EMID-702714

DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-23-BF192-2-1

April 27, 2023

Mr. Rick Shean
Acting Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Submittal of the Plugging and Abandonment Report for Well R-25

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Plugging and Abandonment Report for Well R-25." This plugging and abandonment report details the methods and procedures used to abandon R-25, performed to fulfill requirements set forth in the 2012 "Work Plan to Plug and Abandon Well R-25" and the approval with direction received from the New Mexico Environment Department on January 11, 2013. The plugging and abandonment was performed in accordance with guidance provided in the 2016 Compliance Order on Consent Appendix F, Sampling/Analytical/Field Method Regulatory Guidance, Section II.D, Well Abandonment, and the New Mexico Office of the State Engineer–approved/amended well plugging plan of operations.

If you have any questions, please contact Nancy McDuffie at (505) 350-4985 (nancy.mcduffie@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN
Digitally signed by ARTURO DURAN
Date: 2023.04.27 11:37:42 -06'00'

Arturo Q. Duran
Compliance and Permitting Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s):
1. Two hard copies with electronic files:
   Plugging and Abandonment Report for Well R-25 (EM2023-0262)

cc (letter with CD/DVD enclosure[s]):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Steve Yanicak, NMED-DOE-OB
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cc (letter and enclosure[s] emailed):
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Neelam Dhawan, NMED-HWB
Michael Peterson, NMED-HWB
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Sherry Gaddy, N3B
Thomas Klepfer, N3B
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John Evans, EM-LA
Michael Mikolanis, EM-LA

April 2023
EM2023-0262

Plugging and Abandonment Report for Well R-25

EM2023-0262

Plugging and Abandonment Report for Well R-25

April 2023

Responsible program manager:

Printed Name	Signature	Title	Organization	Date
Amanda White		Senior Manager	Water Program	4/21/2023

Responsible program director:

Printed Name	Signature	Title	Organization	Date
Michael Erickson		Director	Water Program	4/21/2023

Responsible N3B representative:

Printed Name	Signature	Title	Organization	Date
Troy Thomson		Program Manager	N3B Environmental Remediation Program	4/21/2023

Responsible DOE representative:

Printed Name	Signature	Title	Organization	Date
Arturo Q. Duran	ARTURO DURAN Digitally signed by ARTURO DURAN Date: 2023.04.27 11:38:15 -06'00'	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	

EXECUTIVE SUMMARY

Due to groundwater sample quality and contaminant concerns, the New Mexico Environment Department (NMED) directed in 2012 that well R-25 be removed from service from the Los Alamos National Laboratory monitoring network and be plugged and abandoned. This plugging and abandonment (P&A) report details the methods used to abandon R-25. The P&A activities fulfilled the requirements set forth in the 2012 "Work Plan to Plug and Abandon Well R-25" as approved by NMED on January 11, 2013, and were performed in accordance with guidance provided in the 2016 Compliance Order on Consent Appendix F, Sampling/Analytical/Field Method Regulatory Guidance, Section II.D, Well Abandonment.

The New Mexico Office of the State Engineer (NMOSE) approved the "Plugging Plan of Operations for RG-98113 (R-25)" in correspondence to the U.S. Department of Energy (DOE) dated July 15, 2019, and approved the "Revised Plugging Plan of Operations for RG-98113 (R-25)" with amendments in a letter dated June 19, 2020. In April 2021, DOE proposed to NMOSE a revision to the plugging and abandonment plan. On February 7, 2022, NMOSE provided direction on plugging and abandonment in a letter titled "Re: Request for Amendment to Approved [Amended] Well Plugging Plan of Operation Conditions of Approval for RG-98113."

The plugging and abandonment of R-25 was performed in several operational phases from 2019 to 2023. The first phase consisted of attempts to remove the Westbay MP55 sampling system using hoist rigs in 2019 but was only partially successful, extracting approximately 1155 ft of the 1835-ft Westbay system. The second and third phases, in 2020 and 2021, involved attempts to extract the remaining Westbay system components utilizing rotary rigs with abrasive milling tools and circulation. These operations were also only partially successful, leaving Westbay material remaining below 1305 ft below ground surface, and introducing severe damage to the well casing above. Following the direction provided from NMOSE in February 2022, the well was successfully plugged and abandoned in December 2022–February 2023. The well was cement-grouted to ground surface, the aboveground casing extension removed, and the existing bronze well monument stamped to reflect abandonment.

Waste accumulated during plugging and abandonment activities was staged on-site and characterized according to the waste characterization strategy form for further handling and disposal. Upon receipt of analytical results, all remaining waste will be disposed of per federal and state requirements.

CONTENTS

Figures

Appendix

1.0 INTRODUCTION

This report summarizes field activities associated with the plugging and abandonment (P&A) of monitoring well R-25 in Technical Area 16 (TA-16) at Los Alamos National Laboratory (LANL or the Laboratory), Los Alamos County, New Mexico (Figure 1.0-1).

2.0 BACKGROUND SUMMARY

Well R-25, located in TA-16 on the mesa top above Cañon de Valle in the southwestern portion of the Laboratory, was the third well installed as part of the implementation of the "Hydrogeologic Workplan" (LANL 1998, 059599). Well R-25 was primarily designed to provide water-quality, geochemical, hydrologic, and geologic information that would contribute to the understanding of the hydrogeologic setting beneath the Laboratory. Drilling, well installation, and site restoration operations occurred from July 1998 through May 2001. The location of well R-25 is depicted in Figure 1.0-1.

The R-25 borehole was drilled to a depth of 1942 ft (all depths are below ground surface [bgs]) using air-rotary drilling methods. Well R-25 was constructed using 5-in. nominal stainless-steel casing with nine screened intervals; however, two of the screens, screens 3 and 9, were damaged during well installation activities. Screens 3 and 9 were restored to partial usefulness, and all well screen intervals were developed before installation of a Westbay MP55 multiport sampling system (Figure 2.0-1). Due to groundwater sample quality concerns and continued Royal Demolition Explosive (RDX) contamination in the vadose zone (represented by screens 1–4), the New Mexico Environment Department (NMED) directed, in 2012, that well R-25 be removed from service from the Laboratory monitoring network, and plugged and abandoned (NMED 2012, 520747). A P&A plan was submitted on December 13, 2012 (LANL 2012, 232352), and NMED approved the plan with modifications on January 11, 2013 (NMED 2013, 521801).

The original scope of the R-25 P&A project included extraction of the 1834-ft, 9-port Westbay sampling system from the R-25 well casing using a hoist rig, perforation of select intervals of well casing, and plugging of the well.

Newport News Nuclear BWXT-Los Alamos, LLC (N3B) provided the means and oversight for the investigation-derived waste containment, on-site management, and sampling. During initial project preparedness, Holt Services, Inc. (Holt) and Earth Data Northeast, Inc. (EDN) were subcontracted to perform the Westbay system extraction.

The purpose of this report is to document the activities required to complete the P&A scope of work. These services were performed in accordance with direction provided by the New Mexico Office of the State Engineer (NMOSE).

3.0 ABANDONMENT ACTIVITIES

The following field activities were conducted following development and approval of all project-specific implementation documents. Work in all phases was performed in accordance with these documents, including field implementation plans; waste characterization strategy forms (WCSFs); integrated work control documents; and site-specific environmental, safety, and health plans. All operations were conducted in accordance with NMOSE and 19.27.4 New Mexico Administrative Code well or borehole abandonment rules and regulations.

3.1 Initial Westbay Extraction Using Hoist Rig

Utilizing a hoist rig, Holt was tasked to remove the Westbay system and all aboveground appurtenances, using EDN-provided tooling and expertise to deflate the Westbay packers, open sampling ports, and physically engage the system. Fieldwork began in May 2019 and ran through September 2019. A total of 1155 ft of the Westbay system above packer 11 (of 26 packers total on the Westbay system) was extracted until partial disintegration of the system inhibited further progress. During retrieval or "fishing" operations to remove the Westbay system, a portion of the steel pipe fishing string (BQ pipe) became lodged adjacent to, and at the top, of the remaining Westbay casing and debris. Conventional operations were unable to retrieve the remainder of the components in the well, and operations ceased in February 2020 with the depth of the top of the Westbay fish (remaining Westbay system and BQ pipe) at approximately 1088 ft bgs. Approximately 680 ft of the Westbay system remained in the well.

On March 1, 2020, the hoist rig and related equipment were demobilized and the site placed in safe configuration for Mexican spotted owl restrictions. Mexican spotted owl restrictions were lifted on March 10, 2020, for the R-25 project when a biological assessment (based on Hathcock et al. 2017, 700877) determined that the R-25 work would not interfere with spotted owl activities. However, because of COVID-19, no further field activities took place.

In March 2020, the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) and N3B transitioned to essential mission critical activities (EMCA) status as a prudent measure in response to the situation involving the COVID-19 pandemic in New Mexico. Under the EMCA status, the only 2016 Compliance Order on Consent activity that remained operational was the ongoing maintenance of groundwater monitoring well packer systems. The R-25 location was placed in a safe configuration and field activities remain suspended during EMCA status.

After entering the EMCA status, the R-25 Integrated Project Team (IPT) was created to plan, coordinate, and execute project activities. This team met regularly to plan, coordinate project activities, discuss progress, and work through project preparedness issues for future abandonment operations involving rotary milling operations. Monthly email updates and quarterly status reports were submitted to NMED. Several important R-25 project-related communications via correspondence were generated during the first quarter of the EMCA status, including the following:

- In a letter dated March 17, 2020, EM-LA provided NMED information regarding the methods for the removal of pipe and Westbay components in R-25 and a listing of potential drilling fluid additives that might be required to complete the work during milling (DOE 2020, 700806).
- NMED approved the use of a variety of drilling fluids to assist with the recovery of the Westbay system from R-25 in the letter titled "Approval, Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal," dated April 7, 2020 (NMED 2020, 700840). The approval letter stipulates the use of drilling fluids and that transducer pressure responses be recorded at nearby wells R-25b, CdV-16-4ip, and CdV-16-1i.

3.2 Initial Extraction Using Rotary Rig

The second phase of abandonment, to extract the remaining Westbay system components and lodged fishing tooling, was planned for late 2020. Holt was again tasked to undertake the fieldwork, with WRH Fishing and Rental (WRH) providing the fishing tool rental and expertise. Fieldwork began in November 2020 with the mobilization of a Schramm T130 rotary rig to the site. After programming of transducers in nearby wells R-25b, CdV-16-4ip, and CdV-16-1i to record pressure data in 5-min intervals, milling operations commenced on November 21, 2020, using abrasive mills to pulverize the downhole

components and air/foam circulation to lift the material. Fluids and milled material were discharged to the surface and segregated into separate waste streams.

Milling proceeded until December 7, 2020, with approximately 151 ft of the Westbay system extracted, when a partial collapse of the screen 3 interval occurred, dropping screen fragments, formation material, and grout pieces into the well bore. Video logging indicated that the interval, damaged during well construction and sealed with grout, was now extensively damaged with unstable Puye Formation exposed. No pressure responses were noted in nearby wells during this phase of operations. After options were explored, emplacement of a steel casing patch to bridge the damaged interval before a resumption of milling was deemed the best option, and planning for this operation began.

3.3 Second Extraction Using Rotary Rig

Cased Hole Well Services, LLC, the subcontractor selected as the subcontractor for this phase of operations, mobilized a hydraulic workover unit to R-25 in February 2021. After video and caliper logging of the damaged screen 3 interval, Weatherford Drilling & Well Services was mobilized to install a 40-ft-long, .25-in. wall, expandable steel casing patch from 1044 ft to 1084 ft bgs. After a failed first attempt, the casing patch was successfully expanded and swaged into position on March 2, 2021.

Following the casing patch installation, rotary air/foam milling operations resumed, albeit with smaller diameter tools made necessary by the reduced inside diameter of the casing patch. Discharged material was again segregated at the surface into separate waste streams. Transducers in nearby wells continued to record in 5-min intervals. After milling of approximately 66 ft of the Westbay system, to 1305 ft bgs, just below screen 5, the work string became stuck several feet off bottom during an attempt to lift the string. After being freed two days later by 90,000 lb of rig overpull, the work string was tripped out. Subsequent video logging revealed that a section of well casing had been raised and forced into the section of casing above, exposing Puye Formation sediments from 1224 to 1252 ft bgs. Formation slough filled the borehole below 1252 ft bgs, making screens 5–8 in the regional aquifer inaccessible. As in the first phase of operations, no pressure responses were noted in nearby wells during circulation of air and fluids.

After discussion with NMED regarding abandoning the well at 1252 ft bgs, a retrievable packer was set below screen 2 at 972 ft bgs on March 18, 2021, to prevent further commingling of high-explosives-contaminated groundwater to zones below during the planning for future operations.

3.4 Final Abandonment

NMOSE approved the initial “Plugging Plan of Operations for RG-98113 (R-25)” in correspondence to DOE dated July 15, 2019 (N3B 2019, 702637; NMOSE 2019, 700876), and approved the “Revised Plugging Plan of Operations for RG-98113 (R-25)” with amendments in a letter dated June 19, 2020 (N3B 2020, 700936; NMOSE 2020, 700937). In April 2021, N3B proposed to NMOSE a revision to the plugging and abandonment plan (Gaddy 2021, 701382). On February 7, 2022, NMOSE provided direction on plugging and abandonment in a letter titled “Re: Request for Amendment to Approved [Amended] Well Plugging Plan of Operation Conditions of Approval for RG-98113” (NMOSE 2022, 701871). A follow-up meeting was held on February 8, 2022, with representatives of NMOSE, NMED, EM-LA, and N3B to discuss the details of the amended and approved plugging plan of operations.

After this meeting, preparedness for the next phase of P&A began. A New Mexico licensed drilling subcontractor, Layne Christensen (Layne), was selected to perform the scope of work in accordance with NMOSE conditions of approval. Layne’s Atlas Copco RD20 rig and ancillary equipment was mobilized to the site in December 2022.

After removal of the bridge plug installed below screen 2, the depth of formation slough was tagged at 1253 ft bgs and the well was video logged to verify well condition and depth of important features. NMOSE witnessed the tagging and logging and received copies of the video files. Following the video logging, a neat cement plug (Portland Type I/II) was installed to seal the interval from 1253 ft to 1220 ft bgs. NMOSE witnessed cement pumping and received photos of the operation. The rig and site were then secured for the winter holiday break. Upon resumption of field activities on January 9, 2023, the top of cement was tagged to verify depth. Unfortunately, the apparent collapse of formation slough during cement pumping led to the top of cement being located at 1268 ft bgs, approximately 15 ft below the anticipated bottom of the plug.

Another lift of cement (130 gal.) was pumped on January 10, 2023, and after curing was tagged at 1248 ft bgs. A second lift of 130 gal. was pumped on January 11, 2023, but the field crew was unable to tag this because of an obstruction at 1205 ft bgs preventing passage of pipe or depth sounder. Discussions with NMOSE determined that explosive jet perforation could proceed from 1205 ft bgs. Jet perforation was conducted on January 20, 2023, by Jet West, with successful perforation from 1201 ft to 1175 ft bgs. Perforation was witnessed by NMOSE.

After a successful pressure test of the perforated interval, pressure cementing was conducted by Petroplex Acidizing, Inc., on January 25, 2023, using a packer assembly, procedure, and material approved by NMOSE with conditions on December 23, 2022. A fixed calculated volume of 120 gal. of Class C cement was pumped, but no positive pressures were noted during the operation. After subsequent confirmation that no seal had been achieved, a second pressure cementing operation was conducted on January 31, 2023. During this operation, cement with N-Seal lost circulation material (NSF [National Sanitation Foundation] approved with fibrous content to seal off formation porosity) was pumped until positive pressure of 2300 psi was recorded, followed by water to displace cement in the tremie pipe. When pressure climbed to 2500 psi, water displacement was stopped to prevent damage to the formation. The packer was immediately deflated and removed from the well. A total volume of 1134 gal. of cement was pumped in this operation. The emplaced seal was tagged at 915 ft bgs the following day. NMOSE witnessed both cementing operations and approved the continuation of planned P&A activities upward from 915 ft bgs. The pressure-cemented seal straddles the transmissive interval within which screen 4 was located. Since screen 4, above the regional aquifer, was the lowest screen in which RDX contamination above background levels had been detected since 2002, the emplaced seal was deemed by NMOSE to be sufficient to prevent downward migration of RDX in the vicinity of the borehole.

The well casing was mechanically perforated from 915 ft to 55 ft bgs using a starwheel-type perforator on February 2 and February 3, 2023, and after removal of aboveground appurtenances this entire interval was filled in one continuous lift of neat cement grout on February 4, 2023. Overnight settling of the cement required an additional 4 ft of cement to be added to the well on February 5, 2023 (Figure 3.0-1). Demobilization of rig and equipment from the site was conducted on February 6, 2023.

The approved/amended plugging plans of operation from NMOSE are included in Appendix A, along with associated correspondence and plugging records. Appendix B includes field notes from drilling contractors and on-site personnel relating to P&A activities. Appendix C (on DVD included with this document) includes video logs.

4.0 FLUIDS AND MATERIALS INTRODUCED AND DISCHARGED

4.1 Fluids Injected and Fluids Circulated to Surface (2020–2021)

No circulation has been conducted since the retrievable packer was installed in March 2021. The following are totals of fluids injected and circulated from November 2020 through March 2021.

- 345 gal. of AQF-2 foaming agent injected
- 84,000 gal. of potable water injected and pumped (includes water introduced during milling, video logging, and casing patch expansion)
- 59,000 gal. of water (injected and formation), foaming agent, suspended fine Westbay solid material, and suspended formation fines circulated to surface and collected as waste

All 59,000 gal. of liquid waste have been shipped off-site for disposal.

4.2 Fluids Pumped During Cementing Operations (2022–2023)

During pressure testing and cementing operations, the following fluids were introduced into the well:

- 2198 gal. of potable water
- 2565 gal. of cement slurry

5.0 WASTE MANAGEMENT

Waste generated from the P&A project included Westbay system solids, discharged potable water with foaming and de-foaming agents, cement washout, New Mexico Special Waste (petroleum-contaminated soil), and contact waste. During and after well abandonment activities, waste generated was sampled and managed in accordance with the project WCSFs (Plugging and Abandonment of Well R-25 [EM2022-0931] and Westbay Well Reconfiguration Project [EM2019-0074]) and N3B's Waste Management Policy (N3B-P409-0 Revisions 2 and 3). Upon receipt of analytical results, the Laboratory will be responsible for removing and disposing of all waste generated.

6.0 STATUS REPORTS TO NMED

From March 2020 to February 2023, monthly email updates and quarterly status reports were submitted to NMED by EM-LA.

7.0 SUMMARY

All abandonment activities described were conducted from June 2019 to February 2023 in accordance with NMED and NMOSE direction. An estimated 1372 ft of the 1834-ft long Westbay MP55 sampling system was removed from R-25 before deteriorated well conditions mandated abandonment from 1253 ft to surface. This interval was plugged and abandoned as described in section 3.4. All cement grout seals emplaced were either Portland Type I/II or Class C, approved by NMOSE. Aboveground appurtenances other than the well slab and survey monument were removed, and the monument was stamped with the date of final abandonment.

8.0 REFERENCES

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID.ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

Broxton, D., R. Warren, P. Longmire, R. Gilkeson, S. Johnson, D. Rogers, W. Stone, B. Newman, M. Everett, D. Vaniman, S. McLin, J. Skalski, and D. Larssen, March 2002. "Characterization Well R-25 Completion Report," Los Alamos National Laboratory report LA-13909-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 072640)

DOE (U.S. Department of Energy), March 17, 2020. "Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal," U.S. Department of Energy letter (EMLA-2020-1274-02-001) to K. Pierard (NMED-HWB) from A. Duran (EM-LA), Los Alamos, New Mexico. (DOE 2020, 700806)

Gaddy, S.L., April 15, 2021. R-25 Plug and Abandonment meeting. E-mail message to C. Thornburg (NMOSE) from S.L. Gaddy (N3B), Los Alamos, New Mexico. (Gaddy 2021, 701382)

Hathcock, C.D., D.C. Keller, B.E. Thompson, and J. Berryhill, February 2017. "Biological Assessment of the Continued Operation and Expansion of the Water Monitoring Programs at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-17-20753, Los Alamos, New Mexico. (Hathcock et al. 2017, 700877)

LANL (Los Alamos National Laboratory), May 22, 1998. "Hydrogeologic Workplan," Los Alamos National Laboratory document LA-UR-01-6511, Los Alamos, New Mexico. (LANL 1998, 059599)

LANL (Los Alamos National Laboratory), December 2012. "Work Plan to Plug and Abandon Well R-25," Los Alamos National Laboratory document LA-UR-12-26836, Los Alamos, New Mexico. (LANL 2012, 232352)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), March 12, 2019. "Plugging Plan of Operations for RG-98113 (R-25)," to L. Garcia (NMOSE) from M. Everett (N3B), Los Alamos, New Mexico. (N3B 2019, 702637)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), May 28, 2020. "Revised Plugging Plan of Operations for RG-98113 (R-25)," N3B letter (N3B-2020-0181) to L. Garcia (NMOSE) from B. Smith (N3B) and A.Q. Duran (EM-LA), Los Alamos, New Mexico. (N3B 2020, 700936)

NMED (New Mexico Environment Department), June 20, 2012. "Approval with Modifications, Technical Area 16 Well Network Evaluation and Recommendations," New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2012, 520747)

NMED (New Mexico Environment Department), January 11, 2013. “Approval with Modification, Work Plan to Plug and Abandon Well R-25,” New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and J.D. Mousseau (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2013, 521801)

NMED (New Mexico Environment Department), April 7, 2020. “Approval, Drilling Fluid Additive Use Options for Well R-25, Westbay Sampling System Removal,” New Mexico Environment Department letter to A. Duran (EM-LA) from K. Pierard (NMED-HWB), Santa Fe, New Mexico. (NMED 2020, 700840)

NMOSE (New Mexico Office of the State Engineer), July 15, 2019. “Re: Plugging Plan of Operations for RG-98113 (R-25),” NMOSE letter to M. Everett (N3B) from L. Garcia (NMOSE), Santa Fe, New Mexico. (NMOSE 2019, 700876)

NMOSE (New Mexico Office of the State Engineer), June 19, 2020. “Re: Plugging Plan of Operations for RG-98113 (R-25),” NMOSE letter to M. Everett (N3B) from L. Garcia (NMOSE), Santa Fe, New Mexico. (NMOSE 2020, 700937)

NMOSE (New Mexico Office of the State Engineer), February 7, 2022. “Re: Request for Amendment to Approved [Amended] Well Plugging Plan of Operation Conditions of Approval for RG-98113,” NMOSE letter to C. Maupin (N3B) from C. Thornburg (NMOSE), Santa Fe, New Mexico. (NMOSE 2022, 701871)

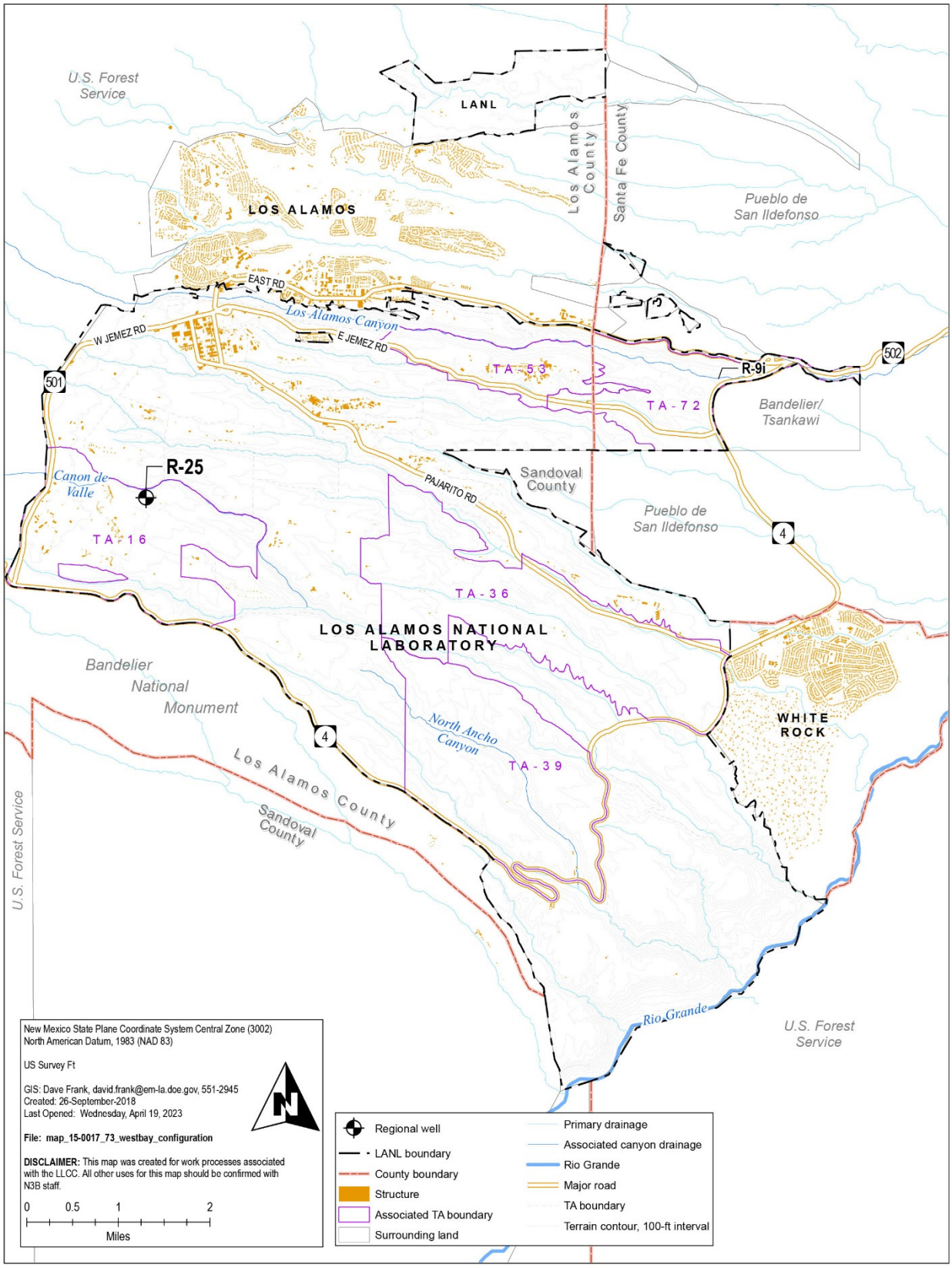
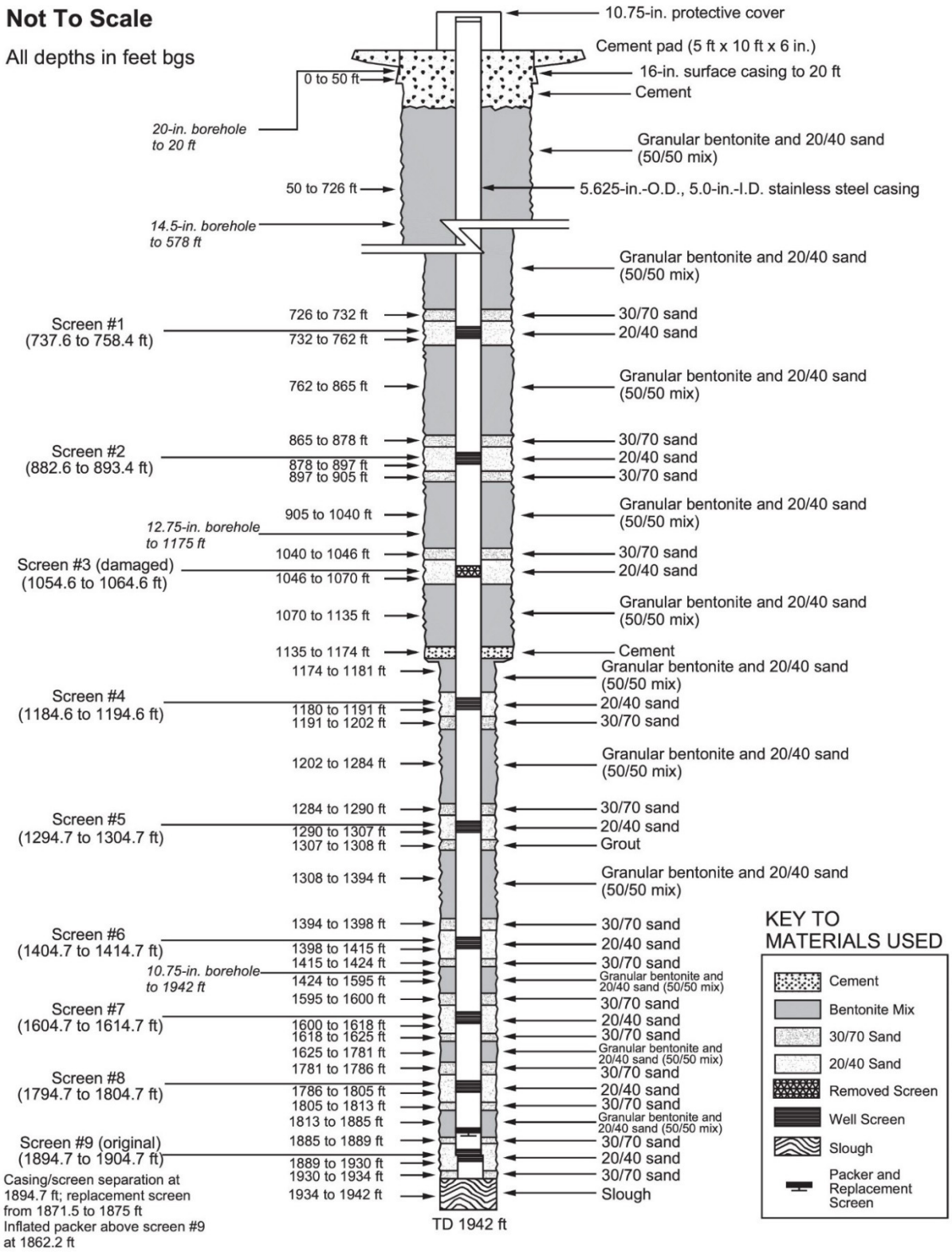


Figure 1.0-1 Site map



Note: The screen intervals list the footages of the pipe perforations, not the tops and bottoms of screen joints.

