

APPENDIX L
Blasting Plan

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**Enbridge Energy, Limited Partnership
Enbridge Pipeline (Southern Lights), L.L.C.**

Blasting Plan

**Alberta Clipper and Southern Lights Diluent
Pipeline Projects**

March 20, 2009

ISSUED FOR PERMITTING

Alberta Clipper and Southern Lights Diluent Pipeline Projects

BLASTING PLAN

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ISSUED FOR PERMITTING

1.0 INTRODUCTION

At present, Enbridge Energy Ltd. Partnership (Enbridge) does not anticipate the use of blasting for installing the Alberta Clipper or Southern Lights Diluent pipelines given that 1) blasting was not required for previous pipeline projects following the same corridor, and 2) less than 1 percent of the pipeline route crosses areas with potential for shallow bedrock (i.e., bedrock within 5 feet of the surface) based on a soils database analysis.

However, in the unlikely event that blasting is required, this Blasting Plan has been prepared to outline the procedures and safety measures that the Contractor will adhere to while implementing blasting activities along the pipeline right-of-way during construction of the Alberta Clipper and Southern Lights Diluent Projects. The Contractor will be required to submit a Blasting Specification Plan to Enbridge that is consistent with the provisions in this Blasting Plan. The Contractor's plan, when approved by Enbridge, will be incorporated into the Contractor's scope of work.

2.0 OBJECTIVE

This Blasting Plan is intended to identify blasting procedures, including safety, use, storage, and transportation of explosives that are consistent with minimum safety requirements as defined by federal (e.g., Title 27 CFR 181 - Commerce in Explosives; Title 49 CFR 177 - Carriage by Public Highway; Title 29 CFR 1926.900 et seq. Sub-part U - Safety and Health Regulations for Construction - Blasting and Use of Explosives; Title 29 CFR 1910.109 – Explosives and Blasting Agents (OSHA); 29 CFR 1926.900-General Provisions and sections 901, 902 and 904-911), state, and local regulations. Additionally, this plan is intended to address environmental aspects of blasting activities and to identify areas of concern along the proposed pipeline route.

3.0 GENERAL REQUIREMENTS

Blasting operations must be conducted by or under the direct and constant supervision of personnel legally licensed and certified to perform such activity in the jurisdiction where blasting occurs. Prior to any blasting activities, the Contractor will provide Enbridge with appropriate information documenting the experience, licenses, and permits associated with blasting personnel.

Blasting-related operations, including obtaining, transporting, storing, handling, loading, detonating, and disposing of blasting material; drilling; and ground-motion monitoring, shall comply with applicable federal, state, and local regulations, permit conditions, and the construction contract.

Blasting for grade or trench excavation must be used where deemed necessary by a construction expert after examination of the site and in other locations only after other reasonable means of excavation have been used and are unsuccessful in achieving the required results. Enbridge may specify locations (e.g., foreign line crossings, near structures) where consolidated rock must be removed by approved mechanical equipment such as rock-trenching machines, rock saws, hydraulic rams, or jack hammers in lieu of blasting.

Before blasting, a site-specific Blasting Specification Plan must be submitted by the Contractor to Enbridge for approval. The site-specific blasting plan must be reviewed by an engineer representing Enbridge. The engineer will analyze the data to determine the combined stress

level of each affected pipeline and will make recommendations and/or forward approval to Enbridge before blasting may commence.

Drilling and blasting must be done with an Enbridge Construction Inspector present. Approval is required to proceed prior to each blast. Approval does not relieve the Contractor from responsibility or liability.

4.0 PRE-BLASTING REQUIREMENTS

Prior to the initiation of blasting operations, the Contractor must comply with the following:

- The Contractor will obtain all required federal, state, and local permits relating to the transportation, storage, handling, loading, and detonation of explosives.
- The Contractor must make all necessary "one calls" notifications 48 hours prior to construction where one-call systems are in place.
- The Contractor must be responsible for the protection of existing underground facilities.
- Before performing any work on, or accessing the right-of-way, the Contractor must verify to Enbridge that all property owners have been notified of the impending construction.
- The Contractor must submit to the Enbridge representative its site-specific Blasting Plan for approval prior to execution of blasting activity.

