Appendix J

Blasting Plan

Prepared for:
Bison Pipeline LLC

Blasting Plan

AECOM, Inc.
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AECOM

Blasting Plan

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Blasting Plan

Significant changes from Bison's Blasting Plan submitted in October 2009, and used for the Final Environmental Impact Statement (EIS) analysis, are identified in **Table 1**. These changes are highlighted with **bolded text** in the body of this report.

Table 1 – Significant Revisions to Bison's Blasting Plan Since October 2009

Section	Description of Modifications
1.0	Changed total project mileage from 302 miles to 301 miles.

1.0 Introduction

The Bison Pipeline Project (Project) will involve installation of approximately 301 miles of 30-inch outside diameter (OD) natural gas pipeline and facilities in Wyoming, Montana, and North Dakota. Pipe installation will typically require trenching to a minimum depth of 7 feet below existing grade. Preliminary data review has identified several areas along the alignment where bedrock may be encountered at less than 5 feet below ground surface and rock removal techniques would be needed. Conventional excavation techniques will be used first, but in the event it becomes necessary to use blasting techniques to remove rock within the trench, all blasting and blasting-related activities will be performed in accordance with the guidelines presented in this Blasting Plan. Specific areas where blasting may be required will be determined during construction.

2.0 Purpose

This Blasting Plan is intended to serve as an overall guidance document for all blasting on the Project; however, the blasting contractor will be responsible for generating an overall Contractor Blasting Plan (CBP) and a written Site-Specific Blasting Plan (SSBP) for each individual area where blasting activities will take place for Bison's approval. Bison will then submit the Company-approved CBP to the Federal Energy Regulatory Commission (FERC) for approval in its Project Implementation Plan. The SSBP will be submitted to the Company for review and for final acceptance by the third party FERC Monitor prior to the commencement of any blasting. Requirements and procedures may vary from one blasting work area to the next due to state or local requirements.

If blasting is required, Bison Pipeline LLC's (Bison's) contractor will perform pre-blasting investigations and will implement blasting techniques in accordance with local, state, and federal regulations and the 2006 International Fire Code. The contractor performing the rock blasting will be responsible for obtaining blasting permits and providing the required notification prior to blasting activities.

3.0 Pre-Blasting Impact Assessment

3.1 Blasting Abatement

If feasible and practical, depending on rock characteristics, alternative bedrock trenching techniques such as ripping and cutting, hydraulic hoe-ramming, rock trenching equipment or non-explosive demolition agents will be used. If blasting is deemed necessary, efforts will be made to avoid or minimize the following potential adverse impacts: ground vibration, air blast overpressure, generation of fly rock, generation of dust, generation of noxious gases, and chemical residue in the subsurface. Methods to prevent these adverse impacts include the design of the actual loads/charges, configuration, delays and the use of blast mats, where necessary.

3.2 Potential Impact Assessment

Prior to initiating blasting operations, and as part of preparation of a CBP and SSBP, the contractor will assess the potential impacts from the proposed blasting operations on nearby residential or other structures, aboveground and below ground utilities, roadways, treed areas, waterbodies, and other sensitive environments or habitats. If federal, state, local, or Occupational Safety and Health Administration (OSHA) regulations dictate minimum distances for assessing or protecting from blasting impacts, these distance thresholds will be followed. If no such regulations exist, the impacts will be assessed and monitored as set forth in the CBP and SSBP. Estimated charges to be used during blasting shall be indicated in the CBP.

Pre-blast condition surveys will be performed on all structures within a prescribed distance from the blast zone. These surveys will include videotape or photographic documentation of structure conditions, and will include any observable cracks in foundation or structure walls, conditions of window glass, and other features as appropriate.

In addition, the locations of private or public water supply wells and springs within 150 feet of potential blasting sites will be identified and documented. Information regarding the well construction (e.g., well depth, casing type/diameter/depth, water depth, water-bearing formations and well yield) will be obtained and reviewed, if available. Well yield will be verified by Bison's EI before and after blasting activities to assure that no appreciable change has occurred as a result of blasting.

4.0 Blasting Procedures and Requirements

The CBP shall provide general specifications for all blasting activities, including safety procedures, and must be submitted for Bison approval. In addition to meeting applicable state and local requirements, the contractor will also provide the SSBP describing detailed blasting specifications to Bison for review. Both of these documents will need additional approvals by FERC. No blasting will be performed without prior approval of Bison and these agencies.

