

**Addison Natural Gas Project – Phase I
Best Management Practices for Blasting to Avoid Environmental Contamination**

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Best Management Practices for Blasting to Avoid Environmental Contamination

Best Management Practices (BMP's) include preparing, reviewing and following an approved blasting plan; proper drilling, explosive handing and loading procedures; observing the entire blasting procedures; evaluating blasting performance; and handling and storage of blasted rock.

Note These BMP's are based on Blasting BMP's developed by the state of New Hampshire and the Institute of Makers of Explosives

1. **Drilling and Loading practices.** The blasting contractor shall utilize the following drilling and loading practices to minimize environmental effects.
 - a) Blasthole boring logs shall be maintained by the driller and communicated directly to the blaster. The logs shall indicate depths and lengths of voids, cavities, and fault zones or other weak zones encountered as well as any groundwater conditions the driller notes (This is not a formal assessment of groundwater).
 - b) Blastholes shall be within five (5) degrees of the intended orientation.
 - c) Blastholes shall be drilled within one foot of the intended blast pattern.
 - d) Explosive products shall be managed on-site so that they are either used in the borehole, returned to the delivery vehicle, or placed in secure containers for off-site disposal.
 - e) Unpackaged/unsleeved ANFO and emulsions shall not be used if artesian or water flowing conditions are encountered.
 - f) Loaded explosives shall be detonated as soon as possible and shall not be left in the blastholes overnight unless weather or other safety concerns reasonably dictate that detonation should be postponed.
 - g) Loading equipment shall be cleaned in an area where wastewater can be properly contained and handled in a manner that prevents release of contaminants to the environment.
2. **Explosive Selection.** The following BMPs shall be followed to reduce the potential for groundwater contamination when explosives are used:
 - a) Explosive products shall be selected that are appropriate for site conditions and safe blast execution.
 - b) Explosive products shall be selected that have the appropriate water resistance for the site conditions present to minimize the potential for hazardous effect of the product upon groundwater.

3. **Ammonium Nitrate and Fuel Oil (ANFO).** The following BMP's shall be followed to reduce nitrate or other impacts when ANFO is used:
 - a) Identify blastholes containing water and remove water prior to loading with ANFO.
 - b) Water resistant ANFO (ANFO-WR) shall be used in blastholes that recharge with groundwater and remain wet even after pumping.
 - c) ANFO should be handled in a manner to avoid spills.
 - d) If spills of ANFO or other blasting agents occur at the ground surface around the blasthole collars, these shall be cleaned up promptly and the ANFO either reused or taken off site for appropriate handling or disposal.
 - e) Adequate unloaded collar lengths shall be established to reduce both "blowback" when loading pneumatically and blasthole proximity effects.
 - f) Proper "standoff" distance and loading vessel pressure shall be maintained to reduce "blowback" during pneumatically loading ANFO.
 - g) Partially used bags of ANFO shall be resealed and returned to the explosive magazine.
 - h) Loading equipment shall be cleaned in an area where the water can be properly contained and handled in a manner that prevents releases.
 - i) Explosives shall only be delivered to the site in approved magazine trucks and should not be stored overnight on-site unless there is a demonstrated need for an on-site explosives magazine.

4. **Bulk emulsions and slurry/watergel explosives.** The following BMP's shall be followed to reduce nitrate or other impacts when bulk emulsions or slurry/watergel explosives are used:
 - a) Spills of the product shall be removed from the spillage area, and either reused or taken off site for disposal.
 - b) Proper loading techniques shall be followed when loading a bulk product into a wet blasthole. The bulk liquid product should be extruded into itself from the bottom of the blasthole and not into the standing water above the product.
 - c) If groundwater conditions are severe, e.g., artesian/flowing conditions, packaged explosives (emulsions, watergels, slurries, blends, cartridged, etc.) shall be used instead of bulk products or as required by the Blasting Engineer.

5. **Blasthole stemming.** The following BMP's shall be followed when placing stemming in blastholes:
- a) Blastholes shall be cleaned out thoroughly using the compressed air stream from the drill to remove the drill cuttings.
 - b) Drill cuttings shall not be used as stemming.
 - c) Stemming shall be placed to prevent bridging, and shall be appropriately sized for the blasthole diameter.
 - d) Blastholes shall be completely stemmed to prevent incomplete detonation.
 - e) Weak zones, voids, and cavities shall be stemmed as decks to prevent the loss of explosive products into the bedrock.
6. **Misfires.** One or more of the following BMP's can be followed to help prevent misfires
- a) Redundant surface delays to connect blastholes if shifting mats, uneven terrain or other conditions could cause cut-offs shall be used.
 - b) Double or triple priming of the blastholes shall be done as applicable depending on the depth of the hole.
 - c) Using electric detonating systems shall be considered.
 - d) Using programmable electronic detonating systems shall be considered.
- 7) **Muck Pile Management.** Muck piles (the blasted pieces of rock) and rock piles shall be managed in a manner to reduce the potential for contamination by implementing the following measures:
- a) Remove the muck pile from the blast area as soon as reasonably possible.
 - b) Manage the interaction of blasted rock piles and storm water to prevent contamination of water supply wells or surface water.