BOARD OF SELECTMEN
TOWN OF NORTHFIELD
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NORTHFIELD, MASSACHUSETTS 01360-1017

(V) 413.498.2901
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February 3, 2015

Ms. Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 1st St NE
Washington, DC 20426-0001

Re: Tennessee Gas Pipeline Company, L.L.C., Docket No. PF14-22-000
Proposed Northeast Energy Direct Project

Dear Ms. Bose:

The Board of Selectmen wish to express concern regarding Kinder-Morgan's proposed natural gas transmission line construction. Northfield is designated as a site for an 80,000 hp compressor station and 8.5 miles of the pipeline that will traverse the length of our community impacting neighborhoods, conservation lands, state managed natural resources, recreational trails and protected forest habitat.

Our primary concern is the appropriate level of scrutiny that will be applied to the environmental, health, and safety precautions to be adopted by this project. We oppose the Massachusetts Environmental Notification Form process and request a full and formal environmental review and consideration of environmental permitting requirements. We feel that the associated risks warrant and merit such an examination of the impacts associated with a project of this magnitude.

Further the Board harbors concerns as to the corporate record of Kinder Morgan which involves activities including violations of the Hazardous Materials Safety regulations, violations of the Clean Air Act, permit misrepresentations, and a safety record that does not inspire confidence.

We wish to point to the National Transportation Safety Board's (NTSB) recently released study entitled, "Integrity Management of Gas Transmission Pipelines in High Consequence Areas," a document that further supports our concerns. The NTSB conducted this study because in the last five years they have investigated three major gas transmission pipeline accidents that were caused by operator's deficiencies or inadequate construction quality control.

We need additional information and discovery about project impacts including but not limited to:

- how long the construction will take within the Town
- noise and light levels during construction and while in operation
- gas and VOC releases
- condensate liquids/PCB's
- water body crossings and wetland construction mitigation
- water runoff, impacts to ground water flow and quality
- spill prevention and control
- construction staging areas
- hazardous materials and the community right to know
- odor
- first responder training, responsibilities and equipment
- road crossings
- soil compaction and displacement

- cultural resource discovery
- necessary construction monitoring and inspection
- impact to access roads
- protection against terrorist threats
- mitigation to protect against pipeline corrosion due to induced electromagnetic fields from adjacent power lines
- provisions for pipeline decommissioning, if needed

We have enclosed copies of the following:

- a comment letter written by the Town of Northfield Open Space Committee
- a comment letter on behalf of the North Quabbin Pipeline Action group
- a resolution of opposition by the Board of Selectmen

We further urge FERC to establish a clear and reasonable schedule to allow for the public and affected property owners to review, discuss and fully comprehend the project's environmental scope and impact.

We hope that you will look favorably upon our requests.

Sincerely,

John G. Spanbauer
Chairman

cc: with enclosures
Congressman James McGovern
Senator Stan Rosenberg
Representative Paul Mark

BSN:mt
enclosures

TOWN OF NORTHFIELD
BOARD OF SELECTMEN
69 Main Street, Northfield, Massachusetts 01360
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August 26, 2014

Federal Energy Regulatory Commission
Senator Edward Markey
Senator Elizabeth Warren
Congressman James McGovern
Governor Deval Patrick
State Senator Stanley Rosenberg
State Representative Paul Mark

Ladies and Gentlemen,

The Board of Selectmen for the Town of Northfield voted on August 26, 2014 to accept the following Resolution:

"**WHEREAS,** Kinder Morgan is proposing to construct a high pressure gas transmission pipeline in Northfield through forest, wetlands, farmland and land under conservation restriction and permanently alter and disturb these lands,
BE IT RESOLVED that the Board of Selectmen as duly elected representatives of the people of Northfield, Massachusetts:

1) Oppose the proposed Kinder Morgan pipeline within the borders of our town and Commonwealth;

2) Hereby ask our legislators and executive branch officials to enact legislation and take other such actions as are necessary to disallow such projects that go against our commitments to life, the environment, our economic well-being and our personal safety, and instead to legislate more stringent energy efficiency and further explorations of subsidies for renewable energy sources.

