Purpose and Scope
The purpose of this procedure is to complete the perforating operation in a safe, efficient manner while in compliance with all Fieldwood, Federal, State, and Local regulations.

Responsibilities
It is the responsibility of Operations Manager, Explosives Coordinator and Engineers/Eline Operators to effectively communicate these requirements to the applicable functional support groups and personnel involved, and follow this procedural guideline during the Explosive Job.

Process Acronyms
AC    Alternating Current
API   American Petroleum Institute
CIP   Continuous Improvement Process
DC    Direct Current
DOT   Department of Transportation
ESD   Emergency Shutdown Device
HSC   Hollow Steel Carriers
HSE   Health, Safety and Environmental
HMX   Her Majesty's Explosive
JSA   Job Safety Analysis
MOC   Management of Change
MSDS  Material Safety Data Sheet
NORM  Naturally Occurring Radioactive Material
PPE   Personal Protective Equipment
RP    Recommended Practices
RTG   Retrieval Tubing Guns

General
Safety and environmental consequences when deviating from your equipment operating limits and steps will require Management of Change (MOC).

Properties of, and hazards presented by, the chemicals used in the operations:
• Material Safety Data Sheet (MSDS) for the involved chemicals will be on the jobsite and made available for review during the JSA process.
• All Hazards shall be identified in accordance with the Job Safety Analysis (JSA) & Hazards Assessment associated with the chemical's MSDS.
• Personal Protective Equipment recommended within the chemical’s MSDS shall be donned by personnel when working with said chemical (i.e. Chemical apron and gloves, splash goggles with face shield, and appropriate respirator as required).

Precautions to adhere with to prevent the exposure of chemicals during operation to personnel and the environment:
• If chemical exposure occurs to personnel then follow MSDS recommended medical guidelines.
• Check for NORM in accordance with the Naturally Occurring Radioactive Materials (NORM) procedures.

• If a spill or release occurs, execute Oil Spill Response Plan (OSRP) procedures.

• Ensure all personnel are using proper PPE in accordance with the Personal Protective Equipment (PPE) Safe Work Practices.

Bypassing and flagging out-of-service equipment.

• If equipment is deemed out-of-service, Energy Isolation (Lockout/Tag out) control procedures must be followed, located in (Section D, Chapter 5) Safe Work Practices.

Any member of the crew, regardless of position has the RESPONSIBILITY to STOP any work, job, or task when un-safe conditions, practices or at-risk behaviors are observed.

Emergency Operations

• Emergency Response shall be identified in accordance with the Emergency Evacuation Plan (EEP) and/or Oil Spill Response Plan (OSRP)

Instructions

Initial Startup

• Inform everyone on site of plan and scope of work.

• Hold a pre-job safety meeting executing Hazard Control Procedures.

• Have pollution control plan appropriate for work to be performed in place.

• Ensure all personnel are using proper PPE including but not limited to hard hat, eye protection, steel toe boots, hearing protection, hand protection and flame retardant clothing worn properly in accordance with the personal protective equipment procedure.

• Area is to be clear of all non-essential personnel.

• Ensure that the work area around the well is completely covered (no open-holes) and is capable of supporting all equipment and personnel.

Normal Operations

This section covers perforating safety, procedures, and techniques. It does not cover the theory of perforating or the many types of devices available for perforating. Safety should be the main consideration for each and every perforating job. Even though we are using explosives for oilfield purposes, this does not detract from their killing power. If a job cannot be done safely, do not do it at all. It is the responsibility of each employee to know and follow Fieldwood's perforating procedures. The prime objective of perforating safety instructions is to develop respect, not fear, in the dangers of the job at hand. This section is by no means all encompassing; you are urged to read API RP-67 (Recommended Practices for Oilfield Explosive Safety).

