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TECHNICAL REPORT

FIRE PROTECTION REVIEW
REVISIT NO. 2
PORTSMOUTH GASEOUS DIFFUSION PLANT
PIKETON, OHIO

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Prepared for:
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Washington, D.C. 20545
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June 1990

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Factory Mutual Research Corp., Norwood, MA (USA)

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PURPOSE

A fire protection survey was conducted for the Department of Energy at the Portsmouth Gaseous Diffusion Plant, Piketon, Ohio, from January 22-26 and March 5-9, 1990. The purpose of the survey was to review the facility fire protection program and to make recommendations or to identify areas according to the following criteria established by the U. S. Department of Energy:

1. Recommendations which would be made as the result of an improved risk or Highly Protected Risk (HPR) fire inspection of an industrial insured facility.
2. Identification of areas where provision of automatic protection would limit a fire or explosion loss to $1 million.
3. Identification of areas where loss potentials exceed $50 million assuming a failure of automatic protection systems and subsequent reliance only on separation, fire walls, or value limitations.
4. Evaluation of adequacy of compliance with recommendations made in prior surveys.

In private industry, the effect of insured losses on continuity of operations is referred to as Business Interruption and is usually expressed in monetary terms to cover continuing expense and loss of profit until such time as repairs are made and production is resumed. Loss of use of a facility of this type does not lend itself to expression in monetary terms. Surveys of other facilities resulted in a classification system for buildings which provide an indication of the importance of the building to the fulfillment of the mission of the facility. Recommendations in this report reflect to some degree the relative importance of the facility and the time to restore it to useful condition in the event a loss were to occur. The following classification system was used:

Critical

The loss of a critical facility would cause shutdown or serious interruption to several facilities housing vital, expensive, and/or hazardous operations.

Vital

The loss of a vital facility would result in interruption of a major program. The equipment is usually specialized and expensive and would require many months or years to replace. The loss of this type of a facility would not significantly affect other programs. The fact that some of these facilities are provided backup from another facility permits them to be classified as vital rather than critical.

Important

The loss of this facility would not seriously impact other programs. It typically houses people and equipment or services involved in support activities.

CONCLUSIONS

Management at the Gaseous Diffusion Plant has excellent interest in fire protection as demonstrated by completion of recommendations between visits during the survey.

There are three buildings where a fire with protection out of service could be expected to exceed $50,000,000. A fire in Process Buildings X-326, X-330, and X-333 could result in losses of $325 million, $331 million, and $303 million respectively.

There are 4 recommendations covering areas which could result in a loss of $1,000,000 or more, or which would have major programmatic impact. A fire in X-3002 could result in a loss of $60 million. The building is being used as a warehouse. The high ceiling in the building presents a condition where the existing sprinkler system would not effectively control a fire in polyurethane storage. The high heat release rate associated with polyurethane would result in fire spread and severe building damage.

There are 27 additional recommendations that would be made during a Highly Protected Risk inspection.

The large loss expectancies with protection out of service in the Process buildings results from lack of physical separation and cannot be economically reduced. The loss expectancy in Building X-3002 can be substantially reduced by limitation of pile area, increased aisle spacing, protection for exposed steel and smoke detection to improve manual response.

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I

INTRODUCTION

This report summarizes findings of a fire protection review conducted during January 22-26 and March 5-9, 1990, at the Portsmouth Gaseous Diffusion Plant, Portsmouth, Ohio. This review was conducted in accordance with DOE Contract No. DE-AC01- 88EH79072. Factory Mutual personnel taking part in this review were L. J. Mattern, D. R. Hertzer, and R. E. Voss.

The visit included 1) tour of the facility, 2) water and fire pump tests, 3) a review of records of testing and inspection of fire protection equipment, and 4) an unannounced fire drill to assess fire department preparedness.

All recommendations are contained in Sections II and III. Recommendations involving loss potentials of $1 million or more are repeated in Appendix B.

II

OVERALL REVIEW OF FIRE PROTECTION

2.1 WATER SUPPLIES

Water for this facility is drawn from three separate well fields. Water is used for process cooling, fire protection and domestic water needs.

The largest water consuming operation is process cooling which uses approximately 80% of the treated water. Raw water is pumped from the well fields through two mains to the water treatment facility located northeast of the process area. All of the well fields are supplied by a major underground aquifer known as the Tayes River. Well field X-608 is located approximately four miles north of facility. This field has a total of fifteen 1000 gpm pumps. Approximately 3.8 miles of 48 in. reinforced concrete pipe transports water to the water treatment Building X-611. All electric power for the pumps is fed from the plant switchyard X-530. An independent backup power supply is provided by a local utility, Columbus Southern Power Company.

A river water inlet is provided near well field X-608 which is supplied by the Scioto River. The inlet is not normally used since the river water requires more treatment. The inlet has four 5,600 gpm river pumps which can be used to lift water to the water treatment facility. Water from this pumphouse is transported to the water treatment facility through the same 48 in. main used by field X-608. A fifth 5600 gpm pump has been converted for use as a sump pump for the inlet pump room.

Well field X-605-G is also located north of the facility. This field has three 1000 gpm and one 500 gpm pump. Water from this field is transported to the water treatment facility through the same 48 in. main used by field X-608. Power is supplied from the X-530 switchyard. A small manually operated diesel generator is provided which can support one or two well pumps.

Well field X-6609 provides the final source. It is located approximately three miles west of the facility on the bank of the Scioto River. This field has twelve 500 gpm pumps. Approximately 19,000 ft of 30 in. ductile iron pipe transports water to the water treatment facility. This 30 in. main is independent from the 48 in. main of well fields X-608 and X-605G. Power to X-6609 is supplied from the X-530 switchyard.

All three well fields are operated by a control room located in water treatment facility X-611. Normally 25% of the wells are out-of-service for normal maintenance or repair. Most of the pumps are submersible types which are not susceptible to impairments caused by flooding. Reportedly the river water pumps are protected from 100 yr flood levels.

At the treatment plant, water passes through softener and floculator units and is distributed to settling basins. The basins have a total capacity of 10.0 million gallons. From the settling basins the water can be drawn into sanitary filtering systems or directly into process "make-up water" systems or to supply the high pressure fire water system. Two basins with a total capacity of 2 1/2 million gallons contain settled water.

Building X-611 contains control equipment, lime storage hoppers, chlorination equipment and a small maintenance area. Construction and occupancy is noncombustible . Filtering and sanitary pumping equipment is located in Building X-611-C which has noncombustible construction. Electric pumps and combination diesel/electric pumps transport the treated water for domestic use. Pumps for the sanitary water system in this building have a total capacity of approximately 7000 gpm at 85 psi. Adequate sprinkler protection is provided above the pumping equipment

Two completely separate electric power supply feeds are provided for the water treatment facility. One supply is from switchyard X-533; the other is from X-530. One operator is present at the water treatment facility at all times. Water usage at this plant is normally 12.0 mgd (million gallons per day) with a peak demand of 18 mgd. Of this amount 2 1/2 to 3 mgd is used for domestic purposes. Total water treatment capacity is approximately 40 mgd.

2.1.1 Sanitary Water System

Recommendations

None.

General Description

The sanitary water system provides domestic water throughout the plant, as well as part of the fire protection water for the switchyards and other support buildings. Fire protection systems which are supplied from the sanitary water system include water spray protection systems for switchyards, hydrant protection for the main process buildings, and hydrant and sprinkler protection for support buildings.

Domestic water use varies between 2.5 and 3.0 mgd. Water is treated with sand filters at Building X-611-C. Treated water is stored in a 2.0 million gallon concrete tank located at X-6644 and in a 250,000 gal clear well at X-611-C which are adequately separated. The total pumping capacity into the system is 8,500 gpm of which 4,900 gpm is available from combination diesel/electric or diesel pumps in the event of electric power loss. The sanitary piping system is well gridded and consists of mostly 8 to 24 in. mains. Piping is mostly cast iron, except ductile iron in Gaseous Centrifuge Enrichment Plant (GCEP). A 250,000 gal elevated storage tank is maintained with a head pressure of 85 psi. The level in the elevated tower is monitored and controlled at Building X-611.

2.1.2 High Pressure Fire Water System

Recommendations

90-1 The 4125 gpm manual start diesel pump in Building X- 640 that is used for fire service should be replaced with an automatic starting fire pump rated at 5000 gpm at 125 psi. The pump, driver and controller should be approved.

Reason: This will provide further reliability to the system.

General Description

This system provides water for sprinkler systems in process buildings and cooling towers as well as hydrant and sprinkler protection for GCEP areas. The system is fed by a 300,000 gal elevated storage tank located near the center of the facility and six fire pumps. Piping of the high pressure water

system is well looped around the main process buildings. Pipe size varies from 12 to 30 in., most of which is 18 in.

Three of the fire pumps and a 200 gpm jockey pump are located in Building X-640. This building is a concrete block building with a steel deck roof. Sprinkler protection is provided throughout. The centrifugal pumps draw water in a manifolded arrangement from the settled water basin through a single main. This main also supplies makeup water for the cooling towers. Two of the three fire pumps are electric and the last is diesel driven. Each is rated at 4,125 gpm at 125 psi. The pumps are mill use grade pumps since this was the only type available for this capacity at time of purchase. When the diesel is operated, the throttle must be manually raised to rated capacity. The diesel driver lacks dual batteries typical on current fire pump installations. Reportedly, there are plans to replace this with an approved fire pump. An immediate supply of settled water is available from two settled water basins for use as a suction supply.

The remaining three fire pumps are located in Building X-6644 which is a noncombustible insulated metal panel building. Sprinkler protection is provided throughout. The centrifugal pumps draw and discharge water in a manifolded arrangement. Two of the three pumps are electric driven; the other is diesel driven. Each is rated at 4,000 gpm at 127 psi. The pumps take suction from two above ground 2.0 million gallon concrete tanks. Water in these tanks is supplied from the sanitary water system. The pumps are controlled by a float type level indicator located in the elevated 300,000 gal storage tank. Electric pumps in alternating pump houses are started when the tank level reaches 75%, 65%, 55% and 45% levels. Similarly, pumps shut off in descending order at 90%, 80%, 70% and 60% levels. Power supplies for each high pressure system pumphouse are supplied from separate switch yards. Further, each electric pump is on a separate buss, feeder and transformer.

The high pressure system fire pumps were tested. Overall performance of each pump was satisfactory (see Appendix D). Minor problems were observed with electric fire pump No. 1 in Building X-6644. After approximately 30 minutes of operation, the outer set of bearings and packing seal was excessively warm. Also during the test, grease leaked from the bearing end cap.

While testing the manual starting diesel fire pump in Building X-640, an overheating problem was observed. After approximately 20 minutes of operation the pump overheated. The gage indicated maximum temperature and water vapor was visible coming from the drain. Attempts to increase the flow of cooling water through the main heat exchanger were unsuccessful. Following the test, the driver oil and water heat exchangers were disassembled and were thoroughly flushed and cleaned. After reassembly, a four-hour test was conducted with satisfactory results. Short test cycles normally used would not detect this problem.

2.1.3 Process Cooling Water

Recommendations

90-2 Provide metal doors with self-closing hardware for the opening between the switchgear rooms and the pumphouses. Doors should be normally closed.

Reason: This will limit the spread of heat and smoke and reduce nonthermal damage to uninvolved equipment. (Loss expectancy = $250,000.)

90-3 Automatic fire detection systems connected to the plant alarm system should be provided in the switchgear rooms of X-626-1, X-630-1, and X-633-1 pumphouses.

Reason This will provide prompt notification of a fire or electrical malfunction.

General Description

Cooling water is used to maintain proper temperature for production equipment in Process Buildings X-333, X-330, and X-326. Each building has a separate system to provide cooling. Cooling water is circulated into each process building where it is passed through heat exchangers and then is recirculated to each cooling tower. Settled water from the water treatment facility is used as make-up water. Building X-633 is the pumphouse for Building X-333. Building construction over the pumping area is mostly steel deck on steel beams. Walls are mostly cement asbestos (CASB) on steel frame. An attached reinforced concrete section of the building is occupied by electric switchgear and motor controls for the cooling towers and circulation

pumps. Sprinkler protection is provided on a wet pipe, ordinary hazard pipe schedule system below the steel deck portion of the building which houses the pumps. A series of transformers which provide power to the pumps are located along the exterior reinforced concrete wall section of the building. A 12 in. concrete block wall is provided between each transformer. Power is supplied from the X-533 switchyard.

A total of four large wood framed cooling towers serve Building X-633. Exterior panels of the tower are CASB and the fill is combustible. Sprinkler protection on deluge systems are provided throughout each tower including above the electric motors on the fan deck. Sprinkler design criteria for a typical tower is 0.50 gpm/ft^2 over the fill and 0.30 gpm/ft^2 under the combustible deck.

Building X-630 provides cooling water to Building X-330. The building has similar occupancy, construction and protection as Building X-633, although on a slightly smaller scale. Two separate cooling towers supply Building X-630. They have similar construction and protection as the X-633 towers.

A single all wood cooling tower is provided for Building X-626. A cross connection between cooling water has been provided so that the towers supplying Building X-330 could supply a major portion of the cooling demand of Building X-326.

On the north side of Building X-626 there are four 2500 KVA, mineral oil filled transformers. Each transformer is separated from the adjacent unit by a concrete block wall. The building has a steel on steel frame roof with corrugated CASB on steel frame walls. The main area of the building is utilized for the vertical shaft pumps which supply water to the cooling tower. There is a cut-off Switchgear Control Power Battery Room. The entire building is protected by a wet pipe sprinkler system. This crossflow cooling tower is fully wood fill and wood super-structure. There are eight cells.

The cooling tower is protected by a pilot operated deluge system. The system is sized so that one deluge system protects two cells. A sprinkler head is provided over each motor on the fan deck. The plant water system is adequate to supply the simultaneous operation of all systems in the cooling towers. The air supply to the pilot head fire detection system is provided

from the plant air system which is breathing air quality (very dry air). However, a desiccant filter is provided to remove moisture.

2.2 UTILITIES

2.2.1 Electrical

Recommendations

None

Description

Electrical power supplies to the site were analyzed and found to have considerable redundancy. When the facility was originally constructed, 17 electric power companies combined to form an operating unit known as Ohio Valley Electric Corp. (OVEC). Two generating stations were erected. Kyger Creek Generating Station is located some 70 miles to the east, while Clifty Generating Station is located some 140 miles to the west. Each of these stations have four 345 KV lines coming to the site. The Clifty Station supply has an intermediate substation referred to as Pierce Sub., therefore the lines coming to the site are normally referred to as the "Pierce" lines. Each of the aforementioned sources have twin lines which go to each of the X-530 and X-533 substations. There are two additional supplies to the site. The Don Marquis Substation, northwest of the site, supplies a single 345 KV line to each of the X-530 and X-533 yards. There is a 13.8 KV line which supplies only the X-530 substation. From the substations, power is supplied to the Process Buildings (X-326, X-330 and X-333) via underground tunnels. Power cables are wrapped with a fire-proof material. Auxiliary substations are provided in each of the Process Buildings.

Each of the substations are independent. There are no tie lines between substations. The X-533 substation supplies power to Building X-333 and its cooling towers. The X-530 substation supplies power to Buildings X-326 and X-330, as well as the balance-of-site. Additionally the X-530 substation supplies power to GCEP via a new 345 KV substation built for that purpose.

The design basis of the plant is 2260 MW. Approximately one-third is from the X-530 substation and the remaining two-thirds is from the X-533 substation.

There have been two major outages at the site since it has gone into production. The first occurred on May 27, 1965, in the X-533 substation due to a manual switching error. The second occurred on May 9, 1982, in the X-530 substation due to an error in a maintenance activity. Both of these involved operator error. Steps were immediately taken to prevent a re-occurrence. This was accomplished by design modifications as well as remedial operator and/or maintenance training.

There are numerous solid, metal bottom cable trays in the switchhouses. The trays have varying depths of cables. A unique method of protecting cable trays was developed and tested at the Oak Ridge Gaseous Diffusion Plant (ORGDP). The concept involves thin plastic bags filled with vermiculite either laid directly on top of cables or on a steel wire mesh structure above the solid bottom cable trays. When a fire develops, the bags quickly melt through, releasing their content and smothering the fire. In July 1986, PORTS experienced a lightning strike which resulted in a severe fault which ignited grouped cables in a tray. The fire was effectively extinguished by the release of the bagged vermiculite. A second occurrence in November, 1988, resulted from an internal fault in switchgear. The fire propagated downward into the switchhouse and involved grouped cables in trays. Once again, the fire was controlled by the release of the bagged vermiculite and prevented the spread of fire to other areas of the switchhouse. Protection of trays is considered adequate. Penetration of the floor between the Control Rooms and the switchgear areas were properly sealed. This will help prevent the spread of fire between areas. The synchronous condensers oil lift pumps are provided to circulate oil in a closed loop for bearing lubrication. The oil gravity flows from the bottom of the condenser to the oil lift pumps on the floor below. The oil is pumped at 20-30 psi to a point above the bearings of the condenser, and then gravity flows back to the pumps. When the condenser is started, the lift pumps operate at approximately 65 psi.

