PUMPING OF FLAMMABLE FLUIDS

AN INDUSTRY RECOMMENDED PRACTICE (IRP) FOR THE CANADIAN OIL AND GAS INDUSTRY

VOLUME 8 - 2009
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PREFACE

INTRODUCTION

A Committee formed by the Petroleum Services Association of Canada (PSAC), developed recommended guidelines for the safe handling and pumping of flammable fluids for the well servicing industry.

The intent of the Industry Recommended Practice, (IRP) for Pumping of Flammable Fluids is to enhance operating consistency within industry through the establishment of minimum standards and procedures. This IRP is intended to clarify and document good practices and procedures. The purpose of this document is to recommend specific standards and operating procedures that should be considered the minimum acceptable for a given application. The IRP stresses the importance of standards and safe operating procedures to protect workers and the public and to minimize environmental risk. They are intended to complement existing documentation and regulation.

The practices recommended are based on engineering judgment, accepted good practices, and experience.

The establishment of these minimum standards does not preclude the need for industry to exercise sound technical judgment in the application of these practices.

The practices described herein describe the requirements for a major well servicing operation with on-site hydrocarbon storage tanks, multiple personnel and equipment. Judgement should be used when applying these practices to smaller well service jobs with low volumes of hydrocarbon and minimal manpower. However, there is still a need to meet the intent of IRP #8. Pre-job planning, written hazard assessments, operating procedures, quality assurance of pressurized equipment, control of ignition sources etc. should be completed for all well servicing jobs. For the majority of well servicing work such as hot oiling, these can be developed ahead of time for a specific well or group of wells and used repeatedly. When well service work involves more than one person, appropriate safety meetings should be held to review the pre-job plan such as the hazards, hazard control methods and emergency response procedures etc. The safety meetings described in this document can be used as a guide but the frequency and content will vary depending on the type of work being performed. The need for mobile safety showers and/or mobile fire fighting equipment for small servicing jobs should be defined as part of the pre-job planning hazard assessment.
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The subcommittee does not endorse the use of any particular manufacturer’s product. Any descriptions of product types or any schematics of components, that bear resemblance to a specific manufacturer’s product, are provided strictly in the generic sense.

SCOPE AND CONTENT

The Pumping of Flammable Fluids Committee was organized by PSAC to establish recommended practices for equipment, procedures and personnel, for the safe handling of fluids associated with the pumping of flammable fluids.

Included in this IRP, and pertinent to the subject of pumping of flammable fluids, are information on: well head requirements for well servicing; guidelines for classifying flammable fluids; guidelines for the placement of tanks and equipment; the HOT ZONE and placarding; high pressure manifolding; pressure relief systems; fire protection, shower units; and static electricity.

The main body of the document describes in detail the procedures for the pre-job plan; the written hazard assessment, the blending, pumping and storage of flammable fluids; safety issues relating to spotting of equipment; flow back procedures; rig out procedures; fire protection requirements and mobile safety shower requirements.

This IRP is intended to supplement existing standards and regulations, and does not replace current regulations.

REVISION PROCESS

Industry Recommended Practices (IRPs) are developed by Enform with the involvement of both the upstream petroleum industry and relevant regulators. IRPs provide a unique resource outside of direct regulatory intervention.
Revision History

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The following organizations have sanctioned this document:

- British Columbia Oil and Gas Commission
- British Columbia Workers Compensation Board (WorkSafeBC)
- Canadian Association of Oilwell Drilling Contractors
- Canadian Association of Petroleum Producers
- Energy Resources Conservation Board
- International Intervention and Coil Tubing Association (Canada)
- Petroleum Services Association of Canada
- Saskatchewan Energy Resource

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Acknowledgements for participation on the committee originally established to prepare this Industry Recommended Practice are listed below, with the individual’s company of employment at the time of contribution:

Development Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Organization Represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arnold McKernon</td>
<td>Halliburton Energy Services Ltd.</td>
<td>CAPP</td>
</tr>
<tr>
<td>Chuck Landry</td>
<td>Fireforce Control &amp; Safety Ltd.</td>
<td></td>
</tr>
<tr>
<td>Dave Webster</td>
<td>Firemaster Oilfield Services Inc.</td>
<td>CAODC, PSAC</td>
</tr>
<tr>
<td>Dennis Seher</td>
<td>Alberta Human Resources &amp; Employment</td>
<td></td>
</tr>
<tr>
<td>Dennis Young</td>
<td>Think H2S Safety Services Ltd</td>
<td></td>
</tr>
<tr>
<td>Doug Massing</td>
<td>Petroleum Services Association of Canada</td>
<td>PSAC</td>
</tr>
<tr>
<td>Doug McNeely</td>
<td>Alberta Human Resources &amp; Employment</td>
<td></td>
</tr>
<tr>
<td>Doug Wahl</td>
<td>Think H2S Safety Services Ltd</td>
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</tr>
<tr>
<td>Eric Boychuk</td>
<td>Dowell Schlumberger of Canada</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Jarvis Jackson</td>
<td>Safety Boss Canada</td>
<td>CAODC</td>
</tr>
<tr>
<td>Kaz Walewski</td>
<td>Waltech Associates</td>
<td></td>
</tr>
<tr>
<td>Lowell Davidson</td>
<td>Nowasco Well Service Ltd.</td>
<td></td>
</tr>
<tr>
<td>Mark Loberg</td>
<td>Canadian Fracmaster Ltd.</td>
<td></td>
</tr>
<tr>
<td>Merrill Jamieson</td>
<td>Halliburton Energy Services</td>
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<tr>
<td>Neil Campbell</td>
<td>Dowell Schlumberger of Canada</td>
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<tr>
<td>Paul Smolarchuk</td>
<td>GTI - E &amp; P Services Canada Inc.</td>
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<tr>
<td>Roy Timmermans</td>
<td>Dowell Schlumberger of Canada</td>
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<tr>
<td>Ryan Cox</td>
<td>Dowell Schlumberger of Canada</td>
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<tr>
<td>Terry Timothy</td>
<td>Splash &amp; Dore Ltd.</td>
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The following are acknowledged for their more recent work in finalizing this Industry Recommended practice:

**Review Committee**

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Organization Represented</th>
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</thead>
<tbody>
<tr>
<td>Al Mahoney</td>
<td>Schlumberger Oilfield Services</td>
<td></td>
</tr>
<tr>
<td>Betty Carew</td>
<td>Think H₂S Safety Services Ltd.</td>
<td></td>
</tr>
<tr>
<td>Dwight Bobier</td>
<td>Calfrac Well Services Ltd.</td>
<td>PSAC</td>
</tr>
<tr>
<td>Gareth Owen</td>
<td>Fire Power Oilfield Fire Fighting</td>
<td>PSAC</td>
</tr>
<tr>
<td>Jim Greenwood</td>
<td>BJ Services Company Canada Ltd.</td>
<td>CAODC, PSAC</td>
</tr>
<tr>
<td>John Artym</td>
<td>BJ Services Company Canada Ltd.</td>
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<tr>
<td>John Gillies</td>
<td>Splash &amp; Dore Ltd.</td>
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</tr>
<tr>
<td>Patrick Delaney</td>
<td>Petroleum Services Association of Canada</td>
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<tr>
<td>Steve Dadge</td>
<td>Calfrac Well Services Ltd.</td>
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**2008 IRP 8 Review Committee**

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<thead>
<tr>
<th>Name</th>
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<tr>
<td>Andre Whitehouse</td>
<td>Nexen</td>
<td>CAPP</td>
</tr>
<tr>
<td>Bob Brownlee</td>
<td>Calfrac Well Services Ltd.</td>
<td>PSAC</td>
</tr>
<tr>
<td>Darren Thatcher</td>
<td>Calfrac Well Services Ltd.</td>
<td>PSAC</td>
</tr>
<tr>
<td>David MacLean</td>
<td>Schlumberger Well Services</td>
<td>PSAC</td>
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<tr>
<td>Dean Jenkins</td>
<td>EnCana Corporation</td>
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<td>Doug Howse</td>
<td>Petro-Canada</td>
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<td>Gareth Owen</td>
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<tr>
<td>John McLaren</td>
<td>DC Energy Services Inc</td>
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<tr>
<td>Kevin Crumly</td>
<td>Trican Well Services Ltd.</td>
<td>PSAC</td>
</tr>
<tr>
<td>Manuel Macias</td>
<td>Enform</td>
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<tr>
<td>Neil McConnachie</td>
<td>Alberta Human Resources and Employment</td>
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</tr>
<tr>
<td>Richard Marcinew</td>
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<tr>
<td>Roger McLeod</td>
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<tr>
<td>Scott Grey</td>
<td>Enerchem International Inc.</td>
<td>PSAC</td>
</tr>
<tr>
<td>Wes Dainard</td>
<td>EnCana Corporation</td>
<td>CAPP</td>
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8.1. **OVERVIEW OF PROCEDURES FOR PUMPING OF FLAMMABLE FLUIDS**

8.1.1 **PRE JOB PLAN**

Job Planning

Written Hazard Assessment for all well site fluids

Classification of fluids to be pumped

Mobile safety shower requirements

Fire protection requirements

Pressure rating of well head and components

Placement of equipment and storage tanks

Requirements for secondary containment

Annular BOP and Ram Type BOP rubber seal requirements

8.1.2 **BULK STORAGE OF FLAMMABLE FLUIDS**

Locating bulk storage tanks on-site (wind, berm, grade and distance)

Pre-loading tank preparation (ground; valves; capacity; level indicators)

Tank Loading

Pre-job fluids handling:

- Fire protection requirements
- Static electricity
- Fluid transfer systems
- Tank gauging (by external means only)

8.1.3 **PRE-JOB MEETING PRIOR TO THE SPOTTING OF EQUIPMENT**

Review of safety hazards

PPE requirements

Positioning of fire fighting equipment

Identification and placarding of **HOT ZONE**

Bonding and grounding of equipment
Safety Showers

Inspection and maintenance of high pressure manifolding and wellhead
  Annular pressure relief systems

8.1.4 Pre-Blending and Blending

Pre-Blending safety meeting

Fluid transfer systems, hoses, connections

Static electricity – bonding, grounding and monitoring

Equipment and personnel – PPE for personnel within HOT ZONE
  Chemical vans

8.1.5 Pumping Procedures

Pre-Pumping safety meeting

Pressure test in accordance with Provincial/Territorial requirements

Independent movement of treating iron by proper placement of swivels
  High pressure treating iron to be non-pressure style or integral union type

8.1.6 Rig Out Procedures

Fire protection

8.1.7 Flow Back Procedures

Refer to Industry Recommended Practice, IRP Volume 4, “Well Testing and Fluid Handling”

8.1.8 Fire Protection Requirements

HOT ZONE

Minimum requirements for PPE for personnel working in the HOT ZONE
  Fire protection requirements for Fracturing using flammable fluids
  Fire fighting equipment suppression capabilities and limitations

Minimum requirements for fire fighting units
  Required fire protection for flammable fluid “Fire Protection Call-out Sheet”
  Assigned rescue personnel
Positioning of fire fighting equipment

**8.1.9 MOBILE SAFETY SHOWER REQUIREMENTS**

- Capabilities and capacities of mobile shower units
- Training and responsibilities of safety shower operators
- PPE requirements for safety shower operators
- Determining the number of safety shower units required
8.2. **Pre Job Plan**

8.2.1 Scope

This section describes the planning phase of well bore service work performed in well-servicing operations involving the use of any fluid.

8.2.2 Job Planning

The lease owner/operator (Prime Contractor), or their designated representative, shall enter into a contract with a Service Company for the completion of operations. The lease owner/operator is responsible for ensuring that the Service Company has an acceptable Safety Management Program and shall use suitable procedures and equipment and materials to perform the task or service contracted with the lease owner/operator, in a safe manner and in accordance with Provincial/Territorial Regulatory requirements. The lease owner/operator and the Service Company shall ensure that all work to be performed under the contract is done only by competent workers or by workers who are not yet competent working under the direct supervision of competent workers, and that no workers who are not yet competent, other than those who are working under the direct supervision of a competent worker, shall do the work.

Prior to the commencement of any work under the contract, representatives of the lease owner/operator and the service company, shall develop a job plan and site layout. The service company shall communicate all details relating to proper procedures and equipment to all personnel on site.