5.0 SITE-SPECIFIC BLASTING PLANS

As stated above, less than 1 percent of the pipeline route crosses areas with potential for bedrock to be within 5 feet of the surface, based on a soils database analysis. For any area determined to require blasting, a site-specific blasting plan will be created. The Contractor's site-specific blasting plan must include at a minimum the following information:

- Blaster's name, company, copy of license, and statement of qualifications; seismograph company, names, equipment and sensor location;
- Site location (milepost and stationing), applicable alignment sheet numbers, and associated rock type and geological structure (solid, layered, or fractured);
- Copies of all required federal, state, and local permits;
- Methods and materials including explosive type, product name and size, weight per unit, and density; stemming material; tamping method; blasting sequence; use of non-electrical initiation systems for all blasting operations; magazine type and locations for storage of explosives and detonating caps;
- Site dimensions including explosive depth, distribution, and maximum charge and weight per delay; hole depth, diameter, pattern, and number of holes per delay;

- Dates and hours of conducting blasting, distance and orientation to nearest aboveground and underground structures; schedule identifying when blasting would occur within each waterbody greater than 10 feet wide, or within any designated coldwater fishery; and
- Blasting procedures for:
 - Storing, handling, transporting, loading, and firing explosives;
 - Prevention of misfires, flyrock, fire prevention, noise, and stray current accidental-detonation;
 - Signs, flagmen, and warning signals prior to each blast;
 - Those locations where the pipeline route:
 - Parallels or crosses an electrical transmission corridor, cable or pipeline;
 - Parallels or crosses a highway or road;
 - Is within or adjacent to treed areas;
 - Approaches within 200 feet of a water well or spring; or
 - Approaches within 1,000 feet of any residence, building or occupied structure;
 - Local notification;
 - Inspections after each blast; and
 - Disposal of waste blasting material.

6.0 MONITORING

During blasting operations the Contractor will be required to monitor operations in the following manner:

- The Contractor must provide seismographic equipment to measure the peak particle velocity (PPV) of all blasts in the vertical, horizontal, and longitudinal directions. Seismic monitoring can only be discontinued if a) the blasting schedule and blasting performance consistently produce PPVs at the pipeline that are lower than the maximum allowable limit and b) an Enbridge representative provides written authorization.
- The Contractor must measure the PPV at the adjacent pipeline; at any water wells, potable springs, and at any above ground structure within 200 feet of the blasting.
- The Contractor must complete a Blasting Log Record immediately after each blast and submit a copy to an Enbridge representative.

7.0 SAFETY

7.1 Protection of Aboveground and Underground Structures

Where blasting is determined to be required, Enbridge will identify any municipal water mains proposed for crossing, and will consult the local water authority. Reports of identified crossings will include location by milepost, owner, and status and results of contacts with the water authority.

The Contractor will exercise control to prevent damage to aboveground and underground structures including buildings, pipelines, utilities, springs, and water wells. The Contractor will implement the following procedures:

