G-SD-Z-00008

Revision 4

SYSTEM DESCRIPTION DOCUMENT

For

SALTSTONE FIRE PROTECTION

CLOSURE BUSINESS UNIT – WASTE SOLIDIFICATION PROJECTS
SALTSTONE FACILITY

Original Document (SS-15) by
Bechtel National, Inc.

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SUMMARY

The Saltstone Facility in Z-Area processes and disposes of radioactive salt solution from the H-Area tank farm. The salt solution consists of low-level mixed waste primarily from the Effluent Treatment Project, Low Curie Salt, and Actinide Removal Project. The Z-Area Saltstone Facility immobilizes the slightly radioactive solution into a concrete-like product (saltstone) suitable for safe disposal in an aboveground vault.

The Saltstone fire suppression and detection systems include the fire water supply and distribution system, exterior fire protection system for Z-Area buildings (all under control of Site Utilities Department), and interior fire sprinkler systems, Halon fire suppression system, and a fire detection and alarm system for the entire Z-Area. The operation and maintenance of the Fire Water System, up to the last post indicating valve feeding the 704-Z and 210-Z sprinkler systems, is the responsibility of the Site Utilities Department.

1.0 FUNCTIONS AND DESIGN REQUIREMENTS

1.1 PROCESS AND SAFETY FUNCTIONS

The function of the Saltstone fire protection systems is to protect plant personnel, facilities, and equipment from smoke and fire by means of detection and alarming, and by use of automatic fire suppression systems. The fire protection systems for the Saltstone facilities shall be selected and designed to achieve a level of fire protection that meets or exceeds the improved risk level as defined by DOE Orders 6430.1A and 5480.7.

1.2 DESIGN REQUIREMENTS

1.2.1 Operational Requirements

1.2.1.1 Fire Water Storage and Supply System

A fire water supply system shall provide sufficient water storage to deliver a fire water flow of 1,000 gpm for 2 hours. The fire water pumping system shall maintain a minimum residual pressure of 65 psig in the distribution system when water is flowing at the design flow rate. The system shall include redundant pumps and shall have a diesel-driven fire pump to ensure fire water flow during a power failure.

A fire alarm system shall be provided to activate alarms in the Central Control Room (CCR), communications center, and the F-Area Fire Station. The system shall be compatible with the plant-wide Digital Alarm Communicator (DACT) and be coded to identify the Z-Area location of the alarm for quick response by the F-Area Fire Station.

1.2.1.2 Process Building (210-Z)

The occupancy classification of the Process Building (210-Z) shall be Ordinary Hazard, Group 3. The primary process in this building shall be contained in the regulated process area, where salt solution, cement, slag, flyash, and liquid admixture are mixed and pumped to a Saltstone surface disposal vault. Minor amounts of lubricating oils shall be allowed in the building. All electric cabling shall be contained in metallic conduit.

The CCR and CCR I/O room shall contain the process control consoles and electrical cabling. The only significant concentrations of combustibles in this area are expected to be within the cabinets and consoles themselves and in the underfloor cable troughs and overhead, open-ladder cable trays. Interconnecting cables shall be specified to meet the fire test requirements of IEEE-383 or UL 1277.

The Electrical Control Room (ECR) shall contain motor control cabinets, uninterruptible power supply (UPS) equipment, battery banks, and electrical distribution equipment typical for this type of occupancy. All electrical cable shall be IEEE-383 or UL 1277 rated and shall be run in two levels of overhead, open-ladder trays.

Other occupancies shall include offices, miscellaneous storage, mechanical equipment, tool crib, electrical and instrument shop, and clean maintenance shop

1.2.1.3 Operations Building (704-Z)

The occupancy classification of the Operations Building (704-Z) shall be Ordinary Hazard, Group 3. The building shall contain offices, a lunchroom, locker rooms, and small laboratories.

The Electrical Control Room (ECR) shall contain electrical distribution equipment typical of this type of occupancy. All electrical cable shall be IEEE-383 or UL 1277 rated and shall be run in two levels of overhead, open-ladder trays.

1.2.1.4 Substation Building (951-Z)

The occupancy classification of the Substation Building (951-Z) shall be Ordinary Hazard, Group 3. The building shall contain electrical distribution equipment typical of this type of occupancy. All electrical cable shall be IEEE-383 or UL 1277 rated and shall be run in two levels of overhead, open-ladder trays.

Combustible materials shall be limited essentially to the flame-retardant cables in trays or cables and components within the metal cabinets. Metal partitions between cabinets shall be provided for compartmentalization and prevention of fire spread.

1.2.1.5 Fire Water Pump House (901-Z)

The occupancy classification of the Fire Water Pump House (901-Z) shall be Ordinary Hazard, Group 3. This building shall be normally unoccupied. The only fire hazard shall be the fuel oil for the diesel engine.

1.2.1.6 Salt Feed Tank / Clean Cap Batch Tank (201-Z) Area

There are no combustibles in the Clean Cap Batch Tank Area.

1.2.2 Structural Requirements

Structural requirements are covered by SDD SS-02, Saltstone Structures and Vault.

1.2.3 System Configuration and Essential Features

The fire water supply system shall include a dedicated water storage tank and redundant fire water pumps. The water distribution system shall be designed so that a portion of the system can be shut down for maintenance or modification without shutting down the entire system.

1.2.4 Maintenance Requirements

The Saltstone fire protection system shall be designed for contact maintenance. Accessibility for removal, repair, and replacement of equipment shall be provided.

1.2.5 Surveillance and In-Service Inspection Requirements

The fire pumps shall be tested periodically in accordance with NFPA No. 20.

1.2.6 Instrumentation and Control Requirements

Ionization smoke detectors or rate-compensated, fixed-temperature thermal detectors shall be provided in all areas of the Process Building (210-Z), and the Substation Building (951-Z).

Fire alarm pull boxes and alarm horns shall be provided in the Process Building (210-Z), Operations Building (704-Z), Substation Building (951-Z), and Bulk Material Handling Facility (205-Z).

Automatic Halon 1301 actuation shall be provided for the CCR.

1.2.7 System Interfacing Requirements

- G-SD-Z-00001, Z-Area Site, provides the space for the Fire Water Pump House (901-Z), the Fire Water Storage Tank and the fire water distribution piping.
- G-SD-Z-00002, Saltstone Structures and Vaults, provides the Fire Water Pump House (901-Z) and the water storage tank foundation, and requires fire protection and detection systems.
- G-SD-Z-00004, Saltstone Electrical Power, provides normal electrical power to the fire pumps and other electrical loads, and emergency power for lighting, controls, and single-phase power loads, and requires fire protection for the equipment at the Substation Building (951-Z).
- G-SD-Z-00005, Saltstone HVAC, provides heating and ventilation of the Fire Water Pump House (901-Z).
- G-SD-Z-00006, Saltstone Support, provides makeup water to the fire water supply system from the domestic water system.

