NEXUS GAS TRANSMISSION PROJECT

RESOURCE REPORT 11

Reliability and Safety

FERC Docket No. CP16-__-000

November 2015

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Filing Requirement	**Location in Environmental Report**
☒ 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))	Sections 11.2 to 11.4

RESPONSE TO FERC SEPTEMBER 2015 COMMENTS ON NEXUS RESOURCE REPORT 11 – RELIABILITY AND SAFETY

FERC COMMENTS ON DRAFT RESOURCE REPORT 11	LOCATION OR RESPONSE TO COMMENT
1. Provide more specificity about how NEXUS plans to maintain emergency vehicle access to public facilities during construction (i.e., will have steel plates on site).	See Resource Report 8, Section 8.2.3.4.
2. Provide more detail about protecting existing utilities from blast damage in locations where blasting is required. Include relevant information in RR6 and the Project Blasting Plan.	See Resource Report 6 and the NEXUS Blasting Plan, Appendix 1B3 to Resource Report 1.
3. Address effectiveness of the cathodic protection system in shallow water table areas or saturated soils.	Cathodic protection systems impress a low voltage current to the pipeline to off-set natural soil and groundwater corrosivity i.e., corrosion potential. Engineering designs of cathodic protection systems are based on soil resistivity (generally the opposite of conductivity) measurements performed to determine the corrosivity of subsurface soils based on site-specific conditions. The type, location, and current capacity of anode beds that make up cathodic protection systems are designed to achieve uniform distribution of protective current based on site specific soil corrosivity /soil resistivity. While the corrosivity of soil increases in lower resistivity soils containing water (i.e., in areas with shallow water tables or saturated soils), water improves electrical conductivity thus offering increased current distribution required for corrosion protection. Therefore, the cathodic protection system's current requirement corrects itself based on corrosivity/resistivity of soil and maintains the effectiveness of the cathodic protection system. This includes the areas with high water tables and with saturated soils.
4. Provide support for references in RR 11 concerning incident rates on Spectra's system compared to industry-wide rates.	See Section 11.3.2 in this Resource Report for citation to reference supporting Spectra's incident rate.
5. Address safety questions identified in letter submitted to the docket by Richard Anthony dated 9/14/2015.	Pipeline safety is addressed throughout Resource Report 11.

ACRONYMS AND ABBREVIATIONS

AC	alternating current
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
DTE	DTE Energy Company
FERC	Federal Energy Regulatory Commission
HCA	High Consequence Areas
NEXUS	NEXUS Gas Transmission, LLC
NEXUS Project	NEXUS Gas Transmission Project
NGA	Natural Gas Act
OSHA	Occupational Safety and Health Administration
Part 192	Title 49 of the CFR Part 192
PHMSA	Pipeline and Hazardous Materials Safety Administration
PIR	Potential Impact Radius
Project	NEXUS Gas Transmission Project
ROW	right of way
Spectra	Spectra Energy Partners, LP
Spectra Energy	Spectra Energy Partners, LP
U.S.	United States
USDOT	U.S. Department of Transportation

11.0 RESOURCE REPORT 11 – RELIABILITY AND SAFETY

11.1 Introduction

NEXUS Gas Transmission, LLC ("NEXUS") is seeking a Certificate of Public Convenience and Necessity ("Certificate") from the Federal Energy Regulatory Commission ("FERC") pursuant to Section 7(c) of the Natural Gas Act ("NGA") authorizing the construction and operation of the NEXUS Gas Transmission Project ("NEXUS Project" or "Project"). NEXUS is owned by affiliates of Spectra Energy Partners, LP ("Spectra" or "Spectra Energy") and DTE Energy Company ("DTE" or "DTE Energy"). The NEXUS Project will utilize greenfield pipeline construction and capacity of third party pipelines to provide for the seamless transportation of 1.5 million dekatherms per day ("Dth/d") of Appalachian Basin shale gas, including Utica and Marcellus shale gas production, directly to consuming markets in northern Ohio and southeastern Michigan, and to the Dawn Hub in Ontario, Canada. Through interconnections with existing pipelines, supply from the NEXUS Project will also be able to reach the Chicago Hub in Illinois and other Midwestern markets. The United States portion of the NEXUS Project includes new greenfield pipeline in Ohio and Michigan and capacity leased from others in Pennsylvania, West Virginia, Ohio and Michigan, terminating at the United States ("U.S.")/Canada international boundary between Michigan and Ontario. The Canadian portion of the Project will extend from the U.S./Canada international boundary to the Dawn Hub. A more detailed description of the Project is set forth in Resource Report 1.

This Resource Report 11 describes the reliability and safety aspects of the proposed Project. Tables for this Resource Report are provided in the Tables section at the end of this report.

Project drawings, maps, and aerial photo based alignment sheets, are provided in Appendix 1A of Resource Report 1.

11.2 Natural Gas Pipeline Industry Safety Overview

The following information provides a perspective of NEXUS' 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.

11.2.1 Pipeline Safety

11.2.1.1 Hazards

According to the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA), the federal agency with authority for regulating oil and gas pipeline safety, there are 2.6 million miles of pipelines across the United States and those pipelines offer one of the safest and most cost-efficient modes to transport oil and natural gas. Natural gas transmission makes up approximately 302,000 miles of the total miles of pipelines in the United States (PHMSA 2014). The risk of pipeline incidents resulting in death or major injury has decreased over the past two decades by approximately 10 percent every three years (PHMSA, 2013). As presented in subsequent sections of this report, through the application of federal law and with technological advances, there are multiple layers of safeguards built into the design, construction and operation of the proposed pipeline.

Methane, the primary component of natural gas, is colorless, odorless, and tasteless. It is not toxic, but it is classified as an asphyxiant for its ability to displace oxygen, resulting in an inhalation hazard. If inhaled in high concentration, oxygen deficiency can result in serious injury or death. Methane has an ignition temperature of 1,000 degrees Fahrenheit and is flammable at concentrations between five percent and 15 percent in air. Unconfined mixtures of methane in air are generally not explosive or a significant health hazard. However, a flammable concentration within an enclosed space in the presence of an ignition source can result in a fire or explosion. The specific gravity (relative density per unit) of methane is 0.55 when

compared to atmospheric air at specific gravity 1.0. This means that natural gas is buoyant at atmospheric temperatures and disperses readily in ambient air, rather than spilling as a liquid would.

11.2.1.2 Safety Standards

Under the Pipeline Safety Act, as amended (49 United State Code [USC] 60101 *et seq*.), the U.S. Department of Transportation ("USDOT") has exclusive authority to promulgate pipeline safety and design standards for interstate pipelines and transportation facilities. The proposed Project facilities will be designed, constructed, operated, and maintained to meet or exceed USDOT minimum federal safety standards set forth in Title 49 of the Code of Federal Regulations ("CFR") Part 192 ("Part 192"). NEXUS safety specifications for the following equipment exceed the minimum standards set forth in Part 192: pipe, valves, pigging facilities, fabrications, pipe fittings, and welding, as well as procedures for pressure testing, corrosion protection, inspection, and record keeping.

Examples of specifications that meet or exceed those required by Part 192 are listed below:

- Minimum depth of cover of 36-inches is required over the proposed pipeline for all pipeline Class Locations and geological conditions;
- All welding, coating, and backfilling activities are inspected;
- All welds are non-destructively examined by an independent radiographic inspection company, regardless of Class Location;
- Remote controlled valves and monitoring equipment will be installed for all mainline valves on the Project;
- Spacing of Mainline Valves is based upon population density and Part 192 area classifications ;
- Valves are also installed as close to roads as possible to provide for good access;
- All mainline piping will have at least 16 mils nominal thickness of epoxy coating;
- The minimum pressure for pressure tests, based upon the pipeline maximum allowable operating pressure, is greater than the operating pressure of the pipeline;
- Testing will be conducted in accordance with USDOT regulations.

Part 192 defines area classifications, based on population density and land uses 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 (660 feet) on both sides of the centerline of any continuous 1-mile length of pipeline. The four Class Location Units defined by Part 192 are as follows:

- Class 1 – Any class location unit with 10 or fewer buildings intended for human occupancy.
- Class 2 – Any class location unit with more than 10 but fewer than 46 buildings intended for human occupancy.
- Class 3 – Any class location unit with 46 or more buildings intended for human occupancy or where pipeline lies within 100 yards of any building, or small, well-defined outside area (such as a playground, recreation area, outdoor theater, or other place of public assembly) occupied by 20 or more people on at least five days a week for 10 weeks in any 12 month period.
- Class 4 – Any class location unit where buildings with four or more stories aboveground are prevalent.