AND BE IT FURTHER RESOLVED that copies of this Resolution be sent to the Federal Energy Regulatory Commission; U.S. Senators Markey and Warren; Congressman Jim McGovern; Governor Deval Patrick; State Senator Stan Rosenberg; and State Representative Paul Mark."

Please take this Resolution into consideration if the proposal from Kinder Morgan is submitted.

Sincerest Regards,

John G. Spanbauer, Chair

Jed Proujansky

Tracy Rogers

Northfield Board of Selectmen

January 5, 2015

Dear Mr. Spanbauer,

Residents of Northfield have been concerned about the proposed the Tennessee Gas Pipeline co./ Kinder Morgan pipeline since we learned that it would affect our town last spring. Recently the route has changed to include much more of Northfield, as well as an 80,000 horsepower compressor station within the town. This infrastructure would significantly change the character of Northfield for the foreseeable future.

On behalf of the North Quabbin Pipeline Action group, I would like to invite you to a meeting at the Erving Senior Center on January 22nd at 7:00 pm. This will include a 20 minute documentary about gas pipeline compressor stations, produced by Plainfield videographer Stephen Wicks, giving you a chance to see and hear what a compressor station of this size would look and sound like. The "red barn" compressor station Kinder Morgan representative Allen Fore showed us in a slide presentation at the August 19 Selectboard meeting was about a quarter the size of the one proposed for Northfield.

In many towns, local governments have become involved in actively opposing the permitting of this pipeline. Selectboards and City Councils have denied permission for the company to survey town-owned land, including conservation land and town roadways. In Deerfield the Board of Health conducted a hearing about the health risks associated with pipeline infrastructure and banned the pipeline within their borders. Conservation Commissions and other town boards have written letters expressing concerns to the Federal Energy Regulatory Commission, the board that will decide the fate of this project.

I ask you to invite members of your board and the community at large to attend this Jan 22nd meeting, and to consider the impact of a large high-pressure natural gas pipeline and compressor station on our town. A letter to FERC from your town board expressing concern would be significant and appreciated.

Respectfully,

Julia Blyth
North Quabbin Pipeline Action Steering Committee
276 Old Wendell Rd.
Northfield, MA 01360

Northfield Open Space Committee
69 Main Street
Northfield, MA 01360

January 26, 2014

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street NE, Room 1A
Washington, DC 20216

RE: Tennessee Gas Pipeline Company, L.L.C., Docket No. PF14-22-000, Northeast Energy Direct Project

Dear Secretary Bose:

The Northfield Open Space Committee (OSC) requests that the Federal Energy Regulatory Commission consider some of the special aspects of the Town of Northfield, Massachusetts in its review of the Tennessee Gas Pipeline Company's proposed Northeast Energy Direct project. The OSC's causes for concern include loss of permanently protected land that is environmentally and economically important to Northfield and impact on recreational use of Northfield's trail system.

Although the proposal currently follows an existing utility corridor though Northfield, the cleared area would be widened for the pipeline, impacting important conservation areas owned by the town, including the Brush Mountain Conservation Area and/or the Northfield Town Forest. Encroaching into the forest area on either side of the existing utility corridor would damage at least one of these properties and violate its conservation contract. In addition, privately owned conservation lands and state forest lands that abut the corridor would be affected by the proposed pipeline.

The OSC is concerned that clearing the forest would make way for invasive species and result in erosion during construction. About 21% of Northfield is quite steep, with slopes of over 25%, and thus very sensitive to erosion; much of the proposed route is within the steepest parts of Northfield.

The proposed pipeline route crosses the New England National Scenic Trail (NET) twice between Alexander Hill Road and Old Turnpike Road. The NET goes within 100' of the existing utility easement in several other places. This highly scenic section of a nationally-significant facility should not be disrupted for the construction of a pipeline. Many additional town-maintained trails would also be affected.

TGP's December 8th filing indicates that a compressor station (Market Path Mid Station 3) is proposed for somewhere between Four Mile Brook Road and Alexander Hill Road. This part of Northfield has many hiking and skiing trails (including the NET), the value of which would be significantly degraded if subjected to compressor noise.The OSC urges that a compressor station not be sited within ear-shot of this trail-dense area.

