Section 49.0
BLASTING AND SPRAY PAINTING

A. Purpose

1. The purpose of this procedure is to establish guidelines for all personnel in blasting and painting and help **JAGUAR ENERGY SERVICES, LLC** with compliance of 29 CFR 1910.94(a).

B. Scope

This procedure applies to all personnel including **JAGUAR ENERGY SERVICES, LLC**, client, and/or visitors while at one of **JAGUAR ENERGY SERVICES, LLC**'s facilities while blasting and painting.

C. Responsibilities

1. The Safety Coordinator or his/her designee is responsible for ensuring that employees have completed the training required by this procedure.
   (a) Additional responsibilities include:
      (i) The implementation of this Policy.
      (ii) Take corrective actions on all violations or suspected violations of this procedure.
      (iii) Documentation of completion by each employee.

2. The Safety Director is responsible for providing assistance in the implementation of this Policy.

3. The Supervisor is responsible for providing assistance in the implementation of this policy.

4. All employees are responsible for understanding the requirements of this procedure and conducting all work-related tasks according to these requirements.

D. Procedure

Abrasive blasting and spray painting can cause airborne particles, be a source of ignition, pollute the atmosphere and/or be harmful to personnel.

1. For those reasons **JAGUAR ENERGY SERVICES, LLC** has requirements for utilizing spray painting equipment and abrasive blaster equipment in accordance with 29 CFR 1910.94(a).
   - (a) All local, state and federal air pollution standards will be adhered to.
   - (b) All employees and contractors performing this type of work will comply with these regulations.

2. Operational Requirements

Prevention of damage to personal property due to overspray warrants one or all of the following fundamental safeguards.

- (a) Determine wind direction and speed before conducting spraying operation (wind sock, contact weather station, a piece of light-weight material hung near area, or wind velocity meter).
- (b) Do not attempt spray painting operations if wind velocity and directions are such that the overspray is carried a distance beyond the spraying area to nearby surfaces that could be damaged.
- (c) Remove personal property from the vicinity of the spraying area.
- (d) Perform spray painting during off-shift (weekend), when exposure to personal property is at a minimum, or there is not exposure.
- (e) All paint storage buildings must have explosion proof lights and conform to the Fire Prevention Section.
- (f) Employees shall take all possible precautions to protect themselves, others and equipment against the hazards of the abrasive blasting operation.
- (g) Spray painting will only be allowed with prior approval by the Supervisor in charge.
  - (i) A hot work permit is required before abrasive blasting in any process location except in areas are that designated as non-hazardous abrasive blasting areas.
- (h) Used blasting agents are to be removed from work area in such a way to avoid dust; e.g., vacuum pickup or wetting down and shoveling.
  - (i) Disposal of spent abrasive is to be coordinated by **JAGUAR ENERGY SERVICES, LLC** and/or client(s) Safety and Environmental group.

(i) All painted surfaces shall be tested for lead prior to blasting.
  (i) If painted surfaces are found to contain lead, refer to **JAGUAR ENERGY SERVICES, LLC**'s procedure for lead.

3. Signs

Warning signs shall be posted in conspicuous locations to warn employees and visitors to the worksite about the hazards associated with exposure to silica.

(a) The blasting should be done in a specified zone, where dust is visible, and the area roped off with posted signs.
  (i) The signs should read "Caution - Sandblasting and Painting in Area"
  (ii) The signs shall also specify the proper personal protective equipment (PPE) required in these areas.

4. Silicosis

All employees that operate sandblasting equipment and coworkers subject to silica exposure, shall be trained and provided information about the adverse health effects, safe work practices, Hazard Communication and the proper use and care of all personal protective equipment (PPE).

