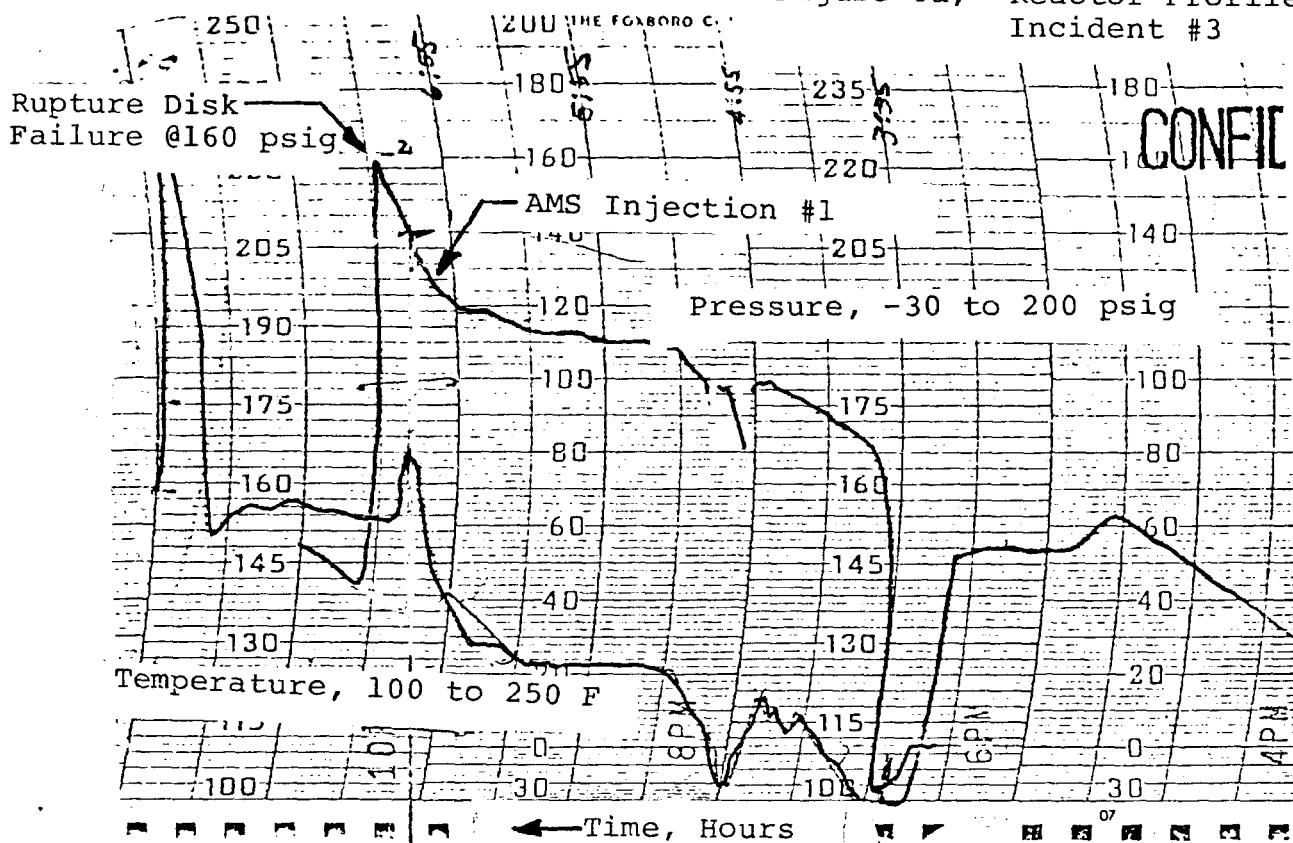
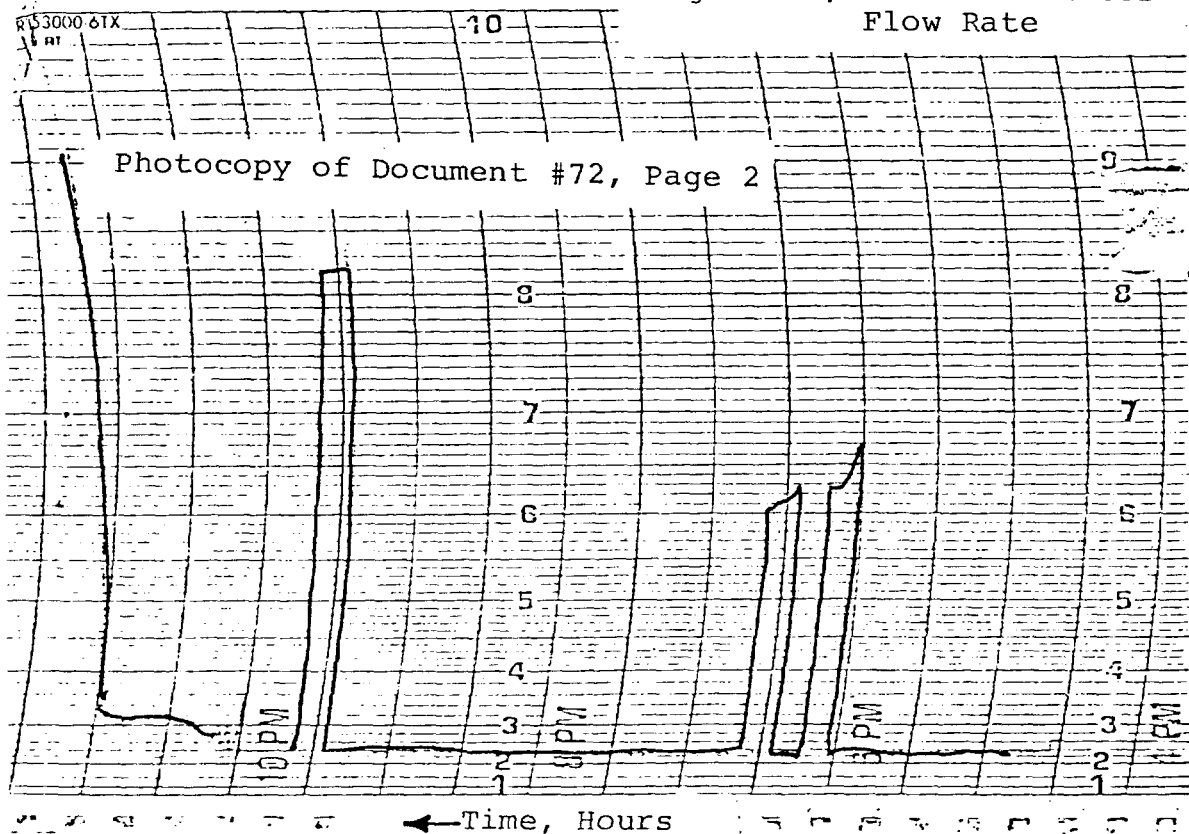


Figure 8b, Condensor Water
Flow Rate



4.1.2 Future VCM Discharge Anticipation

PEDCo Environmental has observed that all present efforts to prevent VCM discharges are directed to the specific types of malfunctions which have occurred at the Aberdeen plant during the last year. While this is unquestionably worthwhile, we suggest that it is equally important to anticipate different malfunctions and to ensure that these also can be minimized. It is somewhat disturbing that there is no corporate study which has addressed this problem, since much might be learned from the experiences at other CONOCO PVC plants. In lieu of adequate company or industry information, we have suggested some possible malfunctions or combinations of malfunctions which could lead to VCM atmospheric discharges.