Class locations representing more populated areas require higher safety factors in pipeline design, testing, and operation. Per Part 192, 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 a depth of cover of 36 inches in normal soil and 24 inches in consolidated rock.

Class locations also specify the maximum distance between sectionalizing block valves with intervals of 20 miles in Class 1, 15 miles in Class 2, 8 miles in Class 3, and 5 miles in Class 4. Pipeline design pressures, hydrostatic test pressures, maximum allowable operating pressure, inspection and testing of welds and frequency of pipeline patrols and leak surveys must also conform to higher standards in more populated areas. NEXUS is conducting thorough class location studies in accordance with USDOT regulations. The pipeline design is based on current class location studies and structure verification; however, the NEXUS team will continue to evaluate potential High Consequence Areas (HCAs) and future development areas and plan for future class location changes accordingly.

When there is a class location change and the MAOP does not conform to the current class location, NEXUS will take actions such as pressure testing certain pipeline areas or replacing the existing pipe with heavier wall pipe in accordance with USDOT regulations. A change in class may result in changes in pipeline operations that do not require physical changes to the pipe. Table 11.2-1 shows current USDOT area classifications for the Project.

In addition to the above design and construction standards, Part 192 also prescribes minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Under Section 192.615, each pipeline operator must also establish an emergency plan that provides written procedures to minimize the hazards resulting 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 them safe from actual or potential hazards; and
5. Emergency shutdown of system and safe restoration of service.

Each operator must establish and maintain adequate means of communication with appropriate fire, police, and public officials to communicate the resources and responsibilities of each organization that may respond to a gas pipeline emergency, and coordinate mutual assistance in responding to emergencies. Under Section 192.616, an operator must also establish a written 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.

11.2.1.3 High Consequence Areas

The Pipeline Safety Improvement Act of 2002 (Pub. L 107-355) mandated that USDOT's PHMSA issue regulations that require operators of natural gas transmission pipelines to develop and implement Integrity Management Programs for pipelines in HCAs. Pipeline integrity management is a systematic approach for identification and mitigation of potential risks to the pipeline. PHMSA promulgated a rule for Pipeline Integrity Management in HCAs for Gas Transmission, which requires that a facility-specific Integrity

Management Plan be developed to document procedures under which pipeline integrity will be monitored and maintained for those areas where the pipeline traverses lands or facilities that are considered HCAs (Part 192 Subpart O). HCAs are defined and discussed further in Section 11.4.1.

NEXUS will implement a comprehensive Integrity Management Program that meets or exceeds the requirements of Part 192. While the pipeline integrity management regulations apply only to HCAs, NEXUS will implement the same principles across its entire pipeline system. These practices will enable NEXUS to identify and mitigate risks for the entire pipeline system, within and outside of HCAs.

11.2.2 Pipeline Accident Data

USDOT has set forth certain reporting requirements for operators of natural gas pipelines in 49 CFR Part 191. Since June 1984, 49 CFR Part 191 has required all operators of transmission and gathering systems to notify USDOT of any reportable incident, and to submit a written report on form 7100.2 within 30 days after detection of the incident's occurrence. A reportable incident includes incidents that involve property damage valued at more than $50,000, injury, death, unintentional loss of 3,000,000 cubic feet or more of gas, or incidents that are otherwise considered significant by the operator. Table 11.2-2 summarizes reported onshore natural gas transmission pipeline incidents by cause from 1995 to 2014. As evidenced in Table 11.2-2, across the industry the highest number of fatalities was associated with onshore natural gas transmission pipeline incidents is caused by excavation damage (15 out of 42 total fatalities or approximately 36 percent).

From 1995 to 2014, industry wide, the most frequent cause of onshore natural gas transmission pipeline incidents was corrosion (533 out of 2,176 incidents or approximately 25 percent). The frequency of corrosion-related incidents is largely dependent on external corrosion. While pipelines installed since 1950 exhibit a fairly constant frequency of corrosion incidents, pipelines installed before that time have a significantly higher rate of incidents. Older pipelines have a higher frequency of corrosion incidents because corrosion is a time-dependent process. The corrosion potential for new pipe over time is further reduced by the use of more advanced coatings and cathodic protection. Prior to 1971, pipelines were not required to use cathodic protection and protective coatings. The use of both an external protective coating and a cathodic protection system significantly reduces the rate of material failure compared to unprotected or partially protected pipe (*see* Sections 11.4.6 Mitigative Measures and 11.4.15.5 Corrosion Control).

Outside force incidents result from excavation damage (i.e., encroachment of mechanical equipment such as bulldozers and backhoes), natural force damage (i.e., earth movements due to soil settlement, washouts, or geologic hazards, and weather effects such as winds, storms and thermal strains), and other outside forces. The breakdown of outside force incidents in Table 11.2-3 shows that third party excavation damage was responsible for 15 percent of all onshore incidents from 1995 to 2014. Since April 1982, operators have been required to participate in "811 Call Before You Dig" public utility programs in populated areas to minimize unauthorized excavation activities in the vicinity of pipelines. State laws also require excavators to call their state "811 Call Before You Dig" centers well in advance of digging (*see* Section 11.4.15.3 below on NEXUS pipeline markers).

11.2.3 Impact on Public Safety

The industry-wide reported incident data summarized in Table 11.2-2 includes onshore natural gas pipeline incidents of all magnitudes with widely varying consequences. As stated previously, the majority of incidents during the reporting period were attributed to corrosion. Table 11.2-4 presents the annual fatalities and injuries which occurred on natural gas transmission pipelines from 1995 through 2014.

Table 11.2-5 presents the 2013 nationwide totals of transportation-related fatalities and injuries, broken down by mode of transportation by USDOT Bureau of Transportation Statistics, Research, and Innovation Technology Administration. These are the latest figures available from USDOT. The table provides a

relative measure of the industry-wide safety of natural gas transmission pipelines. Direct comparisons between modes of transportation should be made cautiously since individuals are not uniformly exposed to hazards from all of the modes. Nevertheless, the average number of fatalities resulting from natural gas transmission pipelines is proportionally small considering the approximately 302,000 miles of onshore and offshore transmission pipelines in service nationwide (PHMSA 2014).

11.3 Safety Overview of NEXUS

The Project facilities constructed by NEXUS will meet or exceed applicable USDOT regulations pertaining to pipeline safety. These safety regulations will be reinforced by the comprehensive and strictly enforced corporate practices of NEXUS. The effectiveness of the federal and corporate requirements in ensuring reliability and safety is illustrated by the following operating experience profile of one of NEXUS' parent companies, Spectra Energy. Spectra Energy will be the operator of the NEXUS pipeline. The empirical information presented illustrates the low potential for public hazard from accidents associated with the operation of the proposed Project facilities.

11.3.1 System Overview

Spectra Energy owns and operates a natural gas transmission system consisting of approximately 19,000 miles of transmission pipeline in North America, as well as natural gas gathering, processing, and local distribution assets. Spectra Energy, and its predecessor companies, have been providing service since the early 1940s when the major portion of its transmission system was constructed.

11.3.2 Historical Operating Record

Generally, the natural gas transmission industry has an excellent record of public safety. Pipelines and related facilities are designed and maintained with strict adherence to USDOT standards to ensure public safety, reliability, and to minimize the opportunity for system failure. Spectra Energy has an excellent record of public safety. According to comparison with Bureau of Labor and Statistics data, over the past five years, the incident rate for Spectra Energy's onshore pipelines in the U.S. is half that of the industry as a whole (Spectra Energy Corp., 2015). However, no incident is acceptable. Spectra Energy works closely with federal and state regulators to ensure safe, reliable natural gas transportation and inspects more pipeline annually than required by state and federal regulations. Spectra Energy is also committed to being a good neighbor in the communities that host our facilities. NEXUS will continue to employ similar system design, construction, operation, and maintenance practices to ensure this excellent record is maintained.

11.4 Measures to Protect the Public and Utilities

11.4.1 High Consequence Area Identification

Federal law and pipeline safety regulations require natural gas transmission pipeline operators to implement Integrity Management Programs for pipelines to identify and prevent potential impacts around areas with greater populations, ecological sensitivities or dense infrastructure and buildings. These areas are referred to as "High Consequence Areas" or "HCAs" in the federal regulations. These federal regulations include specific criteria for pipeline operators to identify and designate HCAs.

