Hot Tapping and In-Service Metal Equipment Program

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1. PURPOSE

This procedure provides information to assist in safely conducting hot tapping operations on equipment in service. No document can address all situations nor answer all potential questions. However, the understanding of potential hazards and application of this knowledge can help reduce the probability and severity of incidents.

2. SCOPE

Hot tapping is the technique of attaching a welded branch fitting to piping or equipment in service, and then creating an opening in that piping or equipment by drilling or cutting a portion of the piping or equipment within the attached fitting. Hot tapping is usually performed when it is not feasible, or is impractical, to take the equipment or piping out of service, or to purge or clean it by conventional methods been safely made without interfering with the process operation.

Virtually every hot tapping job is different. A detailed, written, job-specific hot tap procedure must be developed before starting each job to help ensure that appropriate measures are addressed. These procedures may need revision in response to unique job-specific problems or situations that may arise concerning the safety of personnel and facilities.

This procedure applies to welding or cutting on unlined tanks, piping, vessels, and other process equipment fabricated from ferritic and austenitic steel. Other materials, such as aluminum, copper, plastic, and cast iron may be unsuitable for hot tapping or welding or may require special procedures. This procedure also applies to burning or welding of external attachments on equipment that has not been purged of flammable materials and applies to all hot tap operations performed in Mosaic's Phosphates Business Unit facilities.

Hot tapping is a "change" subject to review based on facility "management of change" (MOC) processes or procedures. Required forms shall be included in the MOC documentation.

3. DEFINITIONS

3.1 Competent Person – A person identified by the employer as being capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to personnel, and who has the authorization to take prompt corrective measures to eliminate them.

3.2 Hot Tapping – The technique of attaching a mechanical or welded branch fitting to piping or equipment in service and creating an opening in that piping or equipment by drilling or cutting a portion of the piping or equipment within the attached fitting. Hot Tapping, by definition, involves Hot Work on equipment in service.

3.3 Hot Work – An operation that can produce heat from flame, spark, or other source of ignition with sufficient energy to ignite flammable vapors, gases, or dust. Hot work includes such things as electric arc and gas welding, chipping, flaming, grinding, cutting, abrasive blasting, brazing, and soldering. Safe Work/Hot Work Permits are required when hot work is to be performed in certain areas

3.4 Qualified Person – A person designated by the employer who, by possession of a recognized degree, certificate, or professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated ability to identify and solve or resolve problems relating to the subject matter, the work, or the project and, when required, is properly licensed in accordance with federal, state, or local laws and regulations.

4. REQUIREMENTS

4.1 Job Analysis

4.1.1 General - Establish what needs to be accomplished, how the associated work is to be done, and whether hot tapping is appropriate. A work scope analysis should be

performed to determine if alternates to hot tapping exist within reasonable engineering and economic bounds and whether hot tapping is appropriate (see 4.2).

Analyze the work area and each activity closely for hazards. Refer to the SDS for the relevant materials and address the hazards as appropriate.

Contingency plans should be put into place for firefighting, personnel evacuation, and/or alternate methods (such as changes in plant operations) to finish the hot work without incident. Appendix D can be used to develop a hot tap emergency action contingency plan.

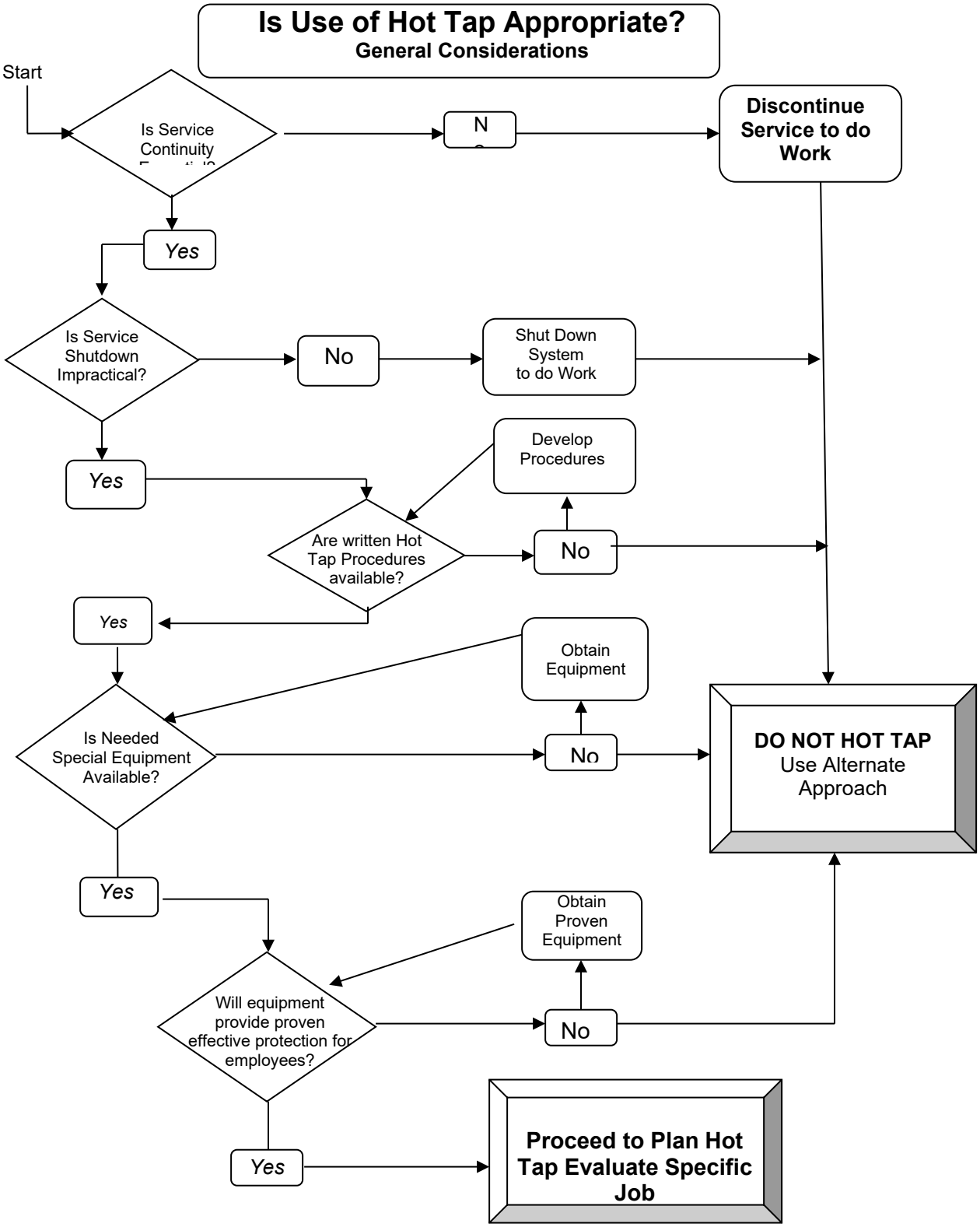
4.1.2 Determining Whether Hot Tapping Is Appropriate