We urge readers of this report to remember that these scenarios are purely speculative. It is unfair to penalize a company for what might happen. Nevertheless, this plant has suffered two recent major discharges of VCM and these incidents involved sets of somewhat improbable malfunctions.

Six different VCM discharge scenarios are presented in the following section. These could be divided into two sections: those which we believe deserve serious plant consideration and those which are too hypothetical to be of concern at this time. These are not listed in order of importance.

Scenario 1 - Valve failure on the reactor.

There are several valves on the reactors including the manual relief valve to atmosphere and the additional tank isolation valve. During stripping, we observed considerable vibration of the entire reactor area. On a long term basis this could lead to fatigue failure on the line connections to the valves. We consider this to be a plausible mode of malfunction.

Scenario 2 - Weld failure in reactor shell.

For reasons similar to those presented in Scenario 1, we believe there is the potential for weld failure in the reactor shell. In such an event there would be no rapid means to stop the VCM discharge.

Scenario 3 - Leakage of VCM into steam jacket.

After the polymerization is initiated the steam flow to the reactor jacket is stopped and the pressure drops. If pinholes developed in the shell and jacket walls due to corrosion or other problems, there would be a considerable driving force across the hole and VCM could be lost to the steam lines. We consider this somewhat less probable than the first two malfunctions, but nevertheless worthy of consideration.

Scenario 4 - Loss of seal water pressure to pumps and agitators.

During a power outage the water supply pumps would not be able to maintain the 180-200 psig pressure in the double mechanical seals. If the reactor was in the polymerization stage, some release of VCM to the water could occur. This water is not sent to the in-process stripper, and the VCM could be ultimately released. We recognize that this should be only a temporary event since a water storage tank will be pressurized with N₂ upon the beginning of the power failure.

Scenario 5 - Gasket failure on condensor lids.

During our review of the records we noted that the condensor lids on Reactors 744, D-400, and D-600 constantly required tightening. Ultimately, this might damage the gasket or more likely lead to failure of the bolts. The latter is particularly possible if the operators do not use torque wrenches. These problems could conceivably lead to failure of the lid during a run and therefore a slow release of VCM. We believe this is an improbable event.

Scenario 6 - Operator error involving failure to close reactor man ways and/or condensor lids.

If the operator failed to completely seal the access hatches to the reactor assembly, it is conceivable that a leak could exist. If the gas used to pressurize the reactor is supplied continuously, it is possible that the unit could pass a cursory pressure check. During the polymerization, VCM would be continuously lost through this leak. We do not consider this a likely event.

4.2 Plant Inspection and Leak Detection

In determining compliance with Sections 61.64 and 61.65 PEDCo Environmental conducted an on-site inventory and inspection of a major portion of vessels which are equipped with rupture disk (RD) and safety relief valves (SRV), rotating pumps and compressors equipped with double mechanical seals, and agitators in reactors. The inspection was designed to verify that the equipment specified in 61.64 and 61.65 was installed and by use of an FID leak detector determine if a leak was occurring from the devices.

4.2.1 Source Inventory

During the inspection of the plant, the location and number of potential emission sources were checked against a source list provided by CONOCO. In that several sources were not in operation and that certain sources were undergoing maintenance, a complete inventory was not completed.

The plant maintains thirty-nine (39) pressure vessels on which fifty-nine (59) rupture disk or rupture disk/safety valve units are installed. During the inspection forty-seven (47) of these units were verified as being installed and in compliance with 61.65(a) and 61.65(b)(4). No vessels which contained VCM were identified which were not listed on the company inventory. A complete list of the sources at the plant is provided in Table 3.

The plant operates fifteen (15) rotating pumps which transfer VCM. During the inspection thirteen (13) of these pumps were verified as being present in the plant and operating with double mechanical seals as provided in 61.65(b)(3)(i). No rotating pumps were observed which handled VCM streams which did not operate with double mechanical seals. The inventory of rotating pumps is provided in Table 4.

The plant operates twelve (12) rotating compressors which are covered under Section 61.65(b)(3)(iii). Ten (10) of these pumps were verified as present in the plant and each was being

TABLE 3. COMPLIANCE WITH EMISSION STANDARDS FROM SOURCES OF VCM FROM
RELIEF VALUE DISCHARGE 61.65(a) and 61.65(b) (4)

CONOCO Source Number	Description	SRV	RD
93-001	VCM Sphere No. 1	Yes	Yes
	VCM Sphere No. 2	Yes	Yes
89-201	E. Bullet No. 1	Yes	Yes
	E. Bullet No. 2	Yes	Yes
89-202	W. Bullet No. 1	Yes	Yes
	W. Bullet No. 2	Yes	Yes
45-305	Tank Farm K.O.	Yes	Yes
45-731	D-300 R RD1	No	Yes
	D-300 R RD2	No	Yes
	D-300 R SV	Yes	Yes
	D-300 C SV	Yes	Yes
45-732	D-400 R RD	No	Yes
	D-400 R SV	Yes	Yes
	D-400 C SV	Yes	Yes
45-734	D-500 R RD	No	Yes
	D-500 R SV	Yes	Yes
	D-500 C SV	Yes	Yes
45-735	D-600 R RD	No	Yes
	D-600 R SV	Yes	Yes
	D-600 R SV	Yes	Yes
45-741	D-701 R RD	No	Yes
	D-701 R SV	Yes	Yes
	D-701 C SV	Yes	Yes
45-742	D-702 R RD	ND	ND
	D-702 R SV	ND	ND
	D-702 C SV	ND	ND
45-743	D-703 R RD	No	Yes
	D-703 R SV	Yes	Yes
	D-703 C SV	Yes	Yes

(Continued)

Table 3 (Continued)