As-built diagram from "Characterization Well R-25 Completion Report" (Broxton et al. 2002, 072640)

Figure 2.0-1 R-25 as-built diagram

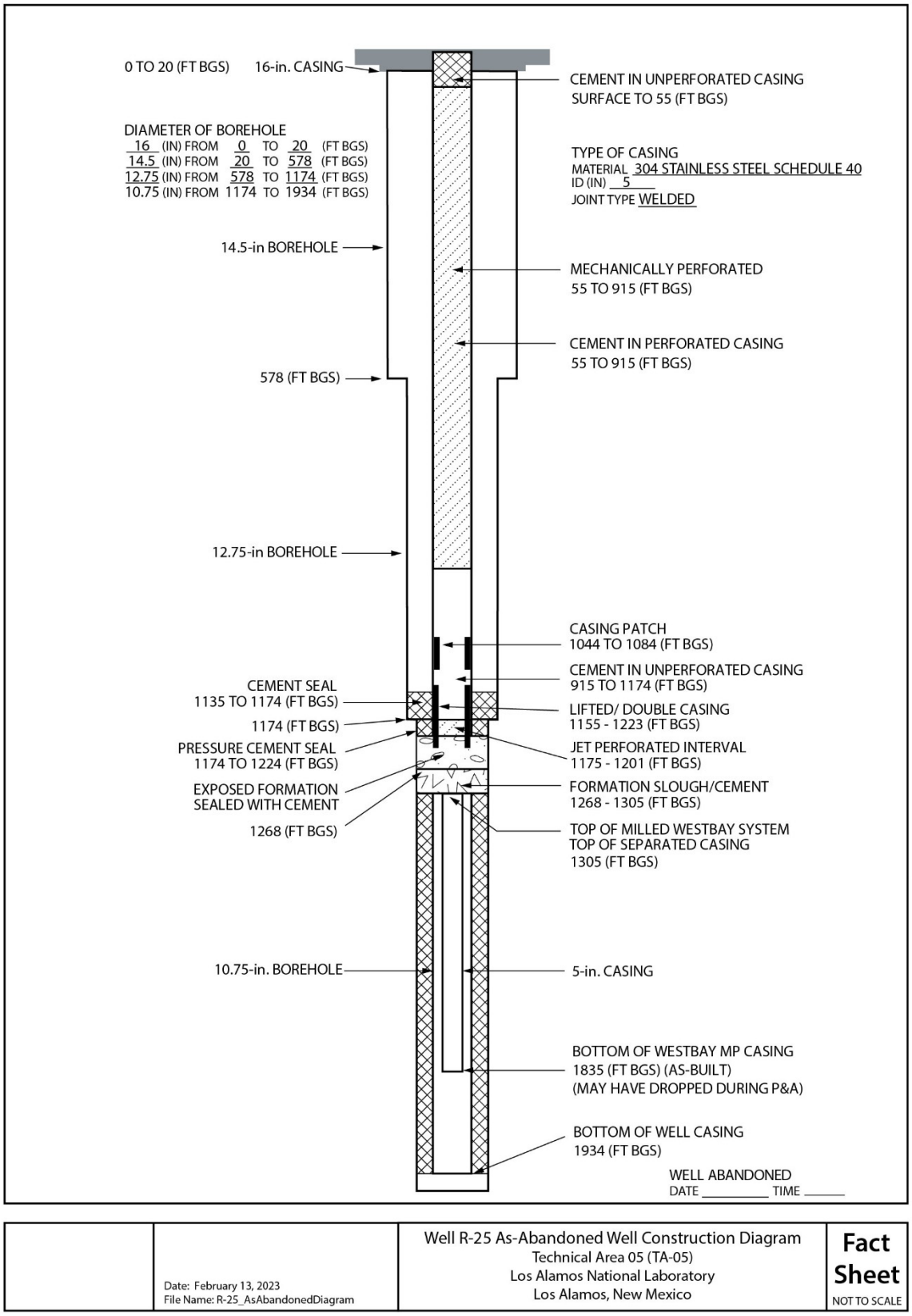


Figure 3.4-1 R-25 as abandoned (February 2023)

Appendix A

Plugging Plans of Operation
(Approved and Amended by the New Mexico Office of the State Engineer) and Plugging Records

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: Well was installed before 200

Name of well owner: Department of Energy

Mailing address: Mark Everett / N3B 600 6th St.

City: Los Alamos State: NM Zip code: 87544

Phone number: 505-309-1367 E-mail: mark.everett@em-la.doe.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Holt Services

New Mexico Well Driller License No.: WD-1780 Expiration Date: June 5, 2020

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 35 deg, 50 min, 53.930284 sec
Longitude: -106 deg, 20 min, 6.642553 sec, WGS84
☑ Check if seconds are decimal format.

2) Reason(s) for plugging well:

Screen #3 and Screen #9 were damaged during the well installation; repair attempted. The well integrity may be compromised. See the attached New Mexico Environment Department approval letter dated January 11, 2013: "Approval with Modification: Workplan to Plug and Abandon Well R-25 Los Alamos National Laboratory"

3) Was well used for any type of monitoring program? yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? no If yes, provide additional detail, including analytical results and/or laboratory report(s):

5) Static water level: see attached feet below land surface / feet above land surface (circle one)

6) Depth of the well: 1942 feet

7) Inside diameter of innermost casing: 5 inches.

8) Casing material: Stainless Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

☒ a well screen or perforated pipe, state the screened interval(s): 9 screened intervals, see attached

10) What annular interval surrounding the artesian casing of this well is cement-grouted? See attached R-25 as-built

11) Was the well built with surface casing? yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? yes If yes, please describe:

20-inch borehole to 20 feet below ground surface (bgs).16-inch steel surface casing to 20 feet bgs. Surface casing annulus was filled with cement grout.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

See attached description of proposed plugging procedures.

2) Will well head be cut-off below land surface after plugging? Well head will be cut-off at surface of the concrete pad.

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 1884 gal

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 5.5-6 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement:

N/A

8) Additional notes and calculations:

Total interval plugged by cement - 1884 ft. Total gallons of cement for 1884 ft of 4.95-inch I.D. casing is approximately 1884 gallons. Total casing depth 1934ft =1884 ft cemented interval, plus 50 ft sand plug at Screen 1 per NMED modifications to the approved workplan.

Note: All calculations for cement volumes were calculated based on 4.95-inch ID casing using the Halliburton e-Redbook Version 3.0.24.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

See the attached sheets.

VIII. SIGNATURE:

I, Mark Everett, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

Mark Everett — Signature of Applicant

3-12-19 — Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

X Approved subject to the attached conditions.

_____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 15 day of July, 19

John D'Antonio

~~Tom Blaine~~ P.E., New Mexico State Engineer

By: L. DeGarcia

STATE ENGINEER SEAL OF THE STATE OF NEW MEXICO 1912 GREAT SEAL OF THE STATE OF NEW MEXICO

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)	770 feet	0 ft ground level	N/A
Bottom of proposed interval of grout placement (ft bgl)	1934 feet	720 feet	N/A
Theoretical volume of grout required per interval (gallons)	1164 gallons based on 4.95-in ID casing and 1164 ft total interval	720 gallons based on 4.95-in ID casing and 720 ft total interval	N/A
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	5.5-6 gallons per sack	5.5-6 gallons per sack	N/A
Mixed on-site or batch-mixed and delivered?	mixed on-site	mixed on-site	N/A
Grout additive 1 requested	N/A	N/A	N/A
Additive 1 percent by dry weight relative to cement	N/A	N/A	N/A
Grout additive 2 requested	N/A	N/A	N/A
Additive 2 percent by dry weight relative to cement	N/A	N/A	N/A

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Bottom of proposed sealant of grout placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Theoretical volume of sealant required per interval (gallons)	N/A	N/A	N/A
Proposed abandonment sealant (manufacturer and trade name)	N/A	N/A	N/A

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
DISTRICT VI - SANTA FE

John R. D'Antonio Jr., P.E.
State Engineer

BATAAN MEMORIAL BUILDING
POST OFFICE BOX 25102
SANTA FE, NEW MEXICO 87504-5102
(505) 827-6120
FAX: (505) 827-6682

July 15, 2019

Los Alamos National Laboratory
Attn: Mark Everett
N3B 600 6th St.
Los Alamos, NM 87544

Re: Plugging Plan of Operations for RG-98113 (R-25)

Greetings:

The Office of the Engineer is returning a favorable approval with specific plugging conditions and has accepted the Well Plugging Plan of Operations submitted March 13, 2019, for filing for the following wells:

- RG-98113 (R-25)

Please return a completed Well Plugging Report that itemizes the actual abandonment process, materials used and total volume of material used within 30 days after completion of well plugging.

Please do not hesitate to contact our office with any questions regarding these plans.

Sincerely,

Lorraine A. Garcia
Office of State Engineer
Water Rights Division District VI

Enclosure
cc: file

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT FOR MONITORING WELL
CONDITIONS OF APPROVAL

This application proposes the pluggin of an existing LANL monitor well, constructed prior to NMOSE administration of monitor well permitting. Upon submission of this application, a NMOSE file number has been assigned to the well for permitting and tracking. As currently configured, the multi-zone monitoring well is screened into ten separate zones, including five zones in an intermediate aquifer and five zones in the regional, as identified by the paperwork submitted by the applicant. The ten aquifer zones are currently kept segregated outside the well casing with intervals of annular sealant, and segregated inside the casing via the installation of a Westbay Multi-packer Sampling System.

The applicant states that screens 3 and 9 were damaged during installation and the well integrity may be compromised, therefore the well needs to be plugged. Permittee proposes plug and abandon the well by completely removing the Westbay sampling system components, back-plugging the well with 1884 gallons of Portland Type I/II cement. At screen 1 a 50 foot sand plug will be placed as required by the New Mexico Environment Department, and the 16-inch well casing will be filled with cement grout to 20 feet below ground surface.

Permittee states the NMED has approved the proposed reconfiguration of this well. The NMOSE therefore approves this application provided it is not exercised to the detriment of any others having existing rights and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the following conditions of approval:

Permittee: Los Alamos National Laboratory
Agent: Mark Everett

Permit Number: RG-98113-POD 1

Application File Date: March 13, 2019

Points of Diversion: RG-98113-POD1, AKA LANL R-25 (WGS84)

OSE File Number	OSE Tag No.	Applicant Well Number	Northing (Y)	Easting (X)
RG-98113	N/A	RG-98113-POD 1	-106° 20' 6.642553"	35° 50' 53.930284"

Well will be located in Section 29, Township 19 North, Range 06 East, NMPM

Purpose of Use: Monitoring

Specific Plugging Conditions of Approval for 1 Well for Los Alamos National Laboratory within Los Alamos County, New Mexico

1. Water well drilling and well drilling activities, including well plugging, are regulated under 19.27.4 NMAC, which requires any person engaged in the business of well drilling within New Mexico to obtain a Well Driller License issued by the New Mexico Office of the State Engineer (NMOSE). Therefore, the firm of a New Mexico licensed Well Driller shall perform the well plugging.

2. Theoretical volume of sealant required for abandonment of the 4.95-inch wellbore is 0.99 gallons per foot. Total theoretical volume of sealant required to fill the overdrilled portion of the hole is tabulated below. Total minimum amount of required sealant will be based on the sounding depth once the 5-inch casing has been removed.

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT FOR MONITORING WELL
CONDITIONS OF APPROVAL

Well Name	Inside Diameter (Inches)	Total Depth (feet)	Volume (Cubic Feet)	Volume (Gallons)
RG-98113-POD1	4.95	1942	259.52	1941
Total:		**1942**	**259.52**	**1941**

3. The 5-inch casing shall be removed from within the auger drill string prior to sealant being placed in the boring.

4. Sealant shall be kept up inside the augers during placement. The augers shall be pulled out of the hole in such a manner that allows the sealant to remain inside the auger at all times, thus providing displacement to prevent borehole collapse. The augers may not be pulled out of the hole prior to the sealant being placed.

5. All surface completions shall be removed, if applicable. The top of the casing shall be terminated ~3-feet bgs and the remaining hole shall be backfilled with concrete to surface.

1. Should the NMED, or another regulatory agency sharing jurisdiction of the project authorize, or by regulation require a more stringent well plugging procedure than herein acknowledged, the more-stringent procedure should be followed. This, in part, includes provisions regarding pre-authorization to proceed, contaminant remediation, inspection, pulling/perforating of casing, or prohibition of free discharge of any fluid from the borehole during or related to the reconfiguration process.

   The NMOSE does not have documentation that surface or subsurface contamination exists in the area, and takes at face value that the applicant's reconfiguration intentions address known or surmised concerns regarding potential contaminant pathways. The reconfiguration method proposed addresses the NMOSE's concern that overt comingling of aquifers or draining of surface water to aquifers is prevented by partial back-plugging the well casing and packer installation.

6. NMOSE witnessing of the plugging will not be required, but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal work hours by calling the District 6 NMOSE Office at 505-827-6120, at least 48-hours in advance. NMOSE inspection will occur dependant on personnel availability.

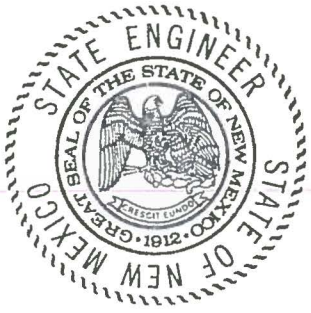
7. A Well Plugging Record (available at: http://www.ose.state.nm.us/STST/Forms/WD-11.pdf) itemizing actual abandonment process and materials used shall be filed with the State Engineer (NMOSE, P.O. Box 25102 - 407 Galisteo Street - Room 102, Santa Fe, NM 87504-5102), within 30 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operation, dated March 13, 2019, as annotated, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 15 day of July, 2019.

John R. D'Antonio Jr., P.E., State Engineer

By: L.A. Garcia
Lorraine A. Garcia
Water Resource Professional- District VI



WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: Well was installed before 200

Name of well owner: Department of Energy

Mailing address: Mark Everett / N3B 600 6th St.

City: Los Alamos State: NM Zip code: 87544

Phone number: 505-309-1367 E-mail: mark.everett@em-la.doe.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Holt Services

New Mexico Well Driller License No.: WD-1780 Expiration Date: June 5, 2020

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 35 deg, 50 min, 53.930284 sec
Longitude: -106 deg, 20 min, 6.642553 sec, WGS84
☑ Check if seconds are decimal format.

2) Reason(s) for plugging well:

Screen #3 and Screen #9 were damaged during the well installation; repair attempted. The well integrity may be compromised. See the attached New Mexico Environment Department approval letter dated January 11, 2013: "Approval with Modification: Workplan to Plug and Abandon Well R-25 Los Alamos National Laboratory"

3) Was well used for any type of monitoring program? yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? no If yes, provide additional detail, including analytical results and/or laboratory report(s):

5) Static water level: see attached feet below land surface / feet above land surface (circle one)

6) Depth of the well: 1942 feet

7) Inside diameter of innermost casing: 5 inches.

8) Casing material: Stainless Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

☒ a well screen or perforated pipe, state the screened interval(s): 9 screened intervals, see attached

10) What annular interval surrounding the artesian casing of this well is cement-grouted? See attached R-25 as-built

11) Was the well built with surface casing? yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? yes If yes, please describe:

20-inch borehole to 20 feet below ground surface (bgs).16-inch steel surface casing to 20 feet bgs. Surface casing annulus was filled with cement grout.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

See attached description of proposed plugging procedures.

2) Will well head be cut-off below land surface after plugging? Well head will be cut-off at surface of the concrete pad.

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 1884 gal

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 5.5-6 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement:

N/A

8) Additional notes and calculations:

Total interval plugged by cement - 1884 ft. Total gallons of cement for 1884 ft of 4.95-inch I.D. casing is approximately 1884 gallons. Total casing depth 1934ft =1884 ft cemented interval, plus 50 ft sand plug at Screen 1 per NMED modifications to the approved workplan.

Note: All calculations for cement volumes were calculated based on 4.95-inch ID casing using the Halliburton e-Redbook Version 3.0.24.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

See the attached sheets.

VIII. SIGNATURE:

I, Mark Everett, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

Mark Everett — Signature of Applicant

3-12-19 — Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

X Approved subject to the attached conditions.

_____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 15 day of July, 19

John D'Antonio

~~Tom Blaine~~ P.E., New Mexico State Engineer

By: L. DeGarcia

STATE ENGINEER SEAL OF THE STATE OF NEW MEXICO 1912 GREAT SEAL OF THE STATE OF NEW MEXICO

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)	770 feet	0 ft ground level	N/A
Bottom of proposed interval of grout placement (ft bgl)	1934 feet	720 feet	N/A
Theoretical volume of grout required per interval (gallons)	1164 gallons based on 4.95-in ID casing and 1164 ft total interval	720 gallons based on 4.95-in ID casing and 720 ft total interval	N/A
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	5.5-6 gallons per sack	5.5-6 gallons per sack	N/A
Mixed on-site or batch-mixed and delivered?	mixed on-site	mixed on-site	N/A
Grout additive 1 requested	N/A	N/A	N/A
Additive 1 percent by dry weight relative to cement	N/A	N/A	N/A
Grout additive 2 requested	N/A	N/A	N/A
Additive 2 percent by dry weight relative to cement	N/A	N/A	N/A

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Bottom of proposed sealant of grout placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Theoretical volume of sealant required per interval (gallons)	N/A	N/A	N/A
Proposed abandonment sealant (manufacturer and trade name)	N/A	N/A	N/A

N3B-Los Alamos
1200 Trinity Drive, Suite 150
Los Alamos, New Mexico 87544
(505) 257-7690

Environmental Management
Los Alamos Field Office
P.O. Box 1663, MS M984
Los Alamos, New Mexico 87545
(505) 257-7950/FAX (505) 606-2132

Date: May 28, 2020
Refer To: N3B-2020-0181

Ms. Lorraine Garcia
Water Rights Division District VI
Office of the State Engineer
Bataan Memorial Building
407 Galisteo Street
Santa Fe, NM 87504-5102

Subject: Revised Plugging Plan of Operations for RG-98113 (R-25)

Dear Ms. Garcia:

The U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) held a teleconference with you and Anthony Meluso on April 30, 2020, to discuss plugging and abandonment operations at well RG-98113 (R-25). This letter is a follow-up to that meeting, providing the enclosed revised supplemental information for the Plugging Plan of Operations (hereafter, the plan). The original plan was submitted to the New Mexico Office of the State Engineer (NMOSE) on March 13, 2019, and NMOSE approved the plan in a letter dated July 15, 2019 (Enclosure 1). The revised plan provides a description of the methods and fluids that will be used to extract the Westbay sampling system from the well (Enclosures 2 and 3). For details on drilling fluid additives, please refer to the enclosed letters from EM-LA to the New Mexico Environment Department (NMED) dated March 17, 2020, requesting approval of drilling fluid additive options (Enclosure 4), and the NMED approval of these options, dated April 7, 2020 (Enclosure 5). The revised plan also clarifies the intent to leave the 5-in. stainless steel well casing in place during plugging and abandonment. The revisions to the plan are provided in two formats—with changes tracked (Enclosure 2) and changes accepted (Enclosure 3)—to make the updates to the plan readily apparent. Please respond with your approval of the revised plan at your earliest convenience.

If you have questions, please contact Mark Everett at (505) 309-1367 (mark.everett@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Bradley Smith
Acting Program Manager
Environmental Remediation
N3B-Los Alamos

Sincerely,

Arturo Duran Digitally signed by Arturo Duran Date: 2020.05.21 07:01:43 -06'00'

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosure(s):
1. Plugging Plan of Operations for RG-98113 (R-25), Submitted March 13, 2019, and NMOSE Approval, Dated July 15, 2019
2. Revised Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R 25 at Los Alamos National Laboratory in Tracked-Change Format
3. Revised Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R 25 at Los Alamos National Laboratory in Changes-Accepted Format
4. Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal (EMLA 2020-1274-02-001, with enclosure)
5. NMED Approval, Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal, Los Alamos National Laboratory

cc (letter and enclosure[s] emailed):
Laurie King, EPA Region 6, Dallas, TX
Chris Catechis, NMED-DOE-OB
Steve Yanicak, NMED-DOE-OB
M. Lee Bishop, EM-LA
Arturo Duran, EM-LA
Stephen Hoffman, EM-LA
Thomas Johnson Jr., EM-LA
David Nickless, EM-LA
Cheryl Rodriguez, EM-LA
Ben Underwood, EM-LA
William Alexander, N3B
Emily Day, N3B
Mark Everett, N3B
Sherry Gaddy, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Frazer Lockhart, N3B
Elizabeth Lowes, N3B

Pamela Maestas, N3B
Christian Maupin, N3B
John McCord, N3B
Glenn Morgan, N3B
Bruce Robinson, N3B
Bradley Smith, N3B
Robert Wilcox, N3B
emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
PRS Website

Pamela T. Maestas

From: Pamela T. Maestas
Sent: Thursday, May 28, 2020 11:22 AM
To: Lorraine.Garcia@state.nm.us
Cc: Mark C. Everett; Regulatory Documentation; cheryl.rodriguez@em.doe.gov
Subject: Submittal to NMOSE on 5/28/2020 of Revised R-25 Plugging Plan
Attachments: N3B-2020-0181_NMOSE_R-25_Rev_Plug_Plan_052820.pdf

Ms. Garcia,
Attached for submittal is a pdf of the following:

- Revised Plugging Plan of Operations for RG-98113 (R-25) (letter and enclosures)

Please acknowledge receipt of this submittal by responding to this email.
Let me know if you have any questions.
Thank you.

Pamela T. Maestas
Regulatory Documentation Manager
Newport News Nuclear BWXT-Los Alamos, LLC
c. 505-927-7882
regdocs@em-la.doe.gov

N3B Los Alamos
1200 Trinity Drive, Suite 150
Los Alamos, NM 87544

Enclosure 1

Plugging Plan of Operations for RG-98113 (R-25), Submitted March 13, 2019, and NMOSE Approval, Dated July 15, 2019

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: Well was installed before 200

Name of well owner: Department of Energy

Mailing address: Mark Everett / N3B 600 6th St.

City: Los Alamos State: NM Zip code: 87544

Phone number: 505-309-1367 E-mail: mark.everett@em-la.doe.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Holt Services

New Mexico Well Driller License No.: WD-1780 Expiration Date: June 5, 2020

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 35 deg, 50 min, 53.930284 sec
Longitude: -106 deg, 20 min, 6.642553 sec, WGS84
☑ Check if seconds are decimal format.

2) Reason(s) for plugging well:

Screen #3 and Screen #9 were damaged during the well installation; repair attempted. The well integrity may be compromised. See the attached New Mexico Environment Department approval letter dated January 11, 2013: "Approval with Modification: Workplan to Plug and Abandon Well R-25 Los Alamos National Laboratory"

3) Was well used for any type of monitoring program? yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? no If yes, provide additional detail, including analytical results and/or laboratory report(s):

5) Static water level: see attached feet below land surface / feet above land surface (circle one)

6) Depth of the well: 1942 feet

7) Inside diameter of innermost casing: 5 inches.

8) Casing material: Stainless Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

☒ a well screen or perforated pipe, state the screened interval(s): 9 screened intervals, see attached

10) What annular interval surrounding the artesian casing of this well is cement-grouted? See attached R-25 as-built

11) Was the well built with surface casing? yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? yes If yes, please describe:

20-inch borehole to 20 feet below ground surface (bgs).16-inch steel surface casing to 20 feet bgs. Surface casing annulus was filled with cement grout.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

See attached description of proposed plugging procedures.

2) Will well head be cut-off below land surface after plugging? Well head will be cut-off at surface of the concrete pad.

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 1884 gal

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 5.5-6 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

2015 MAR 13 AM 7:04

7) Grout additives requested, and percent by dry weight relative to cement:

N/A

8) Additional notes and calculations:

Total interval plugged by cement - 1884 ft. Total gallons of cement for 1884 ft of 4.95-inch I.D. casing is approximately 1884 gallons. Total casing depth 1934ft =1884 ft cemented interval, plus 50 ft sand plug at Screen 1 per NMED modifications to the approved workplan.

Note: All calculations for cement volumes were calculated based on 4.95-inch ID casing using the Halliburton e-Redbook Version 3.0.24.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

See the attached sheets.

VIII. SIGNATURE:

I, Mark Everett, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

Mark Everett — Signature of Applicant

3-12-19 — Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

_____ Approved subject to the attached conditions.
_____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this _____ day of _____, _____

Tom Blaine P.E., New Mexico State Engineer

By: _____

2019 MAR 13 AM 7:00

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)	770 feet	0 ft ground level	N/A
Bottom of proposed interval of grout placement (ft bgl)	1934 feet	720 feet	N/A
Theoretical volume of grout required per interval (gallons)	1164 gallons based on 4.95-in ID casing and 1164 ft total interval	720 gallons based on 4.95-in ID casing and 720 ft total interval	N/A
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	5.5-6 gallons per sack	5.5-6 gallons per sack	N/A
Mixed on-site or batch-mixed and delivered?	mixed on-site	mixed on-site	N/A
Grout additive 1 requested	N/A	N/A	N/A
Additive 1 percent by dry weight relative to cement	N/A	N/A	N/A
Grout additive 2 requested	N/A	N/A	N/A
Additive 2 percent by dry weight relative to cement	N/A	N/A	N/A

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Bottom of proposed sealant of grout placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Theoretical volume of sealant required per interval (gallons)	N/A	N/A	N/A
Proposed abandonment sealant (manufacturer and trade name)	N/A	N/A	N/A

NEW MEXICO OFFICE OF THE STATE ENGINEER

Coordinates

UTM - NAD 83 (m) - Zone 13
Easting 379430.952
Northing 3967946.632
State Plane - NAD 83 (f) - Zone C
Easting 1615177.170
Northing 1764060.000
Degrees Minutes Seconds
Latitude 35 : 50 : 53.930284
Longitude -106 : 20 : 6.642553
Location pulled from Coordinate Search

POD Information
File Number:
Owner:
Permit Use: NoData
POD Status: NoData
Permit Status: NoData

1:2,257
N
ft
0 45 90 180

Image Information
Source: DigitalGlobe
Date: 7/10/2016
Resolution (m): 0.5
Accuracy (m): 10.16

Author:
Purpose:
2/27/2019

Spatial Information
OSE Administrative Area: District
County: Los Alamos
Groundwater Basin: Rio Grande
Abstract Area: Northern Rio Grande
Sub-Basin: Rio Grande-Santa Fe
Land Grant: RAMON VIGIL
Restrictions:
NA

PLSS Description
SW NW NW SW Qtr of Sec 29 of 19N 6E

Calculated PLSS
Coord Search Location
OSE District Boundary

GIS WATERS PODs
Active
Pending

2019 MAR 13 AM

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

R-25 Summary Information

Monitoring Well Completed May 2000.

Location: X= 1615177.17 E; Y =1764060 N; New Mexico State Plane Coordinates, New Mexico Central Zone in feet, 1983 North American datum

Latitude 35 deg 50 min 53.930284 sec Longitude -106 deg 20 min 6.642553 sec

PLSS: SW NW NW SW Qtr of Section 29 T19N R6E

As the well was installed prior to the New Mexico Office of the State Engineer (NMOSE) regulations including monitoring wells, this well does not have an OSE file number.

Hydrogeologic characterization well R-25 is located on the mesa top above Cañon de Valle in the southwestern portion of Los Alamos National Laboratory (LANL). The primary purpose of this well was to provide water-quality, geochemical, hydrologic, and geologic information that would contribute to understanding the hydrogeologic setting beneath LANL. The R-25 borehole was drilled to a depth of 1942 ft bgs using air-rotary drilling and casing advance methods. Well R-25 was constructed with nine screened intervals; however, two of the screens, screens #3 and #9, were damaged during well-installation activities. Screens #3 and #9 were restored to partial usefulness, and all well screen intervals were developed prior to installation of a Westbay MP55 multiport sampling system. The well was completed during May 2000. Pertinent well information is as follows.

- 5-in.–ID stainless-steel casing
- Screen 1, 737.6-758.4 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 2, 882.6-893.4 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 3, 1054.6-1064.6 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 4, 1184.6-1194.6 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 5, 1294.7-1304.7 ft bgs (wire-wrapped screen) Wet, top of the regional water aquifer
- Screen 6, 1404.7-1414.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 7, 1604.7-1614.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 8, 1794.7-1804.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 9, 1894.7-1904.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer

Each screened interval is separated from the other with an annular seal of primarily bentonite with a minor interval of cement. (See attached as-built of R-25.)

In correspondence dated January 11, 2013, the New Mexico Environment Department (NMED) approved the plugging and abandoning of monitoring well R-25 with modifications. The original workplan was detailed in the "Work Plan to Plug and Abandon Well R-25, Los Alamos National Laboratory." Attached to this plugging application are a copy of the NMED workplan approval letter with modifications and the original approved LANL workplan to NMED.

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

Recent groundwater levels in the Westbay System isolated sample intervals at each functional screen are referenced to surveyed brass cap referenced to mean feet above sea level (7516.1 ft amsl) and were obtained during December 2018 and are shown below:

Screen #	Water elev. amsl	Water depth below datum
Screen 1	6771.11'	744.99'
Screen 2	6734.68'	781.42'
Screen 3	No reading, damaged screen	
Screen 4	6345.4'	1107.7'
Screen S	6229.46'	1286.64'
Screen 6	6202.41'	1313.59'
Screen 7	6160.78'	1355.22'
Screen 8	6137.64'	1378.46'
Screen 9	No reading, damaged screen	

N3B has been contracted to plug and abandon the well by removing the Westbay MP55 Sampling System and abandon Screens 2, 3, 4, 5, 6, 7, 8, and 9. Details of the Westbay System removal and plug and abandonment activities. Per NMED's Approval with Modifications, NMED requested a 30/70 sand plug at Screen 1. NMED also approved the plugging and abandoning the well after removing the Westbay System, perforating the casing per the intervals shown below, and plugging the well with cement as detailed in the attached approval letter and workplan.

R-25 Westbay System Removal

To begin the project, a Holt pump hoist rig will mobilize and set up at R-25. Packers in the Westbay system separating the screened intervals will be deflated and pumping ports at each screened interval will be opened to discharge water from the Westbay casing to lessen the Westbay casing string weight. The pump hoist rig will use Westbay-specific tools to connect to the top of the Westbay equipment and the string will be pulled out of the hole.

After removal of the Westbay system in R-25, N3B personnel will perform a downhole camera survey using a borehole camera to confirm the Westbay system removal and observe the condition of the well screen and casing.

Once all Westbay components are removed and the video log collected, Holt personnel will begin plugging and abandoning Screens 2 through 9 in well R-25. Plugging procedures are summarized in the following sections.

R-25 Abandonment of Screens 2, 3, 4, 5, 6, 7, 8, and 9

Screens 2, 3, 4, 5, 6 7, 8, and 9 in R-25 will be plugged and abandoned. Per NMED letter dated January 11, 2013, NMED approved the abandonment with the modification to install a 30/70 sand plug at Screen 1 from approximately 720 to 770 ft bgs.