Use the flow chart in Figure 1 in determining if the use of hot tapping is appropriate. Several criteria must be met to satisfy that this is both needed and safe. These criteria are:

a. Continuity of service is essential;
b. Shutdown of the system is impractical;
c. Documented procedures are followed;
d. Special equipment is used which will provide protection for employees.

As indicated in Figure 1, if all four of these criteria cannot be met, then hot tapping should not be done.

FIGURE 1 – DETERMINE IF HOT TAP WORK IS APPROPRIATE

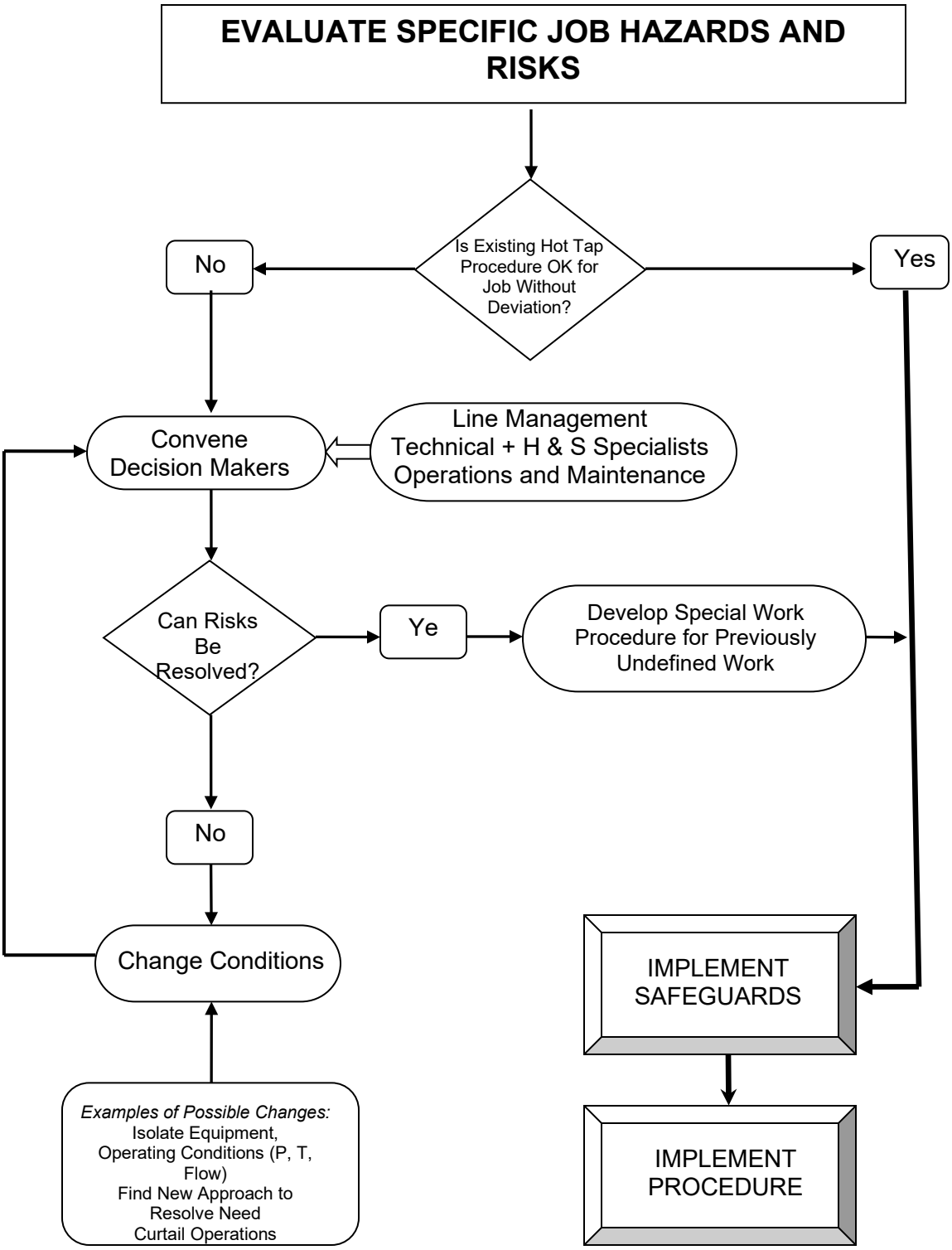


4.2 Job-Specific Hot tapping Review for Work Authorization

4.2.1 Decision Process for Authorizing Hot Tapping

Use Figure 2 (next page) to assist in hot-tap decision-making. First, consider the immediate safety considerations for accomplishing the work. Potential emergency response needs can be reviewed (See Appendix D). Then, the potential immediate and longer-term impact on other parts of the operation can be assessed.