The lease/owner (Prime Contractor) shall designate an individual to be responsible for activities at the well site.

8.2.3 Written Hazard Assessment

A written hazard assessment of all well site fluids such as work-over fluids; fracturing oils; solvents; inhibitor fluids, etc. shall be prepared by the service company for the review and approval of the lease owner/operator. All personnel involved in their use shall be satisfied that the necessary equipment and competent workers are available to handle the material in a safe manner.

Refer to the appropriate legislation/regulations of the jurisdiction in which the work is to be performed for more details on hazard assessments.

The written hazard assessment shall identify all personnel safety hazards and provide suitable control measures, the following list identifies the generic issues that need to be addressed but should not be considered as all-inclusive:

- If special PPE in addition to that specified in 8.9.3 is required to be worn by personnel in the **HOT ZONE**.
If Air Breathing Apparatus (SABA/SCBA) must be available for use by personnel that require it
If dikes or secondary containment is required to be placed around tanks
If an ambulance and adequate shower unit(s) must be available on site
The fire protection requirements as per 8.9.4
The need for bonding or grounding (preferred) of equipment

8.2.4 FLUID CLASSIFICATION

The hazard classifications of all materials added to the well-service fluids shall be determined using the most current MSDS. These sheets shall be made available on-site. An MSDS contains information on the proper and safe use, storage and handling of a material and this information must be conveyed to all workers working with the material. Material classification under W.H.M.I.S. requires the Closed Cup Flash Point be used. Flammable fluids shall also be classified as High Hazard Flammable Fluids, Reduced Hazard Fluids and/or Special Hazard Fluids using the Open Cup Flash Point.

The potential fire hazard associated with flammable fluids is determined by the use of the Open Cup Flash Point method (see Attachment 1). The fluid’s operating conditions and its’ Open Cup Flash Point determine the level of precautions that are required that exceed the minimum regulatory requirements. When using High Hazard or Special Hazard well servicing fluids, the following additional precautions should be considered:

- Closed system gelling and bonding of equipment
- Inert gas blanket to be placed over open blending system
- Fire suits (bunker gear) for the blender crew in the HOT ZONE

8.2.5 MOBILE SAFETY SHOWER REQUIREMENTS

(Refer to Section 8.10 – Mobile Safety Shower Requirements)

The number of personnel inside the HOT ZONE shall be limited to the number of shower heads that have sufficient water supply to meet the Provincial/Territorial Regulations and ANSI- Z358.1 design requirements.

8.2.6 FIRE PROTECTION

The authority to take charge in case of a fire emergency shall be assigned to an on-site person. The establishment of a command structure is recommended.

(Refer to Section 8.9 "Fire Protection Requirements" and complete Section 8.9.8 “Fire Protection Call-out Sheet”.)
The hazard classification information for materials to be used on site shall also be made available to the company contracted to or individuals assigned to provide fire protection, in order that they may:

Ensure that the proper equipment is available on site including the requirement for safety showers (refer to Section 8.10 “Mobile Safety Shower Requirements”).

Be made aware of the type and volume of storage of flammable fluids and chemicals, and

Be made aware of the contents of the chemical van and if it will be equipped with its own fire protection system and if it will be placed outside of the HOT ZONE during operations, or, alternatively, located off of the location, (refer to Section 8.5.6 “Chemical Van”).

### 8.2.7 Pressure Rating of Well Head and Components

Attachment 3: “Wellhead and Components – Pressure Rating Data”

Attachment 4: “Well Servicing – Wellhead Rig-In Procedures and Pressure Rating of Wellhead Valves”

IRP Volume 4: “Well Testing and Fluid Hauling”

### 8.2.8 Placement of Equipment and Fracture Fluid Storage Tanks

Attachment 5: “Strategic Placement of Tanks and Equipment on Location”

### 8.2.9 Requirements for Secondary Containment

If secondary containment is found to be necessary, an earthen berm (or equivalent), other than the lease berm, shall be constructed around the tanks.

When the diked area contains one tank, the dike must be sized to be at least 110% of the capacity of the tank. When the diked area contains more than one tank, the dike must be sized to contain 100% of the volume of the largest tank plus 10% aggregate capacity of all the other tanks.

### 8.2.10 Annular BOP and RAM Type BOP Rubber Seal Requirements

Some fluids used for fracture treatments can cause the rubber elements on BOP systems to swell and cease to function properly. Steps shall be taken to ensure that the fluid used shall not damage these rubber seals. This may require that the rubber elements be tested with the specific fluids to be used to determine the analine point.

### 8.2.11 Site Inspection
A site inspection shall be conducted at the job site prior to spotting equipment to identify existing or potential hazards and to review/approve the pre-job plan and associated hazard assessment, (Refer to Section 8.2.3 "Written Hazard Assessment").
8.3. BULK STORAGE OF FLAMMABLE FLUIDS

8.3.1 SCOPE

This section covers the Bulk Storage of Flammable Fluid in preparation for well-servicing operations where flammable fluids are to be pumped.

8.3.2 LOCATING BULK STORAGE TANKS ON-SITE

Bulk storage tanks should be located so as to:

- Meet Provincial/Territorial regulations for distance from the wellhead
- Be positioned in such a way that prevailing winds will carry any flammable vapours away from the well head and equipment; and either be:
  - Provided with secondary containment – (refer to Section 8.2.9 “Requirements for Secondary Containment”), or
  - Located on a surface grade that will, in the event of a tank rupture, allow fluids to flow away from where the well servicing equipment is located.

8.3.3 PRE-LOADING TANK PREPARATION

Before the tanks can be filled with a flammable fluid they must be:

- Grounded, (refer to Section 8.5.4 “Static Electricity” and Attachment 11 “Static Electricity”)
- Inspected, to ensure that the tank valves are in good working order. Once inspected, a blank cap is to be installed on all tank valves
- Examined, to ensure that there is adequate capacity for the amount of fluid and additives that shall make up the final fluid mixture volume
- Examined, to determine that remote level indicating devices are in working order

8.3.4 TANK LOADING

Splash loading of flammable fluid into any tank or container causes a large amount of vapour to be released into the atmosphere above the fluid in the tank and to the tank’s surrounding area. This causes an ignition hazard. The splash loading also creates a large amount of static electricity to develop in the liquid providing a potential ignition source (Refer to Attachment 11 “Static Electricity”). Therefore, it is recommended that no splash loading of a flammable fluid be conducted. The following methods may be used when loading tanks with flammable fluids.
It is recommended to only use tanks that have the capability for bottom loading either through bottom tank connections or through a filling pipe that rises up the side of the tank and is continuous on the inside to the tank bottom.

**Bottom Loading**

Bottom loading of tank trucks and lease storage tanks tends to reduce the possibility of electrostatic hazards that may result from failure to bond properly and improper positioning of the fill pipe. However, in the initial stages of bottom loading, upward spraying of the product could increase charge generation and should be prevented by reducing filling velocity, by spray defectors, or by other devices. If bottom loading inlets in tanks are not designed to prevent spraying, low-vapour-pressure products may form an ignitable mist.

Bottom loading may result in higher liquid surface voltages than fill pipe loading, because the fill pipe acts as a conductive path to help relax a charge. It is especially important with bottom loading that spark promoters, such as gauging rods or other metallic conductors, are extended to the tank bottom, unless the cargo tank can be kept filled during highway transportation.

**Fill Pipe Loading**

During open-dome top loading of intermediate vapour-pressure products or low vapour-pressure products, the fill pipe should reach as near as possible to the bottom of the tank being loaded and, preferably, should be in contact with the bottom to avoid undue turbulence. However, the fill pipe should not rest “full circle” on the bottom. This can be avoided by using a T-deflector or 45 degree bevel on the end of the fill pipe. If a deflector is used, it should be designed to resist lifting of the fill pipe off the tank bottom when the flow starts. If the fill pipe does not reach the tank bottom, the velocity should be limited to about 1 meter per second (3 ft/sec), until the outlet is submerged. In some cases, the control of loading velocities can be accomplished through the use of two flow loading valves, one of which automatically limits the initial velocity to about 1 meter per second (3 ft/sec).

Splash Loading is **NOT** recommended.

**Tank Loading Safety Precautions**

Care should be exercised to avoid spark promoters, such as un-bonded conducting objects, within a tank compartment. Tanks should be inspected, and any un-bonded object removed prior to loading. A tank gauging rod projecting into the cargo space of a tank truck could provide a gap between itself and the rising liquid and allow static sparking. Trucks having a gauge rod projection, should have the rod extended directly to the bottom of the tank or connected by wire or chain to the bottom of the tank, or a nonconductive rod may be used. In top loading where a grounded conductive fill pipe is placed in close proximity to the gauging rod, the voltage gradient on the liquid surface in the vicinity of the rod will be lowered and reduce the risk of a static discharge.
Where flammable mixtures can be expected in the vapour space, metal or conductive objects - such as gauge tapes, sample containers, and thermometers - should not be lowered into or suspended in a compartment while the compartment is being filled, or immediately after cessation of filling.

A waiting period of about three hours allows for a substantial dissipation of the electrostatic charge.

**8.3.5 Pre-Job Fluids Handling**

The pre-job handling and heating of flammable fluids is to be performed in accordance with the procedures set out in the following:

- Section 8.9 “Fire Protection Requirements”
- Section 8.5.3 “Fluid Transfer Systems”
- Attachment 11 “Static Electricity”

**8.3.6 Tank Gauging**

During tank filling and during pumping operations, the contents should be gauged by external gauges ONLY. This can be accomplished by using either an external mechanical gauge, mounted on the tank, or an external gauge that will determine the amount of fluid in the tank by the hydrostatic head the fluid exerts.

We recommend that personnel should not manually gauge tanks from the top hatch as this will expose the individual to hazardous vapours and leave them without a means to escape in the event of a mishap.

In situations where manual gauging must be used, tanks should be equipped with guardrails or fall arrest systems, someone on location to be trained in rescue from elevated structures, SCBA/SBA to be used, non-sparking gauges, written procedures and/or a Job Safety Analysis, and a hazard analysis. Documented meetings before the gauging is done and archived in the well file.
8.4. **PRE-JOB SAFETY MEETING PRIOR TO THE SPOTTING OF EQUIPMENT**

8.4.1 **SCOPE**

This section describes the recommended practices and procedures for moving the equipment onto a location where flammable fluids are to be used in the work process.

8.4.2 **PRE-SPOTTING SAFETY MEETING**

The service company representative shall conduct a pre-job safety meeting immediately prior to the spotting of equipment on location. The meeting shall be attended by all personnel on location. This meeting should cover the following:

- Discussion of the pre-job plan and review of safety hazards, particularly unusual chemicals and/or highly flammable fluids that will be used.

- Instruction on use of Personal Protective Equipment (PPE). (Refer to Attachment 6 “Personal Protective Equipment Requirements”).

- Details on the movement of equipment, and the guide’s responsibility, before equipment is spotted.

- Details on the positioning of fire fighting equipment and fire trucks. (Refer to Section 8.9 “Fire Protection Requirements”).

- Due to the high fire hazard, all fire protection equipment, including fire fighting truck(s), shall be on location and ready for use, prior to any other well-servicing equipment being located on site, and must remain on site, and ready for use, until “rig out” is completed.

- Escape route(s) and muster stations in the event of an incident or fire.

- Instructions on “rigging-in” high pressure lines and equipment.

- Identification and proper signage of a smoking area.

- Identification of the high fire hazard area (HOT ZONE) and the location of placards placed around the area once equipment is spotted. (Refer to Attachment 7 “HOT ZONE Placard” and Attachment 8 “Hot Zone Placard Placement”).

- The proper grounding and bonding of equipment. (Refer to Section 8.5.4 “Static Electricity” and Attachment 11 “Static Electricity”).

- Location of mobile shower unit(s) (if required). (Refer to Section 8.10 “Mobile Safety Shower Requirements”)

- Confirmation that the high pressure treating iron is suitable for the job. (Refer to Attachment 9 “High Pressure Manifolding Inspection and Maintenance”).
Confirmation that pressure relief systems are installed where required, properly directed and operational. (Refer to Attachment 10 “Annular Pressure Relief Systems”).

