radialdrilling
Advanced Well-Optimization Technologies

ACID JETTING/ CHEMICAL USE PROTOCOL

PROTOCOL

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1. Acid jetting can sometimes be required to be part of the RDS operations, and will be discussed here. The unit is equipped with a valve combination that allows for acid diluted with water (20% max) to be injected thru the existing coil tubing system, using an ACID PUMP to pre load the coil, without flowing thru the high pressure pumping system thereby preventing acid corrosion to the RDS system. Unless the Unit pumps have been modified to accept and pump acid/s, the coil will be pre charged with an acid pump while RIH, followed by a slug of water, and only then will be pumped with the pumps of the unit. The Operator must confirm the Unit pumps are acid compatible or assume that the pumps are NOT DESIGNED TO PUMP ACID. Since 12,000 feet of coil on the unit holds 78.5 Gallons of acid, and jetting at 3.5 GPM, enough for 22 minutes of jetting time, the coil may have to be reloaded several times to get a lateral of 100 meters. This will result in higher than usual jetting times. RDS CAN NOT GUARANTEE THAT LATERALS WILL BE DRILLED TO ITS FULL EXTENT SINCE CUSTOMER HAS NO PREVIOUS EXPERIENCE IN ACID JETTING THIS FORMATION. Based on existing acid frac technology a 20 % acid or acid mixture with HCl, HCF, citric, acetic or organic combined, with an impact of 8/9,000 Psi may result in good laterals. DO NOT USE THE UNIT TANK TO STORE ACID THE ACID HAS TO BE STORED IN AN INDEENDENT TANK AND, placed by the unit, and has to be provided by the customer and drilling contractor

1.1.1 A safety meeting is in order when acid is displaced at high pressures., every crew member and rig/company employees should be aware of the risks involved in acid handling.

1.1.2 **A job/operation specific JSA is to be written up, discussed, and signed off by ALL RDS personnel on location, following the safety meeting and prior to any acid operation commencing**.

1.1.3 Wear protective acid resistant gear at all times when handling acid. Safety gear includes, FACE SHIELD and not safety glasses, rubber apron, rubber boots and gloves of neoprene or nitrile, safety standard certified respirators, and any other gear requested by the safety protocol of the rig company & operator.

1.1.4 Use of a certified respirator is MANDATORY around and inside of the unit. Fumes of acid are toxic.

1.1.5 MSDS sheet of the product have to be distributed, and all RDS crew member need to be familiar with the risks involved with the use of acids, and emergency procedures in case of a spill or direct contact with acid. MSDS sheet also has all the information

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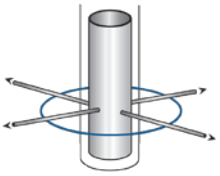

required regarding mixing, transporting, storing, utilizing the acid. MSDS sheet also contains information regarding the safety hazards of this acid regarding health, fire, reactivity, spill control, composition, first aid measures, handling and storage, etc.

1.1.6 Unit should be placed on a containment blanket/membrane, to avoid potential acid spills & contact with the ground.

1.1.7 Crew should keep at location at all times 4.-5 sacks of organic absorbents, and Soda Ash or Sodium Carbonate to neutralize acid spills.

1.1.8 An eyewash station and safety showers should be at location to wash any contact with acid

1.1.9 In case of spill or contact with acid follow indications of the MSDS sheet or Safety Protocol of acid jobs of the rig company & operator

1.1.10 Prepare the displacement calculations for the coil tubing using the following equation: ***Length of coil (feet) X .0066 = Total Gallons in coil***

1.1.11 Time the acid displacement so that the coil can be displaced while running in the hole so as to minimize rig time., but the acid preload has to be synchronized and calculated in such a way that while RIH water is displaced, and acid is only used to jet. Acid based fluids are **NEVER** to be used for casing milling operations.

1.1.12 All acid operations must take place during DAYLIGHT hours only. NO acid operations are to take place or commence at dusk or at night.

1.1.13 Line up main pumps and begin jetting operations. **NOTE** – ***Most units will hold about 70 - 80 gallons of fluid so, at 3-3.5 GPM, you will only have about 20-25 minutes of acid jetting time. If longer times are needed, pre load the coil with the Acid Pump AGAIN and displace more acid. DO NOT pull out of the lateral if the coil has to be re loaded***

1.1.14 After jetting, upon customer request, acid flush the lateral, at a pull out speed of 10 feet per minute.

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1.1.15 Displace coil totally with fresh water with 4000 - 5000 psi surface pressure.,

1.1.16 Once displaced, and the jet is in the vertical part of the hole, circulate another few minutes to eliminate any possible acid remaining in the system.

