

ZF Active Safety US Inc.  
12001 Tech Center Drive, Livonia, Michigan 48150-2122



**VIA EMAIL:** [WojciechowskiK@Michigan.gov](mailto:WojciechowskiK@Michigan.gov)  
**AND CERTIFIED MAIL**

Department	Environmental, Health and Safety
From	Scott Detwiler
Phone	+1 480-722-4139
Email	<a href="mailto:Scott.Detwiler@zf.com">Scott.Detwiler@zf.com</a>
Date	April 22, 2022

Kevin Wojciechowski, Project Manager  
Warren District Office Remediation and Redevelopment Division  
Michigan Department of Environment, Great Lakes, and Energy  
27700 Donald Court  
Warren, Michigan 48092

RE: ZF Active Safety US Inc. Submittal of the Monitoring Well Rehabilitation and Vertical Aquifer Profiling Work Plan Related to the Department of Environment, Great Lakes, and Energy April 14, 2022 Response to ZF's Additional Information for Consideration Related to Administrative Order for Response Activity; EGLE Docket No. AO-RRD-22-001 (AO) Regarding Former Kelsey-Hayes Company, 101 Oak Street, Milford, Oakland County, Michigan, Facility ID No. 63000952 (the "Site").

Dear Mr. Wojciechowski,

ZF Active Safety US Inc. (ZF) is providing the attached Monitoring Well Rehabilitation and Vertical Aquifer Profiling Work Plan (the "Work Plan") for the Department of Environment, Great Lakes, and Energy's (EGLE's) attention related to the April 14th Letter in Response to Additional Information for Consideration Related to the Administrative Order for Response Activity ("EGLE's April 14th Letter").

Pursuant to the Work Plan, ZF will perform the work listed in EGLE's April 14th Letter and will also conduct additional activities to further investigate, redevelop and possibly replace monitoring well OW-16D2, and gather information to further assess the aquifer. ZF will coordinate with EGLE and the Village of Milford as appropriate regarding the activities set forth in the Work Plan.

Thank you for your attention to these matters and please include this letter and its attachment in the administrative record for the AO and the Site.

If you have any questions, please contact me at the phone number listed in the header on the first page of this letter, Mr. Robert Bleazard – ZF Sr. EHS Manager, Environmental Remediation at 480-722-4866, or Mr. John McInnis of Arcadis at 248-994-2285.

Sincerely,

Scott Detwiler  
Sr. Regional Manager  
ZF Environmental, Health and Safety

Enclosures  
cc by email only:

Mr. Robert Bleazard, ZF  
Ms. Kelly Martorano, ZF  
Mr. John McInnis, Arcadis  
Mr. Troy Sclafani, Arcadis  
Mr. Grant Gilezan, Dykema  
Mr. Paul Stewart, Dykema  
Mr. Christian Wuerth, Village Manager, Village of Milford  
Ms. Polly Synk, Michigan Department of Attorney General  
Ms. Danielle Allison-Yokom, Michigan Department of Attorney General  
Mr. Aaron B. Keatley, EGLE - Chief Deputy Director, EGLE  
Mr. Kevin Wojciechowski, Project Manager, EGLE  
Mr. Josh Mosher, EGLE – Remediation and Redevelopment Assistant Director  
Mr. Dan Yordanich, EGLE  
Ms. Mary Miller, EGLE  
Mr. Darren Bowling, EGLE  
Mr. Paul Owens, EGLE  
Ms. Cheryl Wilson, EGLE  
Ms. Lyndsey Hagy, EGLE  
Ms. Katie Noetzel, EGLE

Attachment 1

ZF Monitoring Well Rehabilitation and Vertical Aquifer Profiling Work Plan

**SUBJECT**

Former Kelsey-Hayes Plant,  
101 Oak Street  
Oakland County, Michigan  
EGLE Facility ID No. 63000952

**TO**

Kevin Wojciechowski and Tiffany Yusko-Kotimko,  
Michigan Department of Environment,  
Great Lakes, And Energy

**DATE**

April 22, 2022

**OUR REF**

Monitoring Well Rehabilitation and Vertical Aquifer  
Profiling Work Plan

**DEPARTMENT**

Environment

**PROJECT NUMBER**

30046730

**COPIES TO**

Christian Wuerth, Village of Milford  
Mike Karll, Village of Milford

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## OVERVIEW

On behalf of ZF Active Safety US Inc. (ZF), Arcadis of Michigan, LLC (Arcadis) has prepared this Monitoring Well Rehabilitation and Vertical Aquifer Profiling (VAP) Work Plan (Work Plan) to document proposed activities for the rehabilitation of Monitoring Well OW-16D2, VAP, and potential new well installation. This Work Plan was prepared pursuant to ZF's Letters to Michigan Department of Environment, Great Lakes, and Energy (EGLE) dated April 8, April 13 and April 15, 2022, and EGLE's letter to ZF dated April 14, 2022 and related email correspondence. This Work Plan describes the process for rehabilitating OW-16D2 (including possibly the introduction of an additive), conducting VAP, and possibly replacing OW-16D2.

The objective of these activities as mentioned in the above referenced correspondence is to ensure a properly performing and reliable monitoring well exists at or near the location of OW-16D2 that will provide groundwater data representative of conditions in the aquifer for comparison to Part 201 criteria and for determining whether the Administrative Order for Response Activity, EGLE Docket No. AO-RRD-22-001 was based on accurate prior data concerning the presence of vinyl chloride at that location. In addition, VAP (at three locations) will assess the lateral and vertical extent of groundwater impacts at and in the proximity of OW-16D2 and can be used to verify that the existing screen in OW-16D2 is in the zone of highest contamination and most representative of the impacted groundwater intended to be monitored by OW-16D2. The VAP can also be used if the rehabilitation of OW-16D2 does not meet the objectives set forth above and it is determined that replacement of OW-16D2 is necessary. See **Figures 1 and 2** for reference.

## MONITORING WELL OW-16D2 REHABILITATION

Field activities associated with the rehabilitation of OW-16D2 will include:

- collecting water samples from OW-16D2 for chemical and biological analysis to determine if the recharging issues observed with the well are related to scaling or biofouling;
- performing a camera survey of the groundwater monitoring well to assess the integrity of the screen and the casing;
- performing a rising head/slug-out test to establish baseline well hydraulic performance;

- conducting redevelopment activities using a combination of surging, swabbing, airlifting, possibly the introduction of an approved additive, and removal of liquids from the well.

### **Sample Collection for Chemical and Biological Analysis**

Water samples will be collected for chemical and biological analysis from OW-16D2 for a complete well profile. The samples will be submitted to Water System Engineering, Inc, (WSE) Ottawa, Kansas. The purpose of the sample is to collect data regarding biological and chemical factors (biofouling, scaling, etc.) that might contribute to the poor hydraulic connection of the current well to the aquifer. The data will be used to determine potential mechanical techniques and/or additives to remove a potential blockage from the well screen or maintain proper hydraulic connection of the well to the aquifer.

