



TECHNICAL MEMORANDUM

SITING AND DESIGN REQUIREMENTS

REGARDING VERMONT GAS FACILITIES PROPOSED ALONG, ACROSS OR ADJACENT TO
VELCO'S ELECTRIC TRANSMISSION RIGHT-OF-WAY CORRIDORS



October 1, 2012



Technical Memorandum

Siting and Design Requirements for Vermont Gas Systems Facilities Proposed Along, Across or Adjacent to VELCO's Electric Transmission Right-of-Way Corridors

Introduction

The purpose of this memorandum is to outline design, construction and operation criteria that VELCO (Vermont Electric Power Company / Vermont Transco LLC) will require Vermont Gas (VT Gas) to follow during the siting, layout, installation and operation of VT Gas' proposed Addison Natural Gas Pipeline Project, which consists of the placement of a natural gas pipeline within, adjacent to, and across Vermont Electric Power Company's (VELCO's) electric transmission line right-of-way ("ROW"). These requirements address specific issues including AC protection, transmission structure grounding, counterpoise, cathodic protection, transmission structure and foundation integrity and clearances, blasting, workspace and access roads for construction, public and worker safety. The issues are categorized into the areas of "Land Use and Environmental", "Design", and "Construction and Operations". These requirements are general in nature, and are in no way to be construed as VELCO granting or waiving any rights with respect to its ROW-related property rights. Nothing in this Memorandum shall be deemed as an approval for any VT Gas activity that impacts VELCO's ROW and facilities. Specific requests for VELCO's consent shall be made to Peter W. Lind; VELCO's Project Manager and shall be effective only if made in writing. No approval requested of and obtained from VELCO shall release VT Gas of any obligations or legal duties.

The requirements for these specific areas are identified below:

Land Use and Environmental

This category addresses VELCO's requirements associated with the siting and placement of the pipeline facilities in or adjacent to VELCO's ROW. The intention of the following requirements is to preserve the integrity of VELCO's ROW and ensure that the pipeline is sited in a manner that does not prevent or inhibit VELCO's ability to operate and maintain both existing and future transmission facilities. This includes maintaining VELCO's ability to access transmission structures through existing on and off-corridor access rights and routes and roads and to travel along the ROW with heavy equipment without restriction resulting from the existence of the natural gas pipeline facilities.

Requirements:

- **ROW Width** - Where VT Gas is proposing to install facilities within or contiguous with the outside edge of VELCO's ROW, VT Gas must identify the ROW width desired for its proposed, and potential future facilities.



Optimize Pipe Routing - VT Gas must propose a pipe routing layout that minimizes the number of times the pipeline enters or crosses the ROW. Where entering or crossing the ROW is unavoidable, VT Gas must propose a design that minimizes the environmental and land use impacts of the installation and maintenance of the pipeline.

- **Pipe Location** - The pipeline must be located in a manner that does not preclude VELCO's ability to exercise its existing ROW rights or preclude using the ROW for future expansion of electric facilities. The use of the outer 10-20 ft of ROW is typically used in the transmission line design as horizontal clearance to trees at the edge of the ROW rather than for physical transmission structure placement (except for guying or access). Some transmission ROWs are currently used or are reserved for future electrical facilities along this easement edge strip, and where they exist or are planned, cannot support co-location of a pipeline facility.
- **Soil Spoil** - Soil spoil is typically screened before being replaced in the pipeline trench. VELCO generally prohibits the stockpiling of materials, logs, or other objects in its ROW. VT Gas may not leave stone, boulders, stumps and blast rock spoil piles or other materials in the ROW without VELCO's prior approval. Any such request by VT Gas shall be submitted with information sufficient for VELCO to determine potential impacts to VELCO's ROW rights and usage.
- **AC Mitigation/Cathodic Protection** – Test stations and decoupling box locations must be placed in locations that facilitate easy access. The location of testing stations must be ground-truthed and based on actual field conditions rather than just engineering data. Test stations should be located near existing roads when available and outside of sensitive resources, steep slopes, water bodies, etc. to allow collecting data without risking excessive ground disturbance on VELCO's ROW corridor.
- **Access Points** - Installation of Pipeline facilities (including valve and remote blow off sites) must not interfere with VELCO's off-corridor and in-ROW access rights. VT Gas shall leave suitable access to and down the ROW sufficient, in VELCO's opinion, for existing and future VELCO construction and maintenance activities. For example, if a mainline valve is located on the only piece of upland in the corridor and in an existing access way down the corridor, VELCO would then be required to access through sensitive and difficult resource areas to access (stream and wetlands). Valve sites must not be located in locations that restrict VELCO's upland access in the ROW.
- **Future Vegetation Maintenance** – Vegetative maintenance conditions for the pipeline ROW must not conflict or override VELCO standards for transmission line vegetation maintenance requirements. VT Gas must provide VELCO with their Vegetation Maintenance Plan for review and approval.
- **ATV Deterrents** – Brushy transmission line corridors don't often offer the same open areas for ATV travel as a newly constructed pipeline will. VT Gas must provide an ATV deterrent plan to



VELCO for review and approval if the construction of the pipeline opens new opportunities for ATV activities in the corridor.