1.2.8 Quality Assurance Requirements

Quality assurance requirements for SRS activities are outlined in DOE Order SR-5700.6B. The Savannah River Quality Assurance Plan, DPW 82-111-2, and the DWPF Project Quality Assurance Plan serve as the basis for quality assurance activities for the DWPF. A QA

assessment program was performed for the Saltstone facilities. All systems and components were determined to be non-Q.

1.2.9 Code and Standard Requirements

The fire protection systems shall meet the requirements of the following codes and standards:

- DOE 6430.1, Chapter X, "General Design Criteria Manual," 12/23/83
- DOE 5480.7, "Fire Protection," 11/16/87
- OSHA 29 CFR, Part 1910, Subpart E, "Means of Egress"
- Factory Mutual, "Loss Prevention Data Sheets"

1.2.10 Reliability Assurance

The Saltstone fire protection systems shall have sufficient redundancy built into them so that a failure of any component of the systems will not impair the ability of the systems to perform their life safety functions.

1.3 DESIGN BASIS RATIONALE

This section is not applicable to this SDD.

2.0 DESIGN DESCRIPTION

2.1 DETAILED SYSTEM DESCRIPTION

2.1.1 Fire Water Storage and Supply System

Fire pumps and a storage tank are provided in accordance with NFPA Standards No. 20 and 22. There are two parallel pumps: one diesel-driven, horizontal, centrifugal pump rated at 1,000 gpm at 125 psi total head; and one electric-motor-driven, horizontal, centrifugal pump rated at 1,000 gpm at 125 psi total head. Both take suction from a 130,000-gallon aboveground steel storage tank. The tank is sized to supply a minimum of 1.5 hours of fire protection water as approved by SRS-DOE-5480.7A-EQ-94-075 and 087, "Equivalency Requests for Building 704Z and 210Z", respectively. A low-capacity, electric-motor-driven, centrifugal jockey pump maintains system pressure. Each pump is equipped with a UL-approved controller for automatic start of the pumps. A 4-inch domestic water fill line allows the fire water storage tank to be filled within 24 hours. The diesel fire pump room has a wet pipe sprinkler system for Ordinary Hazard, Group 3 occupancy. The fire water storage and pumping system is illustrated schematically in Figure 1.

A 10-inch underground fire protection water supply loop around the Saltstone Facility is installed in accordance with NFPA No. 24. The fire protection water supply loop feeds seven hydrants distributed around the loop. Each hydrant has a curb box isolation valve and is furnished with a hose box and accessories per DuPont Std. F1C. Seven post indicator valves are installed in the looped main to provide adequate sectional control for the loop. Two 6-inch connections with post indicator valves are provided for fire water supply to the Operations Building (704-Z) and Process Building (210-Z). The fire water distribution loop is illustrated schematically in Figure 2.

2.1.2 Process Building (210-Z) Fire Protection Systems

Because of the limited fire hazard in this area and the lack of any significant combustible materials, it is expected that any fire that may occur would be isolated to the immediate area of origin and would be non-propagating. Significant fire damage in the regulated process area is not anticipated.

The Process Building (210-Z) is equipped with ionization smoke detectors or rate-compensated, fixed-temperature thermal detectors in all areas. There are also fire alarm pull boxes and fire alarm horns. Automatic Halon 1301 protection is provided for the CCR. This system is in compliance with NFPA No. 12A. It is a double-shot system designed to provide a 5 percent minimum concentration within 10 seconds of discharge and to maintain that concentration for at least 10 minutes. The Halon system is automatically actuated by photoelectric and ionization smoke detectors. Portable fire extinguishers and emergency lighting are found throughout the facility.

All areas of the Process Building (210-Z) have sprinkler protection, except for the regulated process area, the CCR and I/O cabinet room, and the ECR.

The sprinkler systems are hydraulically designed for a discharge density of 0.19 gpm/ft^2 over any (including the most hydraulically remote) 2,500 ft^2 area based on Ordinary Hazard, Group 3 occupancy. Sprinkler head spacing is designed so as not to exceed 90 ft^2 per head. The sprinkler system is fed by the previously described fixed fire pumps.

The ECR is equipped with ionization smoke detectors. Because of the relatively light loading of flame-retardant cables and the lack of any other significant combustible materials, automatic fire suppression is not necessary in this area.

2.1.3 Operations Building (704-Z) Fire Protection Systems

A Thermal detector is located in the north ceiling of the lunch room, and manual pull boxes, and fire alarm horns are installed in all areas of the Operations Building (704-Z).

All areas of the Operations Building (704-Z) have sprinkler protection except for the ECR. Because of the relatively light loading of flame-retardant cables and the lack of any other significant combustible materials, automatic fire suppression is not deemed necessary. The shipping/ receiving area of the building is equipped with a dry-pendant-type sprinkler system, and all other areas have wet pipe sprinkler systems.

The sprinkler systems are hydraulically designed for a discharge density of 0.19 gpm/ft^2 over any (including the most hydraulically remote) 2,500 ft^2 area based on Ordinary Hazard, Group 3 occupancy. Sprinkler head spacing is designed so as not to exceed 90 ft^2 per head.

The sprinkler system is fed by the previously described fixed fire pumps through the Z-Area fire water distribution loop.

There are multiple-purpose, dry-chemical portable fire extinguishers throughout the building.

2.1.4 Substation Building (951-Z) Fire Protection Systems

Because of the relatively light loading of flame-retardant cable and the lack of any other significant combustible materials, automatic fire suppression is not deemed necessary. Any fire involving the flame-retardant cable is not expected to propagate very rapidly. Similarly, fires of electrical origin in the cabinets involving cables or other combustible components are unlikely to grow rapidly.

A fire detection and alarm system is provided consisting of ionization smoke detectors, manual pull boxes, and fire alarm horns. There are portable fire extinguishers. The smoke detection system is expected to provide early detection of fires that might occur in this building. Prompt

response by personnel with the portable extinguishers will probably be sufficient to extinguish a slow-growing fire, which is the kind of fire most likely in this type of occupancy. In the unlikely event that the fire progresses to a point beyond the capability of the portable extinguishers, the response of the Savannah River Plant Fire Department will be sufficient to prevent major damage. Estimated response time to this building by the fire department is 7 minutes. Because of the light loading of flame-retardant cables and the lack of any other significant combustible materials, automatic fire suppression systems are not provided. Even under adverse conditions, fire damage is expected to be limited to only a fraction of the equipment in the building, and it is expected that electric power could be restored to the Saltstone Facility in a short period of time.

