

Bow Volunteer Fire Department Battles 3 Day Coal Silo Fire

At 2:28 PM on August 29, 1991 an alarm was sounded for the Bow New Hampshire Fire Department to respond to the Public Service of New Hampshire Merrimack Station, which is a two unit (boiler) coal fired electric generating station. The fire department was requested to stand-by as the plant crews attempted to move some burning coal from the bottom of silo 2B onto a pressurized feeder belt and into the cyclone, which separates the coal from any air that is being carried along with it, and into the furnace for burning. The bottoms of the silos are approximately 95 feet above grade.

Chief Dana Abbott and Deputy Nick Cricenti met Plant Manager Harold Keyes and Operations Manager Bob Pickering on the fourth level at the base of silo 2B. Mr. Keyes related that some wet coal had apparently self ignited at the base of the silo. Upon visual examination it was determined that the stainless steel hopper that funnels the coal to the feeder belt had several hot spots near its base. The normal procedure for plant personnel when faced with this situation is to continue to run the feeder allowing the burning coal to drop onto the belt and be carried into the cyclone and then onto the furnace. It was decided to have two firefighters standby on the fourth floor to provide a watch on the operation. At the end of one and one half-hours with no apparent worsening of the coal fire Chief Abbott turned command over to Deputy Cricenti and left

The fire watch was uneventful until approximately eight o'clock when command was notified that a smoke condition had developed on the fourth level of the plant. At that time Deputy Chief Lee Kimball was the operations officer. He investigated and found that a crack had opened in a weld that held a silo vibrator in place. The smoke was coming from that crack. The vibrator was taken out of service and the crack was monitored for a few hours both for smoke and for any hazardous gases that may have leaked out of the crack. Also the top of the silo was monitored for explosive gas mixtures. Among the gases produced by the burning coal are carbon monoxide and hydrogen. The initial gas meter reading at the top of the silo showed the atmosphere in that area to be over one hundred percent of the lower explosive limit. This was a cause of great concern and measures taken to lower the gas mixture at the top of the silo were the elimination of coal movement into other silos, the cessation of the use of

vibrators in the silos, and the opening of all the doors at the top of the silo.

Fortunately the Merrimack Station had an automatic monitoring system at the top of the silos and thus it was not necessary to send personnel into that hazardous area. Because of the developments a full structural response including mutual aid from surrounding towns was called as a precaution. Handlines were stretched from standpipes on the fourth level of the area of the silo, but the lines were not charged. Included with the request for the structural response was a request for a chief officer from three of the surrounding town & One chief was assigned as resource officer, one was assigned to entry control and one chief assigned to monitor the various gases that the fire was producing. Also responding to the call was Capital Area Mutual Aid Coordinator Richard Wright. Chief Wright's job is to balance coverage in the mutual aid system while at the same time coordinating the resources that are anticipated to be needed at the incident. In addition, Chief

Wright acts as an advisor to the incident commander and assists with the incident management.

Deputy Chief Richard Martel was assigned to gas monitoring. He monitored at both the fourth level near the bottom of the silo and at the eighth level at the top of the silo outside of the area monitored by the automatic equipment. He also requested a hazardous materials gas specialist from the city of Manchester. The monitoring served as a base line for succeeding events and to determine that there were no large amounts of gases present.

When the vibrator was taken out of service the smoke stopped coming from the crack. The watch continued until three o'clock, which was twelve and one half-hours after the initial alarm, with no change in conditions. At three o'clock all companies were released and arrangements were made to have Deputy Cricenti return every ninety minutes to monitor the situation. Hose lines were left in place in case the situation worsened.

At seven o'clock in the morning on August 23 a meeting was held between Deputy Cricenti, the plant manager and the incoming shift supervisor to determine a plan for dealing with what was at that time a stable situation. It was felt by the plant staff that continuing to empty the silo would be the best way to deal with the fire. Deputy

Cricenti suggested that a carbon dioxide blanket be applied to the top of the silo to limit the migration of gases from the top of the silo and to limit the amount of oxygen at the top of the coal in the silo. This was implemented immediately by the plant staff. In addition the plant staff removed several grease fittings from the bottom gate of the silo. Several small carbon dioxide lances were placed into the fitting holes to assist in cooling and replace the oxygen available to the fire. During the incident a total of one hundred "D" sized cylinders of carbon dioxide were used. Fortunately Public Service Company had a supply of carbon dioxide available and a contract with a supplier for immediate refill.

At eleven o'clock on August 23, temperature readings on the outside of the bottom of the silo showed the temperature was not decreasing. At that time the temperature was approximately 400 degrees and had been stable for about five hours. It was decided by Deputy Cricenti to reestablish the fire watch with Bow Fire Department personnel. The watch, was in place by eleven thirty with three men at the scene and a two hour rotation plan set up. At approximately five thirty PM flame erupted from the area of the cracked weld.

