

# WELL STIMULATION SURFACE OPERATIONS INDUSTRY GUIDELINES

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# Acknowledgements

The Energy Workforce & Technology Council (EWTC) is proud to present the Surface Operations Industry Guidelines for Oil and Gas Well Stimulation, which were developed to outline recommended best practices and operational guidance for the industry.

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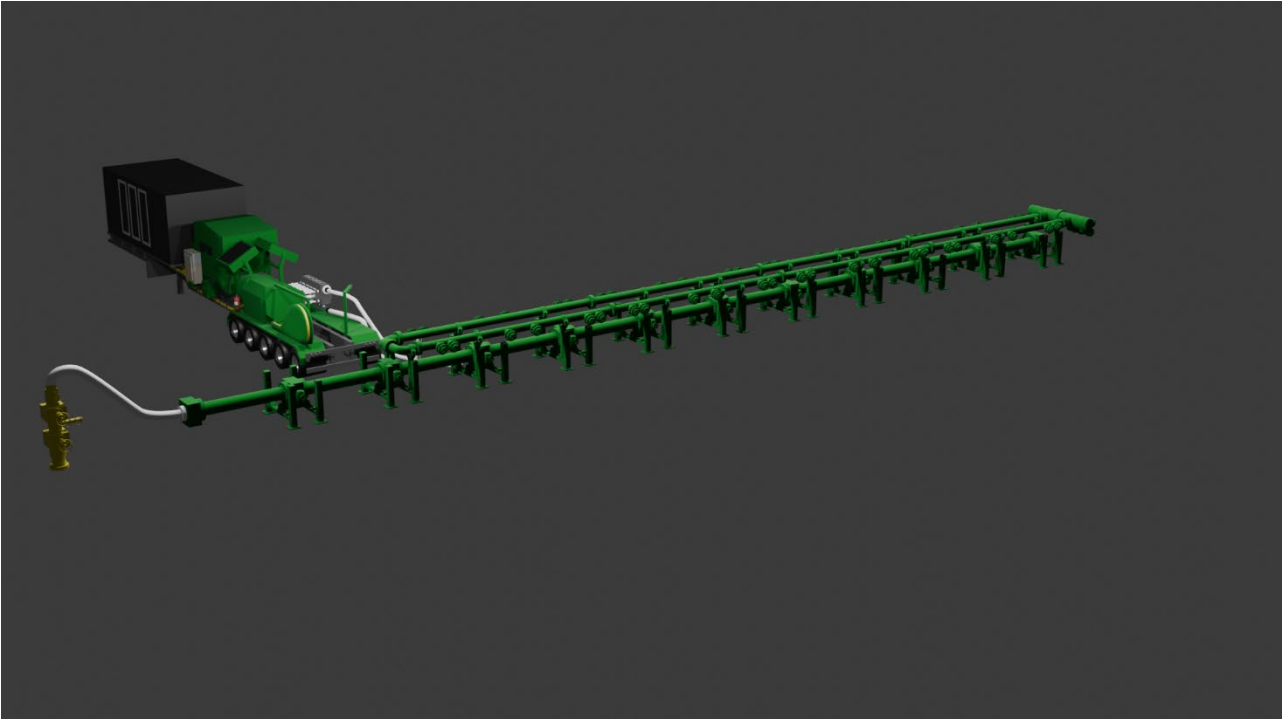
## DISCLAIMER

This voluntary industry guideline document is offered as general guidance only. Each Member Company must still use its own independent judgement and discretion to implement its operations successfully and develop specific systems that best fit its management structure, product lines, location, and other factors that are unique to the company and the products and services it provides. These guidelines are not meant to be a substitute for applicable laws and regulations, nor do they alter or enhance the obligation of Member Companies to fully comply with federal, state and local law.

# Surface Operations

The Surface Operations chapter initiates assessment at the surface treating components where Subject Well Integrity Assessment ends. (see the grey shaded area in Figure 1) This chapter determines surface areas, identifies hazards, and reviews considerations for hazard management planning and wellsite execution.

**Figure 1. Surface Operations includes all above-ground and near-surface equipment and activities with the exception of the well head equipment (not shaded below), which is covered in the Subject Well Integrity chapter.**



Fracture stimulation operations are complex operations. Activities associated with multi-well leases may result in increased activity and congestion surrounding a well under high-pressure. Thorough planning before fracture operations begin can mitigate or control identified, and industry known hazards (Hazard Register). It is the Subject Well Operator's responsibility to review surface operations in the planning stages to minimize the probability of surface and near surface hazards.

**IG            The Subject Well Operator shall minimize surface hazards (to workers, public, and environment) resulting from fracture stimulation operations at the Subject Well**

**REG**        **If an incident occurs at the wellsite because of fracture stimulation operations, then the Subject Well Operator’s Emergency Response Plan (ERP) must be invoked in accordance with relevant jurisdictional regulations.**

Common options to minimize surface hazards include, but are not limited to:

1. Conduct appropriate Surface Operations Hazard Management Planning by consulting and employing the Surface Hazard Management Process (see Figure 2).
2. Adjust the Fracture Stimulation Program.
3. Create clear and transparent processes and communication during concurrent operation

## Surface Hazard Management Process

The Surface Hazard Management Process (SHMP) is part of the larger Fracture Stimulation Hazard Management Process. The SHMP portion of the process determines surface hazards of greatest concern on the lease and/or resulting from related activities necessary to support the fracture stimulation operation.

The SHMP provides a set of recommended practices for both the Subject Well Operator and Service Providers to conduct appropriate surface operations hazard management planning based on a surface operations hazard assessment.

Note. The SHMP is not intended to replace existing organizational risk assessment processes and associated risk analysis tools or registers, nor is it intended to provide a complete risk analysis tool for organizations. Established Operators may use the SHMP and the Hazard Register to augment existing processes and tools. Newer entrants may use the SHMP and Hazard Register as a basis for new processes and tools. Regardless of how an organization chooses to implement the SHMP and Hazard Register, the EWTC Well Stimulation Committee supports and recommends that both be implemented for all fracture stimulation operations.

Figure 2 illustrates the SHMP in relation to the sections of this document. Process boxes (in blue) are aligned with corresponding section headers in this chapter. The bullet points in each process box summarize key elements in the related section. A decision point box is noted with a yellow diamond and change management is in an orange box.