The areas beneath the condensers are curbed to contain large spills. Automatic sprinkler protection is provided over the lift pumps and curbed areas. Additionally, fixed temperature heat detectors are provided to shutdown oil lift pumps and to close a solenoid valve to prevent gravity flow of oil from the condenser. Transformers in the switchyard are protected by

deluge water spray systems. Water spray systems for a number of transformers do not project water beneath the units. This involves T-201 to T-212 in the X-530 yard and T-301 to T- 304, T-308 and T-310 to T-312 in the X-533 yard. The newer transformers have a deluge system designed to protect the shielded space. Newer transformers are T-305 to T-307 and T-309. Though it is desireable to have water spray beneath the transformer, it is unlikely that this deficiency would have a marked effect on its salvage ability. The important aspect is the protection of adjacent units and overhead buss work.

There are two approximately 15,000 gal and two approximately 10,000 gal transformer oil storage and filtration holding tanks in each of the two yards. These tanks are away from lines and buss work. The tanks are used in conjunction with the reprocessing of transformer oil. There is no fixed protection for the tanks or the filter buildings, however, this is felt to be acceptable as their loss would not interfere with plant operations. The oil circuit breakers (OCB's) in the X-533 yard have been changed to sulfur-hexafluoride(SF_6) breakers. The OCB's in the X-530 yard are mineral oil filled.

The X-5000 Switchyard is located in the GCEP area. There are three 330,000 KVA oil filled transformers, all of which are protected by automatic deluge systems. There is an oil insulator pumping station in the yard. The building is steel panel on steel frame. There is an 8,000 gal oil tank within the building. The building is protected by a wet-pipe automatic sprinkler system.

The Control House is of noncombustible construction. Automatic sprinkler protection is provided in the Control Room, UPS Room, and other support areas. The Switchgear area has no detection or protection.

2.2.2 Steam

Steam is supplied throughout the site from X-600. There have been no fundamental changes in the steam distribution system since the first fire protection survey. Details of the power plant are covered in Section 3.4.

2.2.3 Compressed Air

Compressed air is needed for the Process Buildings to operate control valves to withdraw UF_6. Air compressor stations are located in each of the Process Buildings as well as in X-600. The compressed air systems are connected between Process Buildings. The duplicity of off-site power supplies makes loss of all compressors unlikely.

2.3 TESTING, INSPECTION AND MAINTENANCE OF FIRE PROTECTION SYSTEMS

This facility has excellent inspection programs in effect. The following improvements are needed: (a) lock open all sprinkler control valves 1-1/2 in. and larger, (b) inspect all valves on a monthly basis, including a physical "spring" test (c) test flow alarms monthly.

2.3.1 Sprinkler Control Valve Supervision

Recommendations

90-4 All valves 1 1/2 in. and larger controlling fire protection water supplies should be locked in the full open position with nonbreakable shackle locks and welded link chain, as needed.

Reason: This prevents unauthorized closure.

90-5 All valves controlling fire protection water supplies should be included on the valve inspection list. This list should include all valves inside of buildings for such systems as antifreeze systems, paint spray booths, ovens, etc. Valves should be inspected monthly, including a physical "spring" test for post indicator and non-rising stem valves.

Reason: Interior valves are important components of the fire protection system and should be inspected.

90-6 The sprinkler control valves for X-100, X-300, and X-744-G should be provided with valve tamper devices connected to the plant alarm system.

Reason: These are important buildings and the fire protection system control valves should be supervised.

General Description

The sprinkler control valves are sealed open with a plastic seal by Fire Department personnel. Nearly all post indicator valves on the sprinkler system underground lead-ins or outside screw and yolk (OS&Y) valves on the sprinkler system risers are electronically supervised. A few valves controlling sprinkler water for less important buildings, out-of-the-way buildings, or small systems are not electronically supervised.

Curb box sectional valves of the sanitary water system are not electronically supervised.

Monthly recorded visual inspections of sprinkler system post indicator valves and riser OS&Y valves are performed by Fire Department personnel. Current records were observed to be up-to-date. Valves which are not electronically supervised are visually checked weekly.

Annually, all post indicator valves and curb box valves are completely closed and reopened. A computerized preventative maintenance program is used to assign work. Operations personnel perform these tests on all sectional/divisional control valves. Fire Department personnel test control valves on sprinkler system lead-ins. A 2 in. drain test is performed following the tests to verify the valve is reopened.

Closures of any sprinkler control valve are required to be supervised using the plant's "Sprinkler Valve Permit" System. This is an excellent permit system. Valve closures are coordinated with the Fire Department, and valve permit forms are used to track valve closures. The Fire Captain is kept up-to-date with a list of permitted valve closures. A map display of the plant's water system is kept nearby.

2.3.2 Water Flow Alarms

Recommendations

90-7 Waterflow alarms on each wet system should be tested on a monthly basis by opening the inspector's test connection. Tests of dry pipe valves, deluge valve, and preaction valves should be conducted at the riser using the alarm test valve. It should be verified that an electronic signal is transmitted.

Reason: This will assure that equipment is in proper working order.

Description

Water flow alarm test are conducted twice per year and are witnessed by the Fire Department. Results of these tests are recorded on the valve supervision form for each system.

2.3.3 Fire Pumps

Recommendations

90-8 Procedures for testing the electric fire pumps (primary protection) should be revised so that each pump is started automatically by tank level drop and operated for a minimum of seven minutes during weekly tests.

Reason: This is needed to prevent overheating of windings, which will extend the life of the electric motors. Further, this will assure that the pumps are working properly.

90-9 The test procedure should be revised to require operation of the diesel fire pump until normal operating temperature is reached (normally 20 min.). When diesel fire pumps are made automatic starting, the test procedure should be further revised to include a test of the automatic start on tank level drop feature.

Reason: This is needed to detect overheating problems or other potential problems with the equipment.

Description

Operations personnel conduct weekly inspection, testing, and maintenance on high pressure water system fire pumps. The electric fire pumps are tested weekly by performing a manual start. The diesel fire pumps are manually started monthly. The tank float system which starts the fire pumps(s) is tested quarterly. The test involves draining the 300,000 gal elevated storage tank and verifying that each pump starts at the specified float level. A performance test of each pump is completed annually.

The current arrangement of the high pressure water system does not permit the operation of each fire pump for more than a few seconds during the weekly and monthly tests. This is not satisfactory.

2.3.4 Hydrants and Mains

Hydrant flow tests are conducted by the Fire Department personnel on every hydrant on an annual basis. Flow and pressure reading results are kept on file. A gradient test of the high pressure water system is performed annually. Satisfactory records are kept. During this visit, several hydrants

on the sanitary water system and high pressure water system were tested. Results overall were comparable with those conducted by the Fire Department.

A gradient test of the sanitary water system was made during this visit. The test was performed on a 2080 ft long section of a 12 in. main adjacent to Process Building X-326 on Scioto Avenue. During the tests, Valve S-1S was closed and flows were made from Hydrant S-H-1S. Pressures were measured at Hydrants S-H-2S and S-H-9S. Two flow tests were performed. The flow test results indicate an average "C" factor of 95.

The section of cast iron main tested was originally installed in 1953 or 1954. Reportedly, a portion of the main tested was replaced in 1979 with ductile main. Overall results indicate the condition of the main is good considering age of the the system. Complete test details are contained in Appendix C-1.

2.3.5 Special Protection Systems

Testing is completed by Fire Department personnel. A written test procedure is developed for each system for testing and resetting.

Halon systems are visually inspected monthly. Smoke detectors, alarms and the firing mechanism are tested semiannually. The weight of agent in each bottle is verified. Adequate records are maintained.

Carbon dioxide systems are visually inspected on a monthly basis. Bottles of CO_2 are weighed annually and a discharge test is performed annually. These procedures are considered satisfactory.

2.3.6 Dry Pipe Deluge, and Preaction Systems

Two deluge systems and one dry pipe system were trip tested during this visit. These tests demonstrated that equipment was in good working order and that personnel were following proper test procedures.

The first test involved a system protecting Transformer 304 in the X-533 switchyard. This is System 129. The detectors on an adjacent ground transformer was activated. This tripped the valve. Three of the sprinkler heads on the east side were noted to be fully or partially obstructed. Steps were immediately taken to clear the obstruction.

The second test involved tripping the deluge system for Cooling Tower X-633-2D, Cell 9. This is System 149B. As this system has a pilot activator, the bleed-off valve at the end of the pilot system was opened. The valve immediately tripped. Many of the heads could not be viewed due to obstruction by tower structural components. All heads that could be observed were noted to be operating. This included heads below the fan deck, over the fill media, and over the motor on the fan deck. Both deluge valves for the above tests were 6 in. "Automatic" Suprotex valve.

A Grinnell "D" dry pipe valve on the dock of Building X-720 was trip tested. This is System 532. The valve was tripped using the end of line test. The valve tripped properly, and water discharged was noted to be of normal clarity. Additionally, a section of a branch line was disassembled to determine if there was evidence of any unusual corrosion. The pipe was in excellent condition with only minor pitting and corrosion which is typical for pipe of this age.

Complete details of the previously described tests are as noted in Appendix I.

2.3.7 Detection Systems

Operational tests are made on smoke detection systems on a quarterly basis and on heat detection systems on an annual basis. Tests are made by the Plant Fire Department and results are recorded. In addition, recorded monthly visual inspections are made on all detection systems. The test programs are adequate.

2.3.8 Fire Doors

Recommendations

90-10 The implementation of the fire door test program should be expedited.

Reason: Fire doors are an important element of the fire protection system.

Description

There is no formal complete fire door testing program. A list of all fire doors is being developed and a test program is to be implemented in 1990.

2.3.9 Fire Extinguishers

Fire extinguishers are physically checked on a quarterly basis by the Fire Department, at which time they initial tags on extinguishers. Plant Protection does a quarterly spot check of extinguishers.

The Fire Department refills extinguishers on site and the Maintenance hydro-shop does hydrostatic testing on all but carbon dioxide extinguishers. Carbon dioxide bottles are sent to an outside contractor for hydrostatic testing. Fire extinguishers are well maintained and adequately inspected.

2.4 FIRE DEPARTMENT

Recommendations

90-11 The Fire Department should conduct additional, full scale, announced and unannounced fire drills in order to assess their effectiveness and to enhance their skills.

Reason: Though the Fire Department participated in numerous drills and exercises, many were hazardous material release, personnel rescue, etc.; few were fully fire related.

90-12 Fixed fire protection systems should be checked upon arrival at a fire. Lesson plans should be updated to reflect this concern.

Reason: Fixed fire protection systems are the first line of defense. It is essential that these systems be properly supported.

90-13 To assure that both the Fire Department and the Auxiliary Emergency Squad (AES) have adequate training in structural fire fighting, arrangements should be made for either on-site or off-site "live-fire" structural fire fighting training.

Reason: Only actual exposure to the above training can provide assurance that a structural fires can be adequately handled. There are plans to

construct a fire training building. Engineering details of this project are expected in 1990.

90-14 Joint fire drills within the fence line involving the Fire Department, AES, and Mutual Aid companies should be conducted to assure that they can properly interface in an actual fire emergency.

Reason: Joint training greatly improves the ability of each component to function effectively.

90-15 Fire apparatus should be modified as needed to provide for the expeditious donning of SCBA's to reduce fire fighting response time.

Reason: Present procedures and equipment arrangements create an undue delay in donning SCBA's which in turn delays fire fighting and search/rescue activities.

2.4.1 Equipment

The Fire Department operates out of Building X-1007. There are two "Squad" (EMT) units, two 1200 gpm engines, one emergency truck, one mini-emergency/heavy rescue truck, a mini-pumper and a 1000 gpm reserve engine. Normal response includes one engine, emergency truck and a squad.

2.4.2 Manpower

The Fire Department is under the management of the Supervisor of Fire Protection Services. Shift Captains are responsible for tactical fire suppression activities as well as the in-service inspection activities which are performed by firefighters (see Section 2.3 for inspection details).

The minimum shift manpower requirements are five fire fighters plus an officer. Normally there are six fire fighters on duty. The on-duty staff consists of a captain and five or six fire fighters. Three of the firefighters have the responsibility of taking the assigned fire/emergency apparatus to the alarm. Additionally, the dispatcher can be assigned to fire suppression activities if additional manpower is needed. The dispatching and fire ground communication activities are then assumed by Plant Control Facility (X-300). There is also an Auxiliary Emergency Squad (AES). The AES

consists of 12 personnel per shift selected on a seniority basis from the site work staff. These persons respond on an "on-call" basis. The requirements of the AES are outlined in Procedure for Administration of the Emergency Squad (920- P-007).

In the event of a major fire or related incident, the site Fire Department and the AES would be supplemented by the Mutual Aid Response agreement with Pike County. Interfacing of the PORTS and Pike County agencies has been limited to two vehicle fires outside the plant security fence.

2.4.3 Training

Training is under the direction of two captains. There are three types of training: (1) Compliance (2) In-Service and (3) Required. Compliance training is as outlined in DOE orders: i.e., environmental stress, criticality, etc. In-Service Training is training directly related to the work task activity (fire suppression) and is performed on a monthly basis. Topics such as respirator and SCBA (Self-Contained Breathing Apparatus) fittings and training are covered. The AES training consists of 24 hours of classroom and hands-on-training annually. Details of the training are provided on Attachments A to C in Appendix H.

Presently "live-fire" or hands-on fire suppression is limited to three hours of flammable liquid spill fire training with the use of aqueous film forming foam (AFFF), and vehicle fire suppression. Structural fire suppression training is not done on an annual basis. This is a significant weakness. On the positive side, all firefighters are required to have met the requirements of the Ohio Basic Firefighter Training, or equal, and to have at least one year of active firefighting experience. Many of the site firefighters are also involved in their community volunteer fire companies which helps maintain their skill level. This "outside" exposure, however, is not considered to be an acceptable alternative to actual live-fire training. Presently AES members are not required to have structural firefighting experience. Efforts are underway to develop a live-fire training facility on the plant site so that site firefighters, AES and Mutual Aid Companies can enhance their skill levels tnrough actual firefighting experiences. It is not known when this facility will be ready for use.

A training session was witnessed by a member of the audit team. The topic was "Turnout Gear/Protective Clothing". The course outlined the elements of National Fire Protection Association (NFPA) 1500, including Training, Maintenance, and Inspection. The course detailed the types, components, and levels of protective clothing. The instructor was well versed and used good techniques. Multiple types of visual aids were used including video tape, transparencies, and handouts. The session was concluded with a quiz.

2.4.4 Fire Exercise

The unannounced fire exercise was conducted on March 6, 1990. It was initiated at 3:01:35 P.M. E.S.T. The scenario involved a simulated fire in the pit at the varnish impregnation operation along the north wall of Building 720. The only potential obstacle to attacking the fire was the presence of a roped-off radiological area in the motor service department located between the main building entrance and varnish impregnation pit.

The drill began by closing valve 253 six turns to activate the valve tamper device. Radio communications were heard to note a valve closure. Next, an inspector's test connection on System 253 was activated. Some ten seconds after the alarm transmission, an employee used the emergency phone line (5555) to deliver the following message:

"This is a drill. This is (name). We have a fire in the 720 varnish impregnation pit along the north wall. All people are evacuating. Lots of smoke - couldn't put it out with extinguishers. I'm getting out of here. This is a drill."

Within 3 1/2 minutes, a firefighter arrived in a pick-up. He had been dispatched to check on the valve tamper alarm. The referee gave him the scenario. He reported to the fire dispatcher that he was on the scene, acknowledge it as a drill and advised that "heavy smoke" was showing. He did not check the sprinkler control valve. The first engine arrived within five minutes. The referee briefed the Captain. The Captain instructed firefighters to lay a supply line between the hydrant and the engine. The Incident Commander (Shift Superintendent) advised the communication center to

alert the Auxiliary Emergency Squad that they may be needed. Nine minutes from the time of the alarm, two 1 1/2 in. lines were staged at the door to the building and the supply line was charged. An additional three minutes was needed for firefighters to don SCBA's (current policy is to wear full turnout gear, but not SCBA's until arrival at the scene). At approximately eleven minutes into the "incident", firefighters entered through the personnel door. Some access difficulty was encountered with keeping the door open, obstructions due to a parked vehicle, and equipment obstacles in the electric motor service area. Firefighters proceeded through the radiological area. A second 1 1/2 in. line was brought into the building through the overhead door. A further complication arose when attack lines were too short to reach the fire. Additional sections of 1 1/2 in. hose were brought into the building and connected to the original attack lines. After approximately 21 minutes, the drill was concluded as firefighters had attack lines ready to enter the pit area.