(a) All cases of silicosis shall be reported to the State Department of Health and to the Occupational Safety and Health Administration (OSHA) within five (5) days of diagnosis.
(b) Silicosis is characterized by the shortness of breath, fever and bluish colored skin.
  (i) It could be diagnosed as pulmonary edema (fluid in the lungs), pneumonia or tuberculosis.
  (ii) Silica dust can cause severe fungal infections to develop.
  (iii) This condition could be fatal.
(c) There are three (3) types of silicosis.
  (i) Acute
    (i) Exposure to extremely high concentrations can cause symptoms to develop within weeks to months.
  (ii) Chronic
    (i) Exposure for 10 years to low concentrations of silica dust can cause signs and symptoms to occur.

(iii) Accelerated
(i) Exposure to high concentrations for 5 - 10 years after initial exposure.

(d) If a practical substitute with less health hazard than silica sand can be found, it should be used.
(i) However, substitute with caution.

(e) Expensive silica and substitutes are re-used and an accumulation of toxic dusts from paints and coatings may present additional hazards.

5. Medical Surveillance

All workers exposed to crystalline silica shall be subject to a medical surveillance program and medical examinations.

(a) Such examinations shall occur prior to job placement and at least every 3 years thereafter.

(b) More frequent examinations may be required for workers who are at risk, such as those with acute or accelerated silicosis.

(c) Medical examinations shall include at least the following items:
(i) A complete medical and occupationalhis/hertory of the employee
(ii) Chest x - rays
(iii) Pulmonary functions testing
(iv) Annual tuberculosis evaluation

6. Personal Hygiene Methods

Employees working as sandblasters should use personal hygiene methods as often as possible.

(a) A change shack, or other dust free area, should be provided for breaks and changing.

(b) Prior to leaving the worksite, employees shall either decontaminate their clothes or change into clean clothes.

(c) Adequate hand washing facilities must be provided with paint removing products.

(d) All sandblasters should wash their face and hands before eating, drinking, or smoking.

(e) There should be no eating, drinking or smoking in the sandblasting area.

(f) Workers should shower prior to leaving the worksite.

(g) Vehicles should not be parked in contaminated areas.

7. Engineering Control Methods

Air monitoring must be performed to measure worker exposure to air borne crystalline silica and to provide a basis for selecting engineering controls.

(a) Engineering control methods shall be used to decrease exposure to silica dust.

(b) Some of these include:
  (i) Use of alternate blasting media.
  (ii) Containment methods such as blast cleaning machines.
  (iii) Cabinets.
  (iv) Blasting rooms.
  (v) Portable equipment.

(c) If engineering controls cannot keep silica exposures below the NIOSH PEL respiratory protection must be used.

8. Personal Protective Equipment (PPE)

Respirators and blasting hoods are NIOSH/MSHA approved and used in accordance with the manufacturer's specification and 29 CFR 1910.134.

(a) Breathing air systems must meet the requirements of 29 CFR 1910.134.

(b) Eye wash bottles or stations will be made readily available at all blasting and painting locations.

(c) The operator required to wear hearing protection.

(d) In confined places where another employee is within range and exposed to the sand jet, he/she shall wear the full sandblaster's outfit.

(e) Sandblasters shall wear only approved sandblasting helmets with air-flow control valves and air filters approved for such use.

(f) Where employees are exposed only to the dust hazard, goggles and a proper respirator will provide adequate protection.

(g) When blasting and/or painting operations require personnel to work over 6" above ground or deck level proper Fall Protection equipment and procedures will be used.

(h) Workers should change into disposable or washable work clothes at the worksite.
  (i) The employer shall furnish, at no charge, disposable work clothes (tyvek, etc.) for employees to wear while at the worksite.

(i) Workers should change into clean clothing before leaving the worksite.

9. Breathing Air Quality and Use

JAGUAR ENERGY SERVICES, LLC will provide employees using atmosphere-supplying respirators (supplied-air and SCBA) with only D quality breathing air.

(a) **JAGUAR ENERGY SERVICES, LLC** will ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:

(i) Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen.

(ii) Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:

(i) Oxygen content (v/v) of 19.5-23.5%

(ii) Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less

(iii) Carbon monoxide (CO) content of 10 ppm or less.