NEXUS uses a number of methods to ensure that it identifies all HCAs along its pipeline, including aerial photography, field surveys, consultation with emergency response officials, and multiple database searches. NEXUS will perform a comprehensive review each year, or as frequently as needed to meet the requirements of Part 192, to assure that its identification of HCAs is accurate and up to date.

HCAs are identified as an area established by one of the methods described below:

1. An area defined as:
    - Class 3 or 4 Locations; or
    - Class 1 or 2 Locations where the potential impact radius is greater than 660 feet and the area within a potential impact circle contains 20 or more buildings intended for human occupancy; or
    - Any Class 1 or 2 location where the potential impact radius contains any of certain identified sites, such as:
        - An outside area or open structure that is occupied by 20 or more persons for at least 50 days in any 12-month period;
        - A building that is occupied by 20 or more persons for at least five days a week for 10 weeks in a 12-month period; or
        - A facility occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.
2. An area within a potential impact radius containing:
    - 20 or more buildings intended for human occupancy;
    - An identified site such as:
        - An outside area or open structure that is occupied by 20 or more persons for at least 50 days in any 12-month period;
        - A building that is occupied by 20 or more persons for at least five days a week for 10 weeks in a 12-month period; or
        - A facility occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate.

The Potential Impact Radius ("PIR") is a key element of an Integrity Management Program. The PIR model is based on a federally mandated calculation utilizing the diameter of the pipeline and the maximum allowable operating pressure of the pipeline. The PIR is incorporated into the federal regulations solely to identify the location of HCAs for interstate gas transmission pipelines. The PIR for the NEXUS Pipeline is approximately 1,100 feet. With the identification of HCAs, additional maintenance and monitoring criteria are utilized by pipeline operators with the purpose of ensuring public safety in these specific areas.

Table 11.4-1 contains a listing of the identified HCAs along the proposed Project facilities.

As discussed above, the Project facilities will be designed, constructed, operated, and maintained to meet or exceed all USDOT Minimum Federal Safety Standards in Part 192.

11.4.2 Data Gathering

The risk analysis process involves the use of data about the pipeline, potential activities near the pipeline and potential consequences in the unlikely event of a pipeline failure. This information is needed to properly identify integrity risks and potential consequences and is gathered from a number of sources, including but not limited to:

- Original construction records;
- United States Geological Survey Quadrangle maps;
- Pipeline alignment sheet records;

- Digital elevation models;
- Personnel interviews;
- Historical data;
- Database searches;
- Cathodic protection surveys;
- Leak and incident data/reports;
- Subject matter experts;
- Operating characteristics;
- One-call notices;
- Corrosion monitoring; and
- Aerial photography.

11.4.3 Risk Assessment

In accordance with Part 192.917, NEXUS will routinely perform a detailed risk analysis for its entire pipeline system to identify potential integrity threats to the pipeline and potential consequences in the unlikely event of a pipeline failure. This risk analysis allows NEXUS to prioritize integrity management activities, such as integrity assessments and additional prevention measures, to those pipeline segments that have higher risks. Examples of potential integrity threats could include:

- Excavation damage by third parties; and
- Corrosion metal loss.

The risk assessment is performed by subject matter experts using modern risk management tools and techniques to assure the risk assessment process provides an accurate determination of pipeline risks. NEXUS follows the integrity management principles contained in industry standard American Society of Mechanical Engineer's standard B31.8S.

11.4.4 Integrity Assessments

Integrity assessments are prioritized based on the risk assessment, and are conducted to find pipeline defects before they become a threat. The integrity assessment method for each pipeline segment is selected based on the types of potential integrity threats applicable to that segment. The integrity assessment methods could include:

- In-Line Inspection – an assessment method that uses an internal inspection tool (commonly referred to as a "Smart Pig") that is capable of identifying and classifying pipe defects, including metal loss, dents, gouges and other types of defects. The Smart Pig is inserted into the pipeline and is typically pushed by the flow of natural gas in the pipeline.
- Direct Assessment – an assessment method that uses a systematic approach to identifying potential defects through data review, indirect assessments and targeted hands-on inspections.
- Pressure Testing – an assessment method where the pipeline is filled with an inert substance (typically water) and is tested to a pressure that is well above the normal operating pressure to validate the strength of the pipe and identify any smaller defects long before they could become a threat.

11.4.5 Response and Remediation

Pipeline defects identified by the integrity assessments are prioritized and scheduled for field investigation and repair, if required, in accordance with Part 192.933 and the integrity management standards issued by the American Society of Mechanical Engineers, the National Association of Corrosion Engineers, other consensus standards, and industry best practices. NEXUS will schedule and conduct investigations and repairs for any potential defects that exceed specified thresholds. This will be done regardless of whether or not the pipeline is located in a designated HCA.

11.4.6 Preventive and Mitigative Measures

Preventive measures begin with the design and construction of NEXUS' facilities. These measures include design specifications, selection of suitable construction materials, development and selection of welding procedures, pipe coatings and cathodic protection systems. Additionally, quality controls employed during manufacturing of the pipeline contribute to installation of high-quality pipelines with reduced operating stress. During the installation phase, all welders and radiographic technicians performing work on the facilities must take and pass a qualification test. Qualified inspection oversight staff are used to monitor the installation of the facilities.

In roadways, streets, and parking lots a 15:1 sand to concrete mix called flowable fill or Controlled Density Fill, or clean compacted material may be used as backfill around the pipeline following consultation with municipal, county, and state roadway authorities. In addition, approximately 12 inches below the natural grade, bright yellow ribbon, 24-inches in width, will be installed over the pipeline providing another set of warning of a natural gas pipeline and a toll free number to contact. A variety of pipeline location markers (e.g., adhesive decals, marker posts, and signage) will be used above grade to clearly identify the location of the pipeline and provide contact information for the public and parties excavating in the area.

The pipeline will be patrolled in accordance with the requirements of Part 192.705, and personnel well-qualified to perform both emergency and routine maintenance on transmission pipeline facilities will handle emergencies and maintenance related to:

- Erosion and wash-outs along the right of way ("ROW");
- Settling, undermining or degradation of repaired ditch line in streets or parking lots:
- Performance of water control devices such as diversions;
- Condition of banks at stream and river crossings;
- Third-party activity along the pipeline ROW;
- Evidence of subsidence, surface cracks or depressions which could indicate sinkhole formation; and
- Any other conditions that could endanger the pipeline.

NEXUS will also monitor the pipeline 24 hours a day, seven days a week, from Spectra Energy's Gas Control Center. This high-tech computer control center monitors the flow of gas throughout Spectra Energy's interstate transmission pipeline system. The center collects data from all of these pipelines to ensure they are operating within their design parameters. The Gas Control Center monitors and reacts to equipment anomalies and, when necessary, dispatches employees who live and work along the pipeline to respond. As an added safety measure, remote control equipment is installed along the pipeline system, enabling remote operation of the pipeline valves from the Gas Control Center (*see* Section 11.4.15.2 below). Patrolling will also be performed regularly to monitor activity near NEXUS' pipeline, and NEXUS will

become a member of the "811 Call Before You Dig" and related pre-excavation notification organizations in the states of Ohio and Michigan (*see* Section 11.4.15.1 below).

Other preventive and mitigative measures will be implemented as appropriate under the integrity management regulations set forth in Part 192.935 depending on potential threats that may be identified for each pipeline segment.

11.4.7 Continuous Evaluation and Improvement

As required by PHMSA Integrity Management Program regulations, NEXUS will continually refine and enhance the integrity management techniques as it implements the Integrity Management Program on its pipeline system, including performing integrity assessments at specified intervals and periodically evaluating the integrity of a pipeline segment as required under Part 192.937.

11.4.8 Public Safety

NEXUS is committed to safety, protecting the environment, preventing accidents/incidents, and maintaining the highest standards for its pipeline operation and maintenance. NEXUS will accomplish this goal through routine preventative maintenance, pipeline patrols, solid emergency response plans and a strong pipeline integrity management program. NEXUS will establish and maintain strict operating and maintenance policies and procedures that will be audited periodically by the PHMSA and are in compliance with Part 192.

