

SUPPLEMENTAL PIT FIRE CONTROL DELUGE SYSTEM – SPOKANE REGIONAL WASTE TO ENERGY FACILITY

Damon M.K. Taam, System Contract Manager
Chuck Conklin, Plant Manager

Spokane Regional Waste to Energy Facility
Spokane, WA 99224, USA

ABSTRACT

After sixteen years of operation, it became apparent that the pit fire protection system installed during construction of the Spokane Regional Waste to Energy (WTE) Facility (1989-1991) was inadequate. A risk analysis was performed by Creighton Engineering Inc., a fire protection consulting firm, hired by the Spokane Regional Solid Waste System (Regional System) and Wheelabrator Spokane Inc. With input from Spokane County Fire District 10 and the City of Spokane Fire Department, a replacement supplemental fire protection system was designed and ultimately installed. This paper will describe the problems with the once state of the art fire system and the planning, design and installation of the new system.

INTRODUCTION

Fire protection is of paramount importance in any building but becomes even more essential in a waste-to-energy plant where waste is required to be stored in large quantities and the characteristics of the fuel is unknown and cannot be controlled. Given the inability to reduce the risk of fire by eliminating the amount of stored fuel, it is essential to the safety and operation of the facility to have installed a state of the art fire protection system that is reliable and easy to maintain and operate.

DISCUSSION

The Spokane Regional Waste to Energy Facility (Facility) is a typical 800 ton/day mass burn facility designed, constructed and operated by Wheelabrator Spokane Inc. The facility is owned by the Spokane Regional Solid Waste System (System), a department of the City of Spokane, and provides combustion services to the entire Spokane County region. The Facility is the only waste-to-energy plant in the state of Washington and is the largest municipal project in Spokane's history. It is a joint effort between multiple municipal entities and continues to enjoy a cooperative working relationship

between the private and public sector. One unique aspect of the Spokane facility is the way the design allows for both municipal and private citizen vehicles regardless of size to enter and utilize the 2 acre tipping area located within the main building. The Facility's enhanced pit size of 560,000 cubic feet or 5000 ton capacity is sized to accommodate an additional 400 ton/day unit.

During the Facility's construction period (1989-1991), a state of the art fire protection system was installed. The system included 4 pit monitors and a roof deck grid deluge dry sprinkler system. Both items met standard code provisions and were typical of the systems installed in waste to energy facilities at that time. After a series of fires, it became apparent that the existing roof deck grid deluge sprinkler system was inadequate. It had numerous problems and did not prove to be effective and reliable when put to the test of actually battling a blaze. During several fire events at the Facility, the sprinklers were activated but the force of the water coursing through the system resulted in a water hammer which broke apart the pipes delivering the water to the sprinkler heads. Upon further investigation, it was discovered that the breakage may have been caused by several factors. The pipes may not have been initially designed large enough to handle the force of the water or they had degraded over time which compromised their integrity. Another reason for their failure might have been due to air filling the empty pipes when not in use. When the fire protection system was activated and water rushed through the pipes, the air acted as a barrier and the resulting collision between the air and water caused the pipes to vibrate and break. Regardless of the reason, the breakage of the pipes meant the water failed to reach the desired destination necessitating the use of others means to extinguish the fire. During these events, the Facility was fortunate that the fires were contained in the hopper and did not ignite the pit. However, the water which was spilling from the pipes into areas not affected by the fire

reduced water pressure and ultimately could have prevented other fire fighting methods from being effective. The failing fire protection system actually became a liability rather than an asset in fighting the Facility's blazes. During one of the fires, the blaze activated the heat sensor but water was not discharged from the system. It was later discovered that the heat had burned poorly-placed wiring that was necessary to activate valves which started the flow of water. Construction installation had been faulty but inadequate and unclear instructions by the design engineer may have been the cause.

To further accelerate the concerns, Wheelabrator Spokane Inc. had a large fire at their sister plant in North Andover, MD. The Andover plant had the identical small area grid fire system as the Spokane facility which was insufficient to control and extinguish a large area, high ceiling fire and resulted in the loss of the crane system, the pulpit, and the roof structure of the facility. The Andover fire demonstrated to Spokane officials and to Wheelabrator that the code-prescribed sprinkler system was insufficient to extinguish a fire and prevent significant damage to the facility.

The System and Wheelabrator Spokane Inc. discussed the fire protection system and decided that a risk analysis was necessary to further ascertain the problem and to find a solution. They hired Creighton Engineering Inc., a fire protection consulting firm, to evaluate the risks and recommend an upgrade to the existing fire system. Fire District 10 which services the Facility and the Spokane City Fire Department acted in an advisory and approval role. During collaborative meetings, the Spokane City Fire Department engineer stated that certain installed fire systems are deemed to be less than effective.