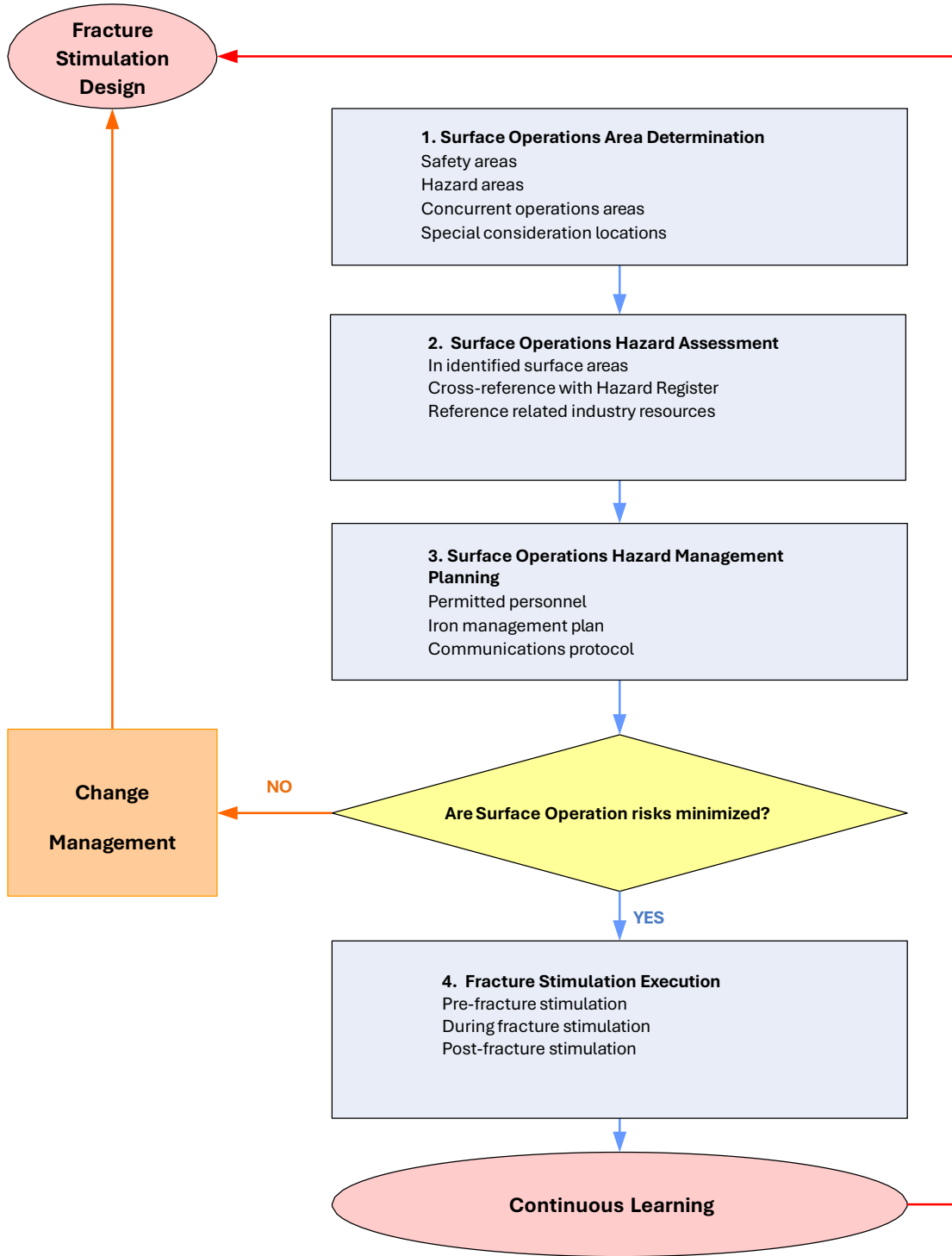
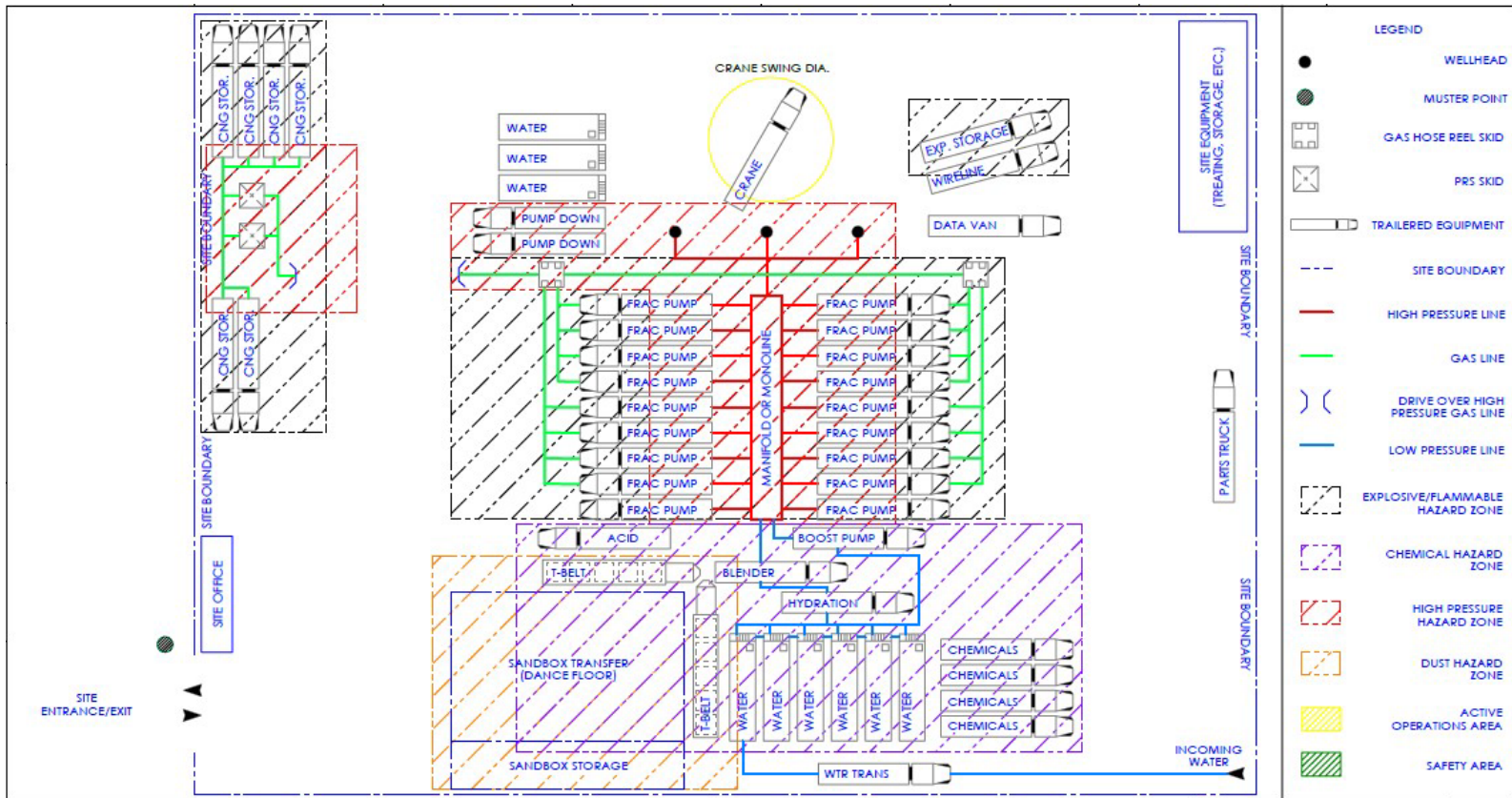


Figure 2. Surface Hazard Management Process.