It took approximately three minutes after suppression equipment was staged at the building doorway before firefighters were equipped with SCBA's and prepared to make entry. Additionally, at no time during the drill was the partially closed post indicator valve checked by firefighters. This latter deficiency is the most disturbing, particularly since automatic sprinkler protection is the first line of defense against fire.

The chronology of the drill and the evaluation check list is in Appendix G.

2.5 HOT WORK PERMITS

There is presently no Hot Work Permit System. However, the implementation of a hot work program is imminent. Lesson plans have been developed. Some 250 plant employees who will serve as fire watch have been trained in the use of fire extinguishers. The proposed program was reviewed and is acceptable.

2.6 PCB FILLED EQUIPMENT

Polychlorinated biphenyls (PCB's) are located throughout the site in transformers and capacitators. Additionally, the same filtration equipment was used for PCB contaminated transformer oil as was used for the lube oils in the Process Buildings. Therefore, the lube oil is contaminated with PCB's, but at a much lower concentration than the transformer oil. It would be expected that a fire in the lube oil system would spread some low level PCB contaminants over a wide area within individual process buildings. The problem of PCB's on the site has been addressed in the "2005 Study". No funding has been provided, but funding requests will be added to future budgets, with the PCB issued to be resolved by 2005.

2.7 MAXIMUM FORESEEABLE LOSS DETERMINATION

A maximum Foreseeable Loss (MFL) is the maximum dollar loss which would be expected from a fire with fire protection systems out-of-service. The dollar values given are replacement values of building and equipment. Four buildings have MFL values over $50,000,000. The MFL for Building X-326 is $325,000,000. The MFL for Building X-330 is $331,000,000. The MFL for Building X-333 is $303,000,000. The MFL for Building X-3002 is estimated at $60,000,000.

The values for the Process Buildings were determined using as a scenario a fire at a lube oil drain tank on the operating floor. It is expected that this fire would collapse the cell floor above the tank. The fire would then spread across the cell floor on lube oil from broken piping. The heat release would ignite the Class II steel deck roof. A collapse of the building roof and walls above the cell floor is expected. There would also be limited building damage to the operating floor, beyond the affected lube oil system area.

Dollar values were obtained from annual appraisal values for buildings and equipment prepared by plant staff.

2.8 OPERATING PROCEDURE

The operating procedure involving the cleaning of cells involves procedures identified as Operating Methods which describe the methods to be employed including the steps to be followed. Included in the procedure is a sign-off sheet which requires the operator performing the task to sign and date/time when the step was completed. This helps to assure that the procedure is properly implemented and reduces the possibility of a chemical reaction during the cleaning process.

III

REVIEW OF SITE FIRE PROTECTION

3.1 Administrative Buildings

Recommendations

None.

Building Descriptions

Building X-100

This building is constructed of boards on heavy timber construction floors and roof. Walls are wood frame with CASB overlay. The building is used for administrative activities. The building is fully sprinklered.

Building X-112 - Computer Center

This building was constructed in 1984. It is provided with a Class I steel deck roof. Walls are concrete block with brick veneer.

This facility is used for administrative functions including inventory control. There is a computer room containing a DEC-10 system. New tape drives and associated equipment are in the process of being installed. This has resulted in some congestion but combustible packaging and new equipment containers are well controlled. The raised floor contains limited amounts of cable. There is also a tape library. The library has moveable retrieval shelves. There is an Uninterruptable Power Supply (UPS) in a cut-off room. There is no hydrogen monitoring system but a fixed continuous operating exhaust fan is provided.

The building is fully sprinklered on a wet pipe system. Halon 1301 protection is provided in the below floor spaces only. Connected reserve supplies are provided. Due to the high velocity air flow, rate-of-rise heat detectors are provided below the floor to activate the Halon 1301.

Building X-1020

This building was erected in 1985. It has a Class I steel deck roof with concrete block-brick veneer walls. Most of the building is comprised of offices and various command post/situation monitoring stations. Automatic sprinkler protection is provided throughout.

3.2 PLANT PROTECTION BUILDINGS

Recommendations

None.

Building Descriptions

Building X-104

This building is occupied by the Police Department for administrative activities, communication, and firing range. The building is composed of combustible building components and combustible interior finishes. The communication center has a raised floor containing minimal quantities of cable. The building is fully sprinklered.

Building X-106

This building is occupied by the Tactical Response Team. It has combustible building components and combustible interior finishes.

The building is fully sprinklered.

Building X-1007

This building services as the site fire station and the administrative offices of the Fire Protection Services department.

This building is of noncombustible construction. Automatic sprinkler protection is provided throughout the facility.

3.3 PROCESS BUILDINGS

General Recommendations

The following general recommendations apply to the process buildings.

90-16 The following improvements are needed for Process Buildings X-326, X-330 and X-333:

a) The cell enclosures should be equipped with automatic sprinkler protection throughout the cells designed for 0.15 gpm/ft^2 over 7500 ft^2 or the entire cell if cell area is less than 7500 ft^2. 286°F temperature rated heads should be used. A 250 gpm hose stream allowance should be included in hydraulic calculations.

b) As an acceptable alternative to automatic sprinklers, one of the following could be completed:

1. The hydraulic oil system could be converted to one using a Factory Mutual approved less hazardous hydraulic fluid, or
2. The existing hydraulic oil system should be revised so total oil capacity available to one cell enclosure is 100 gal or less. In addition, low oil level control should be installed for prompt shut off on leak and drop in oil level in the reservoir. Additionally, a fusible link operated device should be provided in the cells and interlocked to a micro-switch arranged to shut off the hydraulic oil pumps in the event of a fire.

Reason: Oil operated valves inside the cell enclosure could result in an oil leak and shielded fire inside the cell enclosure. Loss expectancy = $3,000,000.

90-17 Cable tunnels from Process Buildings to Building X- 300 should have automatic sprinkler protection throughout. Sprinklers should be on ordinary hazard pipe schedule, rated at 165°F, on 10 ft spacing.

Reason: Access to the below grade cable tunnels during a fire would be difficult or impossible due to smoke and heat from a well-developed cable fire. Loss expectancy = $1,000,000

90-18 Cable openings from the basement cable spreading area into the control cabinets in the area control rooms should be sealed tightly with a noncombustible material to prevent passage of smoke and heat from the basement into the control cabinets.

Reason: The openings through the concrete floor would allow heat and smoke from a fire in the basement to readily pass into cabinets. Loss expectancy is $500,000.

90-19 Cable trays passing over diked areas around lube oil tanks on the operating floors should be protected with a material approved for one hour fire exposure for a distance of 10 ft from the diked area.

Reason: Trays in the area could be damaged by exposure to a fire in the diked area. Frequency of oil leaks and exposure to fire in this area is higher than normal due to the number of fittings and pumps in the area. Loss expectancy = $250,000.

Specific Building Recommendations

The following recommendations apply to specific buildings cited.

90-20 Hose connections (1 1/2 in.) should be installed on the roof of the three Process Buildings in the vicinity of each oil storage penthouse or room. Sufficient hose and combination solid stream and spray nozzles should be provided at each outlet so hose streams are available for all oil storage penthouses or rooms.

Reason: This will provide water supply and equipment readily accessible for manual fire fighting.

90-21 Automatic sprinklers in Building X-330 should be extended beneath the ceiling of the recessed areas at the side of cells.

Reason: The recessed area is shielded from overhead roof sprinkler discharge. The lube oil system is installed below the recessed area. Loss expectancy = $250,000.

90-22 The existing automatic sprinkler heads in the basement of Building X-300 should be relocated to above cable trays.

Reason: Existing heads over 2/3 of the basement are installed below cable trays. Relocation is needed for prompt operation and to protect the cable trays. Loss expectancy = $500,000.

General Description

Building Construction

The three Process Buildings are two story and partial basement. The first floor (operating floor) and second floor (cell floor) are reinforced concrete. The second floor has exposed steel beams below. Concrete columns support the second floor in X-333. Exposed steel columns support the second

floor in X-330 and X-326. The roofs on all buildings are Class II steel deck roof on steel beams on steel truss, supported by steel columns. Columns, trusses, and beams supporting the roof on the cell floor are exposed steel.

Area control rooms on the first floor have concrete block walls and concrete roof. There are no windows. Metal doors are installed at openings. Air supply for ventilation is taken from inside the buildings. Control cabinets are of metal construction, and subdivided by metal partitions. Cable and wiring inside the cabinet enclosure is limited. Cables enter the cabinets, from the basement cable spreading room below, through openings in the concrete floor. Floor opening around cables are not sealed. Automatic sprinkler protection is installed throughout the cable spreading room. A below grade cable tunnel of reinforced concrete construction extends several thousand feet from the cable spreading room in each process building to Building X-300. Signal cables are installed in noncombustible trays, generally one cable deep per tray. There are two to five trays on both sides of the tunnel. Automatic sprinkler protection is not provided.

The second floor (cell floor) has process equipment to enrich U-235. Equipment consists of converters containing barrier material, compressors, control valves, oil and process piping, electric power, control and instrumentation cabling and equipment.

Process equipment for each cell is installed in a insulated metal on steel frame wall and roof enclosure. Multiple cells are installed throughout the cell floors. Cell enclosures are approximately 7500 ft^2 in X-333, 2200 ft^2 in X-330, and 2700 ft^2 in X-326. Hydraulic oil piping and oil operated valves for process operations are installed inside all cells. Excluding the oil piping and valving, all interior construction and equipment is noncombustible . Gas detectors are installed inside cell enclosures in X-333 and X-330. Detectors monitor for process gas leaks. Cell enclosures are not protected by automatic sprinklers.

A hydraulic oil fire inside a cell enclosure would seriously damage the enclosure, the seals and bearings on the compressors, and most probably damage the compressors. Under prolonged fire exposure the converter and barrier material could be damaged.

The number of cells required for operation depends on power level. At current levels, all cells are not in operation. At higher levels, all cells

may be required. If a cell is taken out of service for repair or maintenance, attempts are made to return it to service as soon as possible.

Lube Oil and Hydraulic Oil Systems

Central, recirculating lube oil systems are installed at each of the process buildings to lubricate bearings at motors and compressors. The petroleum oil used in these systems has a flash point of 430° to 460°F. There is a separate system for each process unit. Building X-333 has eight systems, X-330 has 11 systems and X-326 has 10 systems. Each system in X-333 contains 22,000 gals, each system in X-330 contains 15,600 gals and each system in X-326 contains 24,950 gals of oil. Each system has a supply tank or tanks, installed at roof level. X-326 has two 8,300 gal tanks and X-333 has one 8,300 gal tank, for each system, installed in penthouses on the roof. X-330 has one 8,300 gal tank on each system, in an enclosed room immediately below the roof. Penthouses have transite, on metal frame walls and class II steel deck roofs. Inside tank enclosures located below the roof are enclosed by multi-layered gypsum board walls. All enclosures and penthouses have water tight concrete floors with 6 to 12 in. high concrete curbs. A 4 in. steel drain pipe is installed in the floor of all diked areas. These drains discharge into the curbed areas, on the first floor around the drain tanks for the system.

Each system has a drain tank or tanks on the operating (ground floor) sized to hold all of the oil in the system. The drain tanks, pumps and piping are installed in 2 to 3 ft high concrete diked areas. Dikes are designed to hold in excess of the drainable oil in the systems. These diked areas are not cut off. Diked areas are separated by 200 ft or more from adjacent systems. Electric switchgear and transformers are installed within 10 ft of the dikes. A self-priming 750 gpm sump pump is installed in each dike. A liquid sensor and sprinkler waterflow switch are installed in series for automatic starting. A remote manual start switch is installed. Pumps discharge through a 5 in line to outside the building.

Two centrifugal lube oil supply pumps are installed for each system. Pumps are rated at 925 gpm in X-333, 550 gpm in X- 330, and 1125 gpm in X-326. Oil pressures range from 7 psi on the cell floor to 20 psi on the operating floor. Pumps can be controlled from the area control rooms or

Building X-300. One pump normally operates continuously, with the other set to start automatically on drop in oil level in the supply tanks.

Starting of the second pump on low level in the drain tank, sounds an alarm at the area control room and Building X-300. Manual control valves are installed on both sides of pumps and check valves are installed in the pump discharge lines. The oil is pumped through a heat exchanger, then through a header that branches out to feed the cells for the system. The header also connects to the supply tank at roof level. The main header is 8 in., with 4 in., 3 in. and 2 in. branch lines. All lines are installed at ceiling level of the first or operating floor beneath the cell floor. Pipe risers (1 1/2 in.) are installed up through the concrete floor to supply oil to bearings and compressors on the operating or cell floors. One inch return and 3/4 in. supply lines connect from the riser to bearings. All piping is welded steel with short sections of reinforced rubber hose on the supply and return lines where lines connect to bearings. Bearing housings on motors and compressors are outside the cell enclosures. Branch lines supplying cells drop down to operating (ground floor) level where manual valves and a strainer are installed. Manual control valves are installed at connections on the cell floor, and at tank discharge connections, except for the overflow pipe connected from the supply tank to the drain tank. Motor operated valves are installed on the fill line to the supply tank and on a cross connection from the fill line to the pump headers. The oil supply line header from the pumps is also connected directly into the supply tank at roof level to keep the supply tank full. An overflow line from the supply tank connects and returns oil directly to the drain tank. There are no valves in this line. The pumps normally keep the supply tank full. If the pumps fail, the supply tank will drain oil back through the supply line directly to the cells. This supply will operate cells for 15 to 20 minutes. The above is typical of lube oil systems in X-333 and X-330. It is also typical of lube oil systems in X-326, except piping is somewhat smaller, and strainers for oil supply to bearings are installed on the operating floor.

Each cell has a hydraulic oil system to operate process gas valves installed inside the cells. These systems use the same oil lube tanks for supply. Two centrifugal hydraulic pumps are installed, taking suction from

the lube oil supply header in the diked area from the drain tanks on the ground floor. The pump size is 85 gpm at 80 psi in X-333, 65 gpm at 100 psi in X-330, and 45 gpm at 100 psi in X-326. The 3 in. supply header and smaller branch lines to cells are installed on the ground floor, beneath the floor of the cells, with 1 in. risers through the floor into the cells. One inch supply lines and 1/2 in. return lines are installed from the riser to the oil operated valve. All of the piping on the cell floor is inside the cell enclosure with the exception of a 1 in. line that loops outside the cell enclosure to a valve and strainer on the cell floor and then back into the cell. One pump operates on the system. The second pump starts on pressure drop. An alarm sounds in the control room on pressure drop. Automatic sprinklers are installed throughout both floors of the building, in the penthouse and supply tank enclosures, and beneath drain and supply tanks. Automatic sprinklers are not provided in cell enclosures.

Though it is possible for an oil spill on the main floor to "seep" into the cell enclosures, it is not economically practical to seal these enclosures.

Ventilation

Air plenums are installed in the side wall of each process building. Air is drawn from the outside in warm weather and recirculated from inside during cold weather. Metal baffles are installed on the air plenum to control intake of outside air. Metal mesh filters are used to filter incoming air. Supply fans provide make-up air through metal ducts running under the cell floor to floor level ventilators on the cell floor.

Air can be exhausted directly to outside through the plenum. In cold weather, air inlet openings to the filter plenum are closed, but not otherwise sealed, and a large percentage of air is recirculated. Intake and exhaust air is automatically regulated, through baffles on wall intakes and dampers on duct work, to control temperature in the cells. Dampers and baffles are equipped with pneumatic operators, and can be operated from control rooms to exhaust smoke from the building. Power operated roof ventilators are installed and can be operated manually to exhaust smoke. In a fire condition, not involving a process gas leak, the building ventilation system would be operated to exhaust smoke. If a process gas leak and a fire are involved, attempts would be made to contain smoke and process gas within the building.