Trained and qualified pipeline personnel will operate and maintain the pipeline in accordance with Subpart N of Part 192. The training program will ensure all personnel possess the knowledge and competency necessary to efficiently operate and maintain the pipeline in a manner that protects the environment, the public and the health and safety of all employees. More specifically, personnel are trained to: execute normal operating and maintenance procedures; recognize abnormal conditions and take appropriate corrective actions; predict consequences of malfunctions or failures; recognize conditions likely to cause emergencies; respond to emergency situations; control accidental releases of gas; and recognize characteristics and hazards of gas.

During construction, special care will be taken in residential and commercial areas to minimize neighborhood and traffic disruption, to control noise and dust to the extent practicable, and to protect the public at large. Measures to be implemented where the pipeline traverses the vicinity of residential areas include, but are not limited to:

- Fencing the construction work area boundary to ensure construction equipment, materials, and spoil remain in the construction ROW;
- Ensuring piping is welded and installed as quickly as reasonably possible consistent with prudent pipeline construction practices to minimize construction time affecting a neighborhood;
- Backfilling the trench as soon as the pipe is laid or temporarily steel plating the trench; and
- Completing final cleanup and installation of permanent erosion control measures within 10 days after the trench is backfilled, weather conditions permitting.

No ditch will remain open overnight in residential and commercial areas. The installed pipe will be backfilled to near the end of the section, and the remaining open trench will be covered with temporary steel plating. The work will be accomplished so that emergency vehicle access to nearby residences will be maintained by establishing a temporary access road (also known as "shoofly" construction) or by installing steel plating over the trench-line to ensure homeowners are able to access their driveways. NEXUS will coordinate with residents while construction activities are underway. NEXUS has developed

residential construction plans in areas where residential dwellings are within 50 feet of construction workspace. These residential crossing plans are included in Resource Report 8, Appendix 8A.

11.4.9 Emergency Response

Natural gas pipeline operators are required by PHMSA to develop emergency response plans designed to minimize the consequences of a pipeline failure. Operators must also educate local emergency responders on a periodic basis, and have public awareness requirements for informing those living near a pipeline.

Consistent with Part 192.615, NEXUS operations personnel will develop, maintain and implement a written emergency response plan to minimize the hazards from a pipeline emergency. Key features will include:

- Identifying, verifying and classifying emergency events – leaks, fires, explosions or natural disasters;
- Managing communications with emergency responders and public officials to establish incident command and coordinate response efforts;
- Making personnel, equipment, tools and materials available for emergencies;
- Ensuring that response efforts focus on public safety first; and
- Ensuring emergency shutdown actions are taken in a timely manner.

NEXUS will work closely with local, state and federal agencies to ensure our pipelines meet or exceed regulatory requirements for safety. NEXUS will also communicate regularly with members of the public who live or work near our pipelines, and we will collaborate with organizations that share our dedication to pipeline safety and public awareness. Periodically, NEXUS employees and local emergency response personnel will come together for emergency drills to test staff readiness and identify improvement opportunities.

As part of our public awareness program, and in accordance with USDOT regulations, NEXUS will establish a working relationship early on with emergency responders to ensure effective communication, education, and training.

NEXUS will also coordinate efforts with pipeline companies already working with first responders in the area to ensure effective and efficient communications.

Should the need arise, NEXUS will have field service personnel and repair contractors available that are capable of completing emergency repairs and restoration.

11.4.10 Public Awareness Program

NEXUS will develop a Public Awareness Program as outlined in Part 192.616, which will provide outreach measures to the affected public, emergency responders, and public officials. This program will use multi-media channels (direct mail, e-mail, social networking, public service announcements, print advertisement, and public meetings, etc.) to engage these core audiences.

NEXUS' objective is to educate the public on how to recognize the presence of pipelines; understand the potential hazards and safe actions they should take; recognize and report abnormal conditions; and encourage the safe behavior of calling for buried facility location before digging.

11.4.11 One-Call Response

When NEXUS receives notification from a "811 Call Before You Dig" center that someone intends to dig near its pipeline facilities, personnel will be dispatched to mark the location of the facilities in the vicinity

of proposed digging or other earth disturbance activities. NEXUS will have company employees on-site when the excavation occurs to ensure that the facility is not compromised.

11.4.12 Pipeline Safety Brochures

NEXUS will mail informational brochures to landowners, businesses, potential excavators and public officials along the pipeline system each year to inform them of the presence of the pipeline and instruct them on how to recognize and react to unusual activity in the area. These brochures provide emergency contact phone numbers available 24/7 and reinforces the need for excavators to use the "811 Call Before You Dig" service.

In addition to these public awareness outreach efforts, NEXUS will also provide pipeline location information in the National Pipeline Mapping System to inform the public and others of the general location of their pipeline facilities.

11.4.13 Contact Information

NEXUS will include emergency contact information in its Emergency Response Plan.

11.4.13.1 Interactions with Federal Authorities

NEXUS is required by law to notify the USDOT's PHMSA at least 60 days prior to commencement of construction. NEXUS is also in communication with PHMSA to review the project scope and schedule. PHMSA has the authority to review the design of the Project facilities prior to construction, and inspect construction activities and records. PHMSA routinely exercises its oversight authority to ensure that facilities under its jurisdiction are safely designed, constructed, and operated. The PHMSA develops regulations and other approaches to risk management to assure safety in design, construction, testing, operation, maintenance, and emergency response of pipeline facilities.

The PHMSA administers the USDOT's national regulatory program to assure the safe transportation of natural gas, petroleum, and other hazardous materials by pipeline. PHMSA routinely inspects pipeline facilities and records for compliance with design, construction, testing, operations, maintenance, and integrity regulations. NEXUS' procedures and practices will be prepared in a manner to meet or exceed the pipeline safety regulations and related risk management requirements administered by PHMSA.

11.4.13.2 Liaison Procedures with Local Authorities

NEXUS' personnel involved with public awareness will ensure that appropriate liaisons and public education is established and maintained in the communities within which NEXUS operates. NEXUS will establish open relationships with local fire, police, and other governmental leaders in order to efficiently respond in a cooperative manner to pipeline emergencies.

To accomplish this NEXUS will:

- Have informational meetings and training with local fire and police departments, emergency management personnel, and other concerned government agencies at their request;
- Conduct periodic emergency response drills and table top exercises to build familiarity with emergency response personnel and response measures to be taken; and
- Provide literature listing emergency contact phone numbers and other pertinent information.

In addition to maintaining contact with local governmental and emergency response agencies along the pipeline, NEXUS's liaison efforts will allow NEXUS to:

- Determine how local officials may be able to assist NEXUS during an emergency with the determination of jurisdiction and resources that may be involved in responding to an emergency;

- Familiarize local officials with how NEXUS responds to an emergency on its pipeline system;
- Verify notification preferences for pipeline emergencies; and
- Review with local officials the use of incident command system to cooperate and assist with response to an emergency.

Outreach to emergency responders will be conducted by NEXUS on a periodic basis. NEXUS' focus with these organizations will be to review firefighting methods and techniques for natural gas fires and to conduct periodic emergency drills and exercises.

11.4.14 Utility Protection

The majority of the proposed pipeline segments for the Project will be within or adjacent to existing ROWs, consisting of pipeline ROWs, electric transmission line ROWs, public roadway, and/or other utility ROWs. Some portions of the pipeline segments deviate from existing ROWs, generally to avoid specific construction constraints, provide adequate separation from existing residences, or reduce impacts to sensitive resources.

Prior to construction, existing utility lines and other sensitive resources, identified in easement agreements or by federal and state agencies, will be located and marked to prevent accidental damage during pipeline construction. NEXUS' contractors will contact the "811 Call Before You Dig" system, and state or local utility operators, to verify and mark all utilities along the Project workspaces to minimize the potential for damage to other buried facilities in the area. Where there is a question as to the location of utilities, such as water, cable, gas, and sewer lines, they will be located by field instrumentation and test pits. Test pits to verify location of utilities will be excavated using "soft digging" techniques, such as rubber buckets on an excavator, vacuum trucks, jetting of the soil, or excavation by hand.

When trenching for construction activities, soft digging methods can be used to fully excavate any foreign line. At a minimum, an excavator bucket without teeth or side cutters will be used. NEXUS can also shield sensitive lines using a rock shield or plywood. The lines will also be supported, either from below or from a beam installed across the trench.

