



July 10, 2019

Mr. Paul Horwath
Alaska Department of Environmental Conservation
43335 Kalifornsky Beach Rd #11
Soldotna, AK 99669

RE: 2019 Injection Well Rehabilitation Work Plan – Revision 1
Tesoro Kenai Refinery

Dear Mr. Horwath:

Tesoro Alaska, LLC (Tesoro) is submitting this letter work plan for injection well rehabilitation at the Tesoro Kenai Refinery (Refinery). Rehabilitation of wells falls under maintenance activities of the RCRA Post-Closure Permit No. AKD 04867 9682 (Permit); but requires Alaska Department of Environmental Conservation approval due to the use of acid and bio-dispersant. Rehabilitation efforts will be performed on injection well IR-29, IR-30, IR-31, and IR-32, east of the Kenai Spur Highway at the Kenai Refinery (Figure 1). Attachment 1 outlines the well rehabilitation procedures and Figures 1 and 2 show work location and details. The project is tentatively scheduled for July 2019.

PURPOSE

IR-29, IR-30, IR-31, and IR-32 are A-aquifer treated water injection wells installed in 1990. IR-29 stopped taking water on November 9, 2018, due to iron-fouling and was shut down. Decreased well function and eventual failure due to iron fouling is a common problem with recovery wells, injection wells, and air sparge wells at the Refinery. Iron-fouling issues are anticipated in IR-30, IR-31, and IR-32, due to the similar installation timeframe and therefore these wells will be rehabilitated to ensure injection capacity in the future.

SCOPE OF WORK

Well Rehabilitation

As the Refinery pump and treat system operates, injection well screens foul, limiting the well flow capacities. The screen interval on IR-29 appears to have fouling from deposits of iron and biogenic material. The goal of rehabilitation is to remove biofouling and iron encrustation from the well casing and screen. IR-30, IR-31, and IR-32 will be rehabilitated in conjunction with IR-29 to ensure injection capacity is met in the future. The two-primary steps for well rehabilitation include:

- Preliminary scrubbing and bailing of the well casing and screen to remove loose scale and solids
- Acid and bio-dispersant treatment

Well rehabilitation procedures are outlined in Attachment 1, Well Rehabilitation Procedures.



Mr. Paul Horwath
Jul 10, 2019
Page 2

Waste Management

Fluids generated during rehabilitation and disinfection activities will be containerized in a suitable vessel. The fluids will be included in the refinery waste management program for offsite disposal at an appropriate facility.

Schedule

The proposed schedule for 2019 injection well rehabilitation and possible installation is:

- June – Schedule with Tesoro and subcontractors, complete safety and permitting requirements
- July – Complete well rehabilitation
- August – Rehabilitation Report will be included in Quarterly Progress Report 19-3

If you have questions or comments please contact me at (907) 262-2315 or splate@trihydro.com.