It is the responsibility of all crew members to ensure that all explosive safety procedures are followed. Every employee is empowered by management to STOP any work, job, or task when unsafe conditions, practices or at-risk behaviors are observed.
Field Operations

Pre-departure Check

Prior to loading out for a perforating job, all the guns should be checked to ensure the charge type, shot intervals, number of shots, and phasing are correct. Make sure ported guns are pressure tested at the time of loading. In addition, the gun string configuration and length should be noted to confirm that all guns are in the proper firing sequence and that enough lubricators are taken, should it be required. Three other areas also need to be checked for the job.

a) One blasting cap will be needed for each gun. Anytime blasting caps are taken out of, or put back in the shop magazine, they must be inventoried and the magazine inventory book must be signed. The blasting caps must be carried in the original manufacturer’s box or detonator magazine which is to be properly mounted, locked and shunted.

b) A Hazardous Material Shipping manifest must be filled out every time explosives are transported. This paper identifies what type and amount of explosives are being carried. One copy will stay at the shop on the dispatch board with the Explosives Coordinator, one copy will go to the boat Captain, and one copy will go in the driver of the truck carrying the explosives with the red printing visible.

c) If applicable all perforating guns must be labeled with the appropriate DOT label affixed to the gun prior to transport. All perforating guns will display the DOT Hazard Class 1.4D label and sticker.

Remember, it is illegal to carry Hazard Class 1.1D explosives and radioactive material on the same truck.

Arrival on Location

Do not permit anyone to pressure you into doing something foolish or unsafe. Know what to do, how to do it, and do not get excited. Once the equipment is on location, a number of specific items must be carried out. You should consult the Explosives Field Safety Procedures Check List - Placard posted in each of the offshore double-drum unit.

a) Hold a Wellsite safety meeting. This meeting should include Wellsite Supervisor(s) and all personnel affiliated with this task to discuss any possible safety hazards.

b) No smoking except in designated areas. Smoking material must be stored when leaving these areas.

c) Remove platform wiring that might contact the electric line cable.

d) Check for voltage between the platform, casing, and cable armor with the blasters approved meter. Determine the source and eliminate any voltage greater than 0.25 volts.

e) Check the condition of the safety grounding straps by checking continuity between the grounding plug and the C-clamps. Install the safety grounding strap to the wellhead, the platform, and the unit. Remember to connect the grounding plug to the reel.

f) Confirm that no more than 0.25 volts is present between the platform and casing. Do not proceed with operations if residual voltage is in excess of 0.25 volts.

g) Turn off all radio transmitters within 1000 feet of the well. Radios must be disabled to the extent that an incoming call will not activate the transmitter. Follow Fieldwood procedure to close the heliport and notify Flights Ops. to generate a Helideck Closure.
Notification (NOTAM) Form.

h) If the well is within 2-1/2 miles of a large transmitter or if all wellsite transmitters cannot be turned off, contact your Operations Manager.

i) On water operations, install the additional positive grounding cable from the truck to the barge, or from the offshore unit to the power pack.

Rigging Up

a) Connect the cable head to the required equipment such as weights, collar locators, etc.

b) Check for cable insulation, continuity, and collars by shooting down the line.

c) You must ensure no explosives have been attached to the end of the cable.

d) Once the checks have been completed, the computer/power supply is powered down and the safety switch is turned off and the conductor grounded. Remove the key and the key will be in possession by an Eline Operator with an approved blaster’s or user’s license who will be attaching the gun to the cable. Turn off all A/C power sources.

e) Before attaching any explosive device, check voltage between the platform, casing and cable armor using a blasters safety multimeter. If any voltage in excess of 0.25 volts exists, eliminate it before proceeding.

f) If any voltage in excess of 0.25 volts exists, ascertain its nature:
   - Place multi-meter on "AC" position. Start on the 1000 mV scale and step down through each scale to the 200 mV scale reading each scales voltage. If there is an AC component to the voltage, the multi-meter will deflect. If there is not an AC component to the voltage, the multi-meter will not deflect.
   - Place multi-meter on the "DC" position. Start on the 1000 mV scale and step down through each scale to the 200 mV scale reading each scales voltage. This procedure measures the DC component of the voltage.
   - Track down and eliminate any source of voltage. Stray voltage must be below 0.25 volts to continue operations.
   - Attach the platform-to-casing ground clamps and perform electrical checks.

g) Layout the guns in the proper firing order. Check the guns and switches for insulation and continuity only with an approved Blasters Safety Meter.

Note: Use of a Simpson meter or equivalent will set off the blasting cap.