Exhaust air is taken from below electric motors on cell floors and above transformers on the operating floor. Main exhaust ducts up to 12 ft wide run across the width of the buildings. Multiple branch ducts, 3 to 4 ft wide, are installed below the cell floor, and have openings through the cell floor to below motors on the cell floor. These branch ducts are 25 ft to 60 ft long. Oil deposits are present in the exhaust ducts. The main source is oil leaking at bearing seals on motors. Drains are being installed below the duct joints with plastic pipe running across the bottom of the joint, manifolded and drained to a holding tank. Automatic sprinkler protection is installed inside the main exhaust ducts. Branch ducts are not sprinkler protected. Due to limited size and area affected by a single branch duct, protection is adequate.

Ventilation for the area control rooms (ACR) is from inside the Process Buildings and could result in smoke entering control rooms should a fire occur. Process equipment can be shut down from Building X-300 in an emergency.

Additionally, the process can be shut-down at the electrical control rooms at X-530 and X-533. Plant policy is to evacuate ACR's in the event of an emergency.

Building X-300

This building is of reinforced concrete construction with one story and basement. The first floor has control cabinets for monitoring overall operations in the Process Buildings. Cabinets are U-shaped around the exterior of the circular building. The center of the first floor has control panels for monitoring and controlling electric power supplies from switchyard to the Process Building. All cabinets are metal construction and have few combustibles inside of the cabinets. Cable entry into cabinets from the basement floor below are tightly sealed with noncombustible material. The basement has signal cables to first floor cabinets installed at ceiling level above a hallway around the exterior of the basement. Grouped cables are installed in cable trays, three trays deep at ceiling level. A battery room, dry type transformer room and telephone relay room, all with limited combustibles, are located at the center of the basement.

Electric power supplies are monitored and switchyard equipment is operated from the building. Process Building operations are monitored and if ACR's are not accessible can be shut down from this building.

Cable tunnels are provided from X-300 to the three Process Buildings. Tunnels are reinforced concrete construction and several thousand feet long. Signal cables are installed in tunnels on transite cable trays. Cables are generally one cable deep in trays on each side of the tunnel. Tunnel entry to Building X-300 and into cable spreading rooms below ACR's in the Process Buildings, are cut off by concrete walls and metal doors. Cable openings through these walls are sealed tightly. One or two transite walls with metal doors are provided to subdivide tunnels.

Automatic sprinkler protection is installed in the basement hallway area of Building X-300 only.

Building X-300A

This is a one story building with concrete block walls and steel deck roof adjacent to Building X-300. The building houses computer systems used to monitor and control electric power supplies to Process Buildings. Two systems are installed, with one available as back up. Automatic sprinkler protection on a preaction system is installed throughout the building. A total flooding automatic Halon 1301 extinguishing system is installed for the building and under floor space.

3.4 CHEMICAL, UTILITY BUILDINGS

Recommendations

90-23 The proposed automatic sprinkler installation throughout Building X-710 should be completed as soon as possible.

Reason: The building has combustible occupancy throughout. It is planned to install an automatic sprinkler protection system throughout on an ordinary hazard pipe schedule. Loss expectancy = $750,000.

Building Descriptions

Building X-342A, X-342B and X-344B

Building X-342A is one story with transite or metal on steel frame walls and insulated steel deck roof. The south side of the building has steam heated autoclaves that supply various grades of UF_6 to the Process Buildings. Flourine is generated on the north side. Four cells for electrolysis using direct current are installed. Hydrogen is vented to the atmosphere and flourine filtered and pumped to storage tanks in Building X-342B. Automatic sprinkler protection is installed throughout except for the electrolysis cell room. Protection is adequate.

Building X-342B is one story with concrete and transite on steel frame walls and insulated steel deck roof. Three metal tanks for storing flourine are installed on concrete supports. Tanks store and supply fluorine for use in the Process Buildings. Floor level ventilation and gas detectors at roof level are installed. There is no automatic sprinkler protection; none is needed.

Building X-344B is one story with metal on steel frame walls and roof. The building houses repair and yard maintenance shops. Automatic sprinkler protection is installed throughout.

Building X-343

This building is one story with insulated metal panel on steel frame walls and insulated steel deck on steel truss roof. The building is the UF_6 feed and sampling building. Cylinders are placed in steam heated autoclaves to provide UF_6 to the Process Building. Hydraulic systems of 50 to 60 gal capacity are used to operate autoclaves. Automatic sprinkler protection is installed throughout.

Building X-600

This building houses three boilers used to generate steam for building heat. The building is noncombustible with exposed steel framing. High sulfur (6%) coal is received by truck and stored in the yard area south of the building. Coal is moved by semi-enclosed conveyor to the tripper floor where it is directed into one of three 80 ton "day bunkers". The coal gravity feeds into the stoker moving grate boilers. The three (3) Wicker Boilers are rated at 125,000 lbs/hour. The boilers are manually started by building a wood fire on the grate. No combustion safeguards are needed. The flue gases from the boilers are directed to three separate electrostatic precipitators. Each precipitator has its own exhaust stack. The precipitators have two cells in series. As the boilers are the stoker-type, upset conditions are less likely to occur reducing the possibility of unburned product of combustion entering the precipitator. The hoppers are cleaned twice each shift. Occasionally, clinkers will result in some overheating, but no damage has been reported.

The boiler house is fully sprinklered on a dry pipe system. The conveyor is protected with a deluge system which is actuated by a pilot sprinkler system.

Building X-621

The coal pile runn-off building is insulated metal panel on steel frame. The occupancy is noncombustible. No fire protection is provided. None is needed.

Building X-710

The building is two story with concrete block walls and poured concrete floors and roof on concrete beams. An addition has insulated metal panel walls and concrete on steel deck intermediate floor and insulated steel deck roof on steel beams. The building houses office and laboratory areas. Office areas have wood and metal furnishings with paper supplies throughout. Laboratories do various testing, research and calibration for process buildings and equipment. Limited amounts of flammable and toxic liquids are used in the laboratories. Approved flammable liquid storage cabinets are used for storage of 1 gal glass and 1 to 5 gal metal containers. Glass containers are stored in safety holders. Materials are transferred to small plastic squeeze bottles for use. Ventilated metal hoods are used throughout

laboratories. Hood exhaust is ducted directly through the roof. Duct systems are not manifolded. Flammable gases are piped into laboratories from outside manifolds. Manual shut-off switches are located in the hallway, outside of rooms. Noncombustible compressed gas cylinders are properly secured. A small hydraulic reservoir for a hydraulic press is installed in a cut-off sprinkler protected room. A flammable liquid vault is provided. The vault is on an outside wall with concrete block lined brick wall and metal door. Curbs, floor drainage, exhaust ventilation, and explosion-proof electrical equipment are provided. Three drums are used for dispensing flammable liquids. Drums are equipped with self closing faucets, pressure relieving safety bungs and static ground connections. The minimum flash point of the solvents used is $0^{\circ}F$. There is no explosion venting from the vault, but adding explosion venting to the existing vault is not practical.

Automatic sprinkler protection with water supply from the sanitary water system is installed in the flammable liquid vault. Also, an automatic carbon dioxide room flooding system with a connected reserve is installed to protect the vault. Supply cylinders are outside the vault. An interlock is provided to shut down the vault ventilation and close the entry door.

Automatic sprinkler protection is installed throughout the addition. Automatic sprinkler protection is proposed throughout Building X-710 later in 1990.

3.5 ELECTRICAL POWER BUILDINGS

Details of these buildings are included in Section 2.2.1.

3.6 COOLING TOWERS, BUILDINGS AND STRUCTURES

Recommendations

90-24 Automatic sprinkler protection should be provided throughout Building X-752. Sprinklers should be capable of providing a density of 0.25 gpm/ft^2 over the most remote 5000 ft^2. Sprinkler heads should be 286^oF rated. A 500 gpm allowance for hose streams should be used.

Reason: This building contains drum storage of flammable liquids. A fire involving these materials would develop quickly and would be difficult to control manually. If flammable materials can be limited to a small area, then sprinkler protection would be needed over a reduced area. The loss expectancy is estimated at $250,000 with a high frequency since flammable liquids are involved.

Building Description

Building X-101

This building is occupied as a small hospital. The hospital has an emergency room, examination rooms, optical center, X-ray room and offices. Combustible loading is light. The single story building has a plank-on-steel roof with a built-up roof covering. Exterior walls are constructed of wood and steel which is covered by cement asbestos shingles. Sprinkler protection is provided throughout the building on a wet system. A monitored water flow alarm is provided. Protection is satisfactory.

Building X-102

This building is occupied as a cafeteria. Combustible loading is light in most areas. This single story building has a plank-on-steel roof with a built-up roof covering. Exterior walls are constructed of wood and steel covered by cement asbestos shingles. Sprinkler protection is provided throughout the building on a wet system. A monitored waterflow alarm is provided. Protection is satisfactory.

Building X-344A

This building is a loading and shipping building with part 2 story and basement. Concrete or metal-on-steel frame walls and steel deck on steel truss roof is provided. The two story section has empty metal cylinders on the second floor and a vault on the first floor for storage of metal

cylinders. A high bay roof section has steam heated autoclaves for filling cylinders. Material is transferred from large parent cylinders to smaller containers for shipping to customers. Containers are placed in a shipping module and loaded on trucks for transportation. A small basement area is vacant. Automatic sprinkler protection is installed throughout the building.

Building X-540

This building is occupied by a telephone switch, mechanical room and a small office area. The telephone switch is an analog type which services the plant site. A buried cable vault is provided. Wall cable penetrations between equipment rooms are properly sealed. Neither an emergency backup power generator nor battery room is installed in the building.

This single story building is constructed with concrete block exterior walls and a precast concrete plank roof. Sprinkler protection is not provided in the building. The two main telephone equipment rooms are protected by a total flooding Halon 1301 system with connected reserve. Automatic closing doors are provided between the switch room and other areas. Protection of the telephone switching equipment is satisfactory.

Building X-700 & X-700A

Building X-700 is a one story welding shop with attached instrument calibration area for converter testing. Construction is one story with concrete block walls for the calibration addition and transite on metal frame for the high bay welding shop and connector test addition. Roofs are steel deck on steel beam on steel truss.

The welding shop occupies the north end. Cleaning tanks with water and acid solutions for cleaning metal parts are installed at the center of the building. Tanks are metal with concrete or brick lining. A large degreaser at the center area is presently empty with no plans for use. Water treatment equipment for recovering water used in the cleaning process is installed at the south end. The instrument calibration addition has an area for calibrating radiation instruments. A converter repair addition has large ovens formerly used for testing converters. Ovens are electrically heated. The equipment in this addition has not been used for several years and there are no immediate plans for use.

Automatic sprinkler protection is installed throughout.

Building X-700A is a one story metal on steel frame building housing air handling equipment for Building X-700. Air compressors and air handlers are installed. Automatic sprinkler protection is provided.

Building X-705

This is a one story building with part basement and two story section. Construction is concrete block and transite on steel frame walls with Class II steel deck roof on steel truss. The building is used for cleaning and decontamination of process equipment. The cleaning process uses water and nonflammable acid solutions. A former process test loop at the south side of the first floor is no longer used. Automatic sprinkler protection is installed throughout the first and second floor and part of the basement.

Building X-743

This is a noncombustible canopy used for the storage of gas cylinders and carboys containing acids and caustics. The structure is protected by a dry pipe sprinkler system.

Building X-744

This building is occupied by storage of spare parts, valves, electrical switchgear and building fixtures. Nearly all of the storage is noncombustible. The storage is arranged on pallet racks to a maximum of 12 ft in height. The storage racks are in a double row arrangement with aisles 10 to 15 ft wide.

The single story building is constructed with sheet metal panels on steel purlins and beams. The building is not heated or insulated.

Automatic sprinkler protection is provided on a dry pipe system. Sprinkler piping is arranged on a gridded system with sprinkler heads spaced at approximately 100 ft^2. Generally, it is not acceptable for dry systems to be arranged with gridded branch lines due to air locking and extended time-to-trip sequences. However, considering the light combustible loading in this building, the present arrangement is acceptable.

Building X-744H & Building X-744J

These buildings are one story, general supply warehouses, with metal on steel frame walls and roofs. Metal parts in cardboard cartons and wood crates are stored in double row, open frame pallet racks, to 12 ft high and on pallets on the floor to 6 ft high. Racks have 4 ft wide shelves with a 12 in.

longitudinal flue space. Racks are 40 ft long with 12 to 15 ft aisles. Storage is on two tiers with storage on top.

Both buildings have automatic sprinkler protection throughout. Installations are on ordinary hazard pipe schedule, side-feed system with 212°F temperature rated heads on 100 ft^2 coverage.

Buildings X-744 K,N,P,Q,S,U,T

These buildings are used to store Lithium Hydroxide. The Lithium Hydroxide is in a container packaged in a cardboard container within closed metal drums. Four drums are stored on a wood pallet which are then stacked 3 or 4 pallet loads high. The storage arrangement is closely stacked so that adjacent pallet stacks are touching in both directions. The storage nearly occupies the entire volume of each building.

The buildings have similar construction features. All are single story structures with metal panel exterior and a concrete floor. Power to each building has been disconnected. Buildings are not heated or insulated. Unique features of Buildings X-744-S, T, U are that each has a spray on polyurethane roof coating. Ample fire hydrants are provided.

Buildings X-744 N,P,Q have a wood frame to support the exterior metal panels. These buildings are located approximately 500 ft outside of the main facility fence. There are no fire hydrants in the immediate vicinity. Fire extinguishers are provided.

Sprinkler protection is not provided which is considered acceptable due to the low combustible loading.

Building X-744-W

This building is used to temporarily store and display obsolete or used equipment to be sold to the general public. A wide variety of electrical, mechanical, and building materials are present. About 90% of the items are stored on standard wood pallets with a storage height of 1 to 5 ft The remaining 10% is stored on open frame racks having a maximum height of 12 ft The storage is arranged in a well spaced, orderly manner. A small office is located near the east exterior wall having a light combustible loading.

The building is constructed with a metal frame and sheet metal exterior panels. The building is not heated or insulated.

Sprinkler protection is provided throughout the entire building on a dry pipe system. Sprinkler piping is arranged on an ordinary hazard pipe schedule system with approximately 100 ft^2 spacing per head. Water flow alarms are monitored.

Building X-746

This building is used as a receiving and staging area for incoming supplies and equipment. Typical items received are office supplies, electrical equipment, parts, and other miscellaneous items. Small shipments of flammable liquids are received in 55 gal drums or smaller containers. If large shipments of flammable liquids are received they are temporarily stored outside or are transported immediately to the appropriate building.

The building is constructed of concrete block exterior walls with an insulated sheet metal roof on steel beams. Interior walls in the office area are constructed of gypsum board on wood studs. An open grated suspended ceiling is installed throughout office areas with sprinkler heads located a few feet above.

Sprinkler protection is provided throughout the building on a dry pipe system. Sprinkler piping is arranged on a side feed ordinary hazard pipe schedule system with approximately 100 ft^2 spacing per head. The dry system is equipped with an accelerator. Portable fire extinguishers are provided. Protection is considered satisfactory.

Building X-750

This building is used as a service garage for automobiles, trucks, and various industrial vehicles. A small office and a parts storage area is present. There is one large service area with hydraulic lifts and hoists.

An oil lube pit, car wash, and a tire change area is attached to the main service area. Limited amounts of flammable liquids and aerosol cans are properly stored in a flammable liquids cabinet. Solvent parts washers are present and each is equipped with a fusible link activated lid. Maintenance is satisfactory. This building is constructed with concrete block exterior walls with a built-up steel deck on steel beam roof. Concrete block walls subdivide the main service area, lube oil pit, car wash, and the tire change area. The building is heated by a circulated hot water system. No automatic sprinkler protection is provided; none is needed due to low loss expectancy.

Building X-751

This building is occupied as a service garage for National Guard vehicles and machinery. There are two main service garage areas and an office area. The service areas have hoists and hydraulically operated lifts. A few drums of oil, grease, and antifreeze are stored in a separate cut-off room. Small quantities of solvent and aerosol cans are kept in a flammable liquids cabinet. Other solvent storage is located in a small concrete block room. Electrical fixtures in the room are standard hazardous location type. Mechanical ventilation is provided. Two solvent parts washers are present in the service area which are equipped with fusible link activated lids and a localized ventilation system. Grease is dispensed from a small pressurized system.

The building is constructed with a sheet metal panel exterior with a steel frame. Batten type fiberglass insulation is attached to the inner side of the exterior walls. The building is heated by a circulated hot water system.

Sprinkler protection is provided throughout on a hydraulically designed wet pipe system. The design criteria for the installation was not available. Appropriate portable fire extinguishers are provided. A monitored water flow alarm and sprinkler valve tamper device is provided.

Building X-752

This building is used as a temporary storage and staging area for hazardous waste materials. All of the materials are in closed 55 gal metal drums or appropriate non-metal drums. Open containers of material are not handled in the building.