2.1.5 Fire Water Pump House (901-Z) Fire Protection Systems

A wet pipe sprinkler system designed for 0.21 gpm/ft^2 is provided in the diesel-engine-driven fire pump room. There are ionization-type smoke detectors in both pump rooms and a multiple-purpose dry chemical type portable fire extinguisher in each room. Manual fire alarm pull boxes and alarm horns are provided.

2.1.6 Bulk Material Handling Area (205-Z) Fire Protection

Manual fire alarm pull boxes and alarm horns are provided.

2.1.7 Clean Cap Batch Tank and Salt Feed Tank Area (201-Z) Fire Protection

A fire hose station is provided.

2.2 SYSTEM PARAMETERS AND PERFORMANCE CHARACTERISTICS

2.2.1 Fire Water Supply System

The Z-Area fire water supply system is designed to the following parameters:

- The primary fire water pump design flow rate is 1,000 gpm at a discharge head of 125 psig.
- There is a minimum storage capacity of 120,000 gallons.
- During normal standby operation, the fire water distribution system is maintained in the 105-117 psig range by the jockey pump
- Under fire flow conditions, the fire water discharge pressure is maintained in the 80-130 psig range.

2.2.2 Sprinkler Systems

Fire sprinkler systems are designed to the following parameters:

- The wet pipe sprinkler system in the diesel fire pump room is designed to discharge a minimum of 0.21 gpm/ft^2 over 1,500 ft^2 of the room.

- All other wet and dry pipe sprinkler systems are designed to discharge a minimum of 0.19 gpm/ ft^2 over the most remote 2,500 ft^2 of the fire zone covered.

2.2.3 Halon System

The Halon 1301 system for the CCR in the Process Building (201-Z) is designed to attain a minimum Halon concentration of 5 percent in the room within 10 seconds and to maintain that concentration for a period of 10 minutes.

2.3 SYSTEM ARRANGEMENT

2.3.1 Fire Water Supply System

The fire water supply system includes the following:

- A dedicated fire water storage tank
- Two fire water pumps, one electric-motor-driven and one diesel-engine-driven
- An electric-motor-driven jockey pump for maintaining system pressurization
- A looped underground distribution main around the Z-Area facilities with fire hydrants for building exterior fire protection, isolation valves for shutdown of portions of the main loop, and branch lines to the Process Building (210-Z), the Operations Building (704-Z), and the Fire Water Pump House (901-Z), to feed sprinkler systems.

The fire water supply system is shown schematically in Drawings W776910, W776911, and W776912.

2.3.2 Process Building (210-Z) Fire Protection Systems

The Process Building (210-Z) includes the following fire protection systems:

- Wet pipe sprinklers in the shops areas, offices, utility room, and corridors.
- A Halon 1301 system in the CCR and CCR I/O cabinet room
- Smoke detectors throughout the building
- Manual pull stations
- Portable fire extinguishers

The Process Building (210-Z) fire protection systems are identified in fire protection and safety zone Drawing W776815.

2.3.3 Operations Building (704-Z) Fire Protection Systems

The Operations Building (704-Z) includes the following fire protection systems:

- Wet pipe sprinklers throughout the building, except in the shipping/receiving area and the ECR
- A dry pipe sprinkler system in the shipping/receiving area
- A Thermal detection device in the north end of the lunch room
- Manual pull stations
- Portable fire extinguishers

The Operations Building (704-Z) fire protection systems are identified in fire protection and safety zone Drawing W776817.

2.3.4 Fire Water Pump House (901-Z) Fire Protection Systems

The Fire Water Pump House (901-Z) includes the following fire protection systems:

- A wet pipe sprinkler system in the diesel fire pump room
- Smoke detectors throughout the building
- Manual pull stations
- Portable fire extinguishers

The Fire Water Pump House (901-Z) fire protection systems are identified in fire protection and safety zone Drawing W776818.

2.3.5 Substation Building (951-Z) Fire Protection Systems

Fire protection for the Substation Building (951-Z) consists of smoke detectors and manual pull stations, as shown in Riser Diagram W774224.

2.3.6 Bulk Material Handling Area (205-Z) Fire Protection Systems

Fire protection in the bulk material storage and handling area consists of smoke detectors and manual pull stations, as shown in Riser Diagram W774224.

2.3.7 Clean Cap Batch Tank and Salt Feed Tank Area (201-Z) Fire Protection

Fire protection in the area of the Clean Cap Batch Tank (CCBT) and Salt Feed Tank consists of a hose station, as shown in Piping Arrangement W779811.

2.4 COMPONENT DESIGN DESCRIPTIONS

2.4.1 Fire Water Storage Tank

The Fire Water Storage Tank (FWST) is a 30 ft dia., 26-foot-high atmospheric storage tank with a capacity of 135,000 gallons up to the overflow nozzle. The tank is shown in Drawing W776910. The following connections are provided:

- A 10-inch discharge to the fire pumps
- A 6-inch flow test return line from the fire pumps
- An 8-inch pressure relief line from the discharge of the diesel fire pump
- A 2-inch cooling water return line from the diesel engine cooling system
- A 4-inch makeup water line from the site domestic water supply system
- A 6-inch overflow line to a splash block at the base of the tank
- A 4-inch tank drain connection
- Two 3-inch fire hose connections
- Three 24-inch manholes, two on the roof and one on the side of the tank
- An 8-inch vent connection to atmosphere
- One 4-inch spare connection on the roof of the tank
- One 2-inch connection for a level transmitter
- One 1-1/2-inch connection for a local level indicator

The Process Water Tank is a 21 ft dia., 16-foot-high carbon steel tank with a nominal capacity of 37,000 gallons. This tank can be used as a fill point for fire department pumpers, but is not connected to the Z-Area fire water distribution system.

2.4.2 Electric-Motor-Driven Fire Pump

The main fire water supply pump is an electric-motor-driven, horizontal-split-case centrifugal pump with a capacity of 1,000 gpm at a design discharge pressure of 125 psig and a 125 hp motor. A UL-listed fire pump controller is set to start the fire pump whenever the pressure in the fire pump discharge header drops to a low setpoint.

2.4.3 Diesel-Engine-Driven Fire Pump

The backup fire water supply pump is a diesel-engine-driven, horizontal-split-case centrifugal pump with a capacity of 1,000 gpm at a design discharge pressure of 125 psig. A 27 in. dia., 82-inch-long, nominal 180-gallon diesel fuel storage tank is provided. A UL-listed fire pump

controller is set to start the fire pump whenever the pressure in the pump discharge header drops to a low-low setpoint.

2.4.4 Jockey Pump

A jockey pump maintains the pressure in the fire water distribution system when the main or diesel backup fire pump is not running. This is a centrifugal pump with a capacity of 15 gpm at a design discharge pressure of 115 psig and a 7.5 hp electric motor. A UL-listed fire pump controller is provided for the jockey pump. This controller is set to start the jockey pump whenever the fire pump discharge header pressure drops to a low setpoint and to stop the jockey pump when the header pressure rises to a high setpoint.