(iv) Carbon dioxide content of 1,000 ppm or less

(v) Lack of noticeable odor.

(b) That compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.

(c) That oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.

(d) That cylinders used to supply breathing air to respirators meet the following requirements:

(i) That cylinders are tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR part 173 and part 178).

(ii) That cylinders of purchased breathing air have a certificate of analysis from the supplier stating that the breathing air meets the requirements for Grade D breathing air.

(iii) That the moisture content in the cylinder does not exceed a dew point of -50 deg.F (-45.6 deg.C) at 1 atmosphere pressure.

(iv) **JAGUAR ENERGY SERVICES, LLC** will ensure that compressors used to supply breathing air to respirators are constructed and situated so as to:

(i) In a clean atmosphere to prevent entry of contaminated air into the air-supply system.

(ii) Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 deg.C) below the ambient temperature.

(iii) Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality.

(iv) Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.

(e) Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change.

(i) The tag shall be maintained at the compressor.

(f) For compressors that are not oil-lubricated **JAGUAR ENERGY SERVICES, LLC** will ensure that carbon monoxide levels in the breathing air do not exceed 10 ppm.

(g) For oil-lubricated compressors, **JAGUAR ENERGY SERVICES, LLC** will use a high-temperature or carbon monoxide alarm, or both, to monitor carbon monoxide levels.

(i) If only high-temperature alarms are used, the air supply shall be monitored frequently to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

(h) Fittings will be incompatible for non-respirable gases and container**s.**

10. Filter Changes

Conditions play a large part in the life of any filter/ cartridge such as humidity, environment, work location (Up-wind/down-wind), etc.

(a) These Operating Time Lines are more than adequate to protect the user.

Unit	**Replacement Time Line**

1. Air Line Filter (Bullard 41 Series Model 41 P-2) Monthly Basis
   (Note: If there is no sticker with the last change date on the unit ,change the filter.)
2. Organic Vapors /Acid Gases/P100 40 Paint Hours
3. Organic Vapors Cartridge 40 Paint Hours
4. Particulate Prefilter N95 Visual Inspection
5. Blasting (Hood Bullard 88 Series Respirator) Air Supplied

1. Equipment

Blasting nozzles are equipped with dead-man controls to enable the operator start and stop the blasting with one hand.

(a) This will assure positive shut off, and at no time should the dead-man control be taped or wired open.

(b) Pressure pots must meet ASME code requirements.

(c) Machines and hoses must be inspected daily and replaced immediately upon signs of excessive wear.

(d) Abrasive blasting equipment, the blasting nozzle, and the object being blasted are grounded.

(e) All hose couplings shall be wired together to prevent de-coupling.

(f) Machines and hoses should be inspected weekly, and all parts showing excessive wear should be replaced.

(g) When blasting and painting operations required the use of scaffolding proper procedures will be used.

(h) The sandblasting operator must be supplied with a fresh air hood designed for sandblasting operations and:

  (i) Be equipped with a vortex cooling tube.

  (ii) Have no visible dust leaks.

(i) All compressors will be equipped with high oil temperature/high CO level alarm if it will be used to supply Grade D breathing air.

(j) The air supply must meet all the Grade D requirements, and testing criteria, of the OSHA regulation 29 CFR 1910.134 or ANSI Z-88.

(k) Never attempt to adjust the nozzle while the abrasive is flowing.

(l) All air lines supplying air to workmen wearing positive pressure air hoods should be equipped with proper air filters.

  (i) The filter contents should be checked regularly.

2. High Pressure Water Blasting

High pressure water blasting is an efficient and rapid method to clean petrochemical and various chemical process equipment.

(a) The process is also used as a demolition tool for metals, concrete, and masonry.

(b) Tremendous energy is released by the high pressure water blasting, therefore it is necessary to properly train operators, maintain the equipment, and develop procedures for the safety of personnel, equipment, and property.

(c) The main hazard is the extremely high water pressures of the system.

(i) The cutting power can easily tear and puncture skin, causing both injury and infection.