The materials stored include various solvents, laboratory chemicals, PCB contaminated materials, low level radioactive materials, and other miscellaneous chemicals.

Appropriate Department Of Transportation (DOT) identification markings are provided on each drum. Of the 400 to 600 drums present, approximately 150 are marked as flammable liquids.

A brief review of the inventory indicates that all liquids marked with a flammable or other hazardous classification are protected to minimize spills. Spill containment is provided in two ways. The first, by a curbed area at one

end of the building. The second, by storing groups of 10 drums in a five-sided precast concrete basin. Each basin is approximately 5 ft by 12 ft by 18 in. high.

The single story building is constructed with sheet metal panels on a steel frame with a concrete floor. The building is not heated or insulated. All electrical fixtures have been recently updated to types suitable for hazardous locations. Mechanical ventilation is provided by roof mounted fans and open vents. Low level mechanical ventilation is not provided, however, improvements are not justified since open containers are not present, and leakage is strictly monitored with any detected problems corrected. Sprinkler protection is not provided. A monitored heat detection system is provided at roof level. Yard hydrants are provided nearby. The building does not expose utilities or important buildings.

Building X-760

This building is occupied by Health Physics (HP) for a locker room and by the environmental engineering unit. The building has concrete block walls and a Class II steel deck roof.

The building is fully sprinklered.

Building X-770

This building is in the test loop facility. This test loop is not in operation. The building has a Class II steel deck roof with transite on steel frame walls.

The building is fully sprinklered.

Building XT-801

About half of this building is occupied by offices, a small micro-filming operation and a small photo lab. The remaining areas are vacant. Combustibles present include various papers and files, fabric covered office partitions, furniture and carpeting. A mineral board suspended ceiling is provided in part of the building.

The building has an insulated metal deck roof on steel joists. Exterior walls are insulated metal panels. Building heat is provided by a circulated hot water system. Sprinkler protection is provided throughout the entire building on a wet system. Piping is arranged with ordinary hazard branch lines with approximately 100 ft^2 spacing. Water flow alarms are monitored.

Building XT-847

This building is one story, with insulated metal panel walls and roof on steel frames. Foil faced fiberglass insulation is installed at roof level. The building is divided into three sections by double 12 in. concrete block fire walls. Metal rolling steel fire doors are installed on both sides of openings at the fire walls. The building is a warehouse for various government supplies. The north end has expanded styrofoam plastic in cardboard cartons on wood pallets. Storage is two pallets high to 12 ft over an approximate 6000 ft^2 area. Polyurethane in rolls for air filters is stored in cardboard cartons, on wood pallets 7 ft high over an approximately 900 ft^2 area. The remainder of the north section has boots and shoes in cardboard cartons stored on wood pallets to 14 ft high. All of the above are stored in a close stacked arrangement. Adequate aisle space is provided. The center section has one to 2 gal empty, unexpanded plastic bottles in cardboard cartons on wood pallets, to 14 ft high. Boots, shoes, metal cabinets and metal parts are stored in cardboard cartons to 14 ft high. All of the above are in a close stacked arrangement. Adequate aisle space is provided.

The south section has boots, shoes, metal cabinets in cardboard cartons and wood products in wood crates, on wood pallets 14 ft high. An approximate 900 ft^2 area has polyurethane air filter material, in cardboard cartons on wood pallets 7 ft high. All of the above are in a close stacked arrangement. Adequate aisle spaces are provided. Automatic sprinklers are installed on a hydraulic grid system. Six inch risers supply 3 in., 4 in. and 5 in. bulk mains which supply 2 in. branch lines with 13 sprinkler heads per line. Automatic sprinklers rated at 286°F, 17/32 in. large orifice sprinkler heads are installed on 100 ft^2 spacing. Demand for the plastic storage in 0.37 gpm/ft^2 over 2500 ft^2. The system can provide nearly 0.40 gpm/ft^2 over 2500 ft^2. Protection is adequate.

3.7 GASEOUS CENTRIFUGE ENRICHMENT PLANT

Recommendations

90-25 The following is needed for X-3002 (PB2):

a) The storage of material, particularly the polyurethane foam, in X-3002 (PB2) should be limited to piles not exceeding 2000 ft^2. The height of storage piles should not exceed 16 ft.

b) Individual piles should be separated by aisles at least 20 ft wide.

c) One additional sprinkler head should be provided in the web of each column on the opposite side of the web which is presently provided with a sprinkler head.

d) Smoke detectors should be provided in the high bay area.

Reason: The height of the building will result in an extensive delay in operation of the automatic sprinklers resulting in a fire which will open sufficient sprinklers to overtax the existing water supplies. The combination of early warning, protection of columns, and limiting pile size to 20% of the sprinkler system design area will limit the damage to acceptable parameters. The contractor (MMES) has no control over this building. This is a direct concern of DOE. The loss expectancy is $60,000,000.

90-26 The drums of oil in the Feed and Withdrawal Building should be removed from the building.

Reason: Storage of the oil is inappropriate for the building. Additionally, the storage is not contained within a diked area. Loss expectancy is $100,000.

General Description

This complex of buildings was constructed since the last fire protection survey. All buildings are of noncombustible construction including a Class I steel deck roof. The buildings are fully sprinklered with mostly a system designed for a 0.15 gpm/ft^2 over 10,000 ft^2. The buildings have never been used for their intended purpose. The equipment which had been installed is gradually being removed. Process Building (PB) 1 still contains process equipment which is being removed. PB 2 is used as a warehouse.

The 85 ft high bay section of PB 2 is used by both the Air Force and the Defense Logistics Agency for storage of various commodities. The commodities

consist of 16 ft high storage of wood crates containing compacted, shredded aluminum and glass radar interference material. Other items include storage of war surplus items of all commodity classes up through Class IV. Storage is both palletized and in portable racks to a height of 17 ft. The highest hazard item is the storage of polyurethane foam in plastic and paper wrapping to a height of 16 ft.

The approximately 68 ft clearance between the top of storage and automatic sprinklers presents a severe challenge to automatic sprinkler protection. This storage configuration was modeled with the storage configuration described covering approximately a 10,000 ft^2 area. The model generated a 9 MW fire with a growth rate of 511,000 Btu/min. The current storage arrangement and the 65-70 ft of clearance between the top of the storage and sprinklers would result in unacceptable horizontal fire growth. As polyurethane burns as a liquid and pile collapse into aisles is likely, the fire will spread from the foam storage to adjacent crated materials on pallets and to the portable racks. Automatic sprinklers would be expected to operate well beyond the 10,000 ft^2 design area. As more sprinkler heads open, less density will be delivered from each head. When the individual sprinkler head density drops below the 0.15 gpm/ft^2 point, structural roof steel will begin to fail.

If the fire is contained to 1/5 or less of the sprinkler system's 10,000 ft^2 design area, and columns are maintained below the failure point temperature, only localized damage would be anticipated.

The Maintenance, Stores, and Training (MST) Building X-7721 is essentially empty. There are two Automatic Storage and Retrieval Systems (ASRS). One is 30 ft high and is provided with four levels of in-rack flue sprinkler protection. The 70 ft high unit has four levels of in-rack sprinklers which includes both flue and face sprinklers on the same level. These rack systems are not in use.

3.8 MAINTENANCE BUILDINGS

Recommendations

90-27 The G & L "NC" Machine should be equipped with a fusible link type shut-off arrangement interlocked to shut off the hydraulic oil pump controller in the event of an oil fire.

Reason: A high pressure oil line rupture will spray atomized oil and if ignited will cause severe damage if not shut-off promptly. Loss Expectancy = $250,000.

90-28 Aerosol materials in the storeroom should be removed from cartons and placed in the bins, or relocated to the "toxic lockers" at the east end of the building.

Reason: Aerosol materials present a serious fire hazard. Loss Expectancy = $50,000.

90-29 The storage of styrofoam material should be limited to on-floor storage to a maximum height of 8 ft.

Reason: Plastic materials generate a high heat release rate which can open large numbers of sprinkler heads. On-floor storage with limited pile heights slows fire growth.

Building Descriptions

Building X-720

This building has a Class II steel deck roof on steel frame. Walls are concrete, glass on steel frame and/or CASB. The building is provided with complete automatic sprinkler protection.

There is a G & L "NC" machine with a 100 gal hydraulic oil reservoir. The unit operates at approximately 1200 psi. There are other hydraulic oil operated units but reservoir sizes are in the 15-25 gal range. There are no fusible link shut-off devices on the hydraulic oil pumps.

Metal cleaning is performed in a trichloroethane degreaser. The unit is reportedly provided with low liquid and high liquid level cut-off. No liquid testing is conducted. However, one-third of the agent is replaced monthly which eliminates the problem of destabilization. There are six electric heat treating furnaces. The units are capable of using a special atmosphere but reportedly, no such atmospheres are used.

There is a varnish impregnating operation. The varnish has a flash point of 122°F according to the MSDS (Material Safety Data Sheet). Electrical equipment is of the Class I, Div 1 type. Automatic sprinkler protection is provided in the tank pit. There are several spray booths, burnout ovens and curing ovens all of which are adequately protected. The south bay of the building is used as a storeroom. Most of the bay contains 6-7 ft high shelf storage. A portion of the west end has double row racks to 15 ft with 8 ft face to face depth. Both open shelves or solid shelves with shelves less than 50 ft^2 are used. There are adequate transverse flues but there are no longitudinal flues. The bin storage described above is mostly Class III commodity or less, but some small quantities of aerosols in cartons were noted on shelves. Rack storage also is generally Class III commodity or less but some 6 pallets of styrofoam trays were noted.

There are also 4 well cut-off "Toxic Lockers" used for storage of flammable liquids and pesticides as well as ordinary combustibles.

Building X-720C

This building has concrete block walls and a steel-on-steel frame roof. The building is used for storage and dispensing of lubricating oils. There is also a small area used for storage of a limited number of paint and solvent containers. Automatic sprinkler protection is provided.

3.9 SPECIAL NUCLEAR MATERIALS BUILDING

Recommendation

90-30 The storage of Special Nuclear Material (SNM) in plastic vessels in Building X-744G should be confined to a specially designed area with a minimum of a 1 hr fire rating and located on an exterior wall.

Reason: A spill and subsequent ignition would spread resulting in failure of adjacent vessels. Loss expectancy = $1,000,000.

90-31 Waste sludge stored in plastic totes in the high bay area of Building X-744G should be moved to a properly protected area or transferred into metal containers.

Reason: The plastic construction of these totes present a serious challenge to automatic sprinklers, particularly with the extensive clear space between the top of storage and the automatic sprinklers. Reportedly, the sludge will be transferred to steel containers. Loss expectancy = $250,000.

Building Description

Building X-345

This building is of reinforced concrete construction. It is used for the handling, storage and shipping of SNM's. Combustibles are limited, but were noted in small quantities in numerous areas. It is planned to construct a new office inside the controlled area. An old office area will be used for storage of combustible material. Funds have been allocated to install a Halon 1301 system to protect this storage room. Though not the most desireable for of protection it is considered tolerable. There is also a small glove-box used for handling parts. The glove-box is not protected. Smoke detectors are provided throughout the building.

Building X-744G

This building is steel on steel frame construction. Complete automatic sprinkler protection is provided throughout. The southside of the building is used for storage of SNM in solution. The solutions are generally off-falls of various operations. The solutions are in 10.12 liter, plastic cylinders. Each cylinder is supported by a metal frame structure. Vessels containing flammable solvents are segregated along the south wall. Due to criticality concerns, a 1 1/2 in. angle iron curb is provided. The floor slopes slightly to the exterior, away from other vessels. There is approximately 300 gal of

solution in the flammable storage area. The solutions contain a wide variety of liquids including alcohol, acetone, etc. The north side of the building is used for the storage of waste liquids and waste sludges in metal drums. Additionally, there is an 880 ft^2 area in the center, high bay area (35 ft) where 4 by 4 by 3 ft high plastic totes are stored two high to a height of 6 ft. The totes contain metal sludge. The sprinkler system in this area is a dry pipe system on ordinary hazard pipe schedule with 212^oF heads on 100 ft^2 spacing. The storage of these totes requires a 0.40 gpm/ft^2 over 4100 ft^2. This is based on the fact that storage to ceiling clearances do not exceed 10 ft, but with a clearance in excess of 25 ft, the delay in operation, and the inability of the sprinkler water to penetrate the anticipated fire plume will result in severe damage to the building. The surrounding occupancy is noncombustible and therefore fire spread is unlikely throughout the remainder of the building.

APPENDIX A

ABBREVIATIONS

ACR	Area Control Room
AES	Auxiliary Emergency Squad
AFFF	Aqueous Film Forming Foam
CASB	Ceent Asbestos Board
DOT	Department of Transportation
EMT	Emergency Medical Technican
EOC	Emergency Operation Center
GCEP	Gaseous Centrifuge Enrichment Plan
HP	Health Physics
MGD	Million Gallons per Day
MMES	Martin Marietta Energy Systems
MSDS	Material Safety Data Sheet
MST	Maintenance, Stores and Training
NFPA	National Fire Protection Association
OCB	Oil Circuit Breaker
ORGDP	Oak Ridge Gaseous Diffusion Plan
OS&Y	Outside Screw & Yolk
OVEC	Ohio Valley Electric Corp.
PB	Process Building
PORTS	Portsmouth Gaseeous Diffusion Plant
PPM	Parts Per Million
UPS	Uninterruptable Power Supply
SCBA	Self Contained Breathing Appratus
SNM	Special Nuclear Materials.

APPENDIX B

MAJOR RECOMMENDATIONS

The following recommendations, if not completed, could result in loss potentials of $1,000,000 or severe impact on critical programs.

Rec. No.	Area Affected	Loss Expectancy
90-16	Process Building-Cells	$3,000,000
90-17	Cable Tunnels	$1,000,000
90-25	GCEP - PB 2	$60,000,000
90-30	X-744G	$1 000,000

APPENDIX C

WATER FLOW TESTS

APPENDIX C-1

HYDRANT FLOW TESTS

Hydrant[1] Flowed	Pitot (psi)	Flow (gpm)	Press. Hydrant	Static (psi)	Residual (psi)
A-H-1	50, 47	2340	A-H-2	85	76
DI-H-5	65, 65	2700	DI-H-6	129	125(2)
ST-H-3W	76, 82	2980	ST-H-2W	129	125(2)
WO-H-2	65	1350	WO-H-1	86	85
5-H-3W	35, 40	2055	5-H-2W	86	82
16-H-3E	38, 42	2120	16-H-2E	86	85
18-H-3E	37, 37	2050	18-H-1W	85	84
19-H-2W	45, 55	2390	19-H-1W	85	84
HP-20-11E	65, 65	2700	HP-20-10E	121	118(2)
27-H-5E	50, 42	2280	17-H-4E	86	85

[1] All hydrant tests use C=90 and 2 1/2 in. orifice
[2] High Pressure System Tests

APPENDIX C-2

Hydraulic Gradient

A hydraulic gradient was run on Scioto Ave. The sectional control valve at 15th St. and Scioto Ave. (S-1S) was closed. This forced all the water to flow from 5th St. Hydrant S-H-1S was flowed and static and residual pressures were taken at hydrants S-H-2S and S-H-9S. The distance between these two hydrants is 2,080 ft of 12 in. cast iron pipe installed in 1953 or 1954. Two flow test were run. The first used two 2-1/2 butts and the second used one 4-1/2 butt.