Arming the Perforating Guns

Only the Eline Operator with an approved Blaster’s or User’s License is allowed to arm or disarm a gun. Prior to arming conventional explosive devices the following actions must be taken.

- The Well Supervisor is designated to obtain radio silence to ensure all Cell Phones, CBs, Walkie Talkies are turned off. This will include the platform, lift boat and supply vessels in the immediate area.

- All welding operations are ceased prior to disarming the explosive devices.

- The heliport is to be closed and Flight Ops must be notified to generate a Helideck Closure
Notification (NOTAM) Form. Helicopters shall be instructed not to land or depart prior to disarming the explosives devices.

During any arming operation clear the line of fire. Only those immediately concerned with the arming should be present.

If a thunderstorm threatens to arrive on location within 30 minutes, do not arm the guns.

The cable must be attached to the gun string before any gun is armed.

When attaching the explosive device to the head, the Eline Operator performing this operation must ensure the cable conductor is properly grounded. The safety key must be in his/her possession and retained until the tool is at or below 200’ feet for land operations and 200’ below ocean floor (mudline) offshore.

a) Carefully remove the blasting cap from package.

b) Measure and record the distance(s) carrying case with the lead wires shunted together.

c) Place the blasting cap in the safety loading tube, close the top with the wires exposed, and tighten down the allen screw.

d) Continuity can be checked through the blasting cap using only an approved blasters safety meter. Caps with safety resistors should read approximately 50-55 ohms. Those caps designed for high temperature work or dump bailer squibs lack safety resistors and will read a short.

e) Cut one wire lead to desired length at a time. Do not simultaneously cut both lead wires. Wrap the detonator lead wires around your finger and strip the insulation off wires as needed.

f) Any detonating cord that is trimmed off shall be kept as required by local and/or state regulations and locked inside of the offshore workbox.

g) The use of a fluid sensitive cap is mandatory when bottom firing carrier guns.

h) Confirm the line of fire is still clear of all unnecessary personnel.

i) Check that the casing to platform voltage is still reading less than 0.25 volts.

j) Short the gun wires together one last time to check for sparking. While still in the safety loading tube, connect the blasting cap leads to the gun wires.

k) Make a fresh square cut on detonating cord using approved prima cord cutter or a razor blade with block of wood or plastic for back-up.

Note: Never cut with cap crimpers.

l) Remove the blasting cap from the safety loading tube and crimp it to the detonating cord using the blasting cap crimping pliers.

m) Prepare the gun and/or detonator for water from the collar locator to the top shot(s) and the overall gun length.

If there is more than one gun in the string, all but the bottom gun may be armed and connected together before they are connected to the head. This method allows you to check continuity and
Explosive Job Procedures

Perforating the Well

Pickup the gun(s) and proceed in the hole. At or below 200’ feet for land operations and 200’ below ocean floor offshore, turn on the safety switch, restore AC power and power up the surface equipment. Check to see that the collar locator and/or gun gamma ray is working. Use the proper Depth Control practice.

a) Correlate to any known markers in the hole such as SCSSV, nipples, EOT, liner tops, short joints, packer, etc. on the way in the hole. This will help confirm the correlation once you are on bottom.

b) Once on bottom, tie in, correlate to the collars, and if applicable log a strip across the interval to be perforated. Follow any specific from the approved procedures. be sure to include any markers present on the log record to provide adequate evidence that the correct correlation has been made. Wellsite Supervisor agreement and approval of the tie-in is required prior to perforating.

c) If there is a doubt to your tie-in, contact office immediately. Be certain the Wellsite Supervisor agrees with the correlation or tie-in prior to perforating.

d) Drop at least one collar below the interval to be perforated, if possible, and pickup into the correct perforating position and stop.

e) Confirm the gun position with the Wellsite Supervisor one last time to shoot the gun. DO NOT shoot the gun unless you are positive of your tie-in and the guns position. It is much better to make a second or third trip in the hole to substantiate your position than it is to go ahead and shoot the well off depth.

f) If there are more guns to shoot, then log up into the next firing position. Ideally, you will log past another collar before stopping. This will allow you to check for a change in cable stretch due to a change in gun buoyancy. Verify the proper polarity is selected prior to firing the gun. Repeat this sequence until all the guns have been fired.

g) Once all the guns are fired, log or pull out of position and up into tubing if applicable.

h) Proceed out of the hole.

i) If you suspect a misfire, you must come out of the hole before attempting to fire any other guns, unless you are using a dual diode switch. Otherwise, you run the possibility of shooting off depth.