Figure 4.



### Safety Areas

A Safety Area is a designated section, or sections, of the lease where workers can muster, egress or access first aid. These locations may be used for safety meetings and job preparations (see Figure 5).

**IG** The Subject Well Operator in consultation with the Service Provider(s) shall determine the location of two Safety Areas on the lease, ensuring an available muster area upwind of the wellsite.



## Active Operations Area

The Active Operations Area is a designated portion of the lease that contains the fracturing operations (see Figure 6). It includes the High-Pressure Area (see Figure 7) and zones containing elevated hazards (see Figure 8). Personnel allowed in the Active Operations Area may be limited to those deemed essential for the present task.

- IG** The Subject Well Operator, in consultation with the Service Provider(s), shall determine the portion of the lease designated as the Active Operations Area.
  
- IG** The Service Provider shall demarcate areas of high risk, including the high-pressure area, high voltage area, natural gas area (where natural gas refers to any of LNG/CNG or treatment of wellhead gas and the distribution thereof. The Service Provider should demarcate areas of elevated risk including chemical area and proppant handling area, wireline operations through the use of ropes, chains or other similar barrier.
  
- IG** The Service Provider shall make use of signs to classify the severity of workplace hazard and the action to be taken to keep employees and visitors safe.

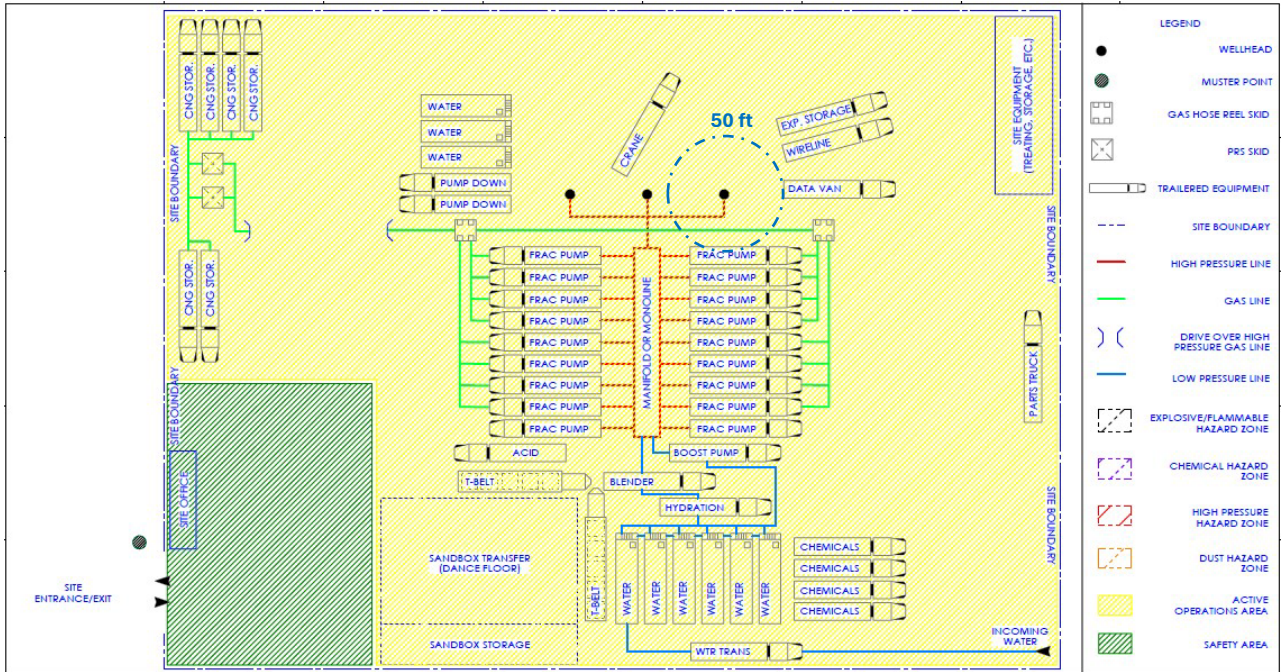


Figure 6. Active Operations Areas

### High-Pressure Area

The High-Pressure Area envelopes all the high-pressure components connecting the fracture pump fluid-ends to the wellhead. Since it is a restricted area, the High-Pressure Area location and boundary are to be determined in consultation between the Operator and the Service Provider(s). It is imperative that the Operator and Service Provider work together to ensure that all reasonable efforts are made to limit exposure or access to the High-Pressure Area. Designated personnel may need to enter the High-Pressure Area only under special circumstances. There may be more than one High-Pressure Area on the lease at any one time. The High-Pressure Area may shift as the operations progress (see Figure 7).

**IG** The Subject Well Operator in consultation with the Service Provider(s) shall determine the location and boundary of the High-Pressure Area and reassess appropriately as the fracture operation progresses.

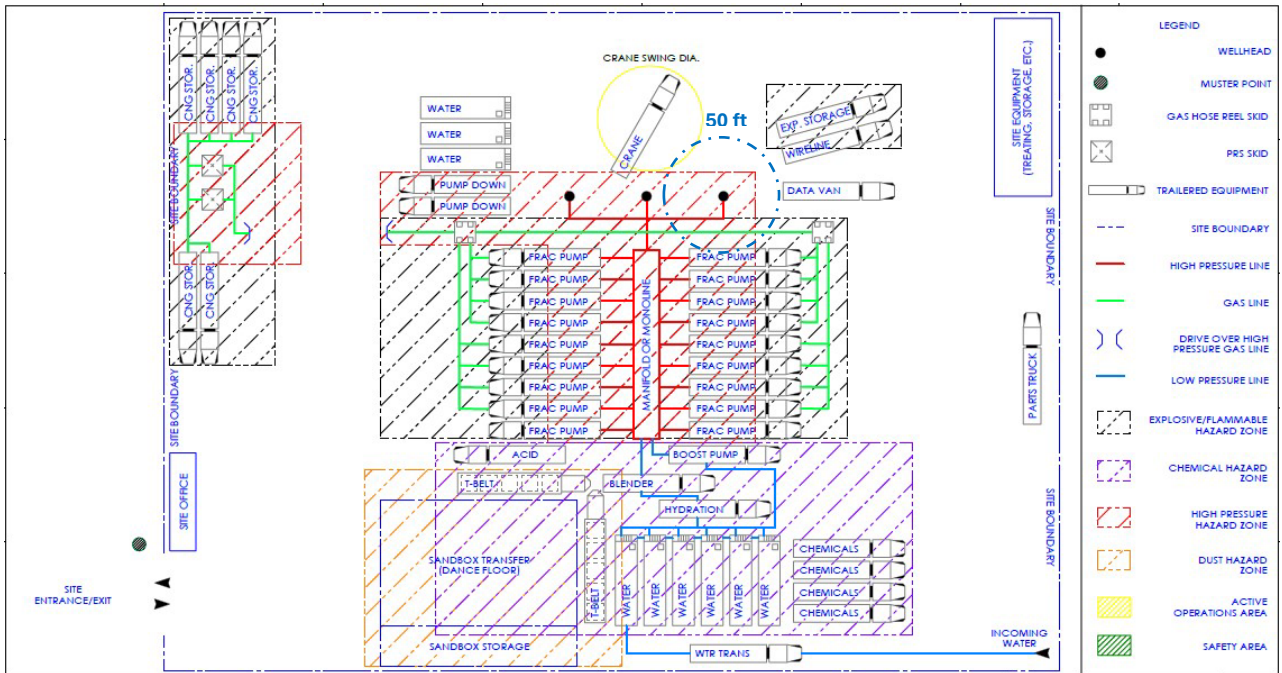
**IG** The boundary of the high-pressure area should include all of the frac pump equipment on the trailer including but not limited to power end, fluid end, transmission, drivelines and high-pressure connections.

