Algonquin Incremental Market Pipeline Risk Analysis Report

Report #17-99

Executive Summary

Within the United States, there is a growing concern over the physical security of our critical infrastructure. Some of our most critical infrastructure includes infrastructure used to transport hazardous materials (specifically oil and gas products). The Pipeline and Hazardous Materials Safety Administration (PHMSA), a branch of the U.S. Department of Transportation (DOT), is responsible for developing and enforcing regulations for safe and reliable transportation of hazardous materials via interstate pipelines. However, PHMSA does not oversee the potential impact to other critical infrastructure (such as interstate highways, electric generation, water treatment, etc.) in the event of a "rupture" of a hazardous material pipeline.

SCOPE

Within the State of New York, the Algonquin Mainline of Spectra Energy Partners, LP (Spectra) included two pipelines (26-inch diameter and 30-inch diameter) which traverse approximately 46 miles from the New Jersey border near the Village of Hillburn in Rockland County to the Connecticut border near the Town of Southeast in Putnam County. Concern was raised to the State of New York over the Spectra Energy Algonquin Incremental Market (AIM) Pipeline, most notably the proximity of some of the AIM Project segments to Entergy's Indian Point Energy Center (IPEC) nuclear facility and the supporting Con Edison Buchanan Substation. The AIM Project is designed to generally replace existing 26-inch diameter Algonquin Mainline pipeline with a maximum allowable operating pressure (MAOP) of 674 pounds per square inch gage (psig) with a new 42-inch diameter pipeline with an MAOP of 850 psig. In New York, approximately 15¾ miles was replaced including 6¾ miles in Rockland County, ¾ mile of HDD under the Hudson River, 8¾ miles in Westchester County, and 1/10 mile in Putnam County. The existing 30-inch diameter pipeline will remain in operation and has an MAOP of 750 psig.

Within the State of New York, the AIM Project also included net increases in horsepower at two existing compressor stations. Two new natural gas turbines were installed at the existing Stony Point Compressor Station in Rockland County and one new natural gas turbine was installed at the Southeast Compressor Station in Putnam County. There were also modifications / improvements to three meter and regulating stations located along the alignment.

The 42-inch diameter pipeline generally replaced the 26-inch diameter pipeline in the same excavated ditch from which the 26-inch diameter pipeline was removed and was generally installed at a minimum depth of three feet from the top of the pipeline. Although the new 42-inch diameter pipeline was generally collocated (side-by-side) with the remaining 30-inch diameter pipeline, it departs from the 30-inch diameter pipeline at several locations. Most notably, several miles of new pipeline right-of-way was required at the Hudson River crossing where the new pipeline is now located about 3,000 feet south of the existing Hudson River crossings.

In the vicinity of the IPEC facility, the existing Algonquin Mainline System consists of one 26-inch diameter pipeline and one 30-inch diameter pipeline that are within approximately 100-200 feet from the IPEC security fence which marks the border of the IPEC security zone. Even after the AIM Project replacements are complete, both of these lines will remain in place and operational to maintain system redundancy for reliability reasons. The new 42-inch diameter AIM Pipeline is approximately 1,500 feet south of the IPEC security fence and approximately 300 feet from the Con Edison Buchanan Substation. Consultations between IPEC's owner and operator (Entergy Nuclear Northeast) and Spectra Energy led to the incorporation of additional design and installation enhancements along approximately 3,935 feet of the AIM Project pipeline where it would lie closest to the IPEC facility and the substation. These measures included using coated pipeline pipe that exceeds the most stringent U.S. DOT requirements, burying the pipeline a minimum depth of 4 feet from the top of the pipeline, the installation of two parallel sets of fiber-reinforced concrete slabs over the pipeline that would act as a physical barrier over the buried pipeline, and installing yellow warning tape above and below the concrete slabs.

There are risks associated with the AIM Project as there are with any of the approximately 3,100 miles of interstate natural gas pipelines and over 1,000 miles of petroleum pipelines within the State and other pipeline systems throughout the country. As most of the pipeline infrastructure is buried, the main source of risk is inadvertent damage due to third party digging / excavation, failure due to faulty welds or corrosion, or operator error. Aboveground facilities are most susceptible to possible physical damage due to accidents and natural disasters. Cyber threats and attacks on critical pipeline infrastructure are also of concern.

RISK ANALYSIS SUMMARY

The U.S. Department of Homeland Security defines critical infrastructure sectors that are considered so vital to the United States that their "incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety, or any combination thereof."[1] In order to evaluate the potential risk associated with the AIM Project relative to critical infrastructure in and around the pipeline segments, the DHSES commissioned a risk assessment of the AIM Pipeline segments within the State of New York and the existing Algonquin Mainline System infrastructure within the AIM Project area that will remain in service.

This risk assessment focused on the key risks of potential pipeline incidents and identified critical infrastructure that could be impacted. The goal of this assessment was to identify and prioritize the top risks and support preliminary response strategies for the State should critical infrastructure be affected.

The project objectives and details were researched including natural gas pipeline incident information in order to develop a working model of a risk register.

This assessment analysis identified and discussed 46 initial potential risks that could be categorized within the following eight failure types:

[1] USDHS, 2016

- Corrosion Failure;
- Equipment Failure;
- Excavation Damage;
- Incorrect Operations;
- Material Failure of Pipe or Weld;
- Natural Force Damage;
- Intentional Damage; and
- Other Outside Force Damage.

The risks were compiled into a risk register or database of risks. The risk discussion focused on the AIM Project within New York and the remaining adjacent Algonquin Mainline System infrastructure within the AIM Project area and how natural or man-made hazards would potentially result in a pipeline incident along any particular segment.