Northfield recently completed a Master Plan. The very first goal is "to promote preservation of open space and natural features" and the second is "to promote opportunities for recreation and community gathering." Tourism, especially outdoor recreation and appreciation of scenic vistas, is a major economic factor in Northfield. The Master Plan states that "care should be taken to avoid development that would promote soil erosion or detract from the visual appeal of the ridges" (p. 11). A list of "What makes Northfield Unique" (p. 27) includes: dark night skies, open spaces, clean air, hiking trails, views and varied vistas, natural beauty, quiet, safe, rural. The construction of this pipeline and especially the presence of a compressor station would compromise the synergistic combination of these qualities and threaten the character of the town.

Thank you for the opportunity to provide comment.

Sincerely,

J. L. Wagener

Jerrold Wagener, Chair, Northfield Open Space Committee

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AC Corrosion Induced by High Voltage Power Line on Cathodically Protected Pipeline

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Abstract — The implications of the influence of alternating currents on buried pipelines are of great concern to all pipeline owners in world. The relevance of the interference is always increasing for operational personnel and for the protection of buried metallic structures from corrosion. The paper studies the electromagnetic interference problem between an existing high voltage power line and a newly designed underground pipeline cathodically protected. Induced voltages and currents are evaluated for steady state operating conditions of the power line. It is found that on pipelines suffering from A.C. interference traditional pipe-to-soil potential measurements do not guarantee efficient cathodic protection against corrosion. A specific approach to assess the effectiveness of cathodic protection should be adopted.

Keywords— AC Interference, Induced Voltages, Electric Power Transmission Lines, pipeline, AC Corrosion, cathodic protection, soil resistivity.

I. INTRODUCTION

A new corrosion phenomenon has been added to the list of corrosion phenomena, and it is related to A.C. currents. These usually result from A.C. voltages induced into the pipeline where the pipeline route is in parallel with, or crosses, high voltage power lines [1].

AC Corrosion is caused by current exchange between soil and metal. This exchange of current depends on the voltage induced on pipelines. The amplitude of induced voltage is due to various parameters such as: the distance between phase cables, the distance between the high voltage electricity lines and the pipeline and the overhead line operating current. Corrosion is mainly influenced, or associated with the A.C. current density, size of coating defect and the local soil resistivity [2], [3] and [4].

The interference between a power system network and neighboring gas pipeline has been traditionally divided into three main categories: capacitive, conductive and inductive coupling [5], [6], [7], and [8].

Capacitive Coupling: Affects only aerial pipelines situated in the proximity of HVPL. It occurs due to the capacitance between the line and the pipeline. For underground pipelines the effect of capacitive coupling may not to be considered, because of the screening effect of earth against electric fields.

Inductive Coupling: Voltages are induced in nearby metallic conductors by magnetic coupling with high voltage lines, which results in currents flowing in a conducting pipeline and existence of voltages between it and the surrounding soil. Time varying magnetic field produced by the transmission line induces voltage on the pipeline.

Conductive Coupling: When a ground fault occurs in HVPL the current flowing through the grounding grid produce a potential rise on both the grounding grid and the neighboring soil with regard to remote earth. If the pipeline goes through the "zone of influence" of this potential rise, then a high difference in the electrical potential can appear across the coating of the pipeline metal.

There has been a considerable amount of research into interference effects between AC power line and pipeline including computer modeling and simulation. [9], [10]. A general guide on the subject was issued later by CIGRE [11], while CEOCOR [12] published a report focusing on the AC corrosion of pipelines due to the influence of power lines.

This piper evaluates and analyzes the electromagnetic interference effects on buried pipelines cathodically protected created by the nearby high voltage transmission lines. We calculate the various parameters of the sacrificial anode cathodic protection system, then we analyze the problem of interference between the power line and pipeline by the calculation of the magnetic field, induced voltage and current density during both normal conditions on the power line and finally we evaluate the AC corrosion likelihoods of pipelines. It is found that on pipelines suffering from A.C. interference traditional pipe-to-soil potential measurements do not guarantee efficient cathodic protection against corrosion. A specific approach to assess the effectiveness of cathodic protection should be adopted.