The water samples will be collected in two steps: The first sample will be collected from the water initially purged from the well (casing sample). After the first sample has been collected, the well will continue to be purged and the water quality will be monitored, using a multiparameter probe. The multiparameter probe will be used to measure field parameters (temperature, specific conductance, oxygen, pH, and Oxidation-Reduction Potential [ORP]) until they have stabilized within 10 percent, indicating that the well is drawing water from the formation. Once the readings indicate that formation water has entered the well, the second sample (well sample) will be collected. Unlike low-flow sampling, which requires the pump to be placed at the center of the screen, the pump will be placed approximately 5 to 10 feet above the well screen to collect the complete well profile. The pump rate will be up to 1,500 milliliters per minute.

The analysis of the samples will include: pH, alkalinity, bicarbonate, carbonates, chloride, total dissolved solids, conductivity, total hardness, calcium, magnesium, copper, iron, manganese, phosphate, nitrate, silica, sulfate, tannin, potassium, sodium, chlorine, ORP, Total Organic Carbon (TOC), Saturation Index calculation, Heterotrophic plate count, cell count made by adenosine triphosphate (ATP) method, bacterial identification of the two major populations, assessment of aerobic and anaerobic growth, sulfate reducing bacteria (SRB), iron oxidizing bacteria, total and E.coli coliform bacteria, and microscopic evaluation.

### **Monitoring Well Camera Survey**

A down-well camera survey will be conducted to assess the integrity of OW-16D2. The survey will assess potential damage to the casing or the screen and will help determine if there is scaling or bioaccumulation in the well screen. The survey will be accomplished by lowering a camera down the well. Sections of the well with obvious defects or irregularities will be noted. A video recording of the camera survey will be created.

### **Assessment of Baseline Hydraulic Performance**

A rising head/slug-out test will be conducted to establish baseline well performance using a disposable bailer. Field staff will use the following procedure for the test:

1. Measure depth to water and well total depth.
2. Total depth will be taken using a weighted tag line to determine the water column length. The "static" depth to water should be representative of the water level after the well equalizes with the atmosphere. Multiple depth to water measurements will be measured and any trends will be noted.
3. Review the well construction log to determine the screened interval and confirm the depth to the bottom. If discrepancies exist, the project hydrogeologist will be consulted.

4. Equip the well with a vented pressure transducer and program the instrument to read water level changes in 1-second intervals. Leave the laptop connected to the transducer during the test. If the transducer is not vented, install a barologger in the headspace of a nearby well to record barometric pressure.
5. Measure the bailer and rope assembly length and mark the rope at lengths as follows: Rope Mark #1 = Depth to Potentiometric Surface from TOC; Rope Mark #2 = Depth to Potentiometric Surface from TOC + Length of Bailer + Safety Factor (Safety Factor = ten percent (10%) of the Length of Bailer)
6. When deployed, Rope Mark #2 should ensure that the bailer is fully submerged. If a sufficient water column is not available to obtain a full bailer, measure the volume removed upon removal.
7. Slowly insert the bailer into the well and stop just above the potentiometric surface Rope Mark #1.
8. With slack in the rope and the bailer being suspended above the water column, lower the bailer and place the Rope Mark #2 at the top of casing. Clamp the non-bailer end of the rope to a static object to keep the rope in place.
9. Wait for the water level to equilibrate using a water level meter or observe using the transducer data displayed in real-time on the laptop computer.
10. Quickly remove the bailer from the water column and carefully pull it to the surface; start recording elapsed time once the bailer has been removed from the water column. Pour the removed water into an empty bucket.
11. Observe the water level response by measuring depth to water and observing water level changes on a laptop computer, if using a transducer. Allow sufficient time for the water level to recover to pre-test level (static). If completing one test, a recovery to 80% is sufficient.
12. With slow recovery, it is recommended to return to the well after a few days to observe recovery. The transducer will be retrieved once recovery has been achieved. The data will be downloaded and processed after the test.

The test will be performed before and after rehabilitation to evaluate the success of the rehabilitation measures.

### Redevelopment of OW-16D2

Following the baseline well performance test, Arcadis will oversee the redevelopment of OW-16D2. Depending on the results of the chemical/biological analysis and camera survey, the redevelopment of OW-16D2 may include the introduction of Aqua-Clear®PFD and mechanical development techniques that will require the use of a water source. The Village of Milford water supply is the most readily available source of water and is proposed for this redevelopment work. If Aqua-Clear®PFD will be used, the date and time of the redevelopment will be coordinated with the Village of Milford to perform the work when its supply wells can be turned-off.

The well was redeveloped using surging/pumping technique on April 1, 2022. However, if additional sediment is found at the bottom of the well, which will be determined by comparing total depth measurements and review of the down well camera survey as described above, the material will be removed via air-lifting or pumping before beginning the next treatment step.

In a first step of the redevelopment process, a nylon brush appropriately sized for the well screen inner diameter (ID) will be used to brush two-foot sections of the screen at least 10 minutes (min) per section until the entire screen has been brushed. This process will be started at the top of the well screen and then continued downward to loosen/remove any biofilm, scaling, or fines that have accumulated on the well screen. After completion, the brush assembly will be removed, the well depth will be measured, and the presence of any sediment or loosened

materials in the bottom of well will be noted. As before, any sediment accumulated at the bottom of the well will be removed via bailer/air lift/pump before beginning the next redevelopment step. This step will be omitted if the review of the camera survey indicates that the well screen is free of scaling or bioaccumulation.

Upon consultation with EGLE and the Village of Milford, a commercially available mud dispersant (Aqua-Clear®PFD which is National Sanitation Foundation (NSF) / American National Standards Institute 60 certified) will be mixed with water following the manufacturer's directions for dosing and introduced into the screened interval. The water will come from the Village of Milford, as that is the nearest water source. Aqua-Clear®PFD is a common liquid polymer dispersant used in the water supply and environmental drilling industry. The material is classified as non-reactive and contains no hazardous substances above Occupational Safety and Health Administration cut-off values. The only ingredient contained in the NSF listing is sodium polyacrylate which is an approved Food and Drug Administration food additive and used in various medical applications. Copies of the NSF certification listing, manufacturer's information, and safety data sheet for Aqua-Clear® PFD are included in **Attachment 1**.

The mixture will be worked through the entire saturated screen interval by surging and brushing the screen for approximately 15 minutes. The dispersant will then be allowed to sit for approximately four hours before continuing well redevelopment activities.

The steps for mixing the dispersant are as follows:

1. Determine the volume of water in the screen area and double the calculated volume to account for water in the gravel pack and formation interface.
2. Once the water volume is determined, calculate the required volume of Aqua-Clear®PFD by using the following formula: Aqua-Clear®PFD (gal or L) = 0.002 x Water Volume (gal or L).
3. This equates to one gallon of Aqua-Clear®PFD for every 500 gallons of water (0.2% by volume) or 2.0 liters of Aqua-Clear®PFD for every cubic meter of water.
4. Mix thoroughly before introducing into well.
5. The preferable application method utilizes a tremie line with the product applied into the screened area.