The top risks, including critical infrastructure risks, identified in the risk register associated with the AIM Pipeline and the existing Algonquin Mainline System adjacent to it are listed in decreasing order of the expected impact:

- River traffic or dredging damage to the existing 30-inch Algonquin Mainline pipeline and dual 24-inch diameter pipelines (not being replaced) in the Hudson River to the southwest of the IPEC facility. This will not be expected to impact the safe operation of the IPEC facility, but an underwater incident could have a long-term impact on the existing pipeline operations.

- Excavation damage by a third-party contractor for the existing 30-inch Algonquin Mainline pipeline (not being replaced) near the IPEC facility.

- Earthquake-related damage to the existing 30-inch Algonquin Mainline pipeline (not being replaced) near to the IPEC facility.

- Excavation damage by a third-party contractor at locations other than identified under Item 2 above.

- Sabotage by a disgruntled employee with specialized knowledge who intentionally damages the pipeline or manipulates controls.

- Corrosion to the exterior of the pipeline that leads to a rupture.

- The release of hazardous waste materials due to a pipeline incident with the proximity of 17 New York State regulated Hazardous Waste Generating facilities within 1 Potential Impact Radius (PIR) of the pipeline.

- Disruption of transit or passenger rail service on the two passenger rail lines within 1 PIR of the pipeline.

- Disruption of the freight rail service with one freight rail line within 1 PIR of the pipeline.

Three of the top four risks above are related to the existing Algonquin Mainline pipeline segments near the IPEC facility. However, none are expected to impact the safe operation of the IPEC facility. The Risk Analysis includes a review of publicly available information from Spectra Energy and the Nuclear Regulatory Commission (NRC). This review indicates that the IPEC facility was evaluated for certain design basis events. It also includes evidence that confirms that this safety risk analysis was performed to the satisfaction of the NRC.

Due to the agreement with IPEC's operator to close the facility, the risk profile of the IPEC facility under a shutdown condition was considered. The inherent risk associated with storage of spent fuel rods on site in the spent fuel pools will be maintained after the final shutdown of IP2 and IP3. As indicated in the full report and Appendix E, it was conservatively concluded that the risk profile of the post-shutdown IPEC facility with spent fuel rod storage relative to the new and existing AIM pipelines will likely not be meaningfully different from the risk profile of the IPEC's normal operating condition. However, it is assumed that the spent fuel rods will be transferred to dry cask storage for long term storage. Following completion of the transfer, it is likely that the risk profile will be reduced.

POTENTIAL CRITICAL INFRASTRUCTURE IMPACTS

Using Geographic Information Systems (GIS) analysis, existing State critical infrastructure near the new AIM Pipeline and the existing Algonquin Mainline System was evaluated. A site conceptual model of the project route was developed that includes the pipeline segments and identified critical infrastructure along the pipeline. The area of review for data gathering was defined by calculating a potential impact radius (PIR) from these components (based on an industry standard formula[2]) within which the potential pipe rupture and subsequent ignition of a natural gas pipeline could have significant impact on people or property based on the size of the pipeline and its associated MAOP (Stephens, 2000). In a general report on hazardous liquids and natural gas pipelines commissioned by the Pipeline and Hazardous Material Safety Administration (PHMSA), Oak Ridge National Laboratory (ORNL) determined a maximum tolerable level of thermal radiation and the potentially severe damage radius to buildings and humans for natural gas pipeline releases and combustion immediately following guillotine-type breaks[3]. As indicated in the ORNL Report, the thermal radiation effects are a function of heat flux intensity and exposure duration. Fire damage to buildings and personal property is considered potentially severe for all areas within 1.5 to 1.7 times the PIR because the heat flux produced by natural gas combustion immediately following the break equals or exceeds the severe damage threshold.

To be conservative, critical infrastructure elements were categorized and mapped at 1.0 and 1.5 PIR as well as within 2.0 times the calculated PIR distance for the various pipeline segments. GIS analysis was utilized to identify 20 specific categories of risk to critical

[2] A Model For Sizing High Consequence Areas Associated With Natural Gas Pipelines, Mark J. Stephens, C-FER Technologies, C-FER Report 99068. October, 2000.

[3] Oak Ridge National Laboratory, Studies for the Requirements of Automatic and Remotely Controlled Shutoff Valves on Hazardous Liquids and Natural Gas Pipelines with Respect to Public and Environmental Safety, Report ORNL/TM-2012/411. October 31, 2012

infrastructure including 78 features such as population centers, railways, hazardous material centers and event sites crossing pipeline segments or within 1.0 PIR of pipeline segments. These risk categories were ranked and compared on the same scale as the initial assessment.

The top risks from these additional critical infrastructure items are:

- Incident within high density population center;
- Release of Hazardous Waste materials due to pipeline incident;
- Disruption in transit or passenger rail service due to a pipeline incident;
- Disruption in freight rail service due to a pipeline incident;
- Disruption to major telecommunication infrastructure from a pipeline incident;
- Incident impacts the Indian Point Evacuation Routes;
- Damage to an active Chemical Bulk Storage Facility;
- Disruption in water conveyance due to a pipeline incident;
- Dam impacted by a nearby pipeline incident; and
- Incident near outdoor event sites.

Benefit of This Risk Assessment to the State

The outcome of this risk assessment process was the development of a risk register that can be utilized by the responsible regulatory agencies within the State (primarily DHSES and DPS) in coordination with the pipeline owner to help manage the risk to critical infrastructure within the State. This risk register is intended to be a living document that can be used by the agencies to track and monitor the identified risks.

Additionally, the State can utilize the experience and results from this process in order to: (1) become more involved in the routing and siting process for new pipeline facilities; and (2) help pipeline operators prioritize their efforts for security and associated mitigation efforts.