Confirmation that all diesel engines that will be running during mixing and pumping are equipped with fully functional air shut-offs –(Refer to Provincial /Territorial Safety Regulation).

Information on the location and readiness of an ambulance (If required refer to Provincial /Territorial First Aid Regulation).

Ensure the proper connections to the wellhead are used (Refer to Section 8.5.3 “Fluid Transfer Systems”).

Ensure an emergency response plan is in place for the mixing of the flammable fluids and everyone on location knows what it is and what his/her duties would be in the event of an emergency.
8.5. **PRE-BLEEDING AND BLENDING**

8.5.1 **SCOPE**

This Section deals with the requirements for a “pre-blending” safety meeting and the requirements for the inspection and maintenance of rubber hoses used for pumping flammable fluids. It also includes information on static electricity and the methods of bonding and grounding, as well as the type of equipment to be used in the blending and pumping process, the requirement for proper personnel protective equipment, and specific requirements for fire protection for chemical vans.

8.5.2 **PRE-BLENDING SAFETY MEETING**

A safety meeting shall be held prior to the blending of any flammable fluid. All personnel on location and all personnel who shall be working in the HOT ZONE shall attend.

The following matters should be part of the ‘Code of Practice’ and should addressed at the pre-blending safety meeting:

- **Roll Call**
  - Identification and introduction of on-site person responsible for conducting the roll-call in the event of an incident

- **Identification and delineation of the HOT ZONE**

- **Identification of personnel permitted to work within the HOT ZONE**

- **Preparation of a list containing the names of all personnel on location, and assignment of the individual responsible for custody of this list**

- **Preparation of a list containing the emergency contact phone numbers, and the name of the individual assigned as the “designated caller” and custodian of the list**

- **Determine procedures for notifying emergency contacts (e.g. STARS Air Ambulance, hospitals, etc)**

- **Identification and introduction of an on-site person to take charge in case of a fire emergency**

- **Designation of a “safe” briefing area**

- **Emergency shut-down, shut-in, and evacuation procedures including muster points**

- **Identification of personnel responsible for activating shut-in procedures**

- **Identification of personnel responsible for rescue procedures and identify back-up personnel**

- **Location of first-aid equipment and identify the first aid person on-site**
Identify the properties and hazards of all well-servicing fluids to be used.

Procedures for notifying the fire fighting personnel of any developing problems (e.g. leaks, overheating equipment etc.)

8.5.3 Fluid Transfer Systems

Rubber hoses used for pumping flammable fluids shall be suitable for the operating conditions and the fluid being handled. All pressurized hoses shall be pressure tested in accordance with Attachment 2 prior to delivery to the work site.

Acceptable Hose Couplings and Clamps

Connections to the well head shall meet Provincial/Territorial Regulatory requirements, but not less than the following:

- Line Pipe Threading (LPT) to 17.2 Mpa (2,500 psi)
- Premium Thread to 34.5 Mpa (5,000 psi)
- Flanged fitting above 34.5 Mpa (5,000 psi)
- Flanged fitting if well service fluid is gas assisted

Hammer union thread connectors are required for all hose couplings, including hoses located on trucks. Standard camlock (type) fittings and cross-overs incorporating standard camlock (type) fittings shall not be used.

However, self-locking camlock (type) fittings can be used within their design limits.

Hose couplings to be secured with connectors capable of withstanding pumping pressures and pump jacking

Suitable pressurized hose restraints should be installed to restrain the hose from whipping should it become disconnected.

Clamping systems from hose to king nipples to be appropriate for conditions of use

Connectors to be installed in accordance with the manufacturer’s guidelines

Pressurized Hose Strength Requirements

When using a centrifugal pump, the pressure ratings of hoses are to be 100% greater than the design head pressure of the pump and be rated to withstand the maximum shut-off head.

Hoses used for the transfer of flammable fluids shall be pressure tested to 150% of the maximum allowable working pressure before they are put into service. All hoses shall be tagged with an identification number and the last test date of the hose. These hoses shall be retested as per the service company guidelines but shall not exceed 2 years of service. Proof of the completion of the pressure test in the form of a chart or a certification sheet shall be available for review on location.
Positive displacement pumps used in conjunction with rubber hoses are to have a full opening pressure and flow bypass. The bypass is to flow back to the tank or suction side of the pump, and be set at 50% or less than the rated working pressure of the hose.

**Pressurized Hose Covers**

Covers are to be in place on all discharge hoses

Covers to be clamped on both ends and allow fluids to flow from the hose through the cover to indicate leaks

**Operator Inspection Checks for Pressurized Hoses**

Hoses shall be inspected prior to each use. This inspection is in addition to the requirements for pressure testing of hoses. The inspection of the hose may not be possible if the ‘Pressurized Hose Covers’ are in place. Inspections of hoses that have hose covers are required monthly and are to be documented and archived with the pressure test data. This inspection should cover the following:

- External surface of the hose for signs of damage to, or exposure of, the hose reinforcement caused by cuts, abrasions, cracks, cover bubbles, severe kinks, etc.
- Hose covers for cuts, deformities and stains which may signal hose failure
- Couplings for slippage, cracks, deformities, excessive corrosion and evidence of movement
- Clamping for proper fitting and connection
- The hose area around fittings for signs of excess wear

If there is any doubt regarding the condition of the hose, clamps or couplings, the hose shall be removed from service for a more detailed inspection and repair.

**8.5.4 Static Electricity**

Static electricity is produced when like or unlike materials are in motion and in contact with each other. The materials may be in the solid, liquid or gaseous state. Flammable fluids that become statically charged can provide a potential for ignition in the presence of oxygen.

One method for preventing a buildup of static electricity during the blending and pumping process is to bond and ground all equipment in the area where there is a potential for flammable fluid vapours to exist (e.g. the **HOT ZONE**).

**Examples of Equipment Requiring Bonding and Grounding**
The following are some examples of equipment requiring bonding and grounding:

- All metal storage tanks
- Hot Oilers
- Service rig pumps
- Pressure trucks
- Transport trucks (chemical vans etc.)
- Acidizing equipment
- Fracturing equipment
- Sand hauling equipment
- Coiled tubing equipment
- Chemical batch equipment

**Bonding**

Before commencing blending or pumping operations, an 8mm gauge wire with CSA approved connectors shall be used to bond all equipment to be used in the blending and pumping process. The connector attachment sites should be non-painted, rust-free surfaces.

Bonding and Grounding will not eliminate electrostatic charging. It will ensure that all parts of the system are at the same electrical potential or ground potential. This will eliminate voltage differences and the risk of ignition caused by sparking or arcing discharges.

The following steps should be taken when bonding equipment:

- Bond all tanks, pumps, sand hauling equipment and chemical vans. Connect the bonding circuit to the well head or other suitable grounded object to form a grounded circuit.
- Hook up an appropriate multi-meter to monitor for static build up.
- Ensure that two grounds are in place and correctly installed (see below).

Fluid tanks and transport trucks must be bonded or grounded before the heating or transfer of flammable fluids commences.

If connections are made during operations on other trucks not previously in the bonding circuit, the connections must be made with cables of sufficient length to perform the connections at a distance of at least 3m away from the **HOT ZONE.**
Grounding

Grounding of a container or tank cannot prevent the accumulation of charges in the liquid.

Two sources of grounding should be used on all flammable fluid sites.

A primary source for grounding is the well head, as long as proper connections are made. Supplemental or alternative grounding methods are:

A 16 mm diameter stake driven into the ground to a depth of 2.5 – 3.0 m minimum. This should be done at the same time that the drilling rig anchors are installed on location, or when the service rig anchors are installed.

A 650mm by 650mm plate buried to a depth of 1.3 m shall also be adequate.

These two methods should be considered as semi-permanent installations.

Location of Ground Stake

The preferred location for (semi-permanent) secondary ground stakes is on the west and north edge of the well site. If temporary ground stakes are installed they should be in an area near the tanks taking into account the lease access road and the location of the drilling sump. Locating two stakes will allow for dealing with lease surface problems that might not be foreseen at the time of installation. If the completion fluid tanks are expected to be placed in an obvious well drained, dry location, one stake should be placed to the edge of this area.

The lease owner/operator is responsible for the proper installation of the ground stakes.

Selection of Bond or Ground

The well logging industry has successfully used a “potential monitor” for a number of years. The system has two grounding clamps on the ends of 33 m flexible conductor cables.

The cables should be connected to the well head and tanks and trucks throughout the entire blending and pumping operation.

High pressure treating lines attached to the well head will be sufficient to ground the pumpers to the well head. However, this ground may become saturated at some point during the operation. Therefore, one fluid pumper should be bonded to the blender / sand truck / chemical truck / fluid storage tank farm grouping. Once all of the fluid storage tanks have been bonded together, a ground line should be run over to the ground stake (see above), to act as a supplementary ground. The secondary ground will provide a conductive path in the event the bonding lines between the trucks in the circuit become loose during the operation.
Monitoring of Bonding and Grounding

The bonding and grounding should be monitored during operations at all times. If a buildup of static potential occurs, the following steps should be taken:

- **STOP** the blending or pumping of the flammable fluids
- check all bonding sites to ensure a good connection on a bare surface
- check all bonding cables (with monitor) to ensure cables are not broken
- install another temporary source of ground, as other grounds may have become saturated

DO NOT re-start the blending or pumping operation until the static has been completely dissipated.

For more information on static electricity, and how to deal with it, refer to Attachment 11 “Static Electricity”.

### 8.5.5 Equipment and Personnel

The number of blender operators and other personnel should be kept to a minimum within the **HOT ZONE**. They should be wearing appropriate PPE.

(Refer to Section 8.9.3 “Minimum PPE Requirements for Personnel Working Within the HOT ZONE”).

Fluids being manipulated on surface should be kept as cool as possible, to minimize the amount of vapours.

High pressure pump fluid-end burst disks should have containment plates that cover the fluid end to direct spray from leaks or ruptures in a downward direction.

Annulus pop-off valves that have flammable fluids behind them must be rigged into a containment tank with a staked steel line and should be sized to relieve the maximum pump rate.

### 8.5.6 Chemical Vans

All equipment inside a chemical van, including lights, pumps and rheology measurement systems, must meet all applicable fire/electrical and transportation code requirements.

It is recommended that enclosed chemical vans have their own automatic fire protection system sufficient to handle all the chemicals carried in the van.

If the chemical van does not have its own automatic fire protection system, then a hazard assessment shall be conducted and made available to the individuals assigned to provide fire protection.

Separate compartments are required for all chemicals that have conflicting fire protection requirements, so as to ensure that they are kept separate during the operation, and during transportation.
8.6. **PUMPING PROCEDURES**

**8.6.1 SCOPE**

This section describes practices and procedures for the high pressure pumping of flammable fluids in conjunction with a hydraulic well-servicing treatment.

**8.6.2 PRE-PUMPING SAFETY MEETING**

The time lapse between the conclusion of the blending procedures and the commencement of the pumping procedures will vary from location to location due to the nature of the operations being performed. As a result, conditions such as wind direction or the number of personnel on location may also change.

A pre-pumping safety meeting shall be held to ensure that any changes that have occurred since the pre-blending safety meeting are addressed and also to address safety concerns specific to the pumping operation. All personnel on location shall attend this meeting.

The following issues should be addressed:

- **Roll call**

  Review all issues covered in the pre-blending safety meeting (Refer to Section 8.5.2 “Pre-Blending Safety Meeting”) especially any changes that have occurred since then.

**8.6.3 HIGH PRESSURE MANIFOLDING**

All high pressure manifolding must be pressure tested in accordance with applicable local regulatory requirements

Swivel joints must be sufficient in number and placed in positions that shall ensure independent movement of the treating manifold between the well-head and the high pressure pumps.

The unions used in the high pressure treating manifolding must be appropriate for the operating conditions (Refer to Section 8.5.3 “Fluid Transfer Systems”), meet manufacturers specifications and meet the requirements of the Provincial/Territorial Regulations.
8.7. **RIG-OUT PROCEDURES**

8.7.1 **SCOPE**

This section deals with the rigging out of equipment after the pumping of flammable fluids.

