As the pumping station is a critical component of the city’s waste water management system, the performance objective in providing a fire protection system was to ensure continual operation of the pumping station. Our initial task as the project’s fire protection engineering group was to address the feasibility of providing a fire protection system within the pumping station, or more specifically, underneath the FRP covers. Factors that were considered included fire suppression system selection, performance of the system, and accessibility of the system for inspection, testing, and maintenance.

**FIRE SUPPRESSION SYSTEM SELECTION**

The primary source of fire and explosion hazard associated with the pumping station involves receipt of flammable and combustible liquids and gases through the collection system. A prior experience was recounted by city officials involving a small fire within the pumping station that originated from an unknown source.

**BACKGROUND**

As part of the overall building upgrades to a 100 year old waste water pumping station located in the center of a large city, project officials requested that an investigation into fire protection systems for the pumping station be conducted. The pumping station receives waste water from the city’s storm and sewage collecting systems, filters it, removing solid waste prior to pumping the water to the city’s waste water treatment facility. The building upgrades included an improved air filtration system, amongst other mechanical, civil, electrical and architectural improvements. To minimize the size of new odor control exhaust units within the pumping station, fiberglass reinforced plastic (FRP) covers were provided over the wells which contained the incoming waste water effluent.

**WATER MIST Fire Suppression System**

Originally introduced in the 1940s for specific fire protection applications such as passenger ferries, there has been a renewed interest over the past 20 years regarding the use of fire protection water mist systems. The renewed interest is attributed in part to the phase out and replacement of ozone depleting agents, such as halon, as well as the International Maritime Organizations requirement for all passenger ships to be provided with a fire suppression system. While the current applications of water mist fire protection systems encompass a wide variety of hazards, this case study will profile a unique application, one that includes a waste water pumping station.

**CASE STUDY**

As the pumping station is a critical component of the city’s waste water management system, the performance objective in providing a fire protection system was to ensure continual operation of the pumping station. Our initial task as the project’s fire protection engineering group was to address the feasibility of providing a fire protection system within the pumping station, or more specifically, underneath the FRP covers. Factors that were considered included fire suppression system selection, performance of the system, and accessibility of the system for inspection, testing, and maintenance.
unknown combustible material that made its way into the pumping station by way of the city’s waste water collection system. With the goal of ensuring mission continuity while providing a reasonable degree of fire and explosion protection, several fire protection systems were evaluated for use. A discussion of two of the systems evaluated follows.

Low Expansion Foam-Water System

Low expansion foam-water systems are effective for the areas at risk within the pumping station that are at risk from fire involving incoming waste water effluent. These areas include the wet wells and the grit and screening processes where floating flammable liquid may collect or pool on the surface. Low expansion foam-water systems are used when a blanket of foam is needed to float on the horizontal surface of a flammable or combustible liquid. Foam-water systems are effective on flammable liquid pool fires because the foam-water mixture separates the fuel from the flame, smothers the fire by blocking air from entering the combustion process, and cools the surface of the fuel. Although we concluded that a foam-water system could foreseeably be designed to discharge under the FRP covers, there were downsides to using such a system. Low expansion foam-water suppression systems are typically applied to fuel under non-flowing conditions, i.e. inside of storage tanks. Two factors, which would affect the blanket of foam needed to float on the horizontal surface of a flammable or combustible liquid in the grit room and wet well, are the incoming wastewater effluent, which is under constant flow, and the air velocity under the FRP covers produced from the ventilation systems. Both factors would make it difficult to provide a foam blanket over the entire fuel source, and result in a potential for reignition. Another challenge regarding the discharge of foam-water under the covers is that the FRP covers are combustible. Foam-water application under the covers may not control fire involving the FRP covers. Further, in recent years, health and environmental concerns have been raised regarding aqueous film-forming foam (AFFF), a specific type of synthetic foam.

Water Mist Fire Suppression System

A water mist system is an automatic water-based fire protection system with nozzles capable of distributing water mist to a variety of hazards. NFPA 750 defines a water mist as a fine water spray whose water droplets are less than 1000 microns at a distance of 3.3 feet from the discharge nozzles. Mechanisms of extinguishment by water mist include but are not limited to heat extraction, oxygen displacement, blocking radiant heat and dilution of vapor/air mixture. A water mist fire extinguishing system would not be as affected as other agents by the constant flow of wastewater effluent, or from the high airflow rate generated by the exhaust system. Also, there is essentially no cleanup required after discharge (compared to other fire extinguishing media), and the infinite water supply available lends itself well to a scenario involving the receipt of flammable or combustible liquids over an extended period of time. Primarily for these reasons, a localized high pressure water mist system was ultimately selected to protect the areas of the pumping station that are most susceptible to fire risk from incoming effluent. Velcro access panels were strategically provided within the FRP covers to allow for the inspection and maintenance of the water mist nozzles. A line-type heat detection system was selected and installed beneath the FRP covers to provide for the activation of the water mist system. Line-type heat detectors are heat-sensitive wiring, the covering of which is suitable for use in harsh conditions such as a waste water treatment plant. When the wiring senses heat the current flow in the wiring changes and sends an alarm signal to the fire alarm releasing panel that controls the water mist fire suppression system.

SUMMARY

This case study illustrates the selection criterion that was used to ultimately arrive at a high pressure water mist fire protection system for a unique hazard. In the end, we felt a water mist fire suppression system provides the best level of protection to safeguard the pumping station from a wide range of flammable and combustible liquid hazards being introduced into the plant through the waste water collection system.