4.1 Contractor's Blasting Plan

A qualified blasting engineer or consultant will oversee the preparation of the CBP, which will include blasting procedures and an engineering report showing recommended blasting charges and methods to be used at specific locations. The CBP will be approved by Bison or its consultant prior to any blasting activity. The CBP will include, but not be limited to, procedures for:

- Storage, handling, transportation, loading, and firing of explosives;
- Communication with authorities and landowners;
- Pre- and post-blast inspections;
- Mitigation controls for flyrock, noise reduction, and misfires;
- Safety procedures (e.g., fire prevention, signs and flagmen, and warning signals);

- Mitigation of environmental impacts; and
- Disposal of waste blast material.

Procedures specified in the CBP will recognize that blasting may be required adjacent to existing overhead or underground utilities, roadways or trails, environmentally sensitive areas, farmland, or areas with potential geologic hazards. The CBP will also include:

- The names of blasting professionals along with copies of licenses and a statement of qualifications summarizing the experience of each professional;
- The names and credentials of all monitoring personnel;
- Typical blasting design criteria:
    - Description of blast products and their justification for selection;
    - Delay type and interval;
    - Maximum charge per hole and per delay;
    - Method for initiating explosives;
    - Stemming material and tamping method; and
    - Hole diameter and pattern;
- A schedule identifying when blasting would occur within a water body greater than 10 feet wide, or within a designated coldwater fishery;
- A description of vibration monitoring equipment, including manufacturer and specifications;
- Copies of all required federal, state, and local permits;
- Magazine types and locations for storage of explosives and detonating caps;
- Test shot forms; and
- Blasting log forms.

4.2 Site-Specific Blasting Plans

All blasting-related activities will be performed in accordance with an SSBP (prepared by the blasting contractor) and will include measures for avoiding, abating, or minimizing potential impacts at a unique location. The following is a list of minimum requirements that must be satisfied by the SSBP. It is possible that additional, specific local requirements not listed herein may be required.

- Prior to blasting, the contractor will provide 48 hours advance notice to all applicable and potentially-affected parties, including adjacent property owners, local municipalities, and other parties as may be required by the FERC Certificate conditions, project permits, or applicable regulations. Locations of structures, utilities, wells, or wetlands within a minimum of 150 feet of the blasting location(s) (or other distance as may be required by regulations) will be inventoried and assessed;

- Controlled blasting techniques will be designed specifically to impact only near-surface materials (i.e., limited in intensity to fracture only shallow rock) to facilitate construction. Ditch blocks will be used during trench blasting;
- The SSBP will contain a Safety Plan that will include, at a minimum:
    - Measures that will be taken to execute the work in a manner that minimizes potential for injury to project personnel, the public-at-large, and adjacent/nearby properties. This could include the use of blast mats if there is the potential for fly rock to damage nearby structures, etc. Blasting will be kept at a minimum distance of 200 feet from any aboveground or belowground structure, and all personnel will be cleared within 1,000 feet of the blasting area;
    - Contact information for all project managerial and emergency personnel, including the local fire department, and any others as may be required by applicable permits;
    - Procedures to follow in the event of injury or other emergency;
    - Procedures for establishing sentries as needed to prevent access to the blast zone(s) by unauthorized personnel. Sentries will be deployed on all pathways (blocked access roads, closed roads, etc.) to the blasting area;
    - Procedures for fire safety in accordance with a Fire Prevention and Safety Plan, including restrictions on blasting in periods of high fire danger;
    - Procedures for explosive materials handling, storage, and use;
    - Proper safeguards for personnel in the event of a misfire until the misfire can be re-blasted or safely removed;
    - Communication protocol between vehicles and office facilities, including cease-use restrictions during blasting activities;
    - Personal protective equipment and tool restrictions to avoid sparking around explosives; and
    - Measures to be implemented for prevention and suppression of wildfires;
- The SSBP also will contain details regarding, but not limited to:
    - Primary rock type and geologic structures (e.g., competence, massive or fractured);
    - Blast hole spacing, blast charge weight, delay type or configuration, and other design aspects to be used to minimize impact as depicted in the Blasting Procedures below;
    - Explosive material cut-sheets, including chemical content of the materials and potential by-products;
    - Provisions for a system of signage and warning signals to warn of impending blasting activities and access limitations;
    - Methodology (blasting mats or pads) for containing fly-rock, dust, fumes, and noise;
    - Proposed vibration monitoring locations;
    - Provisions for a monitored test blast to assess the effects of the blasting as proposed and the potential need for modifications to the blast methodologies;
    - Proposed hours of drilling and blasting operations;

    - Loaded blast holes will not be left unattended;
    - Blast holes will not be left loaded overnight;

- Specific procedures for the transportation and storage of explosives and blasting materials; and
- Other criteria as appropriate.