1.1.17 Pull out slowly from the hole, not exceeding 100 fpm pulling speed with the pumps running at low speed displacing fresh water

1.1.18 Once on surface, immediately clean out the total system with fresh water. This is EXTREMLY important since the acid is highly corrosive with in presence of glass, plastics, stainless steel 316, 2205 and aluminum.

1.1.19 PREVENTIVE MAINTANENCE is a key issue in acid pumping. Unusual wear should be expected in several part of the unit. Components as acid resistant packing for swivel, nozzles, Kevlar hoses an all main components of the unit will have to be checked after every run

****Parameters for lateral jetting operations:**

- Debit, flow level:	2.5 to 5.5 GPM (11 l/min)
- Volume of fluid per lateral:	800 liter +/- ESTIMATED
- Acid to be Used:	Hydrochloric; Organic; Hydrofluoric acid/s
- Pressure expected when jetting:	7,000 to 8,000 Psi depending on coil length, depth, formation and pump maximum working pressure.
- Penetration rate:	1 to 2.0 Meter/min (ESTIMATED).
- Jetting time/lateral:	120-180 minutes +/- depending on formation.
- POOH speed:	45 M/min
- Nozzles to be used:	A 7x5 or 4x5 for max IF, or a rotary nozzle.

**** Acid wash data:**

- Flow rates:	3.5 GPM (9.5 l/min.)
- Volume of acid/lateral:	240 Gal. (1 cube)
- Total Volume required:	960 Gal. (4 cubes)
- Type of Acid:	Generally HCl, HFl, organic or sulfamic acid may be used at customer request.

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Project Location:		Project #:
Date:	Weather Conditions:	
Prime Contractor:		

Jobs being Preformed: Check

1. _____ BHA – Bottom Hole Assembly 2. _____ Spotting Unit 3. _____ Rigging up Riser and Running Coil over Riser 4. _____ PDM –Flex-shaft, Milling, Hook up & Operating 5._____ Jet Hose Hookup & Operating 6. ___**X**____ Acid Operations 7. _____ Unit Maintenance

Acid Pumping for jetting &/or displacing:	Dangers of this operation are: 1. Acid pumping at high pressure 2.	Steps taken to lower the risks 1. 2. 3.

Personal Protective Equipment: Circle

PPE Specifics: X Hard Hat X Hearing Protection X Eye Protection X Gloves X Work Boots Apron X Acid Gloves X Respiratory

Perpared By:	**Position:**	**Date:**
Person(s) carrying out this process on the work-site:		
Name(s):	**Signed:**	**Date:**

RDS-JOB SITE ANALYSIS FORM

Project Location:		**Project #:**
Date:	**Weather Conditions:**	
Prime Contractor:		
Scope of Work:	**Acid Operations**	

1. Sequence of Basic Task Steps	2. Potential Hazards	3. Recommended Action or Procedure
1. Check & Inspect all hoses & connections. 2. Stop Jetstream & Charge Pump 3. Close charge pump valve 4. Open valve leading from Jetstream to Acid Pump 5. Open ball valve on Acid tank 6. Plug in Acid Pump 7. Open bleed off line to tank until you have no air in lines then close. 8. Start Jetstream – No more than 3gpm. Leave on charge pump to lubricate rods. 9. Pump acid for jetting &/or displacing at protocol pressures. 10.Discharge any unused acid in hoses in to separate tank.	1. Acid on your skin or in your eyes 2. Acid spill in the unit or on the ground	1. Wear all proper PPE: Respirator & face shield Acid Gloves Apron Boots 2. Ensure eye wash sufficient 3. Safety/Tailgate meeting to outline responsibilities 4. Contain spill as much as possible and clean up with Soda Ash or equivalent.