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

At the conclusion of the Westbay System removal, perforation operations at R-25 will be performed to enhance plugging and abandoning operations. A Mills Knife Perforator will be prepared and tripped in the hole to the lowest interval and will work up the hole with perforations. Four slots per foot will be installed at approximately 3/8th-inch wide by 2.5-in long. Perforations proposed and approved by NMED are shown below and on Table 1.

Table -1 Proposed Perforation Intervals

	Screen and Interval	Upper perfs ft bgs	Lower perfs ft bgs	Total ft
1	737.6 - 758.4	None	None	0
2	882.6 - 893.4	860 - 880	895 - 910	35
3	1054.6 - 1064.6	1035 - 1050	1067 - 1075	23
4	1184.6 - 1194.6	1176 - 1182	1196 - 1207	17
5	1294.7 - 1304.7	1279 - 1292	1307 - 1313	19
6	1404.7 -1414.7	1389 - 1402	1417 - 1429	25
7	1604.7 - 1614.7	1590 - 1602	1617 - 1630	25
8	1794.7 - 1804.7	1776 - 1792	1807 - 1818	27
9	1894.7 - 1904.7	None	None	0

Cementation of the screens will be performed in multiple lifts per the approved NMED workplan to ensure a good seal around the perforations and screens. Cementation of the separate lifts will utilize the methodology below:

1. Install steel tremie grout line to total depth of grout lift
2. Pump calculated volume of cement for each lift into tremie.
3. Deploy rubber cement wiper plug into tremie
4. Displace wiper plug with mechanical weight while measuring wireline to confirm plug passes completely through tremie pipe displacing all cement
5. Tremie tube will be raised up through the lift interval as needed to allow plug to be fully deployed through the tremie
6. No chase or flush water will be used to clear the grout from the tremie
7. Cement will be allowed to cure and harden overnight before beginning the next lift

The perforations will be completed during two separated operations to prevent comingling of the intermediate aquifer and the regional aquifer below. Screens 5 through 9 in the regional aquifer will be perforated first and a downhole video survey using a borehole camera will be performed to confirm the perforation specifications have been achieved.

Screens 5 through 9 will then be plugged using the methodology described above. The cementation will take place in several lifts from the bottom of casing, 1934 ft, to approximately 1234 ft between Screens 4 and 5. It is impossible to predict cement losses while cementing these perforations and screens. If volume correction factors are required, cement volumes will be modified at the time of cementing. Assuming no losses, the estimated calculated volume of cement for this 700 ft interval with the 5-in I.D. casing is 700 gallons.

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

Screens 2, 3, and 4 in the intermediate aquifer will be then be perforated at the proposed intervals and a downhole video survey using a borehole camera will be performed to confirm the perforation specifications have been achieved.

Screens 2, 3, and 4 will then be plugged using the previously described methodology. The cementation will take place in several lifts from the assumed top of cement, 1234 ft to 770 ft, which is the elevation base of the of the NMED required sand plug at Screen 1 (720-770'). Assuming no losses, the estimated calculated volume of cement for this 464 ft interval with the 5-in I.D. casing is 464 gallons.

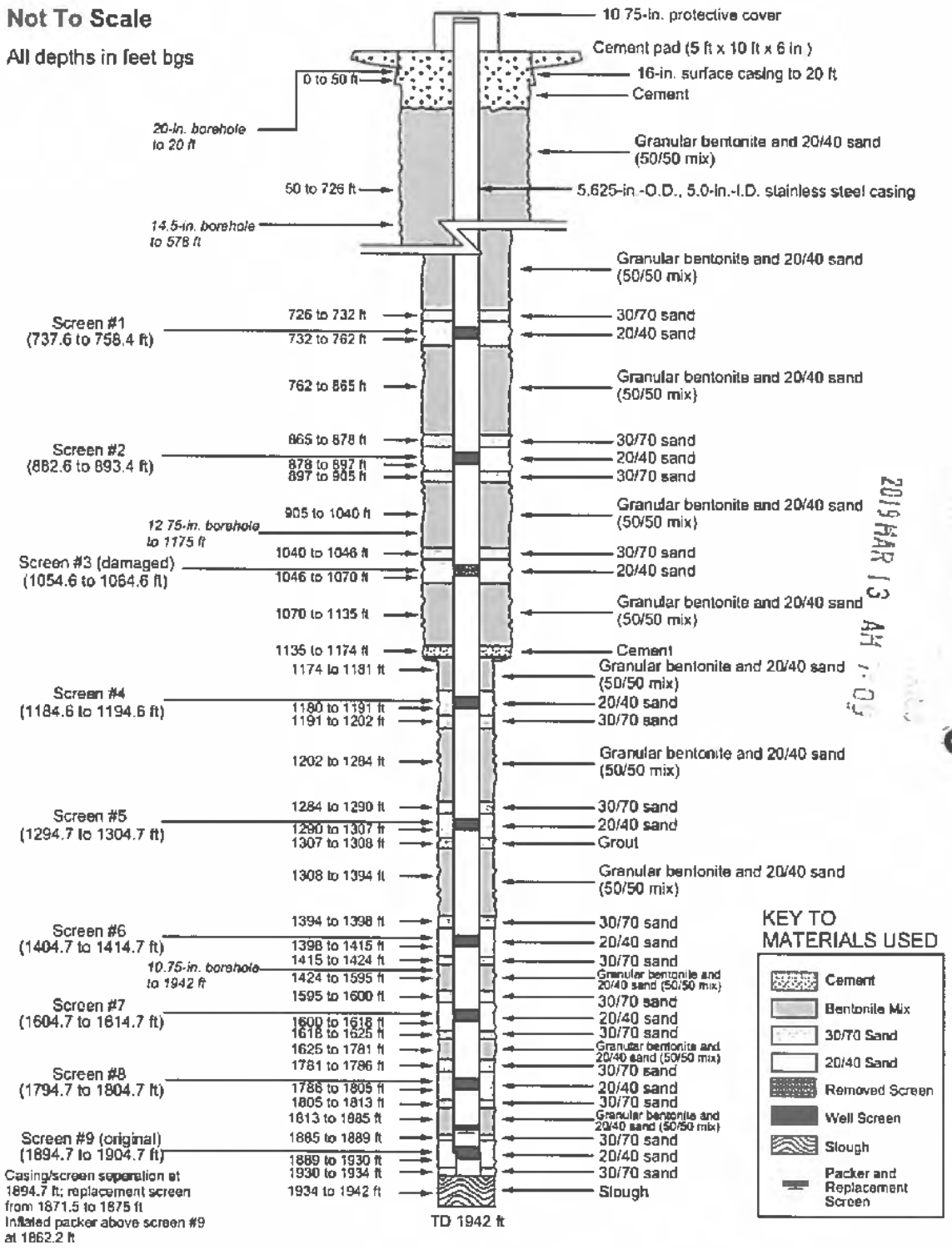
The NMED required 30/70 sand plug will now be installed at Screen 1. In order to emplace the lift of 30/70 sand at Screen 1, a tremie pipe will be tripped in to 768 ft bgs a few feet from the top of cement. Fifty (50) feet of sand will be placed in the interval 720 ft to 770 ft bgs to cover the Screen 1 interval. The top of the sand will be verified by tagging the top with a weighted measuring tape.

The final lift of cement will cover the interval above the sand plug from 720 to the surface. For the final lift, the cement wiper plug will be used only if needed once cement return is visible and confirmed while pulling tremie to minimize cleaning of cement contaminated pipe. No water will be pumped down hole to flush the tremie for this final lift. The calculated volume of cement for this 720 ft interval with the 5-in I.D. casing is 720 gallons.

After 24 hours, the cement level will be verified to be at the surface. The well head will be cut flush to the surface of the concrete pad to complete the plugging and abandoning activities.

Any water used to clean tremie pipe during the project will be captured, segregated from other waste liquids, and stored in drums or poly tanks until characterization and disposal.

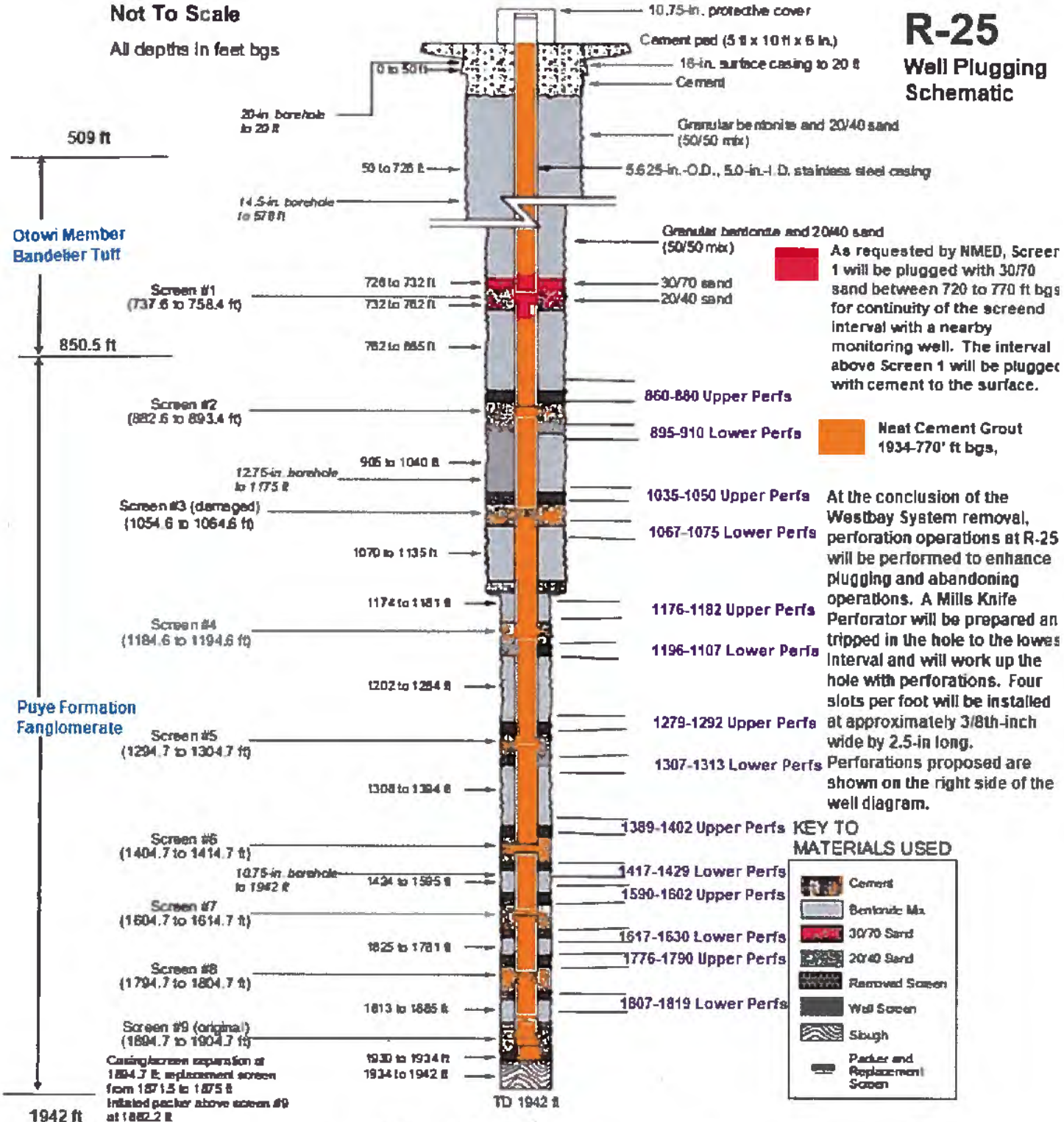
N3B respectfully requests approval of this OSE application to plug and abandon Well R-25.



Note: The screen intervals list the footages of the pipe perforations, not the tops and bottoms of screen joints

Figure 3.2-1. As-built well-completion diagram of well R-25

R-25
Well Plugging Schematic



As requested by NMED, Screen 1 will be plugged with 30/70 sand between 720 to 770 ft bgs for continuity of the screend interval with a nearby monitoring well. The interval above Screen 1 will be plugged with cement to the surface.

Neat Cement Grout 1934-770' ft bgs,

At the conclusion of the Westbay System removal, perforation operations at R-25 will be performed to enhance plugging and abandoning operations. A Mills Knife Perforator will be prepared an tripped in the hole to the lowes interval and will work up the hole with perforations. Four slots per foot will be installed at approximately 3/8th-inch wide by 2.5-in long. Perforations proposed are shown on the right side of the well diagram.

NMED approved the R-25 Plugging and Abandoning Workplan in correspondenc dated January 11, 2013

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

BUTCH TONGATE
Deputy Secretary

THOMAS SKIBITSKI
Acting Director
Resource Protection Division

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

January 11, 2013

Peter Maggiore
Assistant Manager, Env. Projects Office
Los Alamos Site Office, DOE
3747 West Jemez Rd, MS A316
Los Alamos, NM 87544

Jeffrey D. Mousseau
Associate Director, Environmental Programs
Los Alamos National Security, L.L.C.
P.O. Box 1663, MS M991
Los Alamos, NM 87545

2013 MAR 13 AM 7:03

RE: APPROVAL WITH MODIFICATION
WORK PLAN TO PLUG AND ABANDON WELL R-25
LOS ALAMOS NATIONAL LABORATORY
EPA ID#NM0890010515
HWB-LANL-12-022

Dear Messrs Maggiore and Mousseau:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy (DOE) and the Los Alamos National Security, L.L.C.'s (collectively, the Permittees) document entitled *Work Plan to Plug and Abandon Well R-25* (Plan) dated December 13, 2012 and referenced by EP2012-0256. NMED has reviewed the Plan and hereby issues this approval with the following modification.

1. The Permittees propose to pressure grout the entire R-25 well casing with neat cement, including screens 1 to 9. R-25 screen 1 straddles the upper-deep perched intermediate zone currently being monitored at wells R-25b, CdV-16-1(i), and CdV-16-4ip. The lateral distances from R-25 to the wells R-25b, CdV-16-1(i), and CdV-16-4ip are approximately 25 feet (ft) (west), 370 ft (north) and 450 ft (east), respectively. Because of the close proximity of these well screens to R-25 screen 1, there is a potential for their impairment as a result of migration of cement from screen 1. R-25b, located only 25 ft away, will most likely be affected if screen 1 at R-25 is perforated and pressure grouted with cement as described in the Plan. Instead of setting cement at screen 1, the Permittees must install a sand plug (e.g.,

30/70 sand) at screen 1 from approximately 720 ft to 770 ft below ground surface.

The Plan states that the plugging and abandonment of R-25 is contingent on the implementation of a tracer test as described in the Permittee's document titled "Work Plan for a Tracer Test at Consolidated Unit 16-021(c)-99, Technical Area 16", dated January 30, 2012 (EP2012-0017). The tracers were initially required to be deployed no later than October 15, 2012 as directed in NMED's letter titled "*Approval with Modification Work Plan for a Tracer Test at Consolidated Unit 16-021(c)-99, Technical Area 16*", dated February 7, 2012. On July 31, 2012 the Permittees submitted an extension request (see: EP2012-0167) to NMED for deployment of the tracers from the original date of October 15, 2012 to January 27, 2013; the extension request was granted by NMED on August 9, 2012. On November 5, 2012, the Permittees submitted another extension request, from January 27, 2013 to May 30, 2013. The request was granted by NMED on November 20, 2012.

Due to the prolonged time period required to conduct the tracer test, and in order to prevent further delay in plugging and abandoning R-25, the Permittees must deploy the tracers to wells R-25b and CdV-16-1(i) no later than **May 30, 2013**, as requested. Assuming R-25 will no longer be needed for the tracer test, the Permittees must plug and abandon R-25 by **June 30, 2014**, as scheduled in the Plan. A field summary report for the plugging and abandonment of R-25 must be submitted to NMED within 90 calendar days after the completion of plugging and abandonment activities.

Should you have any questions, please contact Michael Dale of my staff at (505) 661-2673.

Sincerely,

John E. Kieling
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
N. Dhawan, NMED HWB
B. Wear, NMED HWB
J. Kulis, NMED HWB
M. Dale, NMED HWB
J. Schoeppner, NMED GWQB
S. Yanicak, NMED DOE OB, MS M894
L. King, EPA 6PD-N
S. Rydeen, San Ildefonso Pueblo
J. Chavarria, Santa Clara Pueblo
M. Everett, EP-ET, MS M992

Work Plan to Plug and Abandon Well R-25

Primary Purpose	Regional aquifer well R-25 is being plugged and abandoned to meet a requirement set forth in the New Mexico Environment Department (NMED) Hazardous Waste Bureau's approval with modifications letter for the Technical Area 16 Network Evaluation and Recommendations report (NMED 2012, 520747). This work plan summarizes the plugging and abandonment methods Los Alamos National Laboratory (LANL) proposes for well R-25, located on the south rim of Cañon de Valle within Technical Area 16 (TA-16), near LANL's southwestern boundary. Well abandonment will be consistent with the requirements in Section X.D, Well Abandonment, of the Compliance Order on Consent (the Consent Order), and New Mexico Office of the State Engineer (NMOSE) regulations. A plugging plan will be submitted to NMOSE for approval before well abandonment, and a plugging record will be submitted to NMED after work is completed.
Construction	The R-25 borehole was advanced to a depth of 1942 ft and completed as a nine-screen stainless-steel monitoring well (Broxton et al. 2002, 072640). The as-built well-completion drawing for well R-25 is shown in Figure 1. The well was drilled from 1999 to 2000 by Dynatec Environmental Drilling Company using a Foremost dual rotary (DR-24) drill rig. The well was constructed of schedule 40 304 stainless-steel riser with 10-slot rod-based wire-wrapped screens. The annular space outside each screen was filled with 20/40 silica sand. An interval of 30/70 sand was generally placed above and below each screen's sand pack, except where tremie difficulties were encountered. Each screened interval was isolated from the others with bentonite seals in the annular space between the outer casing and borehole wall. The annular seals were a 50:50 mix by weight of 20/40 sand and granular bentonite and were placed via the tremie method. All drill casing was removed from the borehole during well construction, except for a 70-ft section of 13 3/8-in.-diameter drill casing that was abandoned in place from 508 to 578 ft below ground surface (bgs). The tremie pipe was also abandoned in place in the annular space of the well during construction activities; the geophysics log could not accurately locate the tremie pipe, but drilling notes document the loss occurred during backfilling above screen 4. Screens 3 and 9 were damaged during well construction. Screen 3 was repaired and screen 9 was abandoned, except for use as a water-level collection point. Details of the disposition are shown in Figure 1.
Abandonment Methods	Abandonment activities will include steps to remove the Westbay casing string, packers (26), and ports (43) from the stainless-steel well casing, followed by selective perforation of the casing intervals above and below screens 1 through 8 (Table 1). The proposed intervals are presented in Figure 1. Following borehole video logging to ensure the location and quality of the casing perforations, the well will be pressure grouted from total depth to surface with a neat cement grout using a pecker or grout shoe. The grout will be placed in lifts, with only one to two screened intervals grouted per lift.
Surface Completion	The existing concrete pad will be left intact and the well and protective casing cut flush with the top of the existing well pad. Concrete will be placed from 2 ft bgs to the top of pad elevation to complete the backfilling of the well. A surveyed brass cap already exists in the 5- × 10-ft pad that is to be left in place.
Waste Disposal	A waste characterization strategy form (WCSF) will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled, if possible. Nonrecyclable materials will be disposed of in accordance with the WCSF.

Summary Report	A brief report summarizing abandonment activities will be prepared for NMED, and a plugging record will be prepared for NMOSE detailing the abandonment methods and the quantities of backfill materials used. A location map and abandonment schematic will also be included in both raports.
Schedule	Well R-25 will be a valuable monitoring point for the tracer study, proposed in the Work Plan for a Tracer Test at Consolidated Unit 16-021(c)-99 (LANL 2012, 210352), which is scheduled to begin by May 30, 2013. Plugging and abandonment activities at R-25 will not begin until sufficient tracer study data have been collected at R-25 or 1 yr after the study begins, whichever comes first. Therefore, LANL proposes to plug and abandon well R-25 by June 30, 2014. A field summary report, required under Section IV.B.1.b v of the Consent Order, will be submitted to NMED within 90 calendar days of completion of plugging and abandonment activities.

REFERENCES

The following list includes all documents cited in this plan. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

Broxton, D., R. Warren, P. Longmire, R. Gilkeson, S. Johnson, D. Rogers, W. Stone, B. Newman, M. Everett, D. Vaniman, S. McLin, J. Skalski, and D. Larssen, March 2002. "Characterization Well R-25 Completion Report," Los Alamos National Laboratory report LA-13909-MS, Los Alamos, New Mexico. (Broxton et al. 2002, 072640)

LANL (Los Alamos National Laboratory), January 2012. "Work Plan for a Tracer Test at Consolidated Unit 16-021(c)-99, Technical Area 16," Los Alamos National Laboratory document LA-UR-12-0440, Los Alamos, New Mexico. (LANL 2012, 210352)

NMED (New Mexico Environment Department), June 20, 2012. "Approval with Modifications, Technical Area 16 Well Network Evaluation and Recommendations," New Mexico Environment Department letter to P. Maggiore (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2012, 520747)

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
DISTRICT VI - SANTA FE

John R. D'Antonio Jr., P.E.
State Engineer

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SANTA FE, NEW MEXICO 87504-5102
(505) 827-6120
FAX: (505) 827-6682

July 15, 2019

Los Alamos National Laboratory
Attn: Mark Everett
N3B 600 6th St.
Los Alamos, NM 87544

Re: Plugging Plan of Operations for RG-98113 (R-25)

Greetings:

The Office of the Engineer is returning a favorable approval with specific plugging conditions and has accepted the Well Plugging Plan of Operations submitted March 13, 2019, for filing for the following wells:

- RG-98113 (R-25)

Please return a completed Well Plugging Report that itemizes the actual abandonment process, materials used and total volume of material used within 30 days after completion of well plugging.

Please do not hesitate to contact our office with any questions regarding these plans.

Sincerely,

Lorraine A. Garcia
Office of State Engineer
Water Rights Division District VI

Enclosure
cc: file

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT FOR MONITORING WELL
CONDITIONS OF APPROVAL

This application proposes the pluggin of an existing LANL monitor well, constructed prior to NMOSE administration of monitor well permitting. Upon submission of this application, a NMOSE file number has been assigned to the well for permitting and tracking. As currently configured, the multi-zone monitoring well is screened into ten separate zones, including five zones in an intermediate aquifer and five zones in the regional, as identified by the paperwork submitted by the applicant. The ten aquifer zones are currently kept segregated outside the well casing with intervals of annular sealant, and segregated inside the casing via the installation of a Westbay Multi-packer Sampling System.

The applicant states that screens 3 and 9 were damaged during installation and the well integrity may be compromised, therefore the well needs to be plugged. Permittee proposes plug and abandon the well by completely removing the Westbay sampling system components, back-plugging the well with 1884 gallons of Portland Type I/II cement. At screen 1 a 50 foot sand plug will be placed as required by the New Mexico Environment Department, and the 16-inch well casing will be filled with cement grout to 20 feet below ground surface.

Permittee states the NMED has approved the proposed reconfiguration of this well. The NMOSE therefore approves this application provided it is not exercised to the detriment of any others having existing rights and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the following conditions of approval:

Permittee: Los Alamos National Laboratory
Agent: Mark Everett

Permit Number: RG-98113-POD 1

Application File Date: March 13, 2019

Points of Diversion: RG-98113-POD1, AKA LANL R-25 (WGS84)

OSE File Number	OSE Tag No.	Applicant Well Number	Northing (Y)	Easting (X)
RG-98113	N/A	RG-98113-POD 1	-106° 20' 6.642553"	35° 50' 53.930284"

Well will be located in Section 29, Township 19 North, Range 06 East, NMPM

Purpose of Use: Monitoring

Specific Plugging Conditions of Approval for 1 Well for Los Alamos National Laboratory within Los Alamos County, New Mexico

1. Water well drilling and well drilling activities, including well plugging, are regulated under 19.27.4 NMAC, which requires any person engaged in the business of well drilling within New Mexico to obtain a Well Driller License issued by the New Mexico Office of the State Engineer (NMOSE). Therefore, the firm of a New Mexico licensed Well Driller shall perform the well plugging.

2. Theoretical volume of sealant required for abandonment of the 4.95-inch wellbore is 0.99 gallons per foot. Total theoretical volume of sealant required to fill the overdrilled portion of the hole is tabulated below. Total minimum amount of required sealant will be based on the sounding depth once the 5-inch casing has been removed.

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT FOR MONITORING WELL
CONDITIONS OF APPROVAL

Well Name	Inside Diameter (Inches)	Total Depth (feet)	Volume (Cubic Feet)	Volume (Gallons)
RG-98113-POD1	4.95	1942	259.52	1941
Total:		**1942**	**259.52**	**1941**

3. The 5-inch casing shall be removed from within the auger drill string prior to sealant being placed in the boring.

4. Sealant shall be kept up inside the augers during placement. The augers shall be pulled out of the hole in such a manner that allows the sealant to remain inside the auger at all times, thus providing displacement to prevent borehole collapse. The augers may not be pulled out of the hole prior to the sealant being placed.

5. All surface completions shall be removed, if applicable. The top of the casing shall be terminated ~3-feet bgs and the remaining hole shall be backfilled with concrete to surface.

1. Should the NMED, or another regulatory agency sharing jurisdiction of the project authorize, or by regulation require a more stringent well plugging procedure than herein acknowledged, the more-stringent procedure should be followed. This, in part, includes provisions regarding pre-authorization to proceed, contaminant remediation, inspection, pulling/perforating of casing, or prohibition of free discharge of any fluid from the borehole during or related to the reconfiguration process.

   The NMOSE does not have documentation that surface or subsurface contamination exists in the area, and takes at face value that the applicant's reconfiguration intentions address known or surmised concerns regarding potential contaminant pathways. The reconfiguration method proposed addresses the NMOSE's concern that overt comingling of aquifers or draining of surface water to aquifers is prevented by partial back-plugging the well casing and packer installation.

6. NMOSE witnessing of the plugging will not be required, but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal work hours by calling the District 6 NMOSE Office at 505-827-6120, at least 48-hours in advance. NMOSE inspection will occur dependant on personnel availability.

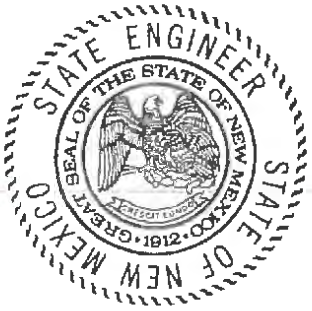
7. A Well Plugging Record (available at: http://www.ose.state.nm.us/STST/Forms/WD-11.pdf) itemizing actual abandonment process and materials used shall be filed with the State Engineer (NMOSE, P.O. Box 25102 - 407 Galisteo Street - Room 102, Santa Fe, NM 87504-5102), within 30 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operation, dated March 13, 2019, as annotated, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 15 day of July, 2019.

John R. D'Antonio Jr., P.E., State Engineer

By: LA Garcia
Lorraine A. Garcia
Water Resource Professional- District VI



WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: Well was installed before 200

Name of well owner: Department of Energy

Mailing address: Mark Everett / N3B 600 6th St.

City: Los Alamos State: NM Zip code: 87544

Phone number: 505-309-1367 E-mail: mark.everett@em-la.doe.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Holt Services

New Mexico Well Driller License No.: WD-1780 Expiration Date: June 5, 2020

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 35 deg, 50 min, 53.930284 sec
Longitude: -106 deg, 20 min, 6.642553 sec, WGS84
☑ Check if seconds are decimal format.

2) Reason(s) for plugging well:

Screen #3 and Screen #9 were damaged during the well installation; repair attempted. The well integrity may be compromised. See the attached New Mexico Environment Department approval letter dated January 11, 2013: "Approval with Modification: Workplan to Plug and Abandon Well R-25 Los Alamos National Laboratory"

3) Was well used for any type of monitoring program? yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? no If yes, provide additional detail, including analytical results and/or laboratory report(s):

5) Static water level: see attached feet below land surface / feet above land surface (circle one)

6) Depth of the well: 1942 feet

7) Inside diameter of innermost casing: 5 inches.

8) Casing material: Stainless Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

☒ a well screen or perforated pipe, state the screened interval(s): 9 screened intervals, see attached

10) What annular interval surrounding the artesian casing of this well is cement-grouted? See attached R-25 as-built

11) Was the well built with surface casing? yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? yes If yes, please describe:

20-inch borehole to 20 feet below ground surface (bgs).16-inch steel surface casing to 20 feet bgs. Surface casing annulus was filled with cement grout.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

See attached description of proposed plugging procedures.

2) Will well head be cut-off below land surface after plugging? Well head will be cut-off at surface of the concrete pad.

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 1884 gal

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 5.5-6 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement:

N/A

8) Additional notes and calculations:

Total interval plugged by cement - 1884 ft. Total gallons of cement for 1884 ft of 4.95-inch I.D. casing is approximately 1884 gallons. Total casing depth 1934ft =1884 ft cemented interval, plus 50 ft sand plug at Screen 1 per NMED modifications to the approved workplan.

Note: All calculations for cement volumes were calculated based on 4.95-inch ID casing using the Halliburton e-Redbook Version 3.0.24.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

See the attached sheets.

VIII. SIGNATURE:

I, Mark Everett, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

[signature] 3-12-19

Signature of Applicant Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

X Approved subject to the attached conditions.

____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 15 day of July, 19

John D'Antonio

~~Tom Blaine~~ P.E., New Mexico State Engineer

By: [signature]

STATE ENGINEER STATE OF NEW MEXICO — GREAT SEAL OF THE STATE OF NEW MEXICO 1912

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)	770 feet	0 ft ground level	N/A
Bottom of proposed interval of grout placement (ft bgl)	1934 feet	720 feet	N/A
Theoretical volume of grout required per interval (gallons)	1164 gallons based on 4.95-in ID casing and 1164 ft total interval	720 gallons based on 4.95-in ID casing and 720 ft total interval	N/A
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	5.5-6 gallons per sack	5.5-6 gallons per sack	N/A
Mixed on-site or batch-mixed and delivered?	mixed on-site	mixed on-site	N/A
Grout additive 1 requested	N/A	N/A	N/A
Additive 1 percent by dry weight relative to cement	N/A	N/A	N/A
Grout additive 2 requested	N/A	N/A	N/A
Additive 2 percent by dry weight relative to cement	N/A	N/A	N/A

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Bottom of proposed sealant of grout placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Theoretical volume of sealant required per interval (gallons)	N/A	N/A	N/A
Proposed abandonment sealant (manufacturer and trade name)	N/A	N/A	N/A

Enclosure 2

Revised Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory in Tracked-Change Format

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

R-25 Summary Information

Monitoring Well Completed May 2000.