Magazines used for storage of explosives must be located on properties permitted for use during the Project if explosives are stored on-site. Explosives will not be stored on state or federal property without written permission from the agency affected by the storage. Magazine locations will be in accordance with local, state, and federal regulations. Magazines will be located in accordance with the 175th anniversary edition of the Blasters Handbook and ATF P5400-7 Explosives Law and Regulations (Bureau of Alcohol, Tobacco, and Firearms) where no regulations apply.

4.3 General Blasting Procedures

The CBP will set forth procedures that will include, at a minimum, five test shots not exceeding 20 feet in length that are monitored with three channel seismographs. The contractor will use the data from the test shots to establish standard shot in terms of pounds of explosives per delay. Production shot procedures and delays will be identical to test shot procedures and delays. Each major change in geology, change in explosive manufacturer, or change in explosive grade as determined by Bison will require new test shots.

In order to provide material suitable for use as backfill after the pipe has been installed, the drilling pattern will be designed to achieve smaller rock fragmentation (maximum 1 foot in diameter). All proposed drilling patterns will be submitted to Bison for approval prior to drilling. The following action items represent minimum requirements and are intended to only provide a general order to the blasting procedure:

- A health and safety tailgate meeting will be held prior to any blasting activities, and all personnel involved with any task associated with the blasting will attend. All safety rules and signaling will be covered during the meeting;
- Warning signs will be placed around the blasting area;
- Lightning detectors will be set up in the blasting area;
- All drilled holes will be accurately measured for both depth and location;
- Seismic equipment will be set up to measure velocities near the pipeline and any structures 200 feet or less from the blast;
- Distances to any nearby structure (aboveground or belowground) suspected of being 200 feet or less from the blast will be measured;
- The blasting affected zone will be cleared;
- Sound the warning signal;
- Sound the blast signal;

- Detonate the blast;
- Inspectors will inspect any aboveground or belowground facilities for damage after the blaster has checked for misfires and given the "ALL CLEAR" signal; and
- Complete the Blasting Log.

4.4 Explosive Types

Some explosives and detonators can have adverse impact on the subsurface in the form of environmentally-harmful residue in soil, bedrock or groundwater. Examples are:

- Explosives that contain perchlorate compounds; and,
- Ammonium Nitrate Fuel Oil (ANFO). If ANFO detonation is not oxygen-balanced, it can result in incomplete detonation and nitrate residue can remain. In addition, ANFO produces significant quantities of gas during the explosive process, which in some circumstances can increase the risk of flyrock.

To avoid potential adverse impacts, special trenching-type explosives which are designed specifically for trench blasting and do not contain perchlorates or ANFO will be required for use on the project.