CONOCO Source Number	Description	SRV	RD
45-744	D-704 R RD	No	Yes
	D-704 R SV	Yes	Yes
	D-704 C SV	Yes	Yes
45-010	N. RVCM Rec.	Yes	Yes
45-011	Mid RVCM Rec.	Yes	Yes
45-012	S. RVCM Rec.	Yes	Yes
45-013	Fresh VCM Rec.	Yes	Yes
45-027	N. K.O. Scrubb	Yes	Yes
45-028	S. K.O. Scrubb	Yes	Yes
45-017	N. Seal Sep.	ND	ND
45-018	S. Seal Sep.	ND	ND
45-005	RVCM Coll. Tank	ND	ND
45-691	RVCM Filter	ND	ND
45-008	N. Chg. Filter	Yes	Yes
45-009	S. Chg. Filter	Yes	Yes
45-026	E. R. Inlet Tank	ND	ND
45-308	E. R. Inter Tank	ND	ND
45-342	E. R. Outlet Tank	ND	ND
55-008	N. RVCM Cond.	ND	ND
55-009	S. RVCM Cond.	ND	ND
45-317	E. RVCM Rec.	Yes	Yes
99-520	W. RVCM Rec.	Yes	Yes
45-745	Fresh VCM Rec.	Yes	Yes
45-761	N. K.O. Scrubb	Yes	Yes

(Continued)

Table 3 (Continued)

CONOCO Source Number	Description	SRV	RD
45-760	S. K.O. Scrubb	Yes	Yes
45-763	N. Seal Sep.	Yes	Yes
45-762	S. Seal Sep.	Yes	Yes
45-764	RVCM Coll. Tank	Yes	Yes
55-338	E. RVCM Cond.	Yes	Yes
55-337	W. RVCM Cond.	Yes	Yes

ND - Not Determined

TABLE 4. COMPLIANCE WITH EMISSION STANDARDS FOR SOURCES OF VCM FROM
ROTATING PUMPS 61.65(b)(3)(i)

CONOCO Source Number	Description	Mechanical Seal
72-217	East Bullet Pump	Yes
72-218	West Bullet Pump	Yes
72-126	North Sphere Pump	ND
72-270	South Sphere Pump	ND
72-044	East Charge Pump	Yes
72-045	West Charge Pump	Yes
72-869	RVCM Pump	Yes
72-001	East Col. Tank Pump	Yes
72-002	West Col. Tank Pump	Yes
72-876	East Charge Pump	Yes
72-875	West Charge Pump	Yes
72-878	East RVCM Pump	Yes
72-877	West RVCM Pump	Yes
72-884	East Col. Tank Pump	Yes
72-883	West Col. Tank Pump	Yes

ND - Not Determined

operated with double mechanical seals. No additional rotating compressors were identified in the facility or any rotating compressors without double mechanical seals. The inventory of rotating compressors is provided in Table 5.

In the process of polymerizing vinyl chloride the reactors require agitation to maintain suspension of the polymer as chain growth occurs. The plant has eight reactors with mechanical agitators entering through the vessel bottom. The presence of double mechanical seals was verified on four agitators in Module 1 as required by 61.65(b)(3)(v). The verification was not possible on Module 2 because of internal seals to the reactor and the sheilding of the agitator shaft. The inventory of agitators is provided in Table 6.

4.2.2 Continuous Leak Detector Monitor Inventory

As provided by Section 61.65(b)(8) the plant must install and operate a network of continuous monitors, to determine leaks within the plant boundary. The plant operates four Honeywell Model 1000 process gas chromatographs which are used to monitor a total of forty (40) leak detection points. The location of each detector is provided in Table 7. The location of twenty-six (26) of the required monitor pick up points were verified. Each point is connected to the GC via a 1/4" diameter PVC tube. The pick up point consists of a filter holder suspended above the required monitoring point.

In the routine monitoring of fugitive VCM concentrations the cycling nature of the Honeywell allows the concentration at each point to be determined each 10 minutes. In observing the recorder output of the unit monitoring the area of module 2, it was noted that a high value was recorded >10 ppm at point 3J (see attached diagram) which is near the fresh VCM charge pump. It was observed that no detectable concentration had been measured in the preceeding data set or in the following data set. The use of the fresh VCM charge pump occurs for a period of six (6) minutes per reactor charge. In the normal charging mode a reactor is charged every six hours. The probability

TABLE 5. COMPLIANCE WITH EMISSION STANDARDS FOR SOURCES OF VCM FROM
ROTATING COMPRESSORS 61.65(b)(3)(iii)

CONOCO Source Number	Description	Mechanical Seal
72-711	East Compressor	Yes
72-712	West Compressor	Yes
72-792	North Compressor	Yes
72-709	East Vacuum Pump	Yes
72-710	West Vacuum Pump	Yes
72-752	East E. R. Compressor	ND
72-753	West E. R. Compressor	ND
72-904	Middle Compressor	Yes
72-903	South Compressor	Yes
72-712	North Compressor	Yes
72-902	North Vacuum Pump	Yes
72-901	South Vacuum Pump	Yes

ND - Not Determined

TABLE 6. COMPLIANCE WITH EMISSION STANDARDS FROM SOURCES OF VCM FROM
REACTOR AGITATORS 61.65(b) (3) (v)

CONOCO Source Number	Description	Mechanical Seal
51-031	D-300 Agitator	Yes
51-032	D-400 Agitator	Yes
51-185	D-500 Agitator	Yes
51-186	D-600 Agitator	Yes
51-101	D-741 Agitator	ND
51-102	D-742 Agitator	ND
51-103	D-743 Agitator	ND
51-104	D-744 Agitator	ND

ND - Not Determined

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TABLE 7. EPA MONITORING POINT LOCATION

Monitor ID	Location	Verification
1A	Fresh VCM Receiver 401	Yes
1B	Recovery System 2nd Floor	Yes
1C	Model No. 1 Sweco	Yes
1D	3rd Recovery Compressor	Yes
1E	Incinerator Stack Gas	Yes
1F	RVCM Receiver	Yes
1G	Reactor D-300 Bottom	Yes
1H	Reactor D-400 Top	Yes
1I	Reactor D-500 Bottom	Yes
1J	Reactor D-600 Top	Yes
2A	South Rail Car Unloading	Yes
2B	Middle Rail Car Unloading	Yes
2C	North Rail Car Unloading	Yes
2D	Compressor Shead	Yes
2E	Control Room	NV
2F	VCM Storage Bullets	Yes
2G	Emission Recovery Area	Yes
2H	Dryers Line 6	NV
2I	Dryers Line 6	NV
2J	Emission Recovery Area	Yes

(Continued)

DTH 000083571

Table 7 (Continued)