IG The boundary of the high-pressure area shall be a minimum of 10 feet from the high-pressure lines. Beyond the 10 feet minimum, it is expected the Operator and Service Provider(s) assess the following factors to expand the boundary of the High-Pressure Area as deemed appropriate:

- sweep radius of the high-pressure components
- equipment restraining the sweep radius of the high-pressure components
- maximum anticipated surface treating pressure
- presence of energized fluids

Since this is a restricted area that presents increased risk to personnel, a visual barrier, a strong communication protocol, and/or clear means of denoting the High-Pressure Area, is encouraged.

Figure 7. High Pressure Areas



## Elevated Hazard Zones

As surface operations initiate and progress within the Active Operations Area there are fracture support operations that present elevated hazards within the Active Operations Area. These Elevated Hazard Zones require prudent attention from personnel. They include activities such as silica exposure, chemical exposure, noise exposure, wireline operations, high voltage equipment, natural gas, fracture fluid transfer, low pressure equipment, or fueling while pumping (see Figure 8).

- IG The Subject Well Operator in consultation with the Service Provider(s) shall identify elevated hazard zones and re-assess appropriately as the fracture operation progresses.**
  
- IG The boundary of the high voltage area shall be a minimum of 10 feet from the high voltage equipment including the high voltage power cables. The boundary for power generation units powering a frac fleet should be at least 15 feet. Road Crossings shall be used over high voltage power cables.**
  
- IG The boundary of the natural gas area shall be at least 15 feet from the natural gas equipment. The Natural Gas Transport Trailer shall be at least 10 feet from any other natural gas delivery equipment. Natural Gas should be located downwind from personnel and away from smoking areas or sparking equipment.**
  
- IG The boundary of the wireline area shall be a minimum of 10 feet from the wireline equipment.**

It is expected that the Wellsite Supervisor will discuss Elevated Hazard Zones of concern at a safety meeting to alert permitted personnel, and identify unique PPE requirements specific to Elevated Hazard Zones. A visual barrier may be used to distinguish Elevated Hazard Zones in the Active Operations Area as illustrated in Figure 8.

Figure 8. Elevated Hazards in the Active Operations Area

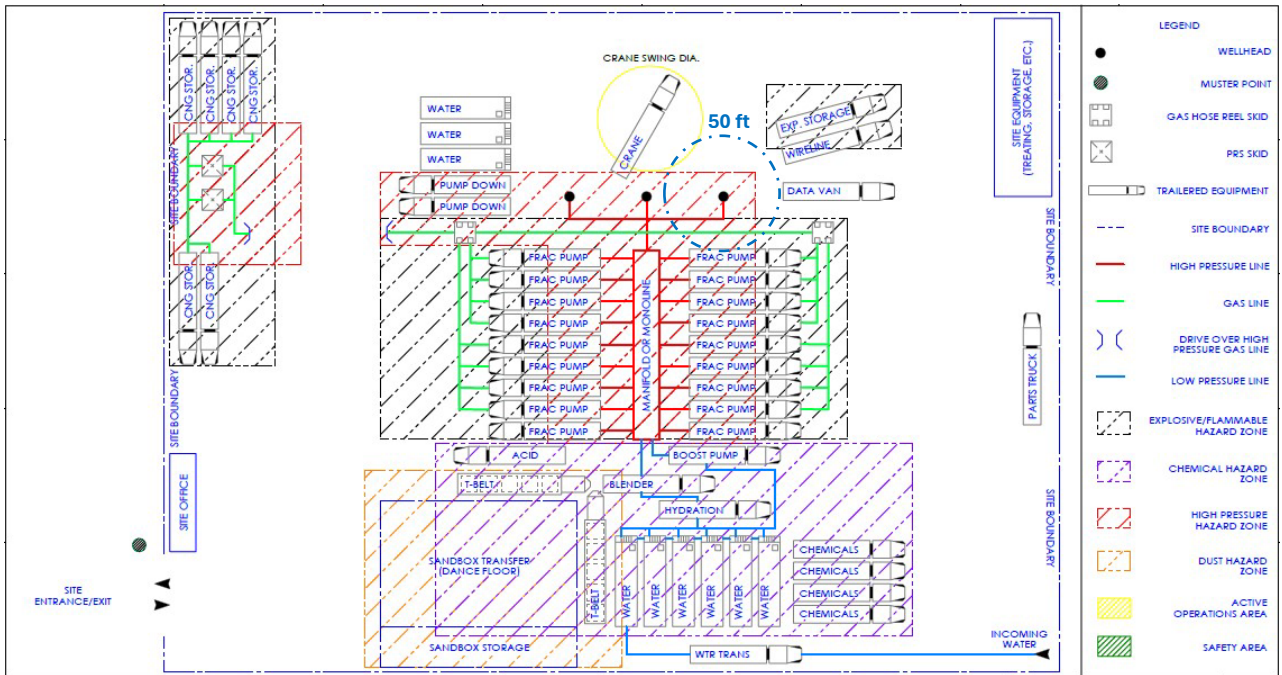
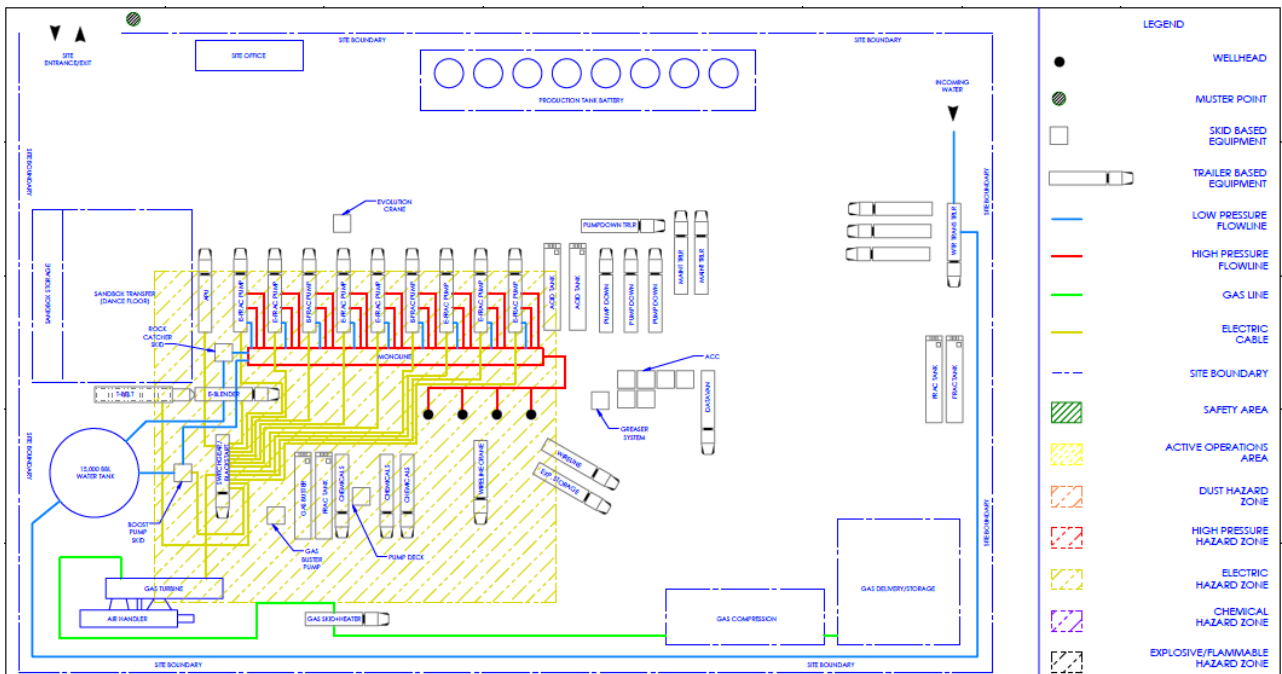