NEXUS plans to work directly with existing utility owner/operators during the development of any site-specific NEXUS blasting plans to mitigate potential damage to foreign utility lines during blasting operations, if such operations are required. Blasting will be strategically used in certain areas along the pipeline based on sub surface conditions. Thorough calculations and studies will be conducted prior to any blasting. Blasting must be within the approved pound per delay limits for the chosen offset distances. The NEXUS Blasting Plan is provided as Appendix 1B3 to RR1. Project Blasting Contractors will also submit a blasting plan for approval to NEXUS. Additionally, the contractor will be responsible for obtaining any local or state blasting permits required for the work. The plan will be prepared in compliance with all Federal and State regulations pertaining to blasting, including but not limited to:

- Bureau of Alcohol, Tobacco and Firearms – 27 CFR 181 (Commerce in Explosives).
- Occupational Safety and Health Administration ("OSHA") – 29CFR 1926.90 (Safety and Health Regulations for Construction Blasting and Use of Explosives).
- Carriage by Public Highway – USDOT 49 CFR 177.
- Explosives and Blasting Agents – OSHA, 29CFR 1910.109 (Safety in the Workplace When Using Explosives).
- Siting and Maintenance Requirements – FERC 18 CFR 380.15.

- USDOT regulation regarding protection from hazards and continuing surveillance – 49 CFR Part 192.317, Part 192.613(b).

It is not uncommon for natural gas pipeline facilities to parallel existing utility ROWs, including electric transmissions ROWs. As part of NEXUS assessment of the reliability and safety of constructing and maintaining its proposed pipeline in proximity to overhead electric facilities, it considered the following.

NEXUS' Use of Heavy Construction Equipment in the Vicinity of High Voltage Powerlines

NEXUS has and continues to meet with electric utilities to obtain information on their requirements for construction activities within the vicinity of their overhead electric transmission lines and structures. NEXUS has conducted surveys and collected information on the location and size of existing powerline structures within the proposed construction corridor, tower footing locations and dimensions, and wire heights (lowest point between towers). Based on its consultations, and construction experience within and adjacent to existing overhead electric transmission lines and structures, NEXUS has designed and will modify its construction techniques on the Project to maintain sufficient offsets from these existing facilities to eliminate the risk of heavy construction equipment interfering with overhead high voltage electric transmission lines during construction and operation of the Project.

Potential Structural Impacts to Electric Transmission Towers Due to Nearby Blasting

NEXUS has designed the proposed pipeline trench to be a minimum of 50 feet from existing electric transmission towers to avoid potential damage, where possible. In those areas where a 50 foot offset could not be achieved, construction techniques will be modified to ensure safety. NEXUS has extensive experience in blasting near structures including other underground pipelines and overhead powerlines. If blasting is required, NEXUS will use a state licensed blasting professional and will follow the Project Blasting Plan (refer to Resource Report 1, Appendix 1B3) to avoid damage to overhead electric transmission lines and structures from blasting.

Effects on the Pipeline Resulting from Lighting Strikes to the Electric Transmission Towers

NEXUS will consult with an engineer that specializes in developing alternating current ("AC") mitigation systems for pipeline utility companies. An AC mitigation system will be designed and installed to mitigate the steady state induced AC on the pipeline and deal with any fault currents should they occur. Typically lightning arrestors along with decoupling devices are employed on the pipeline to protect against electrical surges. See Section 11.4.15.2 for additional discussion of AC mitigation.

Effects on the Pipeline Resulting from a Nearby Electric Transmission Lines

As previously stated, it is not uncommon for natural gas pipelines to share ROWs with electric transmission and other utilities. Where pipelines and electric transmission lines often share ROWs, the pipelines are grounded to dissipate potential electrical interference. In these situations, AC voltages are transmitted to the pipeline by conductive or inductive interference. Magnetic induction acts along the pipeline or pipeline segment that is approximately parallel to the powerline and can cause significant pipeline potentials even at relatively large separation distances.

Consideration must be given to safety of personnel and the public who may come into contact with aboveground portions of the pipeline such as valves and test stations. These exposed structures can be a potential shock hazard when touched while the soil is at a significantly different potential. Typically grounding mats are installed at aboveground pipeline facilities adjacent to powerlines to mitigate this potential.

As stated above, NEXUS will consult with an engineer that specializes in developing AC mitigation systems for pipeline utility companies. Corrosion control systems proposed for the NEXUS project are described in detail in Section 11.4.15.5 below.

11.4.15 Other Protection Measures

11.4.15.1 Surveys

NEXUS will employ an array of patrol methods to conduct comprehensive and effective patrols, again as required by federal law. Aerial, driving, or foot patrols will be used to physically inspect the pipeline facilities. Aerial flyovers will occur weekly, weather permitting. NEXUS will have line field service crews that perform the ground based patrols and facility inspections. When performing patrols, technicians will observe surface conditions on and adjacent to the pipeline ROW for indications of leaks, construction activity, and other factors affecting safety and operation. Conditions identified during patrols will be entered into NEXUS' work management system and remedial actions taken. Preventative maintenance checks shall be performed on the pipeline at a set frequency and shall be compliant with Part 192 safety regulations.

NEXUS will become a member of the "811 Call Before You Dig" and related pre-excavation notification organizations in Ohio and Michigan, as required by law. Through "811 Call Before You Dig" contractors provide notification to a central agency of proposed excavation that in turn notifies NEXUS of the excavation locations. If NEXUS' facilities are located in the area of proposed contractor activity, they will be marked in the field and a representative will be present during excavation to ensure that the facility is not compromised.

11.4.15.2 Equipment

NEXUS' pipeline system includes many equipment features that are designed to increase the overall safety of the system and protect the public from a potential failure of the system due to accidents or natural catastrophes.

NEXUS' pipeline will be built to meet or exceed the USDOT safety standards. Since the pipeline is buried a minimum of three feet underground, it is relatively immune from direct lightning strikes. Specific site conditions, including earthquakes, are considered in the design of the pipeline. The magnitude of earthquakes in the Midwest is relatively low and the ground vibration would not pose a problem for a modern welded-steel pipeline. Even under much higher ground vibrations, the main risk to pipelines would be a slip fault (e.g., San Andreas in California) that displaces laterally during the earthquake. The proposed pipeline route does not cross areas prone to slip faults. Slip faults are described in Resource Report 6, Geologic Resources.

NEXUS' proposed Project pipeline will be equipped with remote control shutoff valves as required by the USDOT regulations. This allows the shutoff valves to be operated remotely by NEXUS' Gas Control Center in the event of an emergency, usually evidenced by a sudden loss of pressure on the pipeline. Remotely closing the shutoff valve allows the section of pipeline to be isolated from the rest of the pipeline system.

Compressor Stations will be located on NEXUS property and will each be completely surrounded by a chain link fence with barbed wire, to maintain the safety of the facility and workers. Facilities will be powered from local electric utility companies and, in case of outage of commercial electric power, each station will be equipped with natural gas fueled standby generator systems.

A controlled access system and intrusion alarm network will be installed to restrict access to only authorized personnel. The facilities will be monitored with video cameras located at strategic locations. The compressor buildings will be properly ventilated to minimize the potential of gas accumulating in enclosed areas and will be constructed of noncombustible material.

Compressor Stations will also be equipped with automatic emergency detection and shut down systems. For example, the stations will have hazardous gas and fire detection systems and an emergency shutdown system. These safety and emergency systems will be maintained and tested routinely to ensure they are operating properly. The emergency shut-down system will be designed to shut down and isolate elements of the compressor station in the event of gas detection or fire detection. The system will include sensors for detecting natural gas concentrations as well as sensors for detecting flames. The critical buildings and areas will be equipped with beacons and alarms as well as emergency and exit lights.

In addition, the compressor station equipment will be designed to shut down automatically if system operation deviates from its designed operating limits, which could cause a mechanical failure and pose risk to personnel and equipment or otherwise constitute a hazard. The compressor stations will be equipped with relief valves to protect the piping from over-pressurization. Fire protection, first aid, and safety equipment will be maintained at the compressor stations and NEXUS' emergency response personnel will be trained in proper equipment use and in first aid. The firefighting equipment that will be maintained on site will consist primarily of hand-held dry chemical fire extinguishers strategically located in the buildings. Data acquisition systems will be installed at all metering and regulation stations and at each mainline valve along the pipeline system. If system pressures fall outside a predetermined ranges, an alarm is activated alerting NEXUS' Gas Control Center.

Cathodic Protection

A cathodic protection system will be installed along the NEXUS Project to protect the integrity of the pipeline from corrosion thereby extending its operating life and providing protection from pipeline failures for NEXUS personnel and the general public. The cathodic protection system impresses a low voltage current on the pipeline to off-set natural soil and groundwater corrosion potential.