2.4.5 Fire Water Distribution Loop

The Z-Area fire water distribution system includes the following:

- A 10 in. dia. buried main pipe that loops around the Z-Area facilities with branch lines to the fire water use points
- Seven fire hydrants, each with a 6-inch branch line and an underground 6-inch shutoff valve (valve Code G21R) in a curb-type valve box. Each hydrant includes two 2-1/2-inch fire hose connections and one 4-1/2-inch fire pumper connection
- Two 6-inch underground branch lines, one each to sprinkler risers in the Process Building (210-Z) and Operations Building (704-Z). Each of these branch lines includes a post-indicator-type shutoff valve that can be locked in the open position
- Five 10-inch buried post-indicator-type shutoff valves in the main fire water loop that are spaced around the loop in such a way that any section of the main loop can be isolated for maintenance without putting more than three use points (hydrants or building branch lines) for fire water out of service at one time
- Two separate 10-inch underground discharge lines from the fire pump discharge header in the pump house to the distribution loop

All piping in the distribution system is ductile iron pipe, P-Code P-126 in Specification 4486. All buried piping has an external coal tar coating conforming to DuPont Specification 7797, System C.

2.4.6 Process Building (210-Z) Fire Protection Systems

The Process Building contains the following fire protection systems:

- A wet pipe fire sprinkler system covering the shop areas, the utilities room, offices, and corridors

- A total flooding Halon 1301 fire suppression system for the CCR and the CCR I/O cabinet room. The system includes the main 265-pound Halon cylinder tied to the system, and the reserve cylinder maintained in storage. The system is activated by cross-zoned, ionization-type smoke detectors in the two rooms
- Ionization-type smoke detectors in the regulated process area, the ECR and the battery room. (There are no automatic fire suppression systems in these rooms.)
- Ionization-type smoke detectors and thermal fire detectors in the utilities room
- Ionization-type smoke detectors in all other sprinklered areas of the building
- Alarm horns
- Local fire alarm panel (LFA-210)

The sprinkler system is fed from a 6-inch riser with a UL-listed and Factory-Mutual (FM) approved alarm check valve in a valve house adjacent to the northwest corner of the building. The sprinkler system is hydraulically designed to provide 0.19 gpm/ft^2 over the most remote 2,500 ft^2 of the building. Sprinkler heads are fusible link type. Piping exposed to the outside is Code P-125 galvanized steel; piping not exposed to the outside is Code P-124 plain black carbon steel.

2.4.7 Operations Building (704-Z) Fire Protection Systems

The Operations Building (704-Z) is protected by the following fire protection systems.

- A wet pipe sprinkler system covering all areas of the building except the ECR and the shipping/receiving area
- A dry pipe sprinkler system in the shipping/receiving area designed to provide 0.19 gpm/ft^2 over the entire area
- A single Thermal detection device located in the north end of the lunch room
- Multiple-purpose, dry chemical portable fire extinguishers
- A manual pull station located near each building exit
- Five fire alarm horns with a double projector located in the building corridors
- Local fire alarm panel LFA-704, located in the building entry vestibule on the north side of the building

The wet pipe sprinkler system is fed from a 6-inch riser with a UL-listed and FM-approved alarm check valve in a valve house adjacent to the southwest corner of the building. The sprinkler system is hydraulically designed to provide 0.19 gpm/ft^2 to the most remote 2,500 ft^2 area of the building. Sprinkler heads are fusible link type with a temperature rating of TBD. Piping exposed

to the outside is Code P-125 galvanized steel; piping not exposed to the outside is Code P-124 plain black carbon steel.

Sprinkler heads in the dry pipe system are fusible link type with a rating of TBD. Piping material is Code P-125 galvanized steel. This dry pipe system is fed from the wet pipe sprinkler system in the building.

2.4.8 Fire Water Pump House (901-Z) Fire Protection Systems

The following fire protection systems are included in Fire Water Pump House (901-Z):

- A wet pipe sprinkler system, in the diesel fire pump room, designed to deliver 0.19 gpm/ft^2
- Ionization-type smoke detectors in both pump rooms
- A multiple-purpose dry chemical portable fire extinguisher in each pump room.

2.4.9 Bulk Materials Handling Area Fire Protection System

There are no fixed fire protection systems for this area. Manual fire protection is considered to be adequate for the hazard. Ionization smoke detectors and manual pull stations are provided.

2.4.10 CCBT and Salt Feed Tank Fire Protection Systems

There are no fixed fire protection systems for this area. Manual fire protection is considered to be adequate for the hazard.

2.4.11 Bulk Material Handling Area Fire Protection

The bulk material handling area has four manual pullboxes and three fire alarm horns installed. There are no fire suppression systems in this area.

2.4.12 Fire Alarm System

The Z-Area fire alarm system includes the following:

- Ionization smoke detectors and/or thermal fire detectors in each facility, depending on the nature of the hazard
- Manual pull stations in each facility
- Water flow switches in all sprinkler systems to alarm when the system discharges
- An alarm from the Halon control panel at the CCR to indicate discharge of the Halon bottle
- A local fire alarm panel is installed in the Process Building (210-Z), in the Operations Building (704-Z), in the Substation Building (951-Z), and in the bulk

material handling area. These local panels transmit fire alarm signals to the CCR and to the F-Area Fire Station through the existing Digital Alarm Communicator (DACT).

- Fire alarm control is provided with standby power in the Operations Building (704-Z), and with UPS power in the Process Building (210-Z), Substation Building (951-Z), and bulk material handling area.

For details, see Riser Diagrams W774224 and W774352, and schematic Drawings W774048, W774066, W774095, W774096, W774097, and W774098.

2.5 CODES AND STANDARDS

The following National Fire Protection Association (NFPA) Standards were used in the design of the fire protection systems:

- NFPA No. 10-84, "Portable Fire Extinguishers"
- NFPA No. 12A-85, "Halon 1301 Systems"
- NFPA No. 13-87, "Sprinkler Systems"
- NFPA No. 20-87, "Centrifugal Fire Pumps"
- NFPA No. 22-87, "Water Tanks for Private Fire Protection"
- NFPA No. 24-87, "Private Fire Service Mains"
- NFPA No. 30-87, "Combustible Liquids Code"
- NFPA No. 37-84, "Stationary Combustion Engines"
- NFPA No. 72E-84, "Automatic Fire Detectors"
- NFPA No. 101, "Life Safety Code"

2.6 INSTRUMENTATION AND CONTROL

2.6.1 Fire Water Storage and Supply

2.6.1.1 Fire Water Storage Tank

The level of the FWST is monitored using a bubbler-type level detection system. Level indicating transmitter LIT-4201 inputs the value of the level to a local controller in 901-Z. Fire water tank inlet valve HCV-4200 is controlled manually.