Figure 9. Electrical Hazard Zone



## Concurrent Operations

Concurrent operations refer to any other operation not associated directly with the fracture operation yet occurring on the same lease or pad. These concurrent operations increase the probability for surface incidents on the lease shared by the fracture stimulation operations and thereby increase risk to all stages of a fracture stimulation operation (pre, during, post). For effective hazard management planning, it is important to determine the location of concurrent operations and be aware of proximity to the Subject Well.

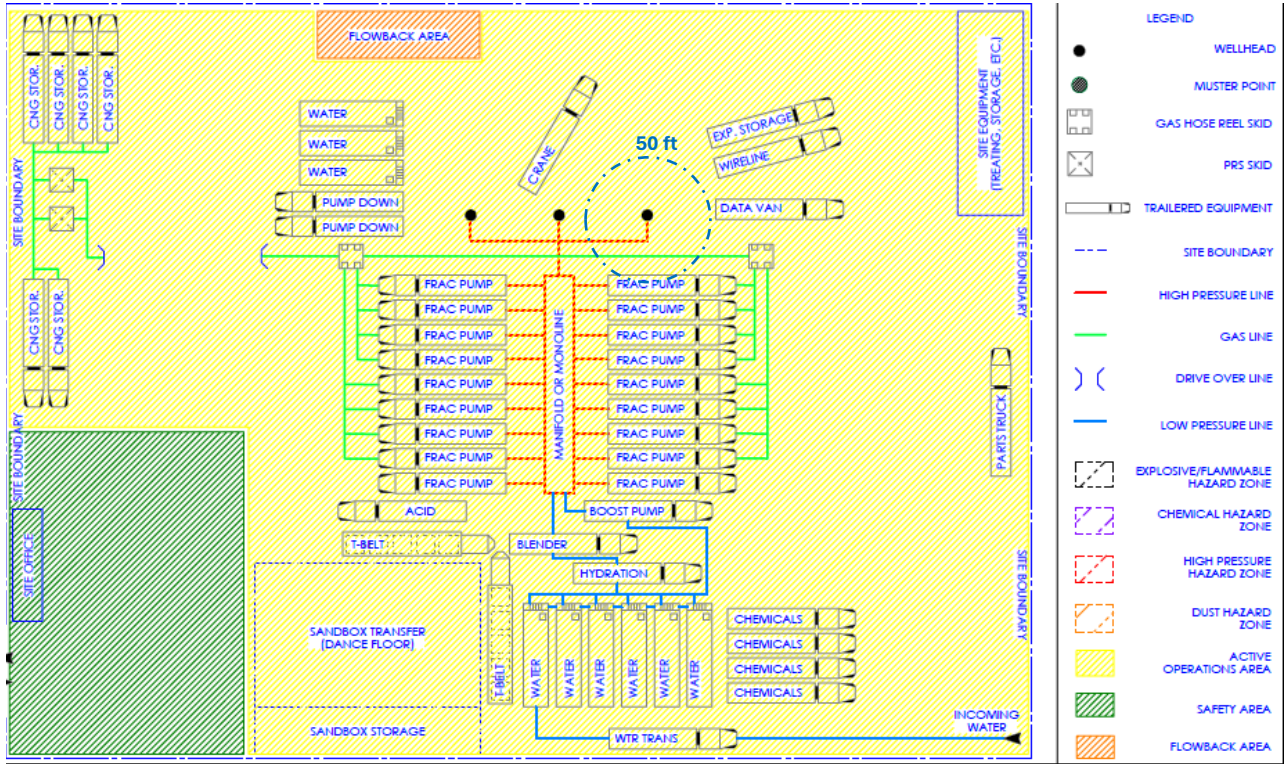
Concurrent operations on a lease may include, but are not limited to:

- flowback (as illustrated in Figure 10),
- wireline operations in progress on an adjacent wellbore,
- drilling while fracturing
- other completions operations (e.g., coiled tubing), or
- facility installation.
- logistics/Vendor traffic/Equipment mobilization
- electrical power generation

**IG The Subject Well Operator, in consultation with the Service Provider(s) involved, shall determine the location of concurrent operations within the Hazard Areas and throughout the duration of the fracture stimulation operation.**

There are some concurrent operations that require an expansion of a hazard area. For example, in Figure 10 below the High-Pressure Area has been enlarged to include flowback equipment. There are also some concurrent operations that may be considered Elevated Hazard Zones as illustrated by the orange ellipses in Figure 10. The flowback equipment is encircled with the orange ellipse to draw attention to areas beyond the High-Pressure Area that workers should be aware are considered concurrent operations. Additionally, concurrent operations such as an ongoing drilling operation on the same pad need to be noted, and hazards assessed and controlled.