FIGURE 2 - DECISION PROCESS FOR AUTHORIZING HOT TAPPING ON EQUIPMENT IN SERVICE



4.3 Hazard Evaluation and Risk Reduction

4.3.1 General

Hazards are inherent properties that relate to specific materials, activities, or situations. While these properties cannot be changed, with knowledge of the hazards a hazardous material might be removed, activities restructured, or an alternate work approach substituted. Thus, an exposure-dependent risk can be reduced or eliminated. A careful job analysis (See 4.1) and determination of whether hot tapping should be used should be made of potential hazards and the operations to be performed prior to starting work. This will help determine the appropriate procedures, safeguards, required engineering controls, and/or personal protective equipment necessary to perform the work (See 4.3). This safety analysis includes elements of a normal hot work permit procedure.

4.3.2 Hot Tapping Overview

Hot tapping involves both welding on equipment in service and cutting through the containment material. Both of these introduce significant elements which are different from normal “hot work.”

Hot tapping should not be emergency work. If precautions cannot be established in advance and accommodated, then the unit or equipment should be taken out of service or shut down. This is because:

a. There is typically a significant inventory of flammable material in vessels or equipment and thus containment is very important.
b. The welding associated with the hot tap can stress metal and heat fluids in vessels and piping.

4.3.3 Thermal Burn Hazards to Personnel and Risk Reduction

Hot tapping often involves cutting into contained flammable or combustible materials, the potential for a release is greater than in normal welding. The use of fire-resistant clothing is especially prudent for personnel working in the hot tap area.

4.3.4 Flammable Liquids, Vapors, Solids, or Dusts

Work area around the hot tap work site should be hydrocarbon vapor and gas free. Attention should be given to drums or other portable containers containing flammable or combustible materials.
When hot tapping is proposed for work on a vessel or piece of equipment within a unit while other parts of the same unit are in operation a Job Analysis (see Section 4) shall determine that no unconfined flammable or combustible material will be present in the

work area and that no reasonable probability exists of any such material entering the area while hot work is being done. Possible precautions may include, but are not limited to:

a. Covering common drains;
b. Ensuring all sewer traps are full and functional, using a steady flow of water when necessary; (Note: Caution must be taken to ensure that hydrocarbon does not enter the work area from sewers.)
c. Halting transfer operations in areas where tanks are receiving flammable liquids or gases;
d. Continuous monitoring to ensure that the atmosphere is free of flammable material;
e. Redirecting the discharge of any relief valves (RVs) in the area to a safe location.

In areas where hot tapping and associated welding are approved, process operators should be made aware of the work in process and must not release flammable liquids or vapor until the hot work has stopped. Hot work should not be permitted where adjacent equipment is being opened, disassembled, steamed, ventilated, or flushed without considering how such actions might affect the hot work.

4.3.5 Combustible Materials and Risk Reduction

Combustible materials should be removed from the work area or protected from welding sparks or slag. Non-combustible covers or “wetting down” are traditionally used. Wooden scaffolding is an example of a vulnerable combustible. Embers from burning wood can be blown some distance downwind and provide an ignition source in remote areas.

4.4 Welding And Hot Tap Metallurgy Considerations

4.4.1 General

The two primary concerns when welding on in-service piping and equipment are burn-through and cracking. Burn-through will occur if the un-melted area beneath the weld pool can no longer contain the pressure within the pipe or equipment. Weld cracking results when fast weld cooling rates produce a hard, crack-susceptible weld microstructure. Fast cooling rates can be caused by flowing contents inside the piping and equipment which removes heat quickly.
Consideration should be given to evaluating heat transfer during welding to determine the heat input and related welding variables in order to prevent overheating and burn-through of the in-service piping or equipment. Also, consideration should be given to evaluating the expected cooling rate of the weld to determine the heat inputs required to produce welds (and heat-affected zones) which are free of cracking.

An engineering evaluation should be conducted before in-service welding is performed on materials which contain laminations or other imperfections. Vessels or lines to be welded and hot tapped must also be inspected for adequate wall thickness and absence of imperfections. To minimize the risk of burn-through, the metal thickness should be adequate for the pressure (vacuum) and temperature involved so that the hot tapping machine, equipment, and personnel can be safely supported and operated.

A determination shall be made of the metal chemistry. The metallurgy of the weld materials, the hot tap fitting, and the welding (rod) electrode must be compatible with the metallurgy of the equipment to be welded or hot tapped.

4.4.2 Burn-Through Prevention

To minimize burn-through, the first weld pass to equipment or piping less than ¼ inch (6.4 mm) thick should be made with a 3/32 inch (2.4 mm) or small diameter welding electrode to limit heat input. Subsequent passes should be made with a 1/8 inch (3.2 mm) diameter electrode or smaller if the metal thickness does not exceed ½ inch (12.7 mm).

For equipment and piping wall thicknesses greater than ½ inch (12.7 mm), where burn-through is not a primary concern, larger diameter electrodes may be used. Where burn-through is of concern, care should be taken by avoiding the use of excessive welding current. In many situations, the use of low hydrogen rods may be preferable to reduce the possibility of burn-through and cracking when welding on high carbon-equivalency components. Some facilities avoid use of penetration electrodes to minimize the potential for burn-through.

4.4.3 Flow in Lines

For metal thickness less than ¼-inch (6.4 mm), some flow during hot tapping minimizes the potential for several undesirable conditions. Overheating liquids, burn-through caused by elevated metal temperatures, and fluid thermal expansion in closed systems are less likely when flow is maintained. However, higher flow increases the weld cooling rate and the risk of cracking. Therefore, when welding, it is desirable to provide some minimum level of flow while avoiding high flow rates. The need for a minimum level of flow is a trade-off between the need to minimize the risks of burn-through and cracking.

