IROQUOIS GAS TRANSMISSION SYSTEM, L.P.

08/09 EXPANSION PROJECT

DRAFT
RESOURCE REPORT 11

RELIABILITY AND SAFETY

PUBLIC

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RESOURCE REPORT 11 – RELIABILITY AND SAFETY
FERC ENVIRONMENTAL CHECKLIST

Part 380 – Minimum Filing Requirements for Environmental Reports	Company Compliance or Inapplicability of Requirement
Describe how the Project facilities would be designed, constructed, operated and maintained to minimize potential hazard to the public from the failure of Project components as a result of accidents or natural catastrophes. (§ 380.12 (m)).	Section 11.3; 11.6

RESOURCE REPORT 11: RELIABILITY & SAFETY

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11.0 RELIABILITY AND SAFETY

Resource Report 11 addresses the reliability and safety aspects associated with the proposed Iroquois 08/09 Expansion Project ("Project"). Section 11.1 of this Resource Report identifies the risk to the public from the transportation of natural gas based on the actual operating experience of Iroquois. The procedures and design features to ensure operational reliability and safety are detailed in Section 11.2. A discussion of the key safety considerations associated with the Project is presented in Section 11.3. The material in Section 11.3 provides a perspective of Iroquois' operating experience and corporate practices with industry-wide regulations and conditions. Section 11.4 summarizes the major causes of pipeline incidents and explains how Iroquois' proposed pipeline incorporates the best available measures to minimize the potential for incidents to occur. Section 11.5 provides the references used in the preparation of this Resource Report. This analysis is based on the design, operation and maintenance of the existing Iroquois facilities with respect to the applicable regulations; historical trends; natural gas transmission line incidents and other related data.

11.1 RELIABILITY AND SAFETY OF IROQUOIS' 08/09 EXPANSION PROJECT

The proposed 08/09 Expansion Project pipeline and aboveground facilities will be designed, constructed, operated, and maintained in accordance with U.S. Department of Transportation ("DOT"), Title 49 of the Code of Federal Regulations ("CFR"), Part 192; 'Transportation of Natural or Other Gas by Pipeline: Minimum Federal Safety Standards'. These safety regulations are augmented by the corporate practices of Iroquois. The effectiveness of these regulations and practices in providing reliability and safety is illustrated by the fact that no pipeline or equipment failures resulting in property damage or personal injury have occurred on Iroquois' existing transmission system to date.

11.2 SYSTEM OVERVIEW

The Iroquois Gas mainline system is currently an approximately 411-mile natural gas transportation system connecting with the TransCanada Pipelines system at the Canadian border near Waddington, New York. It traverses through New York State, Connecticut and Long Island Sound to its terminus on Long Island at Iroquois' South Commack Meter Station in Smithtown, New York and its terminus in the Bronx at Hunts Point, New York. Iroquois' system interconnects with many facilities along the way, including other transmission systems and local natural gas distributors throughout New York and New England.

Since commencing operation in December 1991, Iroquois has expanded its system, most recently through the construction of the Eastchester Extension that was completed in early 2004. This extension involved approximately 36 miles of new pipeline from a tap off the mainline system in Northport (Huntington), New York to Hunts Point in the Bronx, New York via the Long Island Sound as well as the construction of two new compressor stations in upstate New York. In all, Iroquois currently operates five compressor stations, all in New York State. In addition, on December 21, 2006 Iroquois was authorized in Docket CP02-31-002 to construct and operate a new compressor station in Brookfield, Connecticut; the purpose of this proposed compressor station is to allow Iroquois to physically receive natural gas from Algonquin Gas Transmission, LLC. The current estimated in-service date of the Brookfield Compressor Station is November 2008. Figure 1.1-1 in Volume III – Appendix J depicts Iroquois' existing pipeline system.

Natural gas transmission facilities designed and maintained in accordance with DOT regulations and industry standards have an excellent record of public safety and reliability. No pipeline or equipment failures resulting in property damage or personal injury have occurred on the Iroquois system since operations began in 1991. Iroquois will continue to employ similar system design, construction, operation, and maintenance practices to ensure that this excellent record is maintained. For transmission systems and compressor stations in general, empirical information illustrates an extremely low potential for public hazard from incidents associated with the operation of the project facilities (see Section 11.3).