Monitor ID	Location	Verification
3A	Reactor D-741 Bottom	Yes
3B	Reactor D-742 Top	NV
3C	Reactor D-743 Bottom	Yes
3D	Reactor D-744 Top	Yes
3E	North Sweco	Yes
3F	K.O. Tank Pumps	Yes
3G	VCM Receivers Middle	Yes
3H	Rec. VCM Transfer Pumps	Yes
3I	Middle Rec. Compressor	Yes
3J	Fresh VCM Charge Pump	Yes
4A	Vinyl Bagging	NV
4B	Quality Control Laboratory	NV
4C	Compound Line 1	NV
4D	Compound Line 3	NV
4E	Development Laboratory	NV
4F	Welex Deck	NV
4G	Dry Blend Control	NV
4H	V-10 Blend Tank	NV
4I	Middle East Warehouse	NV
4J	Shrink Warp Unit	NV

NV - Not Verified

DTH 000083572

that the leak detection system detecting three consecutive readings exceeding 5 ppm from the pump area is extremely low considering the low use time and the unlikely possibility that four reactor charges would occur consecutively.

It is possible that a significant leak can occur from charge pumps and other cyclic sources which may not be adequately addressed by the three consecutive level criteria. In our opinion the use of this method of defining a leak is adequate for ground level semicontinuous sources, but may not provide adequate protection for cyclic or elevated sources.

This problem is most severe in areas where high pressure leaks may occur and be dispersed before reaching the detection point near ground level.

4.2.3 Leak Detection

As required under Section 61.65(b)(8), the plant is required to conduct routine leak patrol checks in the plant area to determine if leaks are occurring which have not been detected by the continuous monitor.

The plant has a list of one hundred fifteen (115) leak patrol monitoring locations. The date and time of the VCM concentration is recorded and if excessive concentrations are measured, the shift supervisor is notified of the location for corrective action. A check is made after the completion of repairs to determine compliance. As a check of the compliance with the leak patrol, PEDCo Environmental conducted random checks of total hydrocarbon concentrations near pump seals, valve stems, flanges, and rupture disks.

The inspectors monitored the levels at twenty-six (26) locations during the process of conducting the source inventorying of these locations (Reference 90). Thirteen (13) locations were identified as having a level greater than 5 ppm. Results are summarized in Table 8.

It was noted that a total hydrocarbon analyzer does not only respond to the presence of VCM at the monitoring site, but also may respond to other organic compounds. The use of

TABLE 8. LEAK MEASUREMENT CONDUCTED WITH
PORTABLE FID SYSTEM

Source	ID Number	Distance	Total HC Concentration PPM	Comment
Sphere R.D.	93-001	1 cm	< 0.5	Background
VCM Transfer Pump Mechanical Seals	72-044	1 cm	< 0.5	
Continuous Monitor	1A	6 cm	< 0.5	
Reactor Agitator D-600	51-186	3 cm	5	HC Background, 5 ppm from organic injection system
Reactor Agitator D-500	51-185	3 cm	5	HC Background, 5 ppm
Reactor Agitator D-400	51-032	3 cm	< 0.5	
Reactor Agitator D-300	51-031	3 cm	< 0.5	
Reactor Manual Relief Valve D-500	-	1 cm	80	Dropped to < 0.5, 6 in. away from stem, moderate winds
Reactor Man-Way Seal D-400	-	1 cm	15	Dropped to < 0.5, 6 in. away

(Continued)

DTH 000083574

Table 8 (Continued)

Source	ID Number	Distance	Total HC Concentration PPM	Comment
Reactor Manual Relief Valve D-600 Stem	-	1 cm	20	Surges > 60 ppm, dropped to < 0.5 6 in. away
Reactor Man-Way Seal D-600	-	1 cm	< 0.5	
VCM Recovery East Compressor Mechanical Seals	72-711	1 cm	< 5	
VCM Recovery Background	-	5 ft	5	General HC odor in area
VCM Recovery Continuous Monitor	1B	6 cm	10	General HC odor in area/Leak monitor indicated no VCM
VCM Recovery Continuous Monitor	1D	6 cm	2	General HC odor in area/Leak monitor indicated no VCM
RVCM Pump Mechanical Seal	72-904	1 cm	< 0.5	
Reactor D-741 Agitator Seal	51-101	20 cm	< 0.5	Seal not accessible
Reactor D-743 Man-Way Seal	-	1 cm	< 0.5	

(Continued)

DTH 000083575

Table 8 (Continued)

Source	ID Number	Distance	Total HC Concentration PPM	Comment
Reactor D-744 Man-Way Seal	-	1 cm	8	Dropped to < 0.5, 6 in. away
Reactor D-744 Condensor Flange East and West Side	-	1 cm	500	Dropped to 5 ppm at 6 in.
Reactor D-743 Condensor	-	1 cm	< 0.5	
Incinerator	-	Area	< 0.5	
Rail Car Unloading, Car # UTLX 92946	-	1 cm	200-1000	Coupling leak in car dome
		6 in.	100	
		Area top of car	10-20	
Rail Car Unloading, Car # UTLX 37348	-	1 cm	200	Coupling leak in car dome
Rail Car Unloading, Car # DOT 105-A300W	-	1 cm	1000	Coupling leak in car dome
Reciprocating Compressors	-	3 ft	1-5	Restricted area

DTH 000083576

organic chemicals other than VCM in the reactors and the compounding of plastisizer may have caused interference in the determination of a leak. For this reason the concentrations of total hydrocarbons were measured at background areas and at a distance of 1 cm from flanges and seals. The difference in valves was considered due to VCM. A discussion of the monitoring at each point exceeding a total hydrocarbon concentration of 5 ppm is discussed including the interference encountered at each location.

Sample 4 - Concentration of THC within three (3) cm of the mechanical seals of the agitator of reactor D-600 was determined to be 5 ppm. A background level of THC in the area was 5 ppm and a significant odor of butyl hydroxy toluene was detected. The plant indicates background levels in this area >5.0 ppm. Based on the interference of other organics this is not defined as a leak (see Appendix A).

Sample 5 - Concentration of THC within three (3) cm of the mechanical seals of the agitator of reactor D-500 was determined to be 5 ppm. There are similar interferences as in sample 4 therefore this is not considered a leak.

Sample 8 - The concentration of THC at the manual atmospheric relief valve on the condensor of reactor D-500 was measured as 80 ppm. The source was measured at a distance of 1 cm but the level dropped to <0.5 ppm at 6 inches from the stem. Interference of moderate winds would not allow determination of area concentrations. Due to the source of the leak it is assumed that the THC was VCM. In the legal sense the sample was not detected at a reasonable distance from the source (1 foot) but in the physical sense a leak was occurring at this location. This would not be detected by the continuous monitor located under D-500.