(ii) Hazards also exist due to toxic or noxious fumes and gases generated and released during the processes.

(iii) Slip, trip, and fall hazards also exist due to accumulation of free standing water in the area where work is being performed.

3. Potential Energy of High Pressure Water

There is significant potential energy in the form of pressure in the water blasting equipment.

(a) This energy is released through the nozzle as kinetic energy.

(i) Kinetic energy, by definition is energy of a body that results from its motion.

(ii) It is equal to half the product of its mass and the square of its velocity: as opposed to potential energy.

(i) For example, at 9000 psi, water velocities at the nozzle exceed 750 MPH and produce 60 horsepower.

(ii) Note: These numbers vary slightly depending on the nozzle orifice size, water volume, and mass of the water delivered.

(b) Equipment

(i) Filter or Strainer

(i) These are located at the water intake to prevent particle

(ii) Excessive dirt in the system may damage the pump or plug the nozzle tip.

(iii) Water supplies should be potable.

(ii) Pumps

(i) Most high pressure pumps are positive displacement types with single acting plunger designs and three to five plungers per pump.
(ii) Water is discharged from the pump through the manifold to the flexible hoses.
(iii) Pump motors are typically diesel powered, but may also

(iii) Relief System
(i) The relief system consists of a relief valve and rupture disc at the manifold.
(ii) The valve should be capable of handling the full capacity of the pump at maximum speed.
(iii) The valve should be set at the maximum operating pressure and the disc should be set at a pressure less than the maximum rated working pressure of the pump to protect personnel and equipment.

(iv) Pressure Gauge
(i) The pumps should be equipped with a pressure gauge cable of reading at least 50% higher than the maximum working pressure of the total system.
(ii) The gauge should be clean and legible at all times, AND
(iii) Needle fluctuation should be at a minimum.

(v) By-Pass Valve
(i) The by-pass valve should be specifically constructed for this purpose.
(ii) There should be a safety factor of at least three times th

(vi) Hoses and Fittings Hoses and fittings shall be specifically constructed for this purpose.
(i) There should be a safety factor of at least three times the pumps maximum operating pressure.
(ii) Fittings SHOULD NOT be tightened when the system is under pressure.
(iii) Regular coatings of anti-seize on fittings threads is recommended.
(iv) Hoses should be shrouded to reduce wear and protection against water blast if hose burst.

(vii) Lance/Shotgun
- (i) The lance is a steel tube with nozzle attached to the hose.
- (ii) The minimum burst pressure of the lance should be at le
- (iii) The generally accepted practice is to maintain a lance/barrel length of at least 48 inches.
- (iv) Occasionally a job may require a shorter lance/barrel.
- (v) Safety factors involved in accepting those jobs should be weighed carefully and written procedures for length deviation shall be prepared.
- (vi) A double trigger system requiring one arm fully extended is sometimes installed in those circumstances.
- (vii) The lance shall not be set down when the system is tinder pressure.
- (viii) The trigger system or deadman control shall not be defeated at any time.
- (ix) A safety shroud shall be used on all hand-held dump gun whip hoses.

(viii) Dump System
- (i) The dump valve permits the operator to release pressure in the system upon releasing the trigger.
- (ii) The system pressure should be the same as the water source pressure when the dump valve is open.
- (iii) Foot-controlled deadman dump valves require a shielded switch to prevent inadvertent turn-on of the water pressure.

(ix) Nozzle Tips
- (i) The nozzle tip produces a specific formed jet stream.
- (ii) Different nozzles will produce different jet streams, and the design depends on the work to be performed.

(x) Whip Cheeks
- (i) A restraining device used to compromise whipping actio

4. Operating Sequence

The operating sequence of the equipment should be as per the following outline.

(a) Assemble and inspect the water blast system.

(b) Attach the water supply and cheek for system leaks under no load situation.

  (i) Visibly check hoses for frayed wires. Engage the pump and check for leaks again.

  (ii) DO NOT TIGHTEN FITTINGS UNDER PRESSURE.