If the pipeline is left unprotected, the natural electrolytic condition in the soil will cause ions to flow away from the pipe's surface, carrying with it microscopic metal particles, causing corrosion. When initially installed, the outside of the pipeline that is in contact with the soil is coated to isolate it electrically from the surrounding soil. Should damage or deterioration occur in the coating, the cathodic protection system will maintain a protective negative (cathodic) potential at the compromised location by deliberately creating (or "impressing") a low voltage direct current ("DC") current that flows toward the pipe. Positively charged anodes are installed along the pipeline that allow the impressed DC current circuit to be completed. This impressed DC current opposes or cancels out any natural current (ions) attempting to leave the pipe surface. The functional capability of cathodic protection systems are inspected frequently to ensure proper operating conditions for corrosion mitigation.

The cathodic protection system for the NEXUS Project will consist of rectifier groundbed systems. Each groundbed system will protect site-specific segments of the pipeline. The cathodic protection system design is based upon soil resistivity measurements along the proposed pipeline route. These measurements can account for variable soil resistivity conditions that may be present due the soil type and/or groundwater influences. All relevant codes including USDOT, National Association of Corrosion Engineers, and American Society for Testing and Materials standards are taken into consideration while preparing the system design. Additional cathodic protection systems will be installed for the M&R and regulator station piping and the compressor station piping and will be located within those station sites.

AC Mitigation

When steel pipelines are in a common linear corridor with a high-voltage alternating current (AC) transmission line, the pipeline may be subjected to electrical interference from electromagnetic induction during normal operation. The interference is created from the magnetic field produced by the AC flowing in the conductors of the transmission line coupling with the metallic pipeline, which induces a voltage and

associated current on the pipeline. The level of AC induced onto the pipeline varies with the relative location of the pipeline and the power line. This situation can cause a number of safety issues if not mitigated effectively.

If the electrical interference effects are high enough during normal operation of the NEXUS, then anyone who touches an aboveground part of the pipeline, such as a valve or cathodic protection test station, could receive an electric shock. If a powerline phase wire is broken (for example during a storm) and touches the ground causing a phase to ground fault condition, a large amount of current would be injected into the ground. This can also occur when lightning strikes the AC transmission line or its towers and current is directed through its grounding system. If this occurs close to the pipeline, there may be induced voltage to the adjacent pipeline segment. If this was to occur to an unprotected pipeline system, loads that exceed the maximum pipe coating threshold of 5000 volts could occur resulting in coating failure or even perforations in pipe wall. Also, long-term induced AC current, if left unmitigated, can compromise the effectiveness of the cathodic protection system that will be installed for NEXUS Project pipeline and aboveground facilities.

Since portions of the NEXUS Project pipeline route parallels high-voltage transmission line corridors, NEXUS will install an AC interference mitigation (ACIM) system designed per the applicable guidelines from the Institute of Electrical and Electronics Engineers (IEEE 80). Among other reasons, NEXUS will install the ACIM system in order to: (i) protect the public and O&M personnel as well as the NEXUS Project pipeline under steady state operating and power line fault conditions; (ii) safely accommodate the electrical effects of the proximate electrical transmission facilities; (iii) comply with the regulations of the U.S. Department of Transportation; (iv) protect the integrity of the NEXUS Project pipeline's cathodic protection equipment and associated above-ground facilities; and (v) ensure the continued efficient operation of the NEXUS Project pipeline.

Where the pipeline is installed parallel to a high transmission power line, the ACIM will include a zinc ribbon or copper cable grounding system that is attached to the pipeline and installed into the pipeline trench along with the pipeline during construction. Grounding rods will be installed as necessary to mitigate site-specific conditions. The above ground components of the pipeline where direct human contact is possible, such as valve stations and cathodic protection test stations, will be protected with zinc or copper ground matting. The ACIM system effectively transfers the induced AC voltage to the ground from the pipeline and maintains a safe voltage level at all aboveground facilities for the safety of pipeline operators, workers, and the public and to ensure effective operation of the cathodic protection system.

11.4.15.3 Pipeline Markers

PHMSA regulations at Part 192.707 also require pipeline operators to place pipeline markers at frequent intervals along the pipeline ROW, particularly at prominent points along the route, such as where a pipeline intersects a street, highway, railway, waterway, or other significant feature. Pipeline markers will be placed along the upland portion of the pipeline as required. At locations where the pipeline is under pavement, circular decals will be adhesively attached to the surface over the pipeline. In addition, approximately 12 inches below the natural grade, bright yellow ribbon, 24-inches in width, will be installed over the pipeline providing another set of warning of a natural gas pipeline and a toll free number to contact. Pipeline ROW markers can help prevent encroachment and excavation-related damage to pipelines. Since the pipeline ROW is much wider than the pipeline itself, and a pipeline can be located anywhere within the ROW, state laws require excavators to call their state "Call Before you Dig" center well in advance of digging to locate underground utilities, to ensure it is safe for the contractor to dig in that location.

11.4.15.4 Operations and Maintenance

Part 192 prescribes the minimum standards for operating and maintaining pipeline facilities, including the establishment of a written plan governing these activities. NEXUS will develop an Operations &

Maintenance Manual for the facility during the construction phase and this Operations & Maintenance Manual will be in effect prior to initial filling of the pipeline system with natural gas.

NEXUS will have field services crews to perform Part 192 required operations, maintenance and inspection tasks along the entire length of the pipeline. All personnel will have the proper training and qualifications as required by Part 192.

11.4.15.5 Corrosion Control

Design of the corrosion control systems is incorporated into the overall construction of the Project pipeline. See Section 1.7 of Resource Report 1, for a description of the external corrosion control measures that will be implemented during construction of the pipeline. The pipeline will also have cathodic protection and will be closely monitored and maintained in compliance with Part 192 Subpart I and National Association of Corrosion Engineers International ("NACE") standard practice SP 0169. The pipeline will be built with high-strength carbon steel with an epoxy coating. The epoxy coating is a corrosive resistant nonconductive resin that forms a protective coating around the pipe. Pipe sections, or joints, are welded together forming a continuous pipeline. Each of the welded joints are also covered with the epoxy coating which forms a continuous coating of the entire pipeline. Together, the combination of cathodic protection and coating system provide excellent corrosion control. A continuous direct current will be applied to the entire length of the pipeline to manage the potential corrosive nature of the soils and interference potential of nearby underground facilities. The corrosion control system will also include anodes strategically placed within the easements to manage and harmlessly disperse stray currents. The location of proposed anode beds are identified on the Project alignment sheets included as Appendix 1A to Resource Report 1.

Once the pipeline has been built, extensive ongoing corrosion control measures will be implemented to monitor and maintain the pipeline integrity, as defined in USDOT regulations and NEXUS' corrosion control operating procedures. In addition to the other measures, NEXUS will also inspect the pipeline using devices known in the industry as "smart pigs" for the purpose of Integrity Assessments. As described earlier, these devices run inside the pipe and provide indications of internal and external metal loss, deformation, anomalies, ovalities (or areas where the pipeline is not circular), dent detection; valve, fitting and casing locations; pipe repairs; casing ovalities; and external metal objects in the vicinity of the pipeline.

The external corrosion control system for pipeline segments located in wetlands or in areas with a shallow water table will be the same as the remainder of the pipeline. As described above, the pipeline will have a corrosion coating and an impressed current cathodic protection system. After construction, the cathodic protection system will be adjusted to achieve a pipe-to-soil potential criterion for cathodic protection, as established by NACE and the appropriate sections of CFR Title 49 Part 192, along the entire pipeline. The monitoring of the cathodic protection system for the pipeline will include the wetland and shallow water table areas to ensure that the corrosion control system continues to satisfy the established criterion for cathodic protection.