Test 1

flow pitot 30 psi & 30 psi = 1,840 gpm
S-H-9S; static press. = 86 psi; residual press = 78 psi C = 86
S-H-2S; static press. = 87 psi; residual press = 65 psi

Test 2.

flow pitot 27 = 2825 gpm
S-H-9S; static press. = 86; residual press = 77 C = 105
S-H-2S; static press. = 87; residual press = 57

APPENDIX D

FIRE PUMP TESTS

Factory Mutual System

D-1

PUMP ACCEPTANCE TEST DATA

Refer to P&P F(A) - 512.12 & DS 3-7N

PROPERTY OF	ACCT. NO.	INDEX NO.-A/C
X-640 Pump No. 1		
CITY & STATE	**PLACO**	**FMEA D.O.**
CONFERRED WITH / **TITLE**	**TESTED BY**	**DATE**
	D. R. Hertzer	1-25-90

PUMP

SHAFT	MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE
[X] HORIZONTAL [ ] VERTICAL	Allis Chalmers	[ ] YES [X] NO	65116	201-060-502

RATED GPM	RATED HEAD-FT. (psi)	RATED RPM	SUCTION FROM	TANK SIZE	TANK HEIGHT
4125	(125) 289 ft.	1180	Reservoir	2.5 mill gal	-

IF VERTICAL TYPE

VERTICAL DIST. DISCH. GAUGE TO WATER LEVEL	STATIC FT	PUMPING FT	RIGHT ANGLE GEAR DRIVE	MANUFACTURER	SHOP OR SERIAL NO.	APPROVED
				MODEL OR TYPE	PERFORMANCE [ ] SMOOTH [ ] ROUGH	[ ] YES [ ] NO

DRIVER

MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE	RATED H.P.	RATED R.P.M.
Allis Chalmers	[ ] YES [X] NO	7-5154-28112-2-2	AW/30KS8	400	1180

[X] ELECTRIC MOTOR	RATED VOLT.	OPERATING VOLT.	RATED F.L. AMPS	AMPS AT 150%	PHASE	CYCLES	SERVICE FACTOR
	2400		85.7		3	60	1.25

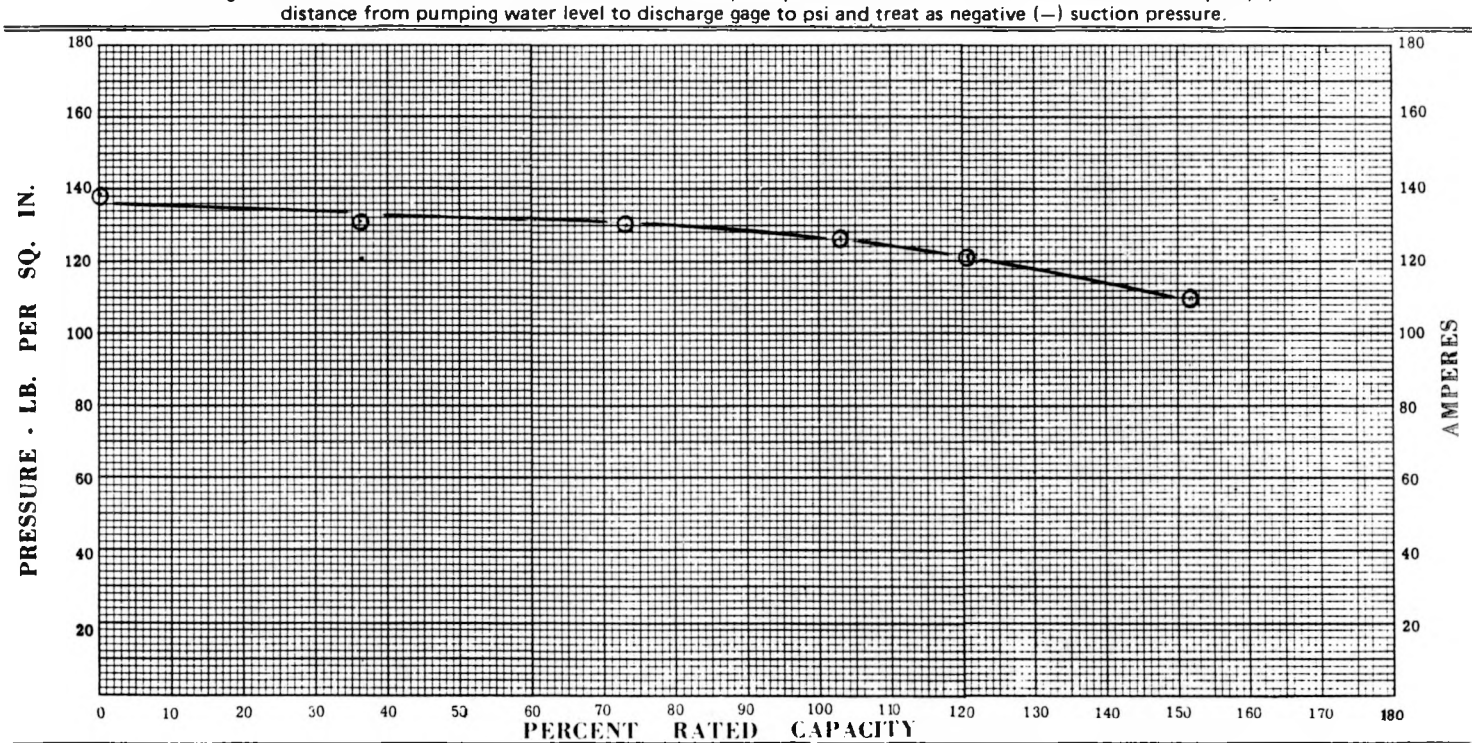
[ ] DIESEL ENGINE [ ] GASOLINE ENGINE [ ] GAS ENGINE [ ] STEAM TURBINE [ ] PRESS. GOVERNOR BUILT IN [ ] INDEPENDENT [ ] TURBINE STEAM PRESS

CONTROLLER

MANUFACTURER	APPROVED	START ____ psi	STOP ____ psi	JOCKEY PUMP
	[ ] YES [ ] NO	[ ] MANUAL [ ] PRESS DROP	[ ] MANUAL	[X] YES ON ____ psi
SHOP OR SERIAL NO.	MODEL OR TYPE	[X] AUTO [ ] WATER FLW	[X] AUTO	[ ] NO OFF ____ psi

SPEED R. P. M.	DISCHARGE PRESSURE P.S.I.	SUCTION PRESSURE P.S.I.	NET HEAD P.S.I.	STREAMS NO.	STREAMS SIZE	STREAMS PITOT PRESSURE	GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE THROTTLE	STEAM PRESSURE CHEST
	155	16	139	Flow Meter			0	0				
	147	16	131		"	"	1500	36				
	145	15	130		"	"	3000	73				
	140	14	126		"	"	4250	103				
	135	14	121		"	"	5000	121				
	123	13	110		"	"	6300	152				

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.



Plot disch. press. and net head curves. For electric-driven pump, plot ampere curve also.

PUMP ACCEPTANCE TEST DATA

Factory Mutual System

D-2

Refer to P&P F(A) - 512.12 & DS 3-7N

PROPERTY OF		ACCT. NO.	INDEX NO.-A/C
X-640 Pump No. 2			
CITY & STATE		PLACO	FMEA D.O.
CONFERRED WITH	TITLE	TESTED BY	DATE
		D. R. Hertzer	1-25-90

PUMP

SHAFT	MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE
[X] HORIZONTAL [ ] VERTICAL	Allis Chalmers	[ ] YES [X] NO	65115	201-060-502

RATED GPM	RATED HEAD-FT. (psi)	RATED RPM	SUCTION FROM	TANK SIZE	TANK HEIGHT
4125	(125) 289	1180	Reservoir	2.5 mill gal	-

IF VERTICAL TYPE

VERTICAL DIST. DISCH. GAUGE TO WATER LEVEL	STATIC FT	PUMPING FT	RIGHT ANGLE GEAR DRIVE	MANUFACTURER	SHOP OR SERIAL NO.	APPROVED
				MODEL OR TYPE	PERFORMANCE [ ] SMOOTH [ ] ROUGH	[ ] YES [ ] NO

DRIVER

MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE	RATED H.P.	RATED R.P.M.
Allis Chalmers	[ ] YES [X] NO	7-5154-28112-2-1	AW/30K58	400	1180

[X] ELECTRIC MOTOR	RATED VOLT.	OPERATING VOLT.	RATED F.L. AMPS	AMPS AT 150%	PHASE	CYCLES	SERVICE FACTOR
	2400		85.7		3	60	1.25

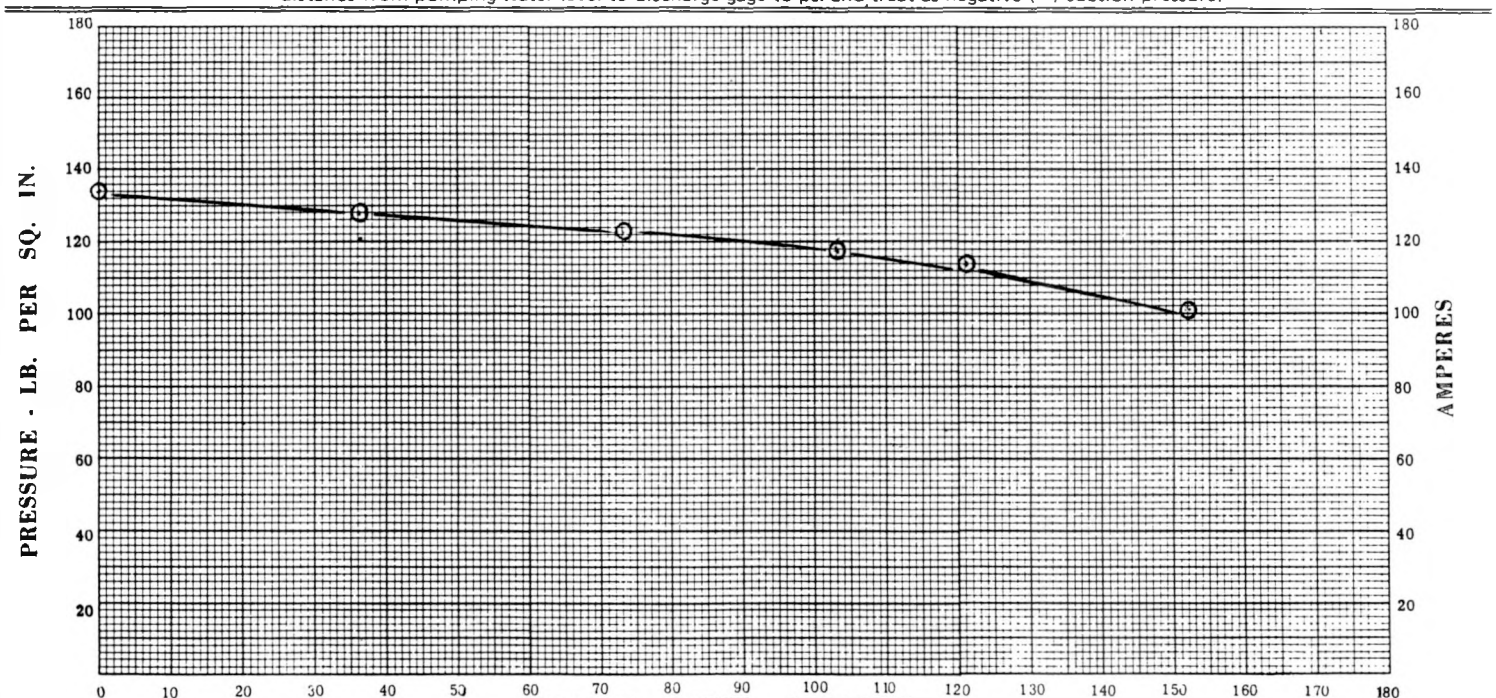
[ ] DIESEL ENGINE [ ] GASOLINE ENGINE [ ] GAS ENGINE [ ] STEAM TURBINE [ ] PRESS. GOVERNOR BUILT IN [ ] INDEPENDENT [ ] TURBINE STEAM PRESS

CONTROLLER

MANUFACTURER	APPROVED	START ____ psi	STOP ____ psi	JOCKEY PUMP
	[ ] YES [ ] NO	[ ] MANUAL [ ] PRESS DROP	[ ] MANUAL	[X] YES ON ____ psi
SHOP OR SERIAL NO.	MODEL OR TYPE	[X] AUTO [ ] WATER FLW	[X] AUTO	[ ] NO OFF ____ psi

SPEED R. P. M.	DISCHARGE PRESSURE P. S. I.	SUCTION PRESSURE P. S. I.	NET HEAD P. S. I.	STREAMS NO.	STREAMS SIZE	STREAMS PITOT PRESSURE	GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE THROTTLE	STEAM PRESSURE CHEST
	150	16	134	Flow Meter			0	0				
	144	16	128		"	"	1500	36				
	139	16	123		"	"	3000	73				
	134	16	118		"	"	4250	103				
	129	15	114		"	"	5000	121				
	115	14	101		"	"	6300	152				

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.



Plot disch. press. and net head curves. For electric-driven pump, plot ampere curve also.

PUMP ACCEPTANCE TEST DATA

Factory Mutual System

Refer to P&P F(A) - 512.12 & DS 3-7N

D-3

PROPERTY OF	ACCT. NO.	INDEX NO.-A/C
X-640 Pump No. 3		
CITY & STATE	**PLACO**	**FMEA D.O.**
CONFERRED WITH / **TITLE**	**TESTED BY**	**DATE**
	D. R. Hertzer	1-25-90

PUMP

SHAFT	MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE
[X] HORIZONTAL [ ] VERTICAL	Allis Chalmers	[ ] YES [X] NO	65117	201-660-502

RATED GPM	RATED HEAD-FT. (psi)	RATED RPM	SUCTION FROM	TANK SIZE	TANK HEIGHT
4120	(125) 289	1200	Reservoir	2.5 mill gal	-

IF VERTICAL TYPE

VERTICAL DIST. DISCH. GAUGE TO WATER LEVEL	STATIC FT / PUMPING FT	RIGHT ANGLE GEAR DRIVE	MANUFACTURER	SHOP OR SERIAL NO.	APPROVED
			MODEL OR TYPE	PERFORMANCE [ ] SMOOTH [ ] ROUGH	[ ] YES [ ] NO

DRIVER

MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE	RATED H.P.	RATED R.P.M.
Caterpillar	[ ] YES [X] NO		D397	450	1200

[ ] ELECTRIC MOTOR	RATED VOLT.	OPERATING VOLT.	RATED F.L. AMPS	AMPS AT 150%	PHASE	CYCLES	SERVICE FACTOR

[X] DIESEL ENGINE [ ] GASOLINE ENGINE [ ] GAS ENGINE [ ] STEAM TURBINE [ ] PRESS. GOVERNOR BUILT IN [ ] INDEPENDENT [ ] TURBINE STEAM PRESS

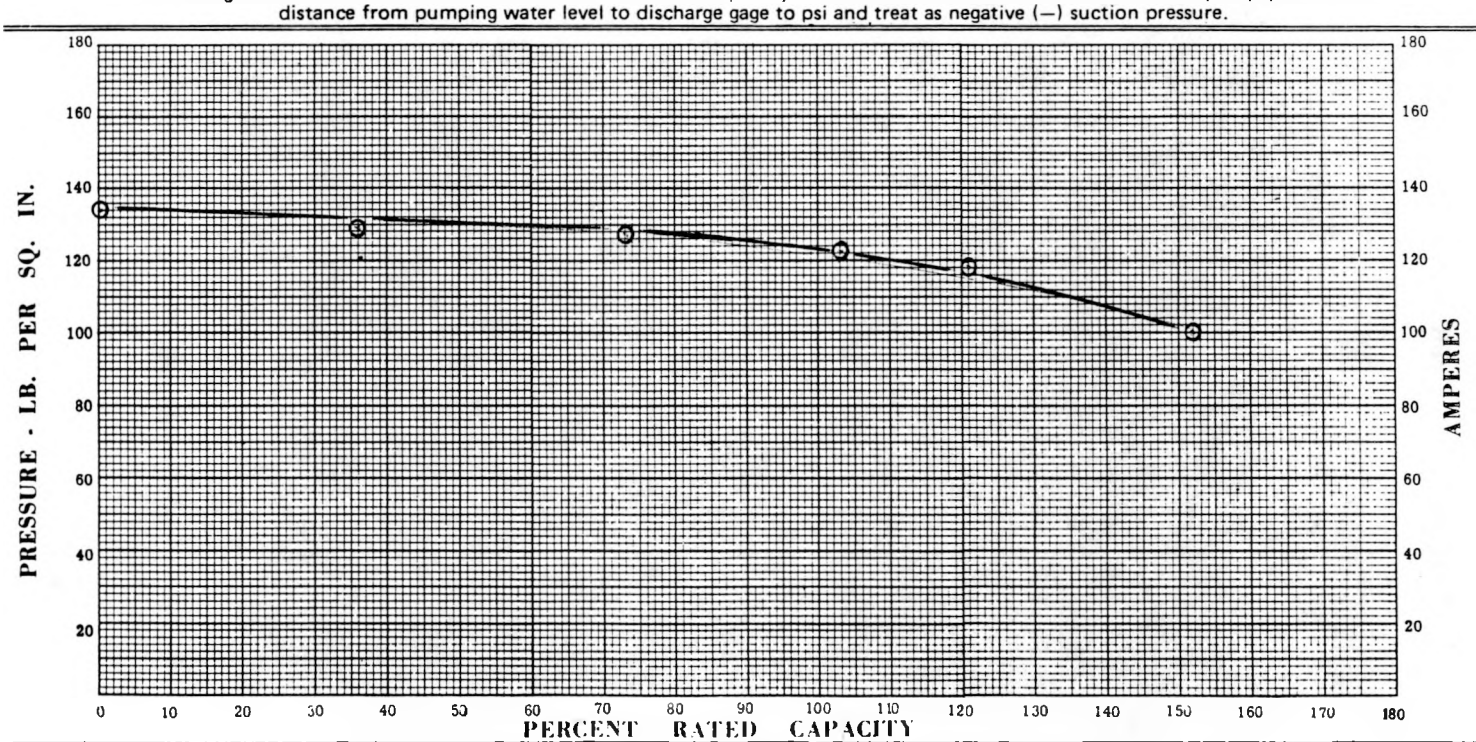
CONTROLLER

MANUFACTURER	APPROVED	START ____ psi	STOP ____ psi	JOCKEY PUMP
	[ ] YES [ ] NO	[ ] MANUAL [ ] PRESS DROP [ ] AUTO [ ] WATER FLW	[ ] MANUAL [ ] AUTO	[ ] YES [ ] NO ON ____ psi OFF ____ psi

SHOP OR SERIAL NO.	MODEL OR TYPE

SPEED R. P. M.	DISCHARGE PRESSURE P. S. I.	SUCTION PRESSURE P. S. I.	NET HEAD P. S. I.	STREAMS NO.	STREAMS SIZE	STREAMS PITOT PRESSURE	GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE THROTTLE	STEAM PRESSURE CHEST
1200	150	16	134	Flow Meter			0	0				
1200	144	15	129		"	"	1500	36				
1200	142	15	127		"	"	3000	73				
1200	136	14	122		"	"	4250	103				
1200	131	13	118		"	"	5000	121				
1200	112	12	100		"	"	6300	152				

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.