8.7.2 **FIRE PROTECTION**

Shut down all equipment not required during vacuum truck operations

Fire protection shall be maintained at a state of readiness during rig-out

Vent hose from vacuum truck to be directed downwind and away from any possible ignition source such as hot manifolds

Remove product from all hoses prior to rig-out

Clean up all spills prior to demobilization
8.8. HANDLING WELL INTERVENTION AND FLOW BACK FLUIDS

8.8.1 INTRODUCTION

The properties of all fluids pumped into and/or produced from formation to be re-used shall be determined. Appropriate steps must be taken to ensure the safety of site workers from the fluids. When the fluids are re-cycled or re-used in whole or in part, the physical and chemical properties shall be determined by the owner and the original MSDS shall be revised to reflect the changes. If applicable, revert to the appropriate crude oil or condensate MSDS. The revised MSDS shall be reviewed with personnel who will be handling the flow back fluid.

8.8.2 GENERAL FLUIDS (APPLICABLE TO ALL FLUID TYPES)

The properties of any produced gases, liquids, or solids should be evaluated as applicable to:

- Identify any potential hazards and PPE to meet identified health hazards
- Follow safe handling procedures as per MSDS
- Select appropriate handling procedures
- Establish criteria for shutdown when using an open tank system
- Establish disposal method
- Identify both acute and chronic toxic effects (H₂S and carcinogens)
- Identify environmental impact of escaped fluids
- Identify corrosive effects
- Identify possible degradation of elastomers
- Identify NORM (Naturally Occurring Radioactive Material).

8.8.3 OILS

In addition to any hazards specified per 8.8.2 "General Fluids." The properties of the produced oils, whether native or previously injected, should also be evaluated for the following hazards:

- Flammability; ignition of oil and oil vapours. Follow safe handling procedures as per MSDS

**Note:** There is a general relationship between flammability and the lighter hydrocarbon content (i.e., hexane and heptanes) of a hydrocarbon fluid. Flammability and Reid Vapor Pressure (RVP)
increases with increasing lighter hydrocarbons. Refer to Attachment-1 for additional detail.

8.8.4 **Gas**

In addition to any hazards specified per 8.8.2 "General Fluids," the properties of the produced gases, whether native or previously injected, should also be evaluated for the following hazards:

- Ignition of contained and escaped vapours
- Hydrate potential.

8.8.5 **Water**

In addition to any hazards specified per 8.8.2 "General Fluids," the properties of the produced water, whether native or previously injected, should also be evaluated for possible gas entrainment and ignition potential.

8.8.6 **Kill Fluids, Frac Fluids, Acids and Solvents**

The properties of well intervention fluids, contaminated from chemical addition and/or reservoir exposure, to be evaluated for the following hazards:

- Flammability, including ability to be retarded
- Special toxic effects
- Possible degradation of elastomeric materials.
- Radioactive tracer in sand
- Special reactive effects
- Erosive potential (e.g., frac sand)

Properties to be considered include:

- Explosive limits
- Flash point
- Chemical composition
- Toxicity information
- RVP (Refer to Attachment A-1.3 for limits)
- pH levels (as applicable)

**Note:** MSDS and TDG information may provide valuable information to assess potential toxicological or flammability hazards related to uncontaminated intervention fluids; however any fluids produced from the reservoir should be considered separately.
8.9. **FIRE PROTECTION REQUIREMENTS**

8.9.1 **SCOPE**

The scope of this section is to provide service companies and well operators with guidelines on the fire protection requirements for personnel and equipment involved in well-servicing activities.

Guidelines and standards based on scientific and industry-accepted practices have been incorporated wherever possible.

There are few constraints that can be cited as the base criteria for determining fire protection requirements. Each well servicing operation will have its own unique set of requirements. Fire Fighters shall be trained as per Attachment 13.

8.9.2 **HOT ZONE**

The area having the highest risk potential to personnel involved in the well servicing process, including the following components:

- Blender
- Fracturing Tank(s)
- Chemical Van
- Sand Truck
- Coiled Tubing Unit

Particular attention must be paid to those areas of the well servicing process involving the highest number of personnel, the amount of well servicing fluid in use, and the difficulties likely to be encountered in isolating the fuel source. Therefore, the blender “area” has been determined as having the highest hazard potential and shall be referred to as the “HOT ZONE”

There are three critical factors involved in determining the hazards associated with oilfield operations involving the use of flammable fluids. These are:

- The presence of flammable vapours caused by the mixing procedures, or the nature of a specific flammable fluid in relation to the temperature and flashpoint of the fluid
- The potential failure of high pressure containment systems and the release of flammable fluids in an atomized state
- The potential ignition sources that are present regardless of the precautions undertaken to minimize these ignition sources
Although dry chemical has quick "knock-down" capabilities, and is required in many cases to extinguish energized liquid and/or gas fires, it does not have the capability to secure fuel vapours or cool after suppression is achieved. Therefore, the ability to generate large amounts of fire suppressant agents at the required rate is vital.

It is extremely important to the safety of personnel and fire fighters that the standards for fire suppression rates set out in N.F.P.A. Standards 10 (Portable Fire Extinguishers), 11 (Low Expansion Foam) and 18 (Wetting Agents), be used in calculating requirements for fire fighting equipment and fire fighting personnel.

### 8.9.3 Minimum PPE Requirements for Personnel Working Within the HOT ZONE

All personnel working within the HOT ZONE during blending of fluid, the pumping operation, or clean-up operations (using a vacuum truck) are required to wear Canadian Standards Association (C.S.A.) or Canadian General Standards Board (CGSB) fire retardant or equivalent approved safety apparel. Bunker Gear and a fire resistant balaclava, as well as fire resistant gloves should be worn when pumping High Hazard or Special Consideration Flammable Fluids.


### 8.9.4 Fire Protection Requirements for Fracturing Using Flammable Fluids

The following table defines the minimum recommended fire protection requirements for personnel safety/rescue. Additional fire suppression resources may be required to provide for equipment protection.

<table>
<thead>
<tr>
<th>Number of Well Service Fluid Tanks</th>
<th></th>
<th>5 or more storage tanks or when pumping energized fluids and using 2 or more storage tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tank</td>
<td>2 - 4 Tank</td>
<td>Special Considerations 2 – Continuous Foam Units with two 15.8 m³ (100 Bbl) water trucks.</td>
</tr>
<tr>
<td>1 – Twin Agent Unit or</td>
<td>1 – Continuous Foam Unit with a 15.8 m³ (100 Bbl) water truck</td>
<td></td>
</tr>
<tr>
<td>1 – Continuous Foam Unit with on board water supply</td>
<td></td>
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</tbody>
</table>

**Note:** Tank = 63 m³ (400 Bbl)
8.9.5 Fire Fighting Equipment Suppression Capabilities and Limitations

There is a variety of oilfield fire fighting equipment available on the market. This equipment falls into two basic categories:

The “Twin Agent” system.

Continuous Foam System

Either of these systems will provide suitable fire suppression capability to facilitate personnel protection and rescue (if required) from the HOT ZONE

Twin Agent System

The Twin Agent System is a fire suppression system consisting of both dry chemical ("Purple K") and pre-mixed foam. Nitrogen is used to propel the fire suppressants out through separate discharge hoses.

The advantages of the Twin Agent System are that it can be activated quickly for fire suppression and rescue purposes, and it can be used independently or with a continuous foam system.

Continuous Foam System

The Continuous Foam System consists of a centrifugal fire pump and a fire suppressant chemical. When combined with supplemental water or onboard water, these two suppressant agents produce a solution that is then pumped through a discharge hose.

The delivery rate of the fire suppressant and fire equipment is pre-determined by the NFPA standards, or the manufacturer’s specifications. The advantages of the Continuous Foam System are:

Continuous foam system can be discharged a longer distance, supply more efficient coverage and effectively secure the liquid spill to control re-ignition.

Fire fighters have more mobility thus ensuring a greater safety factor

8.9.6 Minimum Requirements for Twin-Agent / Continuous Foam System

Twin-Agent Unit

1,136 litres, (300 US gallons) pre-mixed A.T.C foam solution at 6 %

680 Kg. (1,500 lb) Purple "K" Dry Chemical System

30 m discharge hose with Twin-Agent application system
Two fire-fighting personnel

**Continuous Foam System**

475 litres, (125 US gallons) chemical concentrate (suitable for on-site fluids)

1,900 litres per minute, (500 US gpm) centrifugal certified fire pump

Two fire-fighting personnel

680 Kg (1,500 lb) Purple-K Dry chemical system

Continuous Foam System with onboard water supply will have a minimum of 3,028 litres (800 us gal)

### 8.9.7 Fire Protection Call-Out Sheet

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<thead>
<tr>
<th>Fire Protection Call-Out Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Protection Company:</td>
</tr>
<tr>
<td>Fire Protection Company Representative:</td>
</tr>
<tr>
<td>Producing Company:</td>
</tr>
<tr>
<td>Producing Company Representative:</td>
</tr>
<tr>
<td>Directions to Well Sites:</td>
</tr>
</tbody>
</table>

Sweet/Sour Well: % H₂S

Bottom-hole Temperature: °C

Immediate flow-back of well-bore fluids programmed: Yes No

**Type of fluids to be used (MSDS attached):**

Volume of liquids: m³

Number of tanks containing flammable fluids

Maximum temperature of flammable fluid on surface: °C

Closed Cup Flash Point (mandatory): °C

Highest percent of Methanol in tanks or carriers: %

Highest percent of Methanol for treatment: %

Overhead power-lines on location: Yes No
8.9.8 Assigned Rescue Personnel

A competent, properly equipped rescue team shall be available on-site whenever High Hazard Flammable Fluids are to be pumped, (refer to Attachment 13 "Fire and Rescue Training Requirements for Industrial/Oilfield Fire Fighters; Level II"). The firefighting personnel shall assist in a fire exposed rescue attempt by controlling the fire. However, the two person fire fighting team cannot provide fire fighting and rescue duties simultaneously. When fire rescue is required, the minimum requirement shall be two firemen and one dedicated rescue person. The rescue person shall be prepared to initiate a fire rescue whenever personnel are working in the Hot Zone. This requires suitable bunker gear and donned SCBA. The response team shall have a written Emergency Plan that is reviewed, communicated and practiced before the job in order to affect an emergency rescue. The emergency plan shall contain the steps needed to respond to and recover a casualty as a result of an incident. The fire fighting service company can be contracted to supply additional rescue personnel or a third party company can supply the rescue person.

8.9.9 Positioning of Fire Fighting Equipment

The proper positioning of fire fighting equipment is of paramount importance, and should be the first consideration when spotting equipment.

The most common problem encountered by fire fighting teams during well-servicing procedures is the lack of space on location.

Care should be taken to ensure that the spacing of well-servicing equipment allows easy egress for personnel involved in the well-servicing procedures, and adequate access for fire fighting teams.

The following criteria should determine the positioning fire fighting apparatus:

Direction of the wind in relation to the HOT ZONE and Well Head

Equipment should be a minimum distance of 25m from any fuel source

Fire fighting equipment should be positioned so as to avoid any spillage of well-service fluid on the fire truck, should a rupture occur, and should not be located directly in line of any plugs, valves, or other components of the pressurized system.

Foam and dry chemical application hoses should be able to reach all well-servicing and associated equipment on location. If this cannot be achieved, the hoses should be capable of being moved to positions where they can reach this equipment.

All fire fighting equipment should be in place, inspected, and /or tested prior to any other equipment being brought on site and the commencement of transferring, heating, or blending procedures. The amount of hose required for foam application...
will depend on the total discharge rate required calculated from the total area of the HOT ZONE.
8.10. MOBILE SAFETY SHOWER REQUIREMENTS

8.10.1 SCOPE

Shower units are intended to provide standby safety services for workers whenever hazardous fluids (see WHMIS guidelines) are being pumped or handled. There are several different designs of shower units available on the market.

The intent of this section is to recommend MINIMUM standards for:

- The capabilities and capacities of the shower/eyewash units, and drench hoses
- Training requirements for, and responsibilities of, the operators of these units
- Equipment requirements for operators of the shower units
- Factors determining the use of shower units

8.10.2 CAPABILITIES AND CAPACITIES OF MOBILE SHOWER UNITS

In order to meet the requirements set out in the O H & S Code Section 23 and the First Aid Regulation Part 11, suitable on-site facilities shall be provided as defined in Provincial/Territorial Regulations and ANSI – Z358.1 – 1998). On-board water supplies are typically 1.9m³ – 2.3m³ (500 – 600 US gallons). Each person that could be exposed to hazardous fluids requires 1.15m³ (300 US gallons) of potable water available for safety shower use. Seasonal weight restrictions (road bans) may limit the amount of water allowed on-board the mobile shower units. This factor will have to be taken into account when determining the need for a supplemental potable water supply.