Design

This category addresses VELCO's requirements associated with the design and performance of the pipeline facilities in or adjacent to VELCO's ROW. The intention of the following requirements is to preserve the integrity of VELCO's electric transmission facilities and does not prevent or inhibit VELCO's ability operate and maintain both existing and future transmission facilities.

Requirements:

- **Code Compliance** - Pipe facilities shall be designed in accordance with the Code of Federal Regulation 49 Part 192-TRANSPORTATION OF NATURAL AND OTHER GAS BY PIPELINE: MINIMUM FEDERAL SAFETY STANDARDS, ANSI B 31.8 code and any other applicable local, state and federal regulations and standards.
- **ROW Crossing and Exclusion Zones** – Pipe crossings should be relatively perpendicular across the ROW, but may be at an angle not less than 45 degrees to the centerline of the transmission line. Crossings must avoid electric transmission structure construction and maintenance footprint strips (200' along the ROW centered on ROW angle transects, 100' along the ROW centered on existing structures).
- **Guy anchors** - The proposed pipeline must not be located within 50' of any structure guy anchor where it enters the ground.
- **ROW Angles** - At ROW angles, the preferred location for the pipeline is along the "inside" of the angle, as transmission structures may be guyed on the "outside" of the angle, and also, guy rights may exist outside the basic ROW width. Pipeline locations outside the angle need to sweep widely to provide 50' clearance. Closer passage may require modification of the guy systems to add insulators.
- **Cathodic Protection** - The pipeline cathodic protection system must be designed in a manner that will not cause sacrificial corrosion loss of material from VELCO's transmission system, including grounding, counterpoise, guy anchor rods and transmission tower members. VT Gas must demonstrate to VELCO that the cathodic protection system will not cause the metallic portions of the electric transmission line to serve as an anode and sacrifice to the pipeline.
- **Ground System** - Any pipe insulation and the pipeline supplemental grounding system must be designed in a manner to withstand possible transmission ground fault return currents and energy that may occur during a phase-to-ground line fault.

- **Pipeline Blow-down** - Pipeline blow-down facilities (if required) must be located no less than 100' outside the ROW, and directed away from the transmission line, to reduce the risk of spark-ignition of the released gas plume. Compliance with Vermont regulations must be demonstrated.
- **Buried Grounding Cables** - ROW crossings which encounter buried electric transmission grounding cables ("counterpoise") must remove the counterpoise for a distance of at least 50' in both directions along the transmission line. In these occurrences, VT Gas will be responsible for increasing VELCO's counterpoise in the adjacent spans to restore the grounding effectiveness of its electrical system. When encountered during construction, VT Gas must immediately notify VELCO to coordinate mitigation measures.
- **Bonding** - The Pipeline and transmission line systems must not be bonded together in any way, as that increases hazards. VT Gas must demonstrate that the pipeline is not bonded with any transmission facilities.
- **Pipe Route and Depth** - Pipeline route segments under VELCO's access routes and roads and inside the transmission line ROW must be installed at a depth and manner that will not preclude VELCO's movement of heavy construction equipment over the pipeline (e.g. HS-20 crush loading integrity).
- **Drawings** - Drawings must show the proposed pipeline facility referenced by offset dimensions from the monumented centerline of the transmission ROW. If such monumentation does not exist, drawings must reference the centerline of the nearest transmission line.
- **Fault Currents** - Transmission line-to-ground fault currents could damage an underground pipeline. Fault current conducted into and along the metallic pipeline could damage the pipe and present a shock hazard where the pipe or auxiliary equipment is above ground. VT Gas must ensure that the pipeline is protected for this occurrence.

Construction

This category addresses VELCO's requirements associated with the installation and maintenance of the pipeline facilities in or adjacent to VELCO's ROW. The intention of the following requirements is to ensure that the construction, operation and maintenance of the pipeline do not jeopardize the integrity, reliability or operability of the electric transmission system either before, during or after installation. It is also the intent of this section to ensure that worker and public safety is not compromised during the installation of this project.

Operation and Maintenance of the pipeline must be conducted in a manner that does not jeopardize the integrity, reliability or operability of the electric transmission line.