Location: X= 1615177.17 E; Y =1764060 N; New Mexico State Plane Coordinates, New Mexico Central Zone in feet, 1983 North American datum

Latitude 35 deg 50 min 53.930284 sec Longitude -106 deg 20 min 6.642553 sec

PLSS: SW NW NW SW Qtr of Section 29 T19N R6E

As the well was installed prior to the New Mexico Office of the State Engineer (NMOSE) regulations including monitoring wells, this well does not have an OSE file number.

Hydrogeologic characterization well R-25 is located on the mesa top above Cañon de Valle in the southwestern portion of Los Alamos National Laboratory (LANL). The primary purpose of this well was to provide water-quality, geochemical, hydrologic, and geologic information that would contribute to understanding the hydrogeologic setting beneath LANL. The R-25 borehole was drilled to a depth of 1942 ft bgs using air-rotary drilling and casing advance methods. Well R-25 was constructed with nine screened intervals; however, two of the screens, screens #3 and #9, were damaged during well-installation activities. Screens #3 and #9 were restored to partial usefulness, and all well screen intervals were developed prior to installation of a Westbay MP55 multiport sampling system. The well was completed during May 2000. Pertinent well information is as follows.

- 5-in.–ID stainless-steel casing
- Screen 1, 737.6-758.4 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 2, 882.6-893.4 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 3, 1054.6-1064.6 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 4, 1184.6-1194.6 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 5, 1294.7-1304.7 ft bgs (wire-wrapped screen) Wet, top of the regional water aquifer
- Screen 6, 1404.7-1414.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 7, 1604.7-1614.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 8, 1794.7-1804.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 9, 1894.7-1904.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer

Each screened interval is separated from the other with an annular seal of primarily bentonite with a minor interval of cement. (See attached as-built of R-25.)

In correspondence dated January 11, 2013, the New Mexico Environment Department (NMED) approved the plugging and abandoning of monitoring well R-25 with modifications. The original workplan was detailed in the "Work Plan to Plug and Abandon Well R-25, Los Alamos National Laboratory." Attached to this plugging application are a copy of the NMED workplan approval letter with modifications and the original approved LANL workplan to NMED.

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

Recent groundwater levels in the Westbay System isolated sample intervals at each functional screen are referenced to surveyed brass cap referenced to mean feet above sea level (7516.1 ft amsl) and were obtained during December 2018 and are shown below:

Screen #	Water elev. amsl	Water depth below datum
Screen 1	6771.11’	744.99’
Screen 2	6734.68’	781.42’
Screen 3	No reading, damaged screen	
Screen 4	6345.4’	1107.7’
Screen 5	6229.46’	1286.64’
Screen 6	6202.41’	1313.59’
Screen 7	6160.78’	1355.22’
Screen 8	6137.64’	1378.46’
Screen 9	No reading, damaged screen	

N3B has been contracted to plug and abandon the well by removing the Westbay MP55 Sampling System, leaving the stainless steel well casing in place, and abandoning Screens 2, 3, 4, 5, 6, 7, 8, and 9. Details of the Westbay System removal and plug and abandonment activities. NOTE: ~~P~~per ~~NMED's~~ their Approval with Modifications, NMED requested a 30/70 sand plug at Screen 1. NMED also approved the plugging and abandoning the well after removing the Westbay System, perforating the casing per the intervals shown below, and plugging the well with cement as detailed in the attached approval letter and workplan.

R-25 Westbay System Removal

The R-25 Westbay system consists of alternating lengths of polyvinyl chloride (PVC) and stainless-steel pipe for a total length of 1835 ft, of which recovery efforts on the remaining 681 ft continue as of May 6, 2020. The Department of Energy (DOE) expects that the stainless-steel sections may be successfully grappled and pulled to the surface (fished). However, previous experience indicates the PVC sections may shatter. This shattered debris has to be removed from the well or it will clog the area immediately above the Westbay system, preventing further extraction. Current methods utilized to date to remove the PVC pieces have not been successful. Therefore, the path forward for the Westbay system removal will primarily involve pulling out components of the system combined with milling using air rotary methods, with the possibility of switching to mud rotary (see options 1–3 below).

The plan is to use drilling fluid additives to facilitate the removal of debris by increasing the up-hole viscosity and lubricity of the introduced air stream. The efficacy of the various remedies proposed to remove the remaining Westbay system from R-25 cannot be known in advance with certainty; therefore, a graded approach, or options, to the use of multiple fluid strategies will be implemented in an attempt to minimize the use of drilling fluid additives. Options for drilling fluid additives use are provided below. The fishing and milling will be performed inside the 5-in. stainless-steel well casing, with potential exposure of circulation fluids to the aquifer and surrounding formation occurring within the eight screened intervals (Table 1).

Option 1 – Simple Foam

The first additive will consist of a simple foam with a formulation of 0.4 lb of SODA ASH and 1 gal. of Baroid Fluid Services QUIK-FOAM or AQF-2 per 100 gal. of water. This mixture will be injected into the drill pipe with a downward airflow rate of 5–25 gal. per minute depending upon downhole conditions.

The returning flow will be directed to a shaker table mounted on top of a rolloff container where ANTI-FOAM 20 defoamer will be added to reduce the foam. ANTI-FOAM 20 will be introduced only in the aboveground waste containment system and will not be introduced into the well.

Option 2 – Stiff Foam

Should tools get stuck or downhole conditions warrant, the simple foam (formulation specified in Option 1) will be modified to stiff foam with the addition of 1.2 quarts of EZ-MUD PLUS or EZ-MUD GOLD to the mixture described above. It will be injected and managed in the same manner as the simple foam.

Option 3 – Mud Rotary

In the unlikely case where the air rotary method proves ineffective, it may be necessary to convert to mud rotary techniques. Should this occur, a 7000−10,000 gal. self-contained mud system equipped with shakers, cleaners, mixer, and a triplex pump will be used for management of the associated drilling fluids. If the mud system is needed, it will be placed upon secondary containment and all liquid waste will be contained for final characterization and off-site waste disposal, as necessary. The additives used in the mix will include 0.4 lb SODA ASH, 17 lb Baroid QUIK-GEL, and 1.2 lb Baroid QUIK-TROL GOLD or QUIK-TROL GOLD LV. If additional lubrication is needed for torque reduction, 0.5 lb Baroid NXS-LUBE could be added to every 100 gal. of water. N-SEAL (spun glass) might be added to blind off the interior of the screens to minimize fluid loss to the formation.

A letter was submitted to the NMED HWB on March 17, 2020 describing the proposed drilling fluid use in greater detail (attached). This letter contains the safety data sheets and mixing plans provided by Baroid. The NMED HWB letter of approval for the use of the drilling fluids is also attached.

~~To begin the project, a Holt pump hoist rig will mobilize and set up at R-25. Packers in the Westbay system separating the screened intervals will be deflated and pumping ports at each screened interval will be opened to discharge water from the Westbay casing to lessen the Westbay casing string weight. The pump hoist rig will use Westbay specific tools to connect to the top of the Westbay equipment and the string will be pulled out of the hole.~~

~~After removal of the Westbay system in R-25, N3B personnel will perform a downhole camera survey using a borehole camera to confirm the Westbay system removal and observe the condition of the well screen and casing.~~

~~Once all Westbay components are removed and the video log collected, Holt personnel will begin plugging and abandoning Screens 2 through 9 in well R-25. Plugging procedures are summarized in the following sections.~~

R-25 Abandonment of Screens 2, 3, 4, 5, 6, 7, 8, and 9

The 5-in ID stainless steel casing will be left in place and ~~S~~screens 2, 3, 4, 5, 6 7, 8, and 9 ~~in R-25~~ will be plugged and abandoned. ~~Per NMED~~In a letter dated January 11, 2013, NMED approved the abandonment with the modification to install a 30/70 sand plug at Screen 1 from approximately 720 to 770 ft bgs to protect the groundwater chemistry in nearby wells. ~~by the NMOSE in correspondence to LANL dated July 15, 2019, **Re: Plugging Plan of Operations for RG-98113 (R-25)**.~~The methods described below were approved by the NMOSE in correspondence dated July 15, 2019, **Re: Plugging Plan of Operations for RG-98113 (R-25)**.

Once the Westbay System is removed, perforations will be cut in the stainless steel casing above and below the screen intervals to enhance plugging effectiveness. A Mills Knife Perforator will be tripped in the hole to the lowest interval and will work up the hole with perforations. Four slots per foot will be installed at approximately 3/8-in wide by 2.5-in long. Perforations proposed are shown in Table 1.

Table 1. Proposed Perforation Intervals

Screen	Interval (ft, bgs)	Upper Perforations (ft, bgs)	Lower Perforations (ft, bgs)	Total Perforation Length (ft)
1	737.6 - 758.4	None	None	0
2	882.6 - 893.4	860 - 880	895 - 910	35
3	1054.6 - 1064.6	1035 - 1050	1067 - 1075	23
4	1184.6 - 1194.6	1176 - 1182	1196 - 1207	17
5	1294.7 - 1304.7	1279 - 1292	1307 - 1313	19
6	1404.7 -1414.7	1389 - 1402	1417 - 1429	25
7	1604.7 - 1614.7	1590 - 1602	1617 - 1630	25
8	1794.7 - 1804.7	1776 - 1792	1807 - 1818	27
9	1894.7 - 1904.7	None	None	0

~~At the conclusion of the Westbay System removal, perforation operations at R-25 will be performed to enhance plugging and abandoning operations. A Mills Knife Perforator will be prepared and tripped in~~

~~the hole to the lowest interval and will work up the hole with perforations. Four slots per foot will be installed at approximately 3/8th inch wide by 2.5 in long. Perforations proposed and approved by NMED are shown below and on Table 1.~~

~~Table 1 Proposed Perforation Intervals~~

~~Screen and Interval~~	~~Upper perfs ft bgs~~	~~Lower perfs ft bgs~~	~~Total ft~~
~~1 737.6 758.4~~	~~None~~	~~None~~	~~0~~
~~2 882.6 893.4~~	~~860 880~~	~~895 910~~	~~35~~
~~3 1054.6 1064.6~~	~~1035 1050~~	~~1067 1075~~	~~23~~
~~4 1184.6 1194.6~~	~~1176 1182~~	~~1196 1207~~	~~17~~
~~5 1294.7 1304.7~~	~~1279 1292~~	~~1307 1313~~	~~19~~
~~6 1404.7 1414.7~~	~~1389 1402~~	~~1417 1429~~	~~25~~
~~7 1604.7 1614.7~~	~~1590 1602~~	~~1617 1630~~	~~25~~
~~8 1794.7 1804.7~~	~~1776 1792~~	~~1807 1818~~	~~27~~
~~9 1894.7 1904.7~~	~~None~~	~~None~~	~~0~~

Cementation of the screens will be performed in multiple lifts per the approved NMED workplan to ensure a good seal around the perforations and screens. Cementation of the separate lifts will utilize the methodology below:

1. Install steel tremie grout line to total depth of grout lift
2. Pump calculated volume of cement for each lift into tremie.
3. Deploy rubber cement wiper plug into tremie
4. Displace wiper plug with mechanical weight while measuring wireline to confirm plug passes completely through tremie pipe displacing all cement
5. Tremie tube will be raised up through the lift interval as needed to allow plug to be fully deployed through the tremie
6. No chase or flush water will be used to clear the grout from the tremie
7. Cement will be allowed to cure and harden overnight before beginning the next lift

The perforations will be completed during two separated operations to prevent comingling of the intermediate aquifer and the regional aquifer below. Screens 5 through 9 in the regional aquifer will be perforated first and a downhole video survey using a borehole camera will be performed to confirm the perforation specifications have been achieved. NOTE: during well installation Screen 9 separated from the rest of the well casing. A bridge plug was set between screens 8 and 9 to isolate the detached section of the well. The bridge plug will be left in place as part of this plugging effort.

Screens 5 through 9 will then be plugged using the methodology described above. The cementation will take place in several lifts from the bottom of casing, 1934 ft, to approximately 1234 ft between Screens 4 and 5. It is impossible to predict cement losses while cementing these perforations and screens. If volume correction factors are required, cement volumes will be modified at the time of cementing. Assuming no losses, the estimated calculated volume of cement for this 700 ft interval with the 5-in I.D. casing is 700 gallons.

Screens 2, 3, and 4 in the intermediate aquifer will be then be perforated at the proposed intervals and a downhole video survey using a borehole camera will be performed to confirm the perforation specifications have been achieved.

Screens 2, 3, and 4 will then be plugged using the previously described methodology. The cementation will take place in several lifts from the assumed top of cement, 1234 ft to 770 ft, which is the elevation base of the of the NMED required sand plug at Screen 1 (720-770'). Assuming no losses, the estimated calculated volume of cement for this 464 ft interval with the 5-in I.D. casing Is 464 gallons.

The NMED required 30/70 sand plug will now be installed at Screen 1. In order to emplace the lift of 30/70 sand at Screen 1, a tremie pipe will be tripped in to 768 ft bgs a few feet from the top of cement. Fifty (50) feet of sand will be placed in the interval 720 ft to 770 ft bgs to cover the Screen 1 interval. The top of the sand will be verified by tagging the top with a weighted measuring tape.

The final lift of cement will cover the interval above the sand plug from 720 to the surface. For the final lift, the cement wiper plug will be used only if needed once cement return is visible and confirmed while pulling tremie to minimize cleaning of cement contaminated pipe. No water will be pumped down hole to flush the tremie for this final lift. The calculated volume of cement for this 720 ft interval with the 5-in I.D. casing is 720 gallons.

After 24 hours, the cement level will be verified to be at the surface. The well head will be cut flush to the surface of the concrete pad to complete the plugging and abandoning activities.

Any water used to clean tremie pipe during the project will be captured, segregated from other waste liquids, and stored in drums or poly tanks until characterization and disposal.

N3B respectfully requests approval of this modified OSE application to plug and abandon Well R-25.

Enclosure 3

Revised Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory in Changes-Accepted Format

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

R-25 Summary Information

Monitoring Well Completed May 2000.

Location: X= 1615177.17 E; Y =1764060 N; New Mexico State Plane Coordinates, New Mexico Central Zone in feet, 1983 North American datum

Latitude 35 deg 50 min 53.930284 sec Longitude -106 deg 20 min 6.642553 sec

PLSS: SW NW NW SW Qtr of Section 29 T19N R6E

As the well was installed prior to the New Mexico Office of the State Engineer (NMOSE) regulations including monitoring wells, this well does not have an OSE file number.

Hydrogeologic characterization well R-25 is located on the mesa top above Cañon de Valle in the southwestern portion of Los Alamos National Laboratory (LANL). The primary purpose of this well was to provide water-quality, geochemical, hydrologic, and geologic information that would contribute to understanding the hydrogeologic setting beneath LANL. The R-25 borehole was drilled to a depth of 1942 ft bgs using air-rotary drilling and casing advance methods. Well R-25 was constructed with nine screened intervals; however, two of the screens, screens #3 and #9, were damaged during well-installation activities. Screens #3 and #9 were restored to partial usefulness, and all well screen intervals were developed prior to installation of a Westbay MP55 multiport sampling system. The well was completed during May 2000. Pertinent well information is as follows.

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- Screen 3, 1054.6-1064.6 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 4, 1184.6-1194.6 ft bgs (wire-wrapped screen) Wet, intermediate aquifer
- Screen 5, 1294.7-1304.7 ft bgs (wire-wrapped screen) Wet, top of the regional water aquifer
- Screen 6, 1404.7-1414.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 7, 1604.7-1614.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 8, 1794.7-1804.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer
- Screen 9, 1894.7-1904.7 ft bgs (wire-wrapped screen) Wet, within the regional water aquifer

Each screened interval is separated from the other with an annular seal of primarily bentonite with a minor interval of cement. (See attached as-built of R-25.)

In correspondence dated January 11, 2013, the New Mexico Environment Department (NMED) approved the plugging and abandoning of monitoring well R-25 with modifications. The original workplan was detailed in the "Work Plan to Plug and Abandon Well R-25, Los Alamos National Laboratory." Attached to this plugging application are a copy of the NMED workplan approval letter with modifications and the original approved LANL workplan to NMED.

Supplemental Information Provided to the New Mexico Office of the State Engineer for the Plugging and Abandoning of Well R-25 at Los Alamos National Laboratory

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Screen 6	6202.41’	1313.59’
Screen 7	6160.78’	1355.22’
Screen 8	6137.64’	1378.46’
Screen 9	No reading, damaged screen	

N3B has been contracted to plug and abandon the well by removing the Westbay MP55 Sampling System, leaving the stainless steel well casing in place, and abandoning Screens 2, 3, 4, 5, 6, 7, 8, and 9. Details of the Westbay System removal and plug and abandonment activities. NOTE: per their Approval with Modifications, NMED requested a 30/70 sand plug at Screen 1. NMED also approved the plugging and abandoning the well after removing the Westbay System, perforating the casing per the intervals shown below, and plugging the well with cement as detailed in the attached approval letter and workplan.

R-25 Westbay System Removal

The R-25 Westbay system consists of alternating lengths of polyvinyl chloride (PVC) and stainless-steel pipe for a total length of 1835 ft, of which recovery efforts on the remaining 681 ft continue as of May 6, 2020. The Department of Energy (DOE) expects that the stainless-steel sections may be successfully grappled and pulled to the surface (fished). However, previous experience indicates the PVC sections may shatter. This shattered debris has to be removed from the well or it will clog the area immediately above the Westbay system, preventing further extraction. Current methods utilized to date to remove the PVC pieces have not been successful. Therefore, the path forward for the Westbay system removal will primarily involve pulling out components of the system combined with milling using air rotary methods, with the possibility of switching to mud rotary (see options 1–3 below).

The plan is to use drilling fluid additives to facilitate the removal of debris by increasing the up-hole viscosity and lubricity of the introduced air stream. The efficacy of the various remedies proposed to remove the remaining Westbay system from R-25 cannot be known in advance with certainty; therefore, a graded approach, or options, to the use of multiple fluid strategies will be implemented in an attempt to minimize the use of drilling fluid additives. Options for drilling fluid additives use are provided below. The fishing and milling will be performed inside the 5-in. stainless-steel well casing, with potential exposure of circulation fluids to the aquifer and surrounding formation occurring within the eight screened intervals (Table 1).

Option 1 – Simple Foam

The first additive will consist of a simple foam with a formulation of 0.4 lb of SODA ASH and 1 gal. of Baroid Fluid Services QUIK-FOAM or AQF-2 per 100 gal. of water. This mixture will be injected into the drill pipe with a downward airflow rate of 5–25 gal. per minute depending upon downhole conditions.

The returning flow will be directed to a shaker table mounted on top of a rolloff container where ANTI-FOAM 20 defoamer will be added to reduce the foam. ANTI-FOAM 20 will be introduced only in the aboveground waste containment system and will not be introduced into the well.

Option 2 – Stiff Foam

Should tools get stuck or downhole conditions warrant, the simple foam (formulation specified in Option 1) will be modified to stiff foam with the addition of 1.2 quarts of EZ-MUD PLUS or EZ-MUD GOLD to the mixture described above. It will be injected and managed in the same manner as the simple foam.

Option 3 – Mud Rotary

In the unlikely case where the air rotary method proves ineffective, it may be necessary to convert to mud rotary techniques. Should this occur, a 7000−10,000 gal. self-contained mud system equipped with shakers, cleaners, mixer, and a triplex pump will be used for management of the associated drilling fluids. If the mud system is needed, it will be placed upon secondary containment and all liquid waste will be contained for final characterization and off-site waste disposal, as necessary. The additives used in the mix will include 0.4 lb SODA ASH, 17 lb Baroid QUIK-GEL, and 1.2 lb Baroid QUIK-TROL GOLD or QUIK-TROL GOLD LV. If additional lubrication is needed for torque reduction, 0.5 lb Baroid NXS-LUBE could be added to every 100 gal. of water. N-SEAL (spun glass) might be added to blind off the interior of the screens to minimize fluid loss to the formation.

A letter was submitted to the NMED HWB on March 17, 2020 describing the proposed drilling fluid use in greater detail (attached). This letter contains the safety data sheets and mixing plans provided by Baroid. The NMED HWB letter of approval for the use of the drilling fluids is also attached.

R-25 Abandonment of Screens 2, 3, 4, 5, 6, 7, 8, and 9

The 5-in ID stainless steel casing will be left in place and screens 2, 3, 4, 5, 6 7, 8, and 9 will be plugged and abandoned. In a letter dated January 11, 2013, NMED approved the abandonment with the modification to install a 30/70 sand plug at Screen 1 from approximately 720 to 770 ft bgs to protect the groundwater chemistry in nearby wells. The methods described below were approved by the NMOSE in correspondence dated July 15, 2019, **Re: Plugging Plan of Operations for RG-98113 (R-25)**.

Once the Westbay System is removed, perforations will be cut in the stainless steel casing above and below the screen intervals to enhance plugging effectiveness. A Mills Knife Perforator will be tripped in the hole to the lowest interval and will work up the hole with perforations. Four slots per foot will be

installed at approximately 3/8-in wide by 2.5-in long. Perforations proposed are shown in Table 1.

Table 1. Proposed Perforation Intervals

Screen	Interval (ft, bgs)	Upper Perforations (ft, bgs)	Lower Perforations (ft, bgs)	Total Perforation Length (ft)
1	737.6 - 758.4	None	None	0
2	882.6 - 893.4	860 - 880	895 - 910	35
3	1054.6 - 1064.6	1035 - 1050	1067 - 1075	23
4	1184.6 - 1194.6	1176 - 1182	1196 - 1207	17
5	1294.7 - 1304.7	1279 - 1292	1307 - 1313	19
6	1404.7 -1414.7	1389 - 1402	1417 - 1429	25
7	1604.7 - 1614.7	1590 - 1602	1617 - 1630	25
8	1794.7 - 1804.7	1776 - 1792	1807 - 1818	27
9	1894.7 - 1904.7	None	None	0

Cementation of the screens will be performed in multiple lifts per the approved NMED workplan to ensure a good seal around the perforations and screens. Cementation of the separate lifts will utilize the methodology below:

1. Install steel tremie grout line to total depth of grout lift
2. Pump calculated volume of cement for each lift into tremie.
3. Deploy rubber cement wiper plug into tremie
4. Displace wiper plug with mechanical weight while measuring wireline to confirm plug passes completely through tremie pipe displacing all cement
5. Tremie tube will be raised up through the lift interval as needed to allow plug to be fully deployed through the tremie
6. No chase or flush water will be used to clear the grout from the tremie
7. Cement will be allowed to cure and harden overnight before beginning the next lift

The perforations will be completed during two separated operations to prevent comingling of the intermediate aquifer and the regional aquifer below. Screens 5 through 9 in the regional aquifer will be perforated first and a downhole video survey using a borehole camera will be performed to confirm the perforation specifications have been achieved. NOTE: during well installation Screen 9 separated from

the rest of the well casing. A bridge plug was set between screens 8 and 9 to isolate the detached section of the well. The bridge plug will be left in place as part of this plugging effort.

Screens 5 through 9 will then be plugged using the methodology described above. The cementation will take place in several lifts from the bottom of casing, 1934 ft, to approximately 1234 ft between Screens 4 and 5. It is impossible to predict cement losses while cementing these perforations and screens. If volume correction factors are required, cement volumes will be modified at the time of cementing. Assuming no losses, the estimated calculated volume of cement for this 700 ft interval with the 5-in I.D. casing is 700 gallons.

Screens 2, 3, and 4 in the intermediate aquifer will be then be perforated at the proposed intervals and a downhole video survey using a borehole camera will be performed to confirm the perforation specifications have been achieved.

Screens 2, 3, and 4 will then be plugged using the previously described methodology. The cementation will take place in several lifts from the assumed top of cement, 1234 ft to 770 ft, which is the elevation base of the of the NMED required sand plug at Screen 1 (720-770'). Assuming no losses, the estimated calculated volume of cement for this 464 ft interval with the 5-in I.D. casing Is 464 gallons.

The NMED required 30/70 sand plug will now be installed at Screen 1. In order to emplace the lift of 30/70 sand at Screen 1, a tremie pipe will be tripped in to 768 ft bgs a few feet from the top of cement. Fifty (50) feet of sand will be placed in the interval 720 ft to 770 ft bgs to cover the Screen 1 interval. The top of the sand will be verified by tagging the top with a weighted measuring tape.

The final lift of cement will cover the interval above the sand plug from 720 to the surface. For the final lift, the cement wiper plug will be used only if needed once cement return is visible and confirmed while pulling tremie to minimize cleaning of cement contaminated pipe. No water will be pumped down hole to flush the tremie for this final lift. The calculated volume of cement for this 720 ft interval with the 5-in I.D. casing is 720 gallons.

After 24 hours, the cement level will be verified to be at the surface. The well head will be cut flush to the surface of the concrete pad to complete the plugging and abandoning activities.

Any water used to clean tremie pipe during the project will be captured, segregated from other waste liquids, and stored in drums or poly tanks until characterization and disposal.

N3B respectfully requests approval of this modified OSE application to plug and abandon Well R-25.

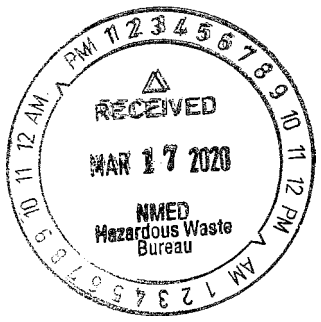
Enclosure 4

Drilling Fluid Additive Use Options
for Well R-25 Westbay Sampling System Removal
(EMLA-2020-1274-02-001, with enclosure)

DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

MAR 17 2020

EMLA-2020-1274-02-001



Mr. Kevin Pierard
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal

Dear Mr. Pierard:

As a follow-up to the discussion on the recovery methods for monitoring well R-25 during a meeting with the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) staff on January 28, 2020, the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) is providing information on milling and lifting procedures and fluids/products that may need to be used in the removal of the Westbay system from R-25. EM-LA has also identified wells near R-25 that will be monitored for impacts related to fluid/product use.

As discussed, the R-25 Westbay system consists of alternating lengths of polyvinyl chloride (PVC) and stainless-steel pipe for a total length of 1835 ft, of which recovery efforts on the remaining 681 ft continue. EM-LA expects that the stainless-steel sections may be successfully grappled and pulled to the surface (fished). However, previous experience indicates the PVC sections may shatter. This shattered debris has to be removed from the well or it will clog the area immediately above the Westbay system, preventing further extraction. Current methods to remove the PVC pieces have not been successful; therefore, going forward with the PVC removal efforts, the primary milling and lifting method will be air rotary with the possibility of mud rotary (see options 1–3 below).

Ideally, the milling and lifting of the PVC could be accomplished with a mixture of air and water only. However, within the R-25 well column there is approximately 1100 linear feet of open space above the water table. Attempts to air-lift debris over this vertical extent could result in the debris sorting in the ascending air stream or coalescing at a particular depth on its ascent to the surface, rather than reaching the surface. As soon as the air is turned off, the debris would settle back in the annular space, frustrating efforts to remove the remaining system.

Therefore, as discussed, the plan is to use drilling fluid additives to facilitate the removal of debris by increasing the up-hole viscosity and lubricity of the introduced air stream. The efficacy of the various remedies proposed to remove the remaining Westbay system from R-25 cannot be known in advance with certainty; therefore, a graded approach, or options, to the use of multiple fluid strategies will be implemented in an attempt to minimize the use of drilling fluid additives. Options for drilling fluid additives use and proposed nearby well monitoring are provided below.

The fishing and milling will be performed inside the 5-in. stainless-steel well casing, with potential exposure of circulation fluids to the aquifer and surrounding formation occurring within the eight screened well sections (Table 1).

Table 1
R-25 Screened Intervals

Screen Number	Screened Interval (ft bgs)	Screen Length (ft)
1	737.6–758.4	20.8
2	882.6–893.4	10.8
3[a]	1054.6–1064.6	10.0
4	1184.6–1194.6	10.0
5	1294.7–1304.7	10.0
6	1404.7–1414.7	10.0
7	1604.7–1614.7	10.0
8	1794.7–1804.7	10.0
9[b]	1894.7–1904.7	10.0

Notes: Well R-25 was constructed with nine screened intervals; two of the screens (#3 and #9) were damaged during well-installation activities. A perched aquifer zone was encountered at a depth of 747 ft below ground surface (bgs) and had a static level of 711 ft bgs. Additional perched aquifer zones were encountered down to a depth of 1132 ft bgs. The regional aquifer water table was encountered at a depth of 1286 ft bgs.

[a] Screen 3 was damaged and partially restored during installation.

[b] Screen 9 was damaged and subsequently abandoned with an inflated packer set at 1862.2 ft bgs.

Option 1 – Simple Foam

The first additive will consist of a simple foam with a formulation of 0.4 lb of SODA ASH and 1 gal. of Baroid Fluid Services QUIK-FOAM or AQF-2 per 100 gal. of water. This mixture will be injected into the drill pipe with a downward airflow rate of 5–25 gal. per minute depending upon downhole conditions. The desired outcome is the return of the foam and debris to the surface with the consistency of shaving cream.

The returning flow will be directed to a shaker table mounted on top of a rolloff container where ANTI-FOAM 20 defoamer will be added to reduce the foam. ANTI-FOAM 20 will be introduced only in the aboveground waste containment system and will not go into the well. The rolloff will be situated in a large secondary containment structure to capture any foam that might spill over while in the process of disintegrating. The residual water and foam will be contained and stored in on-site storage tanks pending final characterization and off-site waste disposal.

Option 2 – Stiff Foam

Should tools get stuck or downhole conditions warrant, the simple foam will be enhanced to stiff foam with the addition of 1.2 quarts of EZ-MUD PLUS or EZ-MUD GOLD to the mixture described above. It will be injected and managed in the same manner as the simple foam.

Option 3 – Mud Rotary

In the unlikely case where the air rotary method proves ineffective, it may be necessary to convert to mud rotary techniques. Should this occur, a 7000−10,000 gal. self-contained mud system equipped with shakers, cleaners, mixer, and a triplex pump will be used for management of the associated drilling fluids. If the mud system is needed, it will be placed upon secondary containment and all liquid waste will be contained for final characterization and off-site waste disposal. The additives used in the mix will include 0.4 lb SODA ASH, 17 lb Baroid QUIK-GEL, and 1.2 lb Baroid QUIK-TROL GOLD or QUIK-TROL GOLD LV. If additional lubrication is needed for torque reduction, 0.5 lb Baroid NXS-LUBE could be added to every 100 gal. of water.

EM-LA envisions that because of the extreme hydrostatic head (1100 ft), N-SEAL (spun glass) might be added to blind off the interior of the screens to minimize fluid loss to the formation.

The safety data sheets and mixing plans provided by Baroid and the drilling contractor, Holt Services, Inc., are enclosed. Baroid has confirmed that none of the products proposed for use on this project contain any per- or polyfluoroalkyl substances (PFAS).

