ACCIDENTAL RELEASE AUDIT
INTERNATIONAL PAPER COMPANY
ANDROSCOGGIN MILL
JAY, MAINE
APRIL 20-27, 1988

UNITED STATES · ENVIRONMENTAL PROTECTION AGENCY ·

PREPARED BY:

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TABLE OF CONTENTS

PAGE #

TABLE OF CONTENTS
Page Two

APPENDICES

SECTION ONE

Introduction

1.0 INTRODUCTION

On April 20-27, 1988, the U.S. Environmental Protection Agency (EPA) conducted an in-depth Accidental Release Audit of International Paper Company's Androscoggin Mill (IP). The facility is an integrated bleached kraft mill which manufactures coated and uncoated white and colored papers for magazines and business applications. It also produces carbonizing tissue and forms paper.

The purpose of the audit was to investigate the causes of the releases at this specific facility and the equipment, procedures, training and management techniques utilized to prevent or mitigate these releases. The evaluations made were based on a comparison with available release potential technology and not on the general practices of the paper industry. The intent of this audit was to provide IP with information to enhance chemical safety practices at the facility and reduce the likelihood of future releases.

The mill utilizes a multitude of chemicals in the manufacturing process. Many of these chemicals are considered hazardous and extremely hazardous, and their use can result in serious safety and environmental consequences unless proper safeguards and prevention measures are routinely implemented. A firm commitment to preventing chemical releases, beginning with high-level corporate management, is a prerequisite to health and safety and environmental protection at IP. This is especially important because the facility is located within one mile of businesses and residences. Schools are located within two miles of the mill. There are approximately 5,000 people within a five-mile radius of the facility, and more than 1,000 people are employed at IP. The mill is located on the banks of the Androscoggin River, a sensitive environmental area. The populace and environment are within the impact area of chemical releases.

The audit results demonstrate the lack of adequate performance by IP management and staff on chemical emergency preparedness and accident prevention. This report describes numerous accidental releases at IP which have occurred over the past two years. Some of these releases posed a direct threat to the surrounding community and environment. The number of releases and their frequency of occurrence shows the lack of proper prevention systems. Field observations document that sufficient corrective measures have not been implemented to minimize the probability of future chemical releases. Recommendations to improve safety are contained in Section 13.0 of this report.

Our observations provide a snapshot of the conditions that existed at the mill during the audit period, and are not a substitute for a comprehensive safety evaluation program. International Paper has informed EPA that safety enhancements have been made since the audit and that many of the Audit Team's recommendations have been followed.

The audit was conducted under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA); Clean Air Act (CAA); Resource Conservation and Recovery Act (RCRA); and EPA's Accidental Release Information Program. It was fully coordinated with the numerous State and Federal agencies having jurisdiction over the facility. Comprehensive information sharing occurred among the various agencies so as not to duplicate efforts and to maximize utilization of the limited amount of resources devoted to the audit. The Federal Emergency Management Agency (FEMA) conducted the alert and notification portion of the audit; their report is available from the FEMA Region I office. FEMA is located at the J.W. McCormik Post Office Building and Courthouse in Boston, Massachusetts.

International Paper cooperated in the Accidental Release Audit and provided EPA with all necessary information upon request. The facility has made significant improvements in preparedness and prevention systems over the past several months. Many improvements were being made during, and as a result of, the State and Federal audits and investigations that have occurred at IP over the past several months. Although improved safety may have resulted from the audit process, additional measures are necessary because of the history of releases at the facility and the potential for severe environmental and safety consequences, both at the mill and in the community.

1.1 REPORT ORGANIZATION

The report is organized in sections to allow easy access to any particular area of interest. The information contained in each section is described below:

- Section 1 - Introduction

  This section also includes an overview of the characteristics of the area surrounding IP and a background description.

- Section 2 - Goals and Objectives

  This section identifies the goals of the Audit Team and includes a discussion of the methodology used for accumulating information. It is important to note that the audit is a preliminary survey and is not a substitute for a comprehensive hazards analysis.

- Section 3 - Audit Team Composition

  This is a listing of the Team members and their specific areas of expertise and responsibilities during the audit. A team approach was used to provide checks and balances and to insure maximum coverage over the specified audit period.

- Section 4 - Facility Representation

  This identifies major IP participants and their titles and functions during the audit. Other IP personnel willingly participated and provided valuable information to EPA.

- Section 5 - General Process Descriptions

  This section provides an overview of the processes utilized in the production of pulp and paper and other areas of the process where hazardous materials are used.

- Section 6 - Hazardous Chemicals and Toxicology

  This is a comprehensive description of hazardous and extremely hazardous chemicals at the mill, with emphasis on their properties and dangers. This section can be used to increase community awareness and training.

- Section 7 - Hazardous Chemical Storage

  This is a review of the storage conditions for the chemicals described in Section 6.0, with particular attention focused on containment, hazards, and storage systems.

- Section 8 - Release Prevention

  This section details various policies, plans, systems, and equipment in place at the mill and includes observations on safety-related improvements.

- Section 9 - Past Hazardous Materials Incidents and Releases

  This is a complete recounting of three major chemical releases that have occurred at IP since early 1987 (sodium hydrosulfite, anhydrous ammonia, and chlorine/chlorine dioxide). It contains a description of chemical identities, event sequences, notification, and corrective actions taken by IP. A discussion of several less severe releases is also included.

- **<u>Section 10 - Emergency Release Exercise</u>**

  During the audit, an Emergency Release Exercise was staged at the request of the EPA team. A brief description of the exercise is included, along with observations and suggestions for improvements.

- **<u>Section 11 - Air Dispersion Modeling</u>**

  This section contains an impact analysis for the three major releases identified above and a credible worst case analysis for the chlorine dioxide and anhydrous ammonia tanks and a chlorine tank car. This analysis was done using a rough screening model to estimate potential community impacts and to determine if sophisticated modeling is necessary.

- **<u>Section 12 - Summary of Observations</u>**

  This is a summary of the Team members' observations during all phases of the audit, focusing primarily on release prevention and safety systems.

- **<u>Section 13 - Recommendations</u>**

  The Audit Team's viewpoints regarding the potential for future accidental releases at the mill. Specific recommendations for implementation of additional safety measures are contained in this section.

- **<u>Section 14 - Conclusion</u>**

  This is an overview of the audit and the Audit Team's reaction to the changes implemented and those planned for the future.

1.2 SITE DESCRIPTION

International Paper Company's Androscoggin Mill is situated on the west side of the Androscoggin River in Jay, Maine. The mill site covers an area of over 600 acres. The terrain surrounding the mill is a rolling hillside which terminates in a river valley of the Androscoggin River. The highest point on the mill site is the landfill, at an elevation of 600 feet; the lowest elevation is the waste treatment plant at 460 feet. Elevations of release points and prevailing wind directions are such that accidental chemical releases have the potential to impact the community adversely.

Paved and dirt roads provide access to virtually every area on the mill site. State Routes 4 and 133, in addition to local routes, provide access through the communities. Additionally, the Rumford branch of the Maine Central Railroad runs through the mill site and local communities. Holding tracks for materials en route to the mill are located in the center of neighboring Livermore Falls on the east bank of the Androscoggin River. This network is used for the transportation of hazardous chemicals as well as by emergency responders and for evacuations.

Although located in Jay, the mill is 3.5 miles north of Livermore Falls and 1.5 miles east of the Town of Canton; these communities also take a keen interest in the activities at the mill because, depending on atmospheric conditions and the magnitude of a potential release, these communities could be involved in a coordinated emergency response or evacuation.

The nearest residence is located 100 yards from the boundary of the mill, and the nearest business is 1.3 miles from its gate. The Jay School and Jay High School are situated 1.7 and 1.8 miles south of the mill, respectively. There are 631 residences and 100 business located within a five-mile radius of the mill. This situation requires fast, efficient alert and notification procedures, which do not currently exist satisfactorily in the tri-town mill area.

1.3 BACKGROUND

The Androscoggin Mill operates 24 hours a day, seven days a week. It is a bleached kraft mill which manufactures white and colored papers for magazines and business forms and carbonizing tissue for use in business papers. It is an integrated pulp and paper facility, providing both pulping and papermaking processes on site. Raw products used in the production process are predominately wood, water, and primary process chemicals.

On June 16, 1987, members of the United Paperworkers International Union and the Brotherhood of Firemen and Oilers went on strike at the plant; subsequently, management hired replacement workers to fill the vacancies. The strike situation was disruptive to the operation of the facility, and it upset the relationship between the mill, the emergency responders, planners, and the community.

Within the past several months, compliance inspections have been conducted at the mill by various Federal, State, and local agencies such as the U.S. Occupational Safety and Health Administration (OSHA) and the Maine Department of Environmental Protection (DEP). Their findings are documented in reports on file at the individual agencies.

This audit does not focus on regulatory compliance. Audit goals and objectives are identified in the following section.

SECTION TWO

Goals and Objectives

2.0 GOALS AND OBJECTIVES

2.1 PURPOSE

The purpose, goals, and objectives of the Accidental Release Audit were to:

- assess chemical emergency prevention procedures;
- determine the potential for and consequences of off-site chemical releases;
- conduct a government file review to determine the compliance status with Federal and State environmental programs and regulations;
- determine the need for independent media inspections; and
- recommend measures to correct safety hazards.

2.2 METHODOLOGY

The Team spent the early part of the audit interviewing various IP employees. Topics discussed included the following:

- past hazardous materials release incidents;
- IP's Emergency Response Procedures and Contingency Plans;
- training (new employee, contractor, Hazmat Team, Fire Brigade, etc.);
- environmental permits and licenses;
- chemical handling and storage;
- alert and notification procedures;
- safety programs (e.g., Respiratory Protection Program);
- maintenance (e.g., upkeep of personal protection equipment, calibration of monitoring instruments, etc.);
- community relations;
- inspections and drills; and
- other safety-related topics necessary to gain a complete overview of IP's potential for chemical releases.

After thoroughly interviewing IP employees, the Audit Team was given tours of the pulp mill, treatment plants, power plant, landfill, and other areas where hazardous chemicals are handled. The locations of past releases were inspected and photographed (see Appendix I). Equipment, production processes, and methods were scrutinized for potential safety hazards. Team members questioned individual employees to obtain perspectives on plant safety.

An emergency release exercise was conducted which involved the sounding of emergency alarms and the subsequent evacuation of area workers. This drill is fully discussed in Section 10.0 of the report.

CHAPTER THREE

Audit Team Composition

3.0 AUDIT TEAM COMPOSITION

The Accidental Release Audit Team was comprised of the following individuals (all of whom assisted in the preparation of this report), chosen for their expertise in diversified environmental and safety disciplines.

AUDIT TEAM MEMBER	AFFILIATION	RESPONSIBILITY
Ray DiNardo	EPA, Region I	Team Coordinator and Mechanical Systems
Steven Novick	EPA, Region I	Technical Assistance Team (TAT) Manager
Norman Beddows	EPA, Region I	Health and Safety Manager
Richard Horner	EPA, HQ	Headquarters Coordination
David Sait	Maine Dept. of Environmental Protection	State Coordination
Vickie Santoro	EPA, Environmental Response Team (ERT)	Safety and Response Systems
Susan Fields	EPA, ERT	Control Equipment and Response
Cosmo Caterino	TAT	Chemical Systems
Ellen Gilley	TAT	Technical Information Coordination
Martha Poirier	TAT	Chemical Information Coordination
Gerald Wire	G. WIRE CO.	Paper Process Consultant

SECTION FOUR

Facility Representation

4.0 FACILITY REPRESENTATION

The following members of IP management and staff participated either on a full-time basis or were available upon request during the full course of the Audit:

James Thompson - Resident Manager

Ronald Charbonneau - Manager of Operations

Bert Turmel - Manager of Manufacturing

Jo-Anne Bean - Environmental Engineer

Lawrence Pattengil - Environmental Engineer/IP, Atlanta

Robert Funkhouser - Attorney/IP, Memphis

Kenneth Gray - Attorney - Pierce, Atwood, Scribner, Allen, Smith & Lancaster

Daniel Boxer - Attorney - Pierce, Atwood

Bonnie Urquhart - Hazardous Materials Coordinator

Elizabeth Martin - Pulp Mill Supervisor

Arthur Young - Power Plant Supervisor

Susan Vantilburg - Safety Supervisor

Diane Johnson - Industrial Hygienist

James Benson - Chief, Fire Brigade

Peter Fredericks - Supervisor, Groundwood

David Bailey - Manager, Technical Services, Paper Group/IP, Purchase, NY

J. P. Drotter - Acting Power Plant Superintendent

Mac Daniels - Training Coordinator/IP, S. Carolina

SECTION FIVE

General Process Descriptions

5.0 GENERAL PROCESS DESCRIPTIONS

5.1 WOOD SUPPLY

Roundwood and wood chips are received by truck. Processing consists of drum debarking, chipping, screening, and storage. The mill processes hardwoods (birch, beech, maple, and oak), and softwoods (spruce, fir, hemlock, and pine).

Fire at any large industrial facility can cause chemical releases. The wood supply represents a potential fire hazard; however, incidents at IP have been confined or readily controlled. The wood area uses uncontrolled pneumatic chip transfer operations, a practice that can contribute to particulate air pollutants becoming airborne.

5.2 GROUNDWOOD (130 TPD)

This process involves five Great Northern grinders and subsequent bleaching with V-Brite (sodium hydrosulfite) ($Na_2S_2O_4$).

The groundwood process itself is wholly mechanical in the presence of water and represents few potential chemical release problems. A walk-through of the groundwood area did not identify any serious chemical hazards. However, the V-Brite storage and handling has been a problem and the source of several past incidents. This system is discussed further in Section 9.0 of this report.

5.3 BLEACHED KRAFT PULP (1300 TPD)

The pulping process consists of two lines, designated as A and B. Both lines employ similar Kamyr continuous digesters and short-sequence bleach lines. A single, centralized control room serves pulping; washing, screening, and cleaning; bleaching; and chemical preparation. Most controls are 1965-1975 vintage Fisher instruments. Certain digital logic and display apparatus are used for informational purposes.

The control room was somewhat crowded, a condition exacerbated by the presence of many maintenance personnel and visitors. Control room air is purified and conditioned by two Westvaco units to protect the digital electronics and peripherals. However, IP has not determined if the units could purify high concentrations of contaminated air from an accidental release. This critical control room is vulnerable to chemical accidents.

Operations personnel were orderly and appeared competent. Generally, the operation was judged to be reasonably modern. The Audit Team observed difficulties in maintaining smooth decker operations and an overflow condition which is indicative of improper operation or maintenance. There did appear to be a good deal of maintenance work underway. Cleanliness and housekeeping could be improved in the pulp mill. The Team observed black liquor on stairways, rails, and dripping in some areas each time the Team toured the mill area. The balance of the pulping operations will be discussed in the order of inspection.

5.3.1 Pulping

The two single vessel Kamyr digesters appear to be in good operational condition, and there were no major deficiencies observed. Review of Process and Control drawings identified questions about valve powerfail condition with respect to fail-safe operations. These questions are discussed in subsequent sections of the report.

5.3.2 Washing, Screening, and Cleaning

The washers consist of both conventional drum washers and diffusion washers. In addition, there are knotters; primary, secondary, and tertiary screening; centrifugal cleaning; decker operations; and high-density storage transfer. To the extent observable, these operations appeared to be in good condition. However, the general area was somewhat cluttered from pulp and black liquor spills and maintenance-related paraphernalia. There were operational problems with the deckers, although this is not necessarily unusual, especially during a startup. Problems with deckers have caused occasional pulp spills.

5.3.3 Cooking Liquor Processing

Kraft pulping liquors are strong caustic sulfide solutions ($NaOH + NaSH$), expressed as Na_2O. White liquor is the pulping reaction reagent, weak black liquor is the liquid resulting from the pulping operation, and strong black liquor is evaporated and concentrated weak black liquor. Green liquor is the dissolved salts from the recovery furnace smelt.

The kraft pulping liquor cycle is a tight system of processes and operations for the recovery and regeneration of the pulping chemicals and the generation of heat and power. Acidified kraft liquors are very dangerous because of hydrogen sulfide off-gas.

Adjunct to the liquor cycle is the lime cycle. White liquor is regenerated from green liquor by causticizing it with lime (CaO: $Na_2CO_3 + CaO$--- $Na_2O + CaCO_3$). The lime is regenerated in the lime kiln. Gases from various liquor off-gas points are usually burned in the lime kiln.

All of the liquor cycle operations of this mill are carried out under the pulp mill group, with the exception of the evaporators and recovery boilers, which are part of the power group. Weak liquor-related operations occur mainly within the pulp mill control room. The green liquor, recausticizing, and lime kiln operations are separate, with a small control room adjacent to the kilns.

The liquor cycle facilities observed were conventional and of the type generally found in a kraft mill. This area of a mill often does not receive the attention that it should. It is generally a hazardous area, and all personnel should receive proper and continuous reinforcement training. For the most part, cleanliness and housekeeping were not adequate. The lime kiln area was excessively dusty.

5.3.4 Bleaching

There are two bleach lines, with both upflow and downflow towers. International Paper uses a modern, short-sequence bleaching operation. Tower configurations, mixing, and flow arrangements appear satisfactory. The Kajanni Cl_2 control system is operated in a manner so as to prevent excessive Cl_2 addition and gas off. Digital controls, for the most part, are not used.

There was no odor of Cl_2 or ClO_2. The Cl_2 and ClO_2 washers, towers, and tanks all had hoods and/or vapor exhaust arrangements connected to two stage scrubbers. There are separate systems for the A and B sides. However, the Audit Team is not convinced that the control system is capable of efficiently controlling chlorine and chlorine dioxide gas releases (see Section 13.5).

5.3.5 Chemical Preparation

This consists of Cl_2, NaOH, NaOCl, ClO_2, $NaClO_3$, H_2SO_4, NaCl, and, in the near future, methanol (CH_3OH) and peroxide (H_2O_2). Handling, preparation, by-products, emissions, and wastes are potentially hazardous operations.

Chlorine and ClO_2 have been the source of several past incidents, and both require special care when handling. General pipeline identification and color coding need improvement, as well as general cleanliness and housekeeping. Each area is discussed below.

5.3.5.1 chlorine (Cl_2)

Liquid chlorine is received from railroad tank cars. The Cl_2 operation involves unloading, vaporizing, pressure and flow control, and delivery to the point of reaction. There is a railroad siding for connection of up to four 90-100 ton tank cars. Equipment includes air and Cl_2 connection hoses; headers and valving; dry (-40°F) padding air apparatus; Cl_2 vaporizors; gas pressure controls; distribution piping; flow controls and flow block valving; and barometric loops between dry and wet Cl_2 regions.

The general arrangement appears satisfactory. However, the Cl_2 systems are in a high risk area and have been the source of several recent incidents at this mill.

Not all piping was color coded or properly identified. The changeover of Cl_2 piping to teflon-lined 316SS is underway, and there is a regular program for piping maintenance and replacement. Fail-safe condition of the Cl_2 and ClO_2 flow control valves is correct.

5.3.5.2 caustic (NaOH)

A 50% caustic solution is unloaded by railcar. The caustic operation includes storage; dilution to 5%; dilute storage; and distribution to mill operations.

Concern was raised regarding the adequacy of unloading practices with truckers, spill/dump containment practices, and the lack of proper decontamination procedures.

5.3.5.3 hypochlorite (NaOCl)

This is produced at IP by the reaction: $2NaOH + Cl_2 \text{---} NaOCl + NaCl + H_2O$. It is the same as common household bleach and swimming pool "dry chlorine." No particular problems were found in this area.

5.3.5.4 sulfuric acid (H_2SO_4)

This is used at the mill for ClO_2 production and for other acid sources. It is received as 93% H_2SO_4 in tank trucks and is stored on site.

Concern was raised regarding unloading practices and spill/dump containment procedures. Unloading and containment are further discussed in other sections of this report.

5.3.5.5 sodium chlorate ($NaClO_3$)

This is the source raw material for ClO_2 manufacture. It is received as a dry, crystalline solid in railroad hopper cars. The $NaClO_3$ is unloaded, then dissolved in hot water. The solution is fed to the SVP ClO_2 generator, with H_2SO_4 and methanol to produce ClO_2. Special training and precautions need to accompany handling of chlorate material.

There is concern regarding the extent of training and precautionary practices relative to disposal of chlorate-soaked apparel and similar fire hazards. Specific decontamination procedures for this material need to be developed. The level of housekeeping and cleanliness in this area should be improved.

5.3.5.6 methanol (CH_3OH)

The mill plans to convert its SVP process to employ methanol in the near future. Methanol is a hazardous material and requires appropriate design, operation, and training.

5.3.5.7 chlorine dioxide (ClO_2)

This chemical is produced as a gas in the SVP plant. In the mixture with Cl_2, ClO_2 is absorbed in chilled water. The Cl_2-laden off-gas is absorbed in caustic-forming, weak hypochlorite. The ClO_2 is stored in three fiberglass reinforced plastic (FRP) tanks, two 30,000-gallon tanks, and one 150,000-gallon tank. The 150,000-gallon tank has been the source of a serious incident.

The SVP plant is a hazardous and dangerous operation. The ClO_2 storage, spill prevention, routing, and containment require improvements.

5.3.5.8 peroxide (H_2O_2)

Installation of an H_2O_2 unload and storage facility is underway. This process must be reviewed for safety prior to start up.

5.4 PAPERMAKING Fine, writing, and coated/1500 TPD

The mill operates five modern Fourdrinier paper machines, producing a variety of business and printing paper grades. Two machines are equipped for clay-coated publication grades. Paper products are slit, rewound, wrapped, labeled, and warehoused for shipment. There are no sheeting or converting operations. No hazardous chemical deficiencies were identified in this area.

5.4.1 Stock Preparation

Raw pulp from the pulp mill is pumped as slurry from high density storage and refined to produce desired paper properties. Other materials such as clay, starch, rosen, alum, resins, dyestuff, and process quality aids are blended in to achieve desired paper properties.

5.4.2 Papermaking

A continuous paper sheet is formed from the paper stock. Water is pressed out and removed through drying. Size (a starch-resin solution) and/or coating (clay/TiO_2 and other pigments with starch/resin binder) are applied, followed by additional drying. The continuous sheet is then calendered to make it smooth and wound onto a reel, forming a "jumbo" roll. This is removed periodically, slit into smaller widths, and rewound into smaller rolls. It is then wrapped and labeled for shipping. The entire process, from forming the sheet to winding it onto the jumbo roll, is performed by the paper machine.

The materials used in this process are not usually considered extremely hazardous. However, there are biocides/fungicides, solvents, oils, etc. which are used in machinery care and maintenance. Their use requires caution.

5.5 STEAM AND POWER

The kraft pulp mill has substantial steam and power needs. The high demand for chemical recovery by furnace combustion justifies the need for cogeneration. The heat and power specifications for this mill are:

Steam: 1.4 million lb./hour at 900 psig and 825°F from two recovery boilers, two oil-fired power boilers, and one waste fuel (bark) boiler.

Power: 98 MW, generated by one BP and two condensing turbogenerators and several small hydrogenerators. Additional power is purchased from Central Maine Power Company.

The power plant is operated from a central control room within the boiler complex. The arrangement was very good, well ordered, and clean. The controls were arranged in conventional manner, in accordance with the operating units. The panel-mounted instruments were of 1965-1975 analog vintage, mostly Fisher. A Measurex 2001 supervisory boiler control system, which was valued by the operator because of its dependability, was also in use.

The following deficiencies were observed:

- #1 recovery boiler ESP procedure was not fully automated;
- low water drum level response delay was deficient; and
- hydrogen gas transfer practice was inadequate.

Overall, this plant area, boilers, turbines, evaporators, and auxiliaries appeared to be in good condition, with excellent cleanliness and housekeeping.

5.6 WATER SUPPLY AND TREATMENT

Water supply is obtained from the Androscoggin River at approximately 34-50 MGPD. Treatment methods include alum flocculation, sand bed filter, and chlorination.

5.7 EFFLUENT TREATMENT

Effluent treatment facilities consist of the following:

- o Primary Clarifiers - 2-Dorr Oliver circular rake type;
- o Secondary Clarifiers - 2-Dorr Oliver circular rake type;
- o Aeration Lagoon - 28 Eimco Aerators; and
- o Sludge System - flotation, filter, press, to landfill.