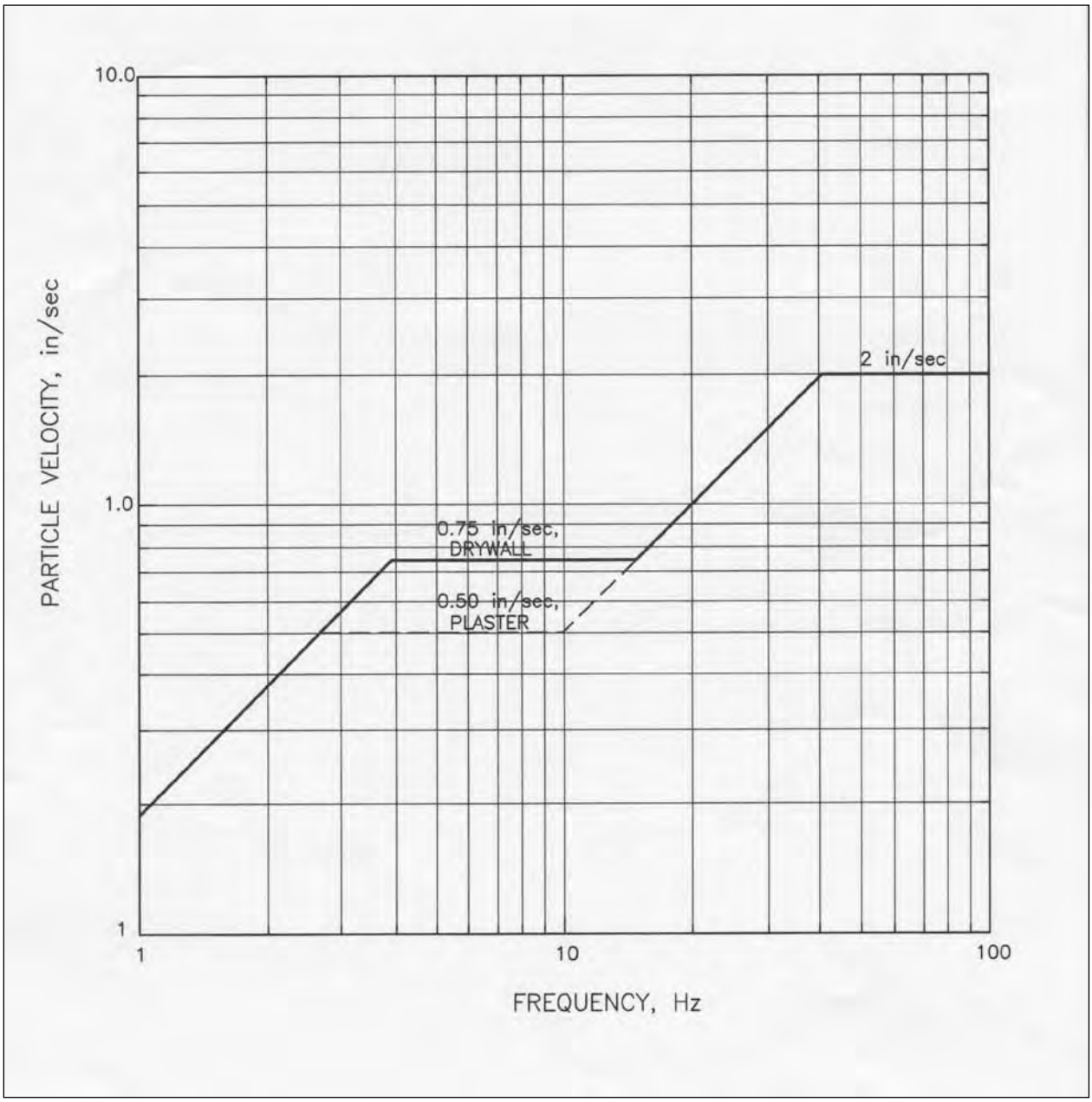
4.5 Vibration Monitoring

As specified in the SSBP, blast vibration and airblast overpressure monitoring will be performed and reported for each round by an experienced, qualified firm. Appropriate documentation will be maintained and available for review by applicable agencies in accordance with the SSBP.

Unless otherwise approved, ground vibrations at adjacent and nearby structures will be kept below the safe limits recommended by the U.S. Bureau of Mines (USBM RI 8507, 1980), which are provided on **Figure 4.5-1**. These limits are based on the frequency and the peak particle velocity of the blast vibrations, and are generally-accepted limits for preventing cosmetic damage to residential structures. These limits may vary in accordance with state-specific or local regulations or codes.

Unless otherwise approved, air blast overpressures will normally be kept below a limit of 133 decibels (dB) (Peak Impulsive), or 0.013 pounds per square inch (psi), which is the limit recommended by the U.S. Bureau of Mines to prevent damage to windows and minimize annoyance (**Figure 4.5-1)**. The maximum peak particle velocity allowed will take into consideration protection of the stability of natural slopes, and to minimize environmental impacts to wells, springs, waterbodies, wetlands, wildlife, and habitat.

Figure 4.5-1 - Blasting Vibration Limit Criteria



Source: U.S. Bureau of Mines (USBM RI 8507, 1980)

4.6 In-Stream Blasting

To date, there is no evidence of a requirement to implement a SSBP in a flowing stream bed. If rock is encountered, conventional excavation and hammer techniques will be used first. If these techniques are not successful then, in addition to the requirements identified in this document, the Contractor will incorporate the following measures when conducting blasting in streams.