Figure 10: Concurrent Operations



### Special Consideration Locations

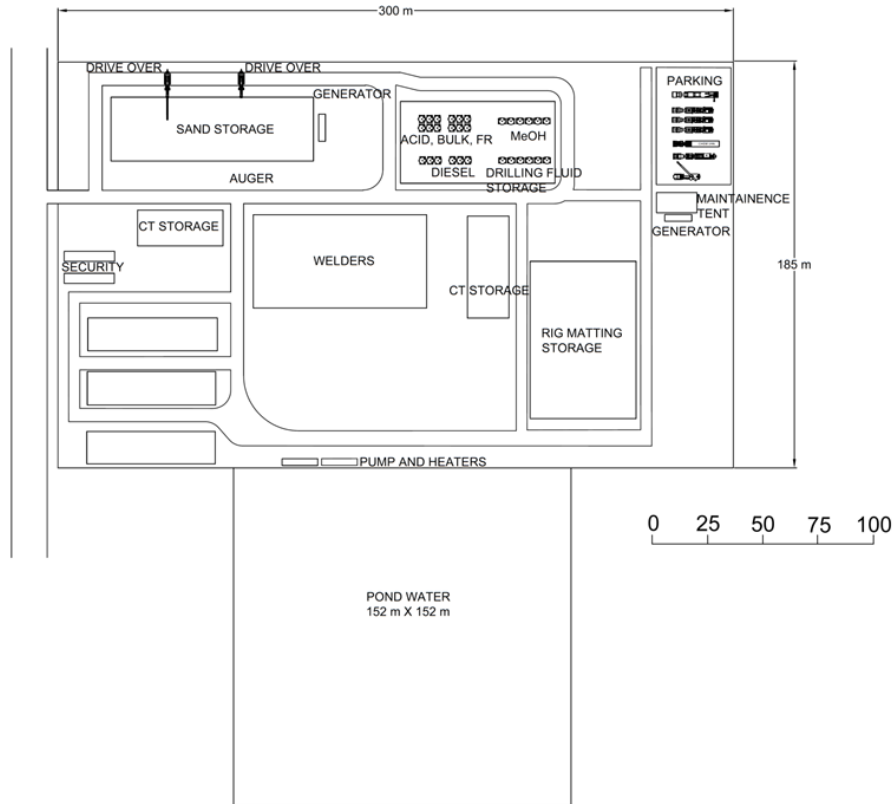
Fracture stimulation operations may require off-site transport, maintenance, storage of equipment, and materials. Special consideration is necessary for off-lease locations that may be impacted throughout the entirety of the fracture stimulation operation. See Figure 11 for a sample illustration of a special consideration location.

Special considerations relevant to off-lease surface risk may include, but are not limited to:

- any extension of fracture stimulation operations off-lease
- proximity to public and residential locations
- road usage
- offset wells included in the IOW Risk Assessment
- environmentally sensitive areas and wildlife
- other existing infrastructure (e.g., power lines, pipelines)

IG The Subject Well Operator in consultation with the parties involved shall identify special consideration locations.

Figure 11. Special Considerations Locations



## Surface Operation Hazard Assessment

The surface hazard area of influence is defined by determining surface safety areas, hazard areas, anticipated concurrent operations, and special consideration locations. The combination of these four denotes the regions for surface hazard assessment. Thorough surface hazard assessment sets the framework for Surface Operations Hazard Management Planning.

**IG The Subject Well Operator shall identify hazards in the following pre-determined areas:**

- **safety area(s),**
- **hazard areas,**
- **concurrent operations areas, and**
- **special consideration locations.**

Surface operations hazard assessment is organized into stages:

1. Hazard identification
2. Cross-reference with the Hazard Register
3. Cross-reference with related IGs and API standards.

### Hazard Identification

Along with the Hazard Register, there are several topics significant specifically to fracture stimulation operations that require explicit attention. It is important to identify and assess relevant hazards in following areas:

### Safety Areas

Hazards in the safety areas can be easily overlooked. Particularly in the event of a surface incident, the safety area needs to be conducive to easy entry and exit on foot or vehicle. Pay special attention to uneven or slippery ground and obstacles that block entry or exit.

## Hazard Areas

### (High-Pressure Area, Active Operations Area, Elevated Hazard Zones)

Given the nature of fracture stimulation treatment and working conditions, surface equipment, the pipe body, and connections are under stress which create potential hazards such as:

- erosion,
- over-pressuring,
- chemical degradation, and/or
- stress fatigue.

Mitigation and control options regarding these specific surface hazards are presented in the Hazard Register. It is important that Operators review for these particular hazards, and account for the nuances of the site's fracture stimulation program when developing control measures.

## Emergency Shut Down

Emergency shutdown procedures should be planned carefully, with potential risks to equipment and personnel considered in full. A risk assessment is vital for preparing a comprehensive emergency response plan. The risk assessment should take into account every possible scenario and develop shutdown procedures for each one. It should be clear among personnel who have responsibility for each action in the event of an emergency. A meeting with workers before starting any new job tasks, at the beginning of each shift, or when a new hazard is introduced can help ensure detailed and clear instructions for items such as:

- How to safely shut down equipment
- How to evacuate from hazardous areas to safe areas
- Emergency Action Plan: emergency contacts, nearest hospital, muster points, and any other information deemed pertinent to the job site
- Responsibility and procedure for shutting in and opening the well

Emergency Shutdown Devices (ESDs) are necessary to mitigate and control the dangers of an emergency situation, such as overpressure events, high voltage surges, fires, unsafe temperatures, and any other emergency that could cause risks to workers, the public, equipment, and/or the environment.

- IG ESDs should be automatically activated when possible and include multiple ESDs in precaution to one method failing to activate.
  
- IG ESDs shall be tested regularly to ensure readiness for when an emergency occurs.
  
- IG If the ESD requires manual activation, this device should be easily accessible and visible with a push button.
  
- IG There shall be a Pressure Relief Device where an overpressure event could occur within a system to safely vent excess pressure.
  
- IG Natural Gas Equipment shall include an ESD to isolate the flow of Natural Gas to the prime movers.
  
- IG Power distribution equipment shall include an ESD to deenergize all connected equipment

## Concurrent Operations

The severity of a surface incident at a concurrent operation and its proximity to the Subject Well will increase the probability and risk of a surface incident at the fracturing operation. Concurrent Operational hazards shall be communicated in a pre-job meeting with well supervision, reviewing additional hazards and contingency planning should a specific hazard be present. Surface hazards resulting from concurrent operations may include:

- an unexpected kick while drilling,
- a perforating detonation before deploying in the wellbore, or
- an uncontrolled flowback of wellbore fluids at an adjacent well.
- an uncontrolled release of flammable gas.

Interwellbore communication at an offset well may result in surface hazards. Onsite downhole concurrent operations that impact the Subject Well are detailed in the interwellbore communication chapter. These onsite offset wells are considered IOWs (Identified Offset Wells) and included in the IOW Risk Assessment.

## Special Consideration Locations

It is important to assess relevant hazards at each special consideration location. Potential hazard scenarios are listed in the Hazard Register. Operators are encouraged to pay particular attention to concerns regarding:

- containment and handling of chemical, flowback fluids, fuel, proppant, equipment; along with,
- site supervision and security issues.