Bioactivity nutrient is provided by anhydrous ammonia. The anhydrous ammonia has been the cause of a serious incident, and raises questions about truck unloading and lock-out tag-out procedures.

5.8 MAINTENANCE AND TECHNICAL SERVICES

5.8.1 Maintenance

The mill employs a full maintenance staff of tradesmen (i.e., machinists, mechanics, millwrights, welders, pipefitters, electricians, instrument technicians, etc.). These are complemented with routine and preventative staff (i.e., oilers, analysts, coordinators, and other specialists). They are organized into three areas, four back shifts (touring maintenance), and a yard crew. They all report to the Manager of Operational Services.

5.8.2 Technical

Many areas of process and manufacturing require physical and chemical testing. This is carried out by operating or testing personnel, as appropriate. Procedures, materials, and standards are under the laboratory services supervisor.

SECTION SIX

Hazardous Chemicals and Toxicology

6.0 HAZARDOUS CHEMICALS AND TOXICOLOGY

The following chemicals were involved in major releases at IP since April, 1987. The paragraphs below include information on physical description, exposure limits, health hazard information, toxicology, and incompatibilities of these hazardous chemicals.

6.1 AMMONIA (NH_3)

Ammonia is a colorless gas with a penetrating, pungent, suffocating odor; it can be a liquid under pressure.

The Permissible Exposure Limit (PEL) is 25 parts per million (ppm), and the Immediately Dangerous to Life and Health (IDLH) level is 500 ppm.

Ammonia can affect the body if it is inhaled or if it comes in contact with eyes or skin. It may also affect the body if it is swallowed.

Short-term exposure can cause severe irritation to the eyes, respiratory tract, and skin. It may cause burning and tearing of the eyes, runny nose, coughing, chest pain, cessation of respiration, and death. It may cause severe breathing difficulties, which may be delayed in onset. Exposure of the eyes to high gas concentrations may produce temporary blindness and severe eye damage. Exposure of the skin to high concentrations of the gas or liquid may cause burning and blistering of the skin. Repeated exposure may cause chronic irritation of the eyes and upper respiratory tract.

Inhalation of concentrations of 2500 to 6500 ppm causes difficulty in breathing, bronchial spasm, chest pain, and pulmonary edema. Consequences can include bronchitis and pneumonia and/or some residual reduction in pulmonary function. Tolerance to usually irritating concentrations of ammonia may be acquired by adaptation.

Ammonia has a characteristic odor detectable at 1 to 5 ppm. It is incompatible with strong oxidizers, cadium, bleaches, gold, mercury, silver, and halogens, and is used primarily in waste treatment as a nutrient.

6.2 CHLORINE (CL_2)

Chlorine is an amber liquid or greenish-yellow gas with an irritating odor. The PEL for chlorine is 1 ppm; the IDLH level is 30 ppm.

Chlorine can affect the body if it is inhaled or if it comes in contact with the skin or eyes.

Short-term exposure to chlorine may cause burning of the eyes, nose, and mouth; sneezing; coughing; choking; and chest pain. Also, severe breathing difficulties may occur which may be delayed in onset. Pneumonia may result. Severe exposures may be fatal. In high concentrations, chlorine may irritate the skin and cause sensations of burning and prickling, inflammation, and blister formation. Liquid chlorine may cause eye and skin burns on contact. Repeated or prolonged exposure may cause corrosion of the teeth, skin irritation, and mucous membrane inflammation.

The odor threshold for chlorine has been reported between 0.02 and 0.2 ppm. Nasal irritation and coughing appear at about 0.5 ppm. Factory fatigue may develop at low concentrations, and some tolerance is built up in chronic industrial exposures. Chronic exposure may increase susceptibility to respiratory infections. Chlorine is incompatible with combustible substances and finely-divided metals.

Chlorine is used in the pulp mill and in the water treatment plant.

6.3 CHLORINE DIOXIDE ($Cl0_2$)

Chlorine dioxide is a yellow-green to orange gas or liquid with a pungent, sharp odor.

The PEL level is 0.1 ppm, and the IDLH level is 10 ppm.

Chlorine dioxide can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

Short-term exposure to chlorine dioxide may cause irritation to the eyes, nose, throat, and lungs. It may produce coughing, wheezing, and severe breathing difficulties, which may be delayed in onset.

Repeated exposure to chlorine dioxide may cause chronic bronchitis. It has an odor threshold of 0.1 ppm and is incompatible with combustible substances, dust, organic matter and sulfur.

Chlorine dioxide is used for pulp mill bleaching.

6.4 SODIUM HYDROSULFITE ($NA_20_4S_2$) (V-BRITE)

Sodium hydrosulfite is a white or grayish white powder; it has a slight characteristic odor.

There are no PEL or IDLH levels available. Sodium hydrosulfite is a strong reducing agent. It may cause irritation to the eyes and respiratory system. It also may cause chemical burns on skin.

Sodium hydrosulfite is incompatible with moisture; contact with moisture causes a chemical reaction. It is used for groundwood bleaching. Sulfur dioxide can be a decomposition or combustion product.

6.5 SULFUR DIOXIDE (SO_2)

Sulfur dioxide is a colorless liquid or gas with a characteristic pungent odor.

The PEL is 2 ppm; the IDLH level is 100 ppm.

Sulfur dioxide can affect the body if it is inhaled or if it comes in contact with eyes or skin.

Exposure to sulfur dioxide may cause aggravation of respiratory diseases (including asthma, chronic bronchitis, and emphysema), reduced lung function, irritation of eyes and respiratory tract, and increased mortality. It may also cause eye and skin burns.

Sulfur dioxide was produced and released during the V-Brite spill on 4/18/87.

6.6 REFERENCES - HAZARDOUS CHEMICALS

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NIOSH Pocket Guide to Chemical Hazards; DHHS (NIOSH) Publication No. 85-114; 1987

Occupational Health Guidelines for Chemical Hazards; DHHS (NIOSH) Publication No. 81-123; 1981

Material Safety Data Sheets (MSDS) (provided by IP)

CHAPTER SEVEN

Hazardous Chemical Storage

7.0 HAZARDOUS CHEMICAL STORAGE

There are many hazardous substances used and stored at the mill. They include bulk quantities of anhydrous ammonia; liquid chlorine; (6-8 gpl.) aqueous chlorine dioxide; 98% sulfuric acid; phosphoric acid; 50% caustic soda; dry sodium chlorate; alum; lime; white, green, and black liquors; petroleum fuels; and, in the near future, methanol and peroxide. These materials are received in truck or railcar quantities, with the exception of chlorine dioxide, lime, white, green, and black liquors, all of which are produced on site. There is also an array of chemicals and hazardous substances received by truckload or rail and packaged in drums, barrels, bins, etc. These include sodium hydrosulfite, biocides, lubricants, solvents and cleaners, and bottled gases such as chlorine, hydrogen, acetylene, and oxygen.

The bulk materials that are received by truck or railcar tankload are offloaded into tanks with the capacity to hold two or more loads. An exception is chlorine dioxide, which is received and stored in up to four 90-100 ton rail tanks and consumed directly from the air-padded cars. Chlorine dioxide is stored at up to eight gpl. in two 10' X 25' (30,000-gallon capacity each) and one 30' X 30' (158,000-gallon capacity) FRP tanks. Lime is produced on site in a kiln and is dry bulk stored in the "reburned lime bin." Purchased makeup lime is stored in the "fresh lime bin." White, green, and black liquors are stored in a number of tanks in accordance with process requirements.

Some liquid-containing tanks are surrounded by containments. However, the chlorine dioxide tanks do not have spill containment, a condition which should be corrected. Chlorine dioxide spills could be contained and controlled while being routed to acidic sewers. A bermed area should be available for containment to prevent sewer overflow and runoff. The acidic sewer could lead to an emergency retention area where the ClO_2 would be treated with an appropriate neutralizing agent. Then the material could be sent through the wastewater treatment system at a controlled rate.

There is a need for evaluation and risk assessment with respect to these storage and handling practices, particularly the chlorine dioxide storage. Smaller chlorine dioxide tanks would reduce the risk of a very large volume spill and, if designed for 50% level operation and adequate pump ability, they would provide emergency containment capacity in the event of an accident. Additionally, the safety of hazardous materials receiving, internal transport, unloading, and egress practices need to be evaluated.

SECTION EIGHT

Release Prevention

8.0 RELEASE PREVENTION

The following subsections evaluate release prevention procedures currently in use at IP and discuss what IP has done to reduce the likelihood of future hazardous material releases.

8.1 ENGINEERING CONTROLS

It is apparent that insufficient effort has been undertaken to utilize qualitative approaches for establishing facility safety and prevention systems for dealing with major releases that may impact the community. Techniques exist for preventing major accidents in industrial facilities. These include: Process Hazard Analysis (PHA); Hazard and Operability studies (HAZOP); Failure Modes and Effects Analysis (FMEA); etc. Also, techniques exist for estimating risks using atmospheric dispersion modeling (see Section 11.0) and other less sophisticated techniques. The need for IP to employ these techniques at the Jay facility is evident. International Paper does not have an acceptable hazardous assessment program for investigating accidents, near misses, and process changes.

As an example, the anhydrous ammonia storage tank fill line (which was involved in an accidental release) was not revalved to prevent reoccurrence of the release. A possible way to prevent the problem of accidental ammonia release might be to insert a check valve in the fill line between the two existing ball valves. In this case, IP mitigated the release when it occurred by simply closing the valve, but did little to prevent it from reoccurring. Prevention studies for past accidents should have been a top priority.

Another observed problem is how plant modifications are managed. An example is the change made to the chlorine dioxide storage tank after the 2/5/88 incident (which involved a 4-inch diameter valve being broken due to operator error, according to IP personnel). The expeditious solution to this failure was to eliminate the valve. This was done without any reliability engineering analysis. While this change to the tank mitigated the incident, it could in fact create new problems. To illustrate the point: if drainage of the chlorine dioxide tank were to become critical for safety, the only current means would be to slowly pump it through the physical plant. In this case, IP failed to take a systems approach to accident prevention.

A formalized hazards analysis program is needed at IP. Major physical changes to the plant which involve hazardous materials should not be made before a formal change procedure is completed and the change is authorized by competent engineering and independent safety personnel, in accordance with good engineering practice.

8.2 ADMINISTRATIVE CONTROLS

Written safety plans and procedures are not fully developed; in fact, many programs (Hazmat Team, fit testing, entrance permits) had been in place for only a few weeks at the time of the Audit. Although IP has made extraordinary efforts to develop the necessary site safety and contingency plans, the plans are not completed, certified, or tested. Moreover, the plans are not adequately integrated with the surrounding communities and mutual aid networks.

In response to our inquiries about the plans, documentation was produced by IP. However, it was inadequate in many areas. For example, names of Hazmat Team personnel and routes of emergency egress were nonexistent.

8.3 PERSONAL RESPIRATORY PROTECTION

Inspection of the respirator storage area in the pulp mill's control room disclosed one opened chlorine canister (presumed to be spent) in the storage rack. Additionally, some disorder in the storage of air tanks and masks was evident. However, an extensive array of SCBAs was in proper order. Inspection tags showed only one previous inspection occurring in early April.

The maintenance program and the respiratory protection program need improvement.

8.4 FACILITY SCRUBBER SYSTEMS

Because of time allowed and scope of this investigation, sufficient data and information were not obtained to conduct an in-depth evaluation of the facility's scrubber systems. However, it is recommended that an in-depth review be conducted because of the numerous deficiencies observed. In particular, emphasis should be placed on the chlorine and chlorine dioxide scrubbers and the scrubbing system for the pulp mill's control room atmosphere.

Some general observations were made on the scrubbing systems. The pulp mill's control room is the operations center for routine operations as well as during an emergency. It is located in the middle of major hazardous materials processing and storage areas. Although the room receives air that is first cleaned through a scrubbing system and personal protective equipment is available as a back-up system, it does not appear that the scrubber would have the capacity to sufficiently purify a highly-concentrated atmosphere that may result from an accidental release. As such, the system may give the operators a false sense of security during critical emergency operations, and the emergency would not be managed from a "safe haven" operations center. The scrubber utilizes a vapor adsorption system to control chlorine, hydrogen sulfide, and sulfur dioxide levels.

The manufacturer of the scrubber inspects it on a quarterly basis and refills the active material, in accordance with an agreement with IP. During the most recent inspection, maintenance was observed to be marginal.

The purpose of the scrubber appears to be to protect electrical and electronic equipment from corrosion. The room is under positive pressure, and an air-locking passageway separates the room from other areas. The probability of an accidental release reaching the scrubber intake and the ability of the scrubber to reduce a concentrated atmosphere should be investigated to determine if a change in the emergency procedures is needed.

Procedures are critical to plant and community safety. During a review of the bleach plant scrubbers, system leaks and equipment malfunctions were observed.

The scrubbers have never been tested to determine removal efficiency and emission levels under current operating and emergency conditions. The units do not have the operating controls and gauges necessary to assure safe operation. There is no reasonable assurance that the units are properly controlling hazardous gas emissions.

8.5 INTERLOCK CONDITIONS

The mill's interlock schematic data provided was reviewed, and no deficiencies were found. However, this review was extremely cursory.

8.6 TRAINING

Several training programs are currently in place at the mill. Some were instituted as a result of the influx of new hires following onset of the strike, and some were reasonably well established at the time of the audit.

All new hires are presented a four-hour chemical handling course, while contractors receive an abbreviated version of the same presentation. Additionally, employees receive department-specific training which is oriented towards the chemicals utilized in their work areas.

The following is a listing of additional training courses provided to new hires, dependent upon their specific need for such instruction:

- Hearing Conservation;
- Fire Protection;
- Environmental Considerations;
- Forklift Operations (safety);
- Forklift Driving;
- First Medical Response;

- o Cardiopulmonary Resuscitation;
- o Back School;
- o Rigging and Lifting; and
- o Paper Mill Safety.

Some training programs, such as management and skill training, are provided to IP employees by private contractors. Supervisory personnel are requested to attend a 17 week safety course which is offered at a nearby university during non-work hours. The course is available to hourly workers as well.

A formal training program for the Hazmat Team was being to be developed and therefore could not be evaluated during the Audit.

The Team believes IP's training programs are comprehensive and well planned. However, it is apparent that some deficiencies currently exist as several of the past chemical releases occurred due to operator error rather than equipment malfunction.

8.7 PROCESS AND CONTROL (P & C) DIAGRAMS

Several flow and P & C drawings were reviewed. In many cases, the P & C's were original plant design drawings and incorrect with regard to production, consistency, and flow rates. In many circumstances, the drawings were not representative of present operations. The mill has changed hazardous material process lines without proper design and safety documentation.

8.8 HAZARDOUS MATERIALS UNLOADING

As outlined previously in this report, the procedure for receiving truck and rail loads of hazardous materials is deficient. Specific problem areas are:

- o Admittance, escort, and direction of trucker or railroad switching operations.
- o Process checkout of unload set-up and connection, and authorization for unload by area supervisor.
- o Unload and disconnect verification procedures before trucker leaves, process conditions verification, and authorization before placing the system on line again.

It is necessary to establish a very complete procedure for check-in, unload, disconnect, and restart.

8.9 POWER FAILURE/BACKUP

The mill generates its own electricity requirements with three steam turbogenerators and several small hydrogenerators. It is interconnected to the utility for about 40% of its total load. This is distributed through three two-way, manually switched internal busses. As a part of their emergency backup power study, solid state controlled automatic switching of the present manually-switched two way busses should be reviewed. A mill power outage could cause chemical releases. Short-term surges can cause switch gear kickout. Utility system brownout or a major loss of power could trip this entire system.

There do not seem to be adequate provisions for emergency or uninterruptable power to alarm sensors or annunciators, communications, or other emergency facilities and services. A priority power distribution plan needs to be implemented, as well as backup power for critical hazardous materials support systems.

8.10 VALVE FAIL-SAFE CONDITIONS

P&C diagrams were reviewed for valve condition upon utility failure and follow up discussions were conducted with appropriate IP supervisors. Although the particular diagrams used are not reliable for a comprehensive assessment, they serve as an indicator of safe conditions and a basis for value fail-safe discussions. The review documented diagrams that were not current and some critical valve fail conditions could not be adequately explained. A detailed review of valve fail-safe and interlock conditions is beyond the scope of this audit. However, preliminary observations by the audit team justify the need for a more comprehensive evaluation.

SECTION NINE

Past Hazardous Materials Incidents and Releases

9.0 PAST HAZARDOUS MATERIALS INCIDENTS AND RELEASES

Since April, 1987, three serious hazardous substance releases have occurred at the IP facility. All but one of the instances involved injuries. No fatalities occurred. At least two of the releases had the potential for escalating into major disasters for IP and the community. Below is a discussion of the three major releases and an overview of several less serious incidents which have occurred within the past two years.

9.1 SODIUM HYDROSULFITE - 4/18/87

On April 18, 1987, a release of 100 lbs. of sulfur dioxide gas, at a concentration of up to 200 ppm, occurred. Sulfur dioxide gas was produced as the result of sodium hydrosulfite reacting with water.

9.1.1 Chemical Description - Sulfur Dioxide

Sulfur dioxide is a colorless, non-flammable gas with a strong, suffocating odor which is intensely irritating to eyes and respiratory tract. See Section 6.5.

9.1.2 Chemical Description - Sodium Hydrosulfite

Sodium hydrosulfite (V-Brite) is a white or grayish-white powder with a slight characteristic odor. See Section 6.4.

9.1.3 Event Description

At 0700 hours on the above date, V-Brite contained in a steel one-ton tote bin began burning, emitting sulfur dioxide vapor. The fire began as a result of the V-Brite's reaction with water. At the time of the accident, IP did not have the V-Brite tote bins contained in an enclosed area. However, they have since erected one structure for storage of the bins and one for dispension of the chemical (see Photograph Log - Appendix II).

At the time of the incident, the wind was traveling in a southwesterly direction at 4 m.p.h. The humidity was 95%, and the temperature was 42^{O}F. There was no precipitation.

Upon discovery of the fire, IP's Fire Brigade was notified, and the area was immediately evacuated, although two injuries to personnel were reported. The containers were transported to an open, non-populated area to allow discharge to the waste treatment plant. The release concluded at approximately 1300 hrs., six hours after it had begun. International Paper believes that no smoke or gas migrated off site, as it rapidly dissipated to the upper atmosphere. As a precautionary measure, however, one nearby residence was evacuated. The site boundary was approximately 500 yards from the source.

9.1.4 Notification

International Paper authorities eventually notified the following Federal, State, and local agencies of the V-Brite incident:

- National Response Center;
- ME DEP/Bureau of Oil and Hazardous Materials Control;
- Jay Police Dept; and
- Jay Fire Department

The Jay Fire Chief notified the National Response Center shortly after occurrence of the incident. However, IP representatives did not contact Federal or State agencies until May 14, almost one month after the actual release. Uncontrolled releases should be reported to the proper authorities immediately to assure proper alert and notification and response actions.

9.1.5 Release Prevention Practices

Groundwood Department personnel and others had received training in handling V-Brite and how to respond in the event of an emergency, including use of personal protective equipment. It is company policy not to transport V-Brite containers in wet weather.

International Paper's report in response to the EPA's Release Prevention Questionnaire states that personnel had not recently participated in dry run exercises and that, in fact, the containers had been transported in wet weather from time to time.

9.1.6 Resulting Corrective Actions Implemented

International Paper instituted the following actions to prevent further V-Brite accidents:

1) completely enclosed and weatherized buildings where V-Brite is stored and used;

2) constructed two buildings: one for storage and one for dispensing the material;

3) provided personnel further training in emergency procedures and general handling of V-Brite, including the use of personal protection equipment;

4) began actively enforcing the policy concerning transport of V-Brite during wet weather; and

5) started conducting field training exercises.

9.1.7 Recommendations

The Audit Team concluded that IP's efforts to contain the release were adequate but that additional precautionary measures should be implemented to prevent future releases. These include:

1) Activate a thermocouple in the unload system to detect a reaction and an emergency condition.

2) Monitor the temperature and humidity in unload room.

3) Exhaust to a dilution stack or scrubber rather than to work and travel areas.

4) Upgrade accident investigation and follow-up procedures.

5) Implement regular field simulations, with community participation.

6) Finalize, certify, implement, and test contingency plans.

Items 4-6 apply to all emergency situations. The V-Brite accident is the first example of IP's failure to implement satisfactory prevention measures.

9.2 ANHYDROUS AMMONIA - 11/6/87

At 1430 hrs. on the above date, 3,700 lbs. of 100% anhydrous ammonia were released from a storage tank at IP's waste treatment plant area; the release lasted approximately ten minutes.

9.2.1 Chemical Description - Anhydrous Ammonia

Anhydrous ammonia is a colorless gas with a very pungent odor. Inhalation of concentrated vapor causes edema of respiratory tract, spasm of the glottis, and asphyxia. Treatment must be prompt to prevent death. See Section 6.1.

9.2.2 Event Description

Due to operator error (the lock-out tag-out procedures were not properly followed because the tag was removed prematurely after loading), 3,700 lbs. of anhydrous ammonia were inadvertently discharged from a fill pipe in the nutrient feed line. The operator of the fill pipe inhaled ammonia gas and immediately fled the area. Persons who might have been affected by the spill were evacuated. The operator was examined by company health officials and released. Within several minutes, the mill's maintenance pipers, after donning SCBA's, closed the unloading valve, thereby stopping the leak.

At the time of the release, the wind direction was northerly at 20 m.p.h. The humidity was 30%, and the temperature was 25°F. There was no precipitation.

The ammonia rapidly volatilized, aided by the wind. Because it volatilized rapidly, IP believes that it is unlikely that any significant amount migrated from the facility. Other than the exposures to the operator, no other ill health effects are known. Because the spill posed no significant health risks after it volatilized, no further precautions were contemplated by IP.

9.2.3 Notification

In the late afternoon on the day of the release, IP environmental officials notified the National Response Center (which in turn notified the U.S. EPA, Region I) and the ME DEP Bureau of Hazardous Materials Control. International Paper attempted to notify the Jay Town Manager who was not available at the time. On 11/9/87, three days after the incident occurred, the Jay Town Manager was made aware of the incident. As a result, IP and the Town of Jay have instituted measures whereby town officials can be reached 24 hours a day. This incident is an example of a communication breakdown in the IP notification procedures

9.2.4 Release Prevention Practices

International Paper reinforced company policy to:

1) require all persons handling ammonia to wear masks;

2) place tags on valves stating whether the valves are open or shut;

3) inspect lines before opening;

4) make available ammonia detection tubes; and

5) review procedures for isolating and purging systems with employees.

Additionally, all personnel working in and around the ammonia tank have undertaken hazardous chemical awareness training.

9.2.5 Resulting Corrective Actions Implemented

No operational or mechanical changes were instituted as a result of this incident. The Audit Team determined that IP had not properly investigated this accident and was not knowledgeable about piping and unload procedures at the ammonia unloading station. Once again, IP effectively terminated the release but failed to initiate long-term prevention measures.

9.2.6 Recommendations

Had proper lock-out procedure been followed, this ammonia release would not have occurred. In addition, the Team believes that mechanical changes are needed to prevent further occurrences. Recommended changes include:

- o improve supervision during unloading;
- o develop, implement, and follow a written unloading procedure;
- o thoroughly familiarize all related personnel with ammonia handling procedures;
- o determine if the process line should be separated from unload line;
- o install backflow check valve in inlet line;
- o color code and label all valves;
- o have proper extinguishing material readily available; and
- o determine if a vacuum break should be installed to prevent suck back.

The Audit Team found the ammonia unload operation to be poorly operated and proper maintenance procedures were not followed.

9.3 CHLORINE/CHLORINE DIOXIDE - 2/5/88

At exactly 1107 hrs. on February 5, 1988, a release of 112,000 gallons of chlorine and chlorine dioxide (0.6% solution in water) occurred at the IP facility. Below is a detailed description of the incident, which was by far the most potentially destructive of the three major releases.

9.3.1 Chemical Description - Chlorine

Chlorine is a greenish-yellow diatomic gas with a suffocating odor. It is dangerous to inhale and is a powerful irritant. Can cause fatal pulmonary edema. See Section 6.2.