4.4.4 Metal Thickness

The piping or equipment base metal thickness must provide support for the new connection and the hot tapping machine. Alternately, reinforcing pads or auxiliary support of the hot tapping machine may be provided. The base metal must be free of laminations, hydrogen attack, or stress corrosion cracking. Imperfections which might

prevent a sound weld from being made must be evaluated by a qualified person or competent person with appropriate experience to conduct the evaluation.

Minimum base thickness requirements shall be stated in the written documentation for the job. A minimum base metal thickness of 3/16 inch (4.8 mm) is recommended for most applications of welding and hot tapping. The actual minimum thickness is a function of the thickness required for strength, plus a safety factor, usually 3/32 inch (2.4 mm), to prevent burn-through. Exceptions to the recommended thickness may be permitted when metallurgical requirements and pressure (vacuum) limitations specified by a qualified company specialist are met.

4.4.5 Fittings

A qualified or competent person shall select the proper fitting for the connection. Fittings must be properly sized to accommodate the hot tapping machine, to allow for full depth of cutter penetration within the travel limits of the machine, and to allow for uninterrupted tapping valve closure when the cutter and cut-out coupon are retrieved.

4.4.6 Post Weld Heat Treatment (PWHT)

When equipment and piping are unsuitable for welding in service because the metallurgy or thickness of the metal and/or the contents required Post Weld Heat Treatment (PWHT) which normally cannot be done while the equipment or piping is pressurized, mechanically attached fittings, or taking the equipment out of service must be considered.

4.4.7 Metal Temperature

Generally, welding should not be performed on lines or equipment when atmospheric temperature is cooler than -50^{O}C) unless special precautions, such as providing temporary shelter, space heaters, and so forth, are taken. API Std 570 notes that pipe material temperatures from +32^{o}F to +50^{o}F require restrictive welding measures including the use of specific electrodes.

Preheating may be required by the welding procedure to avoid cracking whenever the base metal has high carbon equivalency or high tensile strength.

4.4.8 Welding and Hot Tap Connection Design

Welding or hot tapping should not be permitted closer than 18 inches (46 cm) to flange or threaded connection or approximately 3 inches (8 cm) to a welded seam (including a longitudinal seam of welded piping) unless determined by an engineering review to be acceptable.

Choice of hot tap location should assure that the connection is positioned to allow for the installation, operation, and removal of the hot tapping machine. Access and egress in case of a potential release or emergency should be established and communicated to recognize concern for workers and to address emergency response needs.

Welding and hot tap connections and repairs and alterations must be designed to the applicable code.

The design shall cover the specification of gaskets, valves, and bolts. Reinforcing pads or saddles shall be included in the design when required by the applicable code.

4.4.9 Hot tapping Equipment under Vacuum

Hot tapping and hot work shall not be performed on vessels under vacuum (less than atmospheric pressure) unless a qualified person concurs after performing an engineering evaluation. Potential concerns are:

a. Heat from welding might cause the wall of the vessel to buckle locally and deform inward at the hot work location.
b. Deformation or buckling could cause the vessel to rapidly collapse.
c. If welding penetrates the vessel wall, the reduced pressure could draw in oxygen and allow the contents of the vessel to react at potentially violent rates.

4.4.10 Piping and Equipment Contents

Welding and hot tapping should not be performed on piping or equipment containing the following materials:

a. Vapor/air or vapor/oxygen mixtures near or within their flammable explosive range. The higher temperature from the heat of welding may cause a vapor mixture to enter the flammable range with the welding or subsequent hot tapping providing a source of ignition.
b. Oxygen or oxygen-enriched atmosphere. The oxygen may cause a vapor mixture to enter the flammable range and may affect the base metal being welded.
c. Compressed air systems, unless known to be free of flammables and combustibles, such as lubricating oil residues.
d. Hydrogen, unless an appropriate engineering review has been performed by a qualified person who approves welding on such equipment. Carbon and ferritic alloy steel is susceptible to high-temperature hydrogen attack during process operations. Therefore, a review must be conducted to ensure that the equipment has been operated with the Nelson curve for the particular steel involved.
e. Temperature-sensitive, chemically reactive materials (for example, peroxides, chlorine, or other chemicals which might violently decompose or become hazardous from the heat of welding). Engineering evaluation should determine the calculated hot work temperature and whether this could trigger a reaction.
f. Caustics, amines, and acids (such as HF acid), if the concentrations and temperatures are such that the original fabrication specifications require PWHT. These services may cause cracking in the weld area or heat-affected zone.
g. Certain unsaturated hydrocarbons (such as ethylene) may experience exothermic decomposition due to high temperatures caused by welding, creating localized hot spots on piping or equipment walls that could lead to failure.

Where hot work is being done on the outside surface of a vessel or piping, precautions should be in place to protect against overpressure due to thermal expansion of the contents.

4.5 Hot Tapping Machines

4.5.1 General

Hot tapping machines may be powered by hand, air, hydraulic fluid, or electricity. These machines must be able to retain and remove the blank or coupon. The seals and materials of construction of the hot tapping machine must be compatible with the contents in the piping or vessel. The material of the drill or cutter must be suitable for effective penetration of the metal of the piping or vessel being tapped. Hot tapping machines must be designed and constructed to withstand the temperatures, pressure,

and mechanical stress which may be imposed during their operation. The hot tap machine must be "special equipment which will provide proven-effective protection for employees".

4.5.2 Hot tapping Machine Considerations

Before hot tapping is attempted, the machine, cutter, and pilot bit should be carefully inspected to ensure that they are in satisfactory condition and capable of being left in service (if necessary) in the event of mechanical problems or hot tap valve leakage. All hot tapping machines have maximum and minimum working pressure, and high and low temperature ratings.