For details, see P&ID W776910.

2.6.1.2 Electric-Motor-Driven Fire Pump

Electric-motor-driven fire pump Z901-100-020-00 is controlled from local control panel LOS-041, supplied with the pump. The fire water header pressure is monitored by low-pressure switch PSL-4223X, located in LOS-041. When PSL-4223X senses that pressure has dropped below a low setpoint, the pump is automatically started. The following controls and indications are also provided on LOS-041:

- Power on/off control switch HS-4224X (with indicating light)
- Manual start switch HS-4223XA
- Manual stop switch HS-4223XB
- Total running time KQI-4223X
- Pump running alarm XA-4223C
- Control circuit power failure alarm XA-4223A
- Failure to start alarm XA-4223B
- Line power failure alarm JA-4224B
- Power phase reversal alarm JA-4224A

Pump-mounted pressure gages monitor pump suction and discharge pressures. See supplier drawings in purchase order MG20609 for complete information on the motor-driven pump instrumentation and controls.

Electric-motor-driven fire pump running alarm XA-4223D is displayed at the SPCS console in the CCR when the pump is started. All alarms from fire pump control panel LOS-041 are also transmitted to the site-wide fire alarm system.

For details, see P&ID W776912.

2.6.1.3 Diesel-Engine-Driven Fire Pump

Diesel-motor-driven fire pump Z901-100-010-00 is controlled from local control panel LOS-038 supplied with the pump. The fire water header pressure is monitored by low-pressure switch PSL-4209X, located in LOS-038. When PSL-4209X senses that the pressure has dropped below a low setpoint, the pump is automatically started. The following controls and indications are also provided on LOS-038:

- Main selector switch HS-4215 (AUTO/MANUAL)
- Manual start switch HS-4208XA
- Manual stop switch HS-4208XB

- Engine running alarm XA-4214C
- Control circuit power failure alarm XA-4214B
- Failure to start alarm XA-4214A

The following diesel engine and related alarms are provided on LOS-038:

- Low fuel level LAL-4206X
- High fuel level LAH-4206X
- Low lube oil pressure PAL-4206X
- High jacket water temperature TAH-4206X
- Low jacket water temperature TAL-4206X
- Ac charging power failure JA-4206X
- Battery failure XA-4206X (one lamp for each battery)
- Overspeed SAH-4206X
- Low room temperature TAL-4213X

In addition to the above, the diesel engine has its own engine-mounted instrument panel, LOS-039, with such controls and indications as manual/auto/stop switch HIS-4207X, oil pressure indicator PI-4207X, fuel pressure indicator PI-4214X, tachometer SI-4207X, ammeter II-4207X, total running time indicator KQI-4207X, and water temperature indicator TI-4207X.

Pump-mounted pressure gages monitor pump suction and discharge pressures. See supplier drawings in purchase order MG20609 for complete information on the diesel engine and pump instrumentation and controls.

Diesel fuel day tank Z901-100-016-00 is equipped with tank-mounted level gage LG-4206X and tank-mounted high/low level switch, LSHL-4206. Alarms LAH-4206X and LAL-4206X on LOS-038 are actuated by LSH-4206.

The diesel-driven fire pump room is supplied with a floor sump which is monitored for high level by conductivity probe/switch LE/LSH-4216. If a high water level is detected in the sump, floor sump alarm LAH-4216 is actuated at the SPCS console in the CCR.

A fire pump flow test section which serves both fire pumps is provided in the diesel-driven fire pump room. Flow in the test section is monitored by annubar flow indicator FI-4210.

The water relief line from the discharge of the diesel-driven fire pump to the Fire Water Tank is supplied with line-mounted flow switch FSH-4207. If flow is detected in this line, local flow alarm (buzzer) FAH-4207 is actuated.

Diesel-motor-driven fire pump running alarm XA-4214D is displayed at the SPCS console in the CCR when the pump is started. All alarms from fire pump control panel LOS-038 are sent to the site-wide fire alarm system.

For details, see P&ID W776911.

2.6.1.4 Jockey Pump

Electric-driven jockey pump Z901-100-030-00 is controlled from local control panel LOS-040, supplied with the pump. The fire water header pressure is monitored by low pressure switch PSHL-4227X, located in LOS-040. When PSHL-4227X senses that the pressure has dropped below a low setpoint, the pump is automatically started. The pump is automatically stopped again when PSHL-4227X detects that the pressure has risen above a high set value. The following controls and indications are also provided on LOS-041:

- Pump running alarm XA-4227X (light)
- Total running time indicator KQI-4227X
- Selector switch HS-4227X

Line-mounted pressure gages monitor pump suction and discharge pressures. See supplier drawings in purchase order MG20609 for complete information on the jockey pump instrumentation and controls.

For details, see P&ID W776912.

2.6.2 Process Building (210-Z) Fire Protection

The Process Building (210-Z) is monitored by 26 ionization-type smoke detectors in the non-process areas and 15 thermal detectors, primarily in the process area, but also in the utilities room and clean maintenance shop. Nine manual pull stations, one at each major exit, and 10 fire alarm horns, one or two in each major area or room of the building. The fire alarm system is controlled from local fire alarm panel Z-210-FP-PNL-0210 (LFA-210). Upon smoke detection or manual actuation from a pull station in any area, all the fire alarm horns are actuated.

The wet pipe sprinkler system inlet valve is supplied with tamper switch ZS-4238. If the valve is not fully open, ZS-4238 triggers valve tamper alarm ZA-4328 at the SPCS console in the CCR and also inputs to local fire alarm panel LFA-210. The system inlet alarm check valve is equipped with inlet and outlet pressure gages PI-4238X and PI-4236X and pressure alarm switch PSH-4236. If the alarm check valve opens to allow water to flow to the sprinklers, PSH-4236 is

pressurized and triggers Process Building (210-Z) fire alarm PAH-4236 at the SPCS console and also sends a signal to the local fire alarm panel LFA-210.

The Halon 1301 system is controlled from Halon system control panel Z-210-FP-PNL-0032. Two photoelectric-type smoke detectors, BE/BS-1485XA and BE/BS-1485XB, and two ionization-type smoke detectors, BE/BS-1484XA and BE/BS-1484XB, detect smoke in the CCR and input to the Halon control system panel. The Halon 1301 bottle is equipped with a local pressure gauge and low-pressure switch PSL-1481X, which input to the Halon control panel. If low pressure is detected at the Halon bottle, trouble light UA-1491A and buzzer UA-1491XB are actuated at the Halon control system panel. If smoke is detected by the detectors for a set time, as indicated by KS-1491X, the system automatically releases the Halon by energizing Halon cylinder solenoid valve SV-1481X, after a 60 second time delay.