9.3.2 Chemical Description - Chlorine Dioxide

Chlorine dioxide is a strongly oxidizing, green gas, at room temperature. Its odor is unpleasant and similar to that of chlorine and reminiscent of that of nitric acid. It may be highly irritating to skin and mucous membranes of the respiratory tract. It may cause pulmonary edema. See Section 6.3.

9.3.3 Event Description

The above-mentioned chlorine/chlorine dioxide leak began at 1107 hrs. on 2/5/88 and was contained by 1500 hrs. on the same day. The wind was moving in a northwesterly direction at 15 m.p.h., the humidity was 25%, the temperature was 15^{o}F, and there was no precipitation.

Workers cutting and removing an unrelated pipe overhead accidentally dropped it and severed a four-inch diameter by 36" FRP drain nozzle, valved at the discharge end, from which the liquid immediately began escaping. A vapor cloud formed and began dispersing and traveling downwind. It was observed by a Jay police officer stationed at an IP gate, who notified town responders of the incident. The leak was eventually secured by inserting a bladder into the broken pipe, inflating it, and terminating the flow.

Following the accident, there was an evacuation of mill workers to the office area. An evacuation of approximately 4,000 area residents, including school children, commenced. Officials monitored downwind of the site, at the Jay Town Center, and at the perimeter of the mill; no readings were detected. However, the detection and sampling methods were not sophisticated or highly accurate. Officials cordoned off the mill area, allowing no one to enter or exit until the tank had been completely emptied. This occurred at 1500 hrs. Most of the product was diverted to the waste treatment plant via the sewer system and was not volatilized to the atmosphere.

9.3.4 Notification

Shortly following the accident, IP authorities notified the following Federal, State, and local agencies:

- o National Response Center, which then alerted the U.S. EPA, Region I;
- o ME DEP (Bureau of Oil and Hazardous Materials Control and the Air Bureau), which then contacted the Maine Emergency Management Agency (MEMA), the Maine State Police, and the Governor's office;
- o Town of Jay Fire and Police departments, and;
- o the Jay Town Manager.

9.3.5 Release Prevention Practices

Because this incident occurred due to error of maintenance personnel, IP stated that it was to a large extent unavoidable and points out that their hazardous materials training was adequate to prevent large-scale consequences.

9.3.6 Resulting Corrective Actions Implemented

International Paper began a program to identify the potential for other accidents of this type, removed the drain line on the tank, and installed protective shields around similar valves.

9.3.7 Recommendations

Based on the serious nature of this event and our field observations, the Audit Team determined that IP failed to properly evaluate and implement the best corrective and preventative measures.

At a minimum, IP should consider the following:

1) A total redesign of storage tank configuration and construction.

2) An upgrade of the product transfer systems and pumps to create a more efficient, less complex and safer system.

3) A bermed area around the sewer to prevent overflow and spreading of the material and allow time for implementation of control measures.

4) Dump valve as close as possible to the tank, blind flanged, discharge to an acidic sewer, and then a neutralizing area.

5) An emergency retention area where the ClO_2 could be treated with an appropriate neutralizing agent.

6) Increased training for maintenance personnel.

7) An upgrade of post-accident corrective measures to assure fail-safe operations.

The Audit Team believes that IP's solution to the incident did not address long-term prevention requirements. Eliminating the valve may not have solved the problem. International Paper should investigate a complete system modification which would include tank capacity and outage, materials, transfer, and safety.

9.4 NON-NOTIFICATION RELEASE INCIDENTS

International Paper authorities were required by law to notify Federal, State, and local agencies of the above-mentioned releases because they all exceed the Federally-mandated Reportable Quantities for the specific materials involved. Below is a brief discussion of additional releases which have occurred in the past two years but were not extensively discussed during the Audit because they had minimal environmental and community impact.

9.4.1 Sodium Hydrosulfite - 4/13/87

A Virginia Chemical truck backed into the receiving area to deliver nine 1-ton tote bins. Fumes were detected when the trailer door was opened, and it was reported by an employee to the Safety Department. An in-house trained tester for chemical gases ("sniffer") responded, and a Material Safety Data Sheet (MSDS) was obtained. After checking for gas concentrations and researching the MSDS information, the leaky container was transported to the waste treatment facility for disposal. The remaining shipment was forwarded to its designated storage area. No injuries occurred.

9.4.2 Chlorine - 5/5/87 and 5/6/87

On the night of May 4, the pulp mill shut down for a total mill outage. At 1130 hrs. on May 5, liquid chlorine began to leak at flanges on top of the east and middle vaporizers. The pulp mill area was evacuated by personnel donned in protective gear as the alarms could not be sounded due to the power outage. The leak was isolated by closing the valve at the chlorine tank car. At 1130 hrs. on May 6, when the system was turned on, the chlorine expanded as it heated, rupturing the line to the hypo barometric loop. The area was again evacuated, utilizing the alarm system. Eight injuries were reported.

9.4.3 Chlorine - 5/22/87

International Paper reported to Federal and State officials that a corroded line caused a one-gallon release of chlorine. The building was evacuated, and one injury was reported.

9.4.4 Sodium Hydrosulfite - 11/14/87

For unknown reasons (possibly due to reaction with moisture), V-Brite began smoldering in a tote bin. The vessel was removed to an isolated area of the mill and hosed down with water. The immediate area was evacuated, although sulfur dioxide was not present in measurable levels. No injuries were reported.

9.4.5 Hydrogen Sulfide - 1/28/88

A local television station reported a leak of an unknown quantity of hydrogen sulfide to the ME DEP and the EPA. The release occurred because acid slurry overflowed into a dissolving tank, reacting with black liquor to create hydrogen sulfide gas. Once the problem was detected from the control room, the dissolving tank was emptied. Quench was added to the generator tank to prevent an adverse reaction, and materials from the generator tank were emptied into a dump tank. Eight contractor personnel were treated at the local hospital for hydrogen sulfide exposure.

9.4.6 Chlorine - 2/14/88

A 5-10 gallon discharge of chlorine was reported to the ME DEP and the EPA by an IP representative. The interlock system designed to shut off the chlorine flow to the pulp flow from the primary mixer failed, allowing chlorine to flow back through the pulp and exit into the work area through a pulp sampling line over the primary mixer. Seven injuries were reported.

SECTION TEN

Emergency Release Exercise

10.0 EMERGENCY RELEASE EXERCISE

At the request of the Audit Team, an Emergency Drill was conducted on 4/25/88 in the pulp mill. The drill consisted of simulating a chlorine release, causing activation of the alarm system and evacuation of the mill. A Sweep Team, donned in self-contained breathing apparatus (SCBA), proceeded through the building searching for remaining personnel after the evacuation and then terminated the "leak." An "All Clear" notice was announced, and personnel returned to the Mill.

10.1 OBSERVATIONS:

- The commander did not have adequate control of the evacuation and spill termination procedures.
- The communication was poor between the Sweep Team, the control room, and the release area. Because the Sweep Team was outfitted in SCBAs, they were unable to communicate via telephone. Also, high noise levels throughout the mill made communication even more difficult.
- The message over the public address system could not be heard in all areas. In other areas, it was heard but could not be understood.
- The Sweep Team was not thorough and did not inspect all mill areas for remaining employees.
- Some evacuees exited the area without donning respirators.
- Employees were not accounted for after evacuation.
- The Sweep Team served as an Emergency Response Team, although they were not qualified as such.
- Some warning beacons malfunctioned.
- The Sweep Team did not don personal protective clothing.
- "All Clear" was sounded without sufficient evidence and monitoring.

10.2 RECOMMENDATIONS

- The pulp mill should have more drills, and further analysis of the drills should take place. These exercises should be integrated with the community.
- The public address system should be extended to include all vulnerable areas. Additionally, visible beacons should be used to alert personnel in high noise level areas.

- Masks with radio communication ability should be utilized by the Sweep Team in order to keep in contact with the control room and the spill area.

- One designated person per shift should be in charge of emergency situations.

- The Sweep Team should don Level A protective clothing. This would protect the Team, allow them to evacuate the building, and possibly terminate a spill without damage to themselves.

- The Sweep Team should be given emergency response training.

- The mill should involve the Jay Fire Department and community responders and planners in annual drills and simulations.

SECTION ELEVEN

Air Dispersion Modeling

11.0 AIR DISPERSION MODELING

Included in this chapter are air dispersion estimates for the three major air releases which occurred at IP's facility. In addition, there are several air dispersion estimates for credible worst case scenarios included. A description of the conditions and assumptions are included before each estimate.

Two different air dispersion models were utilized. One model was used to estimate concentrations of air pollutants from continuous emissions. These models are based on a binomial continuous plume dispersion equation providing an estimate of ground-level pollutant concentrations. The models are pre-screening models used to estimate concentrations and determine if sophisticated modeling is necessary. The overall results are not accurate representations of actual concentrations and gross overestimates are likely.

The model is based on the following assumptions:

- o Continuous emissions from the source or emission is equal to or greater than travel times to the downwind position under consideration so that diffusion in the direction of transport may be neglected.
- o The material diffused is a stable gas or aerosol (less than 20 microns diameter) which remains suspended in the air over long periods of time.
- o None of the material emitted is removed from the plume as it moves downwind, and there is complete reflection at the ground.
- o The mean wind direction specifies the x-axis, and a mean wind speed is representative of the diffusing layer chosen.
- o The plume constituents are distributed normally in both the crosswind and vertical directions.
- o The dispersion parameters represent sampling periods of about ten minutes. Thus, the parameters are conservative for releases significantly greater than ten minutes and may underestimate dispersion at sampling times less than ten minutes.

The second model was used to estimate concentrations of air pollutants from instantaneous puff air releases. This model is based on Gaussian equations. An instantaneous air release is defined as a short-term release on the order of seconds, such as in an explosion or a release from a process vent. The model is based on the following assumptions: the atmosphere is at a steady state; and pollutants are neutrally buoyant and non-reactive. This model is also used for pre-screening evaluations.

When reviewing the following air dispersion models, the scale should be closely observed. Due to the limits of the paper's dimensions, it was necessary to change the scales for different models. Also, for the instantaneous puff release models, it should be noted that the contours are not a plume. It is important to realize that each specific time and corresponding travel distance on the plot depict the cross-section through the center of the plume at that time.

Three different plots are used for each model. One plot displays numbers from one through five, corresponding to the lowest and highest concentrations in the plume. The last two models display asterisks (*) over the area where the plume concentration exceeds a specified value.

In this report, Threshold Limit Values (TLVs) and Immediately Dangerous to Life and Health (IDLH) values were specified. Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. These values are established by the American Conference of Governmental Industrial Hygienists (ACGIH). Immediately Dangerous to Life and Health values, defined by the Standards Completion Program, represent a maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without experiencing any escape-impairing or irreversible health effects. The effects of the various chemicals can be seen in Chapter 6 of this report.

It should be remembered that these models are estimates and are far from exact. Also, for the credible worst case scenarios, the models display the downwind concentration. The probability of such a release occurring is not included as part of this report and should be taken into consideration when judging the effects of a release. To judge the downwind effects, the parameters described in Section 1.2 (Site Description) should be considered.

11.1 RELEASE OF SULFUR DIOXIDE AT A SODIUM HYDROSULFITE FIRE ON 4/18/87

On April 18, 1987, at 0700 hrs., a fire started in a sodium hydrosulfite storage area after moisture came in contact with the sodium hydrosulfite. As a result, sulfur dioxide was released. The release was stopped at 1300 hrs. and, as a result, approximately 100 pounds of sulfur dioxide were released to the atmosphere. The wind was coming from the southwest at 4 miles per hour, the temperature was 42^{o}F, and no precipitation occurred.

The TLV for sulfur dioxide is 2 ppm and the IDLH is 100 ppm. The two computer models in Appendix II show significant airborne concentrations of sulfur dioxide occur within ten feet of the fire. The TLV level is exceeded 100 feet downwind of the fire.

11.2 RELEASE FROM ANHYDROUS AMMONIA STORAGE TANK ON 11/6/87

On November 6, 1987, at 1430 hrs., anhydrous ammonia began exiting an unloading line from a storage tank. The valve was mistakenly left open and was shut at 14:40 hours. During that time, 3,700 pounds of anhydrous ammonia were released to the atmosphere. The wind was coming from the north at 20 miles per hour, the temperature was 25^{o}F, and there was no precipitation. The TLV for ammonia is 25 ppm and the IDLH is 500 ppm.

The two computer models in Appendix III show the following: significant concentrations occur over one mile downwind; the TLV level is exceeded over one mile downwind; and the IDLH level is exceeded 900 feet downwind of the source.

When reviewing these models, it should be noted that ammonia has a vapor density of 0.6 and would have a tendency to rise in the atmosphere. Since the release occurred at an elevated area, the ground level concentrations for these models have a much greater probability for error.

11.3 RELEASE FROM CHLORINE DIOXIDE STORAGE TANK ON 2/5/88

On February 5, 1988, at 11:07 hrs., a fiberglass drain valve to a storage tank of chlorine dioxide in solution was accidentally severed by a falling pipe. The release was stopped at 13:00 hrs. on the same day by inserting an inflatable bladder into the broken pipe. During that time, 123,799 gallons of solution were released at a rate of 1,032 gallons per minute. The quantity released was 70% of the tank's total capacity. The solution flowed approximately 30 feet to a drain in the ground which led to the facility's wastewater treatment plant. The concentrations of chlorine dioxide and chlorine in the solution were 5.4 grams per liter and 1.9 grams per liter, respectively. The total quantity of chlorine dioxide and chlorine released was 5,579 pounds and 1,962 pounds, respectively. The exact amount of material released to the atmosphere as a gas is unknown. The company estimates it to be 440 pounds of chlorine dioxide and 156 pounds of chlorine. Air dispersion models were developed using these estimates. Also, air dispersion models were developed using the assumption that 80% of the material was released to the atmosphere. This is a high estimate given the situation, but is done so because the exact amount released to the atmosphere can never be known. This estimate results in 4,463 pounds of chlorine dioxide and 1,570 pounds of chlorine released to the atmosphere. The wind was coming from the northwest at 15 miles per hour, the temperature was 15^{o}F, and there was no precipitation.

The first two sets of models in Appendix IV refer to those quantities released to the atmosphere that were estimated by IP. The TLVs for chlorine dioxide and chlorine are 0.1 ppm and 1 ppm, respectively. The IDLH values for chlorine dioxide and chlorine are 10 ppm and 30 ppm, respectively.

As can be seen in the first two sets of models in Appendix IV, significant concentrations of chlorine dioxide occur over one-half mile downwind of the source. The IDLH level is exceeded at 250 feet from the source, and the TLV level is exceeded approximately one mile downwind. The concentrations of chlorine are much smaller than those of the chlorine dioxide. While the TLV level is exceeded at 650 feet downwind, the IDLH level is limited to within 45 feet of the source.

The second two sets of models also in Appendix IV were based on the estimate that 80% of the material was released to the atmosphere. As can be seen, high concentrations of chlorine dioxide occur beyond one-half mile downwind of the source. The IDLH level is exceeded one-quarter mile away, and the TLV level is exceeded over 4 miles downwind. Once again, the concentrations of chlorine in the atmosphere are not as significant as those of chlorine dioxide; however, they are still higher than should be allowed one-quarter of a mile downwind. The IDLH level was not exceeded beyond 300 feet downwind.

11.4 CREDIBLE WORST CASE SCENARIO FOR THE CHLORINE DIOXIDE STORAGE TANK

The two sets of models in Appendix V are air dispersion models for a potential release from the chlorine dioxide storage tank from which a release occurred on 2/5/88. Since the chlorine dioxide and chlorine are in solution, an instantaneous release is improbable, so a continuous model was used with the assumption that all of the gases were released to the atmosphere within one-half hour. Also, it is assumed that the solution is exposed to the atmosphere for at least one-half hour. Although there is a drainage system surrounding the tank, it is assumed that a major rupture in the tank would produce a sufficient flow so that the drainage system could not contain the release.

Since this scenario is to approximate a worst case, the total capacity of the tank (176,856 gallons) is used. This results in the release of 7,970 pounds of chlorine dioxide and 2,804 pounds of chlorine. The wind speed was chosen as 15 miles per hour. This also was the wind speed on the 2/5/88 release and would have a greater downwind effect than a lesser speed. The temperature was chosen as 77^{o}F to assist in the evaporation and warming of the solution. The atmospheric mixing height used is a default of 5,000 feet.

The first set of models in Appendix V display the chlorine dioxide concentrations in the atmosphere. Immediately Dangerous to Life and Health atmospheres would occur over three-quarters of a mile away. The TLV level would be exceeded as far away as 18 miles downwind. While the levels of chlorine in the atmosphere are not as significant as those of the chlorine dioxide, they are still dangerous levels. The TLV level is exceeded over one and three-quarter miles away, and the IDLH level is exceeded one-fifth of a mile downwind of the source.

11.5 CREDIBLE WORST CASE SCENARIO FOR THE ANHYDROUS AMMONIA STORAGE TANK

The set of models in Appendix VI are air dispersion models for a potential release from the anhydrous ammonia storage tank from which a release occurred on 11/6/87. For this scenario, it is assumed that the entire contents of the tank are released at once. This would occur if the tank were to collapse, a major rupture in the tank occurred, or there was an explosion near the tank. It is assumed that if the structure containing the tank is not destroyed, its ventilation would allow for the rapid escape of the gas. The instantaneous puff release model is used. The storage tank has a 12,000-gallon capacity, which would result in a potential release of 68,112 pounds of anhydrous ammonia. Weather conditions are assumed to be the same as the previous model. It should be noted that the vapor density of anhydrous ammonia is 0.6 and it would have a tendency to rise in the atmosphere. This model does not account for the density of the gas.

The first model in Appendix VI depicts the locations where the concentration will exceed the TLV level. As can be seen in a little over an hour and a half, the TLV level will have been exceeded 23 miles downwind. The second model displays those areas where the IDLH level will be exceeded. Within one-half hour, the IDLH concentration will have reached over six and one-half miles downwind of the source. The last two models display the concentrations of ammonia in the atmosphere with time one mile and six miles downwind of the source. As can be seen, the further downwind the plume is located, the greater it will be dispersed. Thus, the concentrations will be lower but the duration over a distinct point will occur longer.

11.6 CREDIBLE WORST CASE SCENARIO FOR A CHLORINE RAIL CAR

The models in Appendix VII are air dispersion models for a potential release from a chlorine rail car. Currently, there are four rail cars kept on site at one time. Only one car is emptied at a time. These dispersion models depict the release from one 90-ton rail car. Weather conditions are the same as in the previous models.

The first set of models displays a continuous release in which the entire contents of the car are released in one hour. This would result from a release of 255 gallons per minute, such as a broken pipe or valve. As can be seen from the first plot, high concentrations of chlorine will occur as far as seven miles away. The TLV level would be exceeded 19 miles downwind of the source, and the IDLH level would be exceeded almost two miles downwind of the source.

The second and third sets of models are instantaneous puff release models. In this type of scenario, the entire contents of the rail car would be released at once. This would result from an explosion or a major rupture of the rail car. The first set of plots assumes the same weather conditions as used previously. The second set of plots assumes more stable weather conditions and a wind speed of only one mile per hour.

In the second set of models, the IDLH level is exceeded 18 miles downwind, but the duration over each distinct location is short. In the third set, where there are more stable conditions, the IDLH level is exceeded only five miles downwind but the duration is much longer. Thus, under the more stable weather conditions fewer people would be affected but much more seriously. In each set of plots is included a display of the ambient concentrations with time one-half mile downwind, one mile downwind, and at the downwind edge of the IDLH plot for comparative purposes.

SECTION TWELVE

Summary of Observations

12.0 SUMMARY OF OBSERVATIONS

A summary of the Audit Team's observations throughout the Mill are included here, with recommendations for possible improvements contained in the following, concluding chapter.

12.1 PULP MILL/BLEACH PLANT

1) A Kraft Pulp Mill Entrance Permit program was begun in February or March for all employees, contractors, and visitors to the pulp mill. The effectiveness of this program is unknown at this time because of its recent implementation. Mechanisms for enforcement did not appear to be in place and safety rules, procedures, and routes of escape were unclear.

2) The digesters and boilers are cleaned once a year and every three years with a hydrochloric acid/nitric acid wash. The boilers are cleaned once a year and every four years with a nitric acid wash.

3) Air pollution control equipment for chlorine and chlorine dioxide does not appear to be adequate to control emissions.

4) During certain times, such as startup and shutdown, chilled water is substituted for 35 Filtrate (a caustic), resulting in inadequate gas scrubbing for routine or accidental releases in the chlorine and chlorine dioxide scrubbers. Plugging, gas channeling, and maintenance problems are likely to occur due to fiber buildup from 35 Filtrate.

5) No efficiency or stack testing was conducted to assure that gas is not emitted to the environment under routine or accidental loads. No limiting operating parameters have been established. No monitoring devices have been installed to assure proper operation or that the control systems are in operation.

6) Housekeeping in this area was generally satisfactory, although excessive amounts of weak black liquor were observed encircling the B Plant chlorine dioxide storage tank. Excess liquid could potentially float the tank, resulting in catastrophic consequences.

7) One primary chlorine dioxide scrubber is not operating, and system leaks in the fan and duct work were apparent. Excessive moisture and condensate are leaking from the system. Additionally, excessive bypass input lines were noted.

12.2 POWER PLANT

The Power Plant has recently instituted a Utilities Entrance Program whereby all employees, contractors, and other visitors to the plant must have on file a Utilities Entrance Permit before being allowed entrance to the premises. It was difficult to gauge the effectiveness of this program as it was implemented less than a month prior to the Audit.

1) No leak detection procedure is used during installation of hydrogen gas cylinders.

2) There do not appear to be sufficient mechanisms in place for contingencies in the event of an emergency power failure. The Audit Team is not convinced that all necessary emergency warning, lighting, and critical valves and equipment are adequately protected.

12.3 SAFETY

1) The Safety Department is headed by a certified Safety Engineer. The Safety Department Manager reports to the Human Resources Manager.

2) There is one Industrial Hygienist who is in the process of becoming certified. The facility is visited semi-annually by a team of six Industrial Hygienists of whom one is certified.

3) Safety issues are routinely discussed at a daily staff meeting attended by department managers. At the meetings, new safety programs are developed and existing ones are assessed for their effectiveness and, if necessary, redesigned.

4) Safety training, under the guidance of a staff member appointed as Safety Trainer, is a newly-instituted program that has yet to be fully integrated into Mill operations.

5) A 17-week Safety course is offered, during non-working hours, for supervisory, management, and hourly personnel.

12.4 ALARMS/MONITORING

1) The areas of the mill where a chemical release might occur do not have established criteria for general sounding of chlorine, chlorine dioxide, and hydrogen sulfide alarms. Currently, hydrogen sulfide is detected by an automatic alarm; however, chlorine and chlorine dioxide alarms are sounded manually by control room staff. As such, sounding of the alarms is discretionary.

2) The emergency alarm lighting system has recently been revised. The flashing of yellow lights indicates that a toxic gas has been released, and a red light is operated during evacuation.

3) Because ammonia has very strong warning properties, no monitoring system is in place for its detection.

12.5 EQUIPMENT DESIGN

1) The facility appears to be undergoing a major reconstruction phase. Changes are planned in piping, chemical storage, and in actual processes. It is very important that these changes are addressed in all contingency plans and response procedures and that proper personnel, such as the local Fire Chief and Fire Brigade, be notified. Should an accident occur, the substance in question may be misidentified. Mitigation procedures previously used may no longer be valid if a key valve or drain has been removed or changed.

2) When design changes costing $75,000 or more are needed, corporate engineering approval is required. A design change is initially initiated via a work order by a department foreman or supervisor. Less expensive changes, even those associated with hazardous substances, are sometimes given cursory reviews.

12.6 COMMUNICATION

Throughout the facility, there appears to be a lack of communication and awareness of procedures between the various departments and with the community. Although it is understandable that this situation may be present due to the change in personnel and labor problems, it is a general feeling by the Audit Team that considerable improvement is needed in this area.

12.7 HAZMAT TEAM

1) At the time of the Audit, a Hazmat Team was being formed. However, it is not expected to be operational for several months. Implementation of this important program is past due.

2) Training for the Hazmat Team has yet to be fully developed, although it is in the planning stages.

3) The IP Fire Brigade and Jay Fire Department have very little hazmat expertise. The functional relationship and efficiency between the Brigade and the Town needs improvement.