After allowing the Aqua-Clear®PFD to sit for approximately four hours, mechanical redevelopment will start by lowering an appropriately sized double-surge block (or similar) into the well. Surging will start above the screen to reduce the possibility of "sand-locking" the surge block and will include the following:

- Initial surging will be done with a long stroke and at a slow rate (20 to 25 strokes per minute).
- After surging above the screen, the well will be cleaned by air-lifting.
- Surging will start at the lower end of the screen - gradually working upward, surging in 2-foot intervals until the entire screen has been developed. The well will be surged for a minimum of 10 throws per 2-ft screen interval.

Each interval may require several surge cycles to achieve the best development. The entire length of well screen must be surged.

The surge block will be moved upward faster than downward to pull the fines out of the filter pack, instead of forcing them back in (and allowing for proper settlement).

During the surging, the total depth of the well will be measured periodically to ensure that excessive amounts of sediment are not being pulled through the screen. Any debris accumulated in the well will be removed via simultaneous airlifting (if a combined tool is available) or pumping.

A multiparameter probe will be used to measure field parameters from the redevelopment water including turbidity during redevelopment. Redevelopment (purging) will continue until turbidity is relatively stable ( $\pm 10\%$ ) and is visibly clear (ideally less than 10 nephelometric turbidity units).

Up to 10 well volumes of water, depending on well production following surging, will be removed from the well once surging has been completed. The extracted liquids will be containerized in totes or tanks and disposed of at the groundwater remediation system at the former Kelsey-Hayes site. The well redevelopment process outlined above will take approximately 8 hours.

Following the redevelopment of OW-16D2, a second hydraulic performance test will be conducted as outlined above. The result will determine if additional mechanical redevelopment will be necessary in the future or possibly plugging and replacement of OW-16D2.

## VERTICAL AQUIFER PROFILING

VAP will be conducted at three locations near and west of OW-16D2 (see **Figure 2**) to determine the potential lateral and vertical extent of groundwater impacts. Prior to any intrusive work, the Village of Milford will be contacted for access and Miss Dig 811 will be informed about the activities and requested that utilities to be marked in the work area. In addition, a private utility locating service will be contracted to confirm the markings.

Soil cores will be logged and screened for evidence of volatile organic compounds using a Photo Ionization Detector (PID).

Groundwater samples will be collected at 10-foot intervals from the water table to a maximum depth of 130 feet below ground surface, or the surface of the clay underlaying the aquifer, using sonic drilling methods in combination with an inflatable packer system or a push ahead sampler to isolate the target sampling interval. Samples will be collected top-down, starting at the highest interval going down.

When the target sampling interval has been reached, the water between the packers will be evacuated prior to collecting the sample. After the sample has been collected, the packer will be retrieved and decontaminated. The boring will then be advanced to the next sampling interval and the process will be repeated.

After finalizing sample collection and when the final depth of the boring has been reached, the borehole will be abandoned by injecting a bentonite grout slurry. The grout will be injected starting at the bottom of the hole using a tremie pipe.

Soil cuttings will be containerized in 55-gallon Department of Transportation approved steel drums and temporarily stored near the groundwater treatment system building at the former Kelsey-Hayes Site for waste characterization prior to off-site disposal. All purge water will be disposed of in the groundwater treatment system at the former Kelsey-Hayes Site.

The groundwater samples will be submitted to Eurofins Laboratories and/or another lab for analysis of volatile organic compounds using USEPA Method SW-846 8260D.

The analytical results of the VAP sampling will be used to assess the lateral and vertical extent of groundwater impacts at and in the proximity of OW-16D2 and can be used to verify that the existing screen in OW-16D2 is in the zone of highest contamination and most representative of the impacted groundwater intended to be monitored by OW-16D2. The VAP can also be used if the rehabilitation of OW-16D2 does not meet the objectives set forth above and it is determined that replacement of OW-16D2 is necessary.



Kevin Wojciechowski  
Michigan Department Environment, Great Lakes, and Energy  
April 22, 2022

If the result of the redevelopment indicates that a replacement for OW-16D2 is necessary, a new 2-inch diameter monitoring well with a 5-foot stainless steel screen will be installed using sonic drilling methods. As described before, the well location and screen placement will be determined by the VAP results.

## **TARGET SCHEDULE**

Arcadis will implement this Work Plan based on the following proposed schedule, pending weather conditions, site access, and EGLE approval of the Aqua-Clear PFD® additive.

- Early May 2022 – Biological and chemical sampling and camera survey of OW-16D2.
- May 2022 – Hydraulic Performance testing, Redevelopment of OW-16D2.
- June 2022 – VAP and potential well replacement.
- Continue groundwater monthly sampling at OW-16D2.
  - The last sample was collected on April 18, 2022
  - The next sample will be collected the week of May 16, 2022.

## **Enclosures: Figures and Attachments**

### **Figures**

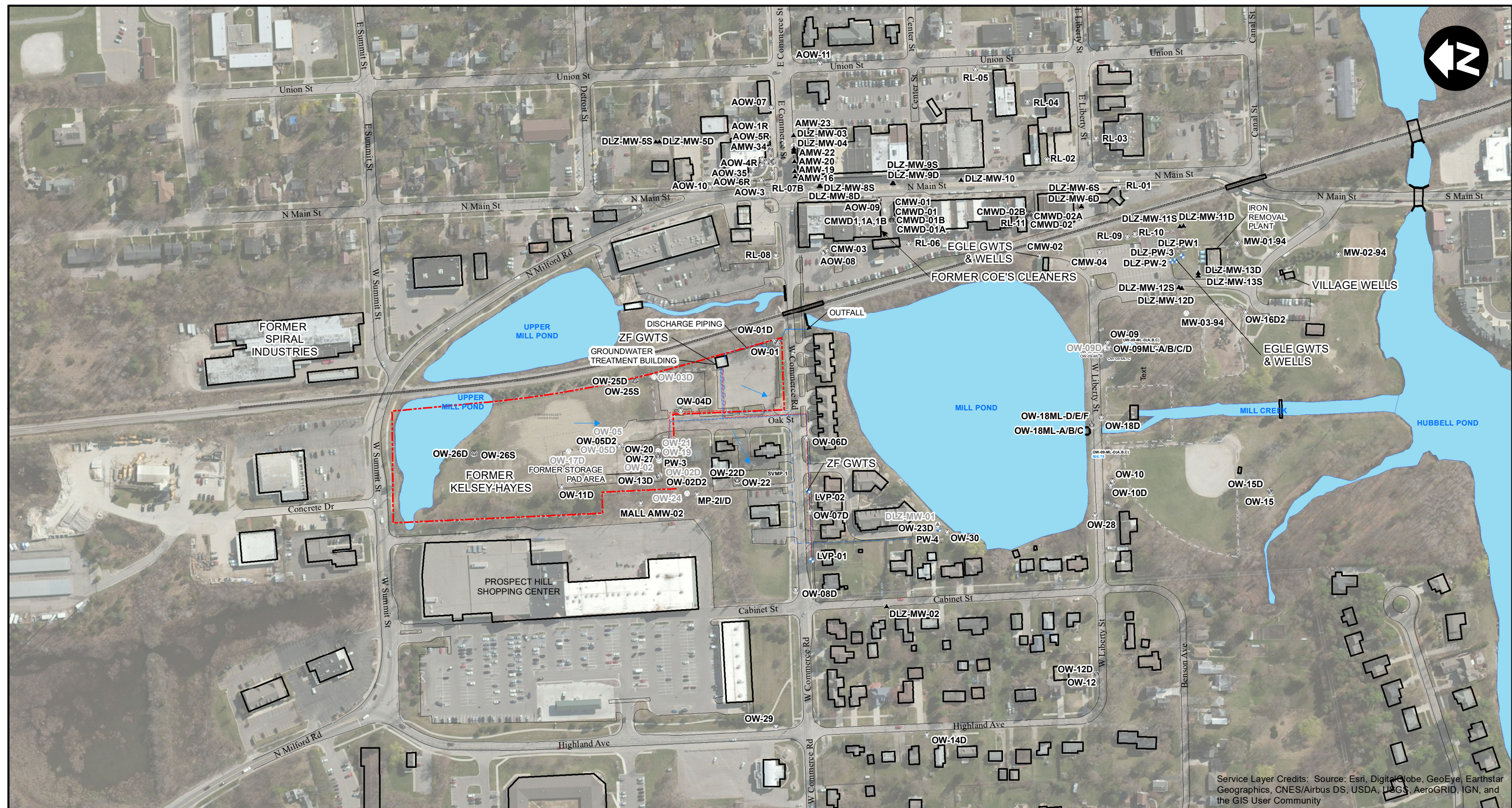
- 1 - Site Layout Map
- 2 – Site Layout Map with Proposed VAP Locations