4.6 Preparations

4.6.1 Written Plans

Prior to conducting welding or hot tapping on piping or equipment in service, a written plan must be prepared which includes at least the following:

a. Connection design, location, and carrier thickness;
b. Hot tap procedure;
c. Detailed written welding procedure (qualified in accordance with the applicable code) documenting heat input, as appropriate;
d. Health, safety, fire protection, emergency response, and other appropriate procedures and instructions, including owner and user requirements.

Additional information when developing a written plan may be obtained from relevant codes and standards for qualification of welders and the fundamental ASME Code welding procedures to be employed.

4.6.2 Management of Change

During the Job Analysis and associated review by qualified persons, consideration shall be given to hazards that may be introduced to the process system as the result of planned use of the hot tap connection. This "Management of Change" review should conform to facility and regulatory requirements. The review should address any potential longer-term concerns related to the revised equipment as well as possible short-term effects during the hot tapping itself.

4.6.3 Personnel, Competency, and Qualifications

Hot tap machine operators and welders must be qualified in accordance with applicable code and specifications. They must be thoroughly familiar with the welding and hot tap equipment and procedures to be used. Only skilled competent personnel should mount and assemble the hot tapping machine.

4.7 Special Conditions

4.7.1 Hot Tapping and Welding on Tanks or Vessels

Welding on the exterior of tanks or vessels in service shall not be conducted unless controls are established and in place to prevent flammable vapors from reaching the area of welding. Work must be stopped immediately should any flammable vapors be detected in the welding area.

Hazards associated with welding or hot tapping on tanks in operation include (but not limited to) the following:

a. Tank venting, with vapors reaching the work area where welding is taking place;
b. Product within the tank rising and overflowing'
c. Inadvertently allowing the liquid level within the tank to fall below the point of welding, thereby losing the heat sink provided by the liquid and exposing the vapor space within the tank to an ignition source.

Welding should not be conducted above the liquid level or on a vessel which is double-walled and/or which has an internal lining such as glass, polymeric, or alloy cladding until inspection and analysis are made by a qualified person to determine whether it is possible to perform the work safely. If welding and hot tapping are to be done on the outside surface of a vessel, and if the area is otherwise safe for the use of an open flame, the following precautions should be employed:

a. Pressure within the vessel shall be maintained in a range determined to be acceptable by a qualified person during the job analysis.
b. Atmosphere within the vessel shall be incapable of being ignited because it is too rich or too lean or is non-combustible or non-reactive as determined during job analysis and associated reviews based on chemical analysis or other reliable evidence.
c. Welding should not be performed on metal contacting a vapor space without a heat sink.
d. Liquid level in the tank shall be maintained at least three feet (1 m) above the area where the work is being performed when welding or hot tapping on atmospheric tanks in service (because of the potential danger of creating an explosive atmosphere inside the tank vapor space).
e. To the extent possible, the tank should be static with no flow in or out.

f. Measurements of atmosphere tank levels should be verified by a hand tape gauge to verify the accuracy of automatic or remove reading gauges.
g. Adequate precautions shall be taken to prevent burning through the tank or vessel wall during welding associated with hot tapping.
h. If under a vacuum, the additional evaluations and precautions in 6.9 should be addressed.

4.7.2 Welding or Hot Tapping Above or Below Grade

For hot tapping (and the associated welding work) above or below grade, provisions shall be made for an easily accessible means of egress. To assure that the atmosphere in excavations and confined spaces is safe for entry and hot work, tests shall be conducted for oxygen, flammable vapors and toxic air contaminants, and permit(s) issued listing the requirements and approving the entry into the confined space and hot work therein. The job analysis should determine of regulatory "Permit Required Confined Space" provisions (such as 1910.146). API Std 2015 and API RP 2016 provide useful guidance for confined space entry and work. If oxygen deficiency, flammable vapors, or hazardous air contaminants are present, an air mover or other positive means of ventilation shall be provided. Respiratory equipment may also be required to provide protection from hazardous contaminants, vapors, or fumes emitted as a result of welding. Air monitoring may also be required during work activity to assure that air quality remains within the permitted safe work levels.

4.7.3 Welding or Hot Tapping on Lined Piping, Lined Equipment, or Cased Lines

Welding or hot tapping should not be permitted on in-service lines or equipment with cladding, or with glass, lead, refractory, plastic, or strip linings, unless specifically authorized by specialized procedures or following an engineering evaluation.

When welding or hot tapping on underground lines which run through casings, care must be taken to assure that the annular space is gas free and that the work is performed on the pipeline and not on the casing.

4.7.4 Hot tapping on Piping

Hot tapping on piping may have specific regulatory requirements (such as DOT for pipelines). Flow should be established in the line to carry heat away from the weld site (See 6.10) and to prevent buildup of hydrostatic pressure due to liquid expansion in static "blocked-in" piping. Reviews of piping and consumable welding material should be included in the job analysis. This review should determine potential thermal, or personnel hazards associated with the material contained in the piping. The need for knowledgeable review by qualified persons increases as temperatures and pressures increase.

4.7.5 Hot Tapping Upstream of Equipment and Valves

Avoid hot tapping upstream of rotating equipment or automatic control valves unless such equipment is protected from the cuttings by filters or traps.

4.8 Hot Tap Operations

4.8.1 Preliminary Requirements

Before proceeding with hot tapping or welding, the following conditions shall be satisfied:

a. A competent person is committed to be present during the hot tapping.
b. The area where the connection is to be made has been identified and physically marked.
c. The metal thickness has been verified and any metal imperfections that might prevent a proper weld have been completely evaluated and approved by a competent person. The measurements must be recent enough to represent the current metal condition.
d. A plan has been prepared to monitor and control process variables within their required limits while hot tapping or welding is being performed.
e. A contingency plan is in place. (This may include an Emergency Action Plan such as shown in the example in Appendix D.)
f. All necessary testing for flammable vapors, oxygen, and hazardous air contaminants has been conducted.
g. Potential safety and health hazards have been assessed and personnel protective equipment (including fire-retardant clothing) is available for use as necessary.
h. Appropriate hot work, hot tapping (and confined space entry if required) permits have been obtained and approved.
i. A dedicated fire watch has been established and equipped with a suitable fire extinguisher or pressurized fire hose. This person shall understand fire watch duties, be able to communicate with the personnel working in the area, and has been trained in the use of the equipment (see example list of duties in Table 2 of Appendix A)
j. Signs and barriers have been provided when warranted to isolate the job site from unauthorized personnel or the public.
k. Procedures have been prepared and are in place to isolate the work area in the event of an emergency.
l. Personnel are trained and familiar with the hot tap or welding procedures and the use and location of applicable equipment.