11.2.1 Aboveground Facilities

As part of the proceedings in Docket CP02-31-002, Iroquois had submitted a study to the Commission Staff entitled "Review of Natural Gas Pipeline Incidents, Onshore Compressor Stations, 1984 through 2000", which was prepared by Ronald E. Schroeder of Quonset Environmental Associates in January 2002. As part of this study, DOT Office of Pipeline Safety incident reports for onshore compressor stations from 1984 to 2000 were researched for incidents involving human injury and/or fatality. These reports were also reviewed to determine if the incidents were applicable to Iroquois' compressor stations based on design considerations and construction/maintenance procedures and whether the incidents involved off-site property damage, injury or fatality impacts to the surrounding communities.

In February 2006, Quonset Environmental Associates updated this 2002 report to include information for the years 2001 to 2005. A copy of this report was also provided to FERC as part of the CP02-31-002 proceedings. In general, the DOT changed its reporting requirements after June of 1984 to gather more comprehensive information about property damage, injury, death, the release of gas, and incidents that are otherwise considered significant by operators. Based on these changes, the definition of a reportable "incident" includes property damage or loss in excess of $50,000, in-patient hospitalization, or fatalities. This more comprehensive data has been used to review the potential risk of incidents at onshore compressor stations for the period from 1985 to 2005.

Overall, Schroeder (2006) found that the DOT Office of Pipeline Safety incident reports do not support concerns regarding off-site injuries, or deaths associated with onshore natural gas transmission system compressor stations. None of the onshore natural gas transmission system compressor station incident reports for the years 1985 through 2005 (135 in total) indicate any injuries or deaths affecting surrounding communities during this 21-year period. The average nationwide incident rate is approximately six per year. The injury rate associated with these incidents is approximately two per year nationwide. In many years, there are no incidents involving any injury or fatality. Only two fatalities occurred between 1985 and 2005, and these are reported to have affected onsite personnel only; no injuries or fatalities were reported off-site.

Schroeder (2006) also found that only 12 of the 135 onshore natural gas transmission system compressor station incidents in the 21-year period could be considered applicable to the Iroquois Brookfield compressor station; this review applies with equal force to the proposed Milford Compressor Station. The majority of the incidents were not deemed applicable because of specific design, equipment selection, and safety and operating procedures in place at Iroquois' compressor stations. There are no reported off-site fatalities or injuries due to incidents applicable to Iroquois' compressor stations during the 21-year reporting period. Only one of the onshore compressor station incidents for the years 1985 through 2005 indicate any off-site damages affecting surrounding communities or the general public. This incident appears to have been caused by an automatic emergency shut-down of the station during an unusually

intense lightning storm in Florida where a pipeline or station isolation valve either may not have been of a fail-safe design or may not have been adequately maintained. The Brookfield Compressor Station modifications will be equipped with fail-safe isolation valves that will be adequately maintained consistent with Iroquois' procedures at its five other compressor stations.

Based on the evaluation of all incidents reviewed, Iroquois has determined that it already has procedures, programs and equipment in place to address the potential causes and to minimize the chance of their occurrence at its facilities. The small frequency of applicable incidents, the lack of historic off-site public health and safety impacts, modern design specifications and controls, and the distance between the proposed Iroquois compressor station and the nearest residences addresses potential safety concerns. The proposed Milford Compressor Station and Brookfield Compressor Station modifications are expected to be consistent with the findings of this 2006 report.

11.3 SPECIFIC MEASURES TO PROTECT THE PUBLIC

11.3.1 Pipeline Facilities

The proposed Iroquois pipeline facilities will be designed, constructed, operated, and maintained in accordance with the DOT Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public from natural gas pipeline failures. Part 192 specifies material selection and qualification, design requirements, and protection from internal, external, and atmospheric corrosion.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but is classified as a simple asphyxiant, possessing only an inhalation hazard. As with all gases, if inhaled in high enough concentration, oxygen deficiency could occur and result in suffocation. Given the unconfined, outdoor conditions of the pipeline right-of-way or easement setting for the 08/09 Expansion Project pipeline facilities, asphyxiation from a pipeline leak is improbable.

The greatest hazard of a natural gas transmission line is a major pipeline leak or pipeline rupture that results in a fire or explosion. Methane has an auto-ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between 5 to 15 percent in air. Unconfined mixtures of methane in air are not explosive. However, a flammable concentration within an enclosed space in the presence of an ignition source can result in a potential hazard. The specific gravity of methane, normalized to air at standard temperature and pressure, is 0.58; therefore, being lighter than air it has the tendency to rise and dissipate into the atmosphere.