Sample 9 - The concentration of THC at a distance of 1 cm from the man way seal on top of reactor D-400 was determined to be 15 ppm. The level six inches from the man way was <0.5 ppm.

The reactor was under pressure and in the polymerization cycle at the time of measurement. The measurement is considered a leak in the physical sense and not defined as such in the legal sense.

Sample 10 - The concentration of THC at 1 cm from the stem of manual atmospheric relief valve located on the top of the condensor of reactor D-600 was measured at 20 ppm with random surges exceeding 60 ppm. The reactor was in polymerization during the sampling and the THC was assumed to be VCM. The level at a distance of 6 inches was <0.5 ppm. The leak would not be defined in legal sense as a leak but in a physical sense is a leak.

Sample 13 - The level of THC on the floor area of the V-11 building at five feet elevation east of the vacuum pumps was measured to be 5 ppm. The odor of plasticizer and catalyst was noted. A specific source of the THC was not detected. An organic interference was suspected.

Sample 14 - A total hydrocarbon concentration was measured six inches below the intake of continuous monitor number 1-B. The concentration of THC was 10 ppm. The general HC background was suspected to be an interference. The continuous monitor did not indicate any VCM in the previous three readings.

Sample 19 - The total hydrocarbon concentration 1 cm from the seal of the upper man way of reactor D-744 was determined to be 8 ppm. The plant conducted an independent check with a detector (hnu photo ionization detector) and concurred that the level at one point on the hatch seal was 8 ppm VCM. The level at six inches from the hatch was less than 0.5 ppm.

Sample 20 - The THC concentration at the top flange seal on the condensor of reactor D-744 was determined to be 500 ppm at locations on the east and west side of the flange. The levels dropped to 5 ppm six inches from the flange. Moderate winds dispersed the vapor and downstream area determinations indicated no detectable limit. Analysis of continuous monitor leak

detection records at monitor point 3-D (top of 744) has indicated chronic level >5 ppm in excess of 100 times between 3/19/79 - 7/30/79.

Sample 23 - The concentration of THC was measured within the dome enclosure of rail car UTLX 92946 unloading VCM under pressure from the compressors and determined to be 200-1000 ppm. The highest reading was measured 1 cm from the joint on the coupling of an elbow on the pressure line. The concentration was measured as 100 ppm at a distance of 6 inches from the elbow. The level several feet from the dome on top of the car was 10-12 ppm. The THC recorded a background <0.5 ppm upwind from the rail cars and it is assumed that the response of the THC detector is VCM. This is considered a legal leak under 61.65(b)(8) and is therefore a violation of this section.

Sample 24 - Total hydrocarbon concentration at a distance of 1 cm from the elbow of the pressure line within the rail car dome was determined to be 200 ppm. The conditions and nature of the leak are similar to sample 23. The rail car number was UTLX 37348. This is a violation of section 61.65(b)(8).

Sample 25 - Total hydrocarbon levels measure within the dome of rail car DOT 105A300W were measured to be >1000 ppm at a distance of 1 cm from the coupling of elbows of the pressure line of the car. This is defined as a leak under 61.65(b)(8).

In conclusion it was determined that the leaks associated with the flange on top of the condensor of reactor D-744 and in the pressure lines of the rail cars were significant and are defined under 61.65(b)(8) as requiring corrective action.

4.2.4 Pressure Gauge Checks

The plant has installed pressure gauges on the space between rupture disk (DK0 and safety relief valve (SRV)) on each RD/SRV unit. The gauges on all units verified in the source inventory indicated no positive pressure. The gauges are used to indicate the rupture or leakage of rupture disks at pressures below that of the safety relief valves. The plant also

has installed water pressure gauges on the double mechanical seal lines of each rotating pump or compressor. The water line pressure on all mechanical seals checked during the inventory was 200 psig. This level is necessary to insure any leakage would be of water into the vessel since the vessel pressures are maintained below 200 psig.

4.2.5 General Observations Concerning VCM Fugitive Leaks

A review of Leak Detection Reports for the period January 1, 1979 to August 15, 1979 yielded several observations. Of the total 86 leaks reported, 33 were identified to be from reactor condensor lids; more specifically, from Reactors D-300, 400, 600, and 744. This demonstrates that the leaks from these sources are chronic. In fact, our leak survey indicated a leak from Reactor 744 condensor lid during our inspection. This persistent problem should not be permitted. We recommend that CONOCO, Inc. begin a leak preventive program which involves,

- (1) Surveying past records to identify all chronic fugitive sources; and
- (2) Regularly (once per day) checking these locations and correcting if necessary.

A comparison of the continuous monitoring data of August 21 in the Tank Farm area (Document 93) indicates that the instrument failed to indicate any VCM leaks. During the same time, we identified several serious leaks in the rail car domes. The low readings of the plant's instrument makes us question the effectiveness of the monitoring network. Possible explanations include:

1. Improperly placed pickup sites,
2. Excessive VCM wall deposition in sampling lines, and
3. Malfunctioning GC.

We believe CONOCO, Inc. should reevaluate the network entirely and emphasize conditions in the unloading area.

It is curious that the leaks reported occur in very distinct bunches. Often there are periods of 2-3 weeks with no reported incidents followed by a 3-day period with 5 to 6 occurrences. We suspect that some operators are more diligent in reviewing continuous monitor data and reporting leaks. The difference in operators is clearly evident in the log sheet (Figure 9) for February 16, 1979 (Claimed Confidential, Document 61). Please note that the operator on the 0700 to 1800 shift has carefully entered the GC readings while the late shift operator merely checked the box on the form. Due to the somewhat unusual nature of the leak reporting frequency and the obvious difference in operators, we speculate that some leaks may have gone unnoticed. For this reason we recommend future inspectors utilize a portable GC (such as used in this case) or photo ionization detector so that independent verifications can be made.

4.3 Recordkeeping Practices

CONOCO, Inc. is required under Section 61.67 to maintain various operating records, log books, and periodic sampling results. These are collectively termed "recordkeeping" requirements.

We requested the records for selected periods of time and found that:

- (1) The records were well organized;
- (2) There was no evidence to suggest that records were not taken as requested or that any were removed from the files; and
- (3) The records were complete enough to satisfy regulation requirements.

PEDCo Environmental believes that CONOCO is in full compliance with the requirement.

For the benefit of future inspections, we note that the records are quite voluminous and that considerable time is necessary to adequately review the data. It would be very difficult during one inspection to perform a comprehensive summary of the 2 year set of records on hand.