ANSI Standard Z358.1 – 1998, Sections 4, 5 and 8, set out the following minimum standards for shower units, eyewash units, and drench hoses:

- Each shower head shall be capable of delivering a minimum of 76 liters per minute (20 US gpm) of “flushing solution” for a minimum of 15 minutes. This requires a minimum of 1.14m³ (300 US gallons) for each person exposed to hazardous fluids.
- Each eyewash unit shall be capable of delivering flushing fluid to the eyes at a rate of not less that 1.5 liters per minute (0.4 US gpm) for 15 minutes
- Each drench hose shall be capable of delivering a minimum of 11.4 liters per minute (3 US gpm) of flushing fluid for a minimum of 15 minutes

The delivered flushing fluid temperature shall be “tepid”. Tepid is defined in the ANSI Standard as “moderately warm; lukewarm”
If the number of persons required to be in the **HOT ZONE** exceeds the on-board water supply of a mobile shower unit, supplemental ( tepid) potable water shall be required.

Refer to ANSI Standard Z358.1 - (latest edition) for more information on the performance requirements and inspection and maintenance of safety shower equipment.

The following minimum standards should also be observed:

- The showering area must be fully enclosed and heated and large enough to comfortably accommodate one adult per shower head
- The showering area shall be provided with forced air ventilation
- The “recovery area” shall not be used for transportation of the victim, and may only be used for first aid purposes until medical aid arrives at the scene. The shower stalls must not be used as a “recovery area”
- A First Aid Kit in accordance with Provincial/Territorial First Aid Regulations
- Two self-contained breathing apparatus (SCBA)
- The shower unit must be fully mobile in order to change position on location to effectively compensate for changes in wind direction or movement of other equipment on location
- The shower unit must be separated from any potential hazard, shall not be located within the **HOT ZONE** and be within 10 second walking distance from the **HOT ZONE**.
- Shower units located on tank trucks delivering acid or other fluids to the location are to be used by the tank truck operator only and shall not be factored in when determining the number of shower heads required to provide adequate protection for personnel working in the **HOT ZONE**.

Ordinary showers installed in travel trailers etc. do not meet the ANSI standard and shall not be factored in when determining the number of shower heads required to provide adequate protection for personnel working in the **HOT ZONE**.

### 8.10.3 **TRAINING AND RESPONSIBILITIES OF SAFETY SHOWER OPERATORS**

Operators of shower units shall be competent in the operation of the unit they will be required to operate.

Operators of shower units shall have current and valid training certificates in the following:

- Standard First Aid/CPR
- H₂S Alive®
Transportation of Dangerous Goods (TDG)

WHMIS

The shower unit operator’s duties and responsibilities shall be limited to the following:

- The administering of first aid to on-site personnel exposed to chemical/corrosive substances
- Provide assistance for on-site first aid
- The safe operation of the shower unit; eyewash unit, and drench hose
- Review of hazard awareness with all personnel
- Instruction of personnel who may be exposed to hazardous materials in the location and proper use of the emergency shower units

8.10.4 **PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS FOR SAFETY SHOWER OPERATORS**

Operators of shower units shall be equipped with a complete acid/chemical resistant wet suit including gloves, rubber boots, eye protection, Fire Retardant Clothing (FRC) and a hard hat. FRC must meet CSA or CGSB Standards.

8.10.5 **DETERMINING FACTORS FOR THE NUMBER OF SAFETY SHOWER UNITS REQUIRED**

The following should be taken into account when determining the number of shower units, eyewash units, drench hoses and supplemental supply of potable water required:

- The number of personnel working in the HOT ZONE. The HOT ZONE area will differ from job site to job site, and will have to be determined at the job site
- Some acid job HOT ZONEs are on the rig floor when the treating iron is suspended
- The number of pumping units and volume of acid on-site
- The shower unit(s), eyewash unit(s), and drench hose(s) should be on location when the acid is being transferred, mixed, or under pressure on the surface. This shall include the time when back pressure is being used to circulate the acid to the bottom
- The shower unit(s), eyewash unit(s), and drench hose(s) shall remain on location until all pumping equipment has been rigged out
ATTACHMENT 1: GUIDELINES FOR CLASSIFYING FLAMMABLE FLUIDS

A-1.0 Introductions

Several methods can be used to determine the hazards associated with the use of flammable fluids. This Attachment deals with the measurement of fire hazard.

The American Society for Testing of Materials (ASTM) has two methods for determining the fire potential of a flammable fluid. They are: the “open cup” method and the “closed cup” method (see definition for flash point). The results obtained by the open cup method are subject to evaporation of light-ends and may be difficult to compare with results from the closed cup method.

The Committee that developed this IRP decided to use the open cup method as it was deemed as the more appropriate method for measuring the potential fire hazard of flammable fluids used in well servicing operations.

The flash point of a flammable fluid is the temperature at which there are sufficient flammable vapours in the atmosphere to cause a flash fire when those vapours come into contact with an ignition source. At the flash point temperature, there is insufficient vapour to support continuous combustion and the fire quickly extinguishes itself. The ignition temperature is the point where there is sufficient vapour generated to support continuous combustion. Generally, the ignition temperature is only a couple of degrees above the flash point temperature. Because these two temperatures are so close together, the flash point temperature is generally used to indicate the potential for continuous combustion. Testing methods and purity of the liquid tested may vary, and as a result, flash points are intended to be used as a guide only, not as fine lines between safe and unsafe. The Committee recognized the need for a buffer between what could be considered a “reduced” fire hazard, and what could be considered a “high” fire hazard. That buffer was determined by the Committee to be 10° C below the open cup flash point temperature.

The fire hazard of flammable fluids used in well servicing can vary, depending on how the flammable fluid is being used, the ambient temperature, and flammable fluid heating etc.

Note: IRP 4 Well Testing Fluid Handling notes API Standards for determining the specific gravity of a fluid. The specific Gravity of the fluid is then used to determine the hazard of the fluid being handled.
As WHMIS legislation requires the flash point of the fluid to be determined IRP 8 only recommends this method for determining the hazard of the fluid being handled.

A-1.1 Classification of Fire Hazards

The IRP Committee has used three classifications to define the level of fire hazard associated with flammable fluids. These are:

**High Hazard Flammable Fluids** – are flammable fluids handled at a temperature within 10° C (18° F) of the open cup flash point. For example, a liquid with a flash point of 15° C (59° F) operating at a temperature above 5° C (41° F) should be treated as a high hazard flammable fluid.

**Reduced Hazard Fluids** - are fluids handled at temperatures at least 10° C (18° F) below the open cup flash point. For example, a liquid with a flash point of 15° C (59° F) operating at a temperature of 5° C (41° F) or less should be treated as a reduced hazard fluid.

**Special Hazard Fluids** – are flammable fluids with an open cup flash point of 0°C (32°F) or less.

A-1.2 Methanol and Methanol Water Blends

Methanol is easily ignited and the flash point has been shown to be a poor indicator of fire hazard. Fire testing of methanol/water mixtures and pure methanol has demonstrated that methanol/water mixtures with 30% by volume or less methanol can be considered as low hazard. Mixtures with higher than 30% v/v methanol should be considered as high hazard flammable fluids. Methanol is considered to be a polar solvent (miscible with water). Specialized extinguisher media (i.e., alcohol type foam) is required to extinguish these fluids.

A-1.3 Oils

Crude oils, and any liquid hydrocarbons produced/returning from well operations, are classified in the same manner as well servicing fluids per flammability limits determined, reference section A-1.1. Additionally, the vapour pressure of the fluid also impacts well servicing applications, and should be evaluated if they are to be used for pumping service operations.

Currently, made under the Oil and Gas Conservation Act ERCB regulation AR 151/71 defines High Vapour Pressure Hydrocarbons and places limitations on their use:

8.110(1) In this section a "high vapour pressure hydrocarbon" means any hydrocarbon and stabilized
hydrocarbon mixture with a Reid Vapor Pressure (RVP) greater than 14 kilopascals.

8.110(2) Where the licensee or operator of a well uses a high vapour pressure hydrocarbon in an operation at a well other than in the hydraulic fracturing of a formation, he shall observe the following rules:

(a) no open tanks shall be used for storing or gauging or measuring the pumping rate;

(b) a minimum distance of 50 metres shall be maintained between the wellhead and storage tank;

(c) positive shut-off valves shall be installed between the tank and pump and between the pump and wellhead;

(d) a check valve shall be installed between the pump and the well to prevent backflow from the well;

(e) all surface lines downstream from the pump shall be pressure tested to 10 000 kilopascals above anticipated maximum pressure to be encountered;

(f) no significant wastage shall occur.

8.110(3) High vapour pressure hydrocarbons shall not be blended with propping agents for the purpose of hydraulically fracturing a formation, but the board may, on application, approve a given fracturing program if conclusive evidence is submitted to show that there is not another carrying fluid available that will be similarly effective.

Note: Reid Vapour Pressure (RVP) testing is standardized at 38⁰ C (100⁰ F). The actual “operating” conditions may be significantly different from the test results. The RVP value changes dramatically as the crude weathers. The RVP test is typically performed in a lab. The time between taking the sample and performing the test can, in some instances, be several hours, making the sample unrepresentative. It is recommended that the open cup flash point test also be used to determine an accurate indication of flammability for crude oils.
ATTACHMENT 2: HYDROSTATIC (SHOP) TESTING REQUIREMENTS FOR PRESSURIZED HOSE

A-2.0 General Hydrostatic testing of hoses, including hoses located on tank trucks, should be conducted at least once every twelve months and whenever the integrity of hoses is in doubt.

All hoses shall be tagged with an identification number and the last test date of the hose.

The tag should be clearly visible and capable of withstand conditions of use.

Precautions should be taken to protect personnel performing the testing, and to ensure that personnel not involved in the testing do not enter the area where the testing is being performed.

Lay hose out in a straight line and perform the inspection as detailed above.

A-2.1 Pressurized Hose Testing Procedures

Bind one end of the hose with a fitting that incorporates a valve with a pressure rating of at least 110% (2-1 safety factor is recommended) of the maximum test pressure being used.

Attach a fitting for connection of a pressure pump to the other end of the hose.

To reduce danger in the case of failure, tie down both ends of the hose in the test area.

Fill the hose with water and ensure that there is no air left in the hose.

Slowly pressure the hose up to 50% test pressure and shut the hose in and inspect for leaks and other indications of hose weakness such as cover bubbles, end coupler slippage, grooves and other defects.

Slowly increase the pressure to 150% of the maximum rated working pressure of the hose (or to manufacturers testing specification) and shut the hose in and then inspect hose as per above.

Monitor and record pressure for at least five minutes.

If hose pressure remains constant (+- 2%) after five minutes and hose does not show evidence of weakness, bleed off and re-stamp the hose with test date.
If the hose fails at any time during the above noted procedures, it should be removed from service for more detailed inspection, testing and repair.

A-2.2 Hose Testing Documentation

Testing documentation shall contain the following information:

- Hose manufacture date
- Date on which hose first placed in service
- Hose pressure ratings (lesser of hose and coupling)
- Details of any repairs carried out to the hose
- Test pressures and dates of testing
**ATTACHMENT 3: WELLHEAD AND COMPONENTS PRESSURE RATING DATA**

**WELLHEAD AND COMPONENTS**
**PRESSURE RATING DATA**

| WELL OWNER: | WELL NAME & LOCATION: |

<table>
<thead>
<tr>
<th>Make and Model</th>
<th>Serial # (Major Component)</th>
<th>Date of Initial Installation</th>
<th>Manufacturer's Working Pressure (New)**</th>
<th>Date Last Reconditioned</th>
<th>Derated Max. Working Pressure (if applicable)</th>
<th>Maximum Allowable Safe Working Pressure***</th>
</tr>
</thead>
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<tr>
<td></td>
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<td>MPa</td>
<td>MPa</td>
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</table>

**Wellhead Schematic Attached?** ☐ YES ☐ NO

Additional Pertinent Information

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* "Assembly* includes all nipples, valves, flanges and any other attached accessories.