The following information addresses how Iroquois proposes to design, operate, and maintain the proposed 08/09 Expansion Project pipeline facilities in accordance with DOT requirements to ensure safe and reliable operation, consistent with Iroquois' existing transmission system.

11.3.1.1 Pipeline Design Specifications

The Iroquois transmission system includes many pipeline design and equipment features, along with routine inspection and maintenance programs, designed to increase the overall safety of the system and protect the public from any system failures due to operations, incidents or natural catastrophes. The pipeline design incorporates the use of high strength micro-alloyed steel pipe, which has extremely good

fracture toughness. This increases resistance to pipe deformation and penetration by excavating equipment, optimizes leak-before-break characteristics in the event of penetration and prevents the initiation and propagation of pipeline ruptures by providing self-arrest of the rupture. Resistance to damage will be further augmented by using mainline pipe with a heavy wall thickness as described below.

Part 192.5 of the DOT Regulations defines pipeline class locations based on population density in the vicinity of the pipeline, which determine more rigorous safety requirements for populated areas. The class location unit is an area that extends 220 yards on either side of the centerline of any continuous one-mile length of pipeline. The four class locations are generally defined as:

Class 1: Location with 10 or fewer buildings intended for human occupancy or is an offshore area;

Class 2: Location with more than 10 but less than 46 buildings intended for human occupancy;

Class 3: Location with 46 or more buildings intended for human occupancy, is within 100 yards of any building, or has a small, well-defined outside area occupied by 20 or more people during normal use, such as playground; and,

Class 4: Location with buildings of four or more stories aboveground is prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. In accordance with the Code of Federal Regulations Title 49, Part 192, Section 192.327, pipelines constructed in Class 1 locations must be installed with a minimum depth of cover of 30 inches in normal soil, and 18 inches in consolidated rock. Class 2, 3 and 4 locations, as well as drainage ditches of public roads and railroad crossings, require 36 inches in normal soil and 24 inches in consolidated rock. Onshore class locations (section 192.179) also specify the maximum distance from any point along the pipeline to sectionalizing block valve: 10 miles in Class 1, 7.5 miles in Class 2, 4 miles in Class 3, and 2.5 miles in Class 4. Pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and weld testing, and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas.

Iroquois is proposing a buried pipeline depth of at least three feet. A discussion of the burial depth and valve site locations is provided in Resource Report 1 (General Project Description).

Iroquois anticipates the use of, API-5L DSAW, Grade X70 line pipe. Wall thicknesses will be sized based on class locations and other required design factors. Iroquois is planning for the 08/09 Expansion Project pipeline facilities to have a maximum operating pressure of 1440 or 1480 psig.

Each sectionizing block valve will contain a means to vent, or blowdown, the contents of the pipeline to decrease the internal pressure of the pipeline in an emergency situation. These blowdown vents will typically consist of vertical riser piping on each side of the block valve, containing manually operated vent valves and operated remotely via telecommunications or satellite technology.

11.3.1.2 Odorant

Iroquois maintains its pipeline system in accordance with Part 192 CFR Title 49, Section 192.625 which prescribes that a natural gas line must contain a natural odorant or be odorized so that at a concentration in air of one-fifth of the lower explosive limit, the gas is readily detectable by a person with a normal sense of smell. Natural gas transported by Iroquois' mainline is currently odorized in accordance with the requirements of 49 CFR Part 192. Odorant is injected at Iroquois' Wright Compressor Station located in Delanson, NY. All piping south (downstream) of the Wright Compressor Station is odorized in accordance with these standards. Piping north of the Wright Compressor Station does not have odorant added to the gas. Iroquois does not currently propose to install any additional odorant injection facilities. Readings of odorant levels are taken periodically at various points along the existing pipeline system to ensure compliance with Part 192 CFR Title 49.

11.3.1.3 Corrosion Protection

The Code of Federal Regulations Title 49, Part 192, Subpart I Requirements for Corrosion Control, Section 192.451 prescribes minimum requirements for the protection of metallic pipelines from external, internal, and atmospheric corrosion. These requirements will be accomplished by externally coating the pipeline with a fusion bond epoxy coating system, which has an outstanding record for preventing external corrosion. The effectiveness of this coating is augmented by a cathodic protection system installed along the new pipeline. Coating and cathodic protection are an integral part of ensuring the structural integrity of Iroquois' existing transmission system in New York and Connecticut.