Sincerely,
Trihydro Corporation

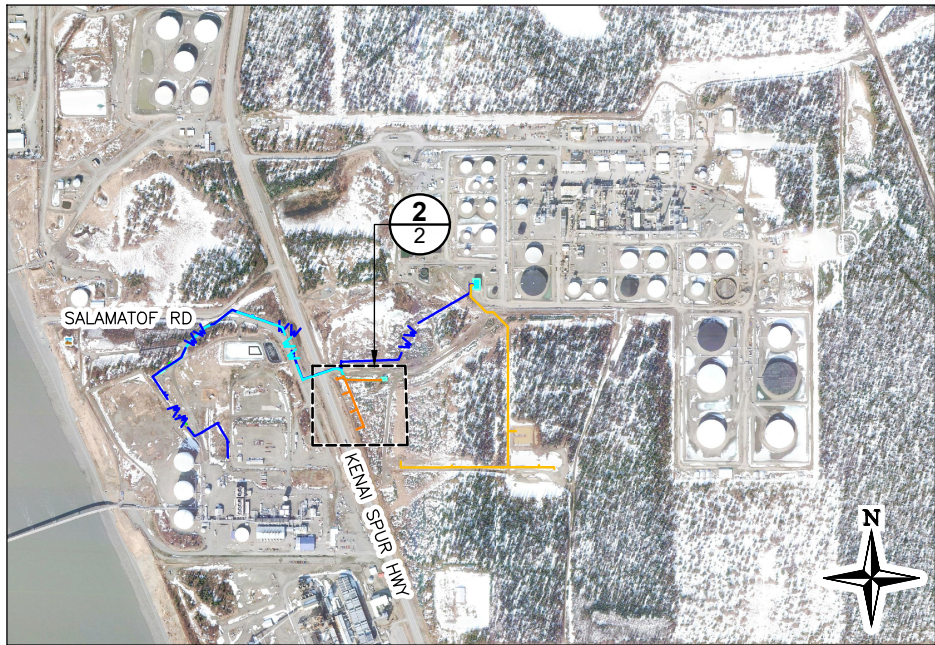
Stephanie Plate, P.E.
Project Manager

39B-003-004

cc: Mike Harper, Tesoro Alaska Company, LLC
Jan Palumbo, Environmental Protection Agency

FIGURES

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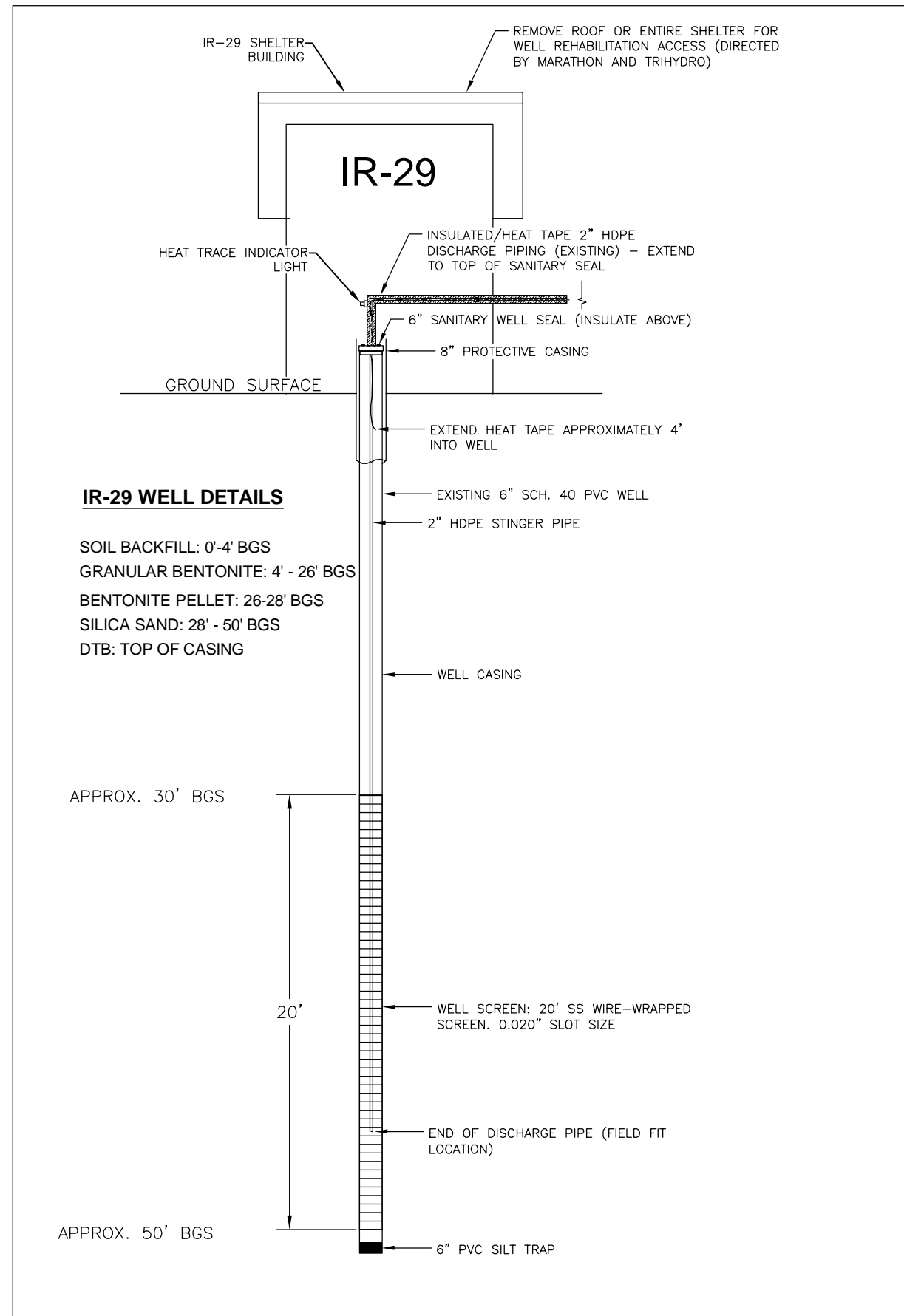
1 VICINITY MAP
SCALE: 1" = 1,500'