- **Construction Work Zones** – VT Gas must identify widths of the temporary construction work zones desired within and outside the VELCO ROW, including construction and delivery equipment and soil spoil storage. VT Gas must also identify where it proposes to overlap into VELCO’s ROW. It must identify its desired use of any existing transmission line access ways outside the above temporary work zones, and the type of equipment to be used.
- **Construction Schedule** - Transmission line dispatching is managed by the New England Transmission Independent System Operator (“ISO-New England”). VELCO must request any outages far in advance and under a strict scheduling regime. Dispatch procedures are not conducive to de-energizing lines for construction of nearby facilities, so pipeline construction should presume the need to keep the transmission line energized. De-activation of line reclosing equipment (which automatically reenergizes the line in the event of a fault) may be a project solution for enhanced worker safety, but also needs advanced planning with and approval by VELCO and possibly ISO-New England. VT Gas needs to plan its construction schedule with VELCO to provide sufficient time to implement any desired special line operations.
- **Tree Clearing** - Tree removal along the edge of transmission ROW must be done only by contractors experienced with such operations along high-voltage lines. VT Gas must develop a vegetation removal plan that includes such aspects as equipment movement along routes that pass within close proximity to, or under overhead electrical conductors, and burning or chip disposal of slash along the ROW and provide to VELCO for review and approval. OSHA Safety clearances include: 12.2 ft for 115kV, and 20 ft for 345-kV transmission lines. VELCO may require full or part time construction inspectors on site having the power to stop construction to maintain safety.
- **Construction Safety Plan** - Pipeline construction within any permanent ROW or temporary construction area within a horizontal distance equal to the OSHA work clearance must be done in accordance with a pre-developed construction plan that must be submitted to VELCO for review. VELCO may require full or part time construction inspectors on site having the power to stop construction to maintain safety.
- **ROW Crossings** - ROW crossings should occur only where electrical clearances significantly exceed National Electrical Safety Code (NESC) vehicle clearance. Note that NESC conductor to ground clearance in vehicle-accessible areas (115kV 20.1 ft.; 345kV 24.7 ft.) will not provide OSHA clearance for typical construction equipment. A 14 ft. high vehicle will have only 6 ft of clearance to a 115-kV conductor, short of 12.2 ft required by OSHA. That vehicle will have about 10 ft of clearance to a 345-kV conductor, short of the 20 ft required by OSHA. Re-grading at ROW crossings is typically not allowed. Re-grading which reduces the conductor clearance may cause NESC clearance violations. Reducing the grade, though increasing conductor clearance may disrupt longitudinal passage of electric company equipment along the ROW.



- **Electric Line Clearances** - Electric transmission line conductors typically operate at or near ambient air temperature, although they are designed for system contingencies which may cause the conductors to quickly heat up, and sag to a lower elevation. Pipeline construction under a transmission conductor must recognize the potential low position of a “hot” conductor, not the “cool” higher conductor position that may be observed. This will be a factor in the decision (mentioned above) regarding the possible need for a VELCO inspector who will be in communication with VELCO Operations.
- **Soil Spoil Piles** – Soil spoil piles under transmission lines could pose a significant safety hazard and may or may not be allowed depending upon the existing transmission line characteristics. Re-grading, and soil stockpiling within VELCO’s ROW should be limited and will require VELCO approval.
- **Safety Training** – VT Gas employees and contractors working on the project must be trained and experienced in construction near high voltage transmission facilities and familiar with the required industry safety practices to protect its workers against conductive and inductive effects of the transmission line upon pipeline strings, construction equipment, etc. VT Gas must demonstrate to VELCO that employees and contractors working on the project have received this training.
- **Blasting** – Blasting in general near transmission structures can be problematic and should be limited. Alternatives to blasting should be fully investigated. Any blasting required for pipeline installation must conform to a blasting plan approved in advance by VELCO and must include criteria for accelerometers at nearby transmission structures and measures to prevent blast materials from impacting the transmission line structures and/or conductors.
- **Horizontal Directional Drill Sites** - Need for construction setup areas or work zones for horizontal directional bores or jack-and-bore operations within VELCO’s ROW must be fully detailed on the preliminary drawings for VELCO review and approval.
- **Draglines** - The use of draglines or other boom-type equipment in connection with pipeline construction, operation, or maintenance work within VELCO’s ROW must comply with the National Electrical Safety Code, OSHA, and any other applicable regulations or codes regarding clearance requirements; in no event shall any equipment be within minimum OSHA safety standards.
- **Conformance to Plans** - The constructed pipeline location must not depart from the construction plans by more than 2’, and be GPS verified with sub-meter accuracy “as-built” location (and documented on “as built” drawings) before cover. The pipe location in the ROW must be identified by marker posts installed over the pipe location at intervals of not more than



200' apart, at the high point of profile changes and at the centerline of the transmission ROW or transmission line, and all recorded on the record "as built" drawings.

- **Construction monitoring** – all construction activities in the VELCO ROW must be monitored by a VELCO representative to document conditions in case there is future disagreement as to the possible origin of potential environmental, safety, or engineering issues associated with the VELCO corridor or facilities.
- **Post construction and restoration monitoring** – VELCO will monitor and review the co-located facilities to evaluate the success of restoration and the condition of the VELCO ROW.
- **Magnetically Induced Voltages** - A transmission line can magnetically induce (from normal electric transmission three-phase currents) hazardous voltages along both above and below ground metallic facilities including pipelines. This risk is greatest during construction when pipe sections are being unloaded, assembled and welded. Where in close proximity to a transmission line, the conductive effects may add to the magnetic effects. VT Gas must take appropriate precautions to protect the safety of workers and the public from this hazard.