Alarm lights on the Halon system control panel indicate which detector circuit(s), BA-1491A and/or BA-1491B, detected smoke, and alarm light XA-1491 indicates that Halon has been released. Halon can be manually released using hand switch HS-1491XB on the Halon system control panel or remote hand switches HS-1483XA, HS-1483XB, or HS-1483XC in the CCR. If the Halon system detects smoke, it sends a signal to the local fire alarm panel Z-210-FP-PNL-0210 (LFA-210) and Halon system release or trouble alarms are transmitted to the site-wide fire alarm system. See supplier drawings in Subcontract SC-18 for complete information on the Halon system instrumentation and controls.

2.6.3 Operations Building (704-Z) Fire Protection

The Operations Building (704-Z) has one thermal detector, six manual pull stations, one at each major exit, and five fire alarm horns, four in the clean area corridors and one in the regulated area corridor. The fire alarm system is controlled from local fire alarm panel Z-704-FP-PNL-0704 (LFA-704). Upon heat detection or manual actuation from a pull station in either area, all the fire alarm horns are actuated.

The wet pipe sprinkler system inlet valve is equipped with tamper switch ZS-4239. If the valve is not fully open, ZS-4239 triggers valve tamper alarm ZA-4239 at the SPCS console in the CCR and also inputs to the local fire alarm panel LFA-704. The system inlet alarm check valve is equipped with inlet and outlet pressure gages PI-4239X and PI-4237X and pressure alarm switch PSH-4237. If the alarm check valve opens to allow water to flow to the sprinklers, PSH-4237 is pressurized and triggers Operations Building (704-Z) fire alarm PAH-4237 at the SPCS console, and sends a signal to the local fire alarm panel LFA-704.

2.6.4 Substation Building (951-Z) Fire Protection

There are four ionization-type smoke detectors in the Substation Building (951-Z). The detectors send a signal to local fire alarm panel Z-951-FP-PNL-0951 (LFA-951). If smoke is detected, two

local fire alarm horns, one next to each door, are actuated. Two manual pull stations are also provided, one next to each door. These stations also send a signal to local fire alarm panel LFA-901 to actuate the local fire alarm horns.

2.6.5 Fire Water Pump House (901-Z) Fire Protection

There are four ionization-type smoke detectors in the Fire Water Pump House (901-Z): two in the diesel pump room and two in the electric pump room. The detectors input to local fire alarm panel Z-901-FP-PNL-0901 (LFA-901). If smoke is detected, a local fire alarm horn is actuated. Two manual pull stations are also provided, one in each pump room. These stations also send a signal to local fire alarm panel LFA-901 to actuate the local fire alarm horn.

Local pressure indicator PI-4246X indicates diesel pump room wet pipe sprinkler system line pressure. Line-mounted flow switch FSH-4246 detects flow in the sprinkler system, inputs to the local fire alarm panel LFA-901, and triggers Fire Water Pump House (951-Z) fire alarm FAH-4246 at the SPCS console in the CCR. The sprinkler system inlet valve is equipped with tamper switch ZS-4227. If the valve is not fully open, ZS-4227 triggers valve tamper alarm ZA-4227 at the SPCS console in the CCR and also sends a signal to the local fire alarm panel LFA-901.

2.6.6 Bulk Material Handling Area (205-Z) Fire Protection

There is one ionization-type smoke detector, a manual pull station, and a fire alarm horn in the unloading control office. The detector and pull station send a signal to local fire alarm panel Z-205-FP-PNL-0205 (LFA-205). If smoke is detected, the local fire alarm horn is actuated. There are three other manual pull stations, one in the unloading shed and two at the silos. These stations also input to local fire alarm panel LFA-205 to actuate the local fire alarm horns. Fire alarm horns are also provided in the unloading shed and at the top of the silo stairs.

2.7 SYSTEM INTERFACES

Saltstone fire protection primary and secondary interfaces are shown in Tables 2.7-1 and 2.7-2, respectively.

Table 2.7-1 Saltstone Fire Protection Primary Interfaces

Interfacing System	Interface Location	Requirements
G-SD-Z-00001	Yard piping and fire hydrants	Provide space for the fire water storage tank and the Z-Area fire water distribution main
G-SD-Z-00002	All buildings	Provide space and supports to accommodate building fire protection systems, including the Fire Water Pump House (901-Z) and the foundation for the FWST
G-SD-Z-00004	Panels Y146 and Y164	Provide UPS and standby power for the fire alarm system
	MCC B124 and	Provide normal and standby electrical power B123
	Equipment	Provide equipment grounding
G-SD-Z-00005	Fire Water Pump House (901-Z)	Provide heating and ventilation to prevent freezing of piping and overheating of equipment
G-SD-Z-00006	FWST	Provide makeup water to fill the FWST

Table 2.7-2. Saltstone Fire Protection Secondary Interfaces

Interfacing System	Interface Location	Requirements
G-SD-Z-00002	All buildings	Provide external fire hydrants for building fire protection
	Building 210-Z,	Provide fire sprinklers, Halon systems, fire detectors, and alarm system for building interior fire protection.
	Building 704-Z,	Provide fire sprinklers, fire detectors, and alarm system for building interior fire protection.
	Building 901-Z,	Provide fire sprinklers, fire detectors, and alarm system for building interior fire protection.
	Substation Building (951-Z)	Provide fire detection and alarm system to protect the Substation Building (951-Z).
G-SD-Z-00004	Electrical Equipment	Provide fire detection and alarm system to protect electrical equipment.
G-SD-Z-00005	Halon control panel	Provide interlock to shut down CCR HVAC system if the Halon system discharges.

3.0 OPERATION

Operation and maintenance of the fire protection system is the responsibility of Site Utilities Department (SUD). The normal operating mode for the Saltstone fire protection systems is the standby mode. The emergency mode of operation occurs when there is a fire or a fire alarm.

3.1 INITIAL CONFIGURATION

The initial configuration of the fire water supply system is the responsibility of SUD.

3.2 STARTUP

SUD covers the startup operations required for the fire water supply system.

3.3 NORMAL OPERATION

3.3.1 Fire Water Supply System

In normal operation, the jockey pump cycles on and off as required in order to maintain the fire water system supply pressure in the range 105-117 psig. The jockey pump controller turns the pump on whenever the system pressure drops to a low pressure setpoint and cycles the pump off whenever the pressure rises to a high pressure setpoint. If the line pressure drops, as a result of the discharge of a sprinkler system, use of a fire hose, or failure of the jockey pump, a fire pump controller automatically starts the main electric-motor-driven fire pump. If the system pressure continues to drop, because of failure of the electric-motor-driven pump to start, then a fire pump controller automatically starts the diesel-engine-driven fire pump. The pump then continues to run until it is manually stopped. If the system pressure rises to a high-high pressure setpoint for any reason, pressure relief valves in the fire pump discharge lines open to relieve pressure.