2 SITE MAP
SCALE: 1" = 50'



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| | <u>EXPLANATION</u> |
|---------|---------------------------|
| APPROX. | APPROXIMATELY |
| PVC | POLYVINYL CHLORIDE |
| DIA. | DIAMETER |
| HDPE | HIGH-DENSITY POLYETHYLENE |
| SCH. | SCHEDULE |
| SS | STAINLESS STEEL |
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ATTACHMENT 1

ATTACHMENT 1. WELL REHABILITATION PROCEDURES

WELL REHABILITATION PROCEDURES

The goal of recovery or injection well rehabilitation is to remove biofouling and iron deposits from the well casing and screen so the screen can function at or near intended capacity. The two-primary steps for well rehabilitation are:

1. Preliminary well casing/screen scrubbing and bailing to remove loose scale and solids
2. Acid and bio-dispersant treatment

1.0 Procedure for Scrubbing Recovery or Injection Well

- 1.1 Prior to cleaning a recovery well, **de-energize pump** and lockout-tagout (**LOTO**) the **appropriate breaker**. Verify all electrical is off by using a fluke meter at the electric control box near the well head.
- 1.2 Prior to cleaning an injection well, close well isolation valve and **LOTO the isolation valve**.
- 1.3 **Remove downhole pumps and equipment** from the well casing. Use equipment appropriate to lift well equipment out of well without damaging (drill rig, crane, excavator as appropriate).

For recovery wells, ensure aboveground piping or piping connected via pitless adapter are appropriately disconnected. Pull pump by connecting to and drop tube and safety cable. If the safety cable is not visible from the top of the well casing, then the pump will be pulled up using the HDPE drop tube. If a pitless adapter is in place, a pipe will be secured to the pitless adapter down well and used to begin lifting pump. Once a section is exposed above ground, the HDPE drop tube will be clamped at the well head to prevent it from falling while the drill rig releases the pipe. Once the clamps are secured to the HDPE at the well head, the drill rig will clamp on to the HDPE pipe near the well head and pull another 10' section. This process will be repeated until the pump is above ground. Once removed, the pipe and pump will be carefully placed on the ground for inspection and any needed reconfiguration.

For injection wells, stinger piping will be removed using same techniques as pulling pump, but the load will be lighter, so rigging and connections can be modified as appropriate to lighter load. Depending on depth, the pipe can also be pulled by hand if a crew of 2 is available.