- As required in Bison's Procedures, Contractor will provide the Company with sufficient prior notice of in-stream blasting so that FERC (and any other applicable agency) may be apprised of the event at least 48 hours before blasting.
- Blasting equipment will not be allowed to ford or drive into any waterbody at any time. All work will be conducted from equipment positioned on the bridge or banks.
- For dam and pump crossings, blasting will only occur after installing dams upstream and downstream of the trench (blast) area.
- For flume crossings, flume pipes can be installed after blasting but prior to trenching.
- If required by regulating agencies, a series of scare charges will be detonated immediately prior to trench blasting to disperse fish from the blast area.
- If required by regulating agencies, pre- and post-detonation monitoring will be conducted to determine the extent, if any, of fish mortality.
- Any fly-rock in streams will be collected immediately and disposed of at an approved disposal site.
- Time allowed for completion of the crossing of a waterbody does not include blasting activities.

5.0 Post-Blast Activities

Upon completion of blasting in a given work area, the following post-blast activities will be implemented:

- Notifications of work completion will be made to the agencies or parties as required by the applicable permit and as specified in the SSBP;
- Post-blast surveys will be completed of those structures, if any, for which a pre-blast survey was performed;
- Documentation of the vibration monitoring, and pre- and post-blast survey results will be provided to applicable agencies as required by permit and as specified in the SSBP; and
- Other permit-specified post-blast requirements, as necessary.

6.0 Lightning Hazards

Lightning strikes pose a serious risk of accidental detonation when thunderstorms or electrical storms are in the vicinity of a blasting site and there are loaded holes on-site. All loading and blasting activities will cease immediately, and personnel will seek shelter a safe distance from the work area. All explosive materials and initiation systems are susceptible to initiation by lightning. If the Contractor determines that such a hazard exists, work will be discontinued for all operations and workers will retreat to a pre-determined safe zone away from the loaded holes when an approaching storm front is within 5 miles. Work will continue only after the nearest lightning activity is at least 5 miles beyond the blasting area. Bison will have on-site approved lightning detectors that are capable of measuring the degree of electrical activity associated with an approaching storm, and the distance to the storm front from the instrument located on the Construction Right-of-Way (ROW).

7.0 Environmental Concerns

The CBP will outline procedures to identify and address environmental concerns along the Construction ROW, including site-specific requirements. An environmental review and checklist will be included in the CBP, which will address the following:

- Prior to blasting, the EI will survey the proposed blasting zone to ensure that areas with threatened or endangered species have been identified;
- Special procedures to minimize disturbance (e.g., noise, air blast effects) of environmentally sensitive areas such as streams, wetlands, and special habitats, and to mitigate the effects of blasting;
- Procedures to protect special status species or prevent the deterioration of existing habitat. Implementation of mitigation measures where blasting is required to excavate the trench and Endangered Species Act-listed wildlife species have a known presence or where survey data do not support a probable absence within 1 mile of the blasting site;
- Compliance with site-specific requirements described above in Section 4.6 when blasting near or within streams, including mitigation procedures to minimize the effect on aquatic ecosystems;
- Implementation of a dust control plan for drilling operations;
- Evaluation of the effect of blasting operations on ambient air quality;
- Acceptable noise levels and guidelines for limiting shot size and frequency of blasting to control noise levels;
- Prevention of unstable geological conditions that may result from blasting operations such as landslides, mudslides, or ground failure, which could result in hazards to people or property;
- Protection of water supply wells, springs, and seeps; and
- Special procedures that will need to be implemented if in-water blasting is required for the Project, including the use of air bubble curtains or other protective equipment.

8.0 References

Du Pont Company 1980. Blaster's Handbook – 175th Anniversary Edition, Explosives Products Division.

Federal Bureau of Alcohol, Tobacco, and Firearms (no date). ATF Explosives Laws and Regulations. ATF P5400.7, Washington, D.C.: Federal Bureau of Alcohol, Tobacco, and Firearms.

Siskind, D.E. Stagg, M.S., et al 1980. United States Bureau of Mines Report of Investigators 8507: 'Structural response and damage produced by ground vibration from surface mine blasting'.