Plot disch. press. and net head curves. For electric-driven pump, plot ampere curve also.

PUMP ACCEPTANCE TEST DATA

Factory Mutual System

D-4

Refer to P&P F(A) - 512.12 & DS 3-7N

PROPERTY OF		ACCT. NO.	INDEX NO.-A/C
CITY & STATE		PLACO	FMEA D.O.
X-6644 Pump No. 1			
CONFERRED WITH	TITLE	TESTED BY	DATE
		D. R. Hertzer	1-25-90

PUMP

SHAFT	MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE
[X] HORIZONTAL [ ] VERTICAL	Allis Chalmers	[X] YES [ ] NO	821-91051-6-2	9000

RATED GPM	RATED HEAD-FT. (psi)	RATED RPM	SUCTION FROM	TANK SIZE	TANK HEIGHT
4000	(127) 293	1770	Tank	4.0 mill gal	41 ft.

IF VERTICAL TYPE

VERTICAL DIST. DISCH. GAUGE TO WATER LEVEL	STATIC FT	PUMPING FT	RIGHT ANGLE GEAR DRIVE	MANUFACTURER	SHOP OR SERIAL NO.	APPROVED
				MODEL OR TYPE	PERFORMANCE [ ] SMOOTH [ ] ROUGH	[ ] YES [ ] NO

DRIVER

MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE	RATED H.P.	RATED R.P.M.
General Electric	[ ] YES [ ] NO	BV074003	5K509AN262	450	1780

[X] ELECTRIC MOTOR	RATED VOLT.	OPERATING VOLT.	RATED F.L. AMPS	AMPS AT 150%	PHASE	CYCLES	SERVICE FACTOR
	2300		102		3	60	1.15

[ ] DIESEL ENGINE [ ] GASOLINE ENGINE [ ] GAS ENGINE [ ] STEAM TURBINE [ ] PRESS. GOVERNOR BUILT IN [ ] INDEPENDENT [ ] TURBINE STEAM PRESS

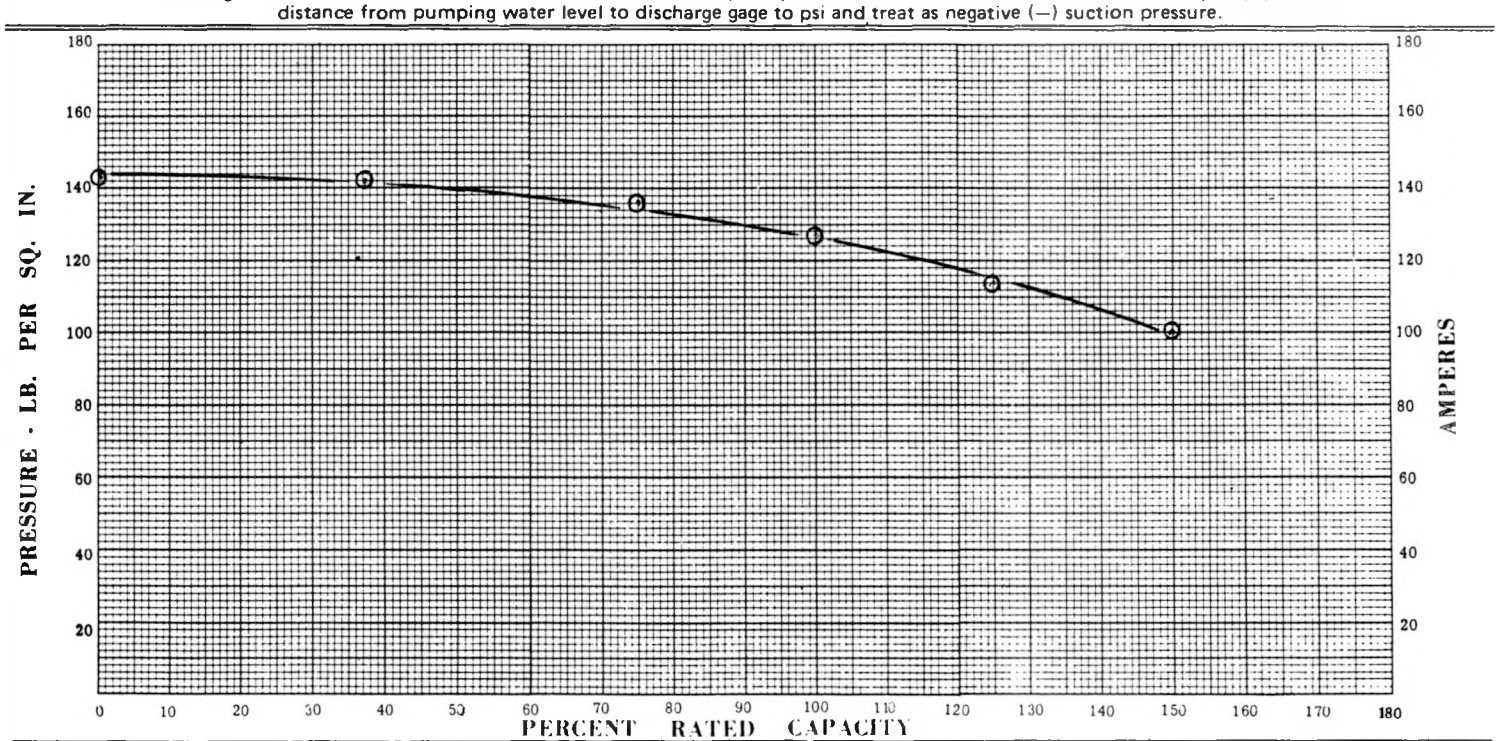
CONTROLLER

MANUFACTURER	APPROVED	START ____ psi	STOP ____ psi	JOCKEY PUMP
Firetrol	[X] YES [ ] NO	[ ] MANUAL [ ] PRESS DROP [X] AUTO [ ] WATER FLW	[ ] MANUAL [X] AUTO	[X] YES ON ____ psi [ ] NO OFF ____ psi

SHOP OR SERIAL NO.	MODEL OR TYPE
112335	H450J FTA-2000A

SPEED R. P. M.	DISCHARGE PRESSURE P. S. I.	SUCTION PRESSURE P. S. I.	NET HEAD P. S. I.	STREAMS NO.	STREAMS SIZE	STREAMS PITOT PRESSURE	GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE THROTTLE	STEAM PRESSURE CHEST
	155	12	143	Flow Meter			0	0				
	154	12	142	"	"		1500	37.5				
	148	12	136	"	"		3000	75				
	139	12	127	"	"		4000	100				
	126	12	114	"	"		5000	125				
	110	11	100	"	"		6000	150				

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.



Plot disch. press. and net head curves. For electric-driven pump, plot ampere curve also.

Factory Mutual System

D-6

PUMP ACCEPTANCE TEST DATA

Refer to P&P F(A) - 512.12 & DS 3-7N

PROPERTY OF	ACCT. NO.	INDEX NO.-A/C
X-6644 Pump No. 2		
CITY & STATE	**PLACO**	**FMEA D.O.**
CONFERRED WITH / **TITLE**	**TESTED BY**	**DATE**
	D. R. Hertzer	1-25-90

PUMP

SHAFT	MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE
[X] HORIZONTAL [ ] VERTICAL	Allis Chalmers	[X] YES [ ] NO	821-91051-6-1	9000

RATED GPM	RATED HEAD-FT. (psi)	RATED RPM	SUCTION FROM	TANK SIZE	TANK HEIGHT
4000	(127) 293	1770	Tanks	4.0 mill gal	41 ft.

IF VERTICAL TYPE

VERTICAL DIST. DISCH. GAUGE TO WATER LEVEL	STATIC FT / PUMPING FT	RIGHT ANGLE GEAR DRIVE	MANUFACTURER	SHOP OR SERIAL NO.	APPROVED
			MODEL OR TYPE	PERFORMANCE [ ] SMOOTH [ ] ROUGH	[ ] YES [ ] NO

DRIVER

MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE	RATED H.P.	RATED R.P.M.
General Electric	[ ] YES [ ] NO	BV074002	5K509AN262	450	1780

[X] ELECTRIC MOTOR	RATED VOLT.	OPERATING VOLT.	RATED F.L. AMPS	AMPS AT 150%	PHASE	CYCLES	SERVICE FACTOR
	2300		102		3	60	1.15

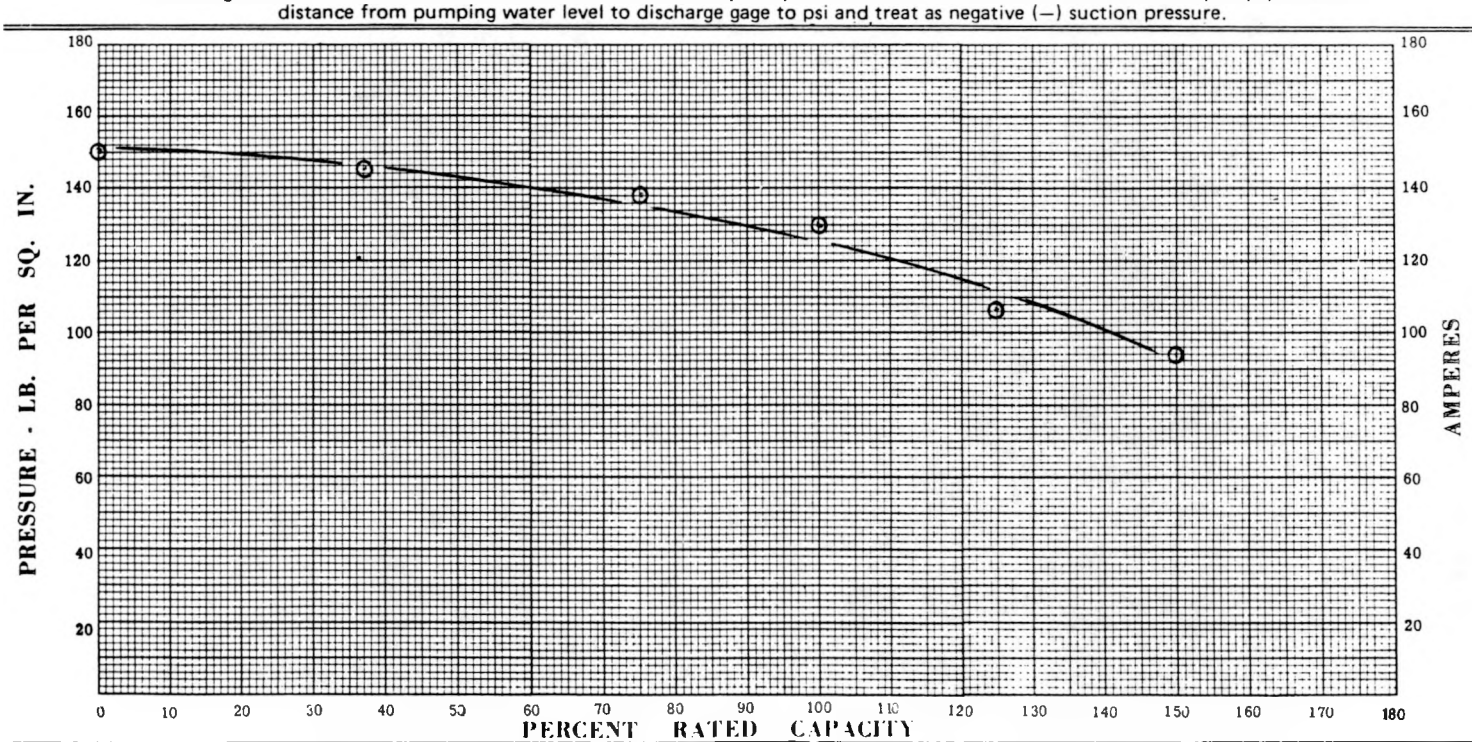
[ ] DIESEL ENGINE [ ] GASOLINE ENGINE [ ] GAS ENGINE [ ] STEAM TURBINE [ ] PRESS. GOVERNOR BUILT IN [ ] INDEPENDENT [ ] TURBINE STEAM PRESS

CONTROLLER

MANUFACTURER	APPROVED	START ____ psi	STOP ____ psi	JOCKEY PUMP
Firetrol	[X] YES [ ] NO	[ ] MANUAL [ ] PRESS DROP	[ ] MANUAL	[X] YES ON ____ psi
SHOP OR SERIAL NO. 1123154	MODEL OR TYPE FTA-2000AH450J	[X] AUTO [ ] WATER FLW	[X] AUTO	[ ] NO OFF ____ psi

SPEED R. P. M.	DISCHARGE PRESSURE P. S. I.	SUCTION PRESSURE P. S. I.	NET HEAD P. S. I.	STREAMS NO.	STREAMS SIZE	STREAMS PITOT PRESSURE	GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE THROTTLE	STEAM PRESSURE CHEST
	162	12	150	Flow Meter			0	0				
	157	12	145	"	"		1500	37.5				
	150	12	138	"	"		3000	75				
	142	12	130	"	"		4000	100				
	119	12	107	"	"		5000	125				
	105	11	94	"	"		6000	150				

Readings marked + in suction column are heads above atmosphere, those marked — are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (—) suction pressure.



Plot disch. press. and net head curves. For electric-driven pump, plot ampere curve also.

PUMP ACCEPTANCE TEST DATA

Factory Mutual System

D-7

Refer to P&P F(A) - 512.12 & DS 3-7N

PROPERTY OF		ACCT. NO.	INDEX NO.-A/C
X-6644 Pump No. 3			
CITY & STATE		PLACO	FMEA D.O.
CONFERRED WITH	TITLE	TESTED BY	DATE
		D. R. Hertzer	1-25-90

PUMP

SHAFT	MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE
[X] HORIZONTAL [ ] VERTICAL	Allis Chalmers	[X] YES [ ] NO	891-91051-7-1	9000

RATED GPM	RATED HEAD-FT. (psi)	RATED RPM	SUCTION FROM	TANK SIZE	TANK HEIGHT
4000	(127) 293	1770	Tanks	4.0 mill gal	41 ft.