Cathodic protection prevents corrosion of the pipeline facilities by providing DC electrical current flow to the pipeline. This offsets the natural soil, groundwater or salt water corrosion potential that can degrade the integrity of the pipe. The cathodic protection system is inspected at regular intervals to ensure proper operating conditions consistent with DOT requirements for corrosion mitigation. For the Project pipeline facilities, Iroquois will augment existing systems to provide cathodic protection.

11.3.1.4 Inspection Equipment

Iroquois' existing pipeline system incorporates launchers and receivers to accommodate the passage of internal inspection tools. Periodic inspections of the pipeline using these inspection tools are part of the Iroquois maintenance activities to detect damage and/or corrosion in the pipeline allowing for remedial action to be undertaken.

11.3.1.5 System Monitoring Equipment

The gas control center is maintained in Shelton, Connecticut. The center monitors system pressures, flows, and customer deliveries 24 hours a day, 365 days a year. Iroquois also operates area offices along the pipeline route whose personnel can provide quick response to emergency situations and direct safety operations as necessary. Additionally Iroquois maintains a backup location for gas control operations in the event the primary location is placed out of service.

The Supervisory Control and Data Acquisition (SCADA) system is the backbone to the Gas Control center. Data collection, monitoring and control of the compressor, meter stations and mainline block valves are accomplished by the SCADA system. If operation conditions fall outside predetermined

ranges, alarms are activated at the Gas Control Center enabling a timely diagnosis and mitigation of the alarm condition. Mainline block valves on the Iroquois system can be operated remotely from the Gas Control Center as well as manually at the field locations.

11.3.1.6 Restricted Access at Aboveground Facility Locations

The Project involves the construction of several aboveground facilities. All of the proposed aboveground facility locations will be securely fenced to prevent unauthorized access to the facilities.

11.3.1.7 Procedures for Operations, Maintenance, and Emergency Response

Iroquois operating policies and procedures are defined in its Operating and Maintenance ("O&M") Manual and Emergency Operating Procedures ("EOP") Manual, which are both readily available to all operations employees. These manuals provide directions in the day to day operation and preventive maintenance of the transmission system, as well as procedures to be followed in the event of an incident or natural catastrophe. The existing O&M and EOP Manuals would be adopted and amended as appropriate for the new facilities proposed in this docket.

Iroquois' O&M and EOP Manuals are implemented according to a defined schedule, revised as necessary and reviewed regularly by operations employees. These include the safe operation and maintenance of all onshore and offshore pipeline facilities, mainline block valves, meter stations and compressor stations, and presentation of public awareness programs and operating procedures. Periodic reviews of these procedures provide for the latest pipeline technology, industry experience, federal regulations and risk management practices to be incorporated into the Iroquois procedures.

11.3.1.8 Field Patrols/Leak Detection Surveys

The pipeline facilities will be marked above ground to indicate the presence of the pipeline as required by 49 CFR Part 192. Regular patrols of the pipeline facilities are performed along to control encroachment by third parties. Any unusual situation or condition is reported and investigated immediately according to directions outlined in the O&M Manual. Additionally, Iroquois performs periodic leak detection surveys in accordance with DOT regulations. The facilities constructed by Iroquois as described in this docket will have similar field survey procedures.

Iroquois is a member of the One Call system for pre-excavation notification in New York and Connecticut. Through these organizations, contractors provide notification to a central agency of proposed excavation, which in turn notifies Iroquois of the excavation locations. Should Iroquois' facilities be located in the area of proposed contractor activity, a representative of Iroquois is dispatched to mark out the area and witness the excavation as necessary to prevent damage to the pipeline.

11.3.1.9 Liaison Procedures with Local Authorities

Liaison with public authorities and local utilities is maintained along the pipeline system. The Emergency Operations Procedures Manual contains a list of those who are to be contacted in case of emergency. Key components of the liaison program consist of:

1. Periodic visits with emergency agencies to inform them of the Iroquois facilities and to

coordinate emergency response in the event of an incident.