L_{anode} : Length of backfill in meters;
d_{anode} : Diameter of anode in meters;
$d_{backfill}$: Diameter of backfill in meters.

$$R_{anode} = 1.58\ \Omega$$

6. Current per anode

To predict the current output of protective current from a sacrificial anode the voltage between anode and cathode (driving voltage) is divided by the resistance of the anode to the electrolyte. The maximum output current from each anode is given by:

$$I_{max} = E/R = 0.65\ A$$

7. Number of anodes needed

The number of galvanic anodes required to protect the pipeline is given by

$$N = I_{total}/I_{max} \simeq 2 \text{ anode}$$

8. Net driving force of the anodes

This implies that the anodes should be spaced at 3.3 km intervals. Because the pipeline will be polarised to at least a potential of (-0.850 V/Cu-cuSo4), the net driving force of the anodes is given by;

$$E = -1.70V-(-0.85V) = -0.85V$$

Current (I) per anode 0.54A

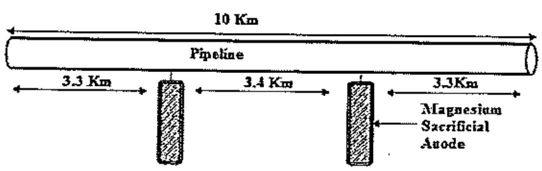

Fig.4. Schematic of the distribution of galvanic anodes along the pipeline

B. Interference Problem

We carried out within the context of this work the calculations carried out on a high voltage power line (HVPL) having the following characteristics. P = 750 MW under a cos (θ) =0.85 and U = 400 KV. Metallic pipeline (MP) Crossings with power lines at the points PK00.970 Km and PK01.170 Km (Figure5)

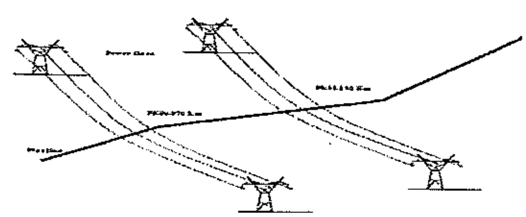
Fig.5. Plan view of the HVPL-MP common distribution corridor.

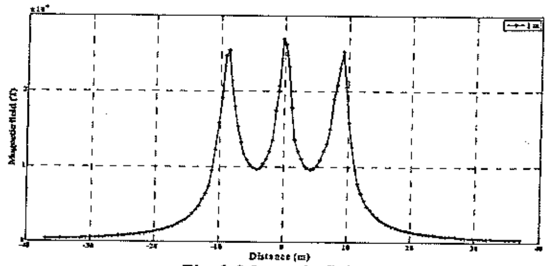

Fig.6. Magnetic field

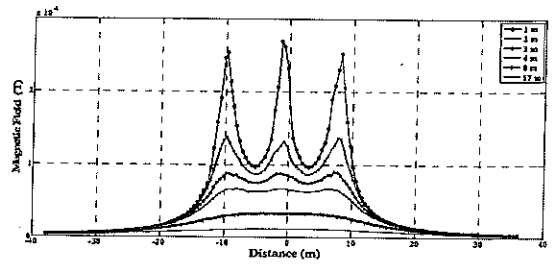

Fig.7. Magnetic field with varying height

Figure 6 shows the magnetic field profile for the horizontal configuration less than one meter of the high voltage power line. Three peaks corresponding to the location of the three phase conductors. The peak at the center of the right of way has a slightly larger magnitude than the two peripheral peaks.
Figure7 shows the magnetic field for horizontal configuration of the power line with varying height. As the height increases, the distance between the charges and the pipe line increases causing a decrease in the magnitude of the magnetic field.

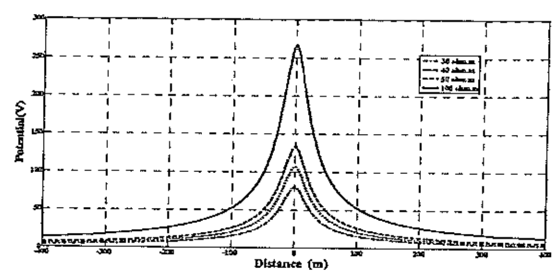

Fig.8. Induced voltage

The resultant pipeline induced voltages are calculated with the variation of the soil resistivity (soil resistivity varied from 30 to 100 Ω.m). In Fig.8, it is clear that the soil resistivity has an influence on the induced voltage. The pipeline induce-voltage reduces by reducing the soil resistivity (i.e. high soil resistivity gives high induced voltage).