- Any water well or potable springs found to be within 150 feet of the temporary construction right-of-way where blasting would occur, would be tested for yield and water quality before blasting. If the water well or spring is damaged, the well or spring will be repaired or otherwise restored or the well owner will be compensated for damages. Enbridge will provide an alternative potable water supply to the landowner until repairs occur. Locations of water wells or systems within 150 feet of the temporary construction right-of-way where blasting would occur will be indicated on Enbridge's construction alignment sheets.
- If blasting occurs within 200 feet of any aboveground structures, the Contractor and an Enbridge representative will inspect structures before and after blasting. In the unlikely event that damage occurs to the aboveground structure, the owner will be compensated.
- The Contractor is responsible for the ultimate resolution of all damage claims resulting from blasting. Such liability is not restricted by the 200-foot inspection requirement cited above.
- Blasting will not be allowed within 15 feet of an existing pipeline, unless specifically authorized by Enbridge.
- Holes that have contained explosive material shall not be re-drilled. Holes must not be drilled where danger exists of intersecting another hole containing explosive material.
- Blasting mats or padding shall be used on all shots where necessary to prevent scattering of loose rock onto adjacent property and to prevent damage to nearby structures and overhead utilities.
- Blasting cannot begin until occupants of nearby buildings, stores, residences, places of business, places of public gathering, and farmers have been notified by the Contractor sufficiently in advance to protect personnel, property, and livestock. The Contractor must notify all such parties at least 48 hours prior to blasting.
- Blasting in or near environmentally sensitive areas such as streams and wildlife areas may include additional restrictions.

- All blasting is subject to the following limitations.
 - Maximum peak particle velocity of 12.0 inches per second in any of three mutually perpendicular axes, measured at the lesser distance of the nearest facility or the edge of the permanent easement.
 - Maximum drill size must be 2.5 inches unless approved by Enbridge.
 - Maximum quantity of explosive per delay is governed by the recorded measurements as influenced by work site conditions.
 - Explosive agents and ignition methods shall be approved by Enbridge. Ammonium Nitrate-Fuel Oil (ANFO) and other free flowing explosives and blasting agents are not acceptable and cannot be used.
 - Drill holes cannot be left loaded overnight.
 - Good stemming material is to be used in all holes.
- The drilling pattern must be set in a manner to achieve smaller rock fragmentation (maximum 1 foot in diameter) in order to use as much as possible of the blasted rock as backfill material after the pipe has been padded in accordance with the specifications. The Contractor must submit the proposed drilling pattern to Enbridge for approval.
- Under pipeline crossings and all other areas where drilling and blasting is required within 15 feet of existing facilities:
 - Drill holes must be reduced to a maximum of 2 inches or less in diameter.
 - The number of holes shot at one time is limited to three unless otherwise approved by Enbridge.
 - Appropriate delay between charges to attain desired fragmentation.

7.2 Protection of Personnel

The Contractor must include in its procedures all federal, state, county, and local safety requirements for blasting. The Contractor's procedures must address, as a minimum, the following requirements:

- Only authorized, qualified, and experienced personnel can handle explosives.
- All blasting activities must be conducted only during daylight hours.
- No explosive materials can be located where they may be exposed to flame, excessive heat, sparks, or impact. Smoking, firearms, matches, open flames, and heat- and spark-producing devices shall be prohibited in or near explosive magazines or while explosives are being handled, transported, or used.

- A code of blasting signals must be established, posted in conspicuous places and utilized during blasting operations. Employee training shall be conducted on the use and implementation of the code.
- The Contractor must use every reasonable precaution including, but not limited to, visual and audible warning signals, warning signs, flag person, and barricades to ensure personnel safety.
- Warning signs, with lettering a minimum of 4 inches in height on a contrasting background, will be erected and maintained at all approaches to the blast area.
- Flaggers will be stationed on all roadways passing within 1,000 feet of the blast area to stop all traffic during blasting operations.
- All personnel not involved in the actual detonation must stand back at least 1,000 feet and workers involved in the actual detonation must stand back at least 650 feet from the time the blast signal is given until the "ALL CLEAR" has been sounded.
- No loaded holes can be left unattended or unprotected. No explosives or blasting agent can be abandoned.
- In the case of a misfire, the blaster must provide proper safeguards for personnel until the misfire has been re-blasted or safely removed.
- The exposed areas of the blast will be matted wherever practicable. In cases where such a procedure is not deemed to be feasible, the Contractor will submit an alternative procedure for review by Enbridge and the site in question must be visited and examined by the consultant before any approval is granted.
- Enbridge may employ two-way radios for communication between vehicles and office facilities. The Contractor must advise Enbridge and other pipeline contractors of any need to cease use of such equipment during blasting activities.
- All loading and blasting activity must cease and personnel in and around the blast area will retreat to a position of safety during the approach and progress of an electrical storm irrespective of the type of explosives or initiation system used. **THIS IS A MAJOR SAFETY PRECAUTION AND WILL ALWAYS BE OBSERVED.** All explosive materials, all electrical initiation systems, and all non-electric initiation systems are susceptible to premature initiation by lightning.
- Previous blast areas must be inspected to verify the absence of misfires. No drilling may commence until such inspection occurs. If a misfire occurs adjacent to a hole to be drilled, the misfire will be cleared by the blaster using whatever techniques are called for by the situation prior to commencement of drilling. If a misfire occurs at some distance from the drilling area, drilling may be stopped while clearing preparations are underway. When the misfire is to be cleared by re-shooting, drilling will be shutdown and personnel evacuated to a place of safety prior to detonation.