Awareness Safety Sheet

101-Foot Protection **102**-Hands and Fingers Safety **103**-Head Protection/Hard Hat **104**-Respiratory Protection **105**-Eye Protection **106**-Hearing Protection **201**-Proper PPE when working with Chemicals **215**-Injury from Slip/Trip/Fall **801-806**-Hazard Communication **811-816**-Material Data Safety Sheet **9002**-General Safety Issues

JOB SITE ANALYSIS FORM

Project Location:		**Project #:**
Date:	**Weather Conditions:**	
Prime Contractor: RDS		
Scope of Work:	**Acid Operations – Rig Down**	

1. Sequence of Basic Task Steps	2. Potential Hazards	3. Recommended Action or Procedure
1. Stop all pumping. 2. Open Suction valve on Jetstream to allow water to fill acid hose 3. Turn on charge pump Open valve on acid tank 4. Open valve on acid tank 5. Acid will be evacuated in to acid tank/tote, lines flushed w/ minimum amount of water. 6. Turn off charge pump 7. Close acid Tote. 8. Close suction valve. 9. Disconnect & discharge acid hose into containment. 10. Neutralize/deactivate acid as per local & state requirements. 11 Loop all hoses and Dead-Head Connections for storage. 12. Plug all Fixed Connections	1. Acid on your skin or in your eyes 2. Acid spill in the unit or on the ground	1. Wear all proper PPE: Respirator or face shield Acid Gloves Apron Boots 2. Ensure eye wash sufficient 3. Safety/Tailgate meeting to outline responsibilities 4. Contain any spills as much as possible and clean up with Soda Ash or equivalent. 5. Dispose of in accordance with local guidelines 6. Maintain adequate supply of soda ash for neutralizing & deactivation purposes.
CTTG Rig Crew 1.		

Awareness Safety Sheet

101-Foot Protection **102**-Hands and Fingers Safety **103**-Head Protection/Hard Hat **104**-Respiratory Protection **105**-Eye Protection **106**-Hearing Protection **201**-Proper PPE when working with Chemicals **215**-Injury from Slip/Trip/Fall **801-806**-Hazard Communication **811-816**-Material Data Safety Sheet **9002**-General Safety Issues

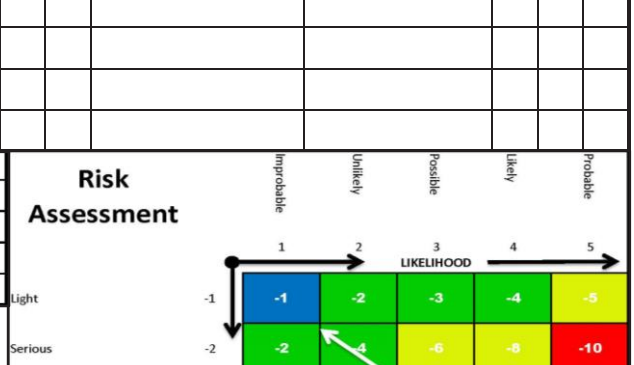
Hazard Analysis and Risk Control Record

Date:			Radial Drilling Supervisor:
Customer / Job:			RDS Safety Coordinator:
Location:			RDS Office Phone: 281-374-7507 www.radialdrilling.com
Task(s) Assessed:			
Assessment Team:			

Detailed Description of Task(s): **Rigging up Acid** 1. Place acid tote in a position that we can get hoses to. 2. Connect hoses from acid tote to charge side of Jet Stream pump.

Activity Steps	Hazard		Initial Risk			Control Measures		Residual Risk		
	Hazard Description	Loss Category	Likelihood	Severity	Risk Level	List all Current and Planned Measures taking into account all contributing and Escalating Factors: Current and planned prevention measures to reduce Likelihood.	Current and and planned mitigation measures to reduce Severity.	Likelihood	Severity	Risk Level
Inspect hoses and camlocks	Slips/ Trips/ Falls		2	-1	-2	Aware of Feet Placement	Proper PPE*	1	-1	-1
Place acid tote into location.	Acid tote falls while lifting, Pinch points (forklift)		2	-4	-8	Communication with Forklift driver	Have Acid containment and Soda Ash ready	1	-2	-2
Connect hoses	Pinch points on Camlocks, Hand injury		2	-1	-2	Awareness of what you are doing	Protective Gloves worn	1	-1	-1

-25 to -20		Black	Non- Operable, Evacuate Area
-16 to -10		Red	Intolerable, Do not take the risk
-9 to -5		Yellow	Undesirable, Demo ALARP before proceeding
-4 to -2		Green	Acceptable, Proceed Carefully
-1		Blue	Negligible, Safe to proceed



* Proper PPE for Rigging up Acid
Hard Hat, Leather gloves, FRC, Steel Toe boots.