V. AC CORROSION

The risk of AC corrosion of the metallic structures is closely linked with the pipeline isolation defects, which might occur, for instance during construction work. From an electrical point of view, coating holidays can be seen as

a small, low impedance AC earthing system connected to the pipeline. If the coating holiday size for example exceeds a certain dimension, corrosion risk likelihood neutralizes according to the relevant current density.
We consider a situation where a pipeline is buried near a high voltage power lines, and let us assume that the pipeline coating has a single defect. At the defect point, the pipeline has a resistance to earth whose approximate value is:

$$R = \frac{\rho_{soil}}{2.D} \cdot \left(1 + \frac{8t_c}{D}\right) \quad (4)$$

Thus the current density J_{ac} (A/m^2) through the coating defect is:

$$J_{ac} = \frac{8.U_{ac}}{\rho_{soil}.\pi(8t_c + D)} \quad (5)$$

U_{ac} is the induced voltage, t_c is the thickness of the coating, ρ_{soil} is the soil resistively, D is the diameter of the coating defect.
Based on actual investigation in the field of AC corrosion, as well as to the actual European technical specifications [16] the AC corrosion risk can already be expected from current densities at coating holidays among 30 A/m^2 . For current densities between 30 A/m^2 and 100 A/m^2 there exists medium AC corrosion likelihood. For current densities upper 100 A/m^2 there is a very high A/m^2 corrosion likelihood [17].

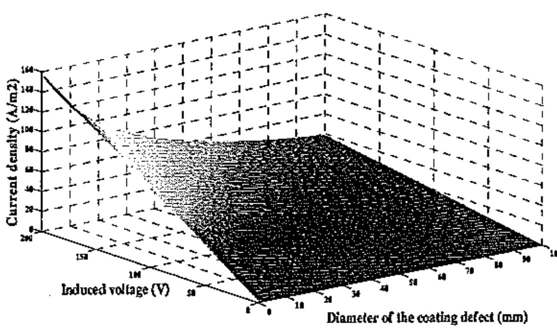

Fig.9. Current density

In Fig.9, the current density varies linearly with induced voltage and depends on soil characteristics by its resistivity, i.e. current density is greater in soil with low electrical resistivity. Moreover, current density increases by decreasing the dimension of the coating defect. The structures with a coating defect of small size may have a higher risk of AC corrosion.

VI. CONCLUSION

The interference problems that affect pipelines near high voltage AC power (HVAC) transmission lines have been well defined .The magnetic field on the pipeline in the vicinity of a high voltage power line have been calculated for horizontal configuration. The voltage profiles for normal operation conditions have been simulated. It is found that on pipelines suffering from A.C. interference traditional pipe-to-soil potential measurements do not guarantee efficient cathodic protection against corrosion.

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Power Technology

Newsletter Issue 96 October 2004

ELECTRICAL RISKS IN TRANSMISSION LINE – PIPELINE SHARED RIGHTS-OF-WAY

Jose R. Daconti
Executive Consultant
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Pipeline Induced Disturbances

Metallic pipelines used for fluid transportation (gas, oil, water, etc) are typically underground, but they may also have above-ground sections. Underground sections are protected by an external anti-corrosive coating. Above-ground sections are usually uncoated (just painted against corrosion) and isolated from the underground sections by means of insulating joints. Both behave like long conductors insulated from the ground.

The pipeline-induced disturbances are basically induced voltages on the pipeline metal. They are caused by the power line operating voltage and circulating currents. Some of these voltages are induced when the power line is under normal steady-state operating conditions. Other induced voltages may occur only during short-circuits on the transmission line.

Overhead power lines as well as underground power lines can induce harmful disturbances on nearby metallic pipelines.

Coupling Mechanisms

Generically, a physical process of transferring disturbances to a nearby installation requires the existence of a source of disturbances, a coupling mechanism and a receptor. In the present analysis, the source of disturbances is the power line, the receptor is the metallic pipeline and the coupling mechanism is the capacitive, inductive and conductive coupling between power line and pipeline.