12.8 FIRE BRIGADE

The IP Fire Brigade is composed of three full-time employees (a fire inspector and two assistants) and a maintenance back shift (7 or 8 employees) for each of the four shifts. Observations about IP's internal firefighting capabilities are as follows:

1) Equipment maintenance and inspections are routinely performed; however, it was learned that the foam stored on site was beyond its shelf life.

2) Much of the firefighting equipment and supplies are old, although two new pumpers and protective clothing are on order.

3) Neither the Jay Fire Chief nor the IP Fire Brigade Chief conduct regularly-scheduled inspections of the mill.

4) Communication between first responders and the Mill Brigade is poor.

5) Fire drills are conducted on a regular basis, although it is unclear whether or not records are kept. The community has not been involved in these drills.

6) The facility's Fire Brigade equipment is stored in a fire barn near a gas cylinder storage area. The company also has intentions of storing their hazardous materials unit at this location. In the event of a leaking gas cylinder or explosion, the equipment to mitigate the hazards would be destroyed or inaccessible. Either of these events are possible since both hydrogen and hydrogen sulfide are stored here.

In addition, there is a railroad line which goes by this area. Although this rail is used mainly for non-hazardous materials, such as clay, on occasion hazardous material rail cars are located here during switching operations. Should an accidental release occur during such a transfer, the necessary equipment to mitigate the release would be inaccessible. Although IP has stated its intentions of transferring the fire barn to a new location, this observation is brought forth so that the same situation will not be overlooked when choosing a new location.

12.9 HAZARD COMMUNICATIONS PROGRAM

OSHA requires all employers who manufacture, distribute, import, or use hazardous chemicals to implement a Hazard Communications Program to inform employees of the dangers of the chemicals they are handling.

1) At IP, all new employees receive a 4-hour course which encompasses: hazardous chemical inventory; container

labels/warnings; Material Safety Data Sheets (MSDS); and chemical exposure control.

2) An abbreviated Hazard Communications course, which consisted primarily of a videotape, was provided to the Audit Team. The program appears to be well organized and informative.

3) Outside contractors must also be trained in hazardous materials handling and are presented an abbreviated version of the Hazard Communications course before entering the facility.

This program is currently being reviewed by OSHA.

12.10 RESPIRATORY PROTECTION

1) All employees, contractors, and visitors to areas where chlorine and chlorine dioxide are handled must carry a 5-minute escape pack, and be familiar with its use, in the event of a release. All mill operators, and some maintenance personnel, have been trained in the use of Scott Air Packs (SCBAs).

2) There are no formal procedures for decontamination of personal protective equipment, although employees are expected to care for all equipment they use. Additionally, employees are requested to replace the cartridges on their face masks weekly.

3) Scott Air Packs are inspected by certified fire inspectors. However, tags on the SCBA cases indicate that they had been inspected only once at the time of the Audit.

4) Documentation that the Fit Testing program is being properly implemented was unavailable for review by the audit team.

12.11 CHEMICAL HANDLING

The supervision provided to employees and vendors handling and delivering chemicals was found to be inadequate.

12.12 AIR MODELING

1) In 1985, IP developed an air model--utilizing flat terrain technology--which was incorporated into a field simulation. However, there is no evidence that modeling was ever used for impact analysis. The community hazards impact analysis at IP is insufficient.

2) Air dispersion estimates have been included in this report. The appropriateness of the models used are not sufficient for the impact studies that are necessary for proper

planning. The results show that more sophisticated modeling is required.

12.13 RELEASE MANAGEMENT

Because the mill is located adjacent to the Androscoggin River, there is a risk of hazardous chemicals entering the river (which is a navigable waterway of the U.S. and therefore under Federal jurisdiction) in the event of a liquid release. IP has made provisions to prevent this from occurring. The audit team did not assess the adequacy of these provisions.

12.14 COMMUNITY RELATIONS

Although a paging system has recently been activated between IP and community responders, there remain many communication problems that need to be resolved.

12.15 HAZARDOUS WASTE

International Paper is a RCRA waste generator. Hazardous wastes are stored in aboveground containers and shipped to RCRA-approved facilities. The Team collected numerous complaints from previous employees alleging past illegal hazardous waste disposal in landfills owned by IP. There is a need to investigate existing landfill sites to determine if any waste was improperly dumped.

SECTION THIRTEEN

Recommendations

13.0 RECOMMENDATIONS

13.1 ACCIDENT INVESTIGATIONS AND FOLLOW UP

Accident investigation procedures are inadequate. International Paper does not adequately investigate potential and actual chemical releases using checklists, codes, standards, or formal techniques. Their existing accident investigation techniques fail to adequately assess system reliability, state-of-the-art technology, and the magnitude and probability of the accident reoccurring. Appropriate investigation and follow up was not initiated for major releases that involved significant worker safety issues and major community impact. The documentation of several accidents which occurred at the mill over the past two years was incomplete.

Accident investigation techniques at IP must be improved to reassure the public that appropriate changes to defective equipment, training, and policy are implemented and that long-term safety considerations are paramount in the accident investigation process.

13.2 CHLORINE DIOXIDE STORAGE AND TRANSFER DESIGN CHANGES

On February 5, 1988, IP released approximately 100,000 gallons of chlorine dioxide from a storage tank over a two-hour period. The release occurred when maintenance workers cut an overhead steel support without having first properly secured their work area. This caused the pipe to fall and sheer an FRP dump nozzle on a 158,616-gallon chlorine dioxide storage tank. The gas plume reportedly migrated beyond property lines within minutes after the release. Chlorine dioxide is a highly unstable, toxic health hazard which can spontaneously, and under certain conditions, react explosively with air. See Section 9.3.3 for further details.

The long-term prevention technique used by IP was to permanently block off the broken valve. International Paper failed to provide adequate assurance that the chlorine dioxide storage and transfer system is likely to continue operating in a failsafe mode. The mill did not determine how the valve removal impacted overall system safety. This important design change was completed without the necessary hazard assessment. The changed design does not allow for efficient product transfer in the event of a process upset or emergency.

It is necessary that IP reevaluate the chosen prevention strategy and determine the need to implement further failsafe design to the chlorine dioxide storage and transfer operation. The study and design changes should, at a minimum, consider the following:

o smaller tanks with more total capacity for emergency pulldown and balance;

- backup pumping capacity;
- close fit, protected valves, discharge blanked;
- dump procedures and secondary containment; and
- floating roof and vapor control.

13.3 AMMONIA STORAGE AND TRANSFER DESIGN CHANGES

On November 6, 1987, IP released 3,700 pounds of anyhydrous ammonia in approximately ten minutes. Ammonia gas is flammable, toxic, and can be explosive. It is considered an extremely hazardous substance. The release was caused when personnel failed to follow a proper lock-out tag-out procedure prior to recommissioning the ammonia transfer system (see Section 9.2.2). International Paper did not provide the Audit Team adequate documentation to assure that reoccurrence of the event is not likely. The arrangement of pipes and valves could not be adequately explained by IP. Supervision of the unloading operation, lock-out tag-out procedures, pipe and valve identification, and safety equipment remained deficient at the time of the audit.

International Paper must assess measures and implement design changes to prevent a similar incident from occurring. The assessment should, at a minimum, include the following:

- improved lock-out tag-out procedures;
- improved unload supervision;
- proper written unload procedures;
- process and load line separation;
- backflow check valve installation;
- labelling and color coding;
- overfill protection; and
- provisions for fire extinguishing.

13.4 V-BRITE HANDLING

On April 18, 1987, IP released approximately 100 pounds of sulfur dioxide (SO_2) over a six-hour period. This release occurred as a result of a fire in a sodium hydrosulfite (V-Brite) tote bin (see Section 9.1.3). V-Brite is used by the mill as a bleaching agent. The product is relatively stable provided it does not contact moisture. A small amount of water in the tote bin, along with the presence of oxygen, can cause flammable and explosive decomposition and the release of SO_2 gas. Sulfur dioxide gas is immediately dangerous to life and health at concentrations of 100 parts per million (ppm). Vapors may cause burns, dizziness, and suffocation.

International Paper implemented major design changes to prevent future V-Brite accidents. These included the weatherizing and enclosing of the V-Brite storage and dispensing areas. However, the mill failed to complete an acceptable safety review and final certification for the new design.

International Paper must initiate a post-modification safety review which should, at a minimum, address the need for the following:

- activation of a reaction detector thermocouple in the bin discharge system;
- temperature and humidity monitoring;
- relocation of the emergency exhaust vent (vent should not exhaust into a traffic area);
- improvement of training programs and warnings for V-Brite powder and SO_2 gas; and
- implementation of additional measures to keep the V-Brite dry during transport from storage and dispensing areas.

13.5 CHLORINE AND CHLORINE DIOXIDE SCRUBBING SYSTEMS

Hazardous chlorine and chlorine dioxide gases from process and upset conditions throughout the mill are scrubbed by a primary and secondary packed, countercurrent spray tower. The units are located in series, with primary and secondary units for both the A and B plants. The scrubbing medium is caustic from the washer 35 Filtrate tank.

International Paper did not provide sufficient evidence to demonstrate the effectiveness and efficiency of the scrubbers in removing hazardous chlorine and chlorine dioxide emissions. Operational deficiencies observed during the audit are listed below:

- Water is substituted for washer 35 Filtrate on occasion (e.g., during startup and shutdown), resulting in inadequate gas scrubbing on routine and upset emissions.
- Plugging, gas channeling, and maintenance problems are likely due to fiber buildup from the washer 35 Filtrate.

- No stack emissions tests or efficiency test information was available to certify acceptable gas emissions under normal and accidental loads.

- No limiting operating parameters have been established as set points for proper removal efficiency.

- No parameter monitoring gauges have been installed to assure and record proper operation. The system should be equipped with the proper instrumentation, for example, flow, pressure, pH, oxidation reduction potential (ORP), temperature, etc. A recorder should be available to monitor off-specification parameters and bypass conditions.

- The A plant primary scrubber was not in operation during the audit.

- Excessive moisture, condensate, and system leaks were observed (e.g., from duct work).

- Numerous bypass lines were observed entering the system.

- The drain sections of the B plant primary and secondary scrubbers were improperly vented to the atmosphere.

- The efficiency of the scrubbing medium needs improvement.

International Paper should carry out comprehensive scrubber design evaluations and stack testing to determine the extent of modifications or design changes necessary to assure that chlorine and chlorine dioxide gas releases from the scrubber stacks are within acceptable levels.

13.6 ENVIRONMENTAL COMPLIANCE

The Audit Team conducted a review of government files to determine IP's environmental compliance status. Results of this review indicate that the mill is operating with air and water licenses and permits that require revision and renewal. There have been numerous wastewater violations and treatment plant bypasses. Past environmental problems were identified, including contaminated groundwater wells MW78 and 8B and hazardous waste storage and disposal problems. The Team collected complaints from previous employees, alleging past illegal hazardous waste disposal in landfills owned by IP.

These compliance issues should be pursued by multi-media government enforcement teams. Enforcement of delegated programs is the primary responsibility of the State of Maine. The EPA provides enforcement assistance to the State upon request.

13.7 HAZARDS ANALYSIS

Although initial steps have been taken to identify plant hazards, the size, complexity, and off-site ramifications require more sophisticated hazards analysis capabilities at IP. These capabilities did not exist at the time of the audit. Improved methods of analysis must be available for certain hazardous material lines at the research and development stage and conceptual and detailed design, as well as operational, phases. Methods include checklists, independent safety audits, "what if" analysis, failure modes, effects and criticality analysis, and hazard and operability studies. For example, a comprehensive hazards/risk analysis should be conducted prior to any implementation of changes to the chlorine dioxide storage and transfer lines.

13.8 DISPERSION MODELING

Dispersion modeling has not been conducted satisfactorily to determine potential community impact from releases. This type of analysis is necessary given EPA's preliminary dispersion calculations conducted in conjunction with the audit and the nature of operations at IP. Properly selected and calibrated modeling must be completed using accepted methods and techniques. Release geometry, heavier-than-air gases, terrain and phase change effects, and downwash should be considered.

13.9 FIRE BRIGADE AND HAZARDOUS MATERIALS RESPONSE

The Fire Brigade does not have the necessary expertise, training, and equipment to effectively deal with hazardous chemical releases. Although significant improvements have been accomplished in these areas, IP must continue efforts to build capabilities in accordance with an acceptable timetable. Mutual Aid capabilities need improvement as well. Inspections and drills must be conducted in conjunction with Mutual Aid responders on a regularly-scheduled basis. Hazardous materials controls, such as foam, are not available at the Brigade, and more emphasis should be placed on personal protective equipment and monitoring instrumentation for Brigade and Hazmat Team members.

13.10 CONTINGENCY PLANS

Contingency plans are not sufficient to prepare the mill and the community for a hazardous materials emergency. Although significant advances have been accomplished by IP over the past several months, the existing contingency plans must be completed, coordinated, certified by company and community officials, tested, and maintained.

13.11 ALERT AND NOTIFICATION

Alert and notification procedures within the mill are deficient. Procedures and equipment must be upgraded to ensure that notification is provided to affected parties for all stages of alerts. Deficiencies observed included failure of personnel to hear signals and malfunctioning beacons. Additionally, critical area alarms are manually actuated and subject to human error. There are no set criteria for determining when the alarms should be sounded.

Alert and notification for the community is inadequate. For example, the community was not notified of an ammonia release which occurred on 4/9/88. The community fire department is not automatically placed on standby or even notified, depending upon the release situation. Community relations, Mutual Aid notification, and response need major improvements. Additional observations and conclusions can be found in the FEMA report.

13.12 HAZARDOUS MATERIALS UNLOADING OPERATIONS

Hazardous materials unloading operations need improvement. Surveillance, supervision, and security need upgrading. Leak detection procedures should be routinely used for hydrogen gas hookup in the power plant. Bulk chlorine derailers and valves should be locked when not in use. The use of unload supervision, escorts, written procedures, and checklists should be implemented for dangerous unloading operations.

13.13 TRAINING

International Paper has been training their employees in on-the-job safety for many years, but a formal, written training program is still in the early stages of development. Some training courses have not been completely developed, and employee training records appear to be sporadic. A more complete written training program and recordkeeping procedure should be provided to ensure that all employees receive the required training.

Some of the training materials requested by the Audit Team were not reviewed because they were not immediately available at the time of the audit. These include employee training records, course content lists, and refresher training information. The information that was provided included: a general training manual; a safety practices guide; the International Paper Safety Policy Manual, the Pulp Mill Safety Manual; and other general training documents.

13.14 DECONTAMINATION

No formal program for decontamination procedures or training was in place at the time of the audit. It is recommended that IP institute a comprehensive, mill-wide program, to include the following: planning, training, implementation, and establishment of designated decontamination zones.

13.15 ACCOUNTABILITY FOR CONTRACTORS

Training and safety must be improved for contractors and outside visitors during both routine and emergency situations. International Paper should assume more responsibility to protect these groups and must enforce standards similar to those required of IP personnel.

13.16 REACTIONS TO SIMULATED EMERGENCIES

The emergency drill conducted at the request of the Audit Team identified deficiencies in the following areas: command and coordination; communication; notification; and response. Simulations involving community planners and responders are not conducted. Regular drills are necessary to improve safety implementation and coordination consistent with the provisions of SARA Title III.

13.17 MONITORS AND ALARMS

The one chlorine monitor currently in operation in the pulp area does not provide adequate monitoring coverage. International Paper is presently installing sixteen sensors throughout the area. However, they will all operate with the same central alarm. This system will require testing and evaluation once installation is complete. Area sensors should be activated automatically rather than from the control room. International Paper needs to develop a system for inspecting, maintaining, and calibrating the detectors. A backup alarm or other provisions should be considered to reduce the possibility of central alarm failure. The expanded network installation schedule should be "fast tracked" to provide increased release detection and safety.

13.18 EMERGENCY BACKUP POWER

Adequate provisions have not been made for emergency, uninterruptible power on hazardous materials alarms, sensors, and other emergency services. International Paper has significant flexibility in obtaining power through three manually-switched two-way busses. Wood, oil, and hydroelectric capabilities, as well as the mill's ability to purchase from the power grid, are available. However, area power outages have caused water treatment plant bypasses and chemical releases to the environment. International Paper should initiate a study to identify improvements in power shedding and utility reliability. Emergency standby power should be available for the alarm and notification system. As a part of their emergency backup power study, IP should review solid state controlled automatic switching of their present manually-switched two way busses.

13.19 FAIL-SAFE INTERLOCKS AND VALVING

A cursory review of critical interlocks and valves identified possible deficiencies in both A and B bleach plants. Drawings and follow up discussions indicated that upon power failure, several valves may fail to an unsafe position. Many of the diagrams presented to the Audit Team were outdated or inadequate for conducting an accurate interlock and valve safety review. Because of the issues raised, we recommend that IP conduct a comprehensive interlock and valve safety study. Modifications should be initiated, where necessary.

13.20 OPERATION AND MAINTENANCE PROCEDURES

The Preventative Maintenance program for equipment used in hazardous materials lines should be upgraded to include routine replacement of critical parts based on the history of failure rather than waiting for the equipment to fail while in service. This program will require time to implement because IP has only recently begun to keep accurate records on corrosion allowance, release valve checks, and other critical maintenance items.

13.21 METEOROLOGICAL MONITORING

Realtime meteorological monitoring data from the 100-meter tower is not currently available at the mill's emergency response command post. This information would be critical in the event of a serious emergency release. International Paper should prioritize this project and bring the system on line as soon as possible.

SECTION FOURTEEN

Conclusion

14.0 CONCLUSION

The primary purpose of the Accidental Release Audit was to identify imminent or potential hazards to the community and the environment and to recommend corrective measures. As a result of recent multi-media agency inspections, IP has improved risk management procedures and has demonstrated an effort to improve release prevention and safety. However, several potentially serious safety problems were identified within the plant and its environs. International Paper should evaluate the outlined recommendations in this report as a means to substantially reduce the risk of occupational and community-related injuries which may occur as the result of a chemical accident or release.

The most significant problems were found in the following areas:

- accident investigation and follow up;
- hazardous materials storage and containment;
- chemical handling and unloading;
- scrubber systems;
- environmental compliance;
- hazards analysis and dispersion modeling;
- fire and hazardous materials response;
- contingency planning;
- alert and notification;
- training;
- decontamination;
- contractor safety;
- emergency drills;
- monitors and alarms;
- emergency backup power;
- failsafe interlocks and valving;
- maintenance procedures; and
- meteorological monitoring.

This listing is not all-inclusive. International Paper should consider conducting a comprehensive internal audit to identify additional safety problems and place a high priority on rectifying all hazards that could impact the community.

Safety is the ongoing responsibility of Federal, State, and local government, the community, and the mill. The EPA will continue to monitor planning, Community Right to Know, and release prevention policies in Jay, Maine, through its Region I SARA Title III program office located in Lexington, Massachusetts.

APPENDICES

APPENDIX I

Photograph Log

Film Roll: 1

LOG SHEET
PHOTOGRAPHY

Frame Number: 1
Site Name: International Paper
Site Location: Jay, Maine

Amplifying Information:

Scene: New V-brite storage facility.

Photo By: E. Gilley

Date/Time: 4/21/88 13:30 hrs

Sky Conditions: Clear

Camera: Olympus Infinity

Setting: Automatic

Film Type: ASA 200

Witnesses: M.Poirier
R.DiNardo

Frame Number: 2
Site Name: International Paper
Site Location: Jay, Maine

Amplifying Information:

Scene: Blue Chlorine Dioxide storage tank from which 2/5/88 release occurred.

Photo By: E. Gilley

Date/Time: 4/21/88 13:40 hrs

Sky Conditions: Clear

Camera: Olympus Infinity

Setting: Automatic

Film Type: ASA 200

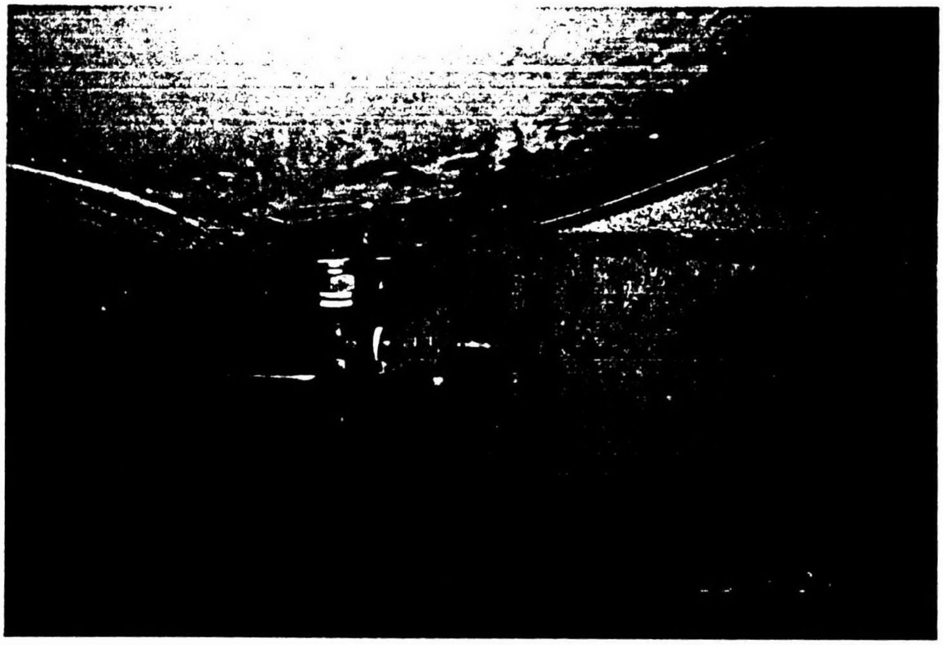
Witnesses: M.Poirier
R.DiNardo

Film Roll: 1

LOG SHEET
PHOTOGRAPHY

Frame Number: 3 Site Name: International Paper
Site Location: Jay, Maine

Amplifying Information:



Scene: Ammonia storage tank in waste water treatment area where spill occurred on 11/6/87.