4.8.2 Welding in Preparation for Hot Tapping

The following requirements are applicable to the welding operation used as the first step in hot tapping:

a. Select and use a welding procedure which is qualified for the specific application as determined by a qualified person.
b. Assure that the welder is qualified for the specified procedure and appropriate code.
c. Assure that the fitting is positioned and supported before welding so that misalignment of the hot tapping machine will not occur.
d. Protect the weld area during cleaning, preparation, welding, and weld inspections if blowing dirt, snow, or rain is present.
e. Assure that downstream pumps designed to be equipped with screens or strainers have them in place in case of a lost coupon.

4.8.3 Inspecting the Weld

Visually inspect all attachment welds after welding and before attaching the hot tap machine. Dye penetrant, ultrasonic, or magnetic particle inspection is also recommended before the hot tapping machine is installed. If these are interim tests conducted after the first weld pass, the weld area must be thoroughly cleaned of any foreign material or residues before doing any more welding passes. *These procedures should not be relied upon to replace the need for hydrostatic or pneumatic testing.*

4.8.4 Installing the Hot Tapping Machine

When installing the hot tapping machine, follow the manufacturer's instructions and the following items:

a. The hot tap valve to be used must be of adequate size and rating, be of proper metallurgy, and be a full opening valve. The hot tap valve should be tested for seat leakage prior to installation (see API Std 598).
b. During installation the valve should be centered on the nozzle flange or fixture.
c. Run the boring bar through the valve opening to be sure the cutter does not jam or drag.
d. Carefully calculate the travel distance of the cutter to ensure that the tap can be completed within the dimensional limits, that the cut will be stopped before the cutter or pilot drill touches the opposite side of the tapped pipe or equipment, and that the retrieved cut-out coupon can be retracted far enough to allow unimpeded closure of the tapping valve.
e. Confirm that the bleed-off valve will hold pressure and is not plugged.
f. Ensure that precautions have been established for safe bleed off and disposal of material collected in the machine above the hot tap valve.

4.8.5 Testing the Weld and Hot Tapping Machine

The welded attachment and hot tapping machine should be tested to assure they are in accordance with applicable codes before the cutting is started, including the following:

a. Check tightness of bolts, packing, packing nuts, and any bypass line to avoid possible leakage.
b. If the current temperature of the line or vessel will permit, conduct a hydrostatic test of the welded attachment and hot tapping machine in accordance with the applicable code. The temperature of the metal should be considered to prevent brittle fracture. The test pressure should be at least equal to the operating pressure of the line or vessel to be tapped. The test pressure should not exceed the present internal pressure by more than approximately 10%, in order to avoid possible internal collapse of the pipe or vessel wall. However, if prevailing conditions could cause collapse of the pipe or vessel walls, the test pressure may be reduced.
c. If the temperature is such that a hydrostatic test cannot be conducted, air or nitrogen with soap solution on the weld can be used. At elevated temperatures, air should be used only after a careful evaluation is made in order to avoid a potential flammable mixture.

4.8.6 Completion

Once work has started, it should proceed without interruption until the hot tap has been completed and the valve closed:

a. It is often possible to know when the cut is complete by the reduced resistance to hand cranking or when the drive motor speeds up.
b. The manufacturer's instructions should be followed when retracting the bore and closing the valve. If the blank or coupon is lost, no attempt should be made to retrieve it with the hot tapping machine. If recovery of the blank or coupon is necessary, it may require shutting down the equipment and de-pressuring and opening the line.
c. Provisions should be made to assure that adequate containment is available to control liquids and vapors trapped within the hot tapping machine which will be released upon removal of the machine after work is completed.

"Closing out the job" should follow normal facility permit procedures along with any special follow-up observation requirements established during the job analysis.

Consult the Hot Work Welding Cutting Program to determine how long the fire watch should remain at the site. Special emphasis should be placed on checking for leaks in the hot tapped areas.

5. CONTRACTORS

5.1 Contractors performing the Hot Tapping will follow the Mosaic Phosphates Hot Tapping Procedure.

6. REFERENCES

6.1 Safety & Health Programs

- 6.1.1 Lockout / Tagout Program – Mosaic Phosphates
- 6.1.2 Safe Work Program – Mosaic Phosphates
- 6.1.3 Welding / Cutting / Hot Work Procedure – Mosaic Phosphates

6.2 OSHA

- 6.2.1 29CFR 1910.147 – Control of Hazardous Energy (Lockout / Tagout)
- 6.2.2 29 CFR 1910.251-257 – Subpart Q, Welding, Cutting, and Brazing

6.3 API

- 6.3.1 RP 2201 - Safe Hot Tapping Practices in the Petroleum & Petrochemical Industries
- 6.3.2 RP 2009 - Safe Welding, Cutting, and Hot Work Practices in the Petroleum & Petrochemical Industries
- 6.3.3 Std. 570 – Piping Inspection Code: Inspection, repair, Alteration, and Rerating of In-Service Piping Systems

6.4 Edison Welding Institute - Project J6176 - Qualification and Selection of Procedures for Welding Onto In-Service Pipelines and Piping Systems

7. REVISION LOG

Revision Log

Rev. No.	Requested By	Approved By	Revised By	Rev. Date
0	Initial Issue for Mosaic	Sr. Management	Safety Dept.	12/5/2006
	Reformat for ISO		D. Allen	8/2/2011
1	Corporate EHS		Lenny Roussel	12/23/2011
2	Safety Department	Lenny Roussel	Reese Withers	5/10/2012
3	Review Cycle	HSS Director – Phosphates	SME Review	12/3/15
4	Review for out of date	PMO	PMO	9/30/2021
5	Adjust review date Fire watch reference to Hot Work Program	EHS PMO	EHS PMO	11/14/2024

Contact the Subject Matter Expert for additional information on this program.