Disarming Misfired Guns

Only the Eline Operator with an approved Blaster’s or User’s License is allowed to arm or disarm a gun. Prior to arming conventional explosive devices the following actions must be taken:

- The Well Supervisor is designated to obtain radio silence to ensure all Cell Phones, CBs, Walkie Talkies are turned off. This will include the platform, Liftboat and supply vessels in the immediate area.
- All welding operations are ceased prior to disarming the explosive devices.
• The heliport is to be closed and Flight Ops must be notified to generate a Helideck Closure Notification (NOTAM) Form. Helicopters shall be instructed not to land or depart prior to disarming the explosives devices.

Expendable Guns:
• Come out of well and stop at 200’ feet below ground level for land operations and 200’ feet below the ocean floor (mudline) for offshore operations. Then shut off generator, all power switches, patch cord and/or safety switch in "safe" positions. Safety key must be in the possession of person at the wellhead. Clear platform floor and possible line of fire. Check the casing and platform for stray voltage using the blasters meter.
• When gun clears rotary table or well head, cover the hole and lay down gun.
• Disconnect detonator from detonator cord as close to the detonator shell as possible using a blade and a wooden or other approved cutter. Never cut with cap crimpers.
• Insert detonator in the safety loading tube.
• Cut the detonator lead wires one at a time.
• Short (shunt) the detonator lead wires together.
• Store detonator in the detonator magazine for later disposal.
• If the leads on the detonator are too short to safely shunt with the cap in the safety tube, an alternate method is to wrap the detonator in aluminum foil.

Hollow Steel Carriers (HSC): With a carrier gun, the disarming procedure is complicated by the relative inaccessibility of the detonator and the possibility of pressure being trapped within the gun. The problem is further complicated by the numerous types of gun construction presently used in our arsenal.
• Clear all unnecessary personnel from the immediate area.
• If there is pressure control equipment on the well the gun should be bumped up into the lubricator. Once the gun is safely in the lubricator then the well may be shut in and any pressure bled off.
• The gun (and lubricator if applicable) should be laid down.
• You must be on the lookout for trapped pressure. Never stand in the path along which debris or fluid could be ejected. Always assume the gun has trapped pressure even if it has fired.
• Lay gun down - it may save some time later if the gun is placed on or near a substantial and immovable object that will permit a tie-down.
• If pressure is suspected, the gun MUST BE chained down prior to relieving pressure.
• Working from a safe position, back off bottom plug until both o’rings are exposed. If pressure exists, STOP and allow pressure to bleed off through bottom sub pressure channel before continuing to unscrew the bottom plug.
• If there are no signs of pressure and the plug turns freely, continue to unscrew plug slowly check continuously for any indication of pressure in the gun. During this procedure, do not stand in front of the plug.
After assuring there is no pressure inside the gun, you must first disarm the lower most guns before the gun is removed from the cable.

When the plug is removed, ascertain that the detonator is intact and in place.

If the detonator is in place:
1. Cut detonator from detonating cord as close to the detonator shell as possible using a blade on a wooden or plastic block.
2. Insert the detonator in the safety loading tube.
3. Cut detonator lead wires separately.
4. Leave as much detonating cord and wire with the gun as possible to permit rerunning if appropriate.
5. Short (shunt) detonator lead wires together.
6. Put detonator in magazine for later disposal.
7. If detonator lead wires are too short to safely shunt while in the safety loading tube, wrap the detonator in aluminum foil.

Retrieval Tubing Guns (RTG): As with the HSC the RTG disarming procedure is complicated by the relative inaccessibility of the detonator and the possibility of pressure being trapped within the gun.

Clear all unnecessary personnel from the immediate area.

If there is pressure control equipment on the well the gun should be bumped up into the lubricator. Once the gun is safely in the lubricator then the well may be shut in and any pressure bled off.

The gun (and lubricator if applicable) should be laid down.