- 1.4 Assess the condition of the well prior to rehabilitation. **Collect a grab sample from the well to confirm background pH levels** using a disposable bailer and PH meter. Measure the bottom depth of each well for reference. Subtract the actual depth measured from the installation bottom depths; this will provide the amount of buildup in the bottom of the well. Confirm well depths and configuration from boring logs and/or well logs so depth of sediment can be assessed.
- 1.5 **Prior to scrubbing the well, all workers should don standard PPE: hard hat, safety glasses, FRCs, steel toed boots, and hand protection (leather work gloves, nitrile gloves).**
- 1.6 The well brush will be raised and lowered using appropriate equipment (preferably a drill rig, but excavator or other lifting equipment might be appropriate). **Attach the lifting mechanism to the top of the metal brush.**
- 1.7 As an extra precaution, **attach a safety wire to the metal part of the brush**. This serves as a backup connection in case It is needed in case the rope is severed or a knot comes loose.

ATTACHMENT 1. WELL REHABILITATION PROCEDURES

- 1.8 **The well will be scrubbed until the brush reaches the associated bottom depths.** Check this periodically with the fluid level meter when the brush is out of the injection well.

Use a hard bristle, non-metallic, multi-stage brush. If a metallic or semi-metallic brush is used, it cannot come in contact with any PVC materials since it will permanently scour, weaken, or compromise the PVC.
- 1.9 **Pump all loose material from the well** and store it in a container stationed near the injection well for disposal. After scrubbing, use an air-lift pump to pump loose material from the well and into a container. Pump until water is clear with no sediment or orange staining is present.
- 1.10 Continue to **scrub the length of the well for at least 30 minutes.** This should become easier as the brush travels up and down the well. Check with the fluid level meter that the well is cleared to the bottom depth.
- 1.11 Clean the brush and other equipment after use.
- 1.12 Re-assess the condition of the well prior to chemical rehabilitation. **Collect a grab sample from well with disposable bailer to assess pH levels** using a pH meter. Measure the bottom depth to confirm well is clear to the bottom.

2.0 Procedure for Chemically Treating Wells

Verify that the mechanical well cleaning has removed encrustation, bio fouling, and loose sediments. Do not chemically treat wells prior to mechanical cleaning.

- 2.1 Prior to cleaning a recovery well, **de-energize pump** and lockout-tagout (LOTO) **the appropriate breaker.** Verify all electrical is off by using a fluke meter at the electric control box near the well head.
- 2.2 Prior to cleaning injection well or injection, close well isolation valve and **LOTO the isolation valve.**
- 2.3 **Don appropriate PPE.** Chemical well cleaning involves using hazardous acid solutions. Acid resistant suit, goggles, face shield, chemical resistant gloves (not nitriles), and chemical resistant steel toe boots are required.
- 2.4 Chemical treatment includes three gallons of Hydrochloric Acid (31% strength) and 0.4 - 0.5 gallons NW-310 Bio dispersant.
- 2.5 Pre-mix acid and bio-dispersant chemicals with potable water in the large 55-gallon plastic drum dedicated for chemical mixing. Place the 55-gallon drum on a duck pond secondary containment and **place the drum near the injection well.** Stage all chemicals near the work area before mixing begins. The chemical mixture must be mixed in the following order:
 1. **Add 23 gallons of potable water to the 55-gallon drum.**
 2. **Add the 0.4 to 0.5 gallons of bio-dispersant to the 23 gallons of potable water inside of the drum.**
 3. **Add 3 gallons of Hydrochloric Acid to the mixture inside of the drum.**

The chemicals in these proportions should achieve a pH of 3 in the injection well.