** Pressures stated are for the lowest rated individual component in each assembly.

*** Alberta Recommended Practices (ARP’s) should be consulted for details regarding pressure testing. *(ARP 2.1.2.2 Pressure Testing Requirements)*

**WELL OWNER REPRESENTATIVE:**

**SIGNATURE:**

**TITLE:**

**DATE:**
ATTACHMENT 4: WELL SERVICING – WELL HEAD RIG-IN PROCEDURES AND PRESSURE RATING OF WELL HEAD VALVES

A-4.0 Procedures

A Pre-Blending Safety Meeting should be held prior to the commencement of operations, at which time, all personnel on location are to be informed of the details of the operation.

Bleed off of well head pressure should be completed by the lease owner/operator prior to the commencement of rig-up.

Gas bled from the rig or other equipment on location shall be directed to the flare.

There should be no open ignition sources on location during bleed down.

The lease owner/operator must attach their own master valve to the well head before making any of the other connections to the well head.

A treating line should not be pressure tested against the well master valve without first testing the line first against the service company main valve and then only if the pressure test is successful can the test be done against the master valve. The master valve test procedure should be supplied by the valve manufacturer because some valves are directional (i.e. they are built to withstand pressure from below). Thus it is important to determine what kind of wellhead master valve is in place during the pre-job planning phase and identify the proper test procedure that is required.

Prior to rigging up, the Service Company Supervisor should check the pressure rating of the wellhead valves and fittings to ensure their rated working pressure shall not be exceeded during pumping.

If valves & fittings are found to be unsatisfactory, the lease owner/operator shall be notified to change them.

Upon completion of these checks, the Service Company Supervisor shall verify that the information on the “Well Head and Components Pressure Rating Data Sheet” is correct. (refer to Attachment 3 “Wellhead and Components Pressure Rating Data”).

An integral flange is preferred for use when connecting treating iron to a tree or the wellhead Blowout Prevention (BOP) stack. Wells without a wellhead may be treated through casing or tubing within the pressure ratings specified by the manufacturer.
Caution  Caution must be exercised when treating through line pipe connections often found as annulus connections. The line pipe thread is very easily cracked by vibration. Always consult the manufacturer's specifications for treating pressure limits of proprietary or "premium threads".

A-4.1 Pressure Rating of Wellhead Valves

Valve sizes are identified by their “nominal” size, which is not an accurate reflection of their I.D. or bore size, but is the size with which the valve is marked. If the valve has a “restricted” or “oversize” bore, it is marked accordingly.

If a valve is flanged, the letter “R” or “BX” and the number indicating the ring size shall be marked near the valve flange.

If the valve is threaded, the thread size and symbol shall be marked near the valve outlet thread.

If only one pressure rating is stamped on a valve, it is not an American Petroleum Institute (API) valve. It must be assumed that this rating refers to the valve’s working pressure.

API specifications for flanged and screwed valves used in drilling and production well control, re-pressuring and cycling services are set out in Sections 4 and 5 of API Specification 6A “Wellhead Equipment”.
ATTACHMENT 5: STRATEGIC PLACEMENT OF TANKS AND EQUIPMENT ON LOCATIONS

(See also, Alberta Energy and Utilities Board Guideline #37 – Schedule 11 – “Equipment Spacing for Well Servicing Conventional Wells”). Ideally, equipment shall be laid out so that any release from the wellhead or rig tanks shall not impact the Frac Van or the Fire Truck.
ATTACHMENT 6: PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIREMENTS

A-6.0 Scope

The following provides a guideline for the PPE requirements at well servicing sites. Provincial/Territorial Regulatory requirements may require additional protective clothing.

These requirements refer only to PPE worn outside of the HOT ZONE. (Refer to Section 8.9.3 "Minimum Requirements for Personal Protective Clothing for Personnel Working Within the HOT ZONE").

A written policy on the use of protective clothing should be prepared by each service company. All on-site personnel shall be equipped with the appropriate PPE in accordance with the company policies.

A-6.1 Minimum Requirements

The following are the minimum requirements for the use and care of PPE:

- **Fire retardant coveralls** - shall be worn at all times while in the work area
- **Footwear** - Safety footwear shall be worn at all times while in the work area
- **Gloves** - appropriate gloves shall be worn when handling chemicals, pipe, etc.
- **Hardhat** - shall be worn at all times while in the work area
- **Hearing protection** - shall be worn when required – see Provincial/Territorial Regulations applicable to the jurisdiction in which work is being performed
- **Safety glasses** (or safety prescription glasses) – shall be worn at all times while in the work area
- **Safety goggles** - shall be worn whenever chemicals are being handled or where there is a danger of splashing or dusting from these chemicals
- **Under garments** made of natural fibres are preferred over synthetic fibres
- **All clothing** should fit properly and be in good repair
- **All clothing** that becomes contaminated with hazardous chemicals or flammable fluids must be removed and replaced
- **All specialized outer garments** used during the handling of hazardous materials must be properly cleaned and stored before re-use
Bunker gear should not be worn outside the HOT ZONE

A-6.2 PPE Minimum Standards

The following standards should be used the minimum for the above noted PPE:

- Hardhats: CSA Z94.1; Saskatchewan – CSA Z94.1 or ANSI
- Footwear: CSA Z195 Grade 1
- Eyewear, Goggles: CSA Z94.3
- Hearing Protection: CSA Z94.2
ATTACHMENT 7: HOT ZONE PLACARD
ATTACHMENT 8: HOT ZONE PLACARD PLACEMENT – WELLSITE

A-8.0 Placement of Placards Around the HOT ZONE

Placement of Placards Around the HOT ZONE

Placard is to be placed on:

All four sides of the HOT ZONE

On all four sides of the rig tank if the high pressure pumpers are to be “picked up” to the rig tanks or if the recovered flammable fluids are to be flowed back to the rig tank

(For more information on the safe handling of recovered flammable fluids refer to IRP Volume 4, “Well Testing and Fluid Handling”, 4.4 Loading, Unloading and Transportation of Fluids).
ATTACHMENT 9: HIGH PRESSURE MANIFOLDING – INSPECTION AND MAINTENANCE

A-9.0 Introduction

This section needs to be in line with the provincial jurisdiction.

The failure of High Pressure Discharge Manifolding (HPDM) during the pumping of flammable fluids can result in a potentially hazardous situation.

Failure of HPDM usually results from one of the following three causes:

- The inability of the rated equipment to withstand the required pressure
- The equipment is subjected to pressures above it’s rated capacity, or
- The equipment is poorly maintained and/or installed incorrectly

Equipment failures below rating may be the result of a defect in manufacture, but it is most often caused by a lack of a proper inspection and maintenance program.

This section provides a brief summary of items that should be included in an inspection and maintenance program.

A-9.1 Identification

The design pressure limitation should be clearly marked on all HPDM. If this information is not stamped on the HPDM by the manufacturer, it can be affixed by way of an identification band. The band can either be a pre-fabricated punch lock band or may be fabricated by cutting pieces from 3 mm by 25 mm flat iron and stamping the piece with the proper markings. The piece can then be bent round the piece of iron to be banded and the ends spot welded together. Do not weld the band directly onto the HPDM, as it will affect the integrity of the steel. The owner of the HPDM is responsible for ensuring that this information is fixed to the equipment or HPDM.
The following information should be stamped onto the band:

<table>
<thead>
<tr>
<th>XXX Mpa</th>
<th>YY</th>
<th>00</th>
<th>## mm</th>
<th>Xxxxx</th>
<th>Dd/mm/yy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xxxxx MPa</td>
<td>Maximum working pressure of the component</td>
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<tr>
<td>YY</td>
<td>Place where permanent records are retained (e.g., -GP- Grande Prairie)</td>
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<tr>
<td>00</td>
<td>Component code (LJ - Long Joint; PJ - Pup Joint; CV-Check Valve etc.)</td>
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<tr>
<td>## mm</td>
<td>ID size of manifold (i.e., -25mm, 50mm etc.)</td>
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<tr>
<td>Xxxxxx</td>
<td>Serial Number for that specific element (record keeping)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dd/mm/yy</td>
<td>Day, month and year of last test</td>
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**A-9.2 Non-Destructive Testing**

There are two types of non-destructive testing:

- On site pressure testing; and
- Maintenance testing

The on-site pressure test should include a visual inspection and a hydrostatic pressure test. The visual examination should include an inspection of the union threads, seal pockets, male sub ends, weld areas, hammer nuts, retainer segments, and visual material loss. This visual inspection will help determine if the components have suffered damage as a result of mishandling; cracks; erosion, or corrosion.

Field hydrostatic testing (pre-job) should not be used to determine whether or not a particular component will fail at a particular pressure. This type of testing should only be performed to detect leaks, and should never exceed the rated working pressure of the component. Pressure tests should be performed using water (compressed gas, acid or flammable fluids shall not be used). Fill the entire component structure with water, positioning it to avoid entrapment of air. If possible, dry all exterior surfaces to enable detection of leaks. The components should then be slowly pressurized up to 110% of the maximum expected pressure, or to the maximum working pressure of the weakest component in the assembly. After the 10 minute pressure test and de-pressurization, inspect the assembly for leaks.

**A pressurized line should not be visually inspected and do not attempt to tighten a component connection while it is pressurized.**

Maintenance testing should be conducted at least once a year, or more often depending upon the exposure of the manifold components to H\textsubscript{2}S, abrasive or corrosive fluids. A testing record should be kept on the unit containing the HPDM with a copy at the base.
Maintenance testing should include:

- Hydrostatic testing (procedures and requirements available at the Boilers Branch)
- Ultrasonic wall thickness measurements – wall thickness should be measured and recorded for each component at pre-determined points on the element.

The above points are a required minimum. Refer to the manufacturer of specific HPDM for their recommended maintenance programs. Additional testing procedures could include:

- Radiography (x-ray) to determine internal structure of welds and castings
- Magnetic particle to detect surface or near surface cracks
- Liquid penetrant to detect surface cracks

Eddy current testing to check for defects such as erosion, corrosion pits, cracks, vibration damage, fretting and freeze or hydrogen bubbles.
### A-9.3 High Pressure Manifolding – Inspection and Maintenance Record Sheet

<table>
<thead>
<tr>
<th>Location Code</th>
<th>Component Code</th>
<th>Size</th>
<th>Serial Number</th>
<th>Previous Serial Number (If Applicable)</th>
<th>Unit Number</th>
<th>Minimum Wall Thickness Observed (mm)</th>
<th>Maximum Pressure</th>
<th>Comments</th>
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</tbody>
</table>
### A-9.4 Sweep Swivel Joints

![Diagram of Sweep Swivel Joints](image)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal New Dimension</td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
</tr>
<tr>
<td>Minimum Dimension</td>
<td>in</td>
<td>mm</td>
<td>in</td>
<td>mm</td>
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</tbody>
</table>

The diagram illustrates the sweep swivel joint with dimensions labeled A, B, C, and D. The table provides the nominal new dimensions and minimum dimensions for each location.
### A-9.5 Wing Union Half Male Sub with Detachable Hammer Nut

![Diagram of A-9.5 Wing Union Half Male Sub with Detachable Hammer Nut](image)

<table>
<thead>
<tr>
<th>SIZE</th>
<th>FIGURE NUMBER</th>
<th>WORKING PRESSURE</th>
<th>SERVICE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
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<td></td>
<td>IN. MM</td>
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</tbody>
</table>

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**Notes:**

- The dimensions are specified in both inches and millimeters. The location of each component is marked as A and B.
- The service section is left blank as it may vary depending on the specific application or usage.

