Background Information

The City Of Washington Distribution Warehouse Fire

Introduction

The structure was a warehouse and distribution facility storing coffee, food commodities, household chemicals, and cleaning products. Originally, the structure stored materials that were classified as non-combustible, and the fire suppression system was designed for noncombustible materials. Over time, the warehouse included combustible materials. Construction was rigid steel frame construction with reinforced concrete slab floors. The walls were heavy corrugated metal on the upper part with masonry nonbearing on the bottom. The roof decking was corrugated metal panels approximately 1/8-inch thick, 6 feet wide, and 20 feet long, laid on top of the rigid steel frames. Offices were located on the southeast end (Side B) of the structure. The warehouse was renovated in 2015, adding 10,000 square feet of floor space to the north end or Side D. On Side A near Side D (Quadrant 4) were rectangular unprotected openings used for offloading products at the loading docks. The building is equipped with an automatic wet sprinkler system, fire pump (due to low pressure with the water distribution system), and a monitored fire alarm control unit (FACU).

At the time of the fire, the system was in service and activated; however, power to the structure was out for several days due to flooding in the area, causing the loss of the underground primary power supply. Workers were using handheld lights and portable generators to provide light. Because of the poor lighting conditions, a forklift operator ran into a main support of the structure, causing server damage that required arc welders to be onsite to repair the damage. Several of the warehouse workers reported seeing sparks dropping from the welding that ignited nearby cardboard boxes. They also reported that the sprinkler heads in front of the loading dock doors were barely operating, and there were no audible alarms sounding as the fire started. It is believed that poorly operating sprinkler heads were the result of low water pressure, because there were multiple heads activated. In addition, the failure of the fire pump to increase pressure was the result of no power. Workers stated that after pulling the manual pull stations, there was no audible alarm. The structure was a Class III non-encapsulated commodity warehouse.

Building Conditions – Construction

The structure featured rigid steel frame construction (commonly called Butler Construction [red oxide primer finished steel]) and masonry nonbearing exterior walls with poured reinforced tie beams. There was a plywood deck over the main office area that was supported by reinforced concrete walls and masonry nonbearing exterior walls. Offices were on the southeast end of the first floor; many of them featured drywall partitioning. In the warehouse area, there were multiple rows of 16-foot high storage racks containing large amounts of coffee products, household chemicals, cooking oil, and paper products that produced a large amount of heat. Rigid steel frame structures all have the inherent qualities and faults associated with steel. The steel beams quickly absorbed the heat of the fire below that was then transmitted to all of the sheet metal and surface fasteners, causing these materials to become compromised. Previous fire inspections from the City of Washington Fire Department revealed that the fire pump was not completely grounded and bonded properly, and the warehouse needed to implement a program that included preparation, prevention, and recognition of fire hazards. The report also noted that workers needed to be trained on proper handling of combustible and flammable material by segregating and separating them and on maintaining safe housekeeping practices that reduce the risk of fire. In addition, key personnel should have been trained in basic fire behavior and suppression.

Building Contents

The fire load in most areas of the warehouse was very high, due to the nature of the business and the contents in storage with large amounts of cardboard debris. The warehouse contained coffee, food commodities, house hold chemicals, and cleaning products that typically incorporate large quantities of plastics, such as Mylar, cardboard, and other synthetic materials with coffee products inside. These materials burn quickly, produce large quantities of smoke, and have high thermal energy release rates. Many of the products in the warehouse were easily ignited, which supported rapid fire spread below the reach of the sprinkler heads. In addition, the smoke generated during burning gave a dark optical density that impeded visual acuity.

Building Fire Protection

During renovation of the building, a fire pump was required because the water supply system was not able to provide sufficient pressure to meet the design requirements of the additional square footage. Due to the strict time frame of completing renovations and the unavailability of fire pumps required for the system, the contractor substituted a foreign-made fire pump. The fire pump complied with foreign regulations and international codes of practice similar to the National Fire Protection Association (NFPA). In addition, the fire pump met International Organization for Standardization's ISO 9001: 2008 *Quality Management System* standards specifically for centrifugal pumps and jockey pumps used in automatic sprinkler installations. However, the foreign-made fire pump was not Underwriters Laboratories (UL) approved. It is unknown how the fire pump was approved by the authority having jurisdiction.

Building Public Water (Potable) Supply System

The public water supply system was ageing, and deterioration of many of the water mains had caused unreliable water needs during the maximum daily consumption demands in the area. The warehouse distribution center was at the end of the water main for the City of Washington controlled by a cross-connection control device connected to the City of Greenville public water supply system. However, due to the City of Greenville believing the water quality from Washington would expose their citizens to potentially unsafe water from the failing water mains, they would not agree to open the cross-connection control until the City of Washington would certify water maintenance and operations.

Fireground Operations

At 1:17 p.m., the fire alarm monitoring company received a report of a water flow alarm at 44614 Mays Street West and dispatched a first-alarm assignment (three engines, one truck, one rescue, and a battalion chief). The first-arriving company arrived shortly thereafter and reported seeing the dense black smoke issuing from the roof area of the Washington Distribution Warehouse.