  (iii) Flush pump and all hoses prior to putting tip on.

(c) Hand signals shall be developed for communication between the lanceman and the pump operator.

(d) There should be one manifold shut-off valve for each hose line.

5. Planning and Preparation

The safe and efficient operation of the equipment can be obtained if proper planning and preparation for the job is done.

(a) A written job procedure shall be developed for each type of water blast operation.

  (i) For example, one for heat exchangers, one for tank cleaning, one for bundle blast equipment, etc.

  (ii) The procedure should outline potential hazards, safety procedures, first aid requirements, and environmental problems.

(b) Equipment should be inspected prior to the job.

  (i) The expected job layout should be reviewed for equipment needs, personnel needs, and barricade applications.

(c) Standards requiring equipment replacement shall be developed and reviewed.

(d) Proper nozzle and tip selection.

(e) Erection and use of scaffolding equipment.

(f) Yard training should be conducted prior to job site activities.

(g) Electrical lines in the work area need to be avoided and/or protected against contact or overspray.

(h) Access to the work area shall be demarcated for safe ingress and egress. Blasting from a ladder SHALL NOT BE PERMITTED.

6. Safety Procedures

Safe operations not only protect the personnel, equipment, and environment but also is the most cost efficient way to conduct business.

(a) This can be accomplished if the following things are done:
- (i) Correct layout and hook-tip of equipment
- (ii) Proper start-up, operation, and control of motor, pump, and lance/discharge system
- (iii) Operating procedures, work permits, and lancing tube and pipe cle
- (iv) Proper nozzle and tip selection
- (v) Erection and use of scaffolding equipment
- (vi) Yard training should be conducted prior to job site activities.

7. Personal Protective Equipment (PPE)

Minimum PPE should include:
- (a) Hard Hat
- (b) Face Shield
- (c) Goggles
- (d) Hearing Protection
- (e) Rain Gear/Acid Suit
- (f) Rubber Gloves
- (g) Rubber Steel-toed Boots w/ Metatarsal Protection
- (h) Shin Guards (when required) - check customer requirements

8. JETTING CONSIDERATIONS

The following procedures will be used while jetting.
- (a) Clear the work area.
- (b) Backstop required on exchanger work (plywood, etc.)
- (c) The operator closest to the nozzle always controls the dump.
- (d) Operate below the rated maximum working pressure of the hose.
- (e) Be prepared for back pressure from plugged tubes.
- (f) Install a rigid extension (approximately 18") at the nozzle tip for both warning protection and control.
- (g) Make sure the pressure is off before pulling the nozzle from the tubes.
- (h) Test the gun lever prior to operations.
- (i) Safety harness required on any scaffold 6' or higher while shot-gunning.
- (j) Barricade work area underneath scaffold with a 30' circumference.
- (k) Use whip cheeks at all high pressure hose connections.

9. FLEX LANCING

The following procedure will be utilized:

(a) Shield or barricade the back of the exchanger.
(b) Replace flex hoses when reinforcing braid is worn.
(c) The operator closest to the nozzle always controls the dump.
(d) Operate below the rated maximum pressure of the hose.
(e) Be prepared for back pressure from plugged tubes.
(f) Install a rigid extension (approximately 18") at the nozzle tip for both warning protection and control.
(g) Make sure the pressure is off before pulling the nozzle from the tubes.

10. LINE MOLEING

The inside pipe diameter should be less than twice the sum of the hose diameter. The intent is to prevent a blocked line from forcing a hose back to the opening.

(a) Procedures otherwise are similar to flex lancing.
(b) A rigid extension, the length of the pipe diameter, shall be used between the

11. WATER BLASTING SAFETY RULES

The following rules will apply to Water Blasting Operations.