A level controller continuously monitors water level in the FWST. If the low water level is low, a low-level switch opens a makeup water control valve in the domestic water line to the tank to start refilling the tank.

3.3.2 Fire Sprinkler Systems

In normal operation, the wet pipe sprinkler systems are water-filled and maintained under pressure by the fire water supply system. In the event of a fire, the fusible link in one or more sprinkler heads melts at its rated temperature, releasing water in the fire area. The alarm check valve at the building fire water riser sends a fire alarm via the fire alarm system.

The dry pipe sprinkler system in the shipping/receiving area of the Operations Building (704-Z) is normally dry and maintained full of pressurized air which, keeps the dry pipe sprinkler control valve in the closed position. In the event of a fire, the fusible link of one or more sprinkler heads melts at its rated temperature, releasing the air pressure in the piping so that the dry pipe sprinkler valve opens to allow water to flow into the sprinkler system. Water is then discharged through

those sprinkler heads with melted fusible links. The flow of water through the dry pipe sprinkler valve causes a fire alarm to be sent through the fire alarm system.

3.3.3 Halon System

The Halon system for the CCR and CCR I/O cabinet rooms comprises two Halon cylinders: one is on line at all times; the other is a stored spare. The system is actuated by either smoke detectors or manual pull stations. Actuation of one detector results in the following:

- A visual alarm at the Halon control panel and an audio alarm in the CCR
- A signal to close fire dampers FD-1676, FD-1677, FD-1678, and FD-1679 in the HVAC supply and return air ducts to the two rooms
- A pre-alarm signal to the fire alarm system through the Process Building (210-Z) local fire alarm panel

Actuation of a second detector in the same room results in the following:

- A visual alarm at the Halon control panel
- Initiation of an adjustable time delay that delays release of the Halon gas for 30 seconds.

Operation of the Halon system from a manual pull station results in immediate release of the Halon and actuates the alarm and damper shutdown circuits mentioned above.

3.4 SHUTDOWN

3.4.1 Fire Water Supply System

Once one of the main fire pumps has been started, it must be manually shut down.

3.4.2 Halon System

No action required, after discharge, Halon bottle must be replaced by the Site Fire department.

3.5 INFREQUENT OPERATIONS

The fire water system is periodically tested By Site Utilities Department.

4.0 SETPOINTS, SYSTEM LIMITATIONS, AND PRECAUTIONS

4.1 SETPOINTS

Table 4.1-1 Saltstone Fire Protection Setpoints

Tag No.	Description	Function
LALL-1408	Process Water Tank low level	Alarm and interlock to stop process water pumps
LSH-4216	Fire pump room sump level high	Alarm
ZS-4227	Diesel fire pump sprinkler valve	Tamper alarm
ZS-4238	210-Z sprinkler valve	Tamper alarm
ZS-4239	704-Z sprinkler valve	Tamper alarm
XA-4214D	Diesel fire pump running	Indication
XA-4223D	Electric fire pump running	Indication
PSH-4236	Process Building (704-Z) sprinkler system pressure	Alarm
PSH-4237	Operations Building (210-Z) sprinkler system pressure	Alarm
FSH-4246	Diesel fire pump room sprinkler flow	Alarm
PSL-1481	Halon cylinder low pressure	Alarm

4.2 SYSTEM LIMITATIONS AND PRECAUTIONS

The fire water pumps continue to operate once started until they are manually shut off. If the water in the FWST is depleted in fighting a fire, the operating fire pump continues to run dry unless it is manually stopped.

5.0 SYSTEM UPSETS AND RECOVERY SEQUENCES

5.1 FIRE WATER SUPPLY SYSTEM

Failure of the electric fire pump to start on a drop in distribution system pressure causes the diesel-driven fire pump to automatically start.

On a loss of normal electric power, the diesel-driven fire pump automatically starts in order to maintain the required residual pressure in the fire water yard loop and to provide the design fire water flow rate if a fire should occur.

If the water storage tank level drops to the low-low level point, an alarm is transmitted to the CCR. The fire pump that is running at the time continues to run until it is manually stopped.

5.2 HALON SYSTEM

On receipt of a low-pressure signal from the pressure switch at the on-line Halon cylinder, or after a discharge, the Fire Department must be notified to replace the cylinder with the reserve cylinder they have in storage.

6.0 MAINTENANCE

6.1 PREVENTIVE MAINTENANCE, INSPECTION, AND SURVEILLANCE

The Site Computerized Maintenance Management System will cover in-service inspection and maintenance of equipment. A schedule for preventive maintenance of each piece of equipment will be developed.

The fire water supply will be inspected once a week as part of the weekly testing.

All equipment will be serviced by contact maintenance. Routine maintenance will be performed when the system is idle.

6.2 CORRECTIVE MAINTENANCE

Spare electric motors for the motor-driven main fire pump and the jockey pump have been purchased and are stored on site for future use.