The first due engine companies proceeded to the northeast corner (Sides A and D) of the building and forced open a door that allowed access to part of the loading dock. Crews advancing handlines quickly discovered the fire involved several rows of racks containing various products. A second alarm was called and then several individual pieces of apparatus were called. Side B had minor smoke conditions, with good visibility in the office area. Units found heavy to moderate smoke conditions in the warehouse area causing near-zero visibility with mazes of storage racks. Smoke was venting through any opening in the structure.

A large amount of cooking oil (56,000 pounds in five-gallon containers [cooking oil weighs between 6-8 pounds per gallon]) made the fire difficult to extinguish. The oil began to run out of the structure making walking and handling equipment even more challenging.

Search and rescue operations had to be abandoned because of the size of the structure, visibility, and fire conditions. There was 33,000 square feet of floor area. Although much of the area was open space with storage racks, limited visibility because of the smoke would have complicated search operations, causing search and rescue to be unsafe for the firefighters who assumed no one was inside the structure due to the fire occurring on a Sunday afternoon.

After crews mounted an exhausting interior attack using a 3" attack line and several hours of flowing master stream devices, the fire was finally declared under control. Including the fourth-alarm assignment, the total deployment included ten (10) engines, four (4) truck companies, three (3) rescues, three (3) battalion chiefs, the fire chief, and one (1) air supply unit. In addition, logistics personnel and twelve (12) overtime personnel were special-called later that evening for personnel relief. Later in the evening, firefighters used a foam solution with moderate success after the main body of the fire was knocked down.

Effective Preplanning

Although the first-due engine company had been inside the structure on an automatic fire alarm, other companies were unaware of the existing building. There were no written preplans or documentation of inspections from the first due engine company. Consequently, once the incident escalated beyond the normal first-alarm assignment, all additional companies had to rely on verbal warnings about hazardous building conditions by radio or face-to-face from personnel assigned to divisions. The automatic fire alarm was March 25, 2009, when a fork lift broke off a sprinkler head and damaged the main support of the building.

This fire also illustrated the need to expect the unexpected. Therefore, pre-fire plans must consider the storage area and the width of access points. Pre-fire plans must evaluate the status of sprinkler systems and quick access to key areas of potential fire hazards. These pre-fire plans should account for the tactical priorities information that is applicable to key placement of aerial operations and fire suppression operations. In addition, listing the strategies that apply to the building, property, and the recognition of any associated hazard would have assisted in the management of this fire.

Pre-fire plans provide valuable information that will assist a command officer in managing an incident at a specific property. This information is particularly valuable when the property is large and complex or when an incident could involve unusual risks or hazards to firefighters.

Lessons Learned or Reinforced from Building Design

Sprinkler Design Must Match the Fire Hazard:

- The sprinkler system was a wet system with 8K type heads, 286^0 upright rough brass, 155^0 F rating. The water main was 8" with 40 Static and 1,002 gpm flow at 20 psi residual pressure on January 4, 2014. Design flow requirements varied between 1,240 gpm and 1,376 gpm

supplemented by a fire pump meeting certification from BRE Global Ltd., as well as Loss Prevention Standards (LPS) for automatic sprinklers, BS EN 12845, LPC sprinkler rules, and technical bulletins in its LPS 1131. NOTE: The fire pump was not UL approved.

- The FACU initiating devices did not sense the presence of the products of combustion and smoke conditions. The spot type heat detector placement was between the steel beams. The designers addressed the beam depth and beam spacing; however, they did not consider the ceiling height as a factor in placement.
- The fire pump did not increase the pressure and the sprinkler system relied on the existing low pressure reducing water volume to the sprinkler heads.
- The sprinkler system protecting the storage of aerosol cans that contained combustible contents, large amounts of cooking oil, plastic bags of coffee products, and cleaning products was at a minimum. These sprinklers were operating above the fire that was involving rack storage. This meant the sprinklers only controlled the fire above allowing the fire to spread horizontally from rack to rack. Fire spread was assumed to be contributed from surface flame spread from rack to rack due to the large amount of fuel.
- Sprinklers in rack storage placed water directly onto the fire to affect the fire in a variety of ways: immediate extinguishment, some fire control, or even hampering the fire with the continued spread at the floor level. In this fire, the sprinkler system hampered the fire in two ways:
    1. The system was supplied by the same water main feeding the immediate hydrant system in the area allowing water to be re-allocated from the sprinkler system during fire operations.
    2. Large amounts of steam and smoke were produced restricting visibility to interior crews while at the same time allowing the fire to spread at the floor level to other racks.
- The fire pump must be able to supply water to all fire suppression systems, maintaining required pressures that are outlined in NFPA.