### **Attachment**









- 1 - Product Information for Halliburton AQUA-CLEAR® PFD.

# Figures





### LEGEND

- |   |  |   |   |
|---|--|---|---|
|  | MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY MONITORING WELL           |  | GROUNDWATER TREATMENT SYSTEM UNDERGROUND ELECTRICAL                       |
|  | ABANDONED MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY MONITORING WELL |  | GROUNDWATER TREATMENT SYSTEM UNDERGROUND ELECTRICAL AND CONVEYANCE PIPING |
|  | MONITORING/OBSERVATION WELL  |  | GROUNDWATER TREATMENT SYSTEM UNDERGROUND CONVEYANCE PIPING                |
|  | ABANDONED OBSERVATION WELL   |  | GROUNDWATER TREATMENT SYSTEM UNDERGROUND DISCHARGE PIPING                 |
|  | PUMPING WELL   |  | FORMER KELSEY-HAYES PROPERTY BOUNDARY                                     |
|   |  |  | RAILROAD TRACK  |
|   |  |  | FENCE LINE  |

FORMER KELSEY-HAYES PLANT  
MILFORD, MICHIGAN

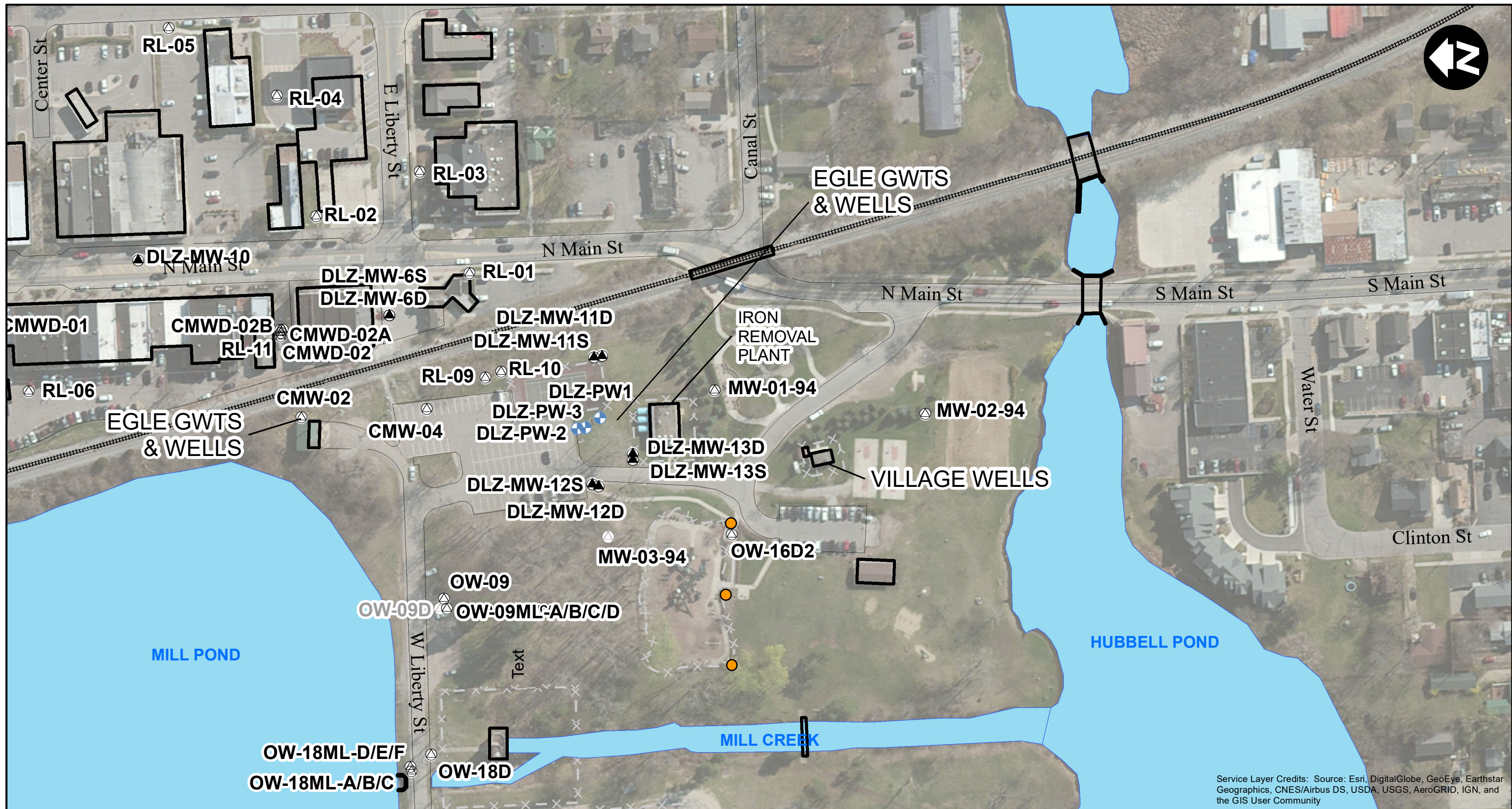
## SITE LAYOUT



FIGURE 1









Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**LEGEND**

-  MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY MONITORING WELL
-  MONITORING/OBSERVATION WELL
-  ABANDONED OBSERVATION WELL
-  PUMPING WELL
-  RAILROAD TRACK
-  FENCE LINE
-  VERTICAL AQUIFER PROFILING (VAP) LOCATION

FORMER KELSEY-HAYES PLANT  
MILFORD, MICHIGAN

**SITE LAYOUT WITH PROPOSED  
VAP BORING LOCATIONS**



FIGURE

2





# **Attachment 1**

**Product Information for Halliburton AQUA-CLEAR® PFD.**



The Public Health and Safety Organization

## NSF Product and Service Listings

These NSF Official Listings are current as of **Monday, April 04, 2022** at 12:15 a.m. Eastern Time. Please [contact NSF](#) to confirm the status of any Listing, report errors, or make suggestions.