Photo By: E. Gilley

Date/Time: 4/21/88 14:10 hrs

Sky Conditions: Clear

Camera: Olympus Infinity

Setting: Automatic

Film Type: ASA 200

Witnesses: M.Poirier
R.DiNardo

Frame Number: 4 Site Name: International Paper
Site Location: Jay, Maine

Amplifying Information:

Scene: Front of International Paper

Photo By: C.Caterino

Date/Time: 4/26/88 13:00 hrs

Sky Conditions: Clear

Camera: Olympus Infinity

Setting: Automatic

Film Type: ASA 200

Witnesses: M.Poirier
R.DiNardo

APPENDIX II

Air Model - Release of Sulfur Dioxide
at a Sodium Hydrosulfite Fire
4/18/87

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               90 FT                    SOURCE                         90 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 50                           111222334455555554433222111
 100                   11111111111222222222222222222211111111111
 150                 111111111111111111111111111111111111111111111
 200                   11111111111111111111111111111111111111111
 250                            1111111111111111111111111
 300
```

LEGEND

1 - .4922702 TO 1.181448 PPM
2 - 1.181448 TO 3.938161 PPM
3 - 3.938161 TO 5.907242 PPM
4 - 5.907242 TO 7.876323 PPM
5 - 7.876323 TO 9.845402 PPM

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

COMMENTS	:	4/18/87 RELEASE
COMPOUND	:	SULFUR DIOXIDE
STABILITY CLASS	:	A
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	16.670
AVERAGE WIND SPEED, MPH	:	4.000
AMBIENT TEMPERATURE, DEG F	:	42.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                9 FT                    SOURCE                         9 FT
(FEET)      +----------+----------+----------0----------+----------+----------+
 5                      1111122233344455555555554443332221111
 10           111111111111222222222223333333332222222222221111111111111
 15         111111111111111112222222?22222222222222222211111111111111111111
 20         1111111111111111111111111111111111111111111111111111111111111
 25         1111111111111111111111111111111111111111111111111111111111111
 30         1111111111111111111111111111111111111111111111111111111111111
 35         1111111111111111111111111111111111111111111111111111111111111
 40                      11111111111111111111111111111111111
 45
```

LEGEND

```
 1 -  13.32983   TO   31.9916   PPM
 2 -  31.9916   TO  106.6387   PPM
 3 -  106.6387   TO  159.958   PPM
 4 -  159.958   TO  213.2773   PPM
 5 -  213.2773   TO  266.5967   PPM
```

GRID INCREMENTS---> Y= .3 FEET AND X= 5 FEET

```
COMMENTS                        : 4/18/87 RELEASE
COMPOUND                        : SULFUR DIOXIDE
STABILITY CLASS                 : A

EFFECTIVE SOURCE HEIGHT, FT  :     0.000
EMISSION RATE, LB/HR         :    16.670
AVERAGE WIND SPEED, MPH      :     4.000
AMBIENT TEMPERATURE, DEG F   :    42.000
ATMOSPHERIC PRESSURE, MM HG  :   760.000
```

```
------------------------------------------------------------------------------
         GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
------------------------------------------------------------------------------


               90 FT                    SOURCE                         90 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 50                              *********************
 100                              *******************
 150

------------------------------------------------------------------------------

 LEGEND

  * - CONCENTRATION OVER -  2  PPM

GRID INCREMENTS---> Y= 3  FEET AND X= 50  FEET
------------------------------------------------------------------------------


COMMENTS                         : 4/18/87 RELEASE
COMPOUND                         : SULFUR DIOXIDE
STABILITY CLASS                  : A

EFFECTIVE SOURCE HEIGHT, FT :      0.000
EMISSION RATE, LB/HR        :     16.670
AVERAGE WIND SPEED, MPH     :      4.000
AMBIENT TEMPERATURE, DEG F  :     42.000
ATMOSPHERIC PRESSURE, MM HG :    760.000
```

APPENDIX III

Air Model - Release From
Anhydrous Ammonia Storage Tank
11/6/87

```
--------------------------------------------------------------------------
          GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
--------------------------------------------------------------------------


             9000 FT                   SOURCE                       9000 FT
(FEET)       +---------+---------+---------0---------+---------+---------+
 5000                                    24542
 10000                                 112222211
 15000                                 111111111
 20000                                11111111111
 25000                                 111111111
 30000                                 111111111
 35000                                   11111
 40000


--------------------------------------------------------------------------

 LEGEND

 1 -  1.503879  TO  3.60931  PPM
 2 -  3.60931  TO  12.03103  PPM
 3 -  12.03103  TO  18.04655  PPM
 4 -  18.04655  TO  24.06207  PPM
 5 -  24.06207  TO  30.07758  PPM

GRID INCREMENTS---> Y= 300  FEET AND X= 5000  FEET
--------------------------------------------------------------------------


COMMENTS                          : 11/6/87 RELEASE
COMPOUND                          : AMMONIA
STABILITY CLASS                   : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR             :22200.000
AVERAGE WIND SPEED, MPH          :    20.000
AMBIENT TEMPERATURE, DEG F  :    25.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                  900 FT                        SOURCE                          900 FT
(FEET)          +---------+---------+---------0---------+---------+---------+
 500                                          1245421
 1000                                       11122222111
 1500                                       11111111111
 2000                                       11111111111
 2500                                       11111111111
 3000                                          11111
 3500
```

LEGEND

1 - 64.98525 TO 155.9646 PPM
2 - 155.9646 TO 519.882 PPM
3 - 519.882 TO 779.823 PPM
4 - 779.823 TO 1039.764 PPM
5 - 1039.764 TO 1299.705 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

COMMENTS	:	11/6/87 RELEASE
COMPOUND	:	AMMONIA
STABILITY CLASS	:	D

EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	22200.000
AVERAGE WIND SPEED, MPH	:	20.000
AMBIENT TEMPERATURE, DEG F	:	25.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

```
----------------------------------------------------------------------------
          GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
----------------------------------------------------------------------------


             900 FT                     SOURCE                          900 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 500                                   *********
 1000                                *************
 1500                               ***************
 2000                             *******************
 2500                             *******************
 3000                            *********************
 3500                            *********************
 4000                             *******************
 4500                              *****************
 5000                                *************
 5500                                   *******
 6000

----------------------------------------------------------------------------

 LEGEND

  * - CONCENTRATION OVER -  25  PPM

GRID INCREMENTS---> Y= 30  FEET AND X= 500  FEET
----------------------------------------------------------------------------


COMMENTS                       : 11/6/87 RELEASE
COMPOUND                       : AMMONIA
STABILITY CLASS                : D

EFFECTIVE SOURCE HEIGHT, FT :      0.000
EMISSION RATE, LB/HR          :22200.000
AVERAGE WIND SPEED, MPH       :    20.000
AMBIENT TEMPERATURE, DEG F    :    25.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               90 FT                    SOURCE                         90 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 50                                   ***********
 100                               *****************
 150                            ***********************
 200                          ***************************
 250                        *******************************
 300                       *********************************
 350                      ***********************************
 400                     *************************************
 450                    ***************************************
 500                    ***************************************
 550                    ***************************************
 600                    ***************************************
 650                     *************************************
 700                      ***********************************
 750                       *********************************
 800                             *****************************
 850                            ***********************
 900                                  ***********
 950
```

LEGEND

* - CONCENTRATION OVER - 500 PPM

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

```
COMMENTS                      : 11/6/87 RELEASE
COMPOUND                      : AMMONIA
STABILITY CLASS               : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :22200.000
AVERAGE WIND SPEED, MPH     :    20.000
AMBIENT TEMPERATURE, DEG F  :    25.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

APPENDIX IV

Air Model - Release From
Chlorine Dioxide Storage Tank
2/5/88

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               900 FT                    SOURCE                          900 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 500                                     1245421
 1000                                  11122222111
 1500                                  11111111111
 2000                                  11111111111
 2500                                  11111111111
 3000                                     11111
 3500
```

LEGEND

1 - .2254029 TO .540967 PPM
2 - .540967 TO 1.803223 PPM
3 - 1.803223 TO 2.704835 PPM
4 - 2.704835 TO 3.606447 PPM
5 - 3.606447 TO 4.508058 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

COMMENTS	:	2/5/88 RELEASE
COMPOUND	:	CHLORINE DIOXIDE
STABILITY CLASS	:	D

EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	234.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	15.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                90 FT                    SOURCE                         90 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 50                                     123555321
 100                                 111222333222111
 150                               1111122222222211111
 200                              111111111111111111111
 250                             11111111111111111111111
 300                             11111111111111111111111
 350                             11111111111111111111111
 400                              111111111111111111111
 450                                11111111111111111
 500                                    111111111
 550
```

LEGEND

```
1 -   4.28311  TO  10.27946  PPM
2 -  10.27946  TO  34.26488  PPM
3 -  34.26488  TO  51.39732  PPM
4 -  51.39732  TO  68.52976  PPM
5 -  68.52976  TO  85.66219  PPM
```

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

COMMENTS	:	2/5/88 RELEASE
COMPOUND	:	CHLORINE DIOXIDE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	234.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	15.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

```
---------------------------------------------------------------------------------
          GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
---------------------------------------------------------------------------------


               900 FT                    SOURCE                         900 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 500                                     *******
 1000                                 *************
 1500                                ***************
 2000                               *****************
 2500                              *******************
 3000                              *******************
 3500                              *******************
 4000                               *****************
 4500                                 *************
 5000                                    *******
 5500


---------------------------------------------------------------------------------

 LEGEND

  * - CONCENTRATION OVER -  .1  PPM

GRID INCREMENTS---> Y= 30  FEET AND X= 500  FEET
---------------------------------------------------------------------------------


COMMENTS                        : 2/5/88 RELEASE
COMPOUND                        : CHLORINE DIOXIDE
STABILITY CLASS                 : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :   234.000
AVERAGE WIND SPEED, MPH     :    15.000
AMBIENT TEMPERATURE, DEG F  :    15.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

```
---------------------------------------------------------------------------
        GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
---------------------------------------------------------------------------


                90 FT                   SOURCE                          90 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 50                                      *******
 100                                   ***********
 150                                  *************
 200                                  *************
 250                                   ***********
 300


---------------------------------------------------------------------------

 LEGEND

  * - CONCENTRATION OVER -  10  PPM

GRID INCREMENTS---> Y= 3  FEET AND X= 50  FEET
---------------------------------------------------------------------------


COMMENTS                          : 2/5/88 RELEASE
COMPOUND                          : CHLORINE DIOXIDE
STABILITY CLASS                   : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :   234.000
AVERAGE WIND SPEED, MPH     :    15.000
AMBIENT TEMPERATURE, DEG F  :    15.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               900 FT                    SOURCE                        900 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 500                                     1245421
 1000                                  11122222111
 1500                                  11111111111
 2000                                  11111111111
 2500                                  11111111111
 3000                                     11111
 3500
```

LEGEND

```
 1 -  7.704953E-02  TO  .1849189  PPM
 2 -  .1849189  TO  .6163963  PPM
 3 -  .6163963  TO  .9245944  PPM
 4 -  .9245944  TO  1.232793  PPM
 5 -  1.232793  TO  1.540991  PPM
```

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

```
COMMENTS                        : 2/5/88 RELEASE
COMPOUND                        : CHLORINE
STABILITY CLASS                 : D

EFFECTIVE SOURCE HEIGHT, FT :      0.000
EMISSION RATE, LB/HR        :     83.000
AVERAGE WIND SPEED, MPH     :     15.000
AMBIENT TEMPERATURE, DEG F  :     15.000
ATMOSPHERIC PRESSURE, MM HG :    760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               90 FT                     SOURCE                          90 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 50                                     123555321
 100                                 111222333222111
 150                               1111122222222211111
 200                              111111111111111111111
 250                             11111111111111111111111
 300                             11111111111111111111111
 350                             11111111111111111111111
 400                              111111111111111111111
 450                                11111111111111111
 500                                    111111111
 550
```

LEGEND

```
 1 -  1.464097  TO  3.513832  PPM
 2 -  3.513832  TO  11.71277  PPM
 3 -  11.71277  TO  17.56916  PPM
 4 -  17.56916  TO  23.42555  PPM
 5 -  23.42555  TO  29.28193  PPM
```

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

```
COMMENTS                        : 2/5/88 RELEASE
COMPOUND                        : CHLORINE
STABILITY CLASS                 : D

EFFECTIVE SOURCE HEIGHT, FT  :     0.000
EMISSION RATE, LB/HR         :    83.000
AVERAGE WIND SPEED, MPH      :    15.000
AMBIENT TEMPERATURE, DEG F   :    15.000
ATMOSPHERIC PRESSURE, MM HG  :   760.000
```

```
-----------------------------------------------------------------------------
         GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
-----------------------------------------------------------------------------


                90 FT                    SOURCE                              90 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 50                                     *********
 100                                 ***************
 150                               *******************
 200                             ***********************
 250                           ***************************
 300                           ***************************
 350                          *****************************
 400                          *****************************
 450                          *****************************
 500                           ***************************
 550                             ***********************
 600                               *******************
 650                                     *******
 700


-----------------------------------------------------------------------------

 LEGEND

  * - CONCENTRATION OVER -  1  PPM

GRID INCREMENTS---> Y= 3  FEET AND X= 50  FEET
-----------------------------------------------------------------------------


COMMENTS                       : 2/5/88 RELEASE
COMPOUND                       : CHLORINE
STABILITY CLASS                : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :    83.000
AVERAGE WIND SPEED, MPH     :    15.000
AMBIENT TEMPERATURE, DEG F  :    15.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                 9 FT                   SOURCE                           9 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 5                                      *********
 10                                  ***************
 15                                *******************
 20                               *********************
 25                              ***********************
 30                              ***********************
 35                               *********************
 40                                *******************
 45                                   *************
 50
```

LEGEND

* - CONCENTRATION OVER - 30 PPM

GRID INCREMENTS---> Y= .3 FEET AND X= 5 FEET

```
COMMENTS                      : 2/5/88 RELEASE
COMPOUND                      : CHLORINE
STABILITY CLASS               : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :    83.000
AVERAGE WIND SPEED, MPH     :    15.000
AMBIENT TEMPERATURE, DEG F  :    15.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               900 FT                   SOURCE                         900 FT
(FEET)        +----------+----------+----------0----------+----------+----------+
 500                                     1245421
 1000                                  11122222111
 1500                                  11111111111
 2000                                  11111111111
 2500                                  11111111111
 3000                                     11111
 3500
```

LEGEND

```
 1 -  2.28678   TO  5.488271  PPM
 2 -  5.488271  TO  18.29424  PPM
 3 -  18.29424  TO  27.44136  PPM
 4 -  27.44136  TO  36.58848  PPM
 5 -  36.58848  TO  45.7356   PPM
```

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

```
COMMENTS                        : 2/5/88 RELEASE
COMPOUND                        : CHLORINE DIOXIDE
STABILITY CLASS                 : D

EFFECTIVE SOURCE HEIGHT, FT     :    0.000
EMISSION RATE, LB/HR            : 2374.000
AVERAGE WIND SPEED, MPH         :   15.000
AMBIENT TEMPERATURE, DEG F      :   15.000
ATMOSPHERIC PRESSURE, MM HG     :  760.000
```

```
-----------------------------------------------------------------------------
          GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
-----------------------------------------------------------------------------


                90 FT                    SOURCE                               90 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 50                                     123555321
 100                                 111222333222111
 150                               1111122222222211111
 200                              111111111111111111111
 250                             11111111111111111111111
 300                             11111111111111111111111
 350                             11111111111111111111111
 400                              111111111111111111111
 450                                11111111111111111
 500                                    111111111
 550

-----------------------------------------------------------------------------

 LEGEND

 1 -   43.45343  TO  104.2882  PPM
 2 -   104.2882  TO  347.6274  PPM
 3 -   347.6274  TO  521.4412  PPM
 4 -   521.4412  TO  695.2548  PPM
 5 -   695.2548  TO  869.0686  PPM

GRID INCREMENTS---> Y= 3  FEET AND X= 50  FEET
-----------------------------------------------------------------------------


COMMENTS                       : 2/5/88 RELEASE
COMPOUND                       : CHLORINE DIOXIDE
STABILITY CLASS                : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        : 2374.000
AVERAGE WIND SPEED, MPH     :   15.000
AMBIENT TEMPERATURE, DEG F  :   15.000
ATMOSPHERIC PRESSURE, MM HG :  760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
              1800 FT                    SOURCE                        1800 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 1000                                   *********
 2000                                 *************
 3000                               *****************
 4000                             *********************
 5000                           *************************
 6000                          ***************************
 7000                         *****************************
 8000                        *******************************
 9000                       *********************************
 10000                      *********************************
 11000                     ***********************************
 12000                     ***********************************
 13000                     ***********************************
 14000                     ***********************************
 15000                     ***********************************
 16000                     ***********************************
 17000                      *********************************
 18000                      *********************************
 19000                       *******************************
 20000                         ***************************
 21000                          *************************
 22000                             *******************
 23000                                *************
 24000
```

LEGEND

* - CONCENTRATION OVER - .1 PPM

GRID INCREMENTS---> Y= 60 FEET AND X= 1000 FEET

COMMENTS	:	2/5/88 RELEASE
COMPOUND	:	CHLORINE DIOXIDE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	2374.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	15.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                90 FT                    SOURCE                          90 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 50                                    ***********
 100                               *******************
 150                            *************************
 200                          *****************************
 250                       ***********************************
 300                     ***************************************
 350                    *****************************************
 400                  *********************************************
 450                 ***********************************************
 500                *************************************************
 550               ***************************************************
 600              *****************************************************
 650              *****************************************************
 700             *******************************************************
 750             *******************************************************
 800             *******************************************************
 850              *****************************************************
 900              *****************************************************
 950               ***************************************************
 1000               *************************************************
 1050                 *********************************************
 1100                   *****************************************
 1150                     *************************************
 1200                        *******************************
 1250                             *********************
 1300
```

LEGEND

* - CONCENTRATION OVER - 10 PPM

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

COMMENTS	:	2/5/88 RELEASE
COMPOUND	:	CHLORINE DIOXIDE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	2374.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	15.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               900 FT                     SOURCE                       900 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 500                                    1245421
1000                                  11122222111
1500                                  11111111111
2000                                  11111111111
2500                                  11111111111
3000                                     11111
3500
```

LEGEND

1 - .7751369 TO 1.860329 PPM
2 - 1.860329 TO 6.201095 PPM
3 - 6.201095 TO 9.301643 PPM
4 - 9.301643 TO 12.40219 PPM
5 - 12.40219 TO 15.50274 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

COMMENTS	:	2/5/88 RELEASE
COMPOUND	:	CHLORINE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	835.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	15.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                90 FT                    SOURCE                         90 FT
(FEET)        +---------+---------+---------Q---------+---------+---------+
 50                                     123555321
 100                                 111222333222111
 150                               1111122222222211111
 200                              111111111111111111111
 250                             11111111111111111111111
 300                             11111111111111111111111
 350                             11111111111111111111111
 400                              111111111111111111111
 450                                11111111111111111
 500                                    111111111
 550
```

LEGEND

1 - 14.72916 TO 35.34999 PPM
2 - 35.34999 TO 117.8333 PPM
3 - 117.8333 TO 176.75 PPM
4 - 176.75 TO 235.6666 PPM
5 - 235.6666 TO 294.5833 PPM

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

COMMENTS	:	2/5/88 RELEASE
COMPOUND	:	CHLORINE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	835.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	15.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                 900 FT                     SOURCE                      900 FT
(FEET)          +---------+---------+---------0---------+---------+---------+
 500                                       *******
 1000                                     *********
 1500                                    ***********
 2000                                     *********
 2500                                       *****
 3000
```

LEGEND

* - CONCENTRATION OVER - 1 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

```
COMMENTS                       : 2/5/88 RELEASE
COMPOUND                       : CHLORINE
STABILITY CLASS                : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :   835.000
AVERAGE WIND SPEED, MPH     :    15.000
AMBIENT TEMPERATURE, DEG F  :    15.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                 90 FT                        SOURCE                          90 FT
(FEET)     +---------+---------+---------O---------+---------+---------+
 50                                   *******
 100                                ***********
 150                               *************
 200                              ***************
 250                               *************
 300                                  *******
 350
```

LEGEND

```
  * - CONCENTRATION OVER -   30   PPM

GRID INCREMENTS---> Y= 3   FEET AND X= 50   FEET
```

```
COMMENTS                       : 2/5/88 RELEASE
COMPOUND                       : CHLORINE
STABILITY CLASS                : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR        :   835.000
AVERAGE WIND SPEED, MPH     :    15.000
AMBIENT TEMPERATURE, DEG F  :    15.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

APPENDIX V

Credible Worst Case Scenario
Chlorine Dioxide Storage Tank

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               9000 FT                      SOURCE                       9000 FT
(FEET)         +---------+---------+---------0---------+---------+---------+
 5000                                       24542
 10000                                    112222211
 15000                                    111111111
 20000                                   11111111111
 25000                                    111111111
 30000                                    111111111
 35000                                      11111
 40000
```

LEGEND

```
 1 -  .4017669  TO  .9642406  PPM
 2 -  .9642406  TO  3.214136  PPM
 3 -  3.214136  TO  4.821203  PPM
 4 -  4.821203  TO  6.428271  PPM
 5 -  6.428271  TO  8.035338  PPM
```

GRID INCREMENTS---> Y= 300 FEET AND X= 5000 FEET

COMMENTS	:	TANK COLLAPSE
COMPOUND	:	CHLORINE DIOXIDE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	15940.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	77.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               900 FT                     SOURCE                      900 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 500                                     1245421
1000                                   11122222111
1500                                   11111111111
2000                                   11111111111
2500                                   11111111111
3000                                      11111
3500
```

LEGEND

```
1 -  17.36105  TO  41.66652  PPM
2 -  41.66652  TO  138.8884  PPM
3 -  138.8884  TO  208.3326  PPM
4 -  208.3326  TO  277.7768  PPM
5 -  277.7768  TO  347.2211  PPM
```

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

```
COMMENTS                         : TANK COLLAPSE
COMPOUND                         : CHLORINE DIOXIDE
STABILITY CLASS                  : D

EFFECTIVE SOURCE HEIGHT, FT      :     0.000
EMISSION RATE, LB/HR             :15940.000
AVERAGE WIND SPEED, MPH          :    15.000
AMBIENT TEMPERATURE, DEG F       :    77.000
ATMOSPHERIC PRESSURE, MM HG      :   760.000
```

```
------------------------------------------------------------------------------
         GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE
------------------------------------------------------------------------------


                9000 FT                    SOURCE                        9000 FT
(FEET)          +---------+---------+---------O---------+---------+---------+
 5000                                      *******
 10000                                   ***********
 15000                                  *************
 20000                                *****************
 25000                               *******************
 30000                              *********************
 35000                              *********************
 40000                             ***********************
 45000                             ***********************
 50000                             ***********************
 55000                            *************************
 60000                             ***********************
 65000                             ***********************
 70000                             ***********************
 75000                              *********************
 80000                               *******************
 85000                                *****************
 90000                                  *************
 95000                                   *******
 100000


------------------------------------------------------------------------------

 LEGEND

  * - CONCENTRATION OVER -   .1   PPM

GRID INCREMENTS---> Y= 300   FEET AND X= 5000   FEET
------------------------------------------------------------------------------


COMMENTS                      : TANK COLLAPSE
COMPOUND                      : CHLORINE DIOXIDE
STABILITY CLASS               : D

EFFECTIVE SOURCE HEIGHT, FT :     0.000
EMISSION RATE, LB/HR         :15940.000
AVERAGE WIND SPEED, MPH      :    15.000
AMBIENT TEMPERATURE, DEG F   :    77.000
ATMOSPHERIC PRESSURE, MM HG  :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                 900 FT                  SOURCE                  900 FT
(FEET)          +---------+---------+---------0---------+---------+---------+
 500                                       *******
 1000                                    ***********
 1500                                  ***************
 2000                                  ***************
 2500                                 *****************
 3000                                  ***************
 3500                                   *************
 4000                                     *********
 4500
```

LEGEND

* - CONCENTRATION OVER - 10 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

COMMENTS	:	TANK COLLAPSE
COMPOUND	:	CHLORINE DIOXIDE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	15940.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	77.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                900 FT                              SOURCE                                  900 FT
(FEET)        +---------+---------+---------0---------+---------+---------+
 500                                     1245421
 1000                                   11122222111
 1500                                   11111111111
 2000                                   11111111111
 2500                                   11111111111
 3000                                      11111
 3500
```

LEGEND

1 -	5.886323	TO	14.12717	PPM
2 -	14.12717	TO	47.09058	PPM
3 -	47.09058	TO	70.63588	PPM
4 -	70.63588	TO	94.18116	PPM
5 -	94.18116	TO	117.7265	PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

COMMENTS	:	TANK COLLAPSE
COMPOUND	:	CHLORINE
STABILITY CLASS	:	D

EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	5608.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	77.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
                 90 FT                       SOURCE                                 90 FT
(FEET)         +----------+----------+----------O----------+----------+----------+
 50                                         123555321
 100                                     111222333222111
 150                                   1111122222222211111
 200                                  111111111111111111111
 250                                 11111111111111111111111
 300                                 11111111111111111111111
 350                                 11111111111111111111111
 400                                  111111111111111111111
 450                                    11111111111111111
 500                                        111111111
 550
```

LEGEND

```
1 -  111.852   TO  268.4448  PPM
2 -  268.4448  TO  894.8161  PPM
3 -  894.8161  TO  1342.224  PPM
4 -  1342.224  TO  1789.632  PPM
5 -  1789.632  TO  2237.04   PPM
```

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

```
COMMENTS                          : TANK COLLAPSE
COMPOUND                          : CHLORINE
STABILITY CLASS                   : D