You must be on the lookout for trapped pressure. Never stand in the path along which debris or fluid could be ejected. Always assume the gun has trapped pressure even if it has fired. Indications of trapped pressure may include the following:
- Hissing or bubbling at the perforated scallops.
- RTG retaining screws are difficult to unscrew or undo.
- RTG threaded subs are difficult to undo.

Lay gun down - it may save some time later if the gun is placed on or near a substantial and immovable object that will permit a tie-down.

If pressure is suspected, the gun MUST BE chained down prior to relieving pressure.

Working from a safe position, back off bottom plug until both o'rings are exposed. If pressure exists, STOP and allow pressure to bleed off through bottom sub pressure channel before continuing to unscrew the bottom plug.

If the bottom plug is attached to the gun body with allen screws and trapped pressure is suspected DO NOT remove the allen screws. Using a hacksaw blade cut across one of the scallop sections and allow the trapped pressure to escape.
• If there are no signs of pressure and the plug or allen screws turn freely, continue to unscrew plug or allen screws slowly continuously checking for any indication of pressure in the gun. During this procedure, do not stand in front of the plug.

• After assuring there is no pressure inside the gun, you must first disarm the lower most guns before the gun is removed from the cable.

• When the plug is removed, ascertain that the detonator is intact and in place.

• If the detonator is in place:
  1. Cut detonator from detonating cord as close to the detonator shell as possible using a blade on a wooden or plastic block.
  2. Insert the detonator in the safety loading tube.
  3. Cut detonator lead wires separately.
  4. Leave as much detonating cord and wire with the gun as possible to permit rerunning if appropriate.
  5. Short (shunt) detonator lead wires together.
  6. Put detonator in magazine for later disposal.
  7. If detonator lead wires are too short to safely shunt while in the safety loading tube, wrap the detonator in aluminum foil.

Exposed guns: Special care must be taken with exposed gun charges that have misfired in a gas filled hole. It is highly probable each charge will contain gas under well pressure. If the gun cannot be re-run in the well, a length of empty casing carrier with the port plugs in place and with the top and bottom subs installed without o’rings must be used as a transport tube. Disassembly must be coordinated with Operations Manager.

• Special care must also be taken with misfired High Temp guns which use HMX explosive. If the gun was exposed to temperatures in excess of 330 degrees F, the gun must not be unloaded for at least 48 hours. This allows the HMX to revert to its normal state of impact sensitivity.

• Remnant detonating cord and charges will need to be carried back, secured in a remnant box locked inside of the offshore workbox. Remnant blasting caps will need to have the wires shorted and be locked inside a blasting cap magazine locked inside of the offshore workbox. Never store remnant detonating chord or shape charges with blasting caps.

**Rigging Down**

a) Stop at 200’ feet below ground level for land operations and 200’ feet below the ocean floor (mudline) for offshore operations, power down the surface equipment and turn off the generator.

b) Remove the safety key to ground the cable conductor. The key must be in the possession of the Eline Operator who will be removing the gun from the line.

c) Prior to returning conventional explosive devices to the surface the following actions must be taken:
  • The Well Supervisor is designated to obtain radio silence to ensure all Cell Phones,
CBs, Walkie Talkies are turned off. This will include the platform, Liftboat and supply vessels in the immediate area.

- All welding operations are ceased prior to disarming the explosive devices.
- The heliport is to be closed and Flight Ops must be notified to generate a Helideck Closure Notification (NOTAM) Form. Helicopters shall be instructed not to land or depart prior to disarming the explosives devices.

d) Clear all unnecessary personnel from the immediate area.

e) If there is pressure control equipment on the well the gun should be bumped up into the lubricator. Once the gun is safely in the lubricator then the well may be shut in and any pressure bled off.

f) The gun and lubricator should be laid down.

g) Check the guns for any signs of trapped pressure prior to breaking them apart.

h) If pressure is found to be trapped inside the gun, it must be bled off prior to breaking the heads. The method of doing this depends on the gun type. Never stand in the path along which debris or fluid could be ejected.

i) With the guns broken down, all the intervals should be checked to look for individual misfires. If a misfire has occurred, you should consult the Office and the gun must be relabeled with the proper DOT label.

j) After the tools and equipment have been loaded, the area should be carefully checked for any remnant explosives. All detonator cord remnants must be secured in the remnant box. Remnant blasting caps must have their wires shorted together and be locked in the blasting cap magazine. Never store remnant detonating cord or shape charges with blasting caps. Prior to leaving location the Hazardous Material Shipping Paper must be updated to reflect the new explosive load returning to the shop.