Monitoring of Nearby Wells

During air-rotary operations, the high velocity and low density of the ascending airflow will likely cause water to be drawn inward (Venturi effect) from the formation through the screens, rather than moving outward into the aquifer. Therefore, EM-LA does not expect adverse impact to adjacent wells from air-rotary fluid use associated with milling operations. Additionally, the use of N-SEAL as a lost circulation material (if mud-rotary methods are employed), will minimize fluid loss from the well into the formation. However, as an added precaution, EM-LA proposes the following actions to assess potential impacts to nearby wells.

The transducers that currently monitor the water levels in nearby wells R-25b, CdV-16-4ip, and CdV-16-1i will be reset to collect water-level measurements every minute. If pressure responses are detected in these wells, EM-LA will carefully review field parameter and analytical data collected as part of the Interim Facility-Wide Groundwater Monitoring Plan for signs of reducing conditions associated with operations at R-25.

If reducing conditions are observed following milling operations at R-25, EM-LA will evaluate and implement rehabilitation options (e.g., redevelopment) in the affected wells, as appropriate.

If you have any questions, please contact Mark Everett at (505) 309-1367 (mark.everett@em-la.doe.gov) or Cheryl Rodriguez at (505) 257-7941 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Cheryl J Rodriguez for

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosures:

1. Two hard copies with electronic files – Safety Data Sheets and Mixing Plans for Proposed Drilling Fluids

CC (letter and enclosure[s] emailed):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Steve Pullen, NMED-GWQB
Andrew Romero, NMED-GWQB
Chris Catechis, NMED-DOE-OB
Steve Yanicak, NMED-DOE-OB
William Alexander, N3B
Emily Day, N3B
Mark Everett, N3B
Danny Katzman, N3B
Patrick McGuire, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
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Elizabeth Lowes, N3B
Pamela Maestas, N3B
Christian Maupin, N3B
Glenn Morgan, N3B
Bruce Robinson, N3B
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Hai Shen, EM-LA
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emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS Website

Enclosure 1

Safety Data Sheets and Mixing Plans for
Proposed Drilling Fluids

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **AQF-2 FOAMING AGENT**

Revision Date: 21-Nov-2017 **Revision Number:** 31

1. Identification

1.1. Product Identifier

Product Trade Name: AQF-2 FOAMING AGENT
Synonyms None
Chemical Family: Blend
Internal ID Code HM000071

1.2 Recommended use and restrictions on use

Application: Foaming Agent
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier
Halliburton Energy Services, Inc.
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Telephone: 1-281-871-6107

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

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

Skin Corrosion / Irritation	Category 2 - H315
Serious Eye Damage/Irritation	Category 2 - H319
Acute Aquatic Toxicity	Category 2 - H401
Flammable liquids.	Category 4 - H227

2.2. Label Elements

Hazard Pictograms

Signal Word: Warning

Hazard Statements

H227 - Combustible liquid
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H401 - Toxic to aquatic life

Precautionary Statements

Prevention

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P273 - Avoid release to the environment
P280 - Wear protective gloves/eye protection/face protection

Response

P302 + P352 - IF ON SKIN: Wash with plenty of water.
P332 + P313 - If skin irritation occurs: Get medical advice/attention
P362 + P364 - Take off contaminated clothing and wash before reuse
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention
P370 + P378 - In case of fire: Use water spray for extinction

Storage

P403 + P235 - Store in a well-ventilated place. Keep cool

Disposal

P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Salts of aliphatic sulfonic acids	Proprietary	30 - 60%	Skin Irrit. 2 (H315) Eye Irrit. 2A (H319) Aquatic Acute 2 (H401)
Ethylene glycol monobutyl ether	111-76-2	10 - 30%	Acute Tox. 4 (H302) Acute Tox. 4 (H312) Acute Tox. 4 (H332) Skin Irrit. 2 (H315) Eye Irrit. 2A (H319) Flam. Liq. 4 (H227)
Diethylene glycol	111-46-6	5 - 10%	Acute Tox. 4 (H302) STOT RE 2 (H373)

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

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

4. First Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult give oxygen. Get medical attention.

Eyes In case of contact, or suspected contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention immediately after flushing.

Skin In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

4.2 Most important symptoms/effects, acute and delayed

Causes skin irritation. Causes eye irritation. May be harmful if swallowed.

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

Do NOT spray pool fires directly with water. A solid stream of water directed into hot burning liquid can cause splattering.

5.2 Specific hazards arising from the substance or mixture

Special exposure hazards in a fire

Decomposition in fire may produce harmful gases. Vapors are heavier than air and may accumulate in low areas. Vapors may travel along the ground to be ignited at distant locations.

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. Ensure adequate ventilation. Avoid breathing vapors. Avoid contact with skin, eyes and clothing. Remove sources of ignition.

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. Remove ignition sources and work with non-sparking tools. Contain spill with sand or other inert materials. Scoop up and remove. Do NOT spread spilled product with water.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

Use appropriate protective equipment. Ensure adequate ventilation. Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Remove sources of ignition. Ground and bond containers when transferring from one container to another.

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. Keep from heat, sparks, and open flames. Store in a cool well ventilated area. Keep container closed when not in use. Keep from freezing. Product has a shelf life of 36 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Salts of aliphatic sulfonic acids	Proprietary	Not applicable	Not applicable
Ethylene glycol monobutyl ether	111-76-2	TWA: 50 ppm TWA: 240 mg/m^3	TWA: 20 ppm
Diethylene glycol	111-46-6	Not applicable	Not applicable

8.2 Appropriate engineering controls

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits. Ensure adequate ventilation, especially in confined areas

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 If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.
When the potential exists for vapors of this product to be present, use a respirator with an organic-vapor filter or a supplied-air respirator as needed for adequate protection.

Hand Protection Suitable materials for longer, direct contact (recommended: protection index 6, corresponding to > 480 minutes permeation time as per EN 374): This information is based on literature references and on information provided by glove manufacturers, or is derived by analogy with similar substances. Please note that in practice the working life of chemical-resistant protective gloves may be considerably shorter than the permeation time determined in accordance with EN 374 as a result of the many influencing factors (e.g. temperature). If signs of wear and tear are noticed then the gloves should be replaced.

Skin Protection Wear protective clothing appropriate for the work environment.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Liquid	**Color**	Clear light yellow
Odor:	Bland	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	6.5-8.5 (10%)
Freezing Point / Range	-16 °C / 3.2 (pour point: 15.8) °F
Melting Point / Range	No data available
Boiling Point / Range	> 100 °C / 212 °F
Flash Point	61 °C / 142 °F PMCC
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	< 1 mmHg
Vapor Density	No data available
Specific Gravity	1.038
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%)	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
Keep away from heat, sparks and flame.

10.5. Incompatible materials
Strong oxidizers.

10.6. Hazardous decomposition products
Oxides of sulfur. 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. Ingestion.

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Acute Toxicity

Inhalation May cause respiratory irritation.
Eye Contact Causes eye irritation.
Skin Contact Causes skin irritation.
Ingestion May be harmful if swallowed.

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
Salts of aliphatic sulfonic acids	Proprietary	2310 mg/kg (Rat) 2079 mg/kg (Rat) 6314 mg/kg (Rat) 4000 mg/kg (Rat)	6300 mg/kg (Rabbit) > 6000 mg/kg	> 52 mg/L (Rat) 4h
Ethylene glycol monobutyl ether	111-76-2	1414 mg/kg-bw (guinea pig)	>2000 mg/kg (Rabbit)	No data available
Diethylene glycol	111-46-6	12565 - 19600 mg/kg (Rat)	11890 - 13300 mg/kg (Rabbit)	> 4.6 mg/L (Rat) 4h

Substances	CAS Number	Skin corrosion/irritation
Salts of aliphatic sulfonic acids		Irritating to skin. (Rabbit)
Ethylene glycol monobutyl ether	111-76-2	Causes moderate skin irritation. (Rabbit) Skin, rabbit:
Diethylene glycol	111-46-6	Non-irritating to the skin (Rabbit)

Substances	CAS Number	Serious eye damage/irritation
Salts of aliphatic sulfonic acids		Irritating to eyes (Rabbit)
Ethylene glycol monobutyl ether	111-76-2	Causes moderate eye irritation (Rabbit) Eye, rabbit:
Diethylene glycol	111-46-6	Non-irritating to the eye (Rabbit)

Substances	CAS Number	Skin Sensitization
Salts of aliphatic sulfonic acids		Did not cause sensitization on laboratory animals (guinea pig)
Ethylene glycol monobutyl ether	111-76-2	Did not cause sensitization on laboratory animals (guinea pig)
Diethylene glycol	111-46-6	Did not cause sensitization on laboratory animals (guinea pig)

Substances	CAS Number	Respiratory Sensitization
Salts of aliphatic sulfonic acids		No information available
Ethylene glycol monobutyl ether	111-76-2	No information available
Diethylene glycol	111-46-6	No information available

Substances	CAS Number	Mutagenic Effects
Salts of aliphatic sulfonic acids		In vitro tests did not show mutagenic effects In vivo tests did not show mutagenic effects.
Ethylene glycol monobutyl ether	111-76-2	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects.
Diethylene glycol	111-46-6	In vitro tests did not show mutagenic effects In vivo tests did not show mutagenic effects.

Substances	CAS Number	Carcinogenic Effects
Salts of aliphatic sulfonic acids		Did not show carcinogenic effects in animal experiments (Rat)
Ethylene glycol monobutyl ether	111-76-2	Not regarded as carcinogenic.
Diethylene glycol	111-46-6	Did not show carcinogenic effects in animal experiments (Rat)

Substances	CAS Number	Reproductive toxicity
Salts of aliphatic sulfonic		No significant toxicity observed in animal studies at concentration requiring classification.

acids		
Ethylene glycol monobutyl ether	111-76-2	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.
Diethylene glycol	111-46-6	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Salts of aliphatic sulfonic acids		No significant toxicity observed in animal studies at concentration requiring classification.
Ethylene glycol monobutyl ether	111-76-2	No data of sufficient quality are available.
Diethylene glycol	111-46-6	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Salts of aliphatic sulfonic acids		No significant toxicity observed in animal studies at concentration requiring classification.
Ethylene glycol monobutyl ether	111-76-2	No data of sufficient quality are available.
Diethylene glycol	111-46-6	Causes damage to organs through prolonged or repeated exposure: Kidney

Substances	CAS Number	Aspiration hazard
Salts of aliphatic sulfonic acids		No information available
Ethylene glycol monobutyl ether	111-76-2	Not applicable
Diethylene glycol	111-46-6	No information available

12. Ecological Information

12.1. Toxicity

Ecotoxicity effects

Toxic to aquatic life.

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Salts of aliphatic sulfonic acids	Proprietary	EC50 (72h) 5.2 mg/L (Skeletonema costatum)	LC50 (96h) 4.2 mg/L (Danio rerio)	No information available	EC50 (48h) 4.53 mg/L (Ceriodaphnia sp) NOEC (21d) 6.3 mg/L (Daphnia magna)
Ethylene glycol monobutyl ether	111-76-2	EC50(72 h)=1840 mg/L (Pseudokirchneriella subcapitata)	LC50(96 h)=1474 mg/L (Oncorhynchus mykiss) NOAEC(21 d)>100 mg/L (Danio rerio)	No information available	EC50(48 h)=1800 mg/L (Daphnia magna) EC50(21 d)=297 mg/L (Daphnia magna)
Diethylene glycol	111-46-6	TGK (8d) 2700 mg/L (Scenedesmus quadricauda)	LC50 75200 mg/L (Pimephales promelas)	EC20 (30m) > 1995 mg/L (domestic activated sludge)	EC50 84000 mg/L (Daphnia magna) EC50 >10000 mg/L (Daphnia magna)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Salts of aliphatic sulfonic acids	Proprietary	Readily biodegradable (80-96% @ 28d)
Ethylene glycol monobutyl ether	111-76-2	Readily biodegradable (90.4% @ 28d)
Diethylene glycol	111-46-6	Readily biodegradable (90-100% @ 28d)

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Salts of aliphatic sulfonic acids	Proprietary	- 1.3
Ethylene glycol monobutyl ether	111-76-2	Log Pow=2.4
Diethylene glycol	111-46-6	BCF: 100 (Leuciscus idus melanotus)

12.4. Mobility in soil

Substances	CAS Number	Mobility
Salts of aliphatic sulfonic acids	Proprietary	No information available
Ethylene glycol monobutyl ether	111-76-2	No information available
Diethylene glycol	111-46-6	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods Follow all applicable community, national or regional regulations regarding waste management methods.

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

US DOT Bulk

NA1993, Combustible Liquid, N.O.S. (Contains Ethylene Glycol Monobutyl Ether), Combustible Liquid, III

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
Salts of aliphatic sulfonic acids	Proprietary	Not applicable
Ethylene glycol monobutyl ether	111-76-2	Not applicable
Diethylene glycol	111-46-6	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Salts of aliphatic sulfonic acids	Proprietary	Not applicable
Ethylene glycol monobutyl ether	111-76-2	Not applicable
Diethylene glycol	111-46-6	Not applicable

EPA SARA (311,312) Hazard Class

Acute Health Hazard
Chronic Health Hazard
Fire Hazard

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Salts of aliphatic sulfonic acids	Proprietary	Not applicable	Not applicable
Ethylene glycol monobutyl ether	111-76-2	1.0%	Not applicable
Diethylene glycol	111-46-6	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Salts of aliphatic sulfonic acids	Proprietary	Not applicable
Ethylene glycol monobutyl ether	111-76-2	Not applicable
Diethylene glycol	111-46-6	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

Substances	CAS Number	California Proposition 65
Salts of aliphatic sulfonic acids	Proprietary	Not applicable
Ethylene glycol monobutyl ether	111-76-2	Not applicable
Diethylene glycol	111-46-6	Not applicable

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Salts of aliphatic sulfonic acids	Proprietary	Not applicable	Not applicable	Not applicable
Ethylene glycol monobutyl ether	111-76-2	Present	0275 3138	Present Environmental hazard
Diethylene glycol	111-46-6	Not applicable	Not applicable	Present

NFPA Ratings: Health 1, Flammability 2, Reactivity 0
HMIS Ratings: Health 1, Flammability 2, Physical Hazard 0 , PPE: C

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: 21-Nov-2017

Reason for Revision SDS sections updated:
2

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **EZ-MUD® GOLD**

Revision Date: 03-Mar-2016 **Revision Number:** 17

1. Identification

1.1. Product Identifier

Product Trade Name: EZ-MUD® GOLD
Synonyms None
Chemical Family: Anionic Polymer
Internal ID Code HM005547

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

Combustible dust	Combustible dust

2.2. Label Elements

Hazard pictograms

Signal Word Warning

Hazard Statements

May form combustible dust concentrations in air.

Precautionary Statements

Prevention	None
Response	None
Storage	None
Disposal	None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Anionic polyacrylamide	Proprietary	60 - 100%	Combustible Dust

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

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

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. Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential.

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. Avoid creating and breathing dust. Slippery when wet. Avoid contact with skin, eyes and clothing. 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

Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Ensure adequate ventilation. Slippery when wet. Wash hands after use. Launder contaminated clothing before reuse. 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
Anionic polyacrylamide	Proprietary	Not applicable	0.03 mg/m^3

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 needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)

Hand Protection Normal work gloves.

Skin Protection Normal work coveralls.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Granules	**Color**	Off white
Odor:	Odorless	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	7.75 (1%)
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	0.8 - 1.0
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%)	No data available
Bulk Density	52 lbs/ft3

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
Ammonia. Oxides of nitrogen. 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	None known.
Eye Contact	May cause mild eye irritation.

Skin Contact May cause mild skin irritation.
Ingestion None known.

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
Anionic polyacrylamide	Proprietary	No data available	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Anionic polyacrylamide		No information available

Substances	CAS Number	Serious eye damage/irritation
Anionic polyacrylamide		No information available

Substances	CAS Number	Skin Sensitization
Anionic polyacrylamide		No information available

Substances	CAS Number	Respiratory Sensitization
Anionic polyacrylamide		No information available

Substances	CAS Number	Mutagenic Effects
Anionic polyacrylamide		No information available

Substances	CAS Number	Carcinogenic Effects
Anionic polyacrylamide		No information available

Substances	CAS Number	Reproductive toxicity
Anionic polyacrylamide		No information available

Substances	CAS Number	STOT - single exposure
Anionic polyacrylamide		No information available

Substances	CAS Number	STOT - repeated exposure
Anionic polyacrylamide		No information available

Substances	CAS Number	Aspiration hazard
Anionic polyacrylamide		Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity effects
Product is not classified as hazardous to the environment.

Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Anionic polyacrylamide	Proprietary	No information available	No information available	No information available	No information available

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Anionic polyacrylamide	Proprietary	No information available

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Anionic polyacrylamide	Proprietary	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Anionic polyacrylamide	Proprietary	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
Anionic polyacrylamide	Proprietary	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Anionic polyacrylamide	Proprietary	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
Anionic polyacrylamide	Proprietary	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Anionic polyacrylamide	Proprietary	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 0, Reactivity 0
HMIS Ratings: Health 1, Flammability 0, Reactivity 0

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: 03-Mar-2016

Reason for Revision SDS sections updated:
1

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^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
w/w - weight/weight
d - day

Key literature references and sources for data
www.ChemADVISOR.com/

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **EZ-MUD® PLUS**

Revision Date: 17-Feb-2016 **Revision Number:** 19

1. Identification

1.1. Product Identifier

Product Trade Name: EZ-MUD® PLUS
Synonyms None
Chemical Family: Blend
Internal ID Code HM003646

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

Halliburton Energy Services
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

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

Prevention	None
Response	None
Storage	None
Disposal	None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Hydrotreated light petroleum distillate	64742-47-8	10 - 30%	STOT SE 3 (H336) Asp. Tox. 1 (H304)
Ethoxylated alcohol	Proprietary	1 - 5%	Acute Tox. 4 (H302) Skin Irrit. 2 (H315) Eye Corr. 1 (H318) Aquatic Acute 1 (H400) Aquatic Chronic 3 (H412)

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

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, move victim to fresh air and seek medical attention.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists. Remove contaminated shoes and discard.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

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. Use water spray to cool fire exposed 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. 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. Avoid breathing vapors. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. 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. Keep container closed when not in use. Product has a shelf life of 12 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Hydrotreated light petroleum distillate	64742-47-8	Not applicable	Not applicable
Ethoxylated alcohol	Proprietary	Not applicable	Not applicable

8.2 Appropriate engineering controls

Engineering Controls A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

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 needed. But if significant exposures are possible then the following respirator is recommended:
Organic vapor respirator with a dust/mist filter. (A2P2/P3)

Hand Protection Impervious rubber gloves.

Skin Protection Rubber apron.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Liquid	**Color**	White to gray
Odor:	Mild hydrocarbon	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	No data available
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	175 °C / 347 °F
Flash Point	> 93 °C / > 200 °F PMCC
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	< 1
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1
Water Solubility	Partly soluble
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) 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

Keep away from heat, sparks and flame.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Ammonia. Oxides of nitrogen. 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 May cause mild skin irritation.
Ingestion May cause mild gastric distress.

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
Hydrotreated light petroleum distillate	64742-47-8	>5000 mg/kg-bw (rat) (similar substance)	>2000 mg/kg-bw (rabbit) (similar substance)	>5.2 mg/L (rat, 4 h, vapor) (similar substance)
Ethoxylated alcohol	Proprietary	1700 mg/kg (Rat) 1650 mg/kg (Dog) 1100 mg/kg (Rat) (similar substance) 2850 mg/kg (Rat)	> 2000 mg/kg (Rabbit) (similar substance)	> saturated concentration (similar substance)

Substances	CAS Number	Skin corrosion/irritation
Hydrotreated light petroleum distillate	64742-47-8	Non-irritating to the skin (similar substances)
Ethoxylated alcohol		Causes moderate skin irritation. (Rabbit) (similar substances)

Substances	CAS Number	Serious eye damage/irritation
Hydrotreated light petroleum distillate	64742-47-8	Non-irritating to rabbit's eye (similar substances)
Ethoxylated alcohol		Causes severe eye irritation which may damage tissue. (Rabbit) (similar substances)

Substances	CAS Number	Skin Sensitization
Hydrotreated light petroleum distillate	64742-47-8	Did not cause sensitization on laboratory animals (guinea pig) (similar substances)
Ethoxylated alcohol		Did not cause sensitization on laboratory animals (guinea pig) (similar substances)

Substances	CAS Number	Respiratory Sensitization
Hydrotreated light petroleum distillate	64742-47-8	No information available
Ethoxylated alcohol		No information available

Substances	CAS Number	Mutagenic Effects
Hydrotreated light petroleum distillate	64742-47-8	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects. (similar substances)
Ethoxylated alcohol		In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Hydrotreated light petroleum distillate	64742-47-8	Did not show carcinogenic effects in animal experiments (similar substances)
Ethoxylated alcohol		Did not show carcinogenic or teratogenic effects in animal experiments (similar substances)

Substances	CAS Number	Reproductive toxicity
Hydrotreated light petroleum distillate	64742-47-8	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments. (similar substances)
Ethoxylated alcohol		Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments. (similar substances)

Substances	CAS Number	STOT - single exposure
Hydrotreated light petroleum distillate	64742-47-8	May cause disorder and damage to the Central Nervous System (CNS) (similar substances)
Ethoxylated alcohol		No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)

Substances	CAS Number	STOT - repeated exposure
Hydrotreated light petroleum distillate	64742-47-8	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Ethoxylated alcohol		No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)

Substances	CAS Number	Aspiration hazard
Hydrotreated light petroleum distillate	64742-47-8	Aspiration into the lungs may cause chemical pneumonitis including coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal.
Ethoxylated alcohol		Not applicable

12. Ecological Information

12.1. Toxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Hydrotreated light petroleum distillate	64742-47-8	EC50 (72h) > 1,000 mg/L (Skeletonema costatum) ErL50 (72h) > 1000 mg/L (Pseudokirchneriella subcapitata) EbL50 (72h) > 1000 mg/L (Pseudokirchneriella subcapitata) NOELR (72h) 1000 mg/L (Pseudokirchneriella subcapitata)	LC50 (96h) > 10,000 mg/L (Scophthalmus maximus) LL50 (96h) > 1000 mg/L (Oncorhynchus mykiss)	No information available	LC50 (48h) > 10,000 mg/L (Acartia tonsa) EC50 (48h) 1100 mg/L (Daphnia pulex) LC50 (48h) 0.12 mg/L (Daphnia magna) EL50 (48h) > 1000 mg/L (Daphnia magna)
Ethoxylated alcohol	Proprietary	EC50 (48h) 2-4 mg/L (Selenastrum capricornutum) (similar substance) ErC50 (72h) 0.282 mg/L (Selenastrum capricornutum) (similar substance) ErC10 0.137 mg/L (Scenedesmus subspicatus) (similar substance)	2.6 mg/L (Brachydanio rerio) (similar substance) LC50 (96h) 1.1 mg/L (Salmo gairdneri) (similar substance) NOEC 0.88 mg/L (reproduction) (Lepomis macrochirus) (similar substance)	No information available	EC50 (48h) 1.2 mg/L (Daphnia magna) (Similar substance) EC50 (48h) 0.6 mg/L (Daphnia magna) (Similar substance) NOEC (21d) 0.77 mg/L (reproduction) (Daphnia magna) (Similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Hydrotreated light petroleum distillate	64742-47-8	(40% @ 28d)
Ethoxylated alcohol	Proprietary	Readily biodegradable (85% @ 28d)

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Hydrotreated light petroleum distillate	64742-47-8	Log Pow Weighted Average7.5
Ethoxylated alcohol	Proprietary	5.17

12.4. Mobility in soil

Substances	CAS Number	Mobility
Hydrotreated light petroleum distillate	64742-47-8	No information available
Ethoxylated alcohol	Proprietary	Kd = 3.07 L/kg Kd = 3.09 L/kg

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
Hydrotreated light petroleum distillate	64742-47-8	Not applicable
Ethoxylated alcohol	Proprietary	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Hydrotreated light petroleum distillate	64742-47-8	Not applicable
Ethoxylated alcohol	Proprietary	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
Hydrotreated light petroleum distillate	64742-47-8	Not applicable	Not applicable
Ethoxylated alcohol	Proprietary	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Hydrotreated light petroleum distillate	64742-47-8	Not applicable
Ethoxylated alcohol	Proprietary	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 0, Flammability 1, Reactivity 0
HMIS Ratings: Health 0, Flammability 1, Reactivity 0 , PPE: C

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:
2
4
11

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
d - day
EC50 – Effective Concentration 50%

ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/
OSHA
ECHA C&L

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **N-SEAL™**

Revision Date: 14-Feb-2017 **Revision Number:** 24

1. Identification

1.1. Product Identifier

Product Trade Name: N-SEAL™
Synonyms None
Chemical Family: Silicate
Internal ID Code HM003708

1.2 Recommended use and restrictions on use

Application: Viscosifier
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

Halliburton Energy Services
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

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

Prevention	None
Response	None
Storage	None
Disposal	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

Inhalation	If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.
Eyes	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.
Skin	Wash with soap and water. Get medical attention if irritation persists.
Ingestion	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

All standard fire fighting media

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

Not applicable

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. Avoid contact with skin, eyes and clothing. Avoid creating and breathing dust. 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
Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling
Handling Precautions
Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. 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 in a dry location.

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 needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)
Hand Protection Normal work gloves.
Skin Protection Normal work coveralls.
Eye Protection Wear safety glasses or goggles to protect against exposure.
Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties
Physical State: fibers
Odor: Odorless
Color White to gray
Odor Threshold: No information available

Property Values

Remarks/ - Method

pH:	No data available
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.6
Water Solubility	Insoluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%)	No data available
Bulk Density	12-26 lbs/ft3

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 acids.

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	None known.
Eye Contact	May cause mechanical irritation to eye.
Skin Contact	None known.
Ingestion	None known.

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

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 Bury in a licensed landfill according to 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 0, Flammability 0, Reactivity 0
HMIS Ratings: Health 0, 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: 14-Feb-2017

Reason for Revision SDS sections updated:
2

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/
NZ CCID

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **NXS-LUBE®**

Revision Date: 19-Sep-2016 **Revision Number:** 13

1. Identification

1.1. Product Identifier

Product Trade Name: NXS-LUBE®
Synonyms None
Chemical Family: Blend
Internal ID Code HM005843

1.2 Recommended use and restrictions on use

Application: Additive
Uses advised against Consumer use

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

Halliburton Energy Services
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazard(s) Identification

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

Skin Sensitization	Category 1 - H317

2.2. Label Elements

Hazard Pictograms

Signal Word: Warning

Hazard Statements H317 - May cause an allergic skin reaction

Precautionary Statements

Prevention
P261 - Avoid breathing dust/fume/gas/mist/vapors/spray
P272 - Contaminated work clothing should not be allowed out of the workplace
P280 - Wear protective gloves/protective clothing/eye protection/face protection

Response
P302 + P352 - IF ON SKIN: Wash with plenty of soap and water
P333 + P313 - If skin irritation or rash occurs: Get medical advice/attention
P363 - Wash contaminated clothing before reuse

Storage None

Disposal P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Sulfurized Olefin	Proprietary	30 - 60%	Acute Tox. 4 (H332) Skin Sens. 1 (H317)

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

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

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

4.2 Most important symptoms/effects, acute and delayed

May cause allergic skin reaction.

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

Do NOT spray pool fires directly with water. A solid stream of water directed into hot burning liquid can cause splattering.

5.2 Specific hazards arising from the substance or mixture

Special exposure hazards in a fire

Decomposition in fire may produce harmful gases.

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

Ensure adequate ventilation. Use appropriate protective equipment. Do not breathe dust/fume/gas/mist/vapors/spray. Avoid contact with skin, eyes and clothing.
See Section 8 for additional information

6.2. Environmental precautions

None known.

6.3. Methods and material for containment and cleaning up

Dike far ahead of liquid spill for later disposal. Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

Do not breathe dust/fume/gas/mist/vapors/spray. Ensure adequate ventilation. Use appropriate protective equipment. Avoid contact with eyes, skin, or clothing.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Information

Store in a well ventilated area.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Sulfurized Olefin	Proprietary	Not applicable	Not applicable

8.2 Appropriate engineering controls

Engineering Controls Ensure adequate ventilation, especially in confined areas

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	If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.
Hand Protection	Use gloves which are suitable for the chemicals present in this product as well as other environmental factors in the workplace.
Skin Protection	Wear protective clothing appropriate for the work environment.
Eye Protection	Safety glasses with side-shields. If splashes are likely to occur, wear: Goggles, Face-shield.
Other Precautions	None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid
Odor: Mild
Color Amber
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	7- 8.5
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	260 °C / 500 °F
Flash Point	150 °C / 302 °F Open cup
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	0.001
Vapor Density	10
Specific Gravity	0.99
Water Solubility	Insoluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) 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
Excessive heat

10.5. Incompatible materials
Strong oxidizers. Strong acids. Strong alkalis.

10.6. Hazardous decomposition products
Oxides of sulfur. Carbon monoxide and carbon dioxide. Hydrogen sulfide.

11. Toxicological Information

11.1 Information on likely routes of exposure
Principle Route of Exposure Eye or skin contact, inhalation. Ingestion.

11.2 Symptoms related to the physical, chemical and toxicological characteristics
Acute Toxicity

Inhalation None known.
Eye Contact Non-irritating to rabbit's eye
Skin Contact May cause an allergic skin reaction.
Ingestion May cause abdominal pain, vomiting, nausea, and diarrhea.

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
Sulfurized Olefin	Proprietary	> 5000 mg/kg (Rat) (similar substance)	> 2000 mg/kg (Rabbit) (similar substance)	< 4.3 mg/L (Rat) 4h (similar substance)

Substances	CAS Number	Skin corrosion/irritation
Sulfurized Olefin		Not irritating to skin in rabbits. (similar substances)

Substances	CAS Number	Serious eye damage/irritation
Sulfurized Olefin		Non-irritating to rabbit's eye (similar substances)

Substances	CAS Number	Skin Sensitization
Sulfurized Olefin		May cause sensitization by skin contact (mouse) (similar substances)

Substances	CAS Number	Respiratory Sensitization
Sulfurized Olefin		No information available

Substances	CAS Number	Mutagenic Effects
Sulfurized Olefin		In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Sulfurized Olefin		No information available

Substances	CAS Number	Reproductive toxicity
Sulfurized Olefin		Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments. (similar substances)

Substances	CAS Number	STOT - single exposure
Sulfurized Olefin		No significant toxicity observed in animal studies at concentration requiring classification. (similar

		substances)

Substances	CAS Number	STOT - repeated exposure
Sulfurized Olefin		No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)

Substances	CAS Number	Aspiration hazard
Sulfurized Olefin		No information available

12. Ecological Information

12.1. Toxicity

Ecotoxicity effects

Product is not classified as hazardous to the environment.