The fire was extinguished by a carbon dioxide extinguisher, but reignited upon removal of the extinguisher. At that time Deputy Cricenti requested a full structural response. Nine minutes later he requested a second alarm. The two alarms brought approximately 45 firefighters to the scene. Because the carbon dioxide would not completely extinguish the fire it was decided to cool the outside of the silo with water and to drill a hole into the bottom of the silo to allow the introduction of class A foam in an attempt to extinguish the fire. The act of putting water on the outside of the silo required that the boiler for the second unit be shut down. The reason for the shut down was the proximity of electrical equipment that controlled the boiler to the burning silo. At the same time crews were assigned to set up hose lines at the top of the silo in case the attack from the bottom failed and total flooding of the silo was necessary. Total flooding of the silo was a last resort since it would certainly damage the silo and possibly cause major damage to the plant. The Merrimack Station has two 2000 gallons per minute fire pumps that maintain a pressure of 150 pounds per square inch and an extensive standpipe system throughout the building.

As more personnel arrived at the scene of the fire several staff positions were established to maintain control over the fire and plant. The plant manager moved to the command post and took a position adjacent to the fire department command post so that close

communication could be maintained. The unified command structure was especially effective for this operation. The Merrimack Station is a very complex facility and having the benefit of having the plant manager available to immediately answer any questions and having plant personnel available to assist fire personnel greatly enhanced the firefighting effort. In addition each level of the plant was given a sector number and, if staffed, a sector commander. Battalion Chief Robert Petrin of the City of Concord (The City of Concord borders Bow to the North) was made operations officer. Chief Peter Russell of Hopkinton Fire Department was made safety officer. Mutual Aid Coordinator Wright served as liaison and personnel officer. Bow Deputy Chief Lee Kimball was in command of the first four stories of the building and Allenstown Deputy Chief Richard Martel was in command of the fifth through eighth floors. In addition staff positions or sectors were established for rehab, resources, and staging.

At approximately seven PM a third alarm was ordered for additional personnel to supplement and assist the initial crews. In addition an aerial ladder was called to provide a third method of escape for the interior crews. At eleven thirty an additional alarm was called to allow rotation of initial crews to return to quarters to sleep. Some of the personnel had only one or two hours sleep the night before.

At approximately one AM the operation to introduce class A foam into the base of the silo was begun. The process involved bringing one hundred gallons of foam concentrate, proportioner and additional hose lines to the fourth floor. An area for proportioning was selected approximately one hundred feet from the silo. Two rangers from the New Hampshire Division of Forest and Lands, Forest Fire Division directed the foam application. The two rangers Sven Carlson and Richard Chase are two of the most knowledgeable Class A foam people in the State of New Hampshire. The two rangers volunteered their time for this project.

Crews from Merrimack Station drilled a one and one half-inch diameter hole in the base of the silo and immediately plugged the hole to prevent the introduction of additional air into the silo until the foam operation began. The machine shop at the power plant had already made up several different nozzles for use in the drilled hole. The nozzles consisted of various lengths of pipe threaded to accept fire department hose shutoffs.

Prior to introduction of the foam all crews were cleared from the fifth through eighth levels. This was done as a precaution should something unexpected occur during

the application of the foam. The foam was proportioned at 0.2% and the foam mixture injected in ten minute charges of one hundred gallons per minute of solution. Several of these charges were introduced into the silo and then the results were reviewed. The first result noticed was the issuance of steam from the failed weld. After several other charges the steam became mixed with water. After the wait of several minutes the steam stopped and only water came from the crack. The second result was the rapidly decreasing temperature of the silo read from the thermal imager. It was decided to continue adding water and foam solution until the bottom of the silo was filled to a depth of six feet. The height would be above any fire in the bottom. When the calculated amount of foam solution had been added a waiting period of thirty minutes was ordered to allow the foam to complete extinguishment.

After thirty minutes the bottom gate of the silo was opened. Foam solution and coal flowed out in the form of a slurry.

The slurry was channeled out of the building in sluiceways constructed by plant personnel. There was no evidence of burning material in the mixture. However, there were several pieces of burnt coal that had fused into chunks the size of a bowling ball. The normal size of the coal in the silo is pea size.

After it was determined that there was no burning coal a meeting was held with the command staff and Merrimack Station staff to establish a procedure for the removal of the balance of the two hundred tons of coal in the silo. It was decided to dump the coal on the fourth floor and a vacuum truck would remove the coal to a safe area. When the coal had been inspected and dried it would then be reused to fire the boilers. A decision was made to maintain as a precaution the carbon dioxide blanket at the top of the silo until such time as the silo was empty. The hose lines were also left in place at the top of the silo. The remainder of the operation was picked up. All units cleared from the area at approximately 9 AM on Saturday, August 24, 1991.

At the height of the operation over ninety fire fighters and twenty-five Merrimack Station personnel were on the fire ground. There was a minimum of thirty firefighters on the fire ground for fourteen hours and the average Bow fire fighter spent twenty hours at the scene. The total man-hours from the Bow Fire Department were 525. The mutual aid departments also contributed over five hundred man-hours to the effort. Throughout the entire three days there were no significant injuries.

The total damage to the power plant was less than one hundred thousand dollars. Lost operating time was less than twenty hours for Unit One and forty hours for Unit Two, which was directly fed by the fire, involved silo.