Alert: NSF is concerned about fraudulent downloading and manipulation of website text. Always confirm this information by clicking on the below link for the most accurate information:

<http://info.nsf.org/Certified/PwsChemicals/Listings.asp?Company=05240&Standard=060&>

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### NSF/ANSI/CAN 60 Drinking Water Treatment Chemicals - Health Effects

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#### Halliburton

3000 North Sam Houston Parkway East

Houston, TX 77032

United States

800-735-6075

281-871-4612

[Visit this company's website \(http://www.baroididp.com\)](http://www.baroididp.com)

**Facility : # 1 USA**

#### Miscellaneous Water Supply Products[1]

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
N-Seal™	Drilling Fluid	NA

[1] These products are designed to be flushed out prior to using the system for drinking water. Before being placed in service, the well is to be properly flushed and drained according to the manufacturer's use instructions.

NOTE: All N-Seal™ from this location is NSF Certified, whether or not it bears the NSF Mark.

**Facility : # 4 USA**

**Miscellaneous Water Supply Products**

<b>Trade Designation</b>	<b>Product Function</b>	<b>Max Use</b>
AQF-2™ XG[1]	Foaming Agent	NA
IDP-1004[1]	Foaming Agent	NA
IDP-1009[2]	Foaming Agent	NA
QUIK-FOAM® HP[2]	Foaming Agent	NA

[1] Certification of this product is based on a well drilling model using assumptions stated in NSF/ANSI Standard 60, Section 8 for well drilling foamers.

[2] Certification of this product is based on a well drilling model using assumptions stated in NSF/ANSI Standard 60, Section 8 for well drilling foamers.

**Facility : # 7 USA****Miscellaneous Water Supply Products[1] [2]**

<b>Trade Designation</b>	<b>Product Function</b>	<b>Max Use</b>
IDP-952	Well Sealant	NA
MAX-YIELD TCM	Well Sealant	NA

[1] The sealant is to be mixed at a ratio of not greater than 36 pounds to 50 pounds of grout.

[2] Certified for use as a well sealant additive only when used in conjunction with a well sealant grout.

**Facility : # 8 USA****Miscellaneous Water Supply Products[1]**

<b>Trade Designation</b>	<b>Product Function</b>	<b>Max Use</b>
IDP-953	Well Sealant	NA
MAX-YIELD HP	Well Sealant	NA

[1] This product is designed to be flushed out until the turbidity of the water is <1 NTU. Flushing is required before the system may be used for drinking water.

**Facility : Belle Fourche, SD****Bentonite[1]**

<b>Trade Designation</b>	<b>Product Function</b>	<b>Max Use</b>
AQUAGEL®	Drilling Fluid	NA
AQUAGEL® GOLD SEAL	Drilling Fluid	NA
AQUAGUARD®	Well Sealant	NA
BAROTHERM® GOLD	Well Sealant	NA
BENSEAL®	Well Sealant	NA
BORE-GEL®	Drilling Fluid	NA
BORE-GROUT®	Well Sealant	NA
IDP-502	Well Sealant	NA
IDP-512	Well Drilling Aid	NA
QUIK-BORE	Well Drilling Aid	NA
QUIK-GEL GOLD®	Drilling Fluid	NA
QUIK-GEL®	Drilling Fluid	NA
QUIK-GROUT®	Well Sealant	NA

[1] This product is designed to be used off-line following manufacturer's use instructions. The well is to be flushed until the turbidity of the water is < 1 NTU before the system may be used for drinking water.

**Miscellaneous Water Supply Products**

<b>Trade Designation</b>	<b>Product Function</b>	<b>Max Use</b>
BARAD-399 CORE[2]	Drilling Fluid	NA
BARASORB 955	Well Sealant	NA
IDP-399[2]	Drilling Fluid	NA

[2] These products are designed to be flushed out prior to using the system for drinking water. Before being placed into service, the well is to be properly flushed according to the manufacturer's use instructions. Certification of these products is based on the well drilling model with the following assumptions:

- The amount of well drilling fluid used is 3780 L (1000 U.S. gallons) to which the drilling fluid has been added at the manufacturer's recommended level.
- The aquifer contains 3.1 million liters of water (815,000 gallons) based on a 0.5 acre aquifer of 6.1 meter depth (20 ft.) and 25% porosity.
- The bore hole is 61 meters in total depth (200 ft.), the screen is 6.1 meters in length (20 ft.), and the bore hole is 25.4 cm. in diameter (10 in.).
- The amount of well drilling fluid removed from the well during construction is equal to the combined volumes of the casing and the screen, plus an additional amount removed through the well disinfection and development (90% removed).



- This product should not be used in constructing wells in highly porous formations, such as cavernous limestone.

NOTE: Only Listed products bearing the NSF Mark are NSF Certified.

## Facility : Conroe, TX

### Miscellaneous Water Supply Products

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
BARAD-658[1] [2]	Other	NA
IDP-658[1] [2]	Other	NA
IDP-920[3]	Drilling Fluid	NA
	Well Drilling Aid	
PENETROL DRY[3]	Drilling Fluid	NA
	Well Drilling Aid	
QUIK-TROL® GOLD[4]	Well Drilling Aid	NA
QUIK-TROL® GOLD LV[1]	Well Drilling Aid	NA

[1] This product is designed to be used off-line following manufacturer's use instructions. The well is to be flushed until the turbidity of the water is < 1 NTU before the system may be used for drinking water.

[2] This product is Certified for use as a well sealant additive only when used in conjunction with a well sealant grout.

[3] These products are designed to be flushed out prior to using the system for drinking water. Before being placed into service, the well is to be properly flushed according to the manufacturer's use instructions.

Certification of these products is based on the well drilling model with the following assumptions:

- The amount of well drilling fluid used is 3780 L (1000 U.S. gallons) to which the drilling fluid has been added at the manufacturer's recommended level.
- The aquifer contains 3.1 million liters of water (815,000 gallons) based on a 0.5 acre aquifer of 6.1 meter depth (20 ft.) and 25% porosity.
- The bore hole is 61 meters in total depth (200 ft.), the screen is 6.1 meters in length (20 ft.), and the bore hole is 25.4 cm. in diameter (10 in.).
- The amount of well drilling fluid removed from the well during construction is equal to the combined volumes of the casing and the screen, plus an additional amount removed through the well disinfection and development (90% removed).
- This product should not be used in constructing wells in highly porous formations, such as cavernous limestone.

[4] This product is designed to be used off-line following manufacturer's use instructions.

The well is to be flushed until the turbidity of the water is 1 NTU before the system may be used for drinking water.