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sulfurized Olefin	Proprietary	EC50 (72h) >100 mg/L (Pseudokirchneriella subcapitata) (Similar substance)	LC50 (96h) >1000 mg/L (Pimephales promelas) (similar substance)	No information available	EC50 (48h) > 1000 mg/L (Daphnia magna) (Similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sulfurized Olefin	Proprietary	(0.3% @ 28d)

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sulfurized Olefin	Proprietary	BCF = 3.16-2,818 Log Kow = 5.1 to >6

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sulfurized Olefin	Proprietary	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods Follow all applicable community, national or regional regulations regarding waste management methods.

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
Sulfurized Olefin	Proprietary	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Sulfurized Olefin	Proprietary	Not applicable

EPA SARA (311,312) Hazard Class
Acute Health Hazard

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Sulfurized Olefin	Proprietary	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Sulfurized Olefin	Proprietary	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 1, Reactivity 0

Canadian Regulations

Canadian Domestic Substances List (DSL)	Product contains one or more components not listed on the inventory.

16. Other information

Preparation Information

Prepared By	Chemical Stewardship Telephone: 1-281-871-6107 e-mail: fdunexchem@halliburton.com
Revision Date:	19-Sep-2016
Reason for Revision	SDS sections updated: 2 11

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **QUIK-FOAM®**

Revision Date: 12-Oct-2017 **Revision Number:** 17

1. Identification

1.1. Product Identifier

Product Trade Name: QUIK-FOAM®
Synonyms None
Chemical Family: Blend
Internal ID Code HM003746

1.2 Recommended use and restrictions on use

Application: Foaming Agent
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier
Baroid Fluid Services
Product Service Line of Halliburton Energy Services, Inc.
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

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

Skin Corrosion / Irritation	Category 2 - H315
Serious Eye Damage/Irritation	Category 1 - H318
Acute Aquatic Toxicity	Category 2 - H401
Chronic Aquatic Toxicity	Category 3 - H412
Flammable liquids.	Category 3 - H226

2.2. Label Elements

Hazard Pictograms

Signal Word: Danger

Hazard Statements

H226 - Flammable liquid and vapor
H315 - Causes skin irritation
H318 - Causes serious eye damage
H401 - Toxic to aquatic life
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements

Prevention

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233 - Keep container tightly closed
P240 - Ground and bond container and receiving equipment.
P241 - Use explosion-proof electrical/ventilating/lighting/equipment
P242 - Use only non-sparking tools
P243 - Take action to prevent static discharges.
P264 - Wash face, hands and any exposed skin thoroughly after handling
P273 - Avoid release to the environment
P280 - Wear protective gloves/eye protection/face protection

Response

P302 + P352 - IF ON SKIN: Wash with plenty of water.
P332 + P313 - If skin irritation occurs: Get medical advice/attention
P362 + P364 - Take off contaminated clothing and wash before reuse
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/physician
P370 + P378 - In case of fire: Use water spray for extinction

Storage

P403 + P235 - Store in a well-ventilated place. Keep cool

Disposal

P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Surfactant	Proprietary	30 - 60%	Skin Irrit. 2 (H315) Eye Corr. 1 (H318) Aquatic Acute 2 (H401) Aquatic Chronic 3 (H412)
Ethanol	64-17-5	10 - 30%	Eye Irrit. 2A (H319) Flam. Liq. 2 (H225)

Isopropanol	67-63-0	1 - 5%	Eye Irrit. 2 (H319) STOT SE 3 (H336) Flam. Liq. 2 (H225)

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

4. First Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, move victim to fresh air and seek medical attention.

Eyes Immediately flush eyes with large amounts of water for at least 30 minutes. Seek prompt medical attention.

Skin Wash off immediately with soap and plenty of water for at least 15 minutes while removing all contaminated clothing and shoes. Get medical attention if irritation persists.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

4.2 Most important symptoms/effects, acute and delayed

Causes severe eye irritation which may damage tissue. Causes skin irritation.

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

May be ignited by heat, sparks or flames Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce harmful gases.

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.

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. Remove ignition sources and work with non-sparking tools. 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. Avoid breathing vapors. Wash hands after use. Launder contaminated clothing before reuse. Ground and bond containers when transferring from one container to another.

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 away from alkalis. Keep from heat, sparks, and open flames. Keep container closed when not in use. 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
Surfactant	Proprietary	Not applicable	Not applicable
Ethanol	64-17-5	TWA: 1000 ppm TWA: 1900 mg/m^3	STEL: 1000 ppm
Isopropanol	67-63-0	TWA: 400 ppm TWA: 980 mg/m^3	TWA: 200 ppm STEL: 400 ppm

8.2 Appropriate engineering controls

Engineering Controls Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

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 Organic vapor respirator.

Hand Protection Impervious rubber gloves.

Skin Protection Rubber apron.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions Eyewash fountains and safety showers must be easily accessible.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Liquid

Odor: Alcohol

Color Light yellow

Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	7.3 - 7.8 (50 % solution)
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	23 °C / 74 °F PMCC
Flammability (solid, gas)	No data available

Upper flammability limit	12%
Lower flammability limit	2%
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	1.02
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	398 °C / 750 °F
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%)	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

Keep away from heat, sparks and flame.

10.5. Incompatible materials

Strong oxidizers. Strong alkalis.

10.6. Hazardous decomposition products

Oxides of sulfur. Oxides of nitrogen. Ammonia. 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. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.
Eye Contact	Causes severe eye irritation which may damage tissue.
Skin Contact	Causes skin irritation.
Ingestion	Irritation of the mouth, throat, and stomach. May cause central nervous system depression including headache, dizziness, drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue blurred vision, slurred speech, giddiness, tremors and convulsions.

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
Surfactant	Proprietary	> 2000 mg/kg (Rat) (similar substance)	> 2000 mg/kg (Rabbit) (similar substance)	No data available
Ethanol	64-17-5	7060 mg/kg (Rat) 10,470 mg/kg (Rat)	> 15,800 mg/kg (Rabbit) 17,100 mg/kg (Rabbit)	124.7 mg/L (Rat) 4h
Isopropanol	67-63-0	5840 mg/kg-bw (rat)	12870 mg/kg-bw (rabbit)	72.6 mg/L (Rat, 4h, vapor)

Substances	CAS Number	Skin corrosion/irritation
Surfactant		Skin, rabbit: Causes moderate skin irritation. (similar substances)
Ethanol	64-17-5	Not irritating to skin in rabbits.
Isopropanol	67-63-0	Non-irritating to the skin (Rabbit)

Substances	CAS Number	Serious eye damage/irritation
Surfactant		Causes severe eye irritation which may damage tissue.
Ethanol	64-17-5	Causes moderate eye irritation (Rabbit)
Isopropanol	67-63-0	Causes moderate eye irritation (Rabbit)

Substances	CAS Number	Skin Sensitization
Surfactant		Did not cause sensitization on laboratory animals (similar substances)
Ethanol	64-17-5	Did not cause sensitization on laboratory animals
Isopropanol	67-63-0	Did not cause sensitization on laboratory animals (guinea pig)

Substances	CAS Number	Respiratory Sensitization
Surfactant		No information available
Ethanol	64-17-5	Did not cause sensitization on laboratory animals
Isopropanol	67-63-0	No information available

Substances	CAS Number	Mutagenic Effects
Surfactant		In vitro tests did not show mutagenic effects In vivo tests did not show mutagenic effects. (similar substances)
Ethanol	64-17-5	Not regarded as mutagenic.
Isopropanol	67-63-0	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects.

Substances	CAS Number	Carcinogenic Effects
Surfactant		Did not show carcinogenic effects in animal experiments (similar substances)
Ethanol	64-17-5	Did not show carcinogenic effects in animal experiments
Isopropanol	67-63-0	Did not show carcinogenic effects in animal experiments

Substances	CAS Number	Reproductive toxicity
Surfactant		Did not show teratogenic effects in animal experiments. Not a confirmed reproductive toxicant. (similar substances)
Ethanol	64-17-5	Animal testing did not show any effects on fertility.
Isopropanol	67-63-0	Animal testing did not show any effects on fertility.

Substances	CAS Number	STOT - single exposure
Surfactant		No data of sufficient quality are available.
Ethanol	64-17-5	No significant toxicity observed in animal studies at concentration requiring classification.
Isopropanol	67-63-0	May cause headache, dizziness, and other central nervous system effects.

Substances	CAS Number	STOT - repeated exposure
Surfactant		No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)
Ethanol	64-17-5	No significant toxicity observed in animal studies at concentration requiring classification.
Isopropanol	67-63-0	No significant toxicity observed in animal studies at concentration requiring classification. (similar substances)

Substances	CAS Number	Aspiration hazard
Surfactant		Not applicable
Ethanol	64-17-5	Not applicable

Isopropanol	67-63-0	Not applicable

12. Ecological Information

12.1. Toxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Surfactant	Proprietary	EC50 (5d) 101 mg/L (Selenastrum capricornutum) (similar substance)	NOEC (28d) 0.12 mg/L (Oncorhynchus mykiss) (similar substance)	EC50 (3h) > 1600 mg/L (similar substance)	EC50 (48h) 3.43 mg/L (Ceriodaphnia dubia) (similar substance) EC50 (24h) 21 mg/L (Daphnia magna) (similar substance) EC50 (96h) 5.7 mg/L (Daphnia magna) (similar substance) NOEC (7d) 0.34 mg/L (Ceriodaphnia dubia) (similar substance) NOEC (21d) 16.5 mg/L (Daphnia magna) (similar substance) NOEC (7d) 6.3 mg/L (Ceriodaphnia dubia) (similar substance)
Ethanol	64-17-5	No information available	LC50 > 100 mg/L (Pimephales promelas)	No information available	LC50 9268 - 14,221 mg/L (Daphnia magna) LC50 5012 mg/L (Ceridaphnia dubia) NOEC 9.6 mg/L (Daphnia magna)
Isopropanol	67-63-0	EC50 (72h) > 1000 mg/L (Desmodesmus subspicatus) EC50 (7d) 1800 mg/L (Scenedesmus quadricauda)	LC50 (96h) 9640 mg/L (Pimephales promelas) LC50 (7d) 7060 mg/L (Poecilia reticulata)	TT (16h) 1050 mg/L (Pseudomonas putida)	EC50 (48h) 13,299 mg/L (Daphnia magna) EC50 (24h) > 10,000 mg/L (Daphnia magna)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Surfactant	Proprietary	Readily biodegradable (similar substances)
Ethanol	64-17-5	No information available
Isopropanol	67-63-0	Readily biodegradable (53% @ 5d)

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Surfactant	Proprietary	No information available
Ethanol	64-17-5	-0.32
Isopropanol	67-63-0	0.05

12.4. Mobility in soil

Substances	CAS Number	Mobility
Surfactant	Proprietary	No information available
Ethanol	64-17-5	No information available
Isopropanol	67-63-0	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 UN1993
UN proper shipping name: Flammable Liquid, N.O.S. (Contains Ethanol, Isopropanol)
Transport Hazard Class(es): 3
Packing Group: III
Environmental Hazards: Not applicable
NAERG: NAERG 128
Not Restricted when shipped in containers less than 119 gallons as authorized by 49 CFR 173.150(e)(1) and 49 CFR 173.150(f)(2).

Canadian TDG

UN Number UN1993
UN proper shipping name: Flammable Liquid, N.O.S. (Contains Ethanol, Isopropanol)
Transport Hazard Class(es): 3
Packing Group: III
Environmental Hazards: Not applicable

IMDG/IMO

UN Number UN1993
UN proper shipping name: Flammable Liquid, N.O.S. (Contains Ethanol, Isopropanol)
Transport Hazard Class(es): 3
Packing Group: III
Environmental Hazards: Not applicable
EMS: EmS F-E, S-E

IATA/ICAO

UN Number UN1993
UN proper shipping name: Flammable Liquid, N.O.S. (Contains Ethanol, Isopropanol)
Transport Hazard Class(es): 3
Packing Group: III
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
Surfactant	Proprietary	Not applicable
Ethanol	64-17-5	Not applicable
Isopropanol	67-63-0	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Surfactant	Proprietary	Not applicable
Ethanol	64-17-5	Not applicable
Isopropanol	67-63-0	Not applicable

EPA SARA (311,312) Hazard Class

Acute Health Hazard
Fire Hazard

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Surfactant	Proprietary	Not applicable	Not applicable
Ethanol	64-17-5	Not applicable	Not applicable
Isopropanol	67-63-0	1.0%	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Surfactant	Proprietary	Not applicable
Ethanol	64-17-5	Not applicable
Isopropanol	67-63-0	Not applicable

EPA RCRA Hazardous Waste Classification

If product becomes a waste, it does meet the criteria of a hazardous waste as defined by the US EPA, because of:

Ignitability D001

California Proposition 65

Substances	CAS Number	California Proposition 65
Surfactant	Proprietary	Not applicable
Ethanol	64-17-5	developmental toxicity carcinogen carcinogen
Isopropanol	67-63-0	Not applicable

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Surfactant	Proprietary	Not applicable	Not applicable	Not applicable
Ethanol	64-17-5	Teratogen	0844	Present
Isopropanol	67-63-0	Present	1076	Environmental hazard

NFPA Ratings: Health 1, Flammability 3, Reactivity 0
HMIS Ratings: Health 1, Flammability 3, Physical Hazard 0 , PPE: H

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: 12-Oct-2017

Reason for Revision SDS sections updated:
2

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **QUIK-GEL®**

Revision Date: 14-Aug-2017 **Revision Number:** 20

1. Identification

1.1. Product Identifier

Product Trade Name: QUIK-GEL®
Synonyms None
Chemical Family: Mineral
Internal ID Code HM003747

1.2 Recommended use and restrictions on use

Application: Viscosifier
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier
Baroid Fluid Services
Product Service Line of Halliburton Energy Services, Inc.
P.O. Box 1675
Houston, TX 77251
Telephone: (281) 871-4000

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

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

Carcinogenicity	Category 1A - H350
Specific Target Organ Toxicity - (Repeated Exposure)	Category 1 - H372

2.2. Label Elements

Hazard Pictograms

Signal Word: Danger

Hazard Statements
H350 - May cause cancer by inhalation
H372 - Causes damage to organs through prolonged or repeated exposure if inhaled

Precautionary Statements

Prevention
P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P264 - Wash face, hands and any exposed skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P280 - Wear protective gloves/protective clothing/eye protection/face protection

Response
P308 + P313 - IF exposed or concerned: Get medical advice/attention
P314 - Get medical attention/advice if you feel unwell

Storage
P405 - Store locked up

Disposal
P501 - Dispose of contents/container in accordance with local/regional/national/international regulations

2.3 Hazards not otherwise classified

This product contains Wyoming bentonite or other sorptive clays. Crystalline silica forms found in this particular clay are limited to quartz. Extreme temperatures that can generate cristobalite or tridymite are not expected to occur under realistic conditions. In addition, all quartz found in sorptive clays are considered “occluded”, i.e., strongly coated with an amorphous silica surface. Occluded quartz has been experimentally-determined to be relatively non-toxic compared to unoccluded quartz. A lack of health effects found in several studies examining occupational exposure to sorptive clays also suggest that chronic inhalation of sorptive clays is not expected to result in silicosis or cancer. In light of these findings OSHA has recently exempted Wyoming bentonite and other sorptive clays from the crystalline silica PEL in §1910.1053(a)(1)(iii).

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Crystalline silica, quartz	14808-60-7	1 - 5%	Carc. 1A (H350) STOT RE 1 (H372)

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

4. First Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Rinse mouth with water many times.

4.2 Most important symptoms/effects, acute and delayed

Breathing crystalline silica can cause lung disease, including silicosis and lung cancer. Crystalline silica has also been associated with scleroderma and kidney disease.

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

All standard fire fighting media

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

None anticipated

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. Avoid creating and breathing dust. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.

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

Collect using dustless method and hold for appropriate disposal. Consider possible toxic or fire hazards associated with contaminating substances and use appropriate methods for collection, storage and disposal.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions

This product contains quartz, cristobalite, and/or tridymite which may become airborne without a visible cloud. Avoid breathing dust. Avoid creating dusty conditions. Use only with adequate ventilation to keep exposure below recommended exposure limits. Wear a NIOSH certified, European Standard En 149, or equivalent respirator when using this product. Material is slippery when wet. 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

Use good housekeeping in storage and work areas to prevent accumulation of dust. Close container when not in use. Keep from excessive heat. Do not reuse empty container. Product has a shelf life of 36 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Crystalline silica, quartz	14808-60-7	TWA: 50 µg/m³	TWA: 0.025 mg/m³

Exposures to crystalline silica that result from bentonite or other sorptive clays are exempt from the PEL in §1910.1053. The PEL in §1910.1000 Table Z–3 (i.e., the formula that is approximately equivalent to 100 µg/m³) applies to occupational exposures to respirable crystalline silica from sorptive clays.

8.2 Appropriate engineering controls

Engineering Controls Use approved industrial ventilation and local exhaust as required to maintain exposures below applicable exposure limits.

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 needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)

Hand Protection Normal work gloves.

Skin Protection Wear clothing appropriate for the work environment. Dusty clothing should be laundered before reuse. Use precautionary measures to avoid creating dust when removing or laundering clothing.

Eye Protection Wear safety glasses or goggles to protect against exposure.

Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Powder
Color Various
Odor: Mild earthy
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	8-10
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.6
Water Solubility	Partly soluble
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) 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
Hydrofluoric acid.

10.6. Hazardous decomposition products
Amorphous silica may transform at elevated temperatures to tridymite (870 C) or cristobalite (1470 C).

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 Inhaled crystalline silica in the form of quartz or cristobalite from occupational sources is carcinogenic to humans (IARC, Group 1). There is sufficient evidence in experimental animals for the carcinogenicity of tridymite (IARC, Group 2A).

Breathing silica dust may cause irritation of the nose, throat, and respiratory passages. Breathing silica dust may not cause noticeable injury or illness even though permanent lung damage may be occurring. Inhalation of dust may also have serious chronic health effects (See "Chronic Effects/Carcinogenicity" subsection below).

Eye Contact May cause mechanical irritation to eye.
Skin Contact None known.
Ingestion None known.

Chronic Effects/Carcinogenicity Silicosis: Excessive inhalation of respirable crystalline silica dust may cause a progressive, disabling, and sometimes-fatal lung disease called silicosis. Symptoms include cough, shortness of breath, wheezing, non-specific chest illness, and reduced pulmonary function. This disease is exacerbated by smoking. Individuals with silicosis are predisposed to develop tuberculosis.

Cancer Status: The International Agency for Research on Cancer (IARC) has determined that crystalline silica inhaled in the form of quartz or cristobalite from occupational sources can cause lung cancer in humans (Group 1 - carcinogenic to humans) and has determined that there is sufficient evidence in experimental animals for the carcinogenicity of tridymite (Group 2A - possible carcinogen to humans). Refer to IARC Monograph 68, Silica, Some Silicates and Organic Fibres (June 1997) in conjunction with the use of these minerals. The National Toxicology

Program classifies respirable crystalline silica as "Known to be a human carcinogen". Refer to the 9th Report on Carcinogens (2000). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies crystalline silica, quartz, as a suspected human carcinogen (A2). There is some evidence that breathing respirable crystalline silica or the disease silicosis is associated with an increased incidence of significant disease endpoints such as scleroderma (an immune system disorder manifested by scarring of the lungs, skin, and other internal organs) and kidney disease.

This product contains Wyoming bentonite or other sorptive clays. Crystalline silica forms found in this particular clay are limited to quartz. Extreme temperatures that can generate cristobalite or tridymite are not expected to occur under realistic conditions. In addition, all quartz found in sorptive clays are considered “occluded”, i.e., strongly coated with an amorphous silica surface (Wendlandt et al., 2007; Hochella and Muryama, 2010; SMI, 2014). Occluded quartz has been experimentally-determined to be relatively non-toxic compared to unoccluded quartz (Geh et al., 2006; Creutzenberg et al., 2008). A lack of health effects found in several studies examining occupational exposure to sorptive clays also suggest that chronic inhalation of sorptive clays is not expected to result in silicosis or cancer (Waxweiler et al., 1988; ACGIH, 1991; USEPA, 1996; IARC, 2005). In light of these findings OSHA has recently exempted Wyoming bentonite and other sorptive clays from the crystalline silica PEL in §1910.1053(a)(1)(iii).

11.3 Toxicity data

Toxicology data for the components

Substances	CAS Number	LD50 Oral	LD50 Dermal	LC50 Inhalation
Crystalline silica, quartz	14808-60-7	> 15000 mg/kg (human)	No data available	No data available

Substances	CAS Number	Skin corrosion/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Crystalline silica, quartz	14808-60-7	Non-irritating to the eye

Substances	CAS Number	Skin Sensitization
Crystalline silica, quartz	14808-60-7	No information available.

Substances	CAS Number	Respiratory Sensitization
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	Mutagenic Effects
Crystalline silica, quartz	14808-60-7	Not regarded as mutagenic.

Substances	CAS Number	Carcinogenic Effects
Crystalline silica, quartz	14808-60-7	Contains crystalline silica which may cause silicosis, a delayed and progressive lung disease. The IARC and NTP have determined there is sufficient evidence in humans of the carcinogenicity of crystalline silica with repeated respiratory exposure.

Substances	CAS Number	Reproductive toxicity
Crystalline silica, quartz	14808-60-7	No information available

Substances	CAS Number	STOT - single exposure
Crystalline silica, quartz	14808-60-7	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Crystalline silica, quartz	14808-60-7	Causes damage to organs through prolonged or repeated exposure if inhaled: (Lungs)

Substances	CAS Number	Aspiration hazard
Crystalline silica, quartz	14808-60-7	Not applicable

12. Ecological Information

12.1. Toxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Crystalline silica, quartz	14808-60-7	EC50 (72 h) =440 mg/L (Selenastrum capricornutum)(similar substance)	LL0 (96 h) =10000 mg/L (Danio rerio)(similar substance)	No information available	LL50 (24 h) >10000 mg/L (Daphnia magna)(similar substance)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Crystalline silica, quartz	14808-60-7	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Crystalline silica, quartz	14808-60-7	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Crystalline silica, quartz	14808-60-7	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods If practical, recover and reclaim, recycle, or reuse by the guidelines of an approved local reuse program. Should contaminated product become a waste, dispose of in a licensed industrial landfill according to 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
Crystalline silica, quartz	14808-60-7	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Crystalline silica, quartz	14808-60-7	Not applicable

EPA SARA (311,312) Hazard Class
Chronic Health Hazard

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Crystalline silica, quartz	14808-60-7	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Crystalline silica, quartz	14808-60-7	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

Substances	CAS Number	California Proposition 65
Crystalline silica, quartz	14808-60-7	carcinogen

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Crystalline silica, quartz	14808-60-7	Carcinogen Extraordinarily hazardous	1660	Present

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

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: 14-Aug-2017

Reason for Revision
SDS sections updated:
2
8
11

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The

information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **QUIK-TROL® GOLD**

Revision Date: 08-Jun-2016 **Revision Number:** 15

1. Identification

1.1. Product Identifier

Product Trade Name: QUIK-TROL® GOLD
Synonyms None
Chemical Family: Polysaccharide
Internal ID Code HM006449

1.2 Recommended use and restrictions on use

Application: Viscosifier
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 1800
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

Combustible dust	Combustible dust

2.2. Label Elements

Hazard pictograms

Signal Word: Warning

Hazard Statements

May form combustible dust concentrations in air.

Precautionary Statements

Prevention	None
Response	None
Storage	None
Disposal	None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Polysaccharide	Proprietary	60 - 100%	Combustible Dust

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

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

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. Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential.

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. Avoid creating and breathing dust. Avoid contact with skin, eyes and clothing. 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
Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling
Handling Precautions
Avoid creating or inhaling dust. Avoid dust accumulations. Ensure adequate ventilation. Avoid contact with eyes, skin, or clothing. Wash hands after use. Launder contaminated clothing before reuse. Slippery when wet. 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. Keep container closed when not in use. Store away from flammables. Store away from direct sunlight. Keep from heat, sparks, and open flames. Store in a cool, dry location. Store in a well ventilated area. Product has a shelf life of 36 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Polysaccharide	Proprietary	Not applicable	Not applicable

8.2 Appropriate engineering controls
Engineering Controls A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

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 needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)
Hand Protection Normal work gloves.
Skin Protection Normal work coveralls.
Eye Protection Wear safety glasses or goggles to protect against exposure.
Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties
Physical State: Granular Powder
Odor: Odorless
Color White to off white
Odor Threshold: No information available

Property Remarks/ - Method	Values
pH:	5-9 (1%)
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	0.6 - 0.9
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	> 370 °C / > 698 °F
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) 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

Excessive heat

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 May cause mild skin irritation.

Ingestion None known.

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
Polysaccharide	Proprietary	27000 mg/kg (Rat)	2000 mg/kg (Rabbit)	5800 mg/m³ (Rat) 4h

Substances	CAS Number	Skin corrosion/irritation
Polysaccharide	Proprietary	Not irritating to skin in rabbits.

Substances	CAS Number	Serious eye damage/irritation
Polysaccharide	Proprietary	Non-irritating to rabbit's eye

Substances	CAS Number	Skin Sensitization
Polysaccharide	Proprietary	Did not cause sensitization on laboratory animals

Substances	CAS Number	Respiratory Sensitization
Polysaccharide	Proprietary	No information available

Substances	CAS Number	Mutagenic Effects
Polysaccharide	Proprietary	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Polysaccharide	Proprietary	Did not show carcinogenic effects in animal experiments (similar substances)

Substances	CAS Number	Reproductive toxicity
Polysaccharide	Proprietary	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Polysaccharide	Proprietary	No information available

Substances	CAS Number	STOT - repeated exposure
Polysaccharide	Proprietary	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Polysaccharide	Proprietary	Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity effects

Product is not classified as hazardous to the environment.

Product Ecotoxicity Data

No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Polysaccharide	Proprietary	No information available	TLM96: 10000 ppm (Oncorhynchus mykiss) LC50 (96h) 20000 mg/L (Oncorhynchus mykiss)	No information available	EC50 (48h) 1000-3300 mg/L (Crangon crangon)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Polysaccharide	Proprietary	No information available

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Polysaccharide	Proprietary	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Polysaccharide	Proprietary	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
Polysaccharide	Proprietary	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Polysaccharide	Proprietary	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
Polysaccharide	Proprietary	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Polysaccharide	Proprietary	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 1, Physical Hazard 0 , PPE: A

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: 08-Jun-2016

Reason for Revision SDS sections updated:
1

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

Disclaimer Statement
This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **QUIK-TROL® GOLD LV**

Revision Date: 19-May-2016 **Revision Number:** 17

1. Identification

1.1. Product Identifier

Product Trade Name: QUIK-TROL® GOLD LV
Synonyms None
Chemical Family: Carbohydrate
Internal ID Code HM006782

1.2 Recommended use and restrictions on use

Application: Viscosifier Filtrate Reducer
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 1800
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

Combustible dust	Combustible dust

2.2. Label Elements

Hazard pictograms

Signal Word: Warning

Hazard Statements

May form combustible dust concentrations in air.

Precautionary Statements

Prevention	None
Response	None
Storage	None
Disposal	None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Polysaccharide	Proprietary	60 - 100%	Combustible Dust

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

4. First-Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

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

Organic dust in the presence of an ignition source can be explosive in high concentrations. Good housekeeping practices are required to minimize this potential.

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. Avoid creating and breathing dust. Slippery when wet. Ensure adequate ventilation. Avoid contact with skin, eyes and clothing.
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

Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions
Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Avoid dust accumulations. Ensure adequate ventilation. Slippery when wet. Wash hands after use. Launder contaminated clothing before reuse. Do NOT consume food, drink, or tobacco in contaminated areas.
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. Keep container closed when not in use. Store in a cool, dry location. Store away from direct sunlight. Keep from heat, sparks, and open flames. Store in a well ventilated area. Product has a shelf life of 36 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Polysaccharide	Proprietary	Not applicable	Not applicable

8.2 Appropriate engineering controls

Engineering Controls A well ventilated area to control dust levels. Local exhaust ventilation should be used in areas without good cross ventilation.

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 needed. But if significant exposures are possible then the following respirator is recommended:
Dust/mist respirator. (N95, P2/P3)
Hand Protection Normal work gloves.
Skin Protection Normal work coveralls.
Eye Protection Wear safety glasses or goggles to protect against exposure.
Other Precautions None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State: Powder **Color** White to off white
Odor: Odorless **Odor** No information available

	Threshold:
Property Remarks/ - Method	Values
pH:	5-9 (1%)
Freezing Point / Range	No data available
Melting Point / Range	No data available
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	No data available
Water Solubility	Soluble in water
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

VOC Content (%) 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

Excessive heat

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 May cause mild skin irritation.
Ingestion None known.

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
Polysaccharide	Proprietary	27000 mg/kg (Rat)	2000 mg/kg (Rabbit)	5800 mg/m³ (Rat) 4h

Substances	CAS Number	Skin corrosion/irritation
Polysaccharide	Proprietary	Not irritating to skin in rabbits.

Substances	CAS Number	Serious eye damage/irritation
Polysaccharide	Proprietary	Non-irritating to rabbit's eye

Substances	CAS Number	Skin Sensitization
Polysaccharide	Proprietary	Did not cause sensitization on laboratory animals

Substances	CAS Number	Respiratory Sensitization
Polysaccharide	Proprietary	No information available

Substances	CAS Number	Mutagenic Effects
Polysaccharide	Proprietary	In vitro tests did not show mutagenic effects. In vivo tests did not show mutagenic effects. (similar substances)

Substances	CAS Number	Carcinogenic Effects
Polysaccharide	Proprietary	Did not show carcinogenic effects in animal experiments (similar substances)

Substances	CAS Number	Reproductive toxicity
Polysaccharide	Proprietary	Animal testing did not show any effects on fertility. Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Polysaccharide	Proprietary	No information available

Substances	CAS Number	STOT - repeated exposure
Polysaccharide	Proprietary	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Polysaccharide	Proprietary	Not applicable

12. Ecological Information

12.1. Toxicity

Ecotoxicity effects
Product is not classified as hazardous to the environment.

Product Ecotoxicity Data
No data available

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Polysaccharide	Proprietary	No information available	TLM96: 10000 ppm (Oncorhynchus mykiss) LC50 (96h) 20000 mg/L (Oncorhynchus mykiss)	No information available	EC50 (48h) 1000-3300 mg/L (Crangon crangon)

12.2. Persistence and degradability

Readily biodegradable

Substances	CAS Number	Persistence and Degradability
Polysaccharide	Proprietary	No information available

12.3. Bioaccumulative potential

Does not bioaccumulate.