11.5 References

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TABLES

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	Pipe Diameter (inches)	Milepost Begin a/	Milepost End a/	Length (miles) b/	Class c/
Ohio					
New Mainline Pipeline					
Columbiana	36	0.0	0.9	0.9	1
Columbiana	36	0.0	0.1	0.1	1
Columbiana	36	0.1	0.2	0.1	2
Columbiana	36	0.2	0.5	0.3	3
Columbiana	36	0.5	0.6	0.1	2
Columbiana	36	0.6	0.9	0.3	1
Columbiana	36	0.9	1.3	0.4	2
Columbiana	36	1.3	1.5	0.2	1
Columbiana	36	1.5	3.0	1.5	2
Columbiana	36	3.0	4.6	1.6	1
Columbiana	36	4.6	4.8	0.2	2
Columbiana	36	4.8	5.3	0.5	1
Columbiana	36	5.3	5.8	0.5	2
Columbiana	36	5.8	6.1	0.2	1
Columbiana	36	6.1	6.6	0.6	2
Columbiana	36	6.6	6.8	0.1	1
Columbiana	36	6.8	7.9	1.1	2
Columbiana	36	7.9	9.7	1.8	1
Columbiana	36	9.7	10.7	1.0	2
Columbiana	36	10.7	11.0	0.3	1
Columbiana	36	11.0	11.6	0.6	2
Columbiana	36	11.6	12.3	0.7	1
Columbiana	36	12.3	12.5	0.2	2
Stark	36	12.5	12.7	0.1	2
Stark	36	12.7	13.0	0.3	1
Stark	36	13.0	13.6	0.6	2
Stark	36	13.6	13.8	0.2	1
Stark	36	13.8	14.5	0.7	2
Stark	36	14.5	18.2	3.7	1
Stark	36	18.2	18.7	0.6	2
Stark	36	18.7	21.8	3.1	1
Stark	36	21.8	22.4	0.6	2
Stark	36	22.4	26.3	3.8	1

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	**Pipe Diameter (inches)**	**Milepost Begin** a/	**Milepost End** a/	**Length (miles)** b/	**Class** c/
Stark	36	26.3	26.5	0.2	2
Stark	36	26.5	26.8	0.2	1
Stark	36	26.8	27.4	0.7	2
Stark	36	27.4	29.2	1.8	1
Stark	36	29.2	29.5	0.3	2
Stark	36	29.5	30.0	0.5	1
Stark	36	30.0	30.5	0.5	2
Stark	36	30.5	31.0	0.5	1
Stark	36	31.0	31.5	0.4	2
Stark	36	31.5	31.9	0.5	1
Stark	36	31.9	34.1	2.2	3
Stark	36	34.1	34.2	0.1	2
Summit	36	34.2	34.2	0.0	2
Summit	36	34.2	34.5	0.3	1
Summit	36	34.5	35.3	0.8	2
Summit	36	35.3	35.8	0.5	1
Summit	36	35.8	36.1	0.3	2
Summit	36	36.1	36.2	0.1	1
Summit	36	36.2	36.4	0.2	3
Summit	36	36.4	37.0	0.6	2
Summit	36	37.0	37.2	0.2	3
Summit	36	37.2	40.6	3.4	2
Summit	36	40.6	40.9	0.3	1
Summit	36	40.9	41.8	0.9	2
Summit	36	41.8	43.0	1.2	3
Summit	36	43.0	43.9	0.9	2
Summit	36	43.9	44.1	0.2	1
Summit	36	44.1	45.8	1.6	2
Summit	36	45.8	46.0	0.3	1
Summit	36	46.0	47.1	1.0	2
Summit	36	47.1	48.6	1.6	1
Summit	36	48.6	49.0	0.4	2
Summit	36	49.0	49.2	0.2	1
Summit	36	49.2	50.1	0.9	3

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	Pipe Diameter (inches)	Milepost Begin a/	Milepost End a/	Length (miles) b/	Class c/
Summit	36	50.1	50.4	0.3	2
Wayne	36	50.4	50.6	0.2	2
Wayne	36	50.6	51.2	0.6	1
Wayne	36	51.2	51.7	0.5	2
Wayne	36	51.7	51.8	0.1	1
Wayne	36	51.8	52.2	0.5	2
Wayne	36	52.2	52.4	0.2	1
Wayne	36	52.4	54.0	1.5	3
Wayne	36	54.0	54.9	0.9	2
Wayne	36	54.9	55.5	0.6	1
Wayne	36	55.5	55.9	0.4	2
Wayne	36	55.9	56.2	0.4	1
Wayne	36	56.2	56.6	0.3	2
Medina	36	56.6	57.3	0.7	2
Wayne	36	57.3	57.3	0.0	2
Wayne	36	57.3	57.5	0.2	3
Wayne	36	57.5	57.7	0.2	2
Medina	36	57.7	58.6	0.9	2
Medina	36	58.6	59.2	0.6	1
Medina	36	59.2	59.7	0.5	2
Medina	36	59.7	60.0	0.3	1
Medina	36	60.0	60.5	0.5	2
Medina	36	60.5	65.3	4.9	1
Medina	36	65.3	66.1	0.7	2
Medina	36	66.1	67.5	1.5	1
Medina	36	67.5	67.9	0.4	2
Medina	36	67.9	68.6	0.7	3
Medina	36	68.6	71.6	3.0	1
Medina	36	71.6	73.0	1.4	2
Medina	36	73.0	73.4	0.4	1
Medina	36	73.4	74.3	0.9	2
Medina	36	74.3	75.8	1.4	1
Medina	36	75.8	76.6	0.8	2
Medina	36	76.6	76.8	0.2	1

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	Pipe Diameter (inches)	Milepost Begin a/	Milepost End a/	Length (miles) b/	Class c/
Medina	36	76.8	77.2	0.4	2
Medina	36	77.2	80.5	3.3	1
Lorain	36	80.5	82.4	2.0	1
Lorain	36	82.4	82.9	0.4	2
Lorain	36	82.9	93.3	10.5	1
Lorain	36	93.3	93.5	0.2	3
Lorain	36	93.5	93.8	0.3	2
Lorain	36	93.8	94.4	0.6	1
Lorain	36	94.4	95.3	0.9	3
Lorain	36	95.3	95.4	0.1	2
Lorain	36	95.4	98.3	2.9	1
Lorain	36	98.3	98.7	0.4	2
Lorain	36	98.7	98.9	0.2	1
Lorain	36	98.9	99.4	0.5	2
Lorain	36	99.4	99.8	0.5	1
Lorain	36	99.8	100.2	0.3	2
Lorain	36	100.2	100.4	0.2	1
Lorain	36	100.4	100.8	0.4	2
Lorain	36	100.8	101.1	0.3	1
Lorain	36	101.1	101.3	0.2	2
Huron	36	101.3	101.5	0.2	2
Huron	36	101.5	104.7	3.2	1
Erie	36	104.7	111.0	6.3	1
Erie	36	111.0	111.4	0.4	2
Erie	36	111.4	111.6	0.3	1
Erie	36	111.6	112.3	0.7	2
Erie	36	112.3	116.8	4.5	1
Erie	36	116.8	117.5	0.7	2
Erie	36	117.5	125.6	8.0	1
Erie	36	125.6	126.0	0.4	2
Erie	36	126.0	126.1	0.1	1
Erie	36	126.1	126.5	0.3	2
Erie	36	126.5	127.3	0.8	1
Erie	36	127.3	127.9	0.6	2

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	Pipe Diameter (inches)	Milepost Begin a/	Milepost End a/	Length (miles) b/	Class c/
Erie	36	127.9	129.9	2.0	1
Erie	36	129.9	131.0	1.1	2
Erie	36	131.0	131.5	0.5	1
Sandusky	36	131.5	145.7	14.2	1
Sandusky	36	145.7	146.1	0.4	2
Sandusky	36	146.1	146.3	0.2	3
Sandusky	36	146.3	146.6	0.3	2
Sandusky	36	146.6	147.2	0.6	1
Sandusky	36	147.2	147.7	0.5	2
Sandusky	36	147.7	153.6	5.9	1
Sandusky	36	153.6	154.0	0.5	2
Sandusky	36	154.0	155.0	1.0	3
Sandusky	36	155.0	157.3	2.3	1
Sandusky	36	157.3	157.8	0.5	2
Sandusky	36	157.8	158.0	0.1	1
Sandusky	36	158.0	158.3	0.4	2
Sandusky	36	158.3	162.7	4.4	1
Sandusky	36	162.7	163.3	0.5	2
Sandusky	36	163.3	163.5	0.2	1
Sandusky	36	163.5	163.7	0.2	2
Wood	36	163.7	164.0	0.2	2
Wood	36	164.0	164.2	0.2	1
Wood	36	164.2	165.3	1.1	2
Wood	36	165.3	173.3	8.0	1
Wood	36	173.3	173.7	0.4	2
Wood	36	173.7	173.8	0.1	1
Wood	36	173.8	174.1	0.3	2
Wood	36	174.1	181.5	7.4	1
Lucas	36	181.5	181.6	0.2	1
Lucas	36	181.6	181.9	0.2	3
Lucas	36	181.9	187.2	5.3	1
Lucas	36	187.2	187.8	0.6	3
Lucas	36	187.8	189.3	1.5	2
Henry	36	189.3	189.5	0.2	2