- All transportation of explosives will be in accordance with applicable federal, state, and local laws and regulations. Vehicles used to transport explosives must be in proper working condition and equipped with tight wooden or non-sparking metal floor and sides. If explosives are carried in an open-bodied truck, they will be covered with a waterproof and flame-resistant tarpaulin. Wiring will be fully insulated to prevent short-circuiting and at least two fire extinguishes will be carried. The truck will be plainly marked to identify its cargo so that the public may be adequately warned. Metal, flammable, or corrosive substances will not be transported in the same vehicle with explosives. There will be no smoking, and unauthorized or unnecessary personnel will not be allowed in the vehicle. Competent, qualified personnel will load and unload explosives into or from the vehicle.
- No sparking metal tools will be used to open kegs or wooden cases of explosives. Metallic slitters will be used to open fiberboard cases, provided the metallic slitter does not come in contact with the metallic fasteners of the case. There will be no smoking, no matches, no open lights, or other fire or flame nearby while handling or using explosives. Explosives will not be placed where they are subject to flame, excessive heat, sparks, or impact. Partial cases or packages of explosives will be re-closed after use. No explosives will be carried in the pockets or clothing of personnel. The wires of an electric blasting cap shall not be tampered with in any way. Wires will not be uncoiled. The use of electric blasting caps will not be permitted during dust storms or near any other source of large charges of static electricity. Uncoiling of the wires or use of electric caps will not be permitted near radio-frequency transmitters. The firing circuit will be completely insulated from the ground or other conductors.
- No blast will be fired without a positive signal from the person in charge. This person will have made certain that all surplus explosives are in a safe place; all persons, vehicles, and/or boats are at a safe distance; and adequate warning has been given. Adequate warning of a blast will consist of but not be limited to the following:
 - Notification to nearby homeowners and local agencies if necessary;
 - Stop vehicular and/or pedestrian traffic near the blast site; and
 - Signal given by an air horn, whistle or similar device using standard warning signals.
- Only authorized and necessary personnel will be present where explosives are being handled or used.
- Condition of the hole will be checked with a wooden tamping pole prior to loading. Surplus explosives will not be stacked near working areas during loading. Detonating fans will be cut from spool before loading the balance of charge into the hole. No explosives will be forced into a bore hole past an obstruction. Loading will be done by a blaster holding a valid license or by personnel under his direct supervision.

- Fly-rock leaving the right-of-way must be collected immediately and disposed of at disposal sites approved by Enbridge. This work shall not be left to the cleanup crew.

7.3 Protection of Threatened and Endangered Species

Enbridge will consult with state and federal agencies regarding areas proposed for blasting where sensitive habitats or species are known to occur. Areas identified as containing sensitive habitats or species, as directed by the appropriate agencies, will be staked and flagged. A qualified project biologist will survey the proposed blasting zone identified by the pipeline Contractor immediately in advance of any drilling or blasting. Areas will be checked before and after blasting for the presence of sensitive species, and disturbance to species and habitats will be resolved in accordance with guidance provided by the appropriate agencies.