(a) Eye protection shall be worn at all times.
(b) High pressure hoses shall not be used if there is any visible sign of damage.
(c) When clearing tubes or pipes with a flexible or rigid lance, the lance is to be
(d) Follow the checklist posted on the machine.
(e) Follow the start-up and tear down procedures.
(f) Water blasting requires extra safety equipment to prevent personal injury. At a minimum a raincoat, face shield, ear protection, goggles, rubber steel toed boots (w/Metatarsal Protection), and rubber gloves are required.
(g) The lance or shotgun shall always maintain proper footing.
(h) The lance operator shall always maintain proper footing.
(i) All personnel shall remain out of barricade area. If personnel should have to enter barricade, be fully geared to water blast.
(j) Do not, at any time, approach the lance operator without first shutting down the pressure.
(k) The operating pressure shall not be in excess of the pressure required to perform the work.
(l) No unauthorized attachments or modifications shall be made to the pressure unit, cleaning gun, or accessories.
(m) Lance operators shall alternate often to avoid fatigue (30-45 minutes is suggested).

(n) Equipment is to be properly maintained as outlined in the maintenance manual supplied by the manufacturer.

(o) Equipment, including pumps, hoses, guns and lances shall be cleaned frequently to prevent dirt and other foreign material from causing overpressures or malfunctions.

(p) Leaking fittings shall be replaced immediately.

(q) All exposed threads on hoses, lances, and guns shall be covered with tape when not in use to protect the connecting ends from being damaged or allowing foreign matter into the water system.

(r) Pipe wrenches shall not be used when tightening nozzles. Use of opened, adjustable, or channel-lock pliers is recommended to prevent galling or grooving he connections.

(s) Use Teflon tape when preparing any pipe joint, coupling, nozzles, or any screwed fitting. Do not let the tape overlap the end of the connection as the tape may shred off and clog nozzle orifices.

(t) Check all nozzles for clogging. Do not use clogged or partially clogged nozzles due to danger of over pressure.

(u) Rupture discs on the pump are to always be in working order. Rupture disc pressure ratings shall never exceed 20% above maximum working pressure of the unit.

(v) Twist all couplings to ensure they are in the locked position.

(w) Water flush water-blaster, hose, guns, and lances before putting nozzle (tip) to system.

(x) Always use whip checks at each high pressure hose connection.

12. Spray Painting

Employees using paint spray guns or painting materials which require respirators shall wear respirators with organic vapor cartridges or other approved respiratory protection as required by the manufacturer of the product being used.

(a) No spray painting will be permitted in the presence of open flames such as acetylene torches, gas burner, welding operations, heaters, etc.

(b) Paint solvents may only be used as a paint thinner and cleaner of painting equipment.

(i) They may not be used for personal hygiene.

(c) No coatings containing heavy metals (lead, chromate, etc.) or cleaners containing methylene chloride will be used by **JAGUAR ENERGY SERVICES, LLC**.

(d) Do not attempt to clean spray tip by passing fingers over the nozzle with the trigger open.
(e) Avoid skin contact with solvents and paint thinners.
(f) Air movers should be installed when painting or blasting in poor ventilating areas.
(g) Good Housekeeping is essential to prevent slips, trips and falls.
(h) When using paint requiring thinners, have adequate ventilation.
    (i) If you feel drowsy, nauseated or dizzy, stop work and get some fresh air.
    (ii) If the feeling persists beyond an hour, see the Supervisor.
    (iii) Exercise strict safety rules for all paints unless labeled non-toxic.
(i) Be extremely cautious when using water solvent paint around electrical outlets or electrical units.

B. Training Requirements

1. All Personnel will be trained on the following topics:
    (a) Hazard Communication
    (b) Respiratory Protection
    (c) LO/TO
    (d) Hearing Protection
    (e) Basic Fire Fighting
    (f) Proper Lifting.
    (g) Scaffolding and Ladder Safety.
    (h) Emergency Response
    (i) Contents of this procedure**.**

2. An adequate number of personnel will be trained on the following topics:
    (a) Basic First Aid.
    (b) CPR.

C. Training Frequency

1. Personnel will be trained according to the following schedule:
    (a) Initially upon hire.

Yearly thereafter.