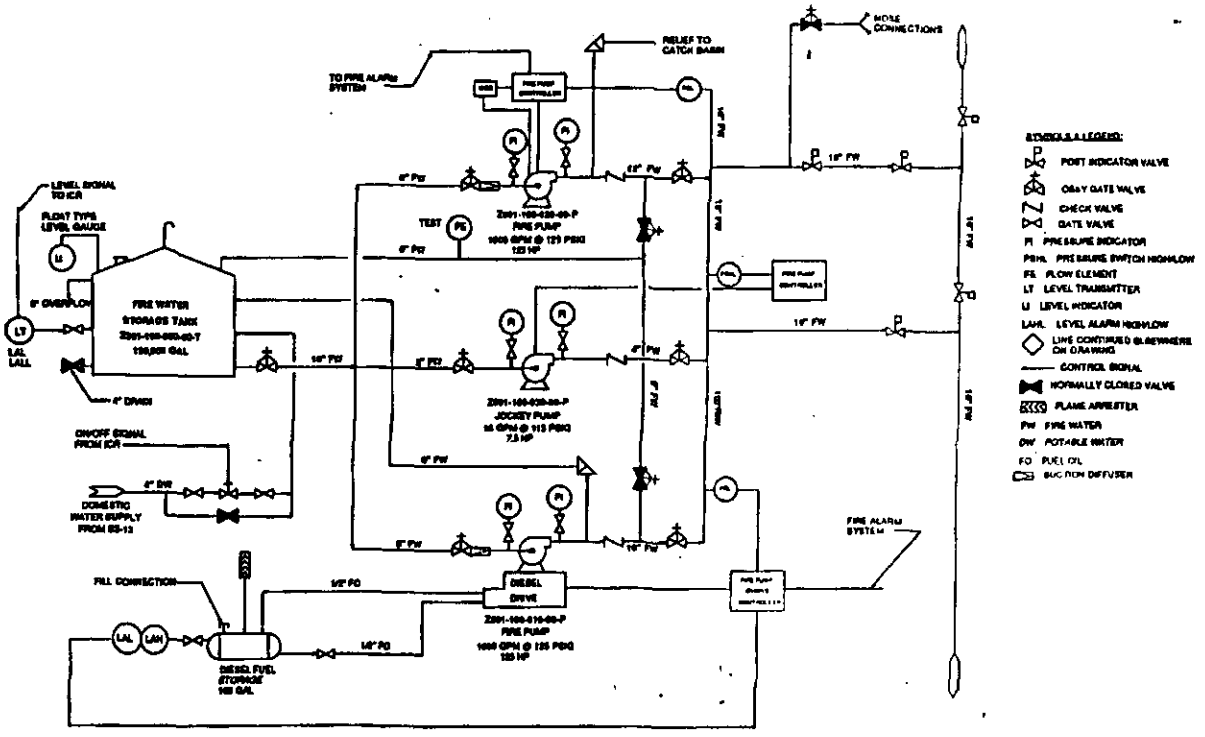

Figure 1 Fire Water Storage and Pumping System

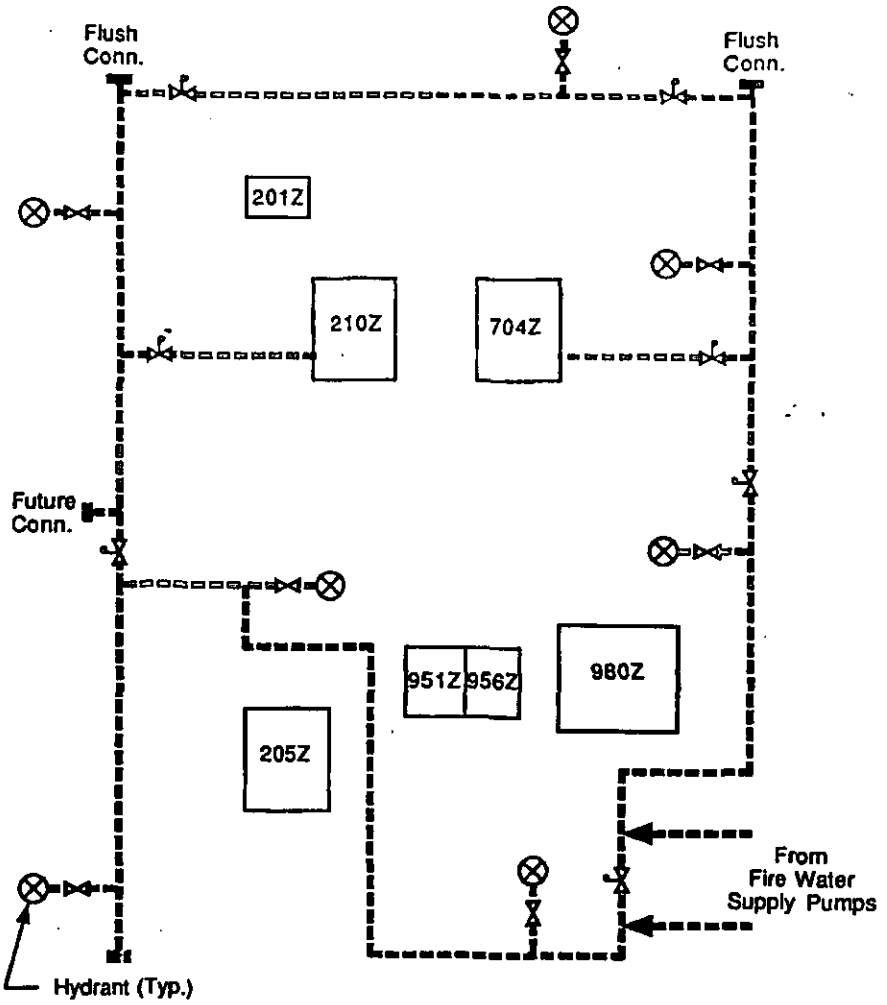

Figure 2 Fire Water Distribution Loop

7.0 APPENDICES

7.1 REFERENCES

7.1.1 Z-Area Operating Procedures

- SAC-FP, "Fire Protection System Alignment Checklist"

7.1.2 Fire Hazards Analyses

- F-FHA-Z-00001, "FHA for the Saltstone Administration Building, 704-Z"
- F-FHA-Z-00002, "FHA for the Saltstone Facilities, 201-Z, 205-Z, 205-8Z, 210-Z, 451-1Z, 451-4Z, 901-Z, & 951-Z"

7.2 PARAMETERS LIST

• Fire water flow	Design pumping rate for 1.5 hours
• Fire water storage volume	120,000 gal minimum design 130,000 gal normal operating
• Fire pump flow rate	1000 gpm minimum
• Fire water supply pressure	105-117 psig normal standby pressure 125 psig design at min. fire flow
• Sprinkler system flow rate	0.19 gpm/ft^2
• Halon design concentration	5% by volume in room

7.3 DRAWINGS AND SPECIFICATIONS

7.3.1 Piping and Instrument Drawings

Drawing No.	Title
W776859	Z-Area Halon System
W776910	Fire Water Storage and Z-Area Yard Loop
W776911	Diesel Fire Pump System
W776912	Electric Fire Pump/Jockey Pump System
W776913	Process & Operations Buildings Wet Pipe Sprinkler System
W776914	Diesel Fire Pump Room Wet Pipe Sprinkler System
W776915	Fire Pump House Heating & Ventilation

7.3.2 Fire Protection Zone Drawings

Drawing No.	Title
W776815	Process Building – Fire Protection and Safety Zone Drawing
W776817	Operations Building – Fire Protection and Safety Zone Drawing
W776818	Electrical Substation Building – Fire Protection and Safety Zone Drawing

7.3.4 Electrical Single Line and Schematic Diagrams

Drawing No.	Title
W774224	Communication & Alarm System Riser Diagram
W774352	Operations Building Communications, Telephone and Fire Alarm Riser/Connection Diagram
W774048	Bldg 210-Z Fire Alarm System Schematic and Connection Diagram
W774066	Area 205-Z & 951-Z Fire Alarm System Schematic and Connection Diagram
W774096	Schematic Diagram – Elect. Driven Fire Pump and Jockey Pump
W774097	Schematic Diagram – Diesel Engine Driven Fire Pump
W774098	Area 901-Z Fire Alarm System Schematic and Connection Diagram

7.3.5 Specifications

No.	Title
M-120	Dry Pipe and Wet Pipe Sprinkler Systems
E-36	Furnishing and Installation of Fire Detection and Alarm Systems
M-445	Saltstone Field Erected Tanks
M-94	Halon 1301 Extinguishing Systems
M-95	Horizontal Jockey and Fire Pumps