Manual Section 7	Issue Date 11/14/07	Revision Date 06/15/21	Policy Number LLCP-083
	Hydro-Blasting		

Purpose
To provide minimum requirements for the safe operations of hydro blasting or water jet cleaning equipment with rated pressures up to 2700 bar (40,000 PSI).

For the purposes of this Guideline, the term "hydro blasting" covers all hydro blasting and water jetting activities.

Scope
All LLC Companies including, Blanchard Industrial, LLC, GIS Engineering, LLC, Grand Isle Shipyard, Inc., and GWIS, Mack Steel, NuWave, Sun Industries; hereafter identified as "Company".

Policy
This Policy provides guidance for the operation of hydro blasting equipment. It describes methods for eliminating or reducing hazards and risks associated with hydro blasting.

This Policy provides guidance for:

- High pressure hydro blasting systems pressurized by positive displacement pumps with an output capability greater than 400 bar liters/minute;
- High pressure hydro blasting operations carried out at pressures above 200 bar and includes hydro blasting operations involving the use of additives and abrasives; and
- Hydro blasting operations below 200 bar where there is a foreseeable risk of injury to operators or other persons.

All personnel who have the need to perform hydro blasting for the Company must abide by this Policy. The Policy applies to all Company employees, Contractor Employees and Contractors.

Immediate Supervisors of personnel operating hydro blasting equipment are responsible for ensuring the requirements of this Policy are followed by their respective work crews.

Introduction
The use of hydro blasting equipment is a potentially hazardous activity. Special precautions must be taken in order to operate the equipment safely and effectively.

Hydro blasting is identified as:

AS/NZS 4233.1 Category	**Pressures**	**Use**
Class A	800> Class A < 5600 bar liter per minute	General use, steam cleaners, pressure washing equipment
Class B	Class B > 5600 bar liters per minute	Special use, very high pressure, high volume

Hydro-Blasting

Class A high pressure Hydro blasting equipment may be operated by a single individual. This person is usually a mechanic, laborer, or process person and not a specialty contractor. Common use for this equipment is concrete cleaning, cleaning pump bases, and other routine housekeeping work.

Class B Hydro blasting is normally a specialty hydro blasting task. The Company has detailed safety procedures considering equipment requirements, operating procedures, and operator qualifications. The job supervisor is responsible for compliance with Company procedures. In accordance with AS/NZS 4233.1:1999 single person operation of this equipment is permitted under the following conditions:

- Where the operator is physically isolated from the pressurized water flow;
- Where there is no risk of the operator being exposed to the jet impact; or
- Where the presence of other hazards does not expose the operator to other occupational, health and safety risks.

Responsibilities

Operations

- Provide proper location for setup of equipment.
- Verify hydro blasting equipment set-up does not interfere with plant, equipment or operations.
- Ensure electrical equipment in the work area has been isolated and protected from water ingress
- Ensure hydro blasting in completed from a stable work surface.
- Only approved scaffolds shall be used while hydro blasting. No stools, benches or ladders are allowed.
- Operations personnel or Equipment Owner must issue the appropriate Work Permit or Isolation Permit prior to Hydro blasting work commencing (in accordance with site procedures).
- Ensure barricades and signs are in place. Signage must indicate:

  "DANGER: HIGH PRESSURE WATER JETTING EQUIPMENT IS IN USE"

Maintenance/Contractors

- Review procedures to ensure the minimum requirements are met.
- Inspect all equipment. Ensure hydro blasting equipment is in good operational condition and safety features are functional. Equipment must comply with the requirements of AS/NZS 4233.1:1999.
- Maintenance to coordinate with Operations regarding the selection of a location for the equipment and to ensure spacing requirements is met.
- Supervisor to verify completion of items on the permit and that appropriate signage is in place.
- Supervisors are responsible for personnel operating the equipment are appropriately trained and follow established procedures
- Supervisors are to assure that all hydro blasting teams consist of a pump operator and a nozzle operator at a minimum.
- All operators engaged in Class A and Class B Hydro blasting operations should carry an immediately accessible, waterproof medical alert card outlining:
  - Possible nature of injuries and post-accident infections that can be caused by high pressure water jetting;
  - Provide details of immediate first-aid treatment until medical treatment can be arranged; and
  - Provide the name/s of personnel who should be contacted for expert medical advice.

HAZARDS AND CONTROL MEASURES

Hydro blasting is an activity with significant inherent hazard. If work tasks are approached inappropriately, significant risks with the potential for serious injury, including fatality are possible.

As such, hydro blasting activities should be approached with a risk control hierarchy approach:

- Firstly, where possible, hydro blasting activity is to be avoided and other methods of cleaning reviewed for practicality (e.g. chemical cleaning).
- Secondly, where hydro blasting activity is required, remotely controlled mechanical cleaning devices should be considered in order to separate the operator from the high pressure water hazards.
- Thirdly, where manual hydro blasting is required, only experienced operators are to be used, appropriate procedures are to be followed and minimum mandatory PPE is to be worn.
    - Customer permits must be obtained and include at a minimum a description of the job, precautions to protect electrical equipment, maximum operating pressure and list of qualified personnel.