2. Special information meetings and training at the invitation of the municipality.

3. Circulation of literature listing emergency telephone numbers and other pertinent data.

11.3.1.10 Emergency Plan

Under Section 192.615 of the DOT Regulations, each pipeline operator must also establish an Emergency Plan that provides written procedures to minimize the hazards from a gas pipeline emergency. Key elements of the plan include procedures for:

1. Receiving, identifying, and classifying emergency events--gas leakage, fires, explosions, and natural disasters;

2. Establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;

3. Making personnel, equipment, tools, and materials available at the scene of an emergency;

4. Protecting people first and then property, and making safe from actual or potential hazards; and

5. Emergency shutdown of system and the safe restoration of service.

Each operator must establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a gas pipeline emergency, and coordinate mutual assistance in responding to emergencies. The operator must also establish a continuing education program to enable customers, the public, government officials, and those engaged in excavation activities to recognize a gas pipeline emergency and report it to appropriate public officials.

Iroquois has established a continuing education and public liaison program since 1991 for its existing 411 miles of pipeline and compression facilities. This plan will be expanded as required to incorporate the towns affected by the Project.

11.3.2 Aboveground Facilities

The proposed Milford Compressor Station and modifications to the Brookfield Compressor Station will be designed and operated using the same or similar techniques that were applied to successfully design, construct, and operate Iroquois' existing compressor stations in the towns of Athens, Boonville, Dover, Croghan, and Wright, NY and the compressor station in Brookfield, CT approved in Docket No. CP02-31-002. Similar features of the existing stations are incorporated into the compressor stations design to maintain the safety and reliability of the stations as proven by the existing stations. These include station material selection, a high degree of equipment monitoring, unit/station shutdown protection, and a number of "fail-safe" systems.

In addition to the measures described above for the pipeline facilities, the following information addresses how Iroquois proposes to design, operate, and maintain the proposed Project aboveground facilities in accordance with DOT requirements to ensure safe and reliable operation, consistent with Iroquois' existing transmission system.

11.3.2.1 Design Specifications

The compressor stations will be designed and constructed to meet or exceed the safety standards established by the DOT. Station and unit control computers will monitor the essential functions of the turbo compressor and will trigger an appropriate sequence of remedial actions if an upset condition is detected. If the compressor station computers detect an alarm condition, appropriate action within the station controls will be commenced automatically. The piping system at the station will meet or exceed 49 CFR Part 192. The Iroquois pipeline is already designed to safely handle the additional gas volumes that would be transported through the system by the additional compressor unit.

The compressor package will be a centrifugal compressor driven by a natural gas-fueled turbine. This offers the advantage of reduced vibration and pulsation effects, and thus vibration and fatigue induced failures compared with reciprocating engines and compressor units. The turbo compressor package is proposed to incorporate a dry gas seal system, which eliminates the high pressure seal oil system, and thus some points of potential failure. The turbo compressor package, including both the turbine engine and gas compressor will be enclosed within an on skid enclosure that provides turbine lube oil containment.

The proposed compressors will be equipped with a full range of automatic emergency detection and shut down systems. The station will have a hazardous gas and fire detection alarm system, a compressor unit enclosure fire suppression system, and emergency equipment shut down system. These safety and emergency systems will be monitored 24 hours a day by Iroquois' Supervisory Control and Data Acquisition ("SCADA") system and the local control systems.

Standard fire protection, first aid, and safety equipment are maintained at the existing compressor station, and station maintenance personnel have been trained in proper equipment use and in first aid. The fire-fighting equipment that is maintained on-site includes dry chemical fire extinguishers. Iroquois also will coordinate with the local emergency response services concerning the equipment at the station.

The proposed compressor station facilities will be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 192. The regulations are intended to ensure adequate protection for the public from natural gas pipeline and compressor facilities. Part 192 defines minimum standards for:

- Materials selection
- System design
- Welding and joining components
- Construction

- Corrosion control
- Testing
- Inspection
- Maintenance
- Personnel qualifications, and
- Pipeline integrity management.

The following information addresses how Iroquois proposes to design, operate, and maintain the proposed Project in accordance with DOT requirements to ensure safe and reliable operation, consistent with Iroquois' existing transmission system.

11.3.2.2 System Monitoring Equipment

The proposed compressor stations will be designed for unattended operation and self-monitoring, and will include a communications and monitoring system which is designed to ensure a response in the event that a mechanical problem or a potentially unsafe condition is detected. This facility will be monitored by Iroquois Gas Control Center in Shelton, CT 24 hours a day. In addition, systems data will be collected in Iroquois' SCADA System.