## Hazard Register

The surface operations hazard scenarios in the Hazard Register offer industry- known surface hazards possibly not familiar to all Operators. It provides Operators a way to be predictive about the potential for new hazards before an incident occurs.

Operators are encouraged to cross-reference hazards identified in the surface areas with the Hazard Register.

**The Subject Well Operator shall employ the Hazard Register to hazard assess determined safety areas, hazard areas, concurrent operations and special consideration locations.**

## Reference Related Resources

A review of relevant guidelines may provide additional guidance. Examples may include the following:

- API RP 54, 4th Edition
- API SPEC 6A: Wellhead and Christmas Tree Equipment
- API Sd 53
- API RP16 ST
- [EWTC Well Stimulation Industry Guidelines: Hydraulic Fracturing with New Technologies and Innovation](#)
- [OSHA/NFPA Standard for Arc Flash](#)
- [US DOI Oil and Gas Gold Book](#)
- ANSI/API RECOMMENDED PRACTICE 100-1 “Hydraulic Fracturing—Well Integrity and Fracture Containment”
- OSHA Standard 1926.152 - Flammable liquids. - [https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.152#:~:text=Areas%20in%20which%20flammable%20liquids,1926.152\(e\)\(5\)](https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.152#:~:text=Areas%20in%20which%20flammable%20liquids,1926.152(e)(5))
- API RP 67 – Oilfield Explosives Safety
- API RP 16ST - Coiled Tubing Well Control Equipment Systems
- API RP 68 - Oil and Well Servicing and Workover Operations Involving Hydrogen Sulfide
- API RP 59 – Well Control Operations
- API RP 55 - Gas Processing Involving Hydrogen Sulfide
- API MPMS – 20.5 Recommended Practice for Application of Production Well Testing in Measurement and Allocation  
[https://www.api.org/~media/files/publications/2018\\_catalog/2018\\_pubs\\_catalog\\_final\\_pm.pdf](https://www.api.org/~media/files/publications/2018_catalog/2018_pubs_catalog_final_pm.pdf)
- API RP 99 - Flash Fire Risk Assessment for the Upstream Oil and Gas Industry

## Surface Operations Hazard Management Planning

Working through the determined surface areas to assess surface hazards highlights the association between surface hazard severity and the hazard area proximity to the fracture operation. Surface operations hazard management planning is intended to determine the control measures for surface hazards identified in the safety area, hazard areas, concurrent operations areas and special considerations locations with attention to hazard severity and proximity to the fracture operation.

- IG The Subject Well Operator shall conduct surface operations hazard management planning that includes control measures for hazards identified in surface operations areas (safety area, hazard areas, concurrent operations areas and special consideration locations).**

### Determine Permitted Personnel

Restricting access to certain areas is a key control measure to mitigate hazards during a fracture operation. It is important to review each surface area throughout the fracture operation for modifications to personnel restrictions as the operation progresses.

The High-Pressure and High Voltage Areas represent the highest risk areas on site. It is imperative that the Operator and Service Provider work together to ensure that all reasonable efforts are made to limit exposure or access to the High-Pressure Area and High Voltage Area.

- IG If necessary, only a Qualified Person for high voltage equipment shall escort an Unqualified Person around high voltage equipment, but the Unqualified Person shall not be allowed where Arc Flash PPE is required.**
- IG The Subject Well Operator shall conduct hazard management planning to determine permitted personnel, duration of exposure, permitted tasks, and tools that address hazards in the following:**
- safety areas,
  - hazard areas,
  - concurrent operations areas, and
  - special consideration locations.

## High-Pressure Component Management

Given the nature of fracture stimulation treatment and working conditions, surface equipment, the pipe body, and connections are under stress which can influence the potential for erosion, over-pressuring, chemical degradation, and stress fatigue. High-pressure components can be summarized to include any connection from the surface treating equipment to the wellhead which sees elevated pressures greater than 500 psi during well stimulation, to include but not limited to: high-pressure treating iron, high-pressure hoses, and monoline or large bore system.

**IG The Subject Well Operator shall ensure the Service Provider has a high-pressure components management plan.**

A Subject Well Operator may have a reasonable expectation that a Service Provider's high-pressure component management plan considers at a minimum, the following:

- documented inspections and validation
- identification and tracking system
- manufacturer's operational specifications
- erosion limits
- chemical / environmental degradation
- temperature
- stress fatigue

Restraint requirements may differ among states/jurisdictions.

**REG The Subject Well Operator shall ensure that restraint protocols and systems adhere to jurisdictional regulations.**

The service provider shall incorporate an emergency pump shut down for over pressure control.

The service provider should consider a pressure relief system as part of the management system for over pressure events where it would be safe to vent the system to atmosphere.

## Communications Protocol

Concurrent and supporting operations located in close proximity to the Subject Well contribute to increased surface hazards. Regular and effective communication among all parties involved is essential. A communication protocol may include onsite operations staff, such as third-party suppliers who are on site for extended periods (e.g., fire suppression, fuel, chemical and medical personnel).

**IG The Subject Well Operator shall establish a communication protocol in consultation with services active in surface operations areas.**

## Minimize Surface Hazards

Once hazard management planning is complete, it is important to review the plan and contemplate if surface operation risk has been minimized within the larger context of the Surface Operations Hazard Management Process and the Fracture Stimulation Hazard Management Process. Does the combination of the hazards identified within the pre-determined surface areas establish a degree of confidence that surface operation risk has been minimized by the set of controls and mitigations? (This question aligns with the yellow diamond in the (SOHMP.)

If the Operator is confident that the planned controls and mitigations will minimize surface operation risk within the Operator's risk tolerance, then the fracture operation can proceed to execution.

If upon reflection in the larger context, the Operator is uncertain that the planned controls and mitigations will minimize surface operations risk within the Operator's risk tolerance, then the Operator needs to resolve why this may be the case. It may require the Operator to review and revise surface operations hazard management planning by revisiting activities as part of surface operations area determination and surface operation hazard assessment. It may require the Operator modify timing on concurrent operations, or it may require the Operator revisit the fracture stimulation program.

Only after the Operator has established a degree of confidence that surface operation risk has been controlled and mitigated within the Operator's risk tolerance, may the Operator move to fracture stimulation execution.

## Fracture Stimulation Execution

Once the fracture stimulation operation is underway, success of execution is highly reliant on effective communications with personnel. Special attention is required regarding the High-Pressure Area. The conditions that impact the degree of risk in the High-Pressure Area change as the operation progresses. It is important that the Subject Well Operator, the Primary Service provider, third-party suppliers, and concurrent operators all be in communication to ensure it is understood when the High-Pressure area is active.

**IG** The Subject Well Operator / Wellsite Supervisor, in consultation with the Service Provider(s) and third-party suppliers, shall communicate the following for each determined surface operations area:

- hazards and control measures
- elevated hazard zones within any of the surface operations areas
- permitted access personnel
- duration of exposure
- permitted tasks and tools

Surface hazard management planning may be categorized chronologically: pre-fracture, during and post-fracture stimulation operations.