APPENDIX A – HOT TAP CHECKLIST

Location _____
Date _____
Job _____
Prepared by _____

Table 1 – Before Starting the Hot Tap

	Each of the following considerations should be satisfied BEFORE STARTING THE HOT TAP	Date	Time	Initials Checked By
1	Review/follow hot tap machine manufacturer's operating instructions.			
2	Have the contents of the line or vessel to be hot tapped or welded been assessed, and SDSs reviewed for health hazards to assure procedure is appropriate?			
3	Is the material in the line or vessel stable under heated conditions?			
4	Has the connection been designed per Section 6 requirements?			
5	Doe the flanges bolts, gaskets, pipe, and valve to be installed meet the code for the line or vessel to be hot tapped?			
6	Has the welding procedure specification been developed as covered in this standard?			
7	Have approved work permits (e.g., Hot Work, Hot Tap, Entry) been obtained?			
8	Review manufacturer's instructions to ensure that the hot tapping machine has suitable pressure, temperature ratings, and adequate cutter travel for this job.			
9	Has the valve been pressure tested and the cover fitted to assure that it will work and fit properly?			
10	Has the exact location of the hot tap been identified and marked on the line or equipment?			
11	Is the area to be hot tapped located on a line in which flow has been established or below the liquid level of the tank or vessel?			
12	Has the area to be welded been inspected for thickness and freedom from existing welds, laminations, hydrogen attack, or other metallurgical imperfections?			
13	Are tests and inspections current?			
14	If laminations or defects have been found, has a thorough engineering evaluation been made by a qualified person to determine if and how to proceed with the work?			
15	Has the metallurgy of the line or vessel been established, and is it compatible with the connecting fitting?			
16	Can the welding and tapping area support the weight of the hot tapping machine, and is there adequate hoisting and support for the hot tapping machine and subsequent piping?			
17	If PWHT of the welded area is required, was an appropriate review conducted in accordance with 6.6?			
18	Is there sufficient external clearance to install the hot tapping machine and extract the cutter through the valve?			
19	Is there sufficient internal clearance to retract the cutter and coupon through the valve?			
20	Is the hot tap fitting of the proper length to accommodate operation of the hot tapping machine?			
21	Have oxygen, combustible gas, and atmosphere contamination tests been conducted in the hot tap area?			
22	Has a dedicated fire watch person been assigned and appropriate training and firefighting equipment provided?			
23	Has the fire watch person been provided with a list of duties as outlined in Table 2?			
24	Is there adequate storage area and room for operational needs and emergency access or egress?			
25	Has a procedure been prepared and in place to isolate the work area in the event of a failure and material release?			
26	Are personnel trained to implement the contingency procedure?			
27	Have the requirements been defined for weld inspection and for pressure testing, and is all of the testing equipment on hand and in good working condition?			

Table 2 – Fire Watch Duties

	FIRE WATCH DUEIES INCLUDE:	Date	Time	Initials Checked By
1	Being able to communicate effectively with personnel in area.			
2	Watching for fires in all exposed area			
3	Knowing how to use the assigned fire suppression equipment			
4	Knowing how to activate the facility fire alarm			
5	Trying to extinguish a fire only when obviously within the capacity of the equipment available (extinguisher or hose)			
6	Activating the fire alarm when available equipment is not sufficient to suppress minor fire			
7	Maintaining a fire watch (per the Hot Work Welding and Cutting Program) after completion of welding, hot tap, or other hot work until the area has been inspected and found to be free of leaks and ignition sources (fires, hot sports, or smoldering materials)			

Note: Facilities may choose to require subsequent follow-up observations to check for leaks.

Table 3 – Before Welding

	Each of the following considerations should be satisfied BEFORE WELDING:	Date	Time	Initials Checked By
1	Are the welders qualified for the approved welding procedure (specification) to be used?			
2	Is a preheat of the weld area required?			
3	Is the fitting properly positioned to prevent misalignment of the hot tapping machine?			
4	Have the pressure and temperature of the contained materials been reduced as much as the process operation will allow?			
5	Have the flow, pressure, and level considerations of 6.3, 6.9, and 9.1 been considered?			

Table 4 – Before Cutting

	Each of the following considerations should be satisfied BEFORE CUTTING:	Date	Time	Initials Checked By
1	Has the weld been inspected and tested?			
2	Has the hot tap fitting been pressure tested?			
3	Have the hot tap valve, packing, gasket, and bolts been checked for leakage?			
4	Has the packing or seals on the hot tapping machine been checked?			
5	Has the bleed off valve been checked to assure it will hold, is operable, and is not obstructed?			
6	Are all bolts on the pilot and cutter bit tight? (e.g., torque to specification)?			
7	Is the coupon catcher on the pilot bit?			
8	Is the valve centered on the flange?			
9	Has cutting depth been calculated to avoid cutting the opposite side of the pipe?			
10	Has the boring bar been run through the valve to assure free passage?			
11	Have the hot tapping machine and valve been purged, if recommended?			

Table 5 – Before Removing the Hot Tapping Machine

	Each of the following considerations should be satisfied BEFORE REMOVING THE HOT TAPPING MACHINE:	Date	Time	Initials Checked By
1	Have the manufacturer's instructions been followed to be sure that the boring bar is fully retracted before closing the hot tap valve?			
2	Has the hot tap valve been closed?			
3	Has the bleeder valve been opened?			
4	Has all the pressure been bled from the hot tapping machine before removing the bolts from the flange?			
5	Have provisions been made to contain or control any liquid or gas in the hot tapping machine?			