The capacitive coupling disturbance is produced by the electric field of the power line and needs to be evaluated only for above-ground sections of pipeline that are electrically isolated from the ground. As shown in Figure 1, the capacitive coupling functions as a capacitive voltage divider. Otherwise, there is no capacitance between the power line and underground sections of pipeline. Any pipeline-to-ground connection makes this disturbance negligible. Usually, the evaluation of this disturbance is performed only for steady-state operation condition of the power line, assuming the line operates at its maximum operational voltage.

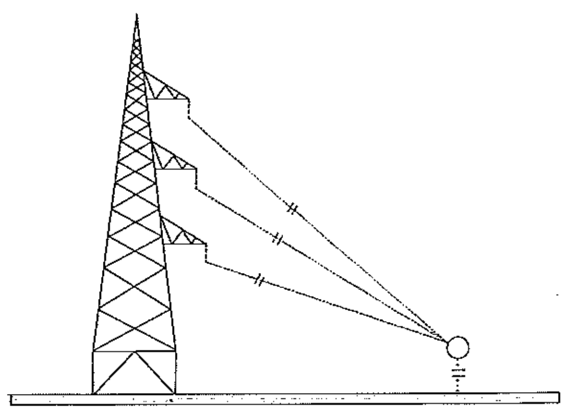

Figure 1 – Capacitive coupling

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Figure 2 shows that the inductive coupling disturbance is produced by the magnetic field of the power line and needs to be evaluated for underground sections of pipeline. It needs to be evaluated for above-ground sections of pipeline, only if these sections are grounded. This disturbance depends directly on the transmission line current unbalance. The evaluation of this disturbance is usually performed for steady-state, as well as short-circuit operational condition of the power line. This disturbance shall be evaluated taking into account the maximum anticipated levels of steady-state and short-circuit currents.

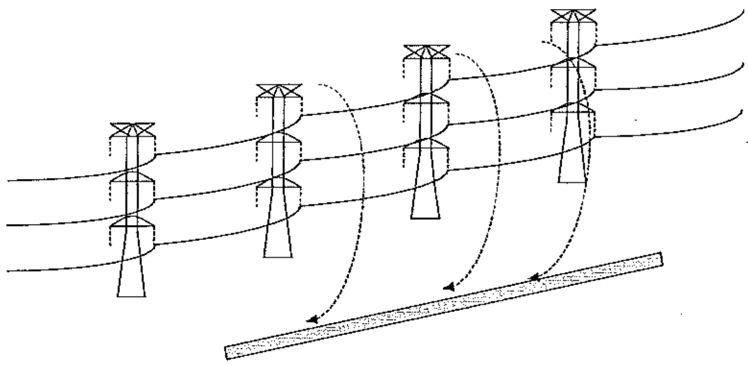

Figure 2 – Inductive coupling

The conductive coupling disturbance is produced by the ground potential rise due to the electrical currents injected into the ground from the transmission line. It needs to be evaluated for underground sections of pipeline. It needs to be evaluated for above-ground sections of pipeline, only if these sections are grounded. The evaluation of this disturbance is performed only for short-circuit condition of the power line. This disturbance shall be evaluated taking into account the maximum anticipated level of short-circuit current.

It is important to mention that under short-circuit condition the disturbances due to inductive and conductive coupling occur simultaneously as shown in Figure 3.