Automatic fire sprinkler systems which rely on heat detection/activation are slower to respond than 24 hour human intervention and activation of systems. A typical waste-to-energy facility like the one in Spokane is designed with high ceilings necessitating the sprinklers to be located way above the pit. The fire must be fully engaged before heat sensors in the ceiling are activated. In a grid deluge dry sprinkler system, only the areas affected by a fire is doused with water. The water capacity in the system is not designed to cover the entire grid. Therefore, there would be insufficient water to extinguish the size of the fire in a facility's pit that is needed to activate the heat sensors located in the ceiling.

Relying on the heat sensors as the first line of defense clearly is an inadequate means given the size of the fire needed to activate the system. In this fire protection system, an alarm is not sounded until the heat sensors detect a fire. By the time the alarm has gone off, the fire is normally so large that plant personnel and fire fighters have a difficult time battling the blaze. According to the plant manager of the North Andover facility, the primary reason the blaze got away from suppression forces was because the operators were not able to access the

manually activated remote monitoring nozzles serving the pit in a timely manner before the fire was so advanced that the monitor deck became inaccessible. The North Andover's event timetable showed that the fire was so large by the time the alarm sounded that only 3 minutes passed between the time of the alarm until the pit surface area was engulfed and the smoke was so thick that the personnel were ordered to give up the fight and evacuate the building. Had alarms gone off earlier in the process when smoke was first detected and not waited until it reached the heat sensors in the ceiling, it is possible that the damage to the Andover facility would have been much less severe. In fact, the National Fire Protection Association (NFPA) Section 850 specifically states that trained plant personnel are the key to early detection and response and is now requiring human activation along with the installation of automatic activation systems.

Another problem discussed by the team was the location of the fire system in the high ceilings making inspection and routine maintenance impractical if not impossible. In the past, Washington State Labor and Industries regulators have not permitted the use of the crane as a working platform for the purpose of accessing the overhead sprinkler system because of the inherent danger of the approximate 150 foot drop to the bottom of the pit. Scaffolding the pit area for access is expensive and hazardous in itself. Without an adequate means of inspecting and keeping important fire protection equipment in top working condition, it is inevitable that the system will fail over time. Spokane City's Fire Protection Engineer stated that the 16 year age of the fire protection system along with the non-galvanized piping originally installed during the plant's construction housed in a humid and corrosive environment without proper maintenance rendered it unreliable in a fire event.

Of primary concern to both the fire departments and plant personnel during the discussion was the protection of the crane, the crane cabling and the crane pulpit in a fire. Use of the crane for active management of the waste during a fire is essential for effective control of the blaze. The crane aids in breaking up the fire source and loosens compacted waste to improve water penetration. This method has been recognized by NFPA and those involved in Municipal Solid Waste fire suppression as an effective means of dealing with smoldering combustion particularly during the early stages of a fire. The inadequate water capacity and the high positioned heat sensors make the grid deluge dry sprinkler system incapable of protecting the crane and the surrounding mechanisms.

After evaluating various solutions, Creighton Engineering recommended that a supplemental deluge system be installed in the Spokane facility. This supplement would provide a flat curtain across the entire width of the pit and would be installed below the festoons and opposite the crane pulpit. Overlapping alternative nozzles would provide for uniform coverage for the entire pit and enable the operator to control the situation and

deliver a significant quantity of water. Traditional deluge heads and sprinkler heads do not have the ability to cover the entire 53' pit from front to back. In order to meet the requirements, the fire engineers specified the adjustable k-factor Elkhart NT-500-C 2.5 fixed system nozzle(350 GPM@ 100 psi). The supplemental deluge system is very simple and is designed to be self-draining and easily maintained. The system is remotely triggered by either the control room or crane pulpit. There are no electronic control cards to replace or to become outdated and only a simple valve that can be activated or deactivated by a push/pull switch.

NFPA 850 states that the key to success in rapidly fighting a fire is trained plant personnel having an early detection and a quick response in the manual activation of the system. However, it was discovered that personnel were hesitant in turning on the system, if deactivation required a supervisor of higher level of authority. In the supplemental deluge system which the Spokane facility selected, it placed a high reliance on the response of trained facility personnel in a fire event. However, the activator was given the ability to disengage the system without waiting for supervisory authority. This eliminated the hesitancy by plant personnel and allows for a faster response time.

Construction of the supplemental deluge system did not occur as smoothly as anticipated. The new addition needed a large quantity of water and ended up necessitating the tapping of the main fire loop with an 8" pipe and routing it to the 5th floor of the Facility via a newly heated valve building. One week after construction and fine tuning of the supplemental deluge system, the system was activated by crane personnel to put out a pit fire. The new fire system worked flawlessly and easily extinguished the blaze. The Spokane solution is a performance specific solution to an industry problem that can be duplicated with minimal cost and effort.

CONCLUSION

Although Spokane installed a state of the art fire protection system during the initial construction of the facility, problems occurred over the years that required an update. The selection of a supplemental deluge system was made after a thorough examination of the various available options and installed at the Spokane facility. Shortly after installation, a fire broke out in the large pit and the ability of the crane personnel to activate the system quickly and efficiently extinguished the blaze. Spokane's experience and solution to the fire protection problem sets an industry example that can be easily duplicated with minimal cost and effort.