Transport

a) Explosives may not be stored in any vehicle. Explosives may not be carried in any vehicle other than a duly licensed Common Carrier.

b) When Hazard Class 1.1 D explosives are carried on a truck, Hazard Class 1.1 D Explosive placards must be displayed on all four sides of the truck. Hazard Class 1.1 D explosives include some casing cutters. Whenever Hazard Class 1.1 D explosives are carried, the truck must stop at all railroad crossings. Hazard Class 1.1 D explosives may not be carried with radioactive material on the same truck.

c) Dangerous placards must be displayed whenever we carry more than 1000 pounds of explosives plus their carriers. This will take place when we carry a number of casing guns on the truck.

d) When loose charges or detonating cord are transported, they must be sealed in the original shipping container provided by the manufacturer.

e) Blasting caps must be carried in a blasting cap magazine, locked and secured with display DOT Hazard Class 1.4S sticker.

f) Primary explosives (detonators) must never be carried in the same box with – secondary explosives (Shape Charges, Detonating Cord).
g) Unusable detonator cord must be carried in a remnant box which is locked and secured.

Loading Facility
a) The loading facility is an area used for loading explosive devices and storing limited quantities of explosives. If possible, it should be separated from the main facilities and kept locked.

b) Otherwise, the loading area should be set apart from the rest of the shop with warning signs.

c) The Explosives Coordinator is responsible for assuring that the facility complies with all the regulations of the federal, state and local agencies.

General Safety Rules
a) Only authorized personnel should be in the loading facility at any time.

b) Visitors are forbidden in the shop without FIELDWOOD employees present.

c) Good housekeeping is essential.

d) Keep the floor clean. Sweep it daily and wash it from time to time.

e) No smoking, welding, or open flames are permitted in the loading shop.

f) "Explosives" and "No Smoking" signs must be prominently displayed.

g) The Operations Manager will inspect the shop from time to time to be sure all safety regulations are followed.

Handling of Explosives
a) The Explosives Coordinator will be in charge of explosives and magazines in which explosives are stored.

b) Do not throw, drop or handle explosives packages roughly.

c) Do not open or repack explosive packages with tools made of sparking metal.

d) Do not open packages while close to other explosives.

e) Empty shaped charge containers and packaging materials are to be used only for the storage of explosives. If they are to be destroyed, use the following procedures if local regulations allow:
   - Be sure the boxes are empty.
   - Remove or paint over any "Explosive" label(s).
   - Discard in trash container.
   - Do not carry blasting caps or explosives in your pocket.

f) Store loaded carrier shaped charge guns on racks.

g) Carrier guns stored in racks must have the gun head and/or butt removed.

h) Expendable guns assembled in advance must be kept in the locked loading area.

i) Keep a constant watch for broken or defective packages.

j) Do not let explosives or detonating cord lie on the bench. Put them away immediately after
use. Clean up spilled powder immediately.

k) Keep magazines locked.

l) Keep an accurate count of all explosives and loaded guns.

m) Only draw enough explosives from the magazine to use immediately.

n) Never use a steam cleaner on a loaded or partially loaded gun.

o) Use only manual or air operated tools for gun maintenance. Never use power tools of any kind for loading guns.

In Case Of Fire

a) Record the telephone number of local fire and police departments on telephone cradles at your location.

b) Facility Management should be familiar with the area around their building and should keep an up to date list of names and telephone numbers of immediate neighbors. This list should be posted beside the telephones in the location in case of emergency.

c) Show local fire officials where explosives are stored.

d) Never try to fight a fire near magazines in the loading facility. Should a fire breakout, evacuate the area. Get everyone a safe distance away, including persons living or working in the vicinity of the building.

e) Fire Extinguishers elsewhere in the loading facility are for use in keeping fires from reaching the magazines. All employees should know how to use fire extinguishers. All fire extinguishers should be checked at their scheduled inspection interval to make sure they are operative.