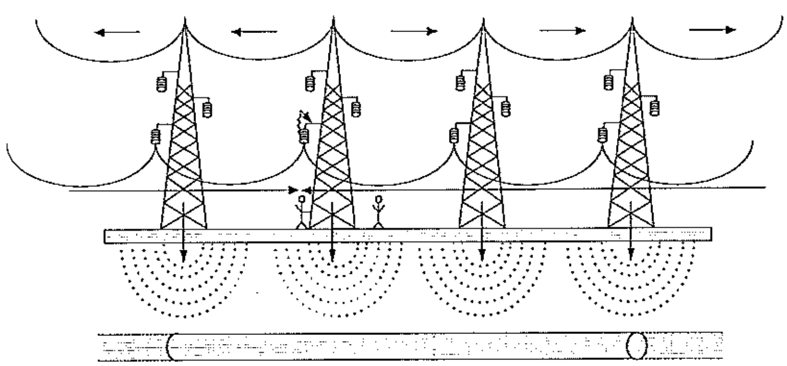

Figure 3 – Inductive plus conductive coupling

Potential Risks

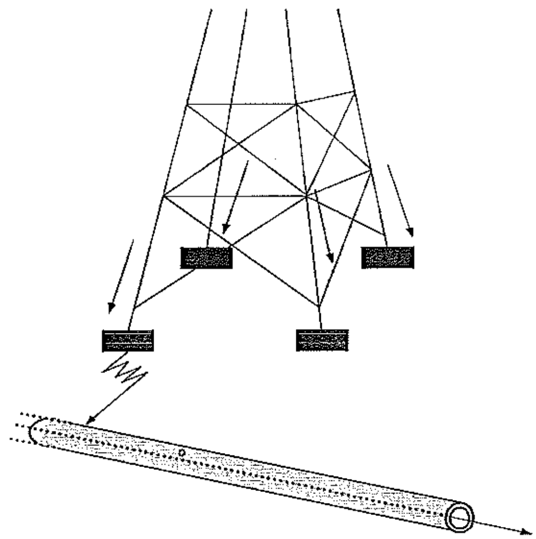

Figure 4 – Electrical discharge from power line to pipeline

The most basic concern regarding the proximity between a power line and a pipeline is to make sure that the electrical clearances between the mentioned installations are large enough to avoid electrical discharges from the former to the latter, as shown in Figure 4. Besides that, the following risks may exist:

- Electric shocks to people who may contact the pipeline: This can happen at above-ground sections of pipeline and above-ground metallic accessories connected to underground sections of pipeline, as shown in Figure 5. The tolerability of people to electric shocks depends on the shock duration;

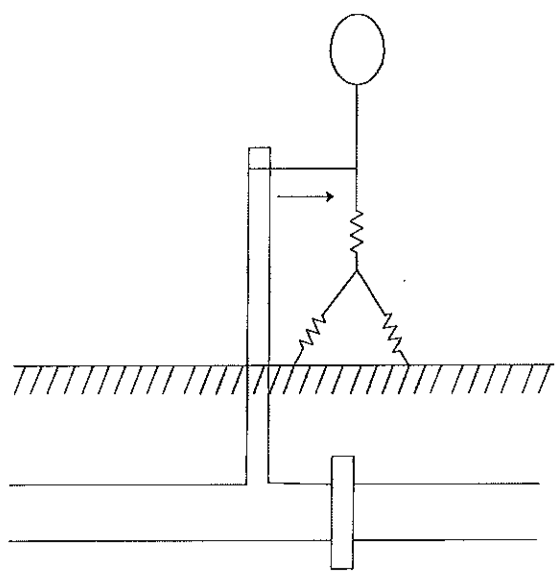

Figure 5 – Electric shock

- Damage to the pipeline insulating coating: This can happen at underground sections of pipeline, as a consequence of the application of an excessive voltage stress across the pipeline coating. The coating becomes internally exposed to the pipeline metal electric potential Vp (produced by inductive plus conductive couplings) while becoming externally exposed to the local ground electric potential Vs (produced by conductive coupling), as shown in Figure 6;

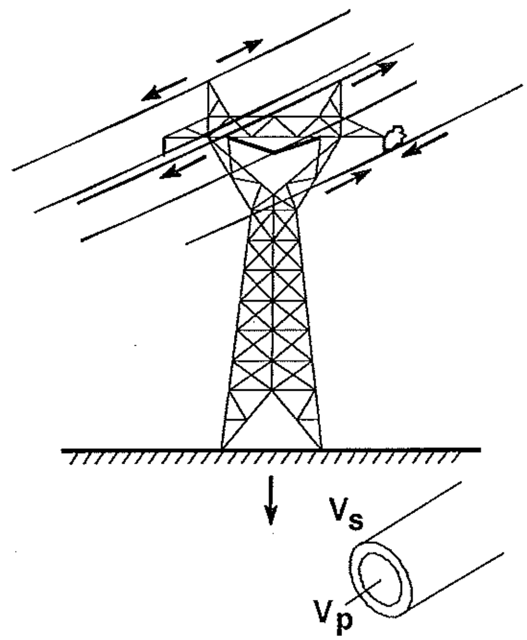

Figure 6 – Electrical stress applied to pipeline coating

- Damage to the pipeline insulating joints: This can happen to insulating joints used to separate above-ground from underground sections of pipeline, or insulating joints used to separate pipeline sections connected to different cathodic protection systems. These insulating joints can be damaged if exposed to voltage stresses above their maximum voltage withstand capability, as shown in Figure 7;