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**Pumping of Flammable Fluids**

Page 58 March 2009
A-9.6 Straight Discharge Joints

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMINAL NEW DIMENSION</td>
<td>in. mm</td>
<td>in. mm</td>
<td>in. mm</td>
<td>in. mm</td>
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<tr>
<td>MINIMUM DIMENSION</td>
<td>in. mm</td>
<td>in. mm</td>
<td>in. mm</td>
<td>in. mm</td>
</tr>
</tbody>
</table>
## A-9.7 Wing Union Half Female Sub

![Diagram of A-9.7 Wing Union Half Female Sub]

<table>
<thead>
<tr>
<th>SIZE</th>
<th>FIGURE NUMBER</th>
<th>WORKING PRESSURE</th>
<th>SERVICE</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A</td>
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<tr>
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</table>

<table>
<thead>
<tr>
<th>NEW NOM. DIMENSION</th>
<th>MINIMUM DIMENSION</th>
</tr>
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<tbody>
<tr>
<td>in. mm</td>
<td>in. mm</td>
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<td>in. mm</td>
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<td>in. mm</td>
<td>in. mm</td>
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</tbody>
</table>
ATTACHMENT 10: ANNULAR PRESSURE RELIEVE SYSTEM

A-10.1 Annular Relief Valve

Commonly referred to as a “pop-valve”, is usually installed on the annulus side of the wellhead on most well service fluids that are being pumped down the tubing.

There are two types of relief valves, the “resetting” and the “full-flow trip.” They operate as follows:

- Resetting – relieves pressure above a given set pressure, and then closes again when the pressure falls below the set pressure
- Full-flow trip – must be manually reset when the set pressure is exceeded.

When installing these valves, it is important to ensure that the outlet is pointed away from equipment and personnel and secured in such a fashion to withstand the back thrust of the discharging fluid without changing the direction of discharge.

A-10.2 Main Line Relief Valve

The use of a relief valve on the main treating line, particularly on well service jobs is not recommended. However, if a relief valve is to be used on the main treating line, the following steps should be taken:

- The relief valve must be rated for 100% of the maximum flow rate being performed on the well.
- Do not place the relief valve directly on the main treating line. Place a tee in the main line and a 50mm x 50mm (i.e. “Hammer” valve) immediately downstream, perpendicular to the main treating line. Place a joint of discharge manifold iron, then the relief valve, downstream of plug valve.
- Place a 50mm x 50mm plug type valve (i.e. “Hammer” valve) before each relief valve. For safety reasons, this valve should be air actuated. It is important to note that relief valves may bleed if they are operating near their set point. They may continue to leak after being closed.
- The relief valve should be pressure tested before use, to confirm that it will open at the required pressure.
- Ensure, where necessary, that the pressure relief valve is protected from freezing while in use.
- Lay a staked line from the valve to a safe location to allow for safe discharge.
Place relief valves upstream (pump side) of the main line check valve.

The relief valve must only be used to provide over pressure protection and not to control well flow.

Do not flow sand through the relief valve as it will quickly cut off the valve body.

Do not place any equipment or personnel in the area around the relief valve.

The installation of relief valves on gas energized systems for treating lines on CO₂ or N₂ jobs is not recommended.
ATTACHMENT 11: STATIC ELECTRICITY

A-11.0 Some Facts About Static Electricity

Some Facts About Static Electricity:

Static electricity consists of opposite charges separated by electrical insulators
Static electricity is caused when electrons are transferred between materials
A static charge can build up on either conducting or non-conducting surfaces
Even though the flow of electricity during generation and accumulations is small – in the range of millionths of an ampere – potential differences amounting to thousands of volts may be produced
Static electricity generally discharges by “sparking” of the accumulated charge
Because static electricity differs from “power” electricity, it requires special measuring instruments and techniques.

The ability of a substance to hold a static charge depends on its conductivity, and its proximity to a charge release point. One unit of conductivity is the picosiemen per metre (pS/m). The lower the conductivity, the longer the substance can hold a static charge.

The conductivity of some substances are listed below:

<table>
<thead>
<tr>
<th>Substance</th>
<th>Conductivity (pS/m)</th>
<th>Half-Value Time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly Refined flammable fluids</td>
<td>0.01</td>
<td>1500</td>
</tr>
<tr>
<td>Light Distillates</td>
<td>0.01 to 10</td>
<td>1500 – 1.5</td>
</tr>
<tr>
<td>Black Oils</td>
<td>1,000 to 100,000</td>
<td>0.015 – 0.00015</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>1,000,000</td>
<td>4 x 10-6</td>
</tr>
</tbody>
</table>

Static accumulation is typically considered to be insignificant when the conductivity of the substance exceeds 50 pS/m. Purified flammable fluids have 100,000,000 times greater ability to retain a static charge than does distilled water.

One method of measuring static accumulation is the “half-value time” which is the time required, in seconds, for the original charge in a substance to drop to one-half of the original value.
The time required for a static charge to decrease to an acceptable level in purified flammable fluids is very long.

**A-11.1 Control of Static Electricity**

Many of the problems associated with static electricity can be removed, or at least reduced, by simply “draining off” the static charge as fast as it is produced. Bonding and grounding are two methods used. Bonding and grounding are two different procedures, and are not always inter-changeable when removing static charges.

**A-11.2 Bonding**

An electrical bond attached to both conducting bodies can prevent sparking. This bond will prevent a difference in potential across the gap by providing a conductive path through which the static charges can re-combine. Thus, a charge cannot accumulate, and a spark cannot occur.

Because of mechanical considerations, static bond wires are usually large, and the resistance of the wire is low. An 8 gauge wire with CSA approved grounding connectors shall be used to bond all equipment being used in the blending and pumping process. The connector attachment sites shall be non-painted surfaces, and free from rust.

**A-11.3 Grounding**

Two sources of grounding shall be used on all high hazard sites.

The wellhead may be used for grounding provided it is properly connected to the pumping or blending equipment. The other grounding source must be a supplementary one, such as a rig anchor driven into the ground to a depth of not less than 2.5 - 3 m or a 0.65 m by 0.65 m (minimum) plate buried not less than .3 m in the ground.
A-11.4 Wearing Apparel

Under the right conditions, a great many fabrics can generate static electricity. This can occur when the fabric is brought into contact with other materials and then separated, or when the fabric is rubbed on other surfaces.

Most synthetic fabrics (nylon, orlon, dacron and rayon), are more active generators of static electricity than natural fabrics.

Rubber and leather-soled shoes can generate static when the wearer walks on dry carpeting or other non-conductive surfaces during periods of low humidity.

The potential for a fabric to generate electricity should be considered and appropriate steps taken to minimize the potential.

The reported incidence (in the petroleum industry), of synthetic fabrics being the cause of ignition of static electricity, suggests that this hazard is not significant. However, clothing should not be removed in a flammable atmosphere because electrostatic discharges normally occur during removal.
ATTACHMENT 12: FIRE TRAINING REQUIREMENTS FOR WELL SERVICE PERSONNEL

A-12.0 Scope

The following basic fire extinguisher training should be given to all personnel that are expected to use an extinguisher.

PART I: FIRE FIGHTING THEORY

1. The Chemistry of Fire
   Fire Prevention
   Classification of Fire
   Fire Extinguishing Agents
   Fire Extinguisher Ratings and Classifications
   Fire Extinguishers

PART II: FIRE EXTINGUISHMENT

1. Attacking The Fire
   2. Use Of Dry Chemical Fire Extinguishers

PART III: BURNS AND BURN TREATMENT

1. Burns

PART IV: PERSONAL PROTECTIVE EQUIPMENT

PART V: PERSONAL FIRE SURVIVAL
ATTACHMENT 13: FIRE TRAINING REQUIREMENTS FOR INDUSTRIAL / OILFIELD FIRE FIGHTERS

A-13.0 Introduction

All Industrial/Oilfield Fire Fighters shall be trained to a level of competency commensurate with the duties and functions that they are expected to perform, including the operation of all the fire fighting and rescue equipment and systems they are expected to use. NFPA 600 Standard 2-3.1

Industrial /Oilfield Fire Fighters shall meet the minimum skills and knowledge requirements of a performance based training and education program. Skill levels shall be obtained by meeting documented job performance requirements for each site-specific task expected to be performed by the Fire Fighter before participating in any emergency operations. NFPA 600 Standard 2-3.2*

Industrial/Oilfield Fire Fighters shall not perform any duties they have not been trained to perform. All Fire Fighters progressing through levels I, II, and III to Senior Fire Fighter, shall be under the supervision of a Senior Fire Fighter.

Drills shall be conducted as often as necessary to evaluate the effectiveness of the fire training and education program and the competence of the Fire Fighter in performing assigned duties. Lessons learned shall be evaluated and documented and additional training shall be provided as necessary to improve performance that is below established standards. NFPA 600 Standard 2-3.8*

A-13.1 National Fire Protection Association (NFPA) Fire Fighting Requirements

Training Industrial/Oilfield Fire Fighter IV (Senior)

A Senior Fire Fighter must have as a pre requisite, Levels I, II, and III, and pump operator training. Candidates receive classroom and practical instruction on pumping engines, designs, accessories, and principles of operation according to the training program.

Industrial/Oilfield Fire Fighter III

A Fire Fighter III must have as a minimum, the equivalency of Level I, II, III according to NFPA 600 Standard 2-3. Fire Fighter III must be fully trained in LPG
and LNG pressure fires. In addition to the required levels of training, a Fire Fighter III shall have as a minimum, two (2) years of fire fighting experience and training with competency levels in area of application.

**Industrial/Oilfield Fire Fighter II**

Fire Fighter II shall have Level I and II according to NFPA 600 Standard 2-3 as a minimum standard of training. The Fire Fighter II must be fully trained in the specific theory and operation of the equipment he/she will be required to operate.

**Industrial/Oilfield Fire Fighter I (Trainee)**

The Fire Fighter I Trainee shall have Level I according to NFPA 600 Standard 2-3, all industry training certification and be fully orientated in the specific tasks he/she may be required to perform. On the job training shall be under the direct supervision of a Senior Fire Fighter.

**Training Records**

Training records shall include, but not be limited to, courses completed, subjects studied, refresher courses completed, and other evaluations of skills and knowledge, drill attendance records, and leadership or other special accomplishments related to the fire fighters activities. NFPA 600 Standard 2-3.14.2

Fire personnel training certification may be supplied upon request.

**Physical Fitness**

Industrial /Oilfield Fire Fighters shall be required to meet the Medical and Physical requirements as set out in the NFPA 600 Standard, 2-5.1.1*.

**A-13.2 NFPA Standards**

**NFPA 600 Standard 2-3.-1**

A training and education program shall be established and maintained for all fire brigade members to ensure that they are able to perform their assigned duties in a safe manner that does not pose a hazard to themselves or other members. All members shall be trained to a level of competency commensurate with the duties and functions that they are expected to perform, including the operation of all of the fire fighting and rescue equipment and systems they are expected to use.
NFPA 600 Standard 2-3.-2*

Members shall meet the minimum skills and knowledge requirements of a performance based training and education program. Skill levels shall be obtained by meeting documented job performance requirements for each site-specific task expected to be performed by brigade members before participating in emergency operations.

NFPA 600 Standard 2-3.-8*

Drills shall be conducted as often as necessary to evaluate the effectiveness of the fire brigade training and education program and the competence of fire brigade members in performing assigned duties. Lessons learned shall be evaluated and documented, and additional training shall be provided as necessary to improve performance that is below established standards.

NFPA 600 Standard 2-3.14.2

Training records shall include, but not be limited to, courses completed, subjects studied, refresher courses completed, and other evaluations of skills and knowledge, drill attendance records, and leadership or other special accomplishments related to fire brigade activities.

NFPA 600 Standard 2-5.1.1*

Prior to being accepted for fire brigade membership, employees shall be examined and certified by a qualified physician as being medically and physically fit. The medical and physical fitness requirements shall take into account the risks and the tasks associated with the individual’s assigned fire brigade duties.

NFPA 600 Standard 4-3.1

The Industrial/Oilfield Fire Fighter must be properly trained on personal protective equipment according to the NFPA 600 Standard, 4-3 Protective Clothing and Protective Equipment, as well as H2S, W.H.M.I.S., T.D.G., and a level of First Aid that is equivalent or greater than Standard First Aid.

Thermal protective clothing and protective equipment shall be available in sufficient quantity and sizes to fit each brigade member expected to enter the hot and warm zones. Thermal protective clothing and protective equipment meeting the following requirements shall be required to be worn by all fire brigade members entering the hot and warm zones.

Protective clothing shall be in accordance with NFPA 1971, Standard on Protective Clothing for Structural Fire Fighting.
Helmets shall be in accordance with NFPA 1972, Standard on Helmets for Structural Fire Fighting.