Substances	CAS Number	Log Pow
Polysaccharide	Proprietary	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Polysaccharide	Proprietary	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
Polysaccharide	Proprietary	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Polysaccharide	Proprietary	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
Polysaccharide	Proprietary	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Polysaccharide	Proprietary	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 One or more components listed.

PA Right-to-Know Law Does not apply.

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

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: 19-May-2016

Reason for Revision SDS sections updated:
1

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
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EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

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End of Safety Data Sheet

HALLIBURTON

SAFETY DATA SHEET

Product Trade Name: **SODA ASH**

Revision Date: 24-Apr-2017 **Revision Number:** 42

1. Identification

1.1. Product Identifier

Product Trade Name: SODA ASH
Synonyms None
Chemical Family: Carbonate
Internal ID Code HM001822

1.2 Recommended use and restrictions on use

Application: Buffer
Uses advised against No information available

1.3 Manufacturer's Name and Contact Details

Manufacturer/Supplier

Halliburton Energy Services, Inc.
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Telephone: 1-281-871-6107

Halliburton Energy Services, Inc.
645 - 7th Ave SW Suite 1800
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
Global Incident Response Access Code: 334305
Contract Number: 14012

2. Hazards Identification

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

Serious Eye Damage/Irritation	Category 2 - H319

2.2. Label Elements

Hazard Pictograms

Signal Word: Warning

Hazard Statements H319 - Causes serious eye irritation

Precautionary Statements

Prevention P264 - Wash face, hands and any exposed skin thoroughly after handling
P280 - Wear eye protection/face protection

Response P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention

Storage None

Disposal None

2.3 Hazards not otherwise classified

None known

3. Composition/information on Ingredients

Substances	CAS Number	PERCENT (w/w)	GHS Classification - US
Sodium carbonate	497-19-8	60 - 100%	Eye Irrit. 2 (H319)

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

4. First Aid Measures

4.1. Description of first aid measures

Inhalation If inhaled, remove from area to fresh air. Get medical attention if respiratory irritation develops or if breathing becomes difficult.

Eyes In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Skin Wash with soap and water. Get medical attention if irritation persists.

Ingestion Do NOT induce vomiting. Give nothing by mouth. Obtain immediate medical attention.

4.2 Most important symptoms/effects, acute and delayed

Causes eye irritation

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.

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. Avoid creating and breathing dust. Avoid contact with skin, eyes and clothing. 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

Scoop up and remove.

7. Handling and storage

7.1. Precautions for safe handling

Handling Precautions
Avoid contact with eyes, skin, or clothing. Avoid creating or inhaling dust. Ensure adequate ventilation. Wash hands after use. Launder contaminated clothing before reuse. 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 acids. Store in a cool, dry location. Product has a shelf life of 60 months.

8. Exposure Controls/Personal Protection

8.1 Occupational Exposure Limits

Substances	CAS Number	OSHA PEL-TWA	ACGIH TLV-TWA
Sodium carbonate	497-19-8	Not applicable	Not applicable

8.2 Appropriate engineering controls

Engineering Controls Use in a well ventilated area. Localized ventilation should be used to control dust levels.

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 If engineering controls and work practices cannot keep exposure below occupational exposure limits or if exposure is unknown, wear a NIOSH certified, European Standard EN 149, AS/NZS 1715:2009, or equivalent respirator when using this product. Selection of and instruction on using all personal protective

equipment, including respirators, should be performed by an Industrial Hygienist or other qualified professional.

Hand Protection	Normal work gloves.
Skin Protection	Normal work coveralls.
Eye Protection	Dust proof goggles.
Other Precautions	None known.

9. Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Physical State:	Powder	**Color**	White
Odor:	Odorless	**Odor Threshold:**	No information available

Property Remarks/ - Method	Values
pH:	11.5
Freezing Point / Range	No data available
Melting Point / Range	851 °C
Boiling Point / Range	No data available
Flash Point	No data available
Flammability (solid, gas)	No data available
Upper flammability limit	No data available
Lower flammability limit	No data available
Evaporation rate	No data available
Vapor Pressure	No data available
Vapor Density	No data available
Specific Gravity	2.5
Water Solubility	Partly soluble
Solubility in other solvents	No data available
Partition coefficient: n-octanol/water	No data available
Autoignition Temperature	No data available
Decomposition Temperature	No data available
Viscosity	No data available
Explosive Properties	No information available
Oxidizing Properties	No information available

9.2. Other information

Molecular Weight	105.99 g/mole
VOC Content (%)	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 acids.

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 Causes eye irritation.

Skin Contact Not irritating to skin in rabbits.

Ingestion Irritation of the mouth, throat, and stomach.

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
Sodium carbonate	497-19-8	4090 mg/kg (Rat) 2800 mg/kg (Rat)	2210 mg/kg (Mouse) > 2000 mg/kg (Rabbit)	2.3 mg/L (Rat) 2h

Substances	CAS Number	Skin corrosion/irritation
Sodium carbonate	497-19-8	Non-irritating to the skin

Substances	CAS Number	Serious eye damage/irritation
Sodium carbonate	497-19-8	Irritating to eyes

Substances	CAS Number	Skin Sensitization
Sodium carbonate	497-19-8	Not classified

Substances	CAS Number	Respiratory Sensitization
Sodium carbonate	497-19-8	No information available

Substances	CAS Number	Mutagenic Effects
Sodium carbonate	497-19-8	In vivo tests did not show mutagenic effects.

Substances	CAS Number	Carcinogenic Effects
Sodium carbonate	497-19-8	No information available

Substances	CAS Number	Reproductive toxicity
Sodium carbonate	497-19-8	Did not show teratogenic effects in animal experiments.

Substances	CAS Number	STOT - single exposure
Sodium carbonate	497-19-8	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	STOT - repeated exposure
Sodium carbonate	497-19-8	No significant toxicity observed in animal studies at concentration requiring classification.

Substances	CAS Number	Aspiration hazard
Sodium carbonate	497-19-8	Not applicable

12. Ecological Information

12.1. Toxicity

Substance Ecotoxicity Data

Substances	CAS Number	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Toxicity to Invertebrates
Sodium carbonate	497-19-8	EC50 242 mg/L (Nitzschia)	TLM24 385 mg/L (Lepomis macrochirus) LC50 310-1220 mg/L (Pimephales promelas) LC50 (96h) 300 mg/L (Lepomis macrochirus)	No information available	EC50 265 mg/L (Daphnia magna) EC50 (48h) 200 – 227 mg/L (Ceriodaphnia sp.)

12.2. Persistence and degradability

Substances	CAS Number	Persistence and Degradability
Sodium carbonate	497-19-8	The methods for determining biodegradability are not applicable to inorganic substances.

12.3. Bioaccumulative potential

Substances	CAS Number	Log Pow
Sodium carbonate	497-19-8	No information available

12.4. Mobility in soil

Substances	CAS Number	Mobility
Sodium carbonate	497-19-8	No information available

12.5 Other adverse effects

No information available

13. Disposal Considerations

13.1. Waste treatment methods

Disposal methods Bury in a licensed landfill according to 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
Sodium carbonate	497-19-8	Not applicable

EPA SARA Title III Extremely Hazardous Substances

Substances	CAS Number	EPA SARA Title III Extremely Hazardous Substances
Sodium carbonate	497-19-8	Not applicable

EPA SARA (311,312) Hazard Class
Acute Health Hazard

EPA SARA (313) Chemicals

Substances	CAS Number	Toxic Release Inventory (TRI) - Group I	Toxic Release Inventory (TRI) - Group II
Sodium carbonate	497-19-8	Not applicable	Not applicable

EPA CERCLA/Superfund Reportable Spill Quantity

Substances	CAS Number	CERCLA RQ
Sodium carbonate	497-19-8	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

Substances	CAS Number	California Proposition 65
Sodium carbonate	497-19-8	Not applicable

U.S. State Right-to-Know Regulations

Substances	CAS Number	MA Right-to-Know Law	NJ Right-to-Know Law	PA Right-to-Know Law
Sodium carbonate	497-19-8	Not applicable	Not applicable	Not applicable

NFPA Ratings: Health 2, Flammability 0, Reactivity 0
HMIS Ratings: Health 2, 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: 24-Apr-2017

Reason for Revision SDS sections updated:
2

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
d - day
EC50 – Effective Concentration 50%
ErC50 – Effective Concentration growth rate 50%
h - hour
LC50 – Lethal Concentration 50%
LD50 – Lethal Dose 50%
LL50 – Lethal Loading 50%
mg/kg – milligram/kilogram
mg/L – milligram/liter
mg/m^3 - milligram/cubic meter
mm - millimeter
mmHg - millimeter mercury
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
w/w - weight/weight

Key literature references and sources for data
www.ChemADVISOR.com/

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End of Safety Data Sheet

Typical Air-Foam Mixing Plan

Per 100 Gallons Make Up Water

.4 lb. Soda Ash (~ 1/4 qt. cup)

1 gallon QUIK-FOAM (1% by volume); stir in with a shovel.

This is a starting point and you can adjust AQF2 or QUIK-FOAM depending on how foam comes out. We want a shaving cream consistency.

Estimated R-25 Air-Foam Mixing Plan

Holt will mix foam as noted above in a 140 to 300-gallon mix tank and inject into air stream of 1300 CFM with water at a rate of 5-25 gallons per minute depending on hole conditions.

Typical Stiff Foam Mixing Plan

Per 100 Gallons Make Up Water

.4 lb. Soda Ash (~ 1/4 qt. cup)

1.2 quarts EZ-MUD PLUS

1 gallon AQF2/QUIK-FOAM (1% by volume)

1,000 Gallon Mixing Tank

4 lbs. Soda Ash (2 Qts)

6 quarts EZ-MUD PLUS (Viscosity no more than 50 seconds/qt., target 40 seconds/qt.)

300 Gallon Injection Tanks

Transfer over EZ-MUD PLUS mixture from mixing tank and add 3 gallons AQF2/QUIK-FOAM. Stir in with shovel.

This is a starting point and you can adjust EZ-MUD up or down depending on viscosity. Also on QUIK-FOAM depending on how foam comes out. We want a shaving cream consistency.

Estimated R-25 Stiff-Foam Mixing Plan

Holt does not anticipate the use of stiff foam unless significant down hole issues such as stuck equipment etc. If used we would mix foam as noted above in a 140 to 300-gallon mix tank and inject into air stream of 1300 CFM with water at a rate of 5-25 gallons per minute depending on hole conditions.

Typical Mud Rotary Mixing Plan

Per 100 Gallons Make Up Water

.4 lb. Soda Ash (~ 1/4 qt. cup)

17 lbs. QUIK-GEL

1.2 lbs. QUIK-TROL GOLD or QUIK-TROL GOLD LV

.5 lb. NXS-LUBE (~1/2 qt. cup) if needed for torque reduction in milling operations

This is a starting point and additives can be adjusted up or down depending on drilling and hole cleaning characteristics.

See attached list of other potential additives and recommended application rates

Estimated R-25 Mud Rotary Mixing Plan

Holt does not anticipate the use of drilling muds or mud rotary except only if air foam circulation is unsuccessful, or complete over drilling of the well is necessary. Holt would use a 7-10,000-gallon self-contained mud system to mix as noted above and triplex down hole mud pump to circulate at a rate to maintain 80 feet per minute of up hole velocity for optimum cleaning. During loss circulation events N-Seal may be mixed in the mud to inhibit loss circulation with normal mix rates or as a pill in significant loss zones. The rate of mixture is for both options is outlined in the attached product data sheet.

Enclosure 5

NMED Approval, Drilling Fluid
Additive Use Options for Well R-25 Westbay
Sampling System Removal, Los Alamos National Laboratory

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6313
Phone (505) 476-6000 Fax (505) 476-6030
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Michelle Lujan Grisham
Governor

Howie C. Morales
Lt. Governor

James C. Kenney
Cabinet Secretary

Jennifer J. Pruett
Deputy Secretary

APR 0 7 2020

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Arturo Q. Duran
Designated Agency Manager
Environmental Management
U.S. Department of Energy
Los Alamos Field Office
P.O. Box 1663 MS M984
Los Alamos, NM 87544

RE: APPROVAL
DRILLING FLUID ADDITIVE USE OPTIONS FOR WELL R-25
WESTBAY SAMPLING SYSTEM REMOVAL
LOS ALAMOS NATIONAL LABORATORY
EPA ID #NM0890010515
HWB-LANL-20-016

Dear Mr. Duran:

The New Mexico Environment Department (NMED) has received the United States Department of Energy (DOE) *Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal* (Request), dated March 2020, and referenced by EMLA-2020-1274-02-001. The document was received March 17, 2020.

DOE has requested approval from NMED to use a variety of drilling fluids to assist with the recovery of the Westbay sampling system from well R-25 as part of the process of plugging and abandoning the well. NMED and DOE discussed the use of drilling fluids during a January 28, 2020 meeting. NMED hereby approves the Request.

The type and use of drilling fluids is limited to what is described in the Request. Details describing the use of drilling fluids and recorded pressure responses at nearby wells R-25b, CdV-16-4ip, and CdV-16-1i must be reported in the monthly project status updates and quarterly reports required by NMED's *Approval, Request for Extension of Fiscal Year 2020 Appendix 8 Milestone #6, Westbay Well Plugging and Abandonment Completion Report for R-25* dated March 18, 2020.

If you have any questions regarding this correspondence, please contact Neelam Dhawan (505) 476-6042.

Sincerely,

Neelam Dhawan

for Kevin Pierard
Chief
Hazardous Waste Bureau

Cc w/out Attachment:
N. Dhawan, NMED HWB
C. Krambis, NMED HWB
M. Jojola, NMED HWB
L. King, US EPA Region 6
M. Hunter, NMED GWQB
C. Rodriguez, EM-LA
H. Shen, EM-LA
R. Martinez, San Ildefonso Pueblo, NM
D. Chavarria, Santa Clara Pueblo, NM
C. Catechis, NMED-DOE-OB
S. Yanicak, NMED-DOE-OB
E. Day, N3B
M. Everett, N3B
E. Lowes, N3B
C. Maupin, N3B
W. Alexander, N3B
P. Maestas, N3B
emla.docs@em.doe.gov

File: LANL 2000 and Reading, Approval R-25 Drilling Fluid Additives

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
DISTRICT VI - SANTA FE

John R. D'Antonio Jr., P.E.
State Engineer

BATAAN MEMORIAL BUILDING
POST OFFICE BOX 25102
SANTA FE, NEW MEXICO 87504-5102
(505) 827-6120
FAX: (505) 827-6682

June 19, 2020

Los Alamos National Laboratory
Attn: Mark Everett
N3B 600 6th St.
Los Alamos, NM 87544

Re: Plugging Plan of Operations for RG-98113 (R-25)

Greetings:

The Office of the Engineer is returning a favorable approval with specific plugging conditions and has accepted the amendeded Well Plugging Plan of Operations submitted March 13, 2019, with amendments submitted May 28, 2020, for filing for the following wells:

- RG-98113 (R-25)

Please return a completed Well Plugging Report that itemizes the actual abandonment process, materials used and total volume of material used within 30 days after completion of well plugging.

Please do not hesitate to contact our office with any questions regarding these plans.

Sincerely,

Lorraine A. Garcia
Office of State Engineer
Water Rights Division District VI

Enclosure
cc: file

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER

John R. D'Antonio Jr., P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations Conditions of Approval for RG-98113

Los Alamos National Laboratory (LANL) has identified one (1) well that requires decommissioning. An initial Well Plugging Plan of Operations received March 13, 2019, and approved July 15, 2019, indicates that this is a Westbay packer system-equipped, multi-zone monitor well, which is no longer needed. While conducting the initial approved Plugging Plan of Operations, issues were encountered with the casing which caused difficulties in the removal of the Westbay system. After contacting OSE an amended Plugging Plan of Operations was submitted by May 28, 2020.

The well is owned by LANL, and is located on lands owned by the applicant. In documents submitted by LANL this well is referred to as R-25. The Office of the State Engineer has no historical records for this well, nor a prior OSE file number. Upon the submission of this application an OSE file number, RG-98113, was assigned to the well for the purpose of identification and tracking.

The well was constructed with a total of nine separate screened intervals, which were kept segregated during use via an internal Westbay monitoring system. The full decommissioning of this well will include complete removal of the internal Westbay equipment, perforating and cementing the majority of blank casing in the well, and internal sand-backfilling of the well interval at the depth of the uppermost well screen. The approval of this plan will allow for the casing to be left in place. Furthermore, the OSE acknowledges that remediation of the bottom of the well could cause more damage, and will not require the applicant to plug below Screen 9, leaving the packer in place. The OSE also recognizes the Work Plan approved for this well by the New Mexico Environment Department (NMED), January 11, 2013 and the letter submitted March 17, 2020 to NMED outlining the amendments original plan (see attachments).

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data (LAT/LONG WGS84).

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude N	Longitude W
RG-98113	5	1934	35°50'53.930284"	106°20'06.642553"

Specific Plugging Conditions of Approval for Well RG-98113 for Los Alamos National Laboratory within Los Alamos County, New Mexico

1. Water well drilling and well drilling activities, including well plugging, are regulated under 19.27.4 NMAC, which requires any person engaged in the business of well drilling within New Mexico to obtain a Well Driller License issued by the New Mexico Office of the State Engineer (NMOSE). Therefore, the firm of a New Mexico licensed Well Driller shall perform the well plugging.

2. Theoretical volume of sealant required for abandonment of the nominal 5-inch (inside) diameter well is approximately 1.0 gallons per foot. Total theoretical volume of cement required to fill the well is tabulated

below. No cement additives have been requested, so all cement slurries will contain no more than 6 gallons of water per 94 pound sack of cement. Total minimum amount of required sealant will be based on the sounding depth inside casing.

Well Name	Inside Diameter (Inches)	Total Depth, less sandpack interval (feet)	Volume (Cubic Feet)	Volume (Gallons)
RG-98113	5	1882	256.61	1920
Total:			256.61	1920

3. Staged perforating and plugging of the multi-screened casing is proposed. Prior to placement of cement intervals within the casing, the well shall be sounded to confirm deleterious fill has not accumulated within the well that may affect effective placement of any segment of the sealant column. Appropriate measures shall be taken as necessary to remove excessive fill from the well before proceeding with subsequent cementing.

4. The Westbay packer system will be fully removed prior to decommissioning of the well.

5. The perforation schedule provided in the NMED Work Plan is approved. Any modifications to the perforation schedule must be submitted to OSE for review, prior to decommissioning.

6. The interval cementing as detailed in the NMED Work Plan is approved for use. Any modifications to the interval cementing plan must be approved by OSE prior to decommissioning.

7. Should the NMED, or another regulatory agency sharing jurisdiction of the project authorize, or by regulation require a more stringent well plugging procedure than herein acknowledged, the more-stringent procedure should be followed. This, in part, includes provisions regarding pre-authorization to proceed, contaminant remediation, inspection, pulling/perforating of casing, or prohibition of free discharge of any fluid from the borehole during or related to the plugging process.

   The NMOSE does not have documentation that surface or subsurface contamination exists in the area, and takes at face value that the applicant's plugging intentions address known or surmised concerns regarding potential contaminant pathways. The plugging method proposed addresses the NMOSE's concern that overt comingling of aquifers or draining of surface water to aquifers is prevented by perforating and plugging the well casing.

   The NMOSE concurs with the NMED request to sand-fill the approximate 770' to 720' bgl interval of the well to best avoid potential for affecting viability of proximal wells due to cement migration, with proposed perforation intervals, and with the general procedure laid out in materials submitted for the complete decommissioning of this well.

8. NMOSE witnessing of the plugging will not be required, but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal work hours by calling the District 6 NMOSE Office at 505-827-6120, at least 48-hours in advance. NMOSE inspection will occur dependant on personnel availability.

9. A Well Plugging Record (available at: http://www.ose.state.nm.us/STST/Forms/WD-11.pdf) itemizing actual decommissioning process and materials used shall be filed with the State Engineer (NMOSE, P.O. Box 25102 - 407 Galisteo Street - Room 102, Santa Fe, NM 87504-5102), within 30 days after completion of well plugging.

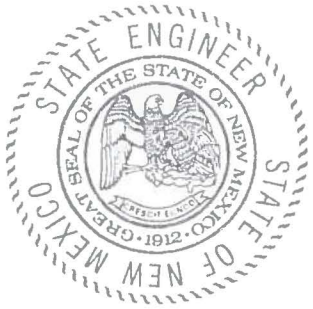
The amended NMOSE Well Plugging Plan of Operation, dated March 13, 2019 is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 10th day of June, 2020

JOHN R. D'ANTONIO JR., P.E.
NEW MEXICO STATE ENGINEER

By: LA Garcia

Lorraine A. Garcia
Water Resources Specialist
NMOSE District VI- Santa Fe



N3B-Los Alamos
1200 Trinity Drive, Suite 150
Los Alamos, New Mexico 87544
(505) 257-7690

Environmental Management
Los Alamos Field Office
P.O. Box 1663, MS M984
Los Alamos, New Mexico 87545
(505) 257-7950/FAX (505) 606-2132

Date: May 28, 2020
Refer To: N3B-2020-0181

Ms. Lorraine Garcia
Water Rights Division District VI
Office of the State Engineer
Bataan Memorial Building
407 Galisteo Street
Santa Fe, NM 87504-5102

Subject: Revised Plugging Plan of Operations for RG-98113 (R-25)

Dear Ms. Garcia:

The U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) held a teleconference with you and Anthony Meluso on April 30, 2020, to discuss plugging and abandonment operations at well RG-98113 (R-25). This letter is a follow-up to that meeting, providing the enclosed revised supplemental information for the Plugging Plan of Operations (hereafter, the plan). The original plan was submitted to the New Mexico Office of the State Engineer (NMOSE) on March 13, 2019, and NMOSE approved the plan in a letter dated July 15, 2019 (Enclosure 1). The revised plan provides a description of the methods and fluids that will be used to extract the Westbay sampling system from the well (Enclosures 2 and 3). For details on drilling fluid additives, please refer to the enclosed letters from EM-LA to the New Mexico Environment Department (NMED) dated March 17, 2020, requesting approval of drilling fluid additive options (Enclosure 4), and the NMED approval of these options, dated April 7, 2020 (Enclosure 5). The revised plan also clarifies the intent to leave the 5-in. stainless steel well casing in place during plugging and abandonment. The revisions to the plan are provided in two formats—with changes tracked (Enclosure 2) and changes accepted (Enclosure 3)—to make the updates to the plan readily apparent. Please respond with your approval of the revised plan at your earliest convenience.

Pamela Maestas, N3B
Christian Maupin, N3B
John McCord, N3B
Glenn Morgan, N3B
Bruce Robinson, N3B
Bradley Smith, N3B
Robert Wilcox, N3B
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NEW MEXICO
ENVIRONMENT DEPARTMENT

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SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

BUTCH TONGATE
Deputy Secretary

THOMAS SKIBITSKI
Acting Director
Resource Protection Division

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

January 11, 2013

Peter Maggiore
Assistant Manager, Env. Projects Office
Los Alamos Site Office, DOE
3747 West Jemez Rd, MS A316
Los Alamos, NM 87544

Jeffrey D. Mousseau
Associate Director, Environmental Programs
Los Alamos National Security, L.L.C.
P.O. Box 1663, MS M991
Los Alamos, NM 87545

2013 MAR 13 AM 7:03

RE: APPROVAL WITH MODIFICATION
WORK PLAN TO PLUG AND ABANDON WELL R-25
LOS ALAMOS NATIONAL LABORATORY
EPA ID#NM0890010515
HWB-LANL-12-022

Dear Messrs Maggiore and Mousseau:

The New Mexico Environment Department (NMED) is in receipt of the United States Department of Energy (DOE) and the Los Alamos National Security, L.L.C.'s (collectively, the Permittees) document entitled *Work Plan to Plug and Abandon Well R-25* (Plan) dated December 13, 2012 and referenced by EP2012-0256. NMED has reviewed the Plan and hereby issues this approval with the following modification.

1. The Permittees propose to pressure grout the entire R-25 well casing with neat cement, including screens 1 to 9. R-25 screen 1 straddles the upper-deep perched intermediate zone currently being monitored at wells R-25b, CdV-16-1(i), and CdV-16-4ip. The lateral distances from R-25 to the wells R-25b, CdV-16-1(i), and CdV-16-4ip are approximately 25 feet (ft) (west), 370 ft (north) and 450 ft (east), respectively. Because of the close proximity of these well screens to R-25 screen 1, there is a potential for their impairment as a result of migration of cement from screen 1. R-25b, located only 25 ft away, will most likely be affected if screen 1 at R-25 is perforated and pressure grouted with cement as described in the Plan. Instead of setting cement at screen 1, the Permittees must install a sand plug (e.g.,

Work Plan to Plug and Abandon Well R-25

Primary Purpose	Regional aquifer well R-25 is being plugged and abandoned to meet a requirement set forth in the New Mexico Environment Department (NMED) Hazardous Waste Bureau's approval with modifications letter for the Technical Area 16 Network Evaluation and Recommendations report (NMED 2012, 520747). This work plan summarizes the plugging and abandonment methods Los Alamos National Laboratory (LANL) proposes for well R-25, located on the south rim of Cañon de Valle within Technical Area 16 (TA-16), near LANL's southwestern boundary. Well abandonment will be consistent with the requirements in Section X.D, Well Abandonment, of the Compliance Order on Consent (the Consent Order) and New Mexico Office of the State Engineer (NMOSE) regulations. A plugging plan will be submitted to NMOSE for approval before well abandonment, and a plugging record will be submitted to NMED after work is completed.
Construction	The R-25 borehole was advanced to a depth of 1942 ft and completed as a nine-screen stainless-steel monitoring well (Broxton et al. 2002, 072640). The as-built well-completion drawing for well R-25 is shown in Figure 1. The well was drilled from 1999 to 2000 by Dynatec Environmental Drilling Company using a Foremost dual rotary (DR-24) drill rig. The well was constructed of schedule 40 304 stainless-steel riser with 10-slot rod-based wire-wrapped screens. The annular space outside each screen was filled with 20/40 silica sand. An interval of 30/70 sand was generally placed above and below each screen's sand pack, except where tremie difficulties were encountered. Each screened interval was isolated from the others with bentonite seals in the annular space between the outer casing and borehole wall. The annular seals were a 50:50 mix by weight of 20/40 sand and granular bentonite and were placed via the tremie method. All drill casing was removed from the borehole during well construction, except for a 70-ft section of 13 3/8-in.-diameter drill casing that was abandoned in place from 508 to 578 ft below ground surface (bgs). The tremie pipe was also abandoned in place in the annular space of the well during construction activities; the geophysics log could not accurately locate the tremie pipe, but drilling notes document the loss occurred during backfilling above screen 4. Screens 3 and 9 were damaged during well construction. Screen 3 was repaired and screen 9 was abandoned, except for use as a water-level collection point. Details of the disposition are shown in Figure 1.
Abandonment Methods	Abandonment activities will include steps to remove the Westbay casing string, packers (26), and ports (43) from the stainless-steel well casing, followed by selective perforation of the casing intervals above and below screens 1 through 8 (Table 1). The proposed intervals are presented in Figure 1. Following borehole video logging to ensure the location and quality of the casing perforations, the well will be pressure grouted from total depth to surface with a neat cement grout using a packer or grout shoe. The grout will be placed in lifts, with only one to two screened intervals grouted per lift.
Surface Completion	The existing concrete pad will be left intact and the well and protective casing cut flush with the top of the existing well pad. Concrete will be placed from 2 ft bgs to the top of pad elevation to complete the backfilling of the well. A surveyed brass cap already exists in the 5- × 10-ft pad that is to be left in place.
Waste Disposal	A waste characterization strategy form (WCSF) will be prepared to guide disposal of any wastes generated during abandonment. Materials removed from the borehole will be reused or recycled, if possible. Nonrecyclable materials will be disposed of in accordance with the WCSF.

EMID-700806

DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

MAR 17 2020

EMLA-2020-1274-02-001

Mr. Kevin Pierard
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Drilling Fluid Additive Use Options for Well R-25 Westbay Sampling System Removal

Dear Mr. Pierard:

As a follow-up to the discussion on the recovery methods for monitoring well R-25 during a meeting with the New Mexico Environment Department Hazardous Waste Bureau (NMED-HWB) staff on January 28, 2020, the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) is providing information on milling and lifting procedures and fluids/products that may need to be used in the removal of the Westbay system from R-25. EM-LA has also identified wells near R-25 that will be monitored for impacts related to fluid/product use.

As discussed, the R-25 Westbay system consists of alternating lengths of polyvinyl chloride (PVC) and stainless-steel pipe for a total length of 1835 ft, of which recovery efforts on the remaining 681 ft continue. EM-LA expects that the stainless-steel sections may be successfully grappled and pulled to the surface (fished). However, previous experience indicates the PVC sections may shatter. This shattered debris has to be removed from the well or it will clog the area immediately above the Westbay system, preventing further extraction. Current methods to remove the PVC pieces have not been successful; therefore, going forward with the PVC removal efforts, the primary milling and lifting method will be air rotary with the possibility of mud rotary (see options 1–3 below).

Ideally, the milling and lifting of the PVC could be accomplished with a mixture of air and water only. However, within the R-25 well column there is approximately 1100 linear feet of open space above the water table. Attempts to air-lift debris over this vertical extent could result in the debris sorting in the ascending air stream or coalescing at a particular depth on its ascent to the surface, rather than reaching the surface. As soon as the air is turned off, the debris would settle back in the annular space, frustrating efforts to remove the remaining system.

Therefore, as discussed, the plan is to use drilling fluid additives to facilitate the removal of debris by increasing the up-hole viscosity and lubricity of the introduced air stream. The efficacy of the various remedies proposed to remove the remaining Westbay system from R-25 cannot be known in advance with certainty; therefore, a graded approach, or options, to the use of multiple fluid strategies will be implemented in an attempt to minimize the use of drilling fluid additives. Options for drilling fluid additives use and proposed nearby well monitoring are provided below.

Option 3 – Mud Rotary

In the unlikely case where the air rotary method proves ineffective, it may be necessary to convert to mud rotary techniques. Should this occur, a 7000–10,000 gal. self-contained mud system equipped with shakers, cleaners, mixer, and a triplex pump will be used for management of the associated drilling fluids. If the mud system is needed, it will be placed upon secondary containment and all liquid waste will be contained for final characterization and off-site waste disposal. The additives used in the mix will include 0.4 lb SODA ASH, 17 lb Baroid QUIK-GEL, and 1.2 lb Baroid QUIK-TROL GOLD or QUIK-TROL GOLD LV. If additional lubrication is needed for torque reduction, 0.5 lb Baroid NXS-LUBE could be added to every 100 gal. of water.

EM-LA envisions that because of the extreme hydrostatic head (1100 ft), N-SEAL (spun glass) might be added to blind off the interior of the screens to minimize fluid loss to the formation.