The compressor stations primary communications system will be via wide area network ("WAN"). Should a WAN communication outage occur, the communications system will revert to the satellite (VSAT) secondary backup system or tertiary dial modem. In the event of an AC power loss at the station, a back-up generator automatically will come on line, and provide station power until commercial power service is restored. A battery system will provide DC power for essential equipment during the interim outage period**.**

11.3.2.3 Emergency Shut-Down System

Part 192 specifies that each compressor station must have an emergency shut-down system that can be manually operated from at least 2 points. In addition to a higher number of manual shutdown points, Iroquois stations have a number of turbo compressor and building monitoring systems that will initiate a shutdown automatically. The turbo compressor enclosure will also be equipped with ultraviolet/infrared, fire, heat and gas detection systems

11.4 NATURAL GAS PIPELINE INDUSTRY SAFETY OVERVIEW

The following information provides a perspective of Iroquois' experience with respect to safety and reliability compared to industry-wide operational data. The information presented also helps to define the key industry-related safety issues and its relevance to the 08/09 Expansion Project.

11.4.1 Gas Transmission Pipeline Incident Data for 1990 to 2004

Since 1970, all operators of transmission and gathering systems under the jurisdiction of the DOT have been required to report pipeline incidents to the Pipeline and Hazardous Materials Safety Administration ("PHMSA") Office of Pipeline Safety ("OPS"). The OPS is the federal safety authority for the nation's 2.3 million miles of natural gas and hazardous liquid pipelines. The DOT changed reporting requirements after June 1984 to gather more comprehensive information including property damage in excess of $50,000, injury resulting in hospitalization, death, or other incidents that are otherwise considered significant by the operator resulting from a release of gas. This more comprehensive data has been used to review all pipeline incidents for a 15-year period between 1990 and 2004 (see Table 11.4-1).

TABLE 11.4-1
TRANSMISSION PIPELINE INCIDENTS BETWEEN 1990 AND 2004 (U.S)

Year	INCIDENTS				Total # of Incidents	Pipeline Length in U.S. (miles)	Incidents/ mile-year
	Construction/ Material Defect	Corrosion	Damage By Outside Force	Other			
1990	22	16	39	12	89	324,410	0.000274
1991	4	16	41	10	71	326,575	0.000217
1992	9	12	32	21	74	324,097	0.000228
1993	15	15	36	29	95	325,319	0.000292
1994	9	33	23	15	81	332,849	0.000243
1995	13	9	27	16	64	327,866	0.000195
1996	8	15	38	12	77	321,791	0.000239
1997	12	21	28	12	73	328,821	0.000222
1998	19	22	37	21	99	331,867	0.000298
1999	8	14	18	14	54	328,378	0.000164
2000	7	31	20	22	80	326,506	0.000245
2001	12	16	36	23	87	312,643	0.000278
2002	0	22	0	60	82	324,754	0.000252
2003	0	25	0	69	98	320,350	0.000293
2004	0	38	0	82	121	322,046	0.000373
					15-year Average:	**0.000256 or 2.54×10^{-4}**	

Source:
USDOT-OPS website: http://ops.dot.gov/stats/stats.htm [accessed October 6, 2005]

During this 15-year period, 1,284 incidents have occurred on approximately 325,220 miles of natural gas transmission and gathering pipelines within DOT jurisdiction. Based on this data, the number of incidents per mile-year calculates to 2.54×10^{-4} incidents/mile-year.

11.4.2 Incident Data on 20-Inch to 28-Inch Gas Transmission Pipelines

Kiefner et al. (1999) studied incident data between 1985 and 1997 of pipeline systems between 20 and 28 inches in diameter. In Table 11.4-2, these incidents are classifiable into 22 distinct causes and by decade of installation for the purposes of this analysis. Three causes, third party damage, internal corrosion and external corrosion account for just over half (51.4 percent) of these incidents. More importantly, it is

evident from this analysis that the frequency of incidents is strongly dependant on pipeline age. Pipelines built in the 1960's and before, account for 80 (76%) of the 105 incidents that have been reported.

Older pipelines have a higher frequency of corrosion incidents since the pipeline coatings and cathodic protection systems available to the industry at this time were not as advanced as currently available. The use of both an external protective coating and a cathodic protection system, required on all pipelines installed after July 1971, significantly reduces the rate of corrosion failure over previously installed pipe. Older pipelines tend to have a higher frequency of outside incidents partly because the precise location of older pipelines may be less well known and less well marked than newer lines.