DTH 000083581

Large Reactor Area

Location_

Date:

2-16-79

Document: b1

Figure 9

Comments:

1. 2. 3. 4. 5. 6.

Unit One A

Stream Locations:

1. East side Control Room
2. 401 VCM receiver
3. 1st floor at H-5 reactor
4. 2nd floor large reactor recovery system
5. Above Sweco
6. 1st floor bottom D-300
7. Top of D-300
8. Bottom D-500
9. Top of D-600
10. Inlet air to Control Room

DTH 000083582

4.4 Recommendations

PEDCo Environmental recommends several general changes in the operating procedures to improve the LDEP program and to reduce the potential of a future emergency discharge. These items alone are not sufficient to guarantee that such problems can be avoided, however, we believe that these recommendations, listed below in the approximate order of importance, will have both environmental and plant operational benefits.

Recommendation 1 - Check Nitric Oxide Cylinders Weekly

As a part of the routine leak patrol, CONOCO, Inc. should verify that each NO cylinder is at the necessary pressure and that NO has not oxidized substantially to NO₂. A chemiluminescent NO/NO_x analyzer stationed in a shelter close to the cylinders would be appropriate for this function. Approximate cost of the instrument is presently \$6,000. No special operator training is necessary since the unit is very easy to operate. An oxygen cylinder would be necessary to support the chemiluminescent analyzer. Capital costs for the shelter, O₂ regulator, and stainless steel pipe fittings would total an additional \$4,000.

It should take a maximum of 4 hours to check pressure, NO/NO_x ratios, and to complete the reports. Based on direct labor cost of \$10.00 per hour, 15% supervisor cost, 50% plant overhead, and 20% payroll overhead, this activity would result in an additional annual cost of \$4,375.

Recommendation 2 - Improve Continuous Monitor Network

During our inspection, we noted significant leaks from the rail car domes. Continuous monitor data for the same period indicated zero VCM. This suggests that the pickup points in the unloading area are improperly sited or that the sample delivery and analysis system was malfunctioning. We also suspect that the overall network is inadequate to identify cyclic leaks such as would occur with some of the pumps. For these reasons, we recommend that CONOCO, Inc. reevaluate the

network. This would involve but not be limited to (1) identifying all cyclic sources which would not yield a 30-minute continuous VCM leak regardless of the physical condition of the equipment, (2) checking each pickup point with a calibrated 10 ppm VCM sample located approximately 1 foot distance, and (3) checking flowrate at the inlet and outlet of each sampling line. We estimate that this would take approximately 4 hours per line. With 38 lines and the same cost assumptions used previously, the additional cost is \$3,150. This does not include any repairs or relocation of pickup points which may result from the study.

Recommendation 3 - Repair Rail Car Dome Leaks

Three of the VCM tank cars being unloaded during the inspection had substantial leaks apparently in the elbow of the pressurization lines. These leaks require repair, however, we are uncertain who actually owns the rail cars. Cost estimates cannot be prepared at this time. It will probably take more effort to survey each car entering the plant than to fix the leaks identified.

Recommendation 4 - Analyze Leak Reports

On a yearly basis, CONOCO, Inc. personnel should review the leak reports to identify chronic problem areas. The routine patrol procedures should be modified to emphasize these areas. We estimate the review will require 80 manhours per year. With a direct labor cost of \$15 per hour and an overhead of 80%, the total additional annual costs are \$2,160.

Recommendation 5 - Increase Routine Leak Patrol Activity

On a regular basis, operators should visit areas of chronic problems and correct conditions contributing to leaks. This could include items such as tightening condensor lids. Based on an 8-hour per week time requirement, a \$10 per hour direct labor cost and the overhead factors, annual costs total \$8,750.

DTH 000083584

The total annual costs involved in the various changes total \$18,435. Capital costs are estimated at \$10,000. Part of these costs may be recovered in reduced VCM losses. A major savings could also result if an emergency discharge was averted. We consider these costs to be modest considering the environmental consequences of VCM emissions and considering that at least part of the cost may be recovered in improved plant operation.

DTH 000083585

ABBREVIATIONS

AMS	- α -methyl styrene
VCM	- vinyl chloride monomer
SRV	- safety relief valve
RD	- rupture disk
PVC	- polyvinyl chloride
THC	- total hydrocarbon concentration
EPA	- Environmental Protection Agency
NESHAPS	- National Emission Standards for Hazardous Air Pollutants - Vinyl Chloride

DTH 000083586

REFERENCES AND DOCUMENTS PERTAINING TO
CONOCO PVC PLANT IN ABERDEEN, MISSISSIPPI

1. Semi-Annual Report prepared by CONOCO and submitted to EPA on March 22, 1979. Copy received from EPA files. Nonconfidential, 4 pages.
2. April 23, 1979 letter from C. Miller of CONOCO to J. Wilburn of EPA, Region IV concerning measures to prevent relief value discharges. Copy received from EPA files. Nonconfidential, 2 pages.
3. Letter dated October 25, 1978 from CONOCO to EPA presenting compliance test results. Copy received from EPA files. Nonconfidential, 3 pages.
4. February 19, 1978 letter from CONOCO, notifying EPA of February 10, 1979 discharge. Copy received from EPA files. Nonconfidential, 2 sheets.
5. Vinyl Chloride Monomer Release, Memorandum. Prepared by W. Anderson of Mississippi Air and Water Pollution Control Commission, dated February 6, 1979. Copy received from EPA files. Nonconfidential, 1 sheet.
6. Vinyl Chloride Monomer Release, Memorandum. Prepared by W. Anderson of Mississippi Air and Water Pollution Control Commission, dated February 8, 1979. Copy received from EPA files. Nonconfidential, 1 sheet.
7. February 9, 1979, letter from CONOCO, notifying EPA of February 2, 1979 discharge. Copy received from EPA files. Nonconfidential, 1 sheet.
8. December 9, 1979 calculations prepared concerning discharge of December 9, 1978. Copy received from EPA files. Nonconfidential, 1 sheet.
9. December 15, 1978 letter from CONOCO notifying EPA of December 9, 1978 discharge. Copy received from EPA files. Nonconfidential, 2 pages.
10. July 6, 1978 letter from EPA notifying CONOCO of approval of the LDEP Program. Copy received from EPA files. Nonconfidential, 1 page.
11. Various letters and memorandums as listed: (1) April 20, 1979, memo from Air Engr. Branch to Enforcement Branch of Region IV, EPA, (2) March 29, 1979 transmittal of CONOCO Compliance Manual to EPA Region IV, (3) August 19, 1978 transmittal of CONOCO Compliance Manual. Nonconfidential, 7 total pages.