Gloves should be in accordance with NFPA 1973, Standard on gloves for Structural Fire Fighting.

Footwear shall be in accordance with NFPA 1974, Standard on Protective Footwear for Structural Fire Fighting.

SCBA and PASS devices meeting the following requirements shall be provided for and shall be used by all fire brigade members working in the HOT ZONE:

PASS devices shall be in accordance with NFPA 1982, Standard in Personal Alert Safety Systems (PASS) for Fire Fighters.

Open-circuit type, self-contained breathing devices shall be in accordance with NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire Fighters.

Closed-circuit type, self-contained breathing devices shall be NIOSH/MSHA approved with minimum service duration of 30 minutes and shall operate in the positive mode only.

Protective clothing and protective equipment shall be used and maintained in accordance with manufacture’s instructions. A maintenance and inspection program shall be established for protective clothing and protective equipment. Specific responsibilities shall be assigned for inspection and maintenance.

A-13.3 Use of Self Contained Breathing Apparatus (SCBA)

Members using SCBA shall operate in teams of two or more who are in communication with each other through visual, audible, physical, safety guide-rope, electronic, or other means to coordinate their activities, and are in close proximity to each other to provide assistance in case of an emergency.

Where members are involved in operations that require the use of SCBA or other respiratory protective equipment, at least one member shall be assigned to remain outside the area where respiratory equipment is required. This member shall be responsible for maintaining a constant awareness of the number and identity of personnel using SCBA, their location, function, and time of entry. Members with SCBA shall be available for rescue.

All fire brigade members entering the HOT ZONE shall be provided with approved protective hoods or a combination of ear flaps and collar that provide protection for the ears and neck and interface with the self-contained breathing apparatus face piece, thermal protective coat and helmet.
A-13.4 Reference to Other NFPA Standards

(NFPA 10 - Standard for Portable Fire Extinguishers)

Covers the selection, installation, inspection, maintenance, and testing of portable extinguishing equipment.

(NFPA 11 - Standard for Low – Expansion Foam)

Covers the characteristics of foam-producing materials and the requirements for design, installation, operation & maintenance of equipment and systems; minimum requirements for flammable ad combustible liquid hazards in areas within buildings, for storage tanks, and for indoor and outdoor processing.

(NFPA 18 - Standard on Wetting Agents)

Covers qualification tests, methods of evaluation, general rule application, and limitations for use of wetting agents as related to fire control and extinguishments.
### ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>CGSB</td>
<td>Canadian General Standards Board</td>
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<tr>
<td>CSA</td>
<td>Canadian Standards Association</td>
</tr>
<tr>
<td>FRC</td>
<td>Fire Retardant Clothing</td>
</tr>
<tr>
<td>HPDM</td>
<td>High Pressure Discharge Manifold</td>
</tr>
<tr>
<td>IRP</td>
<td>Industry Recommended Practice</td>
</tr>
<tr>
<td>LFL</td>
<td>Lower Flammable Limit</td>
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<tr>
<td>LPT</td>
<td>Line Pipe Threading</td>
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<tr>
<td>MSDS</td>
<td>Material Safety Data Sheets</td>
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<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NORM</td>
<td>Naturally Occurring Radioactive Material</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal Protective Equipment</td>
</tr>
<tr>
<td>RVP</td>
<td>Reid Vapor Pressure</td>
</tr>
<tr>
<td>SABA</td>
<td>Supplied Air Breathing Apparatus</td>
</tr>
<tr>
<td>SCBA</td>
<td>Self Contained Breathing Apparatus</td>
</tr>
<tr>
<td>TDG</td>
<td>Transportation of Dangerous Goods</td>
</tr>
<tr>
<td>UFL</td>
<td>Upper Flammable Limit</td>
</tr>
<tr>
<td>WHMIS</td>
<td>Workplace Hazardous Material Information System</td>
</tr>
</tbody>
</table>
GLOSSARY TERMS

ANSI: Establishes industry standards such as ANSI-358.1 Emergency Eyewash and Shower Equipment.

Bonding: The act of forming an electrically conductive circuit between all vessels containing flammable fluids and pieces of well servicing equipment. Bonding ensures that the electrical potential caused by electrostatic build-up or stray currents is the same on all equipment in the circuit. It does not necessarily result in a “Ground Potential” of zero. Bonding is suitable for the transfer of fluids from tank to tank. However, it is preferred that the service equipment be connected together and grounded to the well head.

Bottom Loading: The act of unloading flammable fluid into a tank or container through inlet valves that are situated relatively low on the side of the tank. With the valves located near the bottom of the tank, the fluid that is being unloaded into the tank soon covers the inlet valves and becomes submerged under the fluid that has already been unloaded.

Cleveland Open-Cup (ASTM Test D-92-98a) is used for materials with flash points between 79 and 400°C respectively.

Closed Blending System: A mixing system in which there is no contact between flammable fluid vapours and surrounding air, and one in which air is not introduced via an added component e.g. sand.

Competent: In relation to a worker, means adequately qualified, suitably trained and with sufficient experience, safely to perform the work without or with only a minimal degree of supervision.

Fill Pipe Loading: The act of transferring flammable liquid into a tank or container through a pipe that rises up the outside of the tank and is continuous on the inside of the tank to the bottom. The end of the fill pipe should be one foot off the bottom of the tank or container. A slow filling rate of 1 m/sec (3 ft/sec) should be maintained until the end of the fill pipe is completely submerged so as to eliminate initial splash loading hazards.

Flammable (or Explosive) Limits: Flammable (or explosive) limits are the minimum and maximum concentrations (expressed as volume fraction or %) of a flammable vapour (or aerosol/mist) in air that are capable of supporting combustion. These limits are usually abbreviated to LFL (Lower Flammable Limit) and UFL (Upper Flammable Limit) or LEL/UEL. Flammable limits in the literature are normally given at atmospheric conditions. An increase in oxygen content will widen the flammable range (i.e. the LFL will be lower and the UFL will be higher). A decrease in oxygen (adding inert gas) will narrow the flammability range to the point where combustion cannot occur. An increase in pressure or temperature will also widen the flammable range (or reduce the amount of oxygen required to support combustion).

Flash Point: The flash point is the lowest temperature at which a liquid exposed to air gives off sufficient vapour to form a flammable mixture near the surface of the liquid, or within the test apparatus used, that can be ignited by a suitable flame. Flash Points are derived by the Open Cup or Closed Cup methods. In this publication, references to flash point refer to both the Open and Closed Cup method. As required by WHMIS, an MSDS provides information on the material's fire/explosion hazard by describing the material's flash point as derived by the Closed Cup test method.
Fracturing: A specific type of well service procedure involving the pumping of a specialized fluid or gas into a formation at a sufficient rate and pressure to create certain formation “cracks” through which the fluid or gas is pumped. The fluids or gases used in a fracturing treatment typically carry a natural or man-made, refined and sized set of particles that will be left in the created fracture to prop the crack open.

Grounding: Is similar to bonding except that the equipment circuit is not only connected to each other but also to an adequately grounded object (i.e. the well head, ground anchor etc.). This ensures that the equipment can be at ground (zero) potential.

Half-Value Time: The time taken for an accumulated electrostatic charge in a liquid (within an enclosed conductive container), to decrease to one half of its’ original value.

High Hazard Flammable Fluids: are flammable fluids handled at a temperature within 10° C (18° F) of the open cup flash point. For example, a liquid with a flash point of 15° C (59° F) operating at a temperature above 5° C (41° F) should be treated as a high hazard flammable fluid.

High Pressure Discharge Manifold (HPDM): Steel reinforced hose or steel piping used to carry well servicing fluids from containers through pumps to piping connected to the wellhead and wellbore tubulars.

HOT ZONE: The area immediately around the storage tanks or transport truck used to store flammable fluids. This area would be expanded to include the hot oiler when heating the fluid, and to include the blender, rear of the sand truck and the first row of high-pressure pumps during a well stimulation job. Other cases of a “HOT ZONE” include the area around a rig tank if flammable fluids are being pumped to the tank during a treatment or contained in the tank as part of the workover treatments.

MSDS: Material Safety Data Sheet defines the health, safety and fire risks associated with a specific product. The MSDS shall be available on-site for all hazardous materials that are used on-site. (see also WHMIS).

Non-Destructive Testing: A method of determining the integrity of pressurized equipment without incurring damage to the equipment.

Open Blending System: A mixing system where flammable fluids are exposed to the surrounding air.

Open Cup Flash Point: See definition for “Flash Point”

Open-Cup flash points are determined by one of the following test methods:

Lease Owner/Operator: A person, partnership, company or group of persons who, under contract and agreement of ownership, direct the activities of one or more employers involved at a work site.

Personal Protective Equipment: The equipment or clothing worn by a worker to reduce the consequences of exposure to various hazards associated with working conditions or a work site. Personal protective equipment includes goggles, chemical goggles, chemical suits and aprons, cold weather clothing, dust masks, face shields, fire-retardant clothing, gloves, hard hats, hearing protection, high visibility safety vests, hoods, safety goggles, safety helmets and safety-toed footwear.

Polar Solvents: For the purpose of this document, polar solvents are generally referenced as those organic compounds that are soluble in water or organic compounds that are mixed into water for oilfield well servicing, (e.g. methanol, alcohol, glycol’s, ethers).
Prime Contractor: Means the prime contractor for a work site (this is referred to under the Alberta OH&S Act, section 2.1).

Tag Open-Cup (ASTM Test D-1310-86) is used for materials with flash points between 0 and 325 °C

Reduced Hazard Fluids: are fluids handled at temperatures at least 10° C (18° F) below the open cup flash point. For example, a liquid with a flash point of 15° C (59° F) operating at a temperature of 5° C (41° F) or less should be treated as a reduced hazard fluid.

Note: A Reduced Hazard Fluid may be pumped into a well but because of the temperature increase of the fluid down-hole, the fluid may return to surface in a High Hazard condition.

SABA: Supplied Air Breathing Apparatus (SABA): It consists of a small air cylinder (less than 5 minutes of breathing air) and air mask intended to be carried on the hip of a worker with the ability to connect, by hose, to numerous larger air cylinders. This type of configuration is used for extended work periods where a worker is exposed to an H2S or other hazardous breathing environment.

SCBA: Self-Contained Breathing Apparatus (SCBA): It consists of an air cylinder and mask intended to be carried on the back of the worker and has (+)(-) 30 minutes of breathing air contained in the cylinder. This device is used for short work periods where a worker is in an H2S or other hazardous breathing environment. Also used for emergency situations to aid in the rescue of injured personnel.

Service Company: Means a person, corporation or association who is contracted to supply, sell, offer or expose for sale, lease, distribute or install a product or service to another company, usually the owner of the worksite.

Shower unit: A mobile, truck mounted personnel shower facility which provides the personnel on a work location the facility to “shower off” chemical and or toxic substances should they come in contact with the skin of personnel working on a location.

Spark Promoters: Are un-bonded conducting objects, within a tank or compartment. Metal or conductive objects such as gauge tapes, sample containers and thermometers should not be lowered into a tank or compartment during loading or immediately after cessation of loading.

Special Hazard Fluids: Are flammable fluids with an open cup flash point of 0°C (32°F) or less.

Splash Loading: The act of unloading of flammable fluid into a tank or container, such that the flammable fluid free-falls from the inlet pipe to the surface of the stored flammable fluid. This causes the flammable fluid to splash down in an uncontrolled fashion and increases the risk of an electrostatic ignition.

Well Service Fluids: Fluids used in conjunction with a well service procedure.

Well Service Operations: Work done on a wellbore that is connected to a potential flammable fluid bearing formation, for the purpose of production of petroleum products, whether gases or liquids. Wellbores can also be used for injection of liquids or gases, to enhance the production of petroleum products in other wellbores connected to the same formations.

Wellbores may also be used to dispose of liquids or gases that were produced from other wellbores, and are not wanted by the operator. Stimulation of the wellbores for increased production or injection, or the working over of a well to maintain or regain production, and/or injection, is also considered a well service operation.
Workplace Hazardous Material Information System (WHMIS): an information system that, along with other requirements, includes safe handling precautions of controlled products on labels and material safety data sheets.