TABLE 11.4-2
INCIDENT DATA BY DECADE OF
INSTALLATION FOR 20- TO 28-INCH GAS TRANSMISSION SYSTEMS,
1985 THROUGH 1997

Classification	Before 1960	60's	70's	80's	90's	Not Known	Total Incidents
Cold Weather							0
Defective Fabrication Weld	3	1		1			5
Defective Girth Weld	1						1
Defective Pipe							0
Defective Pipe Seam	2						2
External Corrosion	15	2				1	18
Earth Movement	5			1			6
Gasket or O-ring Failure		1					1
Heavy Rains/Floods	5		1		1		7
Internal Corrosion	4	2	7			1	14
Incorrect Operation	3	1			2	2	8
Lightning							0
Malfunction of Control/Relief Equipment							0
Miscellaneous							0
Previously Damaged Pipe	5	2	1				8
Stress Corrosion Cracking	6						6
Seal or Pump Packing Failure							0
Third Party	11	5	3	3			22
Threads Stripped, Broken Pipe Coupling					1		1
Unknown	1						1
Vandalism	1						1
Wrinkle Bend or Buckle	4						4
Totals	**66**	**14**	**12**	**5**	**4**	**4**	**105**

Iroquois will be exploiting the pipeline technology developed over the last thirty years to:

A. Minimize the potential for third party damage with pre-notification programs, precise pipeline marking and surveying and the use of damage resistant pipe.

B. Prevent external corrosion through the use of a fusion bond epoxy pipeline coating and cathodic protection.

C. Prevent internal corrosion by the transportation of sweet natural gas.

D. Verify the ongoing integrity of the pipeline with in-line pipeline inspection technology.

11.4.3 Pipeline Incidents Relative to Other Modes of Transportation

The nationwide totals of accidental fatalities due to various manmade and natural hazards are listed in Table 11.4-3 to provide a relative measure of the industry-wide safety of natural gas pipelines. Direct comparisons between accident categories should be made cautiously since individual exposures to hazards are not uniform among all categories. Nevertheless, the average number of fatalities among the public for pipelines, 2.1 per year is small considering that more than 325,000 miles of transmission lines in service nationwide.

Furthermore, the fatality rate is more than one order of magnitude lower than the fatalities from natural hazards, such as lightning, tornadoes, floods, and earthquakes.

TABLE 11.4-3
NATIONWIDE ACCIDENTAL DEATHS

Type of Accident	Fatalities [1/]
All accidents	92,200
Motor vehicles	41,200
Falls	16,600
Poisoning	8,400
Drowning	4,100
Fires and burns	3,700
Suffocation by ingested object	3,200
Aircraft	909
Tornadoes and floods (1994-1996 average)	91
Lightning (1994-1996 average)	74
Natural gas transmission and gathering pipeline reportable incidents (1990-2004 average)	2.1 [2/]

Notes:
[1/] All data, except where noted, reflects 1998 statistics from the National Safety Council, "Injury Facts 1999 Edition."
[2/] USDOT-OPS website: http://ops.dot.gov/stats/stats.htm [accessed October 6, 2005]

With regard to the existing Iroquois pipeline system, there have not been any serious injuries or deaths of employees or the public involving any of the Iroquois facilities in its operational history.

11.5 SUMMARY

The DOT incident statistics have been reviewed to assess to relative risk of the proposed Iroquois facilities. Based on this analysis it is apparent that:

1. Gas transmission pipelines provide the least risk to the public of all modes of transportation.

2. Approximately seventy-five percent of all pipeline incidents are attributable to those pipelines installed over thirty years ago.

3. The leading three causes of pipe incidents are external corrosion, internal corrosion and third party damage.

The design features of the proposed Iroquois facilities have been reviewed in light of these findings and the following observations made:

1. The proposed pipeline will utilize a fusion bond epoxy pipeline coating and a cathodic protection system to combat external corrosion.

2. The pipeline will transport sweet natural gas to prevent internal corrosion.

3. The pipeline will be made from damage resistant steel and be precisely surveyed, well marked, regularly patrolled and part of the Call-Before-You-Dig program to minimize third party damage.

4. The proposed compressor stations will incorporate design and features based upon current industry practices.

On the basis of this review, it is anticipated that the proposed Iroquois facilities have incorporated features that will reduce the risk of pipeline incidents to well below the national average and maximize the safety and reliability of the proposed facilities.

11.6 REFERENCES

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