12. Routine Leak Patrol-Data Recording and Handling, Section F from CONOCO Compliance Manual. Copy received from EPA files. Nonconfidential, 17 pages.
13. L. Folsom (EPA) memorandum concerning 04/11/79 Show Cause Hearing. Copy received from EPA files. Confidential, 4 pages.
14. Methods of Compliance - Type III, Section VII of CONOCO Compliance Manual. Copy received from EPA files. Nonconfidential, 15 pages.
15. Request for Waiver of Compliance. Copy received from EPA files. Parts claimed confidential, 21 pages.
16. Methods of Compliance - Type I, Section V of CONOCO Compliance Manual. Copy received from EPA files. Nonconfidential, 25 pages.
17. Specific Methods of Compliance, Section IV of CONOCO Compliance Manual. Copy received from EPA files. Nonconfidential, 3 pages.
18. Methods of Compliance - Type II, Section VI of CONOCO Compliance Manual. Copy received from EPA files. Confidential, 12 pages.
19. Recordkeeping Requirements for Compliance. Sheet from CONOCO Compliance Manual. Copy received from EPA files. Nonconfidential, 1 page.
20. Letter dated March 5, 1979 from CONOCO to EPA presenting information of relief value discharges. Copy received from EPA files. Claimed confidential, 42 pages.
21. Large Reactor Batch Sheet; Batch 743-606, Type 5385, Date 03/20/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
22. Large Reactor Batch Sheet; Batch D600-6323, Type 5385, Date 02/13/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
23. Large Reactor Batch Sheet; Batch D600-6328, Type 5385, Date 02/14/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
24. Large Reactor Batch Sheet; Batch D500-5545, Type 5385, Date 02/07/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
25. Large Reactor Batch Sheet; Batch D300-3490, Type 5385, Date 02/02/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.

26. Large Reactor Batch Sheet; Batch 742-256, Type 5385, Date 08/01/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
27. Large Reactor Batch Sheet; Batch D400-5112, Type 5385, Date 08/14/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
28. Large Reactor Batch Sheet; Batch D400-5075, Type 5385, Date 08/04/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
29. Large Reactor Batch Sheet; Batch D300-3527, Type 5385, Date 02/16/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 4 sheets.
30. Large Reactor Batch Sheet; Batch 741-870, Type 5385, Date 03/10/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 4 sheets.
31. Leak Detection Reporting Form. Old Unit, 03/26/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
32. Leak Detection Reporting Form. Old Unit, 03/25/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
33. Leak Detection Reporting Form. Old Unit, 03/21/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
34. Leak Detection Reporting Form. Old Unit, 03/18/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
35. Leak Detection Reporting Form. Old Unit, 03/18/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
36. Leak Detection Reporting Form. Old Unit, 03/16/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
37. Leak Detection Reporting Form. Old Unit, 03/15/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
38. Leak Detection Reporting Form. Old Unit, 02/16/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
39. Leak Detection Reporting Form. New Unit, 04/19/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.

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41. Leak Detection Reporting Form. New Unit, 04/13/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
42. Leak Detection Reporting Form. New Unit, 05/29/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
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46. Large Reactor Batch Sheet; Batch D500-5542, Type 5385, Date 02/05/77. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
47. Large Reactor Batch Sheet; Batch D300-3496, Type 5385, Date 02/05/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
48. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, 08/11/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
49. Leak Detection Reporting Form. Old Unit, 07/21/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
50. Leak Detection Reporting Form. Old Unit, 07/21/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
51. Leak Detection Reporting Form. Old Unit, 08/08/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
52. Leak Detection Reporting Form. Old Unit, 08/06/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
53. Leak Detection Reporting Form. Old Unit, 08/05/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.

54. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 05/29/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
55. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 03/05/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
56. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Unknown, 03/25/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
57. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 03/26/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
58. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 02/03/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
59. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 02/02/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
60. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 02/09/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
61. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 02/16/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
62. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 08/12/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
63. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 08/11/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
64. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 08/06/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
65. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, New Unit, 08/09/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
66. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, New Unit, 08/09/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
67. Large Reactor Batch Sheet; Batch D300-3574, Type 5385, Date 03/11/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.

68. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 05/11/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
69. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Old Unit, 05/03/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
70. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, New Unit, 03/31/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
71. Vinyl Chloride Monomer Continuous Monitoring Log Sheet. VCM Tank Farm, Unknown, 03/25/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 page.
72. Large Reactor Batch Sheet; Batch D300-3506, Type 5385, Date 02/09/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 2 sheets.
73. Large Reactor Batch Sheet; Batch 742-291, Type 5385, Date 08/13/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 2 sheets.
74. Large Reactor Batch Sheets; Batch 744-275, Type 5385, Date 08/11/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 2 sheets.
75. Large Reactor Batch Sheet; Batch 741-954, Type 5425, Date 08/09/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
76. Large Reactor Batch Sheet; Batch D300-3489, Type 5385, Date 02/01/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
77. Large Reactor Batch Sheet; Batch 741-929, Type 5425, Date 07/31/79. Copy received from CONOCO on 08/21/79. Claimed Confidential, 3 sheets.
78. CONOCO Drawing No. SD-1046-42-1-D, EPA Monitoring Point Locations Plot Plan. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 sheet.
79. Maximum Operating Pressures for Various Grades of PVC. Received from CONOCO on 08/21/79. Claimed Confidential, 1 sheet.
80. CONOCO Drawing: No Number. VC Emission Source Process Flow Diagram, Aberdeen PVC Plant. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 sheet.
81. CONOCO Drawing: No Number. VC Emission Source Process Flow Diagram, Aberdeen PVC Plant. Copy received from CONOCO on 08/21/79. Claimed Confidential, 1 sheet.

82. Preferred Agenda Prepared by John Richards, PEDCo Environmental, Inc., 08/20/79. Nonconfidential, 2 pages.
83. Confidentiality Agreement Between CONOCO, Inc. and PEDCo Environmental, Inc.
84. Inspection Notes of John Richards, PEDCo Notebook, 3470-3-HH-3.
85. Standard Inspection Procedures Notebook, Version Dated August 1979. Prepared by John Richards, PEDCo Environmental.
86. CONOCO Drawing SD-2446-42-2-C, Process Flow Diagram for Inert Vent Incinerator. Received from CONOCO on 08/27/79. Claimed Confidential, 1 sheet.
87. National Emission Standards for Hazardous Air Pollutants, Standard for Vinyl Chloride. Federal Register, Vol. 41, No. 205, pages 46560-46573, October 21, 1976.
88. Telephone Call Notes Prepared August 31, 1979. Concerning conversation between Mr. R. Frohreich and J. Richards On August 30 and 31, 1979.
89. Inspection Notes of Ronald Hawks, PEDCo Notebook, 3470-3-HH-1.
90. Inspection Notes of Herbert Belknap, PEDCo Notebook, 3470-3-HH-2.
91. Continuous Monitor Output Data Sheets for August 21, 1979; New Module area. Received from CONOCO, Inc., September 17, 1979. Claimed Confidential, 8 sheets.
92. Continuous Monitor Output Data Sheets for August 21, 1979; Old Module area. Received from CONOCO, Inc., September 17, 1979. Claimed Confidential, 8 sheets.
93. Continuous Monitor Output Data Sheets from August 21, 1979; Tank Farm. Received from CONOCO, Inc., September 17, 1979. Claimed Confidential, 8 sheets.