When manual flexi-lance cleaning of exchanger tubes is required, fail safe (anti withdrawal) devices attached to the equipment must be used to prevent the lance exiting the tube in a uncontrolled manner. The manual use of hydro blasting equipment will only be utilized as a last resort where the use of other automated or mechanical equipment cannot be used.

The adoption of this philosophy significantly reduces risk exposure, and the potential for personal injury.

Operator Training

The Company will ensure all personnel assigned to hydro blasting operations are satisfactorily trained in the safe operation of equipment required to perform the task at hand. Training shall include a video, or slides of the Company's training program, showing hydro blasting equipment cutting through material expressing the need for an employee to stay out of line of fire (e.g. cutting through wood) and the need for immediate medical attention if penetration of personnel happens. At a minimum training should encompass the requirements outlined in AS/NZS 4233.1:1999. Areas which should be addressed are:

- System Operation
- Personal Protective Equipment
- Cutting Action/Penetration
- Control Devices
- Equipment maintenance
- Compatibility
- Hoses
- Stance

It is the responsibility of the Supervisor of the job to verify proof of training.

PPE Requirements
The PPE worn by operators of hydro blasting equipment should reflect the activities being performed. Whatever the nature of the job, the following PPE is mandatory for operators or those within the blasting area when hydro blasting:

- Hard hat
- Mono Goggles
- Face shield
- Hearing protection
- Heavy duty rain suit or hydro blasting suit
- Protective gloves (dependent on the material / substance being handled or exposed to and the hazard and risk presented to the operators)
- Hydro jet safety rubber boots (with built in metatarsal protection) with steel toe caps
- Other equipment as required if a hazardous chemical is involved.

The Work Permit and JSEA will identify if any additional or specialized personal protective equipment as necessary.

MINIMISING HAZARDS – HYDRO BLASTING GUIDELINE

To minimize the hazards associated with the use of hydro blasting equipment, follow this general hydro blasting Guideline:

General Considerations

NOTE: Hydro blasting equipment has varying working pressures and flow rates. The operating pressure should never exceed the rated pressure of the equipment. Use of equipment with pressures above 2700 bar (40,000 PSI) is not covered by this Guideline.

> WARNING:
>
> WHEN HYDRO BLASTING WITH HAND HELD EQUIPMENT, A COMBINATION OF PRESSURE AND FLOW RATE CAN PRODUCE SIGNIFICANT TORQUE THAT MAY CREATE AN UNCONTROLLABLE SITUATION.

- The blasting equipment should be set-up in an area that is not congested, out of major personnel traffic routes, and is a safe distance from operating equipment as determined by the operating pressure and flow rate of the hydro blasting equipment.

NOTE: If possible, the hydro blasting equipment and work should be located off-site and equipment to be cleaned (e.g. exchanger bundles) transported to the remote cleaning site.

- If access to a blasting area is requested or an unauthorized person enters the blasting area, all operations shall be stopped. Work must not be resumed until the area is cleared.

- Hydro blasting systems should be depressurized if not in use and left unattended, equipment malfunctions or replacement of components or repairs are being made to the system.
- Special hydro blasting techniques such as two-person operation when water lancing, adding fittings onto shotgun, etc., should be discussed with the Company job supervisor before initiating. It is mandatory for a JSEA to be developed for all hydro blasting activities.
- Objects to be cleaned shall not be held manually.

Equipment

- The hydro blasting equipment area must be barricaded using red barricade tape with white lettering stating " DANGER: HIGH PRESSURE WATER JETTING EQUIPMENT IS IN USE". Barricade tape should extend out 10 meters (30 feet) in all directions from blasting equipment. Hoses extending from equipment to blasting area should be surrounded by barricade tape and signs.
- If it is not possible to isolate the prescribed area, sturdy barriers/ panels must be placed/erected to shield operations.
- The pumping unit must be equipped with a safety valve and/or rupture disc capable of rapidly relieving the full capacity of the pump. These safety devices should be checked to ensure a tag is attached indicating they have been properly tested and are operational.
- The pumping unit should be located to minimize the length of hoses required. Considerations should be given to the distance from operating equipment. Select a location that does not require running hoses through an active access way or work area. Care must be taken to protect hoses from damage by vehicular traffic, hot lines/equipment, or external abrasion.
- The operating pressure of the high pressure hose and fittings should not exceed 1/3 of the rated pressure or 40% of the burst pressure of <u>any</u> of its components. Hoses should be inspected before each job and tested every three months at 125 percent of rated pressure. Hoses must be tagged with the latest test date and test pressure.
- Blasting equipment must be grounded to minimize static electricity build-up. Equipment being blasted must also be grounded.
- Quick connect/disconnect fittings are not permissible for use for hydro blasting. Hose connections must have a secondary joining mechanism to prevent whipping if the connection is broken.
- Minimum length of the shotgun barrel (nozzle) is 120cm (48-inches). The minimum length of entire shotgun is 165 cm (66-inches).
- Shotguns shall be equipped with double-action switches. The double-action switches should be positioned so that both the operator's hands are required to initiate high pressure water flow.