#### Polyacrylamide[PC]

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
POLY-BORE™	Well Drilling Aid	NA

[PC] Polyacrylamide Products Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

#### Polymer Blends[PC]

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
Clay-Drill	Drilling Fluid	NA

[PC] Polyacrylamide Products Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

### Facility : Rosenberg, TX

#### Miscellaneous Water Supply Products

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
AQF-2[1] [2]	Foaming Agent	NA
AQF-2™ XG[1]	Foaming Agent	NA
AQUA-CLEAR® AE[3]	Well Rehabilitation Aid	NA
AQUA-CLEAR® MGA[3]	Well Rehabilitation Aid	NA
IDP-1004[1]	Foaming Agent	NA
IDP-1009[1]	Foaming Agent	NA
IDP-930[4] [5] [PC]	Drilling Fluid	NA
	Well Drilling Aid	
PENETROL DRY[2] [4] [5]	Drilling Fluid	NA
	Well Drilling Aid	
Performatrol 930[4] [5] [PC]	Drilling Fluid	NA
	Well Drilling Aid	
QUIK-FOAM® HP[1]	Foaming Agent	NA
QUIK-TROL®	Well Drilling Aid	NA
QUIK-TROL® GOLD[3]	Well Drilling Aid	NA
QUIK-TROL® GOLD LV[3]	Well Drilling Aid	NA
QUIK-TROL® LV	Well Drilling Aid	NA
Quik-Foam®[2]	Foaming Agent	NA

- [1] Certification of this product is based on a well drilling model using assumptions stated in NSF/ANSI/CAN 60, Section 8 for well drilling foamers.
- [2] This product is designed to be used off-line and flushed out prior to using the system for drinking water, following manufacturer's use instructions.
- [3] This product is designed to be used off-line following manufacturer's use instructions. The well is to be flushed until the turbidity of the water is < 1 NTU before the system may be used for drinking water.
- [4] These products are designed to be flushed out prior to using the system for drinking water. Before being placed into service, the well is to be properly flushed according to the manufacturer's use instructions.
- [5] Certification of these products is based on the well drilling model with the following assumptions:
- The amount of well drilling fluid used is 3780 L (1000 U.S. gallons) to which the drilling fluid has been added at the manufacturer's recommended level.
  - The aquifer contains 3.1 million liters of water (815,000 gallons) based on a 0.5 acre aquifer of 6.1 meter depth (20 ft.) and 25% porosity.
  - The bore hole is 61 meters in total depth (200 ft.), the screen is 6.1 meters in length (20 ft.), and the bore hole is 25.4 cm. in diameter (10 in.).
  - The amount of well drilling fluid removed from the well during construction is equal to the combined volumes of the casing and the screen, plus an additional amount removed through the well disinfection and development (90% removed).
  - This product should not be used in constructing wells in highly porous formations, such as cavernous limestone.
- [PC] Polyacrylamide Products Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

#### **Polyacrylamide [PC]**

<b>Trade Designation</b>	<b>Product Function</b>	<b>Max Use</b>
EZ-MUD GOLD[5] [PC] [WL]	Well Drilling Aid	NA
EZ-MUD®[5] [PC] [WL]	Well Drilling Aid	NA
EZ-MUD® DP[5] [PC] [WL]	Well Drilling Aid	NA
EZ-MUD® PLUS[5] [6] [PC] [WL]	Well Drilling Aid	NA
POLY-BORE™[5] [PC] [WL]	Well Drilling Aid	NA

- [5] Certification of these products is based on the well drilling model with the following assumptions:
- The amount of well drilling fluid used is 3780 L (1000 U.S. gallons) to which the drilling fluid has been added at the manufacturer's recommended level.
  - The aquifer contains 3.1 million liters of water (815,000 gallons) based on a 0.5 acre aquifer of 6.1 meter depth (20 ft.) and 25% porosity.
  - The bore hole is 61 meters in total depth (200 ft.), the screen is 6.1 meters in length (20 ft.), and the bore hole is 25.4 cm. in diameter (10 in.).

- The amount of well drilling fluid removed from the well during construction is equal to the combined volumes of the casing and the screen, plus an additional amount removed through the well disinfection and development (90% removed).
- This product should not be used in constructing wells in highly porous formations, such as cavernous limestone.

[6] This product is designed for the treatment of surface water before it enters the water treatment facility.

[PC] Polyacrylamide Products Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

[PC] Polyacrylamide Products Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

[WL] These products are designed to be flushed out prior to using the system for drinking water. The well shall be properly flushed and drained before being placed in service.

#### **Polyamines[PY]**

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
SYSTEM-FLOC 360	Coagulation & Flocculation	10mg/L

[PY] Polyamines Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

#### **Polymer Blends[PY]**

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
Clay-Drill	Drilling Fluid	NA

[PY] Polyamines Certified by NSF International comply with 40 CFR 141.111 requirements for percent monomer and dose.

#### **Sodium Carbonate**

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
SODA ASH	pH Adjustment	100mg/L

#### **Sodium Polyacrylate**

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
AQUA-CLEAR® PFD [2] [4] [5]	Well Cleaning Aid	NA

[2] This product is designed to be used off-line and flushed out prior to using the system for drinking water, following manufacturer's use instructions.

[4] These products are designed to be flushed out prior to using the system for drinking water. Before being placed into service, the well is to be properly flushed according to

the manufacturer's use instructions.

[5] Certification of these products is based on the well drilling model with the following assumptions:

- The amount of well drilling fluid used is 3780 L (1000 U.S. gallons) to which the drilling fluid has been added at the manufacturer's recommended level.
- The aquifer contains 3.1 million liters of water (815,000 gallons) based on a 0.5 acre aquifer of 6.1 meter depth (20 ft.) and 25% porosity.
- The bore hole is 61 meters in total depth (200 ft.), the screen is 6.1 meters in length (20 ft.), and the bore hole is 25.4 cm. in diameter (10 in.).
- The amount of well drilling fluid removed from the well during construction is equal to the combined volumes of the casing and the screen, plus an additional amount removed through the well disinfection and development (90% removed).
- This product should not be used in constructing wells in highly porous formations, such as cavernous limestone.

## Facility : Lovell, WY

### Bentonite[1]

<i>Trade Designation</i>	<i>Product Function</i>	<i>Max Use</i>
AQUAGEL®	Drilling Fluid	NA
AQUAGEL® GOLD SEAL	Drilling Fluid	NA
BARA-KADE CHIPS	Well Sealant	NA
BORE-GEL®	Drilling Fluid	NA
CASING SEAL™	Well Sealant	NA
EZ-SEAL®	Well Sealant	NA
HOLEPLUG®	Well Sealant	NA
QUIK-GEL GOLD®	Drilling Fluid	NA
QUIK-GEL®	Drilling Fluid	NA

[1] This product is designed to be used off-line following manufacturer's use instructions. The well is to be flushed until the turbidity of the water is < 1 NTU before the system may be used for drinking water.

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Number of matching Manufacturers is 1

Number of matching Products is 66

Processing time was 0 seconds



# AQUA-CLEAR® PFD

Phosphate-Free Dispersant

## Description

AQUA-CLEAR® PFD concentrated liquid polymer dispersant provides superior mud and sediment removal from the producing formation and gravel pack. This product is also a highly effective mud thinner. AQUA-CLEAR PFD dispersant contains no phosphates.