EFFECTIVE SOURCE HEIGHT, FT       :    0.000
EMISSION RATE, LB/HR              : 5608.000
AVERAGE WIND SPEED, MPH           :   15.000
AMBIENT TEMPERATURE, DEG F        :   77.000
ATMOSPHERIC PRESSURE, MM HG       :  760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
               900 FT                    SOURCE                        900 FT
(FEET)        +---------+---------+---------O---------+---------+---------+
 500                                    *********
 1000                            ***************
 1500                              *******************
 2000                            ***********************
 2500                           *************************
 3000                          ***************************
 3500                         *****************************
 4000                        *******************************
 4500                        *******************************
 5000                        *******************************
 5500                        *******************************
 6000                        *******************************
 6500                        *******************************
 7000                         *****************************
 7500                          ***************************
 8000                           *************************
 8500                             *********************
 9000                               *****************
 9500                                    *******
 10000
```

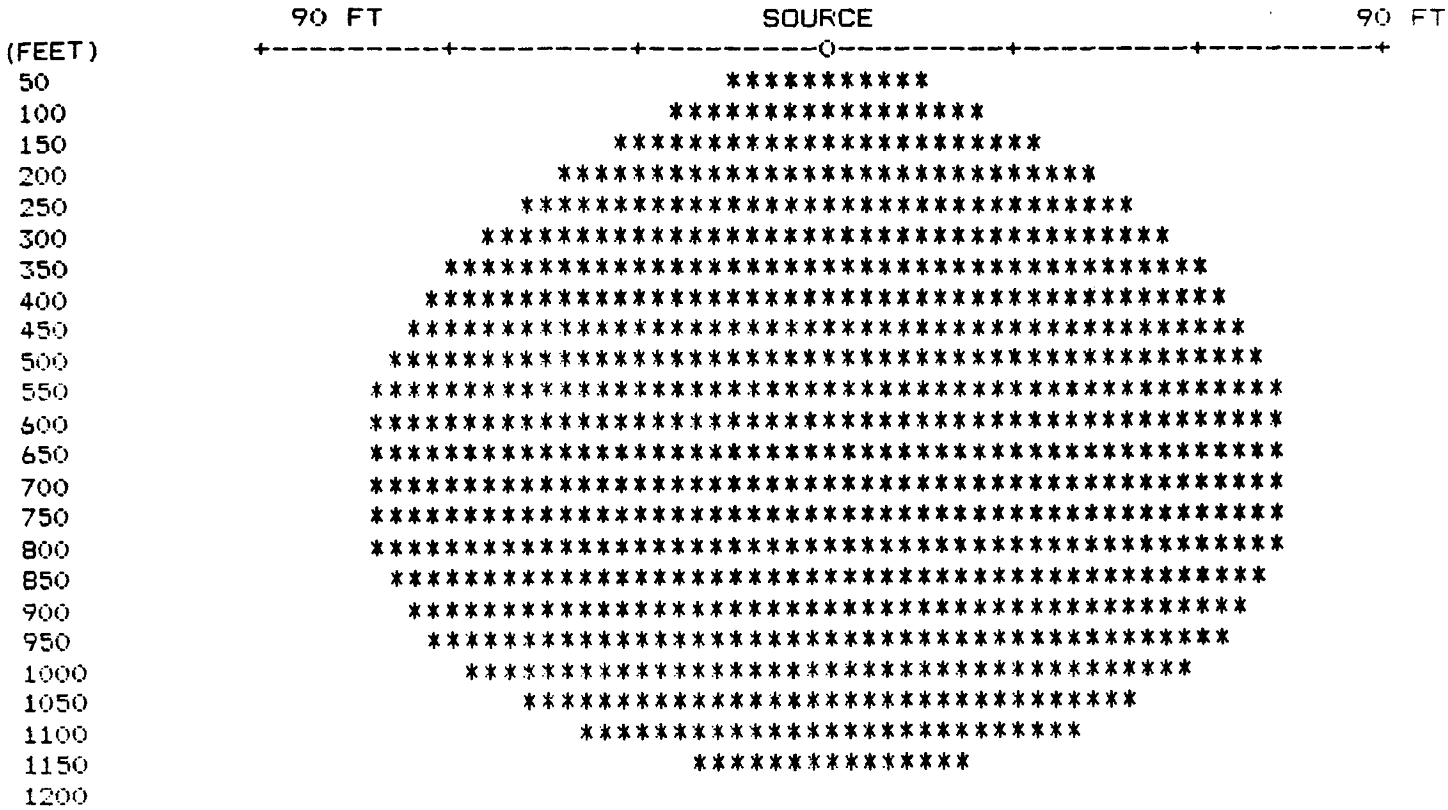
LEGEND

* - CONCENTRATION OVER - 1 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

COMMENTS	:	TANK COLLAPSE
COMPOUND	:	CHLORINE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	5608.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	77.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE



LEGEND

* - CONCENTRATION OVER - 30 PPM

GRID INCREMENTS---> Y= 3 FEET AND X= 50 FEET

COMMENTS	:	TANK COLLAPSE
COMPOUND	:	CHLORINE
STABILITY CLASS	:	D
EFFECTIVE SOURCE HEIGHT, FT	:	0.000
EMISSION RATE, LB/HR	:	5608.000
AVERAGE WIND SPEED, MPH	:	15.000
AMBIENT TEMPERATURE, DEG F	:	77.000
ATMOSPHERIC PRESSURE, MM HG	:	760.000

APPENDIX VI

Credible Worst Case Scenario
Anhydrous Ammonia Storage Tank

GROUND LEVEL CONCENTRATION FROM INSTANTANEOUS (PUFF) RELEASE

```
TRAVEL TIME  DISTANCE      7500 FT               SOURCE               7500 FT
MINUTES      FEET
    0               0      I----+----+----+----+----0----+----+----+----+----I
  3.8            5000                             *****
  7.6           10000                            *******
 11.4           15000                          ***********
 15.2           20000                         *************
 18.9           25000                         *************
 22.7           29999                        ***************
 26.5           35000                       *****************
 30.3           40000                      *******************
 34.1           45000                      *******************
 37.9           50000                      *******************
 41.7           54999                     *********************
 45.5           59999                     *********************
 49.2           64999                     *********************
 53.0           70000                     *********************
 56.8           75000                     *********************
 60.6           80000                     *********************
 64.4           85000                     *********************
 68.2           90000                     *********************
 72.0           95000                      *******************
 75.8          100000                      *******************
 79.5          105000                       *****************
 83.3          109999                        ***************
 87.1          114999                          ***********
 90.9          119999                            *******
 94.7          124999
```

LEGEND

```
* - INDICATES AREA WHERE CONCENTRATION IS OVER  25  PPM
```

GRID INCREMENTS ---> X= 5000 FEET AND Y= 300 FEET

PLOT INTERPRETATION

THE PLOT DEPICTS THE MOVEMENT OF A CROSS SECTION OF THE PUFF. THE PLOT SHOWS TRAVEL DISTANCES AND THE TIME IT TAKES THE CROSS SECTION TO REACH EACH LOCATIO[N]

THE CROSS SECTION IS SHOWN AS A PROFILE LINE (****) WHICH REPRESENTS THE MAXIMUM WIDTH OF THE PUFF WHERE THE SPECIFIED LEVEL OF CONCERN IS EXCEEDED

IT CAN BE ASSUMED THAT THE ACTUAL PUFF, AT A GIVEN TRAVEL TIME AND CORRESPONDING DISTANCE, IS CIRCULAR WITH A RADIUS EQUAL TO THE CROSS SECTION

COMPOUND NAME	:	AMMONIA
COMMENTS	:	TANK COLLAPSE
STABILITY CLASS	:	2

SOURCE STRENGTH, LB	:	68112.00
EFFECTIVE SOURCE HT., FT	:	0.00
AVERAGE WIND SPEED, MPH	:	15.00

```
INITIAL PUFF WIDTH, FT     :    0.00
INITIAL PUFF HEIGHT, FT    :    0.00
AMBIENT TEMPERATURE, DEG F:    77.00
ATMOSPHERIC PRESSURE, MMHG:   760.00
SAMPLING TIME, SECONDS     :    0.00
```

GROUND LEVEL CONCENTRATION FROM INSTANTANEOUS (PUFF) RELEASE

```
TRAVEL TIME   DISTANCE      7500 FT               SOURCE               7500 FT
MINUTES       FEET
    0               0       I----+----+----+----+----O----+----+----+----+----
  3.8            5000                               ***
  7.6           10000                              *****
 11.4           15000                             *******
 15.2           20000                             *******
 18.9           25000                             *******
 22.7           29999                             *******
 26.5           35000                              *****
 30.3           40000
```

LEGEND

* - INDICATES AREA WHERE CONCENTRATION IS OVER 500 PPM

GRID INCREMENTS ---> X= 5000 FEET AND Y= 300 FEET

PLOT INTERPRETATION

THE PLOT DEPICTS THE MOVEMENT OF A CROSS SECTION OF THE PUFF. THE PLOT SHOWS TRAVEL DISTANCES AND THE TIME IT TAKES THE CROSS SECTION TO REACH EACH LOCATION

THE CROSS SECTION IS SHOWN AS A PROFILE LINE (****) WHICH REPRESENTS THE MAXIMUM WIDTH OF THE PUFF WHERE THE SPECIFIED LEVEL OF CONCERN IS EXCEEDED

IT CAN BE ASSUMED THAT THE ACTUAL PUFF, AT A GIVEN TRAVEL TIME AND CORRESPONDING DISTANCE, IS CIRCULAR WITH A RADIUS EQUAL TO THE CROSS SECTION

```
COMPOUND NAME         : AMMONIA
COMMENTS              : TANK COLLAPSE
STABILITY CLASS       : 2

 SOURCE STRENGTH, LB         :68112.00
 EFFECTIVE SOURCE HT., FT    :     0.00
 AVERAGE WIND SPEED, MPH     :    15.00
 ATMOSPHERIC MIX HEIGHT, FT: 5000.00
 INITIAL PUFF WIDTH, FT      :     0.00
 INITIAL PUFF HEIGHT, FT     :     0.00
 AMBIENT TEMPERATURE, DEG F:     77.00
 ATMOSPHERIC PRESSURE, MMHG:    760.00
 SAMPLING TIME, SECONDS      :     0.00
```

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 5280 FT.
3.00	0.00
3.08	0.00
3.17	0.00
3.25	0.01
3.33	0.26
3.42	4.94
3.50	63.55
3.58	551.54
3.67	3231.66
3.75	12783.27
3.83	34136.92
3.92	61542.33
4.00	74901.49
4.08	61542.33
4.17	34136.92
4.25	12783.27
4.33	3231.68
4.42	551.54
4.50	63.55
4.58	4.94
4.67	0.26
4.75	0.01
4.83	0.00
4.92	0.00

COMPOUND NAME : AMMONIA
COMMENTS : TANK COLLAPSE
STABILITY CLASS : 2

SOURCE STRENGTH, LB	:68112.00
EFFECTIVE SOURCE HT., FT	: 0.00
AVERAGE WIND SPEED, MPH	: 15.00
ATMOSPHERIC MIX HEIGHT, FT	: 5000.00
INITIAL PUFF WIDTH, FT	: 0.00
INITIAL PUFF HEIGHT, FT	: 0.00
AMBIENT TEMPERATURE, DEG F	: 77.00
ATMOSPHERIC PRESSURE, MMHG	: 760.00
SAMPLING TIME, SECONDS	: 0.00

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 31680 FT.
19.50	0.00
19.75	0.00
20.00	0.00
20.25	0.00
20.50	0.00
20.75	0.01
21.00	0.06
21.25	0.29
21.50	1.14
21.75	3.95
22.00	12.01
22.25	32.05
22.50	75.03
22.75	154.07
23.00	277.60
23.25	438.82
23.50	608.62
23.75	740.59
24.00	790.65
24.25	740.59
24.50	608.62
24.75	438.83
25.00	277.60
25.25	154.07
25.50	75.03
25.75	32.05
26.00	12.01
26.25	3.95
26.50	1.14
26.75	0.29
27.00	0.06
27.25	0.01
27.50	0.00
27.75	0.00
28.00	0.00
28.25	0.00

COMPOUND NAME : AMMONIA
COMMENTS : TANK COLLAPSE
STABILITY CLASS : 2

SOURCE STRENGTH, LB	:68112.00
EFFECTIVE SOURCE HT., FT	: 0.00
AVERAGE WIND SPEED, MPH	: 15.00
ATMOSPHERIC MIX HEIGHT, FT	: 5000.00
INITIAL PUFF WIDTH, FT	: 0.00
INITIAL PUFF HEIGHT, FT	: 0.00
AMBIENT TEMPERATURE, DEG F	: 77.00
ATMOSPHERIC PRESSURE, MMHG	: 760.00
SAMPLING TIME, SECONDS	: 0.00

APPENDIX VII

Credible Worst Case Scenario
Chlorine Rail Car

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
             9000 FT                    SOURCE                       9000 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 5000                                    24542
 10000                                 112222211
 15000                                 111111111
 20000                                11111111111
 25000                                 111111111
 30000                                 111111111
 35000                                   11111
 40000
```

LEGEND

```
 1 -  4.372267   TO  10.49344  PPM
 2 -  10.49344   TO  34.97814  PPM
 3 -  34.97814   TO  52.4672  PPM
 4 -  52.4672  TO  69.95627  PPM
 5 -  69.95627   TO  87.44534  PPM
```

GRID INCREMENTS---> Y= 300 FEET AND X= 5000 FEET

```
COMMENTS                        : 1 RAIL CAR
COMPOUND                        : CHLORINE
STABILITY CLASS                 : D

EFFECTIVE SOURCE HEIGHT, FT :      0.000
EMISSION RATE, LB/HR           :%180000.000
AVERAGE WIND SPEED, MPH        :    15.000
AMBIENT TEMPERATURE, DEG F   :    77.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
             9000 FT                    SOURCE                        9000 FT
(FEET)       +---------+---------+---------O---------+---------+---------+
 5000                                   *******
 10000                                ***********
 15000                              ***************
 20000                             *****************
 25000                            *******************
 30000                           *********************
 35000                          ***********************
 40000                          ***********************
 45000                         *************************
 50000                         *************************
 55000                         *************************
 60000                         *************************
 65000                         *************************
 70000                         *************************
 75000                          ***********************
 80000                          ***********************
 85000                           *********************
 90000                             *****************
 95000                              ***************
 100000                                 *********
 105000
```

LEGEND

* - CONCENTRATION OVER - 1 PPM

GRID INCREMENTS---> Y= 300 FEET AND X= 5000 FEET

```
COMMENTS                       : 1 RAIL CAR
COMPOUND                       : CHLORINE
STABILITY CLASS                : D

EFFECTIVE SOURCE HEIGHT, FT    :      0.000
EMISSION RATE, LB/HR           :%180000.000
AVERAGE WIND SPEED, MPH        :     15.000
AMBIENT TEMPERATURE, DEG F     :     77.000
ATMOSPHERIC PRESSURE, MM HG    :    760.000
```

GROUND LEVEL CONCENTRATION PLUME FROM POINT SOURCE AIR RELEASE

```
              900 FT                     SOURCE                      900 FT
(FEET)       +---------+---------+---------0---------+---------+---------+
 500                                   *********
 1000                               ***************
 1500                             *******************
 2000                           ***********************
 2500                          *************************
 3000                         ***************************
 3500                        *****************************
 4000                       *******************************
 4500                       *******************************
 5000                      *********************************
 5500                      *********************************
 6000                      *********************************
 6500                      *********************************
 7000                       *******************************
 7500                        *****************************
 8000                         ***************************
 8500                          *************************
 9000                            *********************
 9500                               ***************
 10000                                    ***
 10500
```

LEGEND

* - CONCENTRATION OVER - 30 PPM

GRID INCREMENTS---> Y= 30 FEET AND X= 500 FEET

```
COMMENTS                          : 1 RAIL CAR
COMPOUND                          : CHLORINE
STABILITY CLASS                   : D

EFFECTIVE SOURCE HEIGHT, FT :      0.000
EMISSION RATE, LB/HR             :%180000.000
AVERAGE WIND SPEED, MPH          :    15.000
AMBIENT TEMPERATURE, DEG F       :    77.000
ATMOSPHERIC PRESSURE, MM HG :   760.000
```

GROUND LEVEL CONCENTRATION FROM INSTANTANEOUS (PUFF) RELEASE

```
TRAVEL TIME   DISTANCE    7500 FT                  SOURCE                   7500 FT
MINUTES       FEET
    0             0       I----+----+----+----+----O----+----+----+----+----I
  3.8          5000                              *****
  7.6         10000                             *******
 11.4         15000                            *********
 15.2         20000                           ***********
 18.9         25000                          *************
 22.7         29999                         ***************
 26.5         35000                         ***************
 30.3         40000                         ***************
 34.1         45000                        *****************
 37.9         50000                        *****************
 41.7         54999                        *****************
 45.5         59999                        *****************
 49.2         64999                        *****************
 53.0         70000                         ***************
 56.8         75000                         ***************
 60.6         80000                          *************
 64.4         85000                           ***********
 68.2         90000                            *********
 72.0         95000                              ***
 75.8        100000
```

LEGEND

* - INDICATES AREA WHERE CONCENTRATION IS OVER 30 PPM

GRID INCREMENTS ---> X= 5000 FEET AND Y= 300 FEET

PLOT INTERPRETATION

THE PLOT DEPICTS THE MOVEMENT OF A CROSS SECTION OF THE PUFF. THE PLOT SHOWS TRAVEL DISTANCES AND THE TIME IT TAKES THE CROSS SECTION TO REACH EACH LOCATI[illegible]

THE CROSS SECTION IS SHOWN AS A PROFILE LINE (****) WHICH REPRESENTS THE MAXIMUM WIDTH OF THE PUFF WHERE THE SPECIFIED LEVEL OF CONCERN IS EXCEEDED

IT CAN BE ASSUMED THAT THE ACTUAL PUFF, AT A GIVEN TRAVEL TIME AND CORRESPONDING DISTANCE, IS CIRCULAR WITH A RADIUS EQUAL TO THE CROSS SECTION

```
COMPOUND NAME        : CHLORINE
COMMENTS             : 1 RAIL CAR
STABILITY CLASS      : 2

 SOURCE STRENGTH, LB          :%180000.00
 EFFECTIVE SOURCE HT., FT   :     0.00
 AVERAGE WIND SPEED, MPH    :    15.00
 ATMOSPHERIC MIX HEIGHT, FT:  5000.00
 INITIAL PUFF WIDTH, FT     :     0.00
 INITIAL PUFF HEIGHT, FT    :     0.00
 AMBIENT TEMPERATURE, DEG F:     77.00
 ATMOSPHERIC PRESSURE, MMHG:    760.00
```

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 2640 FT.
1.50	0.00
1.53	0.00
1.57	0.00
1.60	0.03
1.63	0.34
1.67	3.57
1.70	30.33
1.73	205.41
1.77	1110.91
1.80	4797.35
1.83	16541.65
1.87	45542.29
1.90	100117.40
1.93	175736.90
1.97	246306.40
2.00	275642.60
2.03	246306.40
2.07	175736.90
2.10	100117.40
2.13	45542.29
2.17	16541.73
2.20	4797.35
2.23	1110.92
2.27	205.41
2.30	30.33
2.33	3.58
2.37	0.34
2.40	0.03
2.43	0.00
2.47	0.00

COMPOUND NAME : CHLORINE
COMMENTS : 1 RAIL CAR
STABILITY CLASS : 2

SOURCE STRENGTH, LB :%180000.00
EFFECTIVE SOURCE HT., FT : 0.00
AVERAGE WIND SPEED, MPH : 15.00
ATMOSPHERIC MIX HEIGHT, FT: 5000.00
INITIAL PUFF WIDTH, FT : 0.00
INITIAL PUFF HEIGHT, FT : 0.00
AMBIENT TEMPERATURE, DEG F: 77.00
ATMOSPHERIC PRESSURE, MMHG: 760.00
SAMPLING TIME, SECONDS : 0.00

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 5280 FT.
3.00	0.00
3.07	0.00
3.13	0.00
3.20	0.00
3.27	0.01
3.33	0.16
3.40	1.79
3.47	15.18
3.53	100.05
3.60	512.91
3.67	2044.87
3.73	6339.99
3.80	15286.44
3.87	28662.83
3.93	41795.30
4.00	47394.71
4.07	41795.30
4.13	28662.83
4.20	15286.44
4.27	6339.99
4.33	2044.88
4.40	512.91
4.47	100.05
4.53	15.18
4.60	1.79
4.67	0.16
4.73	0.01
4.80	0.00
4.87	0.00
4.93	0.00

COMPOUND NAME : CHLORINE
COMMENTS : 1 RAIL CAR
STABILITY CLASS : 2

SOURCE STRENGTH, LB :%180000.00
EFFECTIVE SOURCE HT., FT : 0.00
AVERAGE WIND SPEED, MPH : 15.00
ATMOSPHERIC MIX HEIGHT, FT: 5000.00
INITIAL PUFF WIDTH, FT : 0.00
INITIAL PUFF HEIGHT, FT : 0.00
AMBIENT TEMPERATURE, DEG F: 77.00
ATMOSPHERIC PRESSURE, MMHG: 760.00
SAMPLING TIME, SECONDS : 0.00

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 95040 FT.
62.00	0.00
62.50	0.00
63.00	0.00
63.50	0.00
64.00	0.00
64.50	0.01
65.00	0.03
65.50	0.09
66.00	0.21
66.50	0.46
67.00	0.96
67.50	1.85
68.00	3.34
68.50	5.62
69.00	8.82
69.50	12.91
70.00	17.64
70.50	22.48
71.00	26.74
71.50	29.67
72.00	30.71
72.50	29.67
73.00	26.74
73.50	22.48
74.00	17.64
74.50	12.91
75.00	8.82
75.50	5.62
76.00	3.34
76.50	1.85
77.00	0.96
77.50	0.46
78.00	0.21
78.50	0.09
79.00	0.03
79.50	0.01
80.00	0.00
80.50	0.00
81.00	0.00
81.50	0.00

COMPOUND NAME : CHLORINE
COMMENTS : 1 RAIL CAR
STABILITY CLASS : 2

SOURCE STRENGTH, LB :%180000.00
EFFECTIVE SOURCE HT., FT : 0.00
AVERAGE WIND SPEED, MPH : 15.00
ATMOSPHERIC MIX HEIGHT, FT: 5000.00
INITIAL PUFF WIDTH, FT : 0.00
INITIAL PUFF HEIGHT, FT : 0.00
AMBIENT TEMPERATURE, DEG F: 77.00
ATMOSPHERIC PRESSURE, MMHG: 760.00
SAMPLING TIME, SECONDS : 0.00

GROUND LEVEL CONCENTRATION FROM INSTANTANEOUS (PUFF) RELEASE

```
TRAVEL TIME   DISTANCE     7500 FT                     SOURCE                7500 FT
MINUTES       FEET
   0              0        I----+----+----+----+----0----+----+----+----+----!
 56.8          5000                                *******
113.6         10000                              ***********
170.5         15000                             *************
227.3         20000                              ***********
284.1         25000                                *******
340.9         29999
```

LEGEND

* - INDICATES AREA WHERE CONCENTRATION IS OVER 30 PPM

GRID INCREMENTS ---> X= 5000 FEET AND Y= 300 FEET

PLOT INTERPRETATION

THE PLOT DEPICTS THE MOVEMENT OF A CROSS SECTION OF THE PUFF. THE PLOT SHOWS TRAVEL DISTANCES AND THE TIME IT TAKES THE CROSS SECTION TO REACH EACH LOCATIO

THE CROSS SECTION IS SHOWN AS A PROFILE LINE (****) WHICH REPRESENTS THE MAXIMUM WIDTH OF THE PUFF WHERE THE SPECIFIED LEVEL OF CONCERN IS EXCEEDED

IT CAN BE ASSUMED THAT THE ACTUAL PUFF, AT A GIVEN TRAVEL TIME AND CORRESPONDING DISTANCE, IS CIRCULAR WITH A RADIUS EQUAL TO THE CROSS SECTION

```
COMPOUND NAME          : CHLORINE
COMMENTS               : 1 RAIL CAR
STABILITY CLASS        : 1

 SOURCE STRENGTH, LB         :%180000.00
 EFFECTIVE SOURCE HT., FT    :      0.00
 AVERAGE WIND SPEED, MPH     :      1.00
 ATMOSPHERIC MIX HEIGHT, FT:   5000.00
 INITIAL PUFF WIDTH, FT      :      0.00
 INITIAL PUFF HEIGHT, FT     :      0.00
 AMBIENT TEMPERATURE, DEG F:      77.00
 ATMOSPHERIC PRESSURE, MMHG:     760.00
 SAMPLING TIME, SECONDS      :      0.00
```

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 2640 FT.
10.00	0.00
11.00	0.00
12.00	0.00
13.00	0.00
14.00	0.00
15.00	0.00
16.00	0.00
17.00	0.01
18.00	0.08
19.00	0.53
20.00	3.01
21.00	14.48
22.00	59.04
23.00	204.03
24.00	597.67
25.00	1483.94
26.00	3122.91
27.00	5570.52
28.00	8422.10
29.00	10792.83
30.00	11723.04
31.00	10792.82
32.00	8422.10
33.00	5570.51
34.00	3122.91
35.00	1483.94
36.00	597.67
37.00	204.03
38.00	59.04
39.00	14.48
40.00	3.01
41.00	0.53
42.00	0.08
43.00	0.01
44.00	0.00
45.00	0.00
46.00	0.00
47.00	0.00
48.00	0.00
49.00	0.00