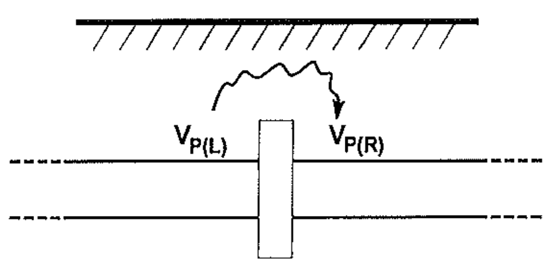

Figure 7 – Electrical stress applied to insulating joint

- Damage to the pipeline cathodic protection system: This can happen if the pipeline electric potential (at the point of connection to the cathodic protection system) is above the maximum reverse tolerable voltage of the cathodic protection system rectifier. See Figure 8.

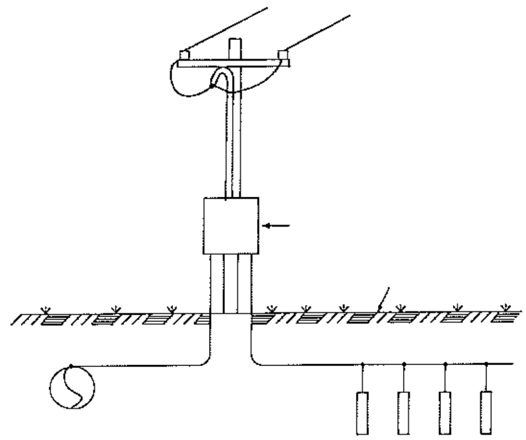

Figure 8 – Electrical stress applied to rectifier

Safety Criteria

People who may contact the pipeline can be exposed to electric shocks (touch voltages) caused by long-duration pipeline induced voltages (produced during the steady-state operation of the power line) or short-duration pipeline induced voltages (produced during short-circuit occurrences on the power line). Typically, long duration shocks should be limited to 5 mA (estimated shock current that would produce loss of muscular control for 0.5% of children) while short duration shocks should be limited to 164 mA (estimated minimum shock current that would produce a ventricular fibrillation probability equal to or less than 0.5% for a 50 kg weight person, according to Dalziel's Equation for a shock duration time equal to 0.5 seconds). Although these are typical limits, each country or state has its own regulation which must be respected. For instance, New York State Pipeline Code requires that long duration voltages induced on pipelines by electric lines must be limited to 15 volts.

Damage to the pipeline insulating (anti-corrosive) coating could lead to pipeline corrosion problems. This risk can be avoided if short-duration voltages applied across the pipeline external coating are limited to 5 kVrms. Such a level has been considered appropriate for the regularly used thicknesses of plastic (polyethylene) and bituminous (coal-tar) coatings. Plastic coatings have high thermal stability whereas bituminous coatings have low thermal stability.

Damage to the pipeline insulating joints can be avoided if the voltage stresses across them are limited to a level below the maximum withstand voltage of the mentioned joints. The maximum withstand voltage depends on the type of insulating joint. Some of them are able to withstand 5 kV when submitted to short-duration voltage stresses. If higher voltage stresses are anticipated, surge arresters should be installed across the insulating joints. In this case the nominal voltage and the energy dissipation capability of the surge arrester need to be appropriately specified.

Damage to the pipeline cathodic protection system (CPS) can be avoided by limiting the pipeline induced electric potential at the point of connection to the CPS to a voltage level that is smaller than the maximum reverse tolerable voltage of the CPS rectifier, which varies with the type of rectifier. If higher voltage stresses are anticipated, surge arresters should be installed. This analysis is usually done for the worst condition that typically occurs during short-duration disturbances.