NOTE: A dump valve which will immediately dump all the water pressure when the control is released is the only approved fail safe control.

- When lancing, a foot or hand operated fail safe control with guard should be manipulated by the lance operator. In some operations such as lancing exchanger tubes or line moleing another person must be used to assist with the lance or hose. Only the lance operator (person nearest the working end of the lance) should operate the fail-safe device.

WARNING:

AT NO TIME SHOULD THE FAIL-SAFE CONTROL BE TIED DOWN OR LOCKED INTO POSITION. INJURY COULD RESULT IF THE FAIL-SAFE IS BYPASSED OR LOCKED.

- Stinger rods, longer in length than the diameter of the pipe will be used when line moleing large bore piping 15cm and larger. A stinger rod is a rigid piece of pipe affixed to a line mole to prevent reversing of mole in the line. The combined length of the hose connection, stinger, and nozzle shall be a minimum of 1.5 times the diameter of the pipe being cleaned unless the pipe being cleaned has a “T” then the combined length shall be 3 times the diameter of the largest pipe.
- Moleing device or lance shall require minimum 2’ end identification when a pipe flange is available. If no flange or other means to secure anti-reversal device is used, the hose/lance shall require a 2’ end identification marking and a 4’ end identification marking of a different color or different pattern.
- When line moleing operations are to be done, an "anti-withdrawal" device securely fastened to the pipe flange must be installed to prevent the removal of the mole nozzle while still under pressure.

Housekeeping
During cleaning operations, accumulations of materials may form at the pipe/tube openings. Work should be stopped and the materials removed when a safe work position or working surface cannot be maintained. This is particularly important where the work area is confined, such as platforms and scaffolds and where material debris may accumulate from the cleaning process.

Working Surfaces
Blast equipment must be operated from approved work surfaces. Due to excessive back thrust exerted on the operator, the use of ladders and "A" frames are not acceptable as work platforms.

APPENDICES

Appendix A Hydro blasting Requirements

Appendix B Hydro blasting Operation Checklist

APPENDIX A

Hydro blasting Requirements

1. Site selected for equipment setup/location is out of major personnel traffic area and is a safe distance from operating equipment.

WARNING: HYDROBLAST EQUIPMENT MAY INCLUDE INTERNAL COMBUSTION ENGINES. SELECT SUITABLE LOCATION TO SETUP EQUIPMENT.

2. Contractor has set up equipment in location designated by Process or Maintenance Supervisor.
    a. Red Barricade tape with white lettering stating "DANGER WATER BLASTING" is extended around the hydro blasting equipment as required for personnel and operation safety.

3. If hydro blasting equipment cannot be adequately spaced from process equipment or personnel traffic, additional sturdy barriers/panels must be installed, such as installing plywood, to provide equipment and personnel protection.

4. Hoses properly installed/attached and pressure test inspection tags verified.
    a. Inspection tag date is within last 3 months.

NOTE: Quick connects / disconnects are not permissible for hydro blasting use.

5. Hoses are properly protected and barricaded.

6. Hydro blasting equipment/hoses are grounded to prevent static electricity.
    a. Verify equipment being cleaned is grounded.

7. Pumping unit is equipped with safety relief devices and have been checked.

8. Entire shotgun lance and barrel (minimum length of barrel/nozzle is 120cm) are at least 165 cm long.

9. Equipment has foot or hand operated fail safe controls that are manipulated ONLY by the lance operator.
    a. For exchanger cleaning an additional operator may be required to walk the lance.

10. Mechanical to complete Appendix B, Hydro blasting Operation Checklist. (Checklist must remain at job site)

APPENDIX B

Hydro blasting Operation Checklist
Work Permit may be required to complete checklist

Unit or Area: _____ Work Date:_____

Description of Process Equipment: _____

Work to be Done: _____

Hydro blasting Equipment: _____ Maximum Pressure: _____ Flow Rate: _____

Signature of Persons Performing Work

_____

_____

Mechanical Supervisor or Contractor can initial if completed
Equipment connected to proper water supply source?

Training and experience verified?

Personal protective equipment available and inspected?

Hydro blasting equipment does not interfere with process operations?

Pump positioned, leveled, and safety relief device operational?

Fail-safe valves, switches or devices operational?

Hoses properly inspected, assembled, and tested?

Barricades in place and warning signs posted?

Waste handling considered and properly managed?

REVIEWED BY: _____
Supervisor

DATE: _____ TIME: _____