7.4 Lightning Hazard

A risk of accidental detonation caused by lightning strikes exists at any time the workplace is experiencing an electrical storm and there are loaded holes on site. If this hazard is judged to exist by the Enbridge representative, work will discontinue at all operations and workers will be moved to secure positions away from the loaded holes. Furthermore, workers cannot return to the work site until the storm has passed and the Enbridge representative has indicated it is clear to return.

Enbridge's Contractor must have on site approved lightning detectors (model SD-2508 manufactured by Electronics Div. of S.D.I. International, Model 350 manufactured by Thomas Instruments Inc., Skyscan Lighting Detector manufactured by Skyscan Technologies or equivalent) capable of measuring the degree of electrical activity as a storm approaches, and the distance to the storm front from the instrument on the right-of-way.

8.0 IN-WATER BLASTING

Enbridge will consult the appropriate agencies regarding waterbody crossings where blasting may be required, to determine the presence and quality of local fisheries. The type of explosive, size of charges, sequence of firing, etc. will be selected to minimize shock wave stresses on aquatic life adjacent to the blasting area.

Where specified, the Contractor will furnish the necessary labor and equipment to employ air bubble curtains at water crossings for the protection of existing pipelines, wildlife or other facilities. In the case of river, creek or lake crossings, any necessary blasting operations will be carried out in such a manner that they conform in all respects with the limitations, requirements and procedures required by the authority having jurisdiction. Explosives used for river, lake or creek crossings must be non-sympathetically propagating explosives and shall be approved by Enbridge.

Notifications will be made to all appropriate resource agencies.

9.0 STORAGE REQUIREMENTS

All explosives, blasting agents, and initiation devices must be stored in locked magazines that have been located, constructed, approved, and licensed in accordance with local, state, and

federal regulations. Magazines must be dry, well-ventilated, reasonably cool (painting of the exterior with a reflective color), bullet and fire resistant, and kept clean.

Initiation devices cannot be stored in the same box, container, or magazine with other explosives. Explosives, blasting agents or initiation devices cannot be stored in wet or damp areas; near oil, gasoline, cleaning solvents; near sources of heat radiators, steam pipes, stoves, etc. No metal or metal tools can be stored in the magazine. There can be no smoking, matches, open lights, or other fire or flame inside or within 50 feet of storage magazines or explosive materials. The loading and unloading of explosive materials into or out of the magazine will be done in a business-like manner with no loitering, horseplay, or prank playing.

Magazines will be kept locked at all times unless explosives are being delivered or removed by authorized personnel. Admittance will be restricted to the magazine keeper, blasting supervisor, or licensed blaster. Magazine construction shall meet the requirements of Bureau of Alcohol, Tobacco and Fire Arms (ATF) P5400.7 "Explosives Law and Regulations" and be in accordance with local, state, or federal regulations and the Blaster's Handbook.

Accurate and current records must be kept of the explosive material inventory to ensure that oldest stocks are utilized first, satisfy regulatory requirements, and facilitate immediate notification of any loss or theft. Magazine records will reflect the quantity of explosions removed, the amount returned, and the net quantity used at the blasting site.

When explosive materials are taken from the storage magazine, they must be kept in the original containers until used. Small quantities of explosive materials may be placed in day boxes, powder chests, or detonator boxes. Any explosive material not used at the blast site must be returned to the storage magazine and replaced in the original container as soon as possible.

Magazine locations must be in accordance with local, state, or federal regulations. Where no regulations apply, magazines shall be located in accordance with the latest edition of the 175th Anniversary Edition of the Blaster's Handbook and ATF P5400-7 Explosives Law and Regulations.

Magazines will be marked in minimum 3-inch high letters with the words "DANGER - EXPLOSIVES" prominently displayed on all sides and roof.

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