IF VERTICAL TYPE

VERTICAL DIST. DISCH. GAUGE TO WATER LEVEL	STATIC FT	PUMPING FT	RIGHT ANGLE GEAR DRIVE	MANUFACTURER	SHOP OR SERIAL NO.	APPROVED
				MODEL OR TYPE	PERFORMANCE [ ] SMOOTH [ ] ROUGH	[ ] YES [ ] NO

DRIVER

MANUFACTURER	APPROVED	SHOP OR SERIAL NO.	MODEL OR TYPE	RATED H.P.	RATED R.P.M.
Cummins	[X] YES [ ] NO	37104957	VT-3730V	683	2100

[ ] ELECTRIC MOTOR	RATED VOLT.	OPERATING VOLT.	RATED F.L. AMPS	AMPS AT 150%	PHASE	CYCLES	SERVICE FACTOR

[X] DIESEL ENGINE [ ] GASOLINE ENGINE [ ] GAS ENGINE [ ] STEAM TURBINE [ ] PRESS. GOVERNOR BUILT IN [ ] INDEPENDENT [ ] TURBINE STEAM PRESS

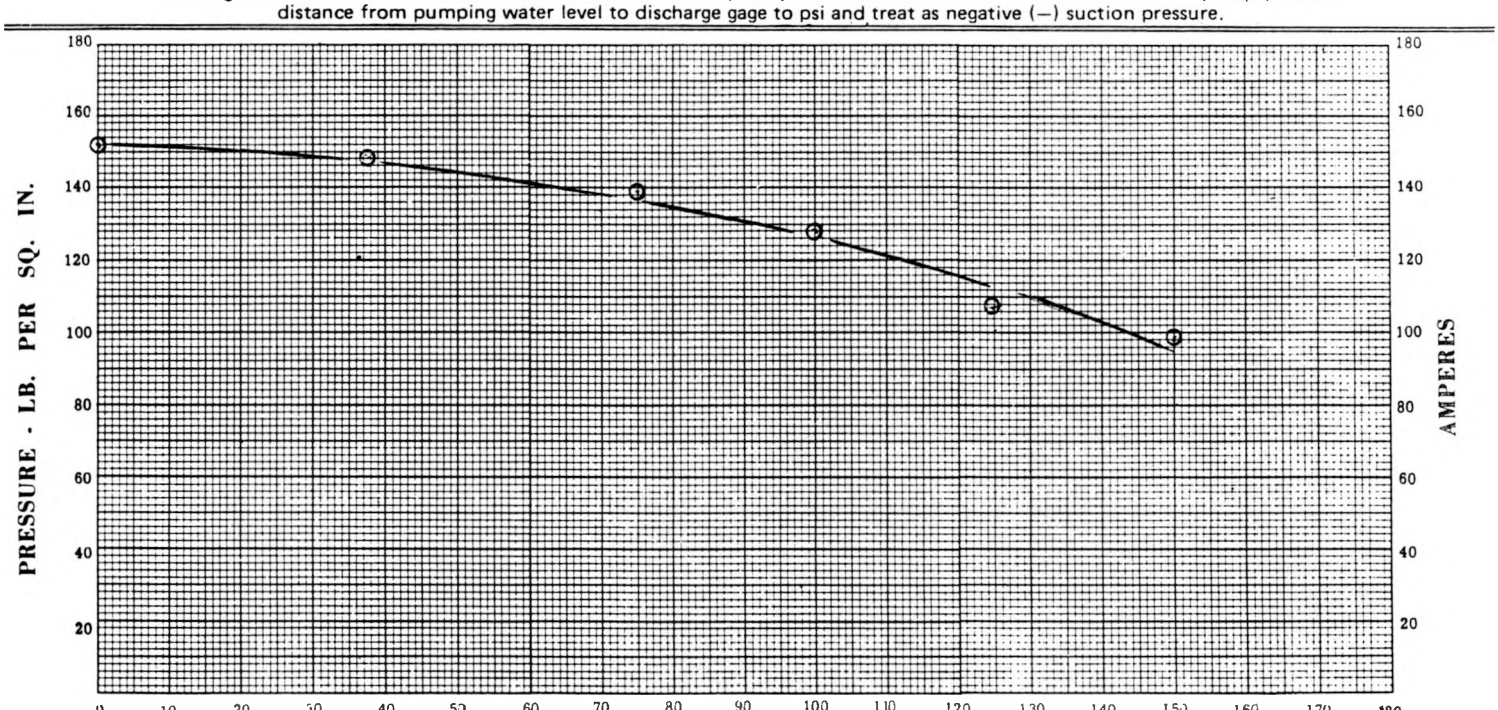
CONTROLLER

MANUFACTURER	APPROVED	START ____ psi	STOP ____ psi	JOCKEY PUMP
Firetrol	[X] YES [ ] NO	[X] MANUAL [ ] PRESS DROP [ ] AUTO [ ] WATER FLW	[X] MANUAL [ ] AUTO	[X] YES [ ] NO ON ____ psi OFF ____ psi

SHOP OR SERIAL NO.	MODEL OR TYPE
112180	1-20-27B FTA1100A42YN

SPEED R. P. M.	DISCHARGE PRESSURE P. S. I.	SUCTION PRESSURE P. S. I.	NET HEAD P. S. I.	STREAMS NO.	STREAMS SIZE	STREAMS PITOT PRESSURE	GALLONS PER MINUTE	PERCENT OF RATED CAPACITY	VOLTS	AMPS	STEAM PRESSURE THROTTLE	STEAM PRESSURE CHEST
1790	164	12	152	Flow Meter			0	0				
1790	160	12	148		"	"	1500	37.5				
1790	151	12	139		"	"	3000	75				
1790	140	12	128		"	"	4000	100				
1790	118	11	107		"	"	5000	125				
1780	110	11	99		"	"	6000	150				

Readings marked + in suction column are heads above atmosphere, those marked – are lifts. For vertical shaft pumps, convert distance from pumping water level to discharge gage to psi and treat as negative (–) suction pressure.



Plot disch. press. and net head curves. For electric-driven pump, plot ampere curve also.

APPENDIX E

CONFERENCE ATTENDESS

Entrance Conference
January 22, 1990

J. Boyce	MMES
L. Calvert	MMES (1-23-90)
E. Gillespie	DOE
D. Hertzer	FMEA
J. Mattern	FMEA
E. Maxie	DOE
R. Voss	FMEA

Exit Conference
March 9, 1990

E. Beasley	MMES
N. Boesch	MMES
J. Boyce	MMES
R. Bush	MMES
L. Calvert	MMES
R. Donnelly	MMES
C. Fouch	MMES
E. Gillespie	DOE
J. Harbert	MMES
D. Hertzer	FMEA
J. Hutton	DOE
J. Mattern	FMEA
S. Preston	MMES
R. Voss	FMEA
C. Weghorst	MMES

APPENDIX F

STATUS OF PREVIOUS RECOMMENDATIONS

Previous Report

Page No.	Rec No.	STATUS			
		Continued	Completed	Revised	Not Applicable
10	4				X
	5		X		
12	12a		X		
	12b		X		
13	13		X		
	16		X		
	17	X(90-2)			
	19	X(90-3)			
14	20				X
	23		X		
15	26				X
15	29		X		
16	31			X(90-5)	
	79-1				X
17	34		X		X[2]
	35				X
19	38b			X(90-8)	
20	40		X		
	41	X(90-6)			
	42		X		
	79-2		X		
21	79-3		X		
22	49		X		
25	55			X(90-18)	
	56				X
26	60				X
27	62	X(90-22)			
	63				X
	64		X		
	79-4				X
29	74				X
	77	X(90-22)			
	78		X		
	79-5				X
31	89				X
	91	X(90-22)			
	93		X		
	79-6		X		
	79-7				X
34	112				X

Previous Report

Page No.	Rec No.	STATUS			
		Continued	Completed	Revised	Not Applicable
35	123		X		
	124				X
36	126	X[3](90-23)			
	127				X
	79-8				X
37	136		X		
	138		X		
	143		X		
	147		X		
42	169				X[4]

Notes:

[1] Designated smoking areas created. All radiation areas are "no smoking".

[2] Plant policy is for employees to evacuate. If employee wants to use fire extinguisher, it is acceptable to do so.

[3] Sprinkler protection for X-710 is budgeted and will be done in 1990.

[4] The alarm to the ACR on start of the second lube pump is adequate to summon building staff and result in prompt shut-off.

APPENDIX G

FIRE DRILL

APPENDIX G-1

Fire Drill Exercise

Time	Elapse Time (min:sec)	Comments
1501:35	0:00	Fire dispatcher receives valve tamper alarm for valve 752. Dispatches firefighters to ivestitate.
1502:35	1:00	Water flow signal received. Code 523. Telephone call on 5555 received by dispatcher.
1503:03	1:28	Apparatus Dispatched.
1503:35	2:00	Request all non-emergency communication to cease on Frequency 2.
1504:03	2:28	Firefighter in pickup arrives; presented with scenario.
1505:58	4:23	Firefighter reports conditions to dispatcher "...heavy smoke... no victims". Fails to check P.I.V.
1507:31	5:56	Fire apparatus on scene. Captain presented with scenario.
1508:09	6:34	Incident commander instructs that A.E.S. should be alerted for possible response.
1509:00	7:25	Laying supply line; laying 1-1/2 in. attack line.
1509:30	7:55	Connect supply line to apparatus.
1509:50	8:15	Laying 2nd 1-1/2 in. attack line.
1510:10	8:35	First firefighter dons SCBA; supply line charged - good lay - no kinks.
1511:40	10:05	Third firefighter dons SCBA.
1513:00	11:25	Firefighters advance attack line into building. Pass through radiological controlled area.

Time	Elapse Time (min:sec)	Comments
1518:30	16:55	Attack lines too short.
1522:10	20:35	Additional hose connected.
1524:40	23:05	Attack lines staged at stairway to pit. Drill exercise concluded.

APPENDIX G-2

Fire Drill Evaluation

	Sat.	Unsat.
1) Handling of Alarm by Dispatcher	X	
2) Travel/Response Time	X	
*3) Firefighters - Full Turnouts	X	
4) Command Post Established	X	
5) Deployment of Manual Suppression Equip.	NRLY	
*6) Verification of Fixed Protection		X
7) Fire Ground Communications	X	
8) HP Interface	X	
9) Security Interface	X	

*Unsatisfactory Rating = Unsatisfactory Drill Evaluation

APPENDIX H

FIRE DEPARTMENT TRAINING

ATTACHMENT A

MINIMUM ANNUAL TRAINING REQUIREMENTS
for
AUXILLARY EMERGENCY SQUAD MEMBERS

SUBJECT	HOURS
SCBA (Self Contained Breathing Apparatus)	4 hours
FIRE HOSE/HOSE TOOLS/APPLIANCES	2 hours
ROPES AND KNOTS	2 hours
EMERGENCY VEHICLES/EQUIPMENT/FACILITIES FAMILIARIZATION	2 hours
CHLORINE KITS "A" AND "B"	2 hours
PERSONAL PROTECTIVE CLOTHING/EQUIPMENT	2 hours
CHEMICAL PROTECTIVE CLOTHING	2 hours
ELECTRICAL GENERATING EQUIPMENT/LIGHTING	2 hours
HIGH/LOW PRESSURE AIR BAGS	2 hours
RESCUE SAW/FORCIBLE ENTRY TOOLS	2 hours
RADIOLOGICAL/GAS DETECTION INSTRUMENTS	2 hours

ATTACHMENT B

MARTIN MARIETTA ENERGY SYSTEMS INC.
FIRE DEPARTMENT

D-921 IN-SERVICE FIRE TRAINING TOPICS

ID NUMBER	TOPIC	FREQUENCY	RESOURCE
FST1010	Chemistry of Fire	3 years	IFSTA O/H slides A/V tape Oh FSTM Mod-2 D-921
FST1011	Fire extinguishment	3 years	Oh FSTM Mod-6 IFSTA O/H slides A/V tapes D-921
FST1012	Water as used in the Fire Service	W/needed	Oh FSTM Mod-3 D-921
FST1013	FD familiarization	New Employee	Fire Dept Check sheet D-921
FST1014	Haz Comm Std.	(See MAN0206)	
FST2010	Alarm room operations	3 years	Lesson plan O/H slides D-921
FST2011	Radiation instruments and Monitoring	Annual	Lesson plan O/H slides D-102
FST2012	NFPA 704 System	3 years	Lesson plan O/H slides NFPA std 704 D-921
FST2013	Ventilation	3 years	Fire Soft Oh FSTM Mod-5 D-921
FST2014	Search & Rescue	Annual	Lesson plan Oh FSTM Mod-6 A/V tapes D-921
FST2015	Monitoring Station Operations	Request	Lesson plan D-921

FST2016	Gas/Oxy detection instruments	2 years	Lesson plan D-921
FST2017	DOT placard system	3 years	Lesson plan DOT response manual. D-921
FST2018	Chlorine emergencies	3 years	Lesson plan A/V material on order Practice cyls. Cl kits D-921
FST2019	Switchyear Safety for Emerg response personnel	3 years	Lesson plan O/H slides D-802
FST2020	Cutting & welding fire watch	Request	Lesson plan Fire pan Extinguishers D-921
FST2021	Vehicle Fires (Live fire)		Lesson plan O/H slides Vehicles D-921
FST3010	Personal Protective Equipment/clothing		Oh FSTM Mod-1 Turn-out-gear D-921
FST3011	Self Contained Breathing Apparatus SCBA	Annual	Lesson plan Oh FSTM Mod-4 SCBA unit(s) 35 mm slides D-921
FST3012	Personal distress device PASS	Annual	Lesson plan PASS unit(s) D-921
FST4010	Fire Hose		Lesson plan Oh FSTM Mod-3 A/V tapes D-921

FST4011	Firefighting Foam(s)	3 years	Lesson plan A/V tapes O/H slides Demo kit Foam eductor Pumper Foam Concentrate D-921
FST4012	Auxiliary equipment	(Not completed)	
FST4013	Salvage Operation	3 years	Oh FSTM Mod-6 Salvage equip. D-921
FST4014	Fire extinguisher maintenance	(Not completed)	
FST4015	Fire extinguishers		Lesson plan O/H slides A/V tapes Oh FSTM Mod-2 D-921
FST5010	Automatic Sprinkler Systems	3 years	Oh FSTM Mod-5 A/V tape(s) D-921
FST5011	Fire Alarm Systems	3 years	Lesson plan O/H slides D-921
FST6010	Ropes & Knots in the Fire Service	Annual	Lesson plan O/H slides A/V tape Oh FSTM Mod-2
FST6011	Ground ladders	2 years	Oh FSTM Mod-4 IFSTA O/H slides A/V tape(s) D-921
FST6012	Forcible entry tools	3 years	Oh FSTM Mod-5 Fire Soft A/V tape(s) D-921
FST6013	Gas/Liquid Release equipment/methods	(Not completed)	
FST6014	(Not used)		

FST6015	High/Low Pressure air bags	2 years	Lesson plan D-921
FST6016	Vehicle extrication	3 years	Lesson plan O/H slides D-921
FST7010	Driving emergency vehicles	3 years	Lesson plan A/V tape(s) D-921
FST7011	Fire Pumps	3 years	Lesson plan 35 mm slides D-921
FST9010	Unannounced Emerg preparedness exercise	Annual	D-920
FST9011	Training exercise	(TBD)	
FST9012	Emerg response demonstration	(TDB)	
FST9013	Hose evolution #1	Annual	Instruction sheet D-921
FST9014	Hose evolution #2	Annual	Instruction sheet D-921
FST9015	Hose evolution #3	Annual	Instruction sheet D-921

ATTACHMENT C

MARTIN MARIETTA ENERGY SYSTEMS INC.
FIRE DEPARTMENT

D-921 MANDATORY TRAINING TOPICS

ID NUMBER	TOPIC	FREQUENCY	RESOURCE
MAN0101	General NCS	Biennial	D-212 SPP H-30
MAN0102	Job Specific NCS	Annual	D-921
MAN0150	Supervisory NCS		D-212
MAN0201	Hearing Conservation	Annual	D-1-2 SPP H-4
MAN0202	Heat Stress	Annual	D-102 SPP H-26
MAN0203	Cold Stress	Annual	D-102 SPP H-44
MAN0204	Confined Spaces	Annual	D-102 SPP H-53
MAN0205	Asbestos	Annual	D-102 SPP H-29
MAN0206	Hazard Comm Standard	Annual	D-102 SPP H-32
MAN0218	Reproductive Hazards	W/Required	D-102
MAN0302	Hand Monitor/frisker	Annual	D-102
MAN0401	Health & Safety Rights	Annual	D-212 DOE order 5483.1
MAN0501	Emergency Preparedness (SafeGuards & Security)	Annual	Emerg Manual POEF-A-366
MAN0404	Stop Tags	Annual	D-921 SPP M-5
EMP0104	Security lock down procedure	Initial employment	Lecture D-912

APPENDIX I

FIXED FIRE PROTECTION SYSTEM TESTS

Trip tests were conducted on two deluge and one dry pipe system. The results were satisfactory. The following information was obtained:

Deluge Valve No.	Water Press. Before Trip (psi)	Water Press. @Trip (psi)	Supervisory Air Press. (psi)	Time to Trip (secs)
129	97	90	18	14
149B	123	120	38	5

Dry Pipe Valve No.	Air Press. Before Trip (psi)	Water Press. Before Trip (psi)	Press @Trip (psi)	Air Press to Trip Ratio	Time to Trip (secs)
532	41	87	18	4.8/1	50