The safety data sheets and mixing plans provided by Baroid and the drilling contractor, Holt Services, Inc., are enclosed. Baroid has confirmed that none of the products proposed for use on this project contain any per- or polyfluoroalkyl substances (PFAS).

Monitoring of Nearby Wells

During air-rotary operations, the high velocity and low density of the ascending airflow will likely cause water to be drawn inward (Venturi effect) from the formation through the screens, rather than moving outward into the aquifer. Therefore, EM-LA does not expect adverse impact to adjacent wells from air-rotary fluid use associated with milling operations. Additionally, the use of N-SEAL as a lost circulation material (if mud-rotary methods are employed), will minimize fluid loss from the well into the formation. However, as an added precaution, EM-LA proposes the following actions to assess potential impacts to nearby wells.

The transducers that currently monitor the water levels in nearby wells R-25b, CdV-16-4ip, and CdV-16-1i will be reset to collect water-level measurements every minute. If pressure responses are detected in these wells, EM-LA will carefully review field parameter and analytical data collected as part of the Interim Facility-Wide Groundwater Monitoring Plan for signs of reducing conditions associated with operations at R-25.

If reducing conditions are observed following milling operations at R-25, EM-LA will evaluate and implement rehabilitation options (e.g., redevelopment) in the affected wells, as appropriate.

Hai Shen, EM-LA
Lee Bishop, EM-LA
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Public Reading Room (EPRR)
PRS Website

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
District VI Office, Santa Fe, NM

MIKE A. HAMMAN, P.E.
STATE ENGINEER

PO Box 25102
Santa Fe, N.M
87504-5102
(505) 827-6120

February 7, 2022

Los Alamos National Laboratory
Attn: Christian Maupin, Agent
600 6th Street
Los Alamos, NM 87544

Re: Request for Amendment to Approved [Amended] Well Plugging Plan of Operation Conditions of Approval for RG-98113

Greetings:

The Office of the State Engineer has denied your [draft] proposed amendment to the Revised Plugging and Abandonment of [RG-98113] R-25.

Please find the approved amended well plugging procedure and Conditions of Approval for the revised Well Plugging Plan of Operations for RG-98113 which hereby supersede all previous approvals for the Well Plugging Plan of Operations, approved July 15, 2019, and approved amendment June 19, 2020. Please note Condition of Approval No. 19 requiring a timeline of events to be submitted to the NMOSE within 30 days of receipt of this approval.

Per Condition of Approval No. 18 herein, no deviation from this approved amended Well Plugging Plan of Operations shall be allowed. Additionally, Condition of Approval No. 17 specifically requires all decommissioning activities for RG-98113 shall be witnessed onsite by NMOSE or its authorized agent. LANL/N3B shall contact NMOSE or its authorized agent within 72 hours of all decommissioning activities to schedule witnessing.

Please review all the Conditions of Approval for the approved OSE Revised Well Plugging Plan of Operations for RG-98113 as they require requires further action on your part.

Pursuant to Section 72-2-16, NMSA 1978, if you are aggrieved by this decision, you may submit a request to this office asking for a hearing to be held. The request must be in writing and must be submitted no later than 30 days after receipt of this letter. Failure to request a hearing by such time will waive your right to request a hearing on this decision. In accordance with Subsection B of 19.25.2.10 NMAC, you will be required to pay a hearing fee when the hearing is announced

Cc: File

by the OSE Hearings Unit. The State Engineer shall determine the amount of the deposit. Aggrieval of the permit or any of the conditions of approval suspends the permit.

Contact me with any questions or comments.

Sincerely,

Christopher M. Thornburg
Upper Pecos Basin Lead
Water Rights Division, Santa Fe
(505) 827-6120

Conditions of Approval and Approved Procedure for Well Decommission

Location: Los Alamos Nation Laboratory, New Mexico.
Approximate well coordinates: See tabulated data (LAT/LONG WGS84).

Well Name	Inside diameter (inches)	Total depth (feet)	Static Water Level	Easting (X)	Northing (Y)
RG-98113	5		0.5 bgs	35°59'58.3"	105°58'56.9"

The following OSE Procedure and Conditions of Approval for this prescribed remedy are approved for use:

OSE Approved Procedure:

1. A complete well video log shall be run from ground surface to total depth of the well. The video log shall be witnessed by the NMOSE or its authorized agent. The well video log shall have an operable depth counter. The depth of log shall be visible on the video and shall be recorded throughout the entire well video log run. A copy (on either a jump drive or DVD) of the entire well video log shall be made available to the NMOSE upon completion of said log.

2. A neat cement plug shall be placed between 1,252 bgs and 1,220 bgs. The plug shall not contain any additives such as sand or bentonite. The tremie shall be placed as close 1,252 bgs as possible and shall remain under the column of cement throughout the placement process. Upon completion of placement, the cement plug shall be allowed to cure no less than 48-hours and no further plugging activities shall be allowed during this wait time.

3. The well casing shall be perforated between 1,220 bgs and 1,184 bgs. No further perforating shall be allowed at this point.

4. A packer or some other means of squeezing cement, approved by the OSE, shall be placed in the hole between 1,135 bgs and 1,174 bgs. A pressure test shall be performed to demonstrate the pressure needed to effectively squeeze the sealant into the formation. A cement plug shall be squeezed into place between 1,220 bgs and approximately 1,184 bgs. All pressures and volumes shall be recorded and submitted with the well plugging record. Cement shall be allowed to cure no less than 48-hours after this step and prior to commencement of further decommissioning activities.

5. Upon completion of the 48-hour wait period, the total depth of the lower seal interval shall be tagged and recorded on the Well Plugging Record.

6. Perforate no less than 4 perforations per foot throughout the entirety of remaining well casing to approximately 55-feet bgs.

7. The tremie shall be placed as close to the top of the lower sealed interval as possible. Neat Type I/II cement grout containing no more than 6 gallons of fresh water per 94-pound sack of Portland cement shall be pumped from the total depth to surface in one continuous lift. The cement shall be placed in one continuous lift and the tremie pipe shall not be pulled above the top of the cementing column, at any time, during placement. No additives shall be permitted for this cement plug.

Conditions of Approval for the procedure as prescribed above:

1. **The proposed [draft] remedy (Request for Variance) and amendment to the OSE approved Well Plugging Plan of Operations for RG-98113, as proposed by LANL and its agent N3B, is denied for use.**

2. Los Alamos National Laboratory shall be held responsible for failure to properly execute the plan as it is prescribed herein, to the maximum extent of over-drilling the entire well and removing all material to properly execute a seal in a manner that will protect the regional aquifer. There will be **no exceptions**.

3. Water well drilling and well drilling activities, including well plugging, are regulated under 19.27.4 NMAC, which requires any person engaged in the business of well drilling within New Mexico to obtain a Well Driller License issued by the New Mexico Office of the State Engineer (NMOSE). Therefore, the firm of a New Mexico licensed Well Driller shall perform the well plugging.

4. A complete well video log shall be run from ground surface to total depth of the open hole portion of the well. The video log shall be witnessed by the NMOSE or its authorized agent. The well video log shall have an operable depth counter. The depth counter shall be visible on the video and shall be operable, accurate and recorded recorded throughout the entire well video log run. A copy (on either a jump drive or DVD) of the entire well video log shall be made available to the NMOSE upon completion of said log.

    1) Should the well log reflect different well conditions than were previously stated by LANL/N3B, the NMOSE reserves the right to amend this plan and/or provide additional information or direction for well decommissioning.

5. The total depth of the well shall be tagged by the Driller to record actual depth of the well prior to decommissioning. The actual depth of the portion of the well being plugged shall be recorded on the Plugging Record prior to submittal.

6. Type I/II neat cement plug containing no more than 6.0 gallons of fresh water per 94-pound sack.
    i. No additives may be used.
    ii. Cement will be allowed to set for no less than 48 hours prior to the commencement of any further plugging activities upon completion of step #1 and step #3 of the approved procedure.

7. Four (4) perforations in the 5-inch casing shall be made placed at intervals not to exceed one (1) linear foot and shall be at least 2.5-inches in length per perforation. The prescribed approved procedure above shall be followed during perforation operations.

8. All tools used for cement squeezing shall be approved by the OSE prior to use.

9. The procedure used by LANL/N3B to pressure test the formation prior to cement squeezing, shall be approved by the OSE prior to use.

10. All recorded pressures during the cement squeeze job and all actual cement volumes shall be recorded and submitted with the Well Plugging Record.

11. Upon completion of the final lift of cement to surface, LANL/N3B shall be required to monitor the top of the cement in the well and replace any volume of cement lost to slippage in the well during the cement set time.

12. The well head and all associated appurtenances shall be removed, and the remaining hole backfilled with concrete to surface.

13. To maintain the integrity of the regional aquifer by assuring the plugging of RG-98113 successfully prevented any contaminants from leaking from the intermediate aquifer to the regional aquifer, Los Alamos National Laboratory shall be required to establish and maintain a monitoring program, including the installation of monitoring wells within proximity of RG-98113, as prescribed by the New Mexico Environment Department Hazardous Waste Bureau(NMED/HWB).

14. Should the NMED/HWB or another regulatory agency sharing jurisdiction of the project authorize, or by regulation require a more stringent well plugging procedure than herein acknowledged, the more-stringent procedure should be followed. This, in part, includes provisions regarding pre-authorization to proceed, contaminant remediation, inspection, pulling/perforating of casing, or prohibition of free discharge of any fluid from the borehole during or related to the plugging process.

15. The highest and best technology available and best management practices shall be used to the maximum extent practicable.

16. Pursuant to section 72-8-1 NMSA, the permittee shall allow the State Engineer and his representative's entry upon private property for the performance of their respective duties.

17. A Well Plugging Record (available at: http://www.ose.state.nm.us/STST/Forms/WD-11.pdf) itemizing actual abandonment process and materials used shall be filed with the State Engineer (NMOSE, P.O. Box 25102 - 407 Galisteo Street - Room 102, Santa Fe, NM 87504-5102), within 30 days after completion of well plugging.

18. Per §19.27.4.37 NMAC Rules and Regulations, NMOSE witnessing of the plugging and associated activities **will** be required and shall be facilitated by a NMOSE observed, or an authorized NMOSE agent, onsite by calling the District 6 NMOSE Office at 505-827-6120, at least 72-hours in advance. Witnessing of decommissioning activities by the NMOSE or its authorized agent, shall occur between the hours of 8:00 A.M. and 5:00 P.M., Monday through Friday and shall not occur during any observed holidays. The decommissioning of RG-98113 or any associated activities prior to placing sealant, **shall not occur** without an observer from the NMOSE present.

19. No deviation from this plan shall be acceptable unless submitted to the OSE and NMED/HWB in the form of a written request for variance. All variance requests shall be reviewed by the OSE and NMED/HWB and may not be acted upon by LANL/N3B without express written approval from both the OSE and NMED/HWB.

20. LANL/N3B shall be required to submit a timeline of events within 30 days of receipt of this approval. Timeline shall include, but is not limited to, commencement of well plugging operations with respect to mobilization of a New Mexico licensed driller with the equipment and tooling designed to properly execute the approved Procedure and Conditions of Approval prescribed herein.

21. The State Engineer shall retain jurisdiction over this permit.

Witness my hand and seal this 7th day of February, 2022

MIKE A. HAMMAN, P.E.
NEW MEXICO STATE ENGINEER

By: _____
Christopher M. Thornburg
Upper Pecos Basin Lead
Water Rights Division

By: Christopher Angel
Christopher E. Angel, PG
Hydrologist
OSE Hydrology Bureau

WELL PLUGGING PLAN OF OPERATIONS

NOTE: A Well Plugging Plan of Operations shall be filed with and accepted by the Office of the State Engineer prior to plugging.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Existing Office of the State Engineer POD Number (Well Number) for well to be plugged: Well was installed before 200

Name of well owner: Department of Energy

Mailing address: Mark Everett / N3B 600 6th St.

City: Los Alamos State: NM Zip code: 87544

Phone number: 505-309-1367 E-mail: mark.everett@em-la.doe.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Holt Services

New Mexico Well Driller License No.: WD-1780 Expiration Date: June 5, 2020

IV. WELL INFORMATION:

Note: A copy of the existing Well Record for the well to be plugged should be attached to this plan.

1) GPS Well Location: Latitude: 35 deg, 50 min, 53.930284 sec
Longitude: -106 deg, 20 min, 6.642553 sec, WGS84
☑ Check if seconds are decimal format

2) Reason(s) for plugging well:

Screen #3 and Screen #9 were damaged during the well installation, repair attempted. The well integrity may be compromised. See the attached New Mexico Environment Department approval letter dated January 11, 2013: "Approval with Modification: Workplan to Plug and Abandon Well R-25 Los Alamos National Laboratory"

3) Was well used for any type of monitoring program? yes If yes, please use section VII of this form to detail what hydrogeologic parameters were monitored. If the well was used to monitor contaminated or poor quality water, authorization from the New Mexico Environment Department may be required prior to plugging.

4) Does the well tap brackish, saline, or otherwise poor quality water? no If yes, provide additional detail, including analytical results and or laboratory report(s):

5) Static water level: see attached feet below land surface / feet above land surface (circle one)

6) Depth of the well: 1942 feet

7) Inside diameter of innermost casing: 5 inches.

8) Casing material: Stainless Steel

9) The well was constructed with:

☐ an open-hole production interval, state the open interval: _____

■ a well screen or perforated pipe, state the screened interval(s): 9 screened intervals, see attached

10) What annular interval surrounding the artesian casing of this well is cement-grouted? See attached R-25 as-built

11) Was the well built with surface casing? yes If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? yes If yes, please describe:

20-inch borehole to 20 feet below ground surface (bgs).16-inch steel surface casing to 20 feet bgs. Surface casing annulus was filled with cement grout.

12) Has all pumping equipment and associated piping been removed from the well? No If not, describe remaining equipment and intentions to remove prior to plugging in Section VII of this form.

V. DESCRIPTION OF PLANNED WELL PLUGGING:

Note: If this plan proposes to plug an artesian well in a way other than with cement grout, placed bottom to top with a tremie pipe, a detailed diagram of the well showing proposed final plugged configuration shall be attached, as well as any additional technical information, such as geophysical logs, that are necessary to adequately describe the proposal.

1) Describe the method by which cement grout shall be placed in the well, or describe requested plugging methodology proposed for the well:

See attached description of proposed plugging procedures.

2) Will well head be cut-off below land surface after plugging? Well head will be cut-off at surface of the concrete pad.

VI. PLUGGING AND SEALING MATERIALS:

Note: The plugging of a well that taps poor quality water may require the use of a specialty cement or specialty sealant

1) For plugging intervals that employ cement grout, complete and attach Table A.

2) For plugging intervals that will employ approved non-cement based sealant(s), complete and attach Table B.

3) Theoretical volume of grout required to plug the well to land surface: 1884 gal

4) Type of Cement proposed: Portland Type I/II

5) Proposed cement grout mix: 5.5-6 gallons of water per 94 pound sack of Portland cement.

6) Will the grout be: _____ batch-mixed and delivered to the site

X mixed on site

7) Grout additives requested, and percent by dry weight relative to cement:

N/A

8) Additional notes and calculations:

Total interval plugged by cement - 1884 ft. Total gallons of cement for 1884 ft of 4.95-inch I.D. casing is approximately 1884 gallons. Total casing depth 1934ft =1884 ft cemented interval, plus 50 ft sand plug at Screen 1 per NMED modifications to the approved workplan.

Note: All calculations for cement volumes were calculated based on 4.95-inch ID casing using the Halliburton e-Redbook Version 3.0.24.

VII. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

See the attached sheets.

VIII. SIGNATURE:

I, Mark Everett, say that I have carefully read the foregoing Well Plugging Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Well Plugging Plan of Operations and attachments are true to the best of my knowledge and belief.

Mark Everett — Signature of Applicant

3-12-19 — Date

IX. ACTION OF THE STATE ENGINEER:

This Well Plugging Plan of Operations is:

X Approved subject to the attached conditions.

_____ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this 15 day of July, 19

John D'Antonio

~~Tom Blaine~~ P.E., New Mexico State Engineer

By: L A Garcia

STATE ENGINEER · SEAL OF THE STATE OF NEW MEXICO · GREAT SEAL OF THE STATE OF NEW MEXICO · 1912

TABLE A - For plugging intervals that employ cement grout. Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of grout placement (ft bgl)	770 feet	0 ft ground level	N/A
Bottom of proposed interval of grout placement (ft bgl)	1934 feet	720 feet	N/A
Theoretical volume of grout required per interval (gallons)	1164 gallons based on 4.95-in ID casing and 1164 ft total interval	720 gallons based on 4.95-in ID casing and 720 ft total interval	N/A
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	5.5-6 gallons per sack	5.5-6 gallons per sack	N/A
Mixed on-site or batch-mixed and delivered?	mixed on-site	mixed on-site	N/A
Grout additive 1 requested	N/A	N/A	N/A
Additive 1 percent by dry weight relative to cement	N/A	N/A	N/A
Grout additive 2 requested	N/A	N/A	N/A
Additive 2 percent by dry weight relative to cement	N/A	N/A	N/A

TABLE B - For plugging intervals that will employ approved non-cement based sealant(s). Start with deepest interval.

	Interval 1 – deepest	Interval 2	Interval 3 – most shallow
			Note: if the well is non-artesian and breaches only one aquifer, use only this column.
Top of proposed interval of sealant placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Bottom of proposed sealant of grout placement (ft bgl)	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	None proposed in original workplan or specified by NMED in modification to include the sand plug 720-770 ft bgl	N/A
Theoretical volume of sealant required per interval (gallons)	N/A	N/A	N/A
Proposed abandonment sealant (manufacturer and trade name)	N/A	N/A	N/A

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
DISTRICT VI - SANTA FE

John R. D'Antonio Jr., P.E.
State Engineer

BATAAN MEMORIAL BUILDING
POST OFFICE BOX 25102
SANTA FE, NEW MEXICO 87504-5102
(505) 827-6120
FAX: (505) 827-6682

July 15, 2019

Los Alamos National Laboratory
Attn: Mark Everett
N3B 600 6th St.
Los Alamos, NM 87544

Re: Plugging Plan of Operations for RG-98113 (R-25)

Greetings:

The Office of the Engineer is returning a favorable approval with specific plugging conditions and has accepted the Well Plugging Plan of Operations submitted March 13, 2019, for filing for the following wells:

- RG-98113 (R-25)

Please return a completed Well Plugging Report that itemizes the actual abandonment process, materials used and total volume of material used within 30 days after completion of well plugging.

Please do not hesitate to contact our office with any questions regarding these plans.

Sincerely,

Lorraine A. Garcia
Office of State Engineer
Water Rights Division District VI

Enclosure
cc: file

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT FOR MONITORING WELL
CONDITIONS OF APPROVAL

This application proposes the pluggin of an existing LANL monitor well, constructed prior to NMOSE administration of monitor well permitting. Upon submission of this application, a NMOSE file number has been assigned to the well for permitting and tracking. As currently configured, the multi-zone monitoring well is screened into ten separate zones, including five zones in an intermediate aquifer and five zones in the regional, as identified by the paperwork submitted by the applicant. The ten aquifer zones are currently kept segregated outside the well casing with intervals of annular sealant, and segregated inside the casing via the installation of a Westbay Multi-packer Sampling System.

The applicant states that screens 3 and 9 were damaged during installation and the well integrity may be compromised, therefore the well needs to be plugged. Permittee proposes plug and abandon the well by completely removing the Westbay sampling system components, back-plugging the well with 1884 gallons of Portland Type I/II cement. At screen 1 a 50 foot sand plug will be placed as required by the New Mexico Environment Department, and the 16-inch well casing will be filled with cement grout to 20 feet below ground surface.

Permittee states the NMED has approved the proposed reconfiguration of this well. The NMOSE therefore approves this application provided it is not exercised to the detriment of any others having existing rights and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the following conditions of approval:

Permittee: Los Alamos National Laboratory
Agent: Mark Everett

Permit Number: RG-98113-POD 1

Application File Date: March 13, 2019

Points of Diversion: RG-98113-POD1, AKA LANL R-25 (WGS84)

OSE File Number	OSE Tag No.	Applicant Well Number	Northing (Y)	Easting (X)
RG-98113	N/A	RG-98113-POD 1	-106° 20' 6.642553"	35° 50' 53.930284"

Well will be located in Section 29, Township 19 North, Range 06 East, NMPM

Purpose of Use: Monitoring

Specific Plugging Conditions of Approval for 1 Well for Los Alamos National Laboratory within Los Alamos County, New Mexico

1. Water well drilling and well drilling activities, including well plugging, are regulated under 19.27.4 NMAC, which requires any person engaged in the business of well drilling within New Mexico to obtain a Well Driller License issued by the New Mexico Office of the State Engineer (NMOSE). Therefore, the firm of a New Mexico licensed Well Driller shall perform the well plugging.

2. Theoretical volume of sealant required for abandonment of the 4.95-inch wellbore is 0.99 gallons per foot. Total theoretical volume of sealant required to fill the overdrilled portion of the hole is tabulated below. Total minimum amount of required sealant will be based on the sounding depth once the 5-inch casing has been removed.

NEW MEXICO OFFICE OF THE STATE ENGINEER
PERMIT FOR MONITORING WELL
CONDITIONS OF APPROVAL

Well Name	Inside Diameter (Inches)	Total Depth (feet)	Volume (Cubic Feet)	Volume (Gallons)
RG-98113-POD1	4.95	1942	259.52	1941
Total:		1942	259.52	1941

3. The 5-inch casing shall be removed from within the auger drill string prior to sealant being placed in the boring.

4. Sealant shall be kept up inside the augers during placement. The augers shall be pulled out of the hole in such a manner that allows the sealant to remain inside the auger at all times, thus providing displacement to prevent borehole collapse. The augers may not be pulled out of the hole prior to the sealant being placed.

5. All surface completions shall be removed, if applicable. The top of the casing shall be terminated ~3-feet bgs and the remaining hole shall be backfilled with concrete to surface.

1. Should the NMED, or another regulatory agency sharing jurisdiction of the project authorize, or by regulation require a more stringent well plugging procedure than herein acknowledged, the more-stringent procedure should be followed. This, in part, includes provisions regarding pre-authorization to proceed, contaminant remediation, inspection, pulling/perforating of casing, or prohibition of free discharge of any fluid from the borehole during or related to the reconfiguration process.

   The NMOSE does not have documentation that surface or subsurface contamination exists in the area, and takes at face value that the applicant's reconfiguration intentions address known or surmised concerns regarding potential contaminant pathways. The reconfiguration method proposed addresses the NMOSE's concern that overt comingling of aquifers or draining of surface water to aquifers is prevented by partial back-plugging the well casing and packer installation.

6. NMOSE witnessing of the plugging will not be required, but shall be facilitated if a NMOSE observer is onsite. NMOSE witnessing may be requested during normal work hours by calling the District 6 NMOSE Office at 505-827-6120, at least 48-hours in advance. NMOSE inspection will occur dependant on personnel availability.

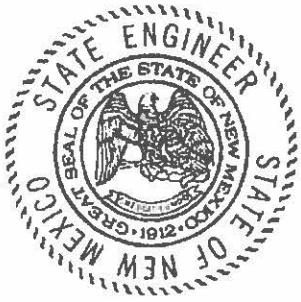
7. A Well Plugging Record (available at: http://www.ose.state.nm.us/STST/Forms/WD-11.pdf) itemizing actual abandonment process and materials used shall be filed with the State Engineer (NMOSE, P.O. Box 25102 - 407 Galisteo Street - Room 102, Santa Fe, NM 87504-5102), within 30 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operation, dated March 13, 2019, as annotated, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Witness my hand and seal this 15 day of July, 2019.

John R. D'Antonio Jr., P.E., State Engineer

By: L A Garcia
Lorraine A. Garcia
Water Resource Professional- District VI



PLUGGING RECORD

NOTE: A Well Plugging Plan of Operations shall be approved by the State Engineer prior to plugging - 19.27.4 NMAC

I. GENERAL / WELL OWNERSHIP:

State Engineer Well Number: RG-98113

Well owner: U.S. Dept of Energy Environmental Management, Los Ala Phone No.: (575) 373-5966

Mailing address: 1200 Trinity Drive, Suite 400

City: Los Alamos State: New Mexico Zip code: 87544

II. WELL PLUGGING INFORMATION:

1) Name of well drilling company that plugged well: Layne Christensen

2) New Mexico Well Driller License No.: WD-1808 Expiration Date: July 15,2024

3) Well plugging activities were supervised by the following well driller(s)/rig supervisor(s): Lennington R Godwin

4) Date well plugging began: 12-17-2022 Date well plugging concluded: 2-5-2023

5) GPS Well Location: Latitude: 35 deg, 50 min, 53.930284 sec
Longitude: -106 deg, 20 min, 6.642553 sec, WGS 84

6) Depth of well confirmed at initiation of plugging as: 1253' ft below ground level (bgl),
by the following manner: Tubing and Sounder. After first cement job, was tagged at 1268' with tubing and sounder.

7) Static water level measured at initiation of plugging: 768' ft bgl

8) Date well plugging plan of operations was approved by the State Engineer: 2-7-2022

9) Were all plugging activities consistent with an approved plugging plan? NO If not, please describe differences between the approved plugging plan and the well as it was plugged (attach additional pages as needed):

The initial 150 gallon lift of neat cement (15.2 ppg) pumped at the tagged depth of 1253' on 12/20/2022 led to an apparent collapse of formation slough, leading to a tag after curing at 1268'. A follow up lift of 130 gallons of cement slurry (15.65-15.95 ppg) was pumped on 01/10/2023, subsequently tagged at 1249'. An additional lift of 130 gallons of slurry, calculated to achieve a build to 1220' using a theoretical borehole diameter of 15.25 inches (15.7-16.1 ppg) was pumped on 01/11/2023. An attempt to tag the cement with tubing was unsuccessful due to a mechanical obstruction at 1205'. Turbidity and well conditions prevented video logging of the well. NMOSE personnel witnessed and approved tagging and cement pumping activities.

Per direction from NMOSE, jet perforation of the interval 1201'-1175' was conducted on 01/20/2023. After installing an NMOSE approved packer to 1155' and pressure testing, an initial squeeze on 01/25/2023 of 120 gallons of Class C cement (approved by NMOSE), followed by 378 gallons of water tail, failed to yield any recordable pressures. A second squeeze of Class C cement with LCM on 01/31/2023 achieved 2300 psi after 1134 gallons were pumped. This was followed by a 242 gallons water tail (insufficient volume to displace slurry in tremmie), stopped at 2500 psi to avoid over-pressurizing pipe and cement. Both squeeze operations were performed by Petroplex Acidizing and witnessed by NMOSE. After deflating and

10) Log of Plugging Activities - Label vertical scale with depths, and indicate separate plugging intervals with horizontal lines as necessary to illustrate material or methodology changes. Attach additional pages if necessary.

For each interval plugged, describe within the following columns:

Depth (ft bgl)	Plugging Material Used (include any additives used)	Volume of Material Placed (gallons)	Theoretical Volume of Borehole/ Casing (gallons)	Placement Method (tremie pipe, other)	Comments ("casing perforated first", "open annular space also plugged", etc.)
	1253' Portland 15.2 lbs.	150 Gallons	313 gallons 1253-1220' (using 15.25" estimated borehole diameter)	Tubing	Open Hole Below Casing
	1268' Portland 15.7 lbs.	130 Gallons	2.95 gallons 1224-1220' (using 4.25" estimated casing diameter)	Tubing	Open Hole Below Casing
	1248' Portland 16.1 lbs.	130 Gallons		Tubing	Open Hole Below Casing to 1224' and double casing 1224-1220' (final top of cement unknown)
	1155'-1206' Type C/Portland 15.8 lbs.	120 Gallons	Squeeze .789/FT	Tubing Packer @1155'	Perforated F/1175'-1201' (unable to achieve recordable pressure)
	915'-1206' Type C/Portland 15.8 lbs.	1134 Gallons 10 Bags N-Seal	Squeeze .789/FT	Tubing Packer @1155'	Perforated F/1175'-1201' (achieved pressure of 2300 psi)
	915'-0' Portland 15.5 lbs.	836 Gallons	933 Gallons/1.02/FT	Tubing@915' Poured in continuous lift	Roller/starwheel Perforated 915'-55'
	4'-0' Portland 15.5 lbs.	4.5 Gallons	4 Gallons	Top off poured from surface	Blank Casing

MULTIPLY		BY		AND OBTAIN
cubic feet	x	7.4805	=	gallons
cubic yards	x	201.97	=	gallons

III. SIGNATURE:

I, Lennington R Godwin , say that I am familiar with the rules of the Office of the State Engineer pertaining to the plugging of wells and that each and all of the statements in this Plugging Record and attachments are true to the best of my knowledge and belief.

Lenny Godwin Digitally signed by Lenny Godwin Date: 2023.02.27 10:38:47 -07'00' 2/27/23

Signature of Well Driller Date

Appendix B

Plugging and Abandonment Field Notes
(on CD included with this document)

Appendix C

Video Logs
(on DVD included with this document)

Well R-25 was video logged on December 19, 2023, in compliance with the February 7, 2022, "Request for Amendment to Approved [Amended] Well Plugging Plan of Operation Conditions of Approval for RG-98113" (NMOSE 2022, 701871), and before commencement of actual plugging and abandonment operations. New Mexico Office of the State Engineer staff members Lorraine Garcia, Chris Thornburg, Chris Angel, and Joey Maestas witnessed the video logging and authorized continuation of abandonment operations.

The depths annotated on the video log diverge from actual well depths because of a faulty wireline depth counter, the divergence increasing with depth. The table below compares annotated depths with actual well component depths. Note: some depths are estimated or approximate and the deltas are therefore approximate.

Well Component	Established Component Depth (ft bgs*)	Video Log Annotated Depth (ft bgs)	Delta (ft bgs)
Top of Screen 1	737.6	742.05	4.45
Top of Screen 2	882.6	~887.0	4.4
Static Water Level	~925.0	~930.0	5.0
Top of Casing Patch	1040.0	1045.06	5.06
Top of Lifted Casing	~1155.0	~1162.0	7.0
Bottom of Lifted Casing/ Exposed Formation	~1224.0	~1233.0	9.0

*bgs = Below ground surface.

REFERENCE

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID.ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by Newport News Nuclear BWXT-Los Alamos, LLC (IDs 700000 and above).

NMOSE (New Mexico Office of the State Engineer), February 7, 2022. "Re: Request for Amendment to Approved [Amended] Well Plugging Plan of Operation Conditions of Approval for RG-98113," NMOSE letter to C. Maupin (N3B) from C. Thornburg (NMOSE), Santa Fe, New Mexico. (NMOSE 2022, 701871)