Hazard Analysis and Risk Control Record

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Location:			RDS Office Phone: 281-374-7507 www.radialdrilling.com
Task(s) Assessed:			
Assessment Team:			

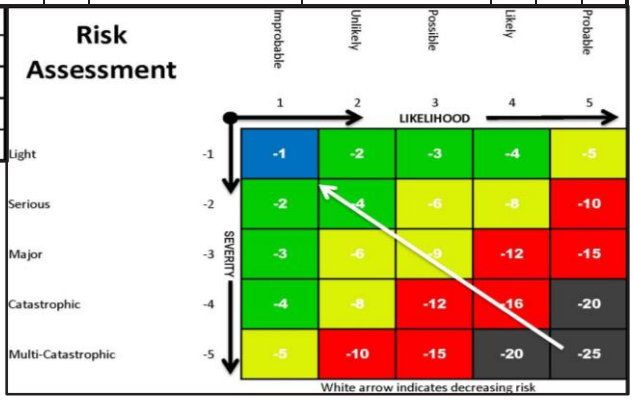
Detailed Description of Task(s): **Pumping Acid**

1. Turn off Jetstream and charge pump.
2. Close charge pump valve.
3. Open Acid valves (tote and at the head).
4. Using an Acid resistant receptacle and attached rubber hose on Jetstream, open discharge valve and bleed off all air in hoses and Jetstream head.
5. Close discharge valve and begin pumping acid with the Jetstream.

Activity Steps	Hazard		Initial Risk			Control Measures		Residual Risk		
	Hazard Description	Loss Category	Likelihood	Severity	Risk Level	List all Current and Planned Measures taking into account all contributing and Escalating Factors: Current and planned prevention measures to reduce Likelihood.	Current and and planned mitigation measures to reduce Severity.	Likelihood	Severity	Risk Level
Turn off pumps										
Close charge pump valve	Pinch points on handles		1	-1	-1	Awareness	Proper PPE *	1	-1	-1
Open Acid Valves	Pinch points on handles		1	-1	-1	Awareness	Proper PPE *	1	-1	-1
Bleed air off	Water/Acid splashes, Fumes		3	-2	-6	Control of valve and	Proper PPE * and	2	-1	-2
						hose at all times	soda ash available			
Begin pumping.	Acid hoses begin leaking.		2	-2	-4	Inspection of hoses	Have spill kit available	1	-2	-2
							and soda ash.			

-25 to -20		Black	Non- Operable, Evacuate Area
-16 to -10		Red	Intolerable, Do not take the risk
-9 to -5		Yellow	Undesirable, Demo ALARP before proceeding
-4 to -2		Green	Acceptable, Proceed Carefully
-1		Blue	Negligible, Safe to proceed

* PPE for Pumping Acid
Hard hat, Full Face mask respirator, Acid resistant Apron and gloves
FRC's, Steel toe boots.



Hazard Analysis and Risk Control Record

Date:			Radial Drilling Supervisor:
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Location:			RDS Office Phone: 281-374-7507 www.radialdrilling.com
Task(s) Assessed:			
Assessment Team:			

Detailed Description of Task(s): **Rigging Down Acid**

1. Lower Acid tote to ground level
2. Turn on charge pump
3. Open acid valves and flush water back through to acid tote.
4. Close acid valves and turn off charge pump.
5. Remove hoses and discharge

water into acceptable receptacle.

Activity Steps	Hazard		Initial Risk			Control Measures		Residual Risk		
						List all Current and Planned Measures taking into account all contributing and Escalating Factors				
	Hazard Description	Loss Category	Likelihood	Severity	Risk Level	Current and planned prevention measures to reduce Likelihood.	Current and and planned mitigation measures to reduce Severity.	Likelihood	Severity	Risk Level
Lower tank to ground	Over head, Tank falls - Acid spills		2	-4	-8	Communication	Containment and PPE*	1	-2	-2
Flush hoses back to tank	leaks in hose, Pinch points on handles		2	-1	-2	Hand Placement/PPE*		1	-1	-1
Remove hoses	water spills, slips/trips/ falls		2	-1	-2	Awareness of foot placement	Containment	1	-1	-1

-25 to -20		Black	Non- Operable, Evacuate Area
-16 to -10		Red	Intolerable, Do not take the risk
-9 to -5		Yellow	Undesirable, Demo ALARP before proceeding
-4 to -2		Green	Acceptable, Proceed Carefully
-1		Blue	Negligible, Safe to proceed

* PPE for Rigging down of Acid
Hard hat, Full face respirator, Acid resistant gloves and apron, FRC's, Steel Toe boots.