COMPOUND NAME : CHLORINE
COMMENTS : 1 RAIL CAR
STABILITY CLASS : 1

SOURCE STRENGTH, LB :%180000.00
EFFECTIVE SOURCE HT., FT : 0.00
AVERAGE WIND SPEED, MPH : 1.00
ATMOSPHERIC MIX HEIGHT, FT: 5000.00
INITIAL PUFF WIDTH, FT : 0.00
INITIAL PUFF HEIGHT, FT : 0.00
AMBIENT TEMPERATURE, DEG F: 77.00
ATMOSPHERIC PRESSURE, MMHG: 760.00
SAMPLING TIME, SECONDS : 0.00

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 5280 FT.
40.00	0.19
41.00	0.47
42.00	1.11
43.00	2.49
44.00	5.35
45.00	10.94
46.00	21.36
47.00	39.86
48.00	70.99
49.00	120.75
50.00	196.10
51.00	304.12
52.00	450.33
53.00	636.75
54.00	859.70
55.00	1108.32
56.00	1364.36
57.00	1603.73
58.00	1800.02
59.00	1929.14
60.00	1974.21
61.00	1929.14
62.00	1800.02
63.00	1603.73
64.00	1364.36
65.00	1108.32
66.00	859.70
67.00	636.75
68.00	450.33
69.00	304.12
70.00	196.10
71.00	120.75
72.00	70.99
73.00	39.86
74.00	21.36
75.00	10.94
76.00	5.35
77.00	2.49
78.00	1.11
79.00	0.47

COMPOUND NAME : CHLORINE
COMMENTS : 1 RAIL CAR
STABILITY CLASS : 1

SOURCE STRENGTH, LB :%180000.00
EFFECTIVE SOURCE HT., FT : 0.00
AVERAGE WIND SPEED, MPH : 1.00
ATMOSPHERIC MIX HEIGHT, FT: 5000.00
INITIAL PUFF WIDTH, FT : 0.00
INITIAL PUFF HEIGHT, FT : 0.00
AMBIENT TEMPERATURE, DEG F: 77.00
ATMOSPHERIC PRESSURE, MMHG: 760.00
SAMPLING TIME, SECONDS : 0.00

GROUND LEVEL CONC. AS A FUNCTION OF TIME AT A SPECIFIC DOWNWIND POINT

TIME (MIN) AFTER RELEASE	CONCENTRATION PPM AT 26400 FT.
260.00	4.66
262.00	5.62
264.00	6.71
266.00	7.93
268.00	9.28
270.00	10.76
272.00	12.36
274.00	14.07
276.00	15.85
278.00	17.70
280.00	19.56
282.00	21.42
284.00	23.24
286.00	24.96
288.00	26.56
290.00	28.00
292.00	29.23
294.00	30.22
296.00	30.96
298.00	31.40
300.00	31.55
302.00	31.40
304.00	30.96
306.00	30.22
308.00	29.23
310.00	28.00
312.00	26.56
314.00	24.96
316.00	23.24
318.00	21.42
320.00	19.56
322.00	17.70
324.00	15.85
326.00	14.07
328.00	12.36
330.00	10.76
332.00	9.28
334.00	7.93
336.00	6.71
338.00	5.62

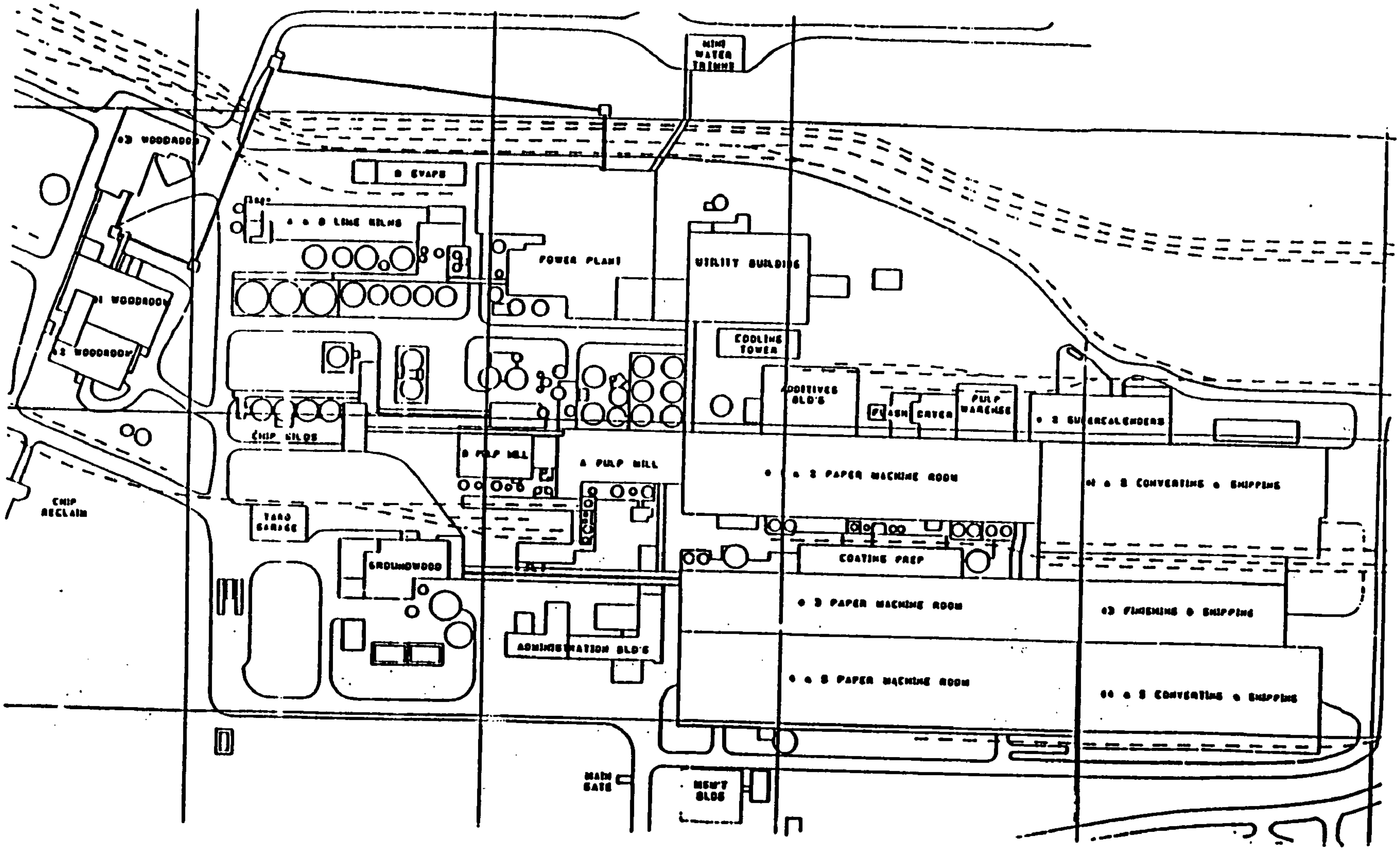
COMPOUND NAME : CHLORINE
COMMENTS : 1 RAIL CAR
STABILITY CLASS : 1

SOURCE STRENGTH, LB :%180000.00
EFFECTIVE SOURCE HT., FT : 0.00
AVERAGE WIND SPEED, MPH : 1.00
ATMOSPHERIC MIX HEIGHT, FT: 5000.00
INITIAL PUFF WIDTH, FT : 0.00
INITIAL PUFF HEIGHT, FT : 0.00
AMBIENT TEMPERATURE, DEG F: 77.00
ATMOSPHERIC PRESSURE, MMHG: 760.00
SAMPLING TIME, SECONDS : 0.00

APPENDIX VIII

Mill Plot Plan

ENVIRONMENTAL PROTECTION AGENCY
MILL AUDIT, INTERNATIONAL PAPER CO., JAY, MAINE



APPENDIX IX

Hazardous Substance Storage

HAZARDOUS SUBSTANCES AND STORAGE

Wood and Fuel

MATERIAL					USAGE		DELIVERY		STORAGE						
AREA	NAME	TYPE	Hazard	UNITS	DAILY	ANNUAL/k	/LOAD	/Mo.	TYPE	DIMEN.	CAPACITY	HAZMAT 1		HAZMAT 2	
WOOD & FUEL															
W&F	Roundwood	Truck	Fuel	Cords											
W&F	Roundwood	Rail	Fuel	Cords											
W&F	Roundwood	Total	Fuel	Cords	2,500										
W&F	Roundwood	Cold deck 1	Fuel	Cords					4" S & F	_x40'					
W&F	Roundwood	Cold deck 2	Fuel	Cords					8' S &F	_x40'					
W&F	Roundwood	Cold deck 3	Fuel	Cords					8' P &H	_x40'					
W&F	Roundwood	Cold deck 4	Fuel	Cords					8" hw	_x40'					
W&F	Chips	Truck	Fuel	Cunits											
W&F	Chips	Rail	Fuel	Cunits											
W&F	Chips	Roundwood	Fuel	Cunits											
W&F	Chips	Total	Fuel	Cunits	3,000	1,050									
W&F	Chips	Pile A	Fuel	Cunits							9,452				
W&F	Chips	Pile B	Fuel	Cunits							2,710				
W&F	Chips	Pile C	Fuel	Cunits							14,000				
W&F	Chips	Pile D	Fuel	Cunits							13,000				
W&F	Chips	Silo 1, HW	Fuel	Cunits							162				
W&F	Chips	Silo 2, SW	Fuel	Cunits							208				
W&F	Chips	Silo 3, SW	Fuel	Cunits							208				
W&F	Chips	Silo 4, SW	Fuel	Cunits							100				
W&F	Bark & Waste	Truck	Fuel	c											
W&F	Bark & Waste	Rail	Fuel												
W&F	Bark & Waste	Total	Fuel												
W&F	Bark & Waste	Bin	Fuel												
W&F	Bark & Waste	Outside 1	Fuel												
W&F	Bark & Waste	Outside 2	Fuel												
W&F	Heavy Oil	Storage	Oil												
W&F	Heavy Oil	Rtn Oil	Oil												

ENVIRONMENTAL PROTECTION AGENCY
MILL AUDIT, INTERNATIONAL PAPER CO., JAY, MAINE

HAZARDOUS SUBSTANCES AND STORAGE

Groundwood and Pulp

	MATERIAL				USAGE		DELIVERY		STORAGE						
AREA	NAME	TYPE	Hazard	UNITS	DAILY	ANNUAL/k	/LOAD	/Mo.	TYPE	DIMEN.	CAPACITY	HAZMAT 1		HAZMAT 2	
*GROUNDWOOD															
GW	V-BRITE	Truck	H2S2O4—)SO2	Bins			10		bins	2,200	22,000	15,400			
GW	V-BRITE	Makeup	H2S2O4—)SO2	4400 #			2		bins	2,200	8,800	6,160			
GW	V-BRITE	Storage	H2S2O4—)SO2	@ 70 %			10		bins	2,200	22,000	15,400			
*PULPING															
A-PULP MILL:		650 ADTPD													
PMA	650/10 Br Stk	SV Kamyr Dig	WL—) H2S+OH	USG	975	GPM			Tank	24'dx47'	159,042	128,205	lb AA	18,934	lb H2S
PMA	650/10 Br Stk	#1 Blow Tank	WBL—) H2S+OH	USG	975	GPM			Tank	24'dx47'	159,042	53,585	lb Na2O	7,547	lb H2S
PMA	650/10 Br Stk	#2 Blow Tank	WBL—) H2S+OH	USG	975	GPM			Tank	24'dx47'	159,042	53,585	lb Na2O	7,547	lb H2S
PMA	Knots	Knot Tnk	WBL—) H2S+OH	USG	790	GPM			Tank	12'dx13'	10,938				
PMA	Br Stk Filt.	#1 Wshr Seal	WBL—) H2S+OH	USG	7,755	GPM			Tank	40'rx50'	469,983	158,349	lb Na2O	22,302	lb H2S
PMA	Br Stk Filt.	#2 Wshr Seal	WBL—) H2S+OH	USG	7,755	GPM			Tank	34'dx30'	203,728	68,644	lb Na2O	9,668	lb H2S
PMA	750/1.1 BS	Pr. Scrn Tank	WBL—) H2S+OH	USG	10,227	GPM							lb Na2O		lb H2S
PMA	Br Stk Dil.	Ubl WW Chest	WBL—) H2S+OH	USG	22,500	GPM							lb Na2O		lb H2S
PMA	Sec. Scr. Dil	WW Tank	WBL—) H2S+OH	USG	550	GPM			Tank	18'dx10'	19,034		lb Na2O		lb H2S
B-PULP MILL		680 ADTPD													
PMA	680/10 Br Stk	SV Kamyr Dig	WL—) H2S+OH	USG	1,020	GPM			Tank	24'dx47'	159,042	138,205	lb AA	18,934	lb H2S
PMB	10% Br Stk	Dif. Washr	WBL—) H2S+OH	USG	233				Tank		371,703	323,004	lb Na2O	44,251	lb H2S
PMB	Br Stk Filt.		WBL—) H2S+OH	USG									lb Na2O		lb H2S
PMB	#4 UBHD	120 ADT @10%	WBL—) H2S+OH	USG							287,770	250,067	lb Na2O	34,259	lb H2S
PMB	Deck. Filt.		WBL—) H2S+OH	USG							81,900	71,170	lb Na2O	9,750	lb H2S
*BLEACHING															
A-Bleach Plant															
BPA	BS HiD		WBL—) H2S+OH	USG									lb Na2O		lb Na2O
BPA	BS Level		WBL—) H2S+OH	USG									lb Na2O		lb Na2O
BPA	C-Twr 10A*	638/3/2120	Cl2 + pH<2	USG					Up Twr	38 min	80,560	1,411	lb CL2		
BPA	Wshr 15A Seal		Cl2 + pH<2	USG											
BPA	E-Twr 20A	606/11/826	Cl.HC + pH>10	USG						107 min	88,382	4,054	lb NaOH		
BPA	Wshr 25A Seal		Cl.HC + pH>10	USG											
BPA	D-Twr 40A	588/10/882	ClO2 + pH<5	USG						130 min	114,660	956	lb ClO2		
BPA	Wshr 45A Seal		ClO2 + pH<5	USG											
B-Bleach Plant															
	BS HiD		WBL—) H2S+OH	USG									lb Na2O		lb H2S
	BS Level	500/3.9/1912	WBL—) H2S+OH	USG							28,530		lb Na2O		lb H2S
	C-Twr 10B1*	500/3.5/2143	Cl2 + pH<2	USG			10	min	Up Flo	11.5dx30'	23,308	650	lb Cl2		
	C-Twr 10B2*	500/3.5/2143	Cl2 + pH<2	USG			10	min	Up Flo	11.5dx30'	23,308	531	lb Cl2		
	Wshr 15B Seal		Cl2 + pH<2	USG											
	E-Twr 20B	482/12/602	Cl.HC + pH>10	USG					Dwn Flo	16dx72	108,284	5,419	lb Cl2		
	H-Twr 30B	460/12.5/554	NaOCl + pH>10	USG						10dx30'	17,624	367	lb Cl2	459	lb NaOH
	Wshr 35B Seal		NaOCl + pH>10	USG											
	D-Twr 40B	460/10.7/641	ClO2 + pH<5	USG			230	min	Up Flo	17.5dx105	188,911	1,686	lb ClO2		
	Wshr 45B Seal		ClO2 + pH<5	USG											

ENVIRONMENTAL PROTECTION AGENCY

MILL AUDIT, INTERNATIONAL PAPER CO., JAY, MAINE

HAZARDOUS SUBSTANCES AND STORAGE

Bleach Chemicals Preparation

MATERIAL AREA NAME	MATERIAL TYPE	Hazard	UNITS	USAGE DAILY	USAGE ANNUAL/k	DELIVERY /LOAD	DELIVERY /Mo.	STORAGE TYPE	DIMEN.	CAPACITY	HAZMAT 1		HAZMAT 2	
*CHEMICALS PREPARATION														
Chlorine														
C12, Liq.*	4-90 T cars	C12, liq + gas	cars/t	120	42,000					360	720,000	lb C12		
C12, Liq.*	3-Vaporizor	C12, liq + gas	Tons											
Caustic Soda														
NaOH, 50%*	1-100 T car	NaOH, 50%	cars							100	100,000	lb NaOH		
NaOH, 50%*	2-tanks	NaOH, 50%						Tank	2-18'dx24	91,365	582,916	lb NaOH		
NaOH, 5%*	2-tanks	NaOH, 5%						TAnk	2-8'dx16'	12,032	5,298	lb NaOH		
Hypochlorite														
C12 Blowdown Tank*		NaOCl, dil	USG					Tank	12'dx16	13,621	3,510	lb C12	3,861	lb NaOH
Hypo Storage*		NaOCl, 40 gpl	USG											
Oxygen														
Oxygen	Liquid	Oxidizer	Tons	2,328										
SVP C1O2 Plant														
H2SO4*	1-23 T Truck	H2SO4, 98%	Lbs							46,000	45,080	lb H2SO4		
H2SO4*	Tank	H2SO4, 98%	Lbs							46,000	45,080	lb H2SO4		
NaCl	Hooper Car	NaCl, Dry	Lbs					RR Car		90,000				
NaCl Prep	Tank	NaCl, Soln	USG					1-Tank	13.5'x30'	32,120				
Brine	Tank	NaCl, Soln	USG					1-Tank	13.5'x28'	29,979				
NaClO4*	4-100 T Cars	NaClO4, dry	Lbs					4-RR Cars		800,000				
R2 Mix*	Tank	NaClO4, sol'n	USG					2-Tanks	13.5'dx22	47,110				
R2 Storage*	Tank	NaClO4, sol'n	USG					2-Tanks	13.5'dx28	59,958				
Methanol	CH3OH	Fire						2-Tanks	13.5'dx28	59,958				
SVP Generator*			USG											
SVP Dump*	Tank		USG											
Salt Cake*	Dissolv. Tank		USG											
C1O2*	Absorber	C1O2, 8gpl	USG											
C1O2*	Tank, FRP	C1O2, 8gpl	USG					2-Tanks	10'dx25	29,374	1,960	lb C1O2		
C1O2*	Tank, FRP	C1O2, 8gpl	USG					1-Tanks	30'dx30	158,619	10,583	lb C1O2		
C12	Absorber	NaOCl, 40 GPL												

HAZARDOUS SUBSTANCES AND STORAGE

Black Liquor

MATERIAL				USAGE		DELIVERY		STORAGE						
AREA NAME	TYPE	Hazard	UNITS	DAILY	ANNUAL/k	/LOAD	/Mo.	TYPE	DIMEN.	CAPACITY	HAZMAT 1		HAZMAT 2	
*BLACK LIQUOR														
A-Line														
WBL/Soap*	Tank	(10% NaOH+H2S	USG					1-Tank	36'dx40'	304,549	105,542	lb Na2O	14,864	lb H2S
WBL*	Tank	(10% NaOH+H2S	USG					1-Tank	40'dx40'	375,987	130,299	lb Na2O	18,351	lb H2S
Soap Collect.*	Tank	(10% NaOH+H2S	USG					1-Tank	12'dx20	16,919	5,863	lb Na2O	826	lb H2S
Evaps.*	6-effect	)10% NaOH+H2S	USG											
Seal Tank*	T14-27-11	(10% NaOH+H2S	USG											
50% SBL*	Tank	)25% NaOH+H2S	USG					1-Tank	30'dx36'	190,343	276,885	lb Na2O	38,996	lb H2S
63% SBL*	Tank	)25% NaOH+H2S	USG					1-Tank	18'dx25	47,586	87,219	lb Na2O	12,284	lb H2S
SBL-Salt Cake*	Mix Tank	)25% NaOH+H2S	USG											
Precip.*	Mix Tank	)25% NaOH+H2S	USG											
Dissolv. Tank*		)15% NaOH+H2S	USG											
B-Line														
WBL/Soap*	Tank	(10% NaOH+H2S	USG					2-Tank	45'dx40'	951,716	329,819	lb Na2O	46,451	lb H2S
Soap Collect.*	Tank	(10% NaOH+H2S	USG					1-Tank	11'dx20	14,217	4,927	lb Na2O	694	lb H2S
Soap Stor*	Tank	(10% NaOH+H2S	USG					1-Tank	10'dx51	29,961	10,383	lb Na2O	1,462	lb H2S
Oxid.Twr.*	Foam Tank	(10% NaOH+H2S	USG											
Evaps.*	6-effect	)10% NaOH+H2S	USG											
Seal Tank*		(10% NaOH+H2S	USG											
52.5% SBL*	Stor.Tank	)25% NaOH+H2S	USG					1-Tank	24'dx26'	87,981	134,382	lb Na2O	19,025	lb H2S
63% SBL Dump*	Tank	)25% NaOH+H2S	USG					1-Tank				lb Na2O		lb H2S
SBL-Salt Cake*	Mix Tank	)25% NaOH+H2S	USG					1-Tank						
Precip.*	Mix Tank	)25% NaOH+H2S	USG					1-Tank						
BL Mix Tank*	66-94	)25% NaOH+H2S	USG					1-Tank						
BL Sump*		)25% NaOH+H2S	USG					1-Tank						
Dissolv. Tank*		)15% NaOH+H2S	USG					1-Tank						