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	**Pipe Diameter (inches)**	**Milepost Begin** a/	**Milepost End** a/	**Length (miles)** b/	**Class** c/
Henry	36	189.5	190.0	0.5	1
Henry	36	190.0	190.2	0.2	2
Fulton	36	190.2	190.4	0.1	2
Fulton	36	190.4	193.2	2.8	1
Fulton	36	193.2	194.0	0.8	2
Fulton	36	194.0	194.6	0.7	1
Fulton	36	194.6	195.0	0.3	2
Fulton	36	195.0	195.2	0.3	1
Fulton	36	195.2	196.4	1.2	2
Fulton	36	196.4	204.7	8.3	1
Fulton	36	204.7	205.1	0.4	2
Fulton	36	205.1	208.3	3.2	1

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	Pipe Diameter (inches)	Milepost Begin a/	Milepost End a/	Length (miles) b/	Class c/
Michigan					
New Mainline Pipeline					
Lenawee	36	208.3	230.4	22.1	1
Monroe	36	230.4	234.0	3.6	1
Monroe	36	234.0	234.6	0.7	2
Monroe	36	234.6	236.8	2.2	1
Washtenaw	36	236.8	244.2	7.4	1
Washtenaw	36	244.2	244.5	0.4	2
Washtenaw	36	244.5	244.7	0.1	1
Washtenaw	36	244.7	245.5	0.8	2
Washtenaw	36	245.5	247.2	1.7	1
Washtenaw	36	247.2	247.6	0.4	2
Washtenaw	36	247.6	248.2	0.6	3
Washtenaw	36	248.2	248.4	0.2	2
Washtenaw	36	248.4	248.5	0.1	1
Washtenaw	36	248.5	248.8	0.4	3
Washtenaw	36	248.8	249.3	0.5	2
Washtenaw	36	249.3	249.4	0.1	1
Washtenaw	36	249.4	249.6	0.2	2
Washtenaw	36	249.6	250.3	0.7	3
Washtenaw	36	250.3	250.5	0.2	1
Washtenaw	36	250.5	252.9	2.4	3
Washtenaw	36	252.9	253.6	0.7	1
Washtenaw	36	253.6	253.8	0.2	3
Washtenaw	36	253.8	253.9	0.1	1
Washtenaw	36	253.9	254.0	0.2	3
Washtenaw	36	254.0	254.4	0.3	1
Wayne	36	254.4	254.7	0.3	1
Washtenaw	36	254.7	255.1	0.0	3
Wayne	36	255.1	255.2	0.4	3

TABLE 11.2-1

NEXUS Pipeline Class Location Analysis

State Facility Name County	**Pipe Diameter (inches)**	**Milepost Begin** a/	**Milepost End** a/	**Length (miles)** b/	**Class** c/

a/ Approximate milepost along the proposed pipeline rounded to the nearest tenth mile.

b/ Crossing length of each pipeline class within each county.

c/ Class 1: Location with 10 or fewer buildings for human occupancy.

Class 2: Location with more than 10 but fewer than 46 buildings intended for human occupancy.

Class 3: Location with 46 or more buildings intended for human occupancy or where pipeline lies within 100 yards of any building, or small, well-defined outside area occupied by 20 or more people during normal use.

Class 4: Location where buildings with four or more stories aboveground are prevalent.

TABLE 11.2-2

Incident Summary for Onshore Natural Gas Transmission Pipelines by Cause 1995-2014

Reported Cause of Incident	Number of Incidents a/	Fatalities	Injuries
Corrosion	533	13	11
Excavation Damage	391	15	34
Human Error	62	0	12
Material Failure	300	8	59
Natural Force Damage	241	0	1
Other Outside Force Damage	138	0	14
Other Causes	511	6	53
Total	2,176	42	184

a/ Includes all reported incidents

Notes:

Source: U.S. Department of Transportation. Pipeline and Hazardous Materials Safety Administration ("PHMSA"). Internet site accessed on August 3, 2015: http://phmsa.dot.gov/pipeline/library/datastatistics/flagged-data-files

TABLE 11.2-3

Outside Force Incidents on Onshore Natural Gas Transmission Pipelines by Cause 1995-2014

Cause	Percentage
Third Party Damage	15.0
Earth Movement	2.8
Heavy Rains/Floods	4.6
Other Outside Forces	0.6

Notes:

Source: U.S. Department of Transportation. Pipeline and Hazardous Materials Safety Administration ("PHMSA"). Internet site accessed on August 3, 2015: http://phmsa.dot.gov/pipeline/library/datastatistics/flagged-data-files

TABLE 11.2-4

Natural Gas Transmission and Gathering Systems Fatalities and Injuries 1995-2014

Year	Fatalities	Injuries
1995	2	7
1996	1	5
1997	1	5
1998	1	11
1999	2	8
2000	15	16
2001	2	5
2002	1	4
2003	1	8
2004	0	2
2005	0	5
2006	3	3
2007	2	7
2008	0	5
2009	0	11
2010	10	61
2011	0	1
2012	0	7
2013	0	2
2014	1	1
Total	**40**	**174**

Notes:

Source: U.S. Department of Transportation. Pipeline and Hazardous Materials Safety Administration. Internet site accessed on August 3, 2015: https://hip.phmsa.dot.gov/analyticsSOAP/saw.dll?Portalpages

TABLE 11.2-5

Transportation Fatalities and Injuries in the United States by Mode in 2013

Mode	Fatalities	Injuries
Highway	32,719	2,313,000
Railroad	706	8,704
Waterborne	642	2,768
Air	429	250
Transit	266	2,768
Pipeline (All)	9	44
Gas Transmission Pipelines	8	39

Notes:

Source: U.S. Department of Transportation Bureau of Transportation Statistic, Research and Innovation Technology Administration. Pipeline data updated with 2013 statistics. Tables 2-1 and 2-2 (Accessed August 3, 2015).

http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/index.html

TABLE 11.4-1

Location of High Consequence Areas along the NEXUS Project Pipeline Facilities

State *Facility Name* County	**Milepost Begin** a/	**Milepost End** a/	**Length (miles)** b/
Ohio			
Mainline			
Columbiana	0.0	0.8	0.8
Columbiana	1.5	2.4	0.9
Stark	18.1	18.9	0.8
Stark	29.2	29.8	0.6
Stark	31.9	34.2	2.3
Summit	34.2	34.3	0.1
Summit	34.8	35.3	0.5
Summit	35.9	37.8	1.9
Summit	38.4	38.8	0.4
Summit	38.8	39.4	0.6
Summit	39.6	40.1	0.5
Summit	40.3	41.8	1.5
Summit	42.0	44.0	2.0
Summit	44.7	45.2	0.5
Summit	49.2	50.2	1.0
Wayne	51.7	52.1	0.4
Wayne	52.3	54.1	1.8

TABLE 11.4-1

Location of High Consequence Areas along the NEXUS Project Pipeline Facilities

State *Facility Name* County	**Milepost Begin** a/	**Milepost End** a/	**Length (miles)** b/
Wayne	56.3	56.5	0.2
Medina	56.5	56.8	0.3
Medina	57.0	57.3	0.3
Wayne	57.3	57.7	0.4
Medina	57.7	57.8	0.1
Medina	62.3	62.9	0.6
Medina	64.6	65.1	0.5
Medina	67.7	68.7	1.0
Medina	69.9	71.4	1.5
Medina	76.1	76.5	0.4
Lorain	93.0	93.9	0.9
Lorain	94.3	95.6	1.3
Erie	116.9	117.8	0.9
Erie	118.2	119.6	1.4
Erie	120.2	120.7	0.5
Erie	130.5	131.2	0.7
Sandusky	138.7	139.2	0.5
Sandusky	145.9	146.6	0.7
Sandusky	153.9	155.2	1.3
Lucas	181.4	182.2	0.8
Lucas	187.2	188.0	0.8
Ohio Subtotal			**31.7**
Michigan			
Mainline			
Washtenaw	244.5	245.6	1.1
Washtenaw	247.7	254.3	6.6
Wayne	254.5	255.1	0.6
Michigan Subtotal			**8.3**
Total	**---**	**---**	**40.0**

a/ Approximate milepost along the proposed pipeline rounded to the nearest tenth mile.
b/ Crossing length of segment within county.