Table 6 – After Removing the Hot Tapping Machine

	Each of the following considerations should be satisfied AFTER REMOVING THE HOT TAPPING MACHINE:	Date	Time	Initials Checked By
1	The hot tapping machine should be cleaned, removing the hydrocarbons/chemicals from the line or equipment.			
2	All rags, absorbent pads, and other cleaning materials must be disposed of properly.			
3	When the work is completed, a follow-up job site visit may be done by operations and craft personnel to see that:			
3(a)	The work is complete.			
3(b)	No safety hazards have been introduced during the work activity.			

APPENDIX B - HOT TAP REQUEST FOR EQUIPMENT IN SERVICE

TO BE FILLED OUT BY INITIATOR:

TYPE OF PROPOSED INSTALLATION

HEADER OR VESSEL INFORMATION

LINE SIZE (inch) _____ METALLURGY _____

OPERATING PRESSURE _____ PSIG TEMPERATURE _____ F

PROCESS DESCRIPTION _____

BRANCH CONNECTION INFORMATION

LINE SIZE (inch) _____ FLANGE RATING _____PSI

GASKET MATERIAL _____ METALLURGY _____

INITIATOR _____ DATE _____

A location sketch of the proposed hot tap is recommended. The hot tap location must have scaffolding (where required for access), insulation must be removed, and the equipment must be marked for the exact hot tap location prior to notifying Pressure Equipment Inspection.

TO BE FILLED OUT BY THE AREA INSPECTOR AND PRESSURE EQUIPMENT ENGINEER

WALL THICKNESS AT HOT TAP LOCATION _____(INCH) DETERMINED BY: _____ DATE: _____

WELD DETAIL NUMBER:

1. PROCEDURE _____ X-RAY _____

2. PROCEDURE _____ X-RAY _____

3. PROCEDURE _____ X-RAY _____

INSPECTOR: _____

TESTS REQUIRED:

(A)NOZZLE _____ PSIG MEDIUM _____

(B) REINFORCING PAD _____ PSIG MEDIUM _____

(C)BLOCK VALVE: HYDROSTATIC SEAT EACH SIDE AT _____ PSIG

AREA INSPECTOR _____ DATE _____

PRESSURE EQUIPMENT ENGINEER _____ DATE _____

TO BE FILLED OUT BY THE MAINTENANCE DEPARTMENT

HOT TAP MACHINE:

MAKE _____ MACHINE RATING _____ PSIG AT _____ F

MODEL _____ PRESSURE TESTED AT _____ PSIG

SERIAL NO. _____ BY _____ DATE _____

MAINTENANCE DEPARTMENT REPRESENTATIVE _____ DATE _____

APPENDIX C – WELDERS INSTRUCTIONS PRIOR TO HOT TAPPING

WELDING SAFETY TASK REVIEW (WSTR) – PREPARATION FOR HOT TAPPING

Review the Hot Tap Plan and verify that all workers understand their duties. (All members of the crew are to be present for the Welding Safety Task Review (WSTR), including pipe foreman, welding foreman, pipe welder, pipefitter, and helper.)	
Discuss proper clearance for hot tap machine.	
Discuss hot tap request form information and requirements (thickness of pipe to be welded, temperature of pipe to be welded, pressure in line, and product in line to be welded).	
Verify that the right location or area was ultrasonic tested for thickness and marked for weld attachment of hot tap fitting.	
Discuss how to clean area to be welded, prior to welding.	
Discuss required tools to be used for cleaning pipe, grinding tacks, grinding stringer. (If power tools are not recommended, what alternative tools must be used?)	
Discuss gap needed for root pass between stub and existing header.	
Discuss need to electrically bond (ground (ground cable to hot tap fitting.	
Discuss amount of penetration needed on stringer bead. (Avoid excess amount of weld penetration which could interfere with drilling of hot tap; don't back weld fittings.)	
Discuss requirement to clean out hot tap stub and remove all debris at completion of weld.	

APPENDIX D – IN-SERVICE HOT TAP EMERGENCY ACTION PLAN

A Hot tap Emergency Plan does not replace the facility's established Emergency Action Plan, but rather is a supplement for this special type of work. The Plan addresses what specific problems could arise and what to do if things go wrong during a Hot Tap. (Some examples include leaks, losing the hot tap coupon, hot tap machine becoming "stuck" and unable to be withdrawn, cutting through the opposite side of a pipe, or significant loss of containment of process materials.)

1. This Plan has been communicated to all parties involved:
   ( ) Operations ( ) Craft Persons ( ) Fire Watch

2. Fire watch has been familiarized with equipment on site:
   ( ) Fire Watch Equipment ( ) Contractor Equipment ( ) Facility Equipment
   ( ) Emergency PPE

3. Emergency Action Plan

   a. Emergency Equipment Description, including personal protective equipment for emergency response (such as SCBA, specific gloves, bunker gear, chemical suit, etc.): _____

   b. Exaction Location: _____

   c. Process Material _____ SDS Hazard Ratings
      Temperature _____ Fire _____ Reactivity _____
      Pressure _____ Health _____ Other _____

   d. Attach field sketch of isolation points to be used in the event of an emergency situation. (Isolation points must be tagged.) _____

   e. List action steps to be taken in the event of an emergency. (Provide reference sketch when appropriate and specify PPE.) _____

   f. If storage tank, note isolation valves to be chained and locked on sketch.
      Is liquid level three feet above weld location? ( ) Yes ( ) No

4. Facility representative coordinating Emergency Action Plan response:

   Name of Facility Representative: _____ Phone: _____

   Alternate Facility Representative: _____ Phone: _____