APPENDIX A

DEFINITIONS

- Leak: In Document 12, CONOCO has defined leak as follows: "A condition which results in the emission of persistent amounts of vinyl chloride." This is further clarified to be a 5 ppm concentration for 3 successive measurements at one location taken at a frequency of one every ten minutes. PEDCo has adopted this definition for use in evaluating compliance.
- Physical Leak: PEDCo Environmental has the following definition for the purposes of the facility inspection: A physical leak is any persistent emission of vinyl chloride which can be measured by a portable GC with the sensor within 1 cm of the source. PEDCo Environmental recognizes that this is a very strict definition and that its primary usefulness is limited to screening potential fugitive sources for more detailed analyses.
- Reactor Opening Loss: Emission of vinyl chloride monomer to the atmosphere during steam jet evacuation of the polymerization reactor immediately following reactor recovery.
- Reactor Recovery: The steam stripping of the PVC resin slurry in order to remove the unreacted monomer.
- Runaway Excessive polymerization rate requiring repeated injections of AMS in order to prevent pressure buildup above safe operating levels.
- Bumping: The use of small quantities of AMS to reduce polymerization rate for a short period of time.

APPENDIX B

CHRONOLOGY

8/14/78 to 8/21/79

August 21, 1979	PEDCo Environmental inspection for EPA Region IV.
July 6, 1979	EPA approves Leak Detection and Elimination Program (revised). Records are to be retained for EPA inspectors.
April 20, 1979	Air Engineering Branch of EPA refers case of reactor opening loss calculation to Enforcement Branch for further action.
April 11, 1979	Show Cause Hearing concerning emergency reactor discharges.
March 27, 1979	EPA invites CONOCO, Inc. to Show Cause Hearing.
March 22, 1979	CONOCO, Inc. submits Semi-annual Report; reports compliance.
March 5, 1979	CONOCO, Inc. submits additional information of emergency discharge incidents.
February 21, 1979	EPA conducts plant inspection.
February 19, 1979	CONOCO, Inc. reports emergency discharge of February 10, 1979.
February 10, 1979	Emergency discharge occurred from Reactor D-300 for ~ 5 minutes. Cause thought to be premature failure of rupture disk. Loss estimated at 7,100 pounds.
February 9, 1979	CONOCO, Inc. report emergency discharge of February 2, 1979.
February 5, 1979	CONOCO, Inc. notifies EPA by phone of February 2, 1979 discharge.
February 2, 1979	Emergency discharge occurred from Reactor D-300 for ~ 30 minutes. Cause of incident thought to be condensor pluggage. Intensity of release aggravated by failure of NO line and failure of relief valve to reset. Estimated loss was 25,500 pounds.

CHRONOLOGY (continued)

December 9, 1978	Discharge for vessel FA701 for a period of 5-10 seconds due possibly to freeze-up of level sensor. Estimated loss was 522 pounds. Plant later added second sensor and heat traced and insulated the first sensor.
October 25, 1978	CONOCO, Inc. submits stack test results. All units in compliance.
September 26-28, 1978	Stack tests conducted.
August 14, 1978	CONOCO, Inc. submits "Compliance Manual"; also requests equivalency ruling on reactor opening loss calculations.

APPENDIX C

DTH 000083599

CLIENT EPA; TASK 110
LOCATION CONOCO - MISS.
SUBJECT PREFERRED AGENDA



PN 3146-3-HH Sheet No. 1

Checked By _____ Date _____

Computed By JBB Date 8/20/79

DOCUMENT 82
3470-3-HH

1. PURPOSE OF INSPECTION & INTRODUCTION OF EPA AND PEDCO STAFF
8:30 - 8:45 AM.

2. GENERAL INFORMATION

8:45 - 9:15 AM

a. PEDCO PROCEDURES

b. CONFIDENTIALITY

3. PREFERRED AGENDA

9:15 - 9:30

a. PHASE I - REVIEW OF BASIC DESCRIPTIVE DATA &
SELECTED RECORDS

b. PHASE II - GENERAL SURVEY

c. PHASE III REVIEW OF EMERGENCY DISCHARGES

4. PHASE I

9:30 - ~ 2:30 PM. JOHN RICHARDS

a. CHECK IDENTIFICATION DATA

b. CHECK REACTOR BATCH DATA 8/20/79 → 10/1/78

c. CHECK CONTINUOUS MONITORING DATA 8/20/79 → 10/1/78

d. RANDOM CHECK OF STRIPPED SLURRY DATA

e. REVIEW OF DATA CONFIDENTIALITY.

5. PHASE II

9:30 AM - ~ 4:30 PM HERB BELKNAP

RON HAWKS

WAYNE ARABON (UNTIL 2:30 PM)

a. CHECK STATUS OF LDEP PROGRAM

b. CONFIRM LOCATIONS OF CONTINUOUS MONITOR SITES

(CONTINUED)

CLIENT EPA, TASK 110

LOCATION CONOCO

SUBJECT AGENDA



PN 3146-3-HH Sheet No. 2

Checked By _____ Date _____

Computed By JRR Date 8/20/79

6. PHASE II (CONT.)

- c. CHECK FOR LEAKS ON RANDOM BASIS USING PEDCO GC & OTHER TECHNIQUES.
- d. CHECK PRESSURES BETWEEN RADIATOR DISKS & RELIEF VALVES.
- e. CHECK INCINERATOR & HCL SCRUBBER.
- f. CONFIRM INVENTORY OF SOURCES.

6. PHASE III.

2:30pm - 4:30pm WAYNE ARONSON
JOHN RICHARDS

- a. DISCUSS INCIDENTS OF EMERGENCY DISCHARGE
- b. REVIEW CONTROL MODIFICATIONS

7. CONCLUSION

4:30pm - 5:00pm

BRIEF SUMMARY OF RESULTS