ATTACHMENT 1. WELL REHABILITATION PROCEDURES

- 2.6 Use a long mixing stick to mix the chemicals inside the drum. **Mix chemicals at a slow pace to prevent splashing. DO NOT** lean over the drum while chemicals are being mixed. The chemicals being mixed can adversely affect human health through injection, skin contact, and inhalation. See SDS for hazards associated with both NW-310 Bio dispersant, and Hydrochloric Acid (31% strength).
- 2.7 Use at least 70 feet of polypropylene tubing (poly tubing) to syphon the chemicals out of the mixing barrel and into the injection well. The poly tubing will be available on-site and will be gravity fed down well. **Fill the 70 feet of poly tubing by submerging it in the barrel and filling the last 5' with water then lower the poly tube down the well.**
- 2.8 Visually verify that the chemical mixture is flowing down the injection well. Do not pull poly tubing out of well until all of the solution is down the well.
- 2.9 **Use a surge block to adequately mix the applied chemicals in the well.** Continue surging for a period of two hours while periodically confirming the pH level inside the well. Samples should be recovered using a disposable bailer and analyzed using a PH meter. Allow the solution to sit in the well overnight at a pH level of 3. If a pH of 3 is not achieved, repeat steps 5 and 6 in the following mixture ratio of 6.5 parts HCL, 1-part NW-310, 50-parts potable water.
- 2.10 Surge the well for a period of one hour the following day. Pump a sufficient amount of groundwater from the well to restore pH levels to within background conditions (approximate). Chemicals need to be pumped out of the injection wells since acidic conditions will neutralize the chemicals used to disinfect the well during the second phase of well rehabilitation. Pumped groundwater can be transported and consolidated into the container staged near the recovery wells for eventual transport and disposal upon completion of well rehabilitation activities.
- 2.11 After reinstalling appropriate well pumps, pipes, and wire, and before energizing and putting well back into service, perform a system walkthrough to ensure that all valves restoring flow to the injection wells are in the correct position, and all electrical connections have been appropriately completed.
- 2.12 Put well back into service and set appropriate flows and pressures.

Nu-Well 310

Bioacid Dispersant

Description

Nu-Well 310 bioacid dispersant is a unique polymeric-acid chemistry that is the most effective product available for breaking down biofilm and dispersing mineral salts. Nu-Well 310 bioacid dispersant provides a considerable boost to any acid-cleaning operation, is readily biodegradable and may be used to treat potable water systems and related equipment. Maintains the acid reaction, holding minerals in suspension at pH levels of 3.0 and higher. Controls sludging by preventing re-precipitation or adhesion, for thorough removal of biological material during flushing.

- Dislodges biofilm masses associated with iron oxidizing, sulfate-reducing and more prevalent slime forming bacteria, which are not removed by mineral acids alone
- Sequesters iron and inhibits corrosion on metal surfaces. Iron sequestering allows the chemical solution to remove heavy accumulation of iron compounds, often the cause of fouling water systems
- Protects all forms of metal in the system and will not attack plastic, neoprene or other synthetic materials, eliminating the need for acid inhibitors
- Provides passivation of metals when used with phosphoric acid
- NSF approved for cleaning potable water wells, pipelines and filter systems



Application

Nu-Well 310 bioacid dispersant is designed for use with acid solutions to enhance the acid cleaning reaction and improve the overall cleaning. Standard dosage is 3 percent (1 to 2 percent for maintenance). Dosage of Nu-Well 310 bioacid dispersant can range from 0.5 to 5 percent (by weight) of treatment volume.

Optimal concentration depends on the type and severity of the fouling and degree of impaction on the wells efficiency. It is recommended that well construction and performance history be submitted, along with water samples for lab analysis, to properly determine dosage on large municipal and industrial wells.

1. Surface prepare a solution of water, acid and Nu-Well 310 bioacid dispersant equal to approximately 40 percent of the total static volume into a vessel of appropriate size. First add water, then acid, then Nu-Well 310 bioacid dispersant. **(Note: NEVER add water to acid! DO NOT mix Nu-Well 310 bioacid dispersant directly to commercial concentrations of liquid acid, as polymer destruction may occur.)**
2. Place the surface-solution evenly across the intake zone, ensuring contact with affected areas at the recommended concentration. Agitate the cleaning solution to enhance the effectiveness of cleaning
3. The solution should remain in contact for 18 to 48 hours, depending on the nature of the deposit. Monitor the pH and keep it below 3.0 during treatment. If additional acid is needed (to lower pH), add an amount equal to approximately 20 percent of the initial amount of acid applied
4. Discharge the acid solution from the well, neutralize at the surface and dispose in accordance with local regulations

Nu-Well 320

Biocaustic Dispersant

Description

Nu-Well 320 biocaustic dispersant is designed to enhance solubility of minerals and biological debris when used with caustic (alkaline) products for cleaning wells, potable water distribution lines or other structural systems. Water systems that are heavily fouled with bacteria are often cleaned with a strong caustic cleaner to help dissolve the biological matrix. While the caustic reaction effectively dissolves the polysaccharide exopolymer material (slime secreted by the bacteria), the high pH decreases the solubility of the mineral constituents, causing precipitation of mineral deposits in the area being cleaned.