**RP** The Subject Well Operator must confirm casing integrity pre-, during and post fracture stimulation operations in accordance with ANSI/API RECOMMENDED PRACTICE 100-1 "Hydraulic Fracturing—Well Integrity and Fracture Containment", and relevant jurisdictional regulations.

**IG** The Subject Well Operator should ensure the AMP is not exceeded pre-, during or post fracture stimulation operations.

**Note.** Ensure pressure is relieved after the pressure test is completed.

## Pre-Fracture Stimulation

Pre-fracture stimulation refers to all on-lease activities in relation to the fracture stimulation that occurs before pressurizing high-pressure components. Fracture stimulation operations may experience simultaneous events that need to be communicated to personnel before fracturing operations begin.

Pre-fracture stimulation surface hazards may not be obvious to onsite personnel; for example, the presence of silica dust during sand transfers to onsite storage. Near-surface hazards may be present as well, such as buried natural gas lines and or grounding rods associated with dual-fuel and electric pumps, respectively. Personnel need to be responsible for their awareness of surface and near-surface hazards.

Before pressurizing the high-pressure components, it is imperative all personnel are aware that:

- Additional obstacles on the ground, like treating iron, are tripping hazards.
- High-Pressure components are rigged-in to allow for normal movement-while minimizing wear points during pumping operations.
- High-Pressure component restraints are utilized according to local jurisdictional requirements
- Proppant and product transport can be continuous, which causes a large volume of vehicle traffic. This congestion leaves poor sight lines for personnel on foot and in vehicles.
- Exposure to high noise levels from pumps, engines, and heavy machinery can harm hearing and lead to fatigue. Use required hearing protection to mitigate the hazard.
- There are hazardous chemicals and materials as part of any fracture stimulation operation (e.g., silica dust, hydrochloric acid, hydrocarbons and other stimulation chemicals). It is important to ensure there are plans to minimize exposure.
- There may be hazards associated with energized medium or high-voltage electrical infrastructure.
- There may be hazards associated with pressurized natural gas infrastructure.
- There may be near-surface infrastructure present on location associated with the utilization of natural gas and/or electric pumps.

The Subject Wellsite Supervisor plays a significant role in both communications and operations. This individual needs to have working knowledge of the subject well integrity concerns and any IOW concerns.

- IG Prior to initiation of fracturing operations, the Subject Wellsite Supervisor shall ensure that the Subject Well Controls have been executed.**
  
- IG Prior to initiation of fracturing operations, the Subject Wellsite Supervisor should ensure that the IOW Operator has executed the mutually agreed well control plan.**

The Subject Wellsite Operator may consider collecting IOW pressure data in advance of the fracture stimulation operation to create baseline data.

The Subject Wellsite Supervisor may expect the following additional responsibilities unique to fracture stimulation:

- Review and confirm the accuracy of data and information supplied in the IOW Well Control Plan.
- Ensure contingencies are in place in the event of an IOW monitoring communication failure.
- Consider a drive-around recce of the FPZ to determine if other operations are planned to occur at the time of the fracture stimulation.
- Effectively communicate with IOW active downhole operations Wellsite Supervisor prior to commencement of Subject Well fracture stimulation operations.
- Ensure monitoring described in the IOW Well Control Plan is fully operational.
- Ensure all IOW field notifications have been completed.
- Ensure the implementation of the IOW Well Control Plan, as mutually agreed upon between the Subject Well Operator and the IOW Operator.

## During-Fracture Stimulation

It is imperative that the Subject Wellsite Supervisor has functional knowledge of operations surrounding and at the Subject Well including:

- surface areas
- surface hazards and control measures
- buried infrastructure hazards and control measures
- maintenance and proximity requirements associated with ancillary equipment and operations (e.g., gas turbines/electrical generation)
- fracture stimulation program and related subject well control measures
- at-risk IOWs in the FPZ and the supporting IOW Well Control Plan
- other operations associated with fracture operations (e.g., plug-and-perf on an offset well ) and the related IOW Well control plan

**IG The Subject Well Operator should maintain a copy of a Well Control Plan at the Subject Wellsite.**

It is equally critical that the Subject Wellsite Supervisor can efficiently and appropriately assess multiple streams of data that may require the initiation of IOW Well Control. The Subject Wellsite Supervisor should expect the following additional responsibilities unique to fracture stimulation:

- Effectively communicate with IOW active downhole operations Wellsite Supervisor during the Subject Well fracture stimulation operations.
- If a well control event occurs, Subject Well integrity fails or communication to an IOW occurs, the Wellsite Supervisor should initiate notification in accordance with relevant jurisdictional regulations.
- Take appropriate actions on the Subject Well to reduce the hazards when approaching the Subject Well's or an IOW's adjusted maximum pressure (i.e., go to flush, stop pumping, relieve pressure, etc.).
- Once the fracture stimulation is underway, personnel need to be aware of any shift in hazards and related controls which may include:
  - Subject Wellsite Supervisor communicating to all personnel the location of the Safety Areas and the controls in place to restrict access.
  - A communications protocol outlining communication with various Service Providers' onsite personnel including those involved in concurrent operations, and any communications plans for IOWs).

**IG** The Subject Well Operator should establish a communication protocol that uses a “triple handshake” method when any valve is being opened or closed along the fracturing fluid flow path.

**Note.** The triple handshake method should include the Wellsite Supervisor, the Fracture Supervisor, and all other Service Providers impacted by the fracture fluid flow path.

Personnel identified to constantly monitor the high-pressure components and Subject Well surface equipment related to the following:

- to ensure legacy treating iron can move freely (jacking) while paying attention to potential wear points.

**Note.** Iron that is bound, will cause stress cracking

- leaks (small leaks can turn into big holes quickly)
- pressures are not to exceed the AMP of the wellhead or the OEM pressure rating of the surface equipment while being in accordance with jurisdictional requirements.
- rates are not to exceed OEM suggested maximum linear velocity (may differ for viscosified and non-viscosified fluids)

## Post-Fracture Stimulation

Post-fracture stimulation refers to all operations that occur after the high-pressure components have been de-pressurized. Post-fracture stimulation operations experience

many of the same surface risks as pre-fracture stimulation operations. However, flowback risks are an additional concern and discussed in the hazard register.

Post-fracture stimulation activities include:

- Evacuate fluid from all lines
- Concurrent operation notification (pad drilling, perforating, adjacent wellbores)
- At-risk IOW Operator notification

## Operational Change

Once a fracture stimulation operation has commenced, operational plans, can and often do, change. It is imperative to re-evaluate surface hazards when operational plans change and regularly review the surface areas for elevated hazard zones and concurrent operations. It is important that amendments to the hazard areas be communicated to personnel when tasks or operations change. Operator and service provider should agree on a management of change procedure prior to start of operation.