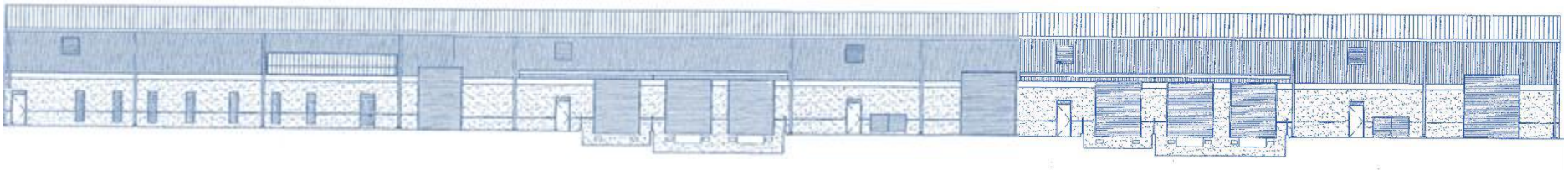
Office Area

SIDE C

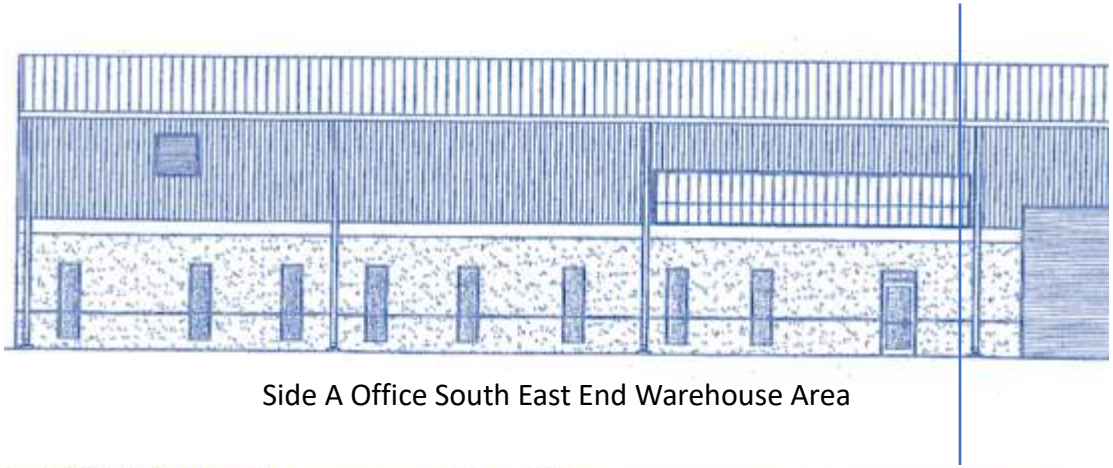
SIDE B

SIDE D

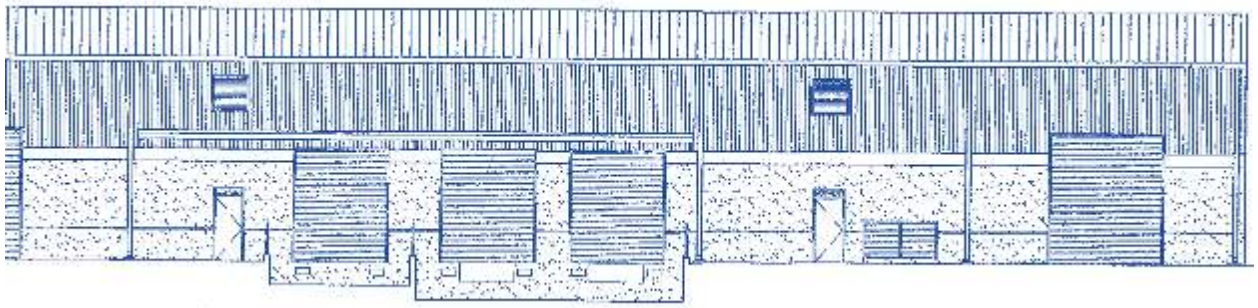
SIDE A



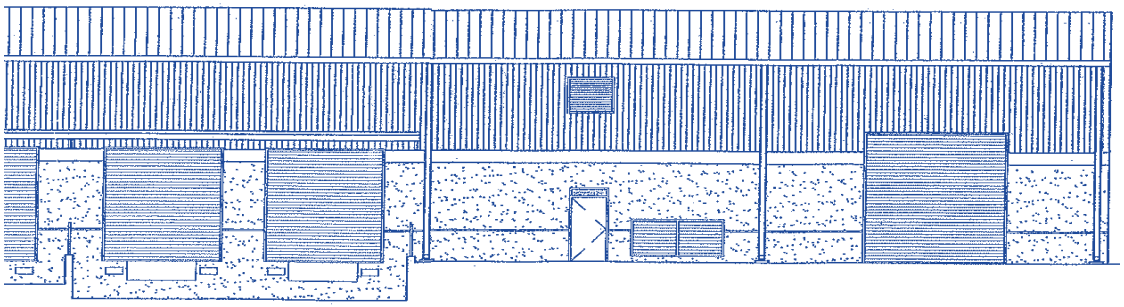
Side A Warehouse
67,000 Square Feet (63,000 Warehouse / Storage)



Side A Office South East End Warehouse Area



Side A North End Warehouse Area



Side A Middle Warehouse Area