For more information on Nu-Well 320, please visit www.jswaterwell.com

Dosage Guide

1. Determine static height of water in well
2. Multiply height by dosage factor
3. Mix Nu-Well 310 bioacid dispersant into acid solution, and apply to well

| Nominal Well Size | | Well Volume | | Standard Dosage, 3% | |
|-------------------|-----|-------------|-----|---------------------|-------|
| in. | mm | gal./ft. | l/m | gal./ft. | l/m |
| 2 | 51 | 0.16 | 2 | 0.004 | 0.051 |
| 3 | 76 | 0.37 | 5 | 0.009 | 0.114 |
| 4 | 102 | 0.65 | 8 | 0.016 | 0.203 |
| 5 | 127 | 1.02 | 13 | 0.026 | 0.317 |
| 6 | 152 | 1.47 | 18 | 0.037 | 0.456 |
| 8 | 203 | 2.62 | 32 | 0.07 | 0.81 |
| 10 | 254 | 4.09 | 51 | 0.10 | 1.27 |
| 12 | 305 | 5.89 | 73 | 0.15 | 1.82 |
| 14 | 356 | 8.02 | 99 | 0.20 | 2.48 |
| 16 | 406 | 10.47 | 130 | 0.26 | 3.24 |
| 18 | 457 | 13.25 | 164 | 0.33 | 4.10 |
| 20 | 508 | 16.36 | 203 | 0.41 | 5.07 |
| 22 | 559 | 19.80 | 245 | 0.49 | 6.13 |
| 24 | 610 | 23.56 | 292 | 0.59 | 7.30 |
| 26 | 660 | 27.65 | 343 | 0.69 | 8.56 |
| 30 | 762 | 36.82 | 456 | 0.92 | 11.40 |
| 34 | 864 | 47.29 | 586 | 1.18 | 14.64 |
| 36 | 914 | 53.01 | 657 | 1.32 | 16.42 |

***Note:** Standard dosage is for well rehabilitation. For routine maintenance, reduce dosage by 30 to 50 percent

Physical properties, shipping and handling

Appearance: Amber liquid

Density: 10 lbs./gal.

pH (as shipped): 2.0

Specific Gravity: 1.19

Freeze point: 26 °F (-3 °C)

Solubility (in water): 100%

Use range: 0.5 to 5% by volume

- Nu-Well 310 bioacid dispersant is an acid-based liquid. Avoid contact with strong alkaline materials or oxidizers. Use personal protective devices (PPD) and clothing, especially where the possibility of inhalation exists. Most acids and alkaline materials will not affect Nu-Well 310 bioacid dispersant at concentrations below 25 percent
- Not regulated as a hazardous material under 49CFR 172.101, RECRA, SARA and CERCLA
- 1 gal. and 5 gal. containers can be shipped by UPS ground delivery
- Additional physical and handling data are available on the product SDS
- Nu-Well 310 bioacid dispersant is available in 1, 5, 30 and 55 gal. containers
- Non-bioaccumulating

Example

12 in. well, total depth = 600 ft.,
SWL = 50 ft.

Step 1

Static height = (600 ft. - 50 ft.) = 550 ft.

Step 2

550 ft. x 0.15 gal./ft. = 82.5 gal.

Step 3

83 gal. Nu-Well 310 bioacid dispersant needed.*

* Better results can be achieved when the total treatment volume of chemical solution is 1.5 to 2 times the static well volume (allowing for penetration into surrounding formation)