ENVIRONMENTAL PROTECTION AGENCY

MILL AUDIT, INTERNATIONAL PAPER CO., JAY, MAINE

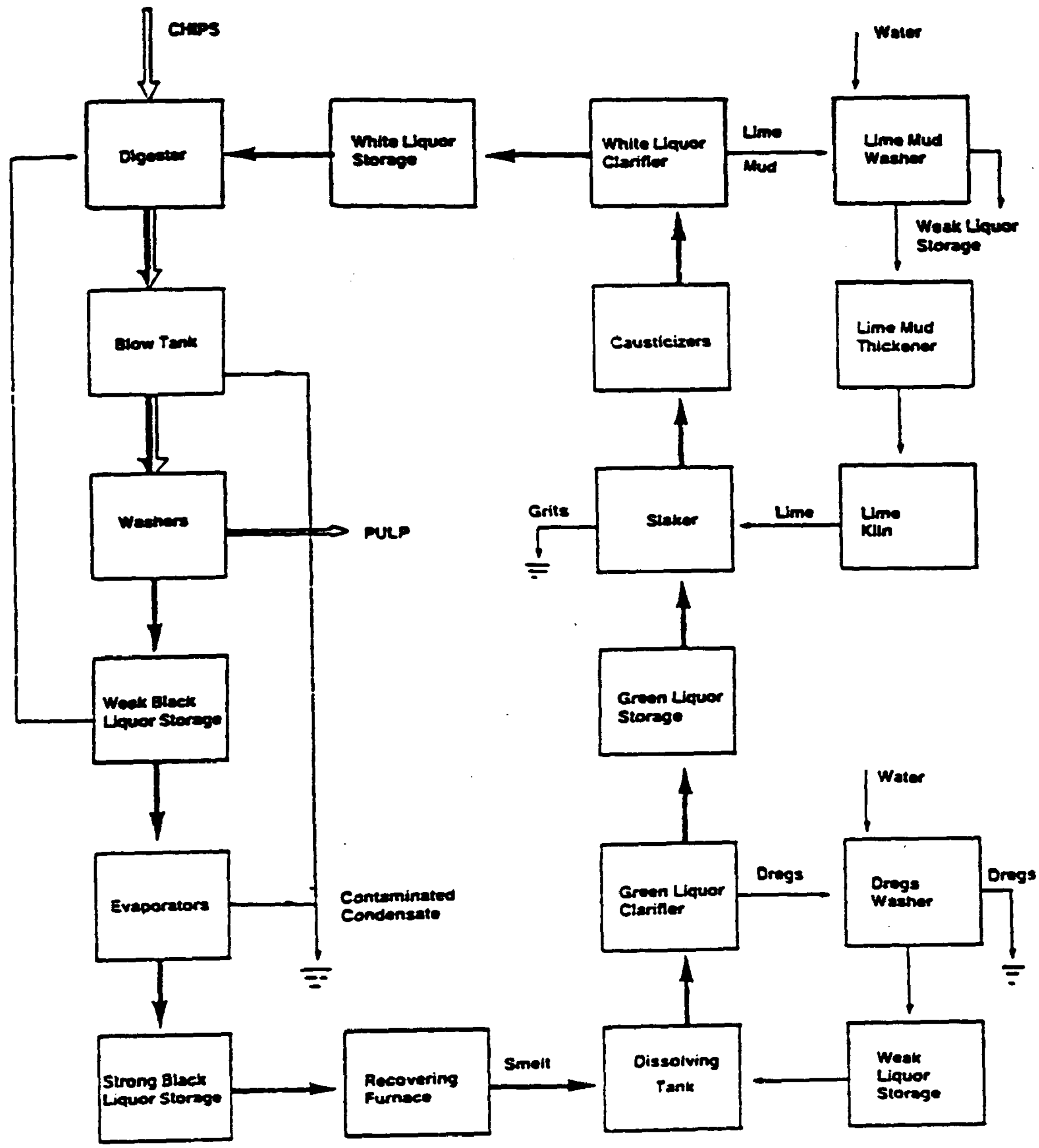
HAZARDOUS SUBSTANCES AND STORAGE

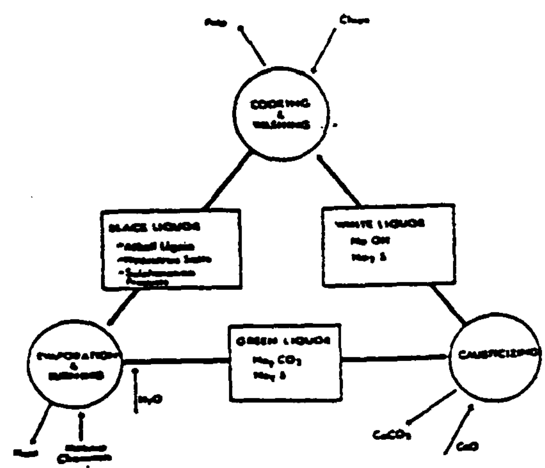
Pulping and Recausticizing Liquors

MATERIAL				USAGE		DELIVERY		STORAGE						
AREA NAME	TYPE	Hazard	UNITS	DAILY	ANNUAL/k	/LOAD	/Mo.	TYPE	DIMEN.	CAPACITY	HAZMAT 1		HAZMAT 2	
*RECAUSTICIZING														
LINE #1														
Green Liquor*	Storage	)15% $NaOH+H_2S$	USG					1-Tank	35'dx24'	172,719	173,181	lb Na_2O	23,726	lb H_2S
Green Liquor*	Clarifier	)15% $NaOH+H_2S$	USG					1-Tank	40'dx26'	244,391	245,045	lb Na_2O	33,571	lb H_2S
Green Liquor	Dregs Wash	)15% $NaOH+H_2S$	USG					1-Tank	20'dx26'	61,098				
White Liquor*	Causticizers	)15% $NaOH+H_2S$	USG					4-Tanks	16'dx10'	60,158	60,319	lb Na_2O	8,264	lb H_2S
White Liquor*	Clarifier	)15% $NaOH+H_2S$	USG					1-Tank	40'dx26'	244,391	245,045	lb Na_2O	33,571	lb H_2S
White Liquor*	Storage	)15% $NaOH+H_2S$	USG											
Spare WL	Clarifier	)15% $NaOH+H_2S$	USG					1-Tank	35'dx24'	172,719	173,181	lb Na_2O	23,726	lb H_2S
Multipurpose	Storage	)15% $NaOH+H_2S$	USG					1-Tank	35'dx24'	172,719				
Lime Mud	Washer	Dil. Caustic						1-Tank	35'dx26'	187,112				
Lime Mud	Storage	Dil. Caustic						1-Tank	20'dx18'	42,299				
Lime Mud	Filter	Dil. Caustic												
Lime	Silo	Dil. Caustic												
Weak Wash	Storage	Dil. Caustic						1-Tank	35'dx24'	172,719				
Lime	Makeup	Cao—)OH												
LINE #2														
Green Liquor*	Storage	)15% $NaOH+H_2S$	USG					1-Tank	40'dx24'	225,592	226,195	lb Na_2O	30,989	lb H_2S
Green Liquor*	Clarifier	)15% $NaOH+H_2S$	USG					1-Tank	60'dx36'	486,433	487,733	lb Na_2O	66,819	lb H_2S
Green Liquor	Dregs Wash	)15% $NaOH+H_2S$	USG					1-Tank						
White Liquor*	Causticizers	)15% $NaOH+H_2S$	USG					3-Tanks	16'dx10'	45,118	15,080	lb Na_2O	2,066	lb H_2S
White Liquor*	Clarifier	)15% $NaOH+H_2S$	USG					2-Tank	60'dx36'	1,522,746	763,409	lb Na_2O	104,587	lb H_2S
White Liquor*	Storage	)15% $NaOH+H_2S$	USG											
Lime Mud	Washer	Dil. Caustic						1-Tank	40'dx26'	244,391				
Lime Mud	Storage	Dil. Caustic						1-Tank	20'dx18'	42,299				
Lime Mud	Filter	Dil. Caustic												
Lime	Silo	Dil. Caustic												
Weak Wash	Storage	Dil. Caustic						1-Tank	35'dx24'	172,719				

APPENDIX X

General Kraft Pulping Schematic


CHIPS
Digester
White Liquor Storage
White Liquor Clarifier
Lime Mud
Lime Mud Washer
Water
Weak Liquor Storage
Blow Tank
Causticizers
Lime Mud Thickener
Washers
PULP
Grits
Slaker
Lime
Lime Kiln
Weak Black Liquor Storage
Green Liquor Storage
Water
Evaporators
Contaminated Condensate
Green Liquor Clarifier
Dregs
Dregs Washer
Dregs
Strong Black Liquor Storage
Recovering Furnace
Smelt
Dissolving Tank
Weak Liquor Storage


BLACK LIQUOR
WHITE LIQUOR
GREEN LIQUOR
H_2O
$CaCO_3$
CaO

APPENDIX XI

Pulp Process Hazardous Substance Summary

ENVIRONMENTAL PROTECTION AGENCY
MILL AUDIT, INTERNATIONAL PAPER CO., JAY, MAINE

	MATERIAL	HAZMAT	CAPACITY	HAZMAT
1.	WOOD & FUEL	----------	----------	----------
	Round Wood	----------	----------	----------
	Chips	----------	----------	----------
	Waste Fuel	----------	----------	----------
2.	GROUNDWOOD			
	V-BRITE	$H_2S_2O_4$-->SO_2	30,800 lb.	21,560 lb.
3.	PULPING			
	A Digester	WBL-->H_2S	160,000 USG	18,900 lb.
	A Blow Tanks	WBL-->H_2S	320,000 USG	15,000 lb.
	A Filtrate	WBL-->H_2S	670,000 USG	32,000 lb.
	B Digester	WBL-->H_2S	160,000 USG	18,900 lb.
	B Washer	WBL-->H_2S	372,000 USG	44,000 lb.
	B Filtrate	WBL-->H_2S	287,000 USG	34,000 lb.
4.	BLEACHING			
	T10A	Cl_2	80,000 USG	1,411 lb.
	T40A	ClO_2	114,000 USG	1,000 lb.
	T10B(2)	Cl_2	46,000 USG	1,200 lb.
	T40B	ClO_2	189,000 USG	1,700 lb.
5.	CHEMICAL PREPARATION			
	Chlorine Cars	Cl_2	360 TON	720,000 lb.
	Caustic Cars	50% NaOH	100 TON	100,000 lb.
	Caustic Tanks	50% NaOH	91,000 USG	583,000 lb
	Caustic Tanks	5% NaOH	12,000 USG	5,000 lb
	Hypochlorite	4% NaOCl	----------	----------
	Oxygen	100% O_2	----------	----------
	Sulfuric Acid	98% K_2SO_4	46,000 lb.	45,000 lb
	Chlorate	Na_2ClO_4	800,000 lb.	800,000 lb
	R2 Solution	Na_2ClO_4	----------	----------
	Methanol	CH_3OH	60,000 USG	396,000 lb.
	Chlorine Dioxide	ClO_2	188,000 USG	12,000 lb.
6.	BLACK lIQUOR			
	Weak BL (15%)	H_2S	1,000,000+USG	50,000 lb.
	50% BL	H_2S	280,000+USG	60,000 lb.
	63% BL	H_2S	100,000+USG	25,000 lb.
7.	LIQUOR PREPARATION			
	Green Liquor	H_2S	1,128,000+USG	155,000 lb.
	White Liquor	H_2S	2,200,000+USG	196,000 lb.
	Lime	CaO	----------	----------

APPENDIX XII

Kraft Pulping Process/Pulping Liquor Terms and Properties

MILL AUDIT, INTERNATIONAL PAPER CO., JAY, MAINE

DESCRIPTION	"A" LINE	"B" LINE
Wood	Softwood	Hardwood & Softwood
Digester	Kamyr SV	Kamyr SV
B.S. Washers	Diff. & Drum	Diffusion
Unbl. HD		
Bleaching	CEHD	CEHD
ClO_2	<-------SVP------>	
Bleached HD		
Recausticizing	2-green & white liquor lines 2-lime kiln lines	
Recovery & Power:		
Evaporators	2-sets with concentrators	
Recov. Boilers	1-B&W: 1-CE/Gotevarkin	
Power Boilers	2-oil, 1-waste fuel (bark)	
Steam	1,400 kLb/Hr high pressure. superheated	

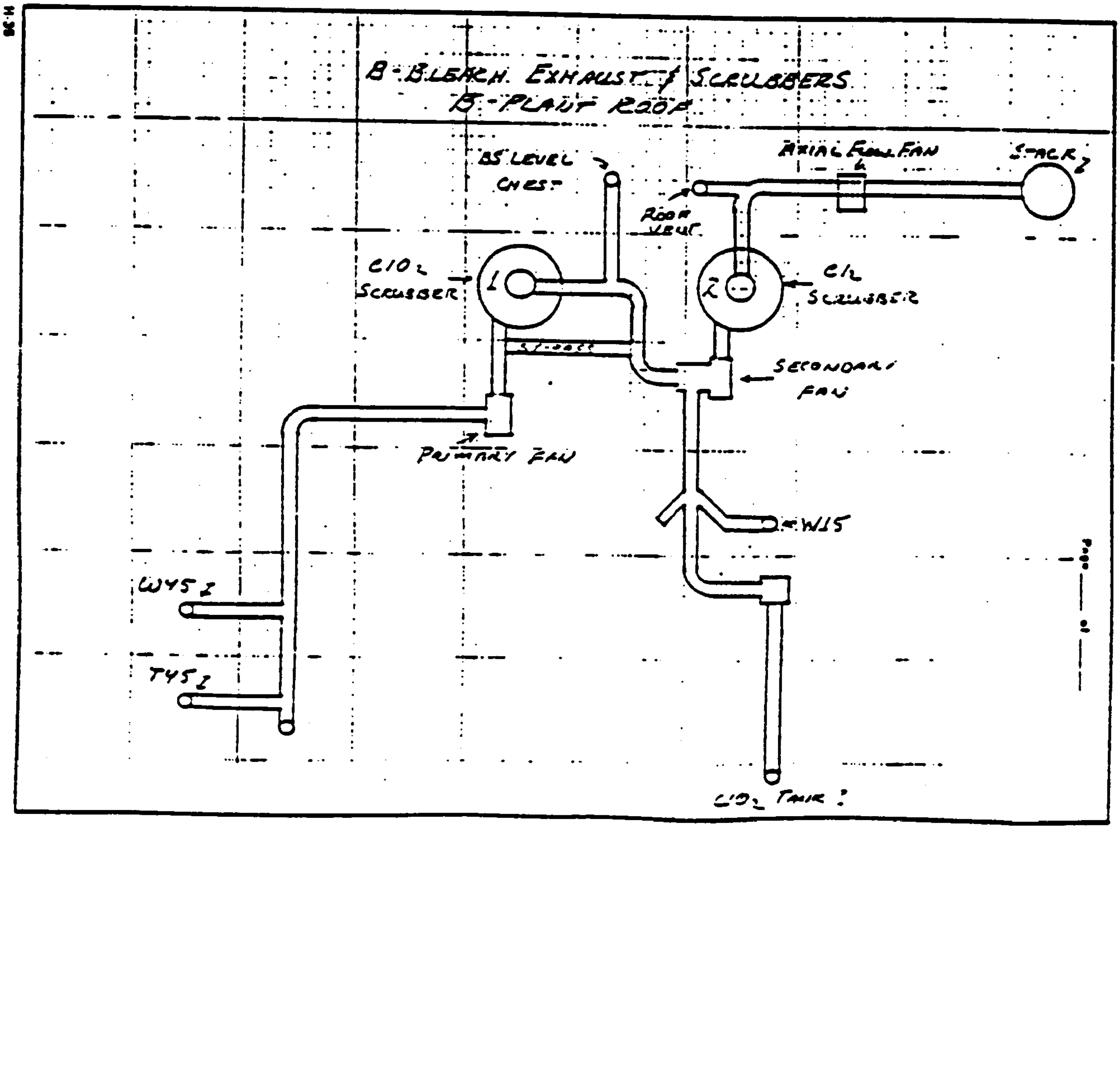
Power & distribution, MW:

Bus, 13,800 vac	"A"	"B"	"C"	TOTAL
Turbogenerator	30	25	30	85
Hydrogenerator	10	10	10	30
Purchased	15	15	0	30
Total	55	50	40	145

	Term	*Definition*	*Units*
(1)	Total Alkali	Total of all "viable" sodium alkali compounds, i.e. $NaOH + Na_2S + Na_2CO_3 + Na_2SO_4 + Na_2S_2O_3 + Na_2SO_3$ (Does *not* include NaCl)	g/L as Na_2O
(2)	Total Titratable Alkali (TTA)	Total of $NaOH + Na_2S + Na_2CO_3$	g/L as Na_2O
(3)	Active Alkali (AA)	Total of $NaOH + Na_2S$	g/L as Na_2O
(4)	Effective Alkali (EA)	Total of $NaOH + 1/2\ Na_2S$	g/L as Na_2O
(5)	Activity	Ratio of AA to TTA	expressed as %
(6)	Causticity	Ratio of NaOH to $NaOH + Na_2CO_3$	% (on Na_2O basis)
(7)	Sulfidity	Ratio of Na_2S to AA (or to TTA) NB: The basis of sulfidity must be defined in each case.	% (on Na_2O basis)
(8)	Causticizing Efficiency (White Liquor)	Same as causticity. (However, the concentration of NaOH in the green liquor should be subtracted so that the value of NaOH represents only the portion produced by the causticizing reaction.)	% (on Na_2O basis)
(9)	Residual Alkali (Black Liquor)	Alkali concentration determined by acid titration.	g/L as Na_2O
(10)	Reduction Efficiency (Green Liquor)	Ratio of Na_2S to all soda sulfur compounds (sometimes simplified as ratio of Na_2S to $Na_2S + Na_2SO_4$)	% (on Na_2O basis)

APPENDIX XIII

Bleaching Vapor Collection


B-BLEACH EXHAUST & SCRUBBERS
B-PLANT ROOF
BS LEVEL CHEST
AXIAL FLOW FAN
STACK
ROOF VENT
ClO2 SCRUBBER
Cl2 SCRUBBER
SECONDARY FAN
PRIMARY FAN
W15
W45
T45
ClO2 TANK

APPENDIX XIV

Environmental Response Team Report

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
EDISON, NEW JERSEY 08837

June 22, 1988

MEMORANDUM

SUBJECT: International Paper Company Safety Audit comments

FROM: Vickie L. Santoro
Environmental Response Team

TO: Steve Novick
US EPA Region I

This past April the USEPA Environmental Response Team took part in an extensive safety audit conducted by the Environmental Protection Agency, Region I, at the International Paper Company in Jay, Maine. The audit was performed due to several reports of hazardous substance releases during the past year at the mill. During the audit, several documents were requested from I.P., some that were not available at that time. After the on-site audit had been completed, I brought the documents dealing with the mill's safety program, training program, and emergency response program back with me to further evaluate them. I had also requested additional safety training information in the form of a chart depicting all the training courses, what the training consisted of, who was required to take the training and how often. Although I did receive some additional information from the mill, it was not the information I had requested earlier. My overall comments on the audit, the documents I brought back with me and that I received in the mail, and some general recommendations for the mill are contained in this report.

The mill's structured safety program appears to be in its initial phases. It was initiated only six weeks prior to the audit and it is currently being implemented. Overall, the mill has made good progress in the development of a safety program. I suggest, however, they would benefit by better organization of all the program elements. For example: the safety program has been split between an Environmental section and the Human Resources section; the duties of each apparently overlap, and the mill uses more than one contingency/emergency response plan. When all plans are looked at together most of the bases are covered, but neither of the plans is complete by themselves. I recommend that it would be less complicated and confusing for everyone if all aspects of safety and health: policies, procedures, records, training, etc., could be handled in one place in one safety and health plan for the entire mill.

I observed that International Paper Company has been training their employees in on the job safety for many years, but a formal, written training program, is still in its early stages. Some training courses have not been completely developed, and employee training records appear to be sporadic. Missing from the set of documents I reviewed is a written Hazardous Communication Program, and the MSDSs that were provided do not fulfill OSHA's hazard communication requirements. It is difficult to make recommendations in this area without additional information, such as course content, frequency of refresher training, who is required to be trained, etc. The information that was given to us on training at the mill, which included a general training manual, a safety practices guide, the International Paper Safety Policy Manual, the Pulp Mill Safety Manual-including mill "do's and don't's", and sundry other unrelated training documents, all seemed to be fairly basic, and no explanation was given as to where each fit in with the other in the overall safety program at I.P. Therefore, I recommend a more complete written training program and record keeping procedure to ensure that all employees receive the required training be implemented. All training should be included in this program, and it should be part of the overall safety and health program and the mill's safety and health plan.

In the area of emergency preparedness and community right to know, the mill is working very diligently towards community planning with both of the counties on its borders. Despite some in house difficulties, plans seem to be progressing well. The mill has had funds approved for installation of the SAFER system, which they plan on using for demonstration and planning exercises with the communities. International Paper Company also has a plan for developing a HAZMAT response team which will be available to the bordering communities for emergency response.

International Paper Company has made plans for a solid HAZMAT team. The documents should be more complete and detailed, but the overall organization and management of the team is good. I suggest that 6 to 8 individuals may not be enough for a team with this responsibility. The fire brigade will be called in to assist as a supplement to the team; however, in acting as a support organization, the fire brigade is an extension of the HAZMAT team, and as such may require additional training and medical monitoring.

The following areas relative to the HAZMAT team should be improved; explanations of exact training, risk evaluations, air monitoring, and contingency planning. The who, what, and when's need to be identified. The actual location for equipment storage should be identified in the plan, as well as maintenance procedures. The equipment list is extensive, and it emphasizes spill response kits or repair kits, rather than protective gear. The plan only calls for 4 SCBA units. My site observations revealed several more units around the mill. I recommend that more be made available to the HAZMAT team, especially if they will be expected to respond to emergencies off-site. In addition, different types of protective suits should be made available. ACGIH recommends the following suit materials for the contaminants on-site:

Contaminant	Suit Materials
Ammonia Chlorine/ Chlorine Dioxide	Butyl, Neoprene, Natural Rubber, Saranex
H2S	Butyl, Neoprene, PVC
NaOH	Natural Rubber, Neoprene Nitrile, saranex
Sulfuric Acid	Natural Rubber, Neoprene Nitrile, PVC, Saranex
Phosphoric Acid	Butyl, Neoprene, PVC

Another reference for the selection of chemical protective clothing is the USEPA Guidelines for the Selection of Chemical Protective Clothing, February, 1987.

The Respiratory Protection Program defined by International Paper meets the requirements prescribed by OSHA 1910.134. However, there are some issues which I recommend be included in the program. I.P. depends upon the employee to maintain and clean their respirator, however, I did not observe this happening at the plant. The respiratory program should address the following questions: Are there any periodic inspections? Are personnel fully capable and trained in the maintenance of their equipment? Is there a system for proficiency testing? Is there any refresher training in the event long periods of time elapse between use? Who does the training? Is there any monitoring of the work area while respirators are being worn? Is there a periodic review of airborne levels of contaminants? What monitoring is performed during emergencies? I suggest referring to OSHA 29 CFR 1910.134 for the requirements.

I would also recommend that a lot more attention be focused on dermal protection during emergencies and accident mitigation. Along with additional dermal protection for hands, feet, body, and limbs, I recommend a more detailed decontamination plan be instituted and followed for PPE and other equipment-especially after accident mitigation.

The HAZMAT team plan included plans for a medical monitoring program, but I did not find any other written program for the other mill employees. This information could be missing from the documents I received, and without it there is no indication that the safety plan contains OSHA 1910 guidelines. As another facet of a medical monitoring program, I would suggest the mill have, both posted and written in their plan-which is a sub-part of the overall mill safety and health plan, symptoms of heat and cold stress. This is especially true in the dryer building and during the extremely cold months of winter. For more information and additional assistance in developing a medical monitoring program, I recommend consulting with OSHA.

The mill's monitoring program for airborne contaminants, and the alarm system, augmented as it will be upon completion, seem to be technically sound and well planned. I was pleased to learn that the mill is investigating perimeter monitors. On the other hand, there did appear to be some problems during the simulation exercise with alarms that could not be heard, and some areas were identified that could and should have additional alarms/warning devices considered. If the alarm system malfunctions, it should become the highest priority to get it back in operation again.

Finally, I cannot recommend strongly enough that the mill develop some way of performing pre-emergency risk analysis. In the prevention of accidents, "prevention" is the operative word. As you know, risk analysis is important and written procedures are a necessity. My on-site visit did not reveal such documents, which leaves me with the impression of a "reactionary" approach-wait until something happens, then investigate it, then make changes if necessary. Even the accident investigation procedures did not appear to be consistent mill-wide and were not written down and included in the mill's safety and health plan. Some questions that arise are: Who reviews the results? Is there a formal report? Are records kept in a central location? Who authorizes capital/procedural changes as a result of the investigation? Many unanswered questions that could be answered in a written policy/procedure.

There was reference to risk analysis programs in the emergency preparedness plan, but no follow up report or survey was presented. The only documents presented by the mill as risk analysis programs were various industrial hygiene surveys performed by outside companies-usually on a piece of equipment purchased from that company, and they too raised some questions: Did I.P. follow up on the recommendations? Were corrective actions taken to mitigate the leaks and prevent further failures? Here again, the reference to present leaks and failures indicates a reactionary approach. Upper management have apparently been introduced to survey/audit functions through the DuPont training seminar, but a follow-up or action plan is not evident. A more rigorous, periodic review of plant conditions and potential risks is necessary and highly recommended.

In conclusion, International Paper Company has a strong beginning in putting together and implementing their safety and health program. There are particular strengths in the upgraded plans for alarms and air monitoring, the plans for working with the community, the development of their HAZMAT team, and possibly their training program, although it's difficult to tell by the information presented. My strongest recommendations are that the entire safety and health program be organized more completely and in one department or unit, and better records should be kept. I believe that the information given to us in the several contingency/ emergency/safety plans can be consolidated. I also suggest investigation into protection from dermal exposure, expanded decontamination procedures, and most importantly, International Paper Company should become a preventive mill verses a reactionary mill by developing procedures for pre-emergency risk/hazard analysis.

Some additional general comments:

1) The evacuation procedures would be enhanced if maps accompanied them. Also, a thorough explanation of the entire plant evacuation process would assist in evaluating an integrated egress from individual areas.

2) Pictures and diagrams would enhance the respiratory protection program.

3) A wider selection of personal gas detectors in the form of real time monitors for the HAZMAT team would be nice.

4) The vessel entry procedure needs supplemental information such as specific test requirements prior to entry, and is the instrument calibrated and/or working properly?

5) How does I.P. ensure subcontractor personnel have adequate training, medical monitoring, etc.?

6) Are employees who are potentially exposed to lead compounds enrolled in a blood monitoring program?

cc: Ray DiNardo, Region I
Ellen Gilley, TAT
Rod Turpin, ERT