## Applications/Functions

- Can disperse mud, sediment and clay from the producing formation and gravel pack in the screened interval.
- Can reduce viscosity and gel strength of drilling fluids

## Advantages

- NSF/ANSI Standard 60 certified
- Helps reduce development time
- Helps increase well yield and capacity
- Safe to use on most plastics, rubber and metals
- Non-fermenting
- Can reduce pumping costs

## Typical Properties

- |                    |                      |
|--------------------|----------------------|
| • Appearance       | straw colored liquid |
| • Specific gravity | 1.2 to 1.4           |
| • pH (neat)        | 6.5 to 7.5           |

## Recommended Treatment

### As a Well Development Aid

- Determine volume of water in screen area and double the calculated volume to account for water in gravel pack and formation interface or determine the static volume of water and add 50% excess.
- Once the water volume is determined, calculate the required treatment volume of AQUA-CLEAR PFD by the following formula:

$$\text{AQUA-CLEAR PFD (gal or L)} = 0.002 \times \text{Water Volume (gal or L)}$$

*This equates to one gallon of AQUA-CLEAR PFD for every 500 gallons of water (0.2% by volume) or 2.0 liters of AQUA-CLEAR PFD for every cubic meter of water.*

- Mix thoroughly before introducing into well.
- The preferable application method utilizes a tremie line with the product applied into the screened area.
- If necessary, the AQUA-CLEAR PFD/water solution may be poured into the well.
- Mixture should be thoroughly blended in well, then agitated using a surge

**Recommended  
Treatment  
(continued)**

and swab, jetting, or other developmental technique repeatedly every two hours for a period of up to 24 hours.

- Pump to waste until turbidity clears up and then connect well to distribution system.

**As a Mud Thinner**

- Start by adding one pint of AQUA-CLEAR® PFD to 500 gallons of mud. Increase concentration until desired viscosity is achieved.

Well Capacity Chart (Gallons per Foot)					
Well Diameter (Inches)	Well Capacity in Gallons/ft	Well Diameter (Inches)	Well Capacity in Gallons/ft	Well Diameter (Inches)	Well Capacity in Gallons/ft
2	0.2	12	5.9	24	23.5
4	0.7	14	8.0	26	27.6
6	1.5	18	13.2	30	36.7
8	2.6	20	16.3	36	52.9
10	4.1	22	19.7	48	94.0

Well Capacity Chart (Liters per Meter)					
Well Diameter (millimeters)	Well Capacity Liters/meter	Well Diameter (millimeters)	Well Capacity Liters/meter	Well Diameter (millimeters)	Well Capacity Liters/meter
51	2.0	305	73.0	610	292.0
102	8.1	356	99.3	660	342.6
152	18.3	457	164.2	762	456.1
203	32.4	508	202.7	914	656.8
254	50.7	559	245.3	1219	1167.7

**Note:** The volumes in these tables show only the volume of water in a 1 foot or 1 meter section of a given size of screen. Excess volume must be included to account for water present in the formation interface and gravel pack.

**Packaging**

AQUA-CLEAR PFD is packaged in 50-lb (22.7-kg) or 25-kg (55-lb) plastic containers or in a case of 4, 1-gal (3.8 liter) plastic containers weighing 43-lbs (19.6-kg).

**Availability**

AQUA-CLEAR PFD can be purchased through any Baroid Industrial Drilling Products Retailer. To locate the Baroid IDP retailer nearest you contact the Customer Service Department in Houston or your area IDP Sales Representative.

**Baroid Industrial Drilling Products  
Product Service Line, Halliburton**

3000 N. Sam Houston Pkwy E.  
Houston, TX 77032

<b>Customer Service</b>	(800) 735-6075 Toll Free	(281) 871-4612
<b>Technical Service</b>	(877) 379-7412 Toll Free	(281) 871-4613

## SAFETY DATA SHEET

**Product Trade Name:** AQUA-CLEAR® PFD

**Revision Date:** 17-Feb-2016

**Revision Number:** 17

### 1. Identification

#### 1.1. Product Identifier

**Product Trade Name:** AQUA-CLEAR® PFD  
**Synonyms** None  
**Chemical Family:** Blend  
**Internal ID Code** HM004116

#### 1.2 Recommended use and restrictions on use

**Application:** Additive  
**Uses advised against** No information available

#### 1.3 Manufacturer's Name and Contact Details

##### Manufacturer/Supplier

Baroid Fluid Services  
Product Service Line of Halliburton  
P.O. Box 1675  
Houston, TX 77251  
Telephone: (281) 575-5000  
Emergency Telephone: 1-866-519-4752 (US, Canada, Mexico) or 1-760-476-3962

Halliburton Energy Services  
645 - 7th Ave SW Suite 2200  
Calgary, AB  
T2P 4G8  
Canada

**Prepared By** Chemical Stewardship  
Telephone: 1-281-871-6107  
e-mail: fdunexchem@halliburton.com

#### 1.4. Emergency telephone number

**Emergency Telephone Number** 1-866-519-4752 or 1-760-476-3962

### 2. Hazard(s) Identification

#### 2.1 Classification in accordance with paragraph (d) of §1910.1200

As adopted by the competent authority, this product does not require an SDS or hazard warning label.

Not classified

#### 2.2. Label Elements

**Hazard pictograms**

**Signal Word** Not Classified

**Hazard Statements** Not Hazardous



**Precautionary Statements**

<b>Prevention</b>	None
<b>Response</b>	None
<b>Storage</b>	None
<b>Disposal</b>	None

**2.3 Hazards not otherwise classified**

None known

**3. Composition/information on Ingredients**

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	60 - 100%	Not classified

The exact percentage (concentration) of the composition has been withheld as proprietary.

**4. First-Aid Measures****4.1. Description of first aid measures**

<b>Inhalation</b>	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
<b>Eyes</b>	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
<b>Skin</b>	Wash with soap and water. Get medical attention if irritation persists.
<b>Ingestion</b>	Under normal conditions, first aid procedures are not required.

**4.2 Most important symptoms/effects, acute and delayed**

No significant hazards expected.

**4.3. Indication of any immediate medical attention and special treatment needed**

**Notes to Physician** Treat symptomatically.

**5. Fire-fighting measures****5.1. Extinguishing media****Suitable Extinguishing Media**

Water fog, carbon dioxide, foam, dry chemical.

**Extinguishing media which must not be used for safety reasons**

None known.

**5.2 Specific hazards arising from the substance or mixture****Special exposure hazards in a fire**

Decomposition in fire may produce harmful gases. Spills produce extremely slippery surfaces.

**5.3 Special protective equipment and precautions for fire-fighters****Special protective equipment for firefighters**

Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

## 6. Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

Use appropriate protective equipment. Spills of this product are very slippery. Avoid contact with skin, eyes and clothing. Avoid breathing vapors. Ensure adequate ventilation.

See Section 8 for additional information

### 6.2. Environmental precautions

Prevent from entering sewers, waterways, or low areas.

### 6.3. Methods and material for containment and cleaning up

Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

## 7. Handling and storage

### 7.1. Precautions for safe handling

#### Handling Precautions

Avoid contact with eyes, skin, or clothing. Wash hands after use. Avoid breathing vapors. Ensure adequate ventilation. Use appropriate protective equipment.

#### Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

### 7.2. Conditions for safe storage, including any incompatibilities

#### Storage Information

Store away from oxidizers. Store in a cool, dry location. Product has a shelf life of 24 months.

## 8. Exposure Controls/Personal Protection

### 8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable

### 8.2 Appropriate engineering controls

**Engineering Controls** Use in a well ventilated area.

### 8.3 Individual protection measures, such as personal protective equipment

**Personal Protective Equipment** If engineering controls and work practices cannot prevent excessive exposures, the selection and proper use of personal protective equipment should be determined by an industrial hygienist or other qualified professional based on the specific application of this product.

**Respiratory Protection** Not normally necessary.

**Hand Protection** Impervious rubber gloves.

**Skin Protection** Normal work coveralls.

**Eye Protection** Safety glasses.

**Other Precautions** None known.

## 9. Physical and Chemical Properties

### 9.1. Information on basic physical and chemical properties

<b>Physical State:</b> Liquid	<b>Color</b>	Yellowish
<b>Odor:</b> Slight	<b>Odor</b>	No information available

	Threshold:
<u>Property</u>	<u>Values</u>
<u>Remarks/ - Method</u>	
<b>pH:</b>	7 - 9
<b>Freezing Point / Range</b>	No data available
<b>Melting Point / Range</b>	No data available
<b>Boiling Point / Range</b>	No data available
<b>Flash Point</b>	> 100 °C / > 212 °F Cleveland Open Cup (COC)
<b>Flammability (solid, gas)</b>	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
<b>Evaporation rate</b>	No data available
<b>Vapor Pressure</b>	No data available
<b>Vapor Density</b>	No data available
<b>Specific Gravity</b>	1.3
<b>Water Solubility</b>	Soluble in water
<b>Solubility in other solvents</b>	No data available
<b>Partition coefficient: n-octanol/water</b>	No data available
<b>Autoignition Temperature</b>	No data available
<b>Decomposition Temperature</b>	No data available
<b>Viscosity</b>	No data available
<b>Explosive Properties</b>	No information available
<b>Oxidizing Properties</b>	No information available
<b>9.2. Other information</b>	
<b>VOC Content (%)</b>	No data available

## 10. Stability and Reactivity

### 10.1. Reactivity

Not expected to be reactive.

### 10.2. Chemical stability

Stable

### 10.3. Possibility of hazardous reactions

Will Not Occur

### 10.4. Conditions to avoid

None anticipated

### 10.5. Incompatible materials

Strong oxidizers.

### 10.6. Hazardous decomposition products

Carbon monoxide and carbon dioxide.

## 11. Toxicological Information

### 11.1 Information on likely routes of exposure

Principle Route of Exposure      Eye or skin contact, inhalation.

### 11.2 Symptoms related to the physical, chemical and toxicological characteristics

#### Acute Toxicity

##### Inhalation

May cause mild respiratory irritation.

##### Eye Contact

May cause mild eye irritation.

**Skin Contact  
Ingestion**

Prolonged or repeated contact may cause slight skin irritation.  
Swallowing a relatively large amount of this material is unlikely to produce serious illness or death.

**Chronic Effects/Carcinogenicity** No data available to indicate product or components present at greater than 0.1% are chronic health hazards.

**11.3 Toxicity data****Toxicology data for the components**

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No data available	No data available	No data available

**12. Ecological Information****12.1. Toxicity**  
**Ecotoxicity effects****Product Ecotoxicity Data**

No data available

**Substance Ecotoxicity Data**

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available	No information available	No information available	No information available

**12.2. Persistence and degradability**

Substances	CAS Number	Persistence and Degradability
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

**12.3. Bioaccumulative potential**

Substances	CAS Number	Log Pow
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

**12.4. Mobility in soil**

Substances	CAS Number	Mobility
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	No information available

**12.5 Other adverse effects**

No information available

**13. Disposal Considerations****13.1. Waste treatment methods**

**Disposal methods** Disposal should be made in accordance with federal, state, and local regulations.  
**Contaminated Packaging** Follow all applicable national or local regulations.

**14. Transport Information****US DOT**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**Canadian TDG**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**IMDG/IMO**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**IATA/ICAO**

**UN Number** Not restricted  
**UN proper shipping name** Not restricted  
**Transport Hazard Class(es)** Not applicable  
**Packing Group:** Not applicable  
**Environmental Hazards** Not applicable

**Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code** Not applicable

**Special Precautions for User** None

**15. Regulatory Information****US Regulations**

**US TSCA Inventory** All components listed on inventory or are exempt.

**TSCA Significant New Use Rules - S5A2**

Substances	CAS Number	TSCA Significant New Use Rules - S5A2
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

**EPA SARA Title III Extremely Hazardous Substances**

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

**EPA SARA (311,312) Hazard Class**

None

**EPA SARA (313) Chemicals**

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable	Not applicable

**EPA CERCLA/Superfund Reportable Spill Quantity**

Substances	CAS Number	CERCLA RQ
Contains no hazardous substances in concentrations above cut-off values according to the competent authority	NA	Not applicable

**EPA RCRA Hazardous Waste Classification**

If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.

**California Proposition 65** All components listed do not apply to the California Proposition 65 Regulation.

**MA Right-to-Know Law** Does not apply.

**NJ Right-to-Know Law** Does not apply.

**PA Right-to-Know Law** Does not apply.

**NFPA Ratings:** Health 1, Flammability 1, Reactivity 0  
**HMIS Ratings:** Health 1, Flammability 0, Physical Hazard 0, PPE: B

**Canadian Regulations**

**Canadian Domestic Substances List (DSL)** All components listed on inventory or are exempt.

**16. Other information****Preparation Information**

**Prepared By** Chemical Stewardship  
 Telephone: 1-281-871-6107  
 e-mail: fdunexchem@halliburton.com

**Revision Date:** 17-Feb-2016

**Reason for Revision** SDS sections updated:  
 7

**Additional information**

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Safety Data Sheet for this or other Halliburton products, contact Chemical Stewardship at 1-580-251-4335.

**Key or legend to abbreviations and acronyms used in the safety data sheet**

bw – body weight

CAS – Chemical Abstracts Service

EC50 – Effective Concentration 50%

ErC50 – Effective Concentration growth rate 50%

LC50 – Lethal Concentration 50%

LD50 – Lethal Dose 50%

LL50 – Lethal Loading 50%

mg/kg – milligram/kilogram

mg/L – milligram/liter

NIOSH – National Institute for Occupational Safety and Health

NTP – National Toxicology Program

OEL – Occupational Exposure Limit

PEL – Permissible Exposure Limit

ppm – parts per million

STEL – Short Term Exposure Limit

TWA – Time-Weighted Average

UN – United Nations

h - hour

mg/m<sup>3</sup> - milligram/cubic meter

mm - millimeter

mmHg - millimeter mercury

w/w - weight/weight

d - day

**Key literature references and sources for data**

[www.ChemADVISOR.com/](http://www.ChemADVISOR.com/)

**Disclaimer Statement**

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**End of Safety Data Sheet**