Appendix A

New Mexico Office of the State Engineer
Plugging Plans of Operation and Plugging Records
(on CD included with this document)

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
SANTA FE

Tom Blaine, P.E.
State Engineer

CONCHA ORTIZ Y PINO BLDG.
POST OFFICE BOX 25102
130 SOUTH CAPITOL
SANTA FE, NEW MEXICO 87504-5102
(505) 827-6091
FAX: (505) 827-3806

September 1, 2016

U.S Department of Energy/ Los Alamos National Laboratory
C/O Mark Everett
P.O Box 1663
Los Alamos, NM 87545

Re: Plugging Plans of Operation, LANL Wells RG-96311 through RG-96320

Greetings:

After a review of the Well Plugging Plan of Operations submitted on June 21, 2016, The Office of the Engineer is returning a favorable approval with specific Plugging Conditions and has accepted the Plugging Plan submitted for filing.

Please return a completed Well Plugging Report that itemizes the actual abandonment process and materials used within 20 days after completion of well plugging. In addition, please include a copy of the approved Plugging Conditions enclosed.

Please address any questions via- telephone to Ramona Martinez at 505.827.6120 or via e-mail at Ramona.Martinez2@state.nm.us.

Sincerely,

Ramona Martinez
Water Rights Division
Office of the State Engineer

Enclosure
cc: file

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: N/A BG-96311 (CDB0-1)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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, 23.198 sec
Longitude: -106 deg, 15 min, 29.736 sec, NAD 83
CDB0-1.

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 14.42 feet

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SANTA FE NEW MEXICO
DATE 6/21/16

7) Inside diameter of innermost casing: 4 inches.

8) Casing material: PVC

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): Unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 14.42' then regrouted 14.42'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~6.5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDRB-1 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Ramona Martinez

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~6.5~~ gal. Up to 8.5 gallons ok
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96311

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 14.42 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for groundwater observation and is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96311 (CDBO-1)	4	14.42	35°50'23.198	-106°15'29.736

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.
   The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or

the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 4-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 4-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 4-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO- 1 (Auger Boring)	4	14.42	1.3	9.4
Totals:			1.3	9.4

7. All surface completions (vaults) will be removed, if applicable. The top of the 4-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 8/31/16

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: N/A BG-96312 (CDBO-2)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBO-2

Latitude: 35 deg, 50 min, 24.773 sec

Longitude: -106 deg, 15 min, 27.909 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 19.25 feet

7) Inside diameter of innermost casing: 4 inches.

8) Casing material: PVC

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): Unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 19.25' then regrouted for the 19.25'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~80~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-2 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: _____

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~8.5~~ gal. Up to 8.5 gal.
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96312

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 19.25 feet below ground surface (bgs) via tremie pipe. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for groundwater observation and is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96312 (CDBO-2)	4	19.25	35°50'24.773	-106°15'27.909

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.
   The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the

cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 4-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 4-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 4-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-2 (Auger Boring)	4	19.25	1.7	12.6
Totals:			1.7	12.6

7. All surface completions (vaults) will be removed, if applicable. The top of the 4-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Date: 8/31/16

Ramona Martinez, NMOSE District 6, Water Rights Division

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: N/A RG-96313(CDBO-3) RNW

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBO-3
Latitude: 35 deg, 50 min, 10.016 sec
Longitude: -106 deg, 14 min, 56.837 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 13.55 feet

7) Inside diameter of innermost casing: 4 inches.

8) Casing material: PVC

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): Unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 13.55' then regrouted to 13.55'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-3 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Pamela Yates

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~8.5~~ gal. Up to 8.5 gallons (RA)
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96313

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 13.55 feet below ground surface (bgs) via tremie pipe. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for groundwater observation and is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96313 (CDBO-3)	4	13.55	35°50'10.016	-106°14'56.837

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.
   The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the

cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 4-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 4-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 4-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-3 (Auger Boring)	4	13.55	1.2	8.8
Totals:			1.2	8.8

7. All surface completions (vaults) will be removed, if applicable. The top of the 4-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 8/31/16

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: N/A RG-96314 (CDBO-4 RLM)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBO-4
Latitude: 35 deg, 49 min, 59.487 sec
Longitude: -106 deg, 13 min, 58.565 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 13.4 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: PVC

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): 8-12

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 13.4', then regrouted to 13.4'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~6.5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-4 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Ramon Martinez

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~8.5~~ gal. Up to 8.5 gal per
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96314

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 13.4 feet below ground surface (bgs) via tremie pipe. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for groundwater observation and is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96314 (CDBO-4)	2	13.4'	35°49'59.487	-106°13'58.565

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.
   The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the

cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-4 (Auger Boring)	2	13.4	0.3	2.2
Totals:			0.3	2.2

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 8/31/16

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: N/A RG-96316 (CDBO-5) RM

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBO - 5
Latitude: 35 deg, 51 min, 11.401 sec
Longitude: -106 deg, 16 min, 23.015 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 20.81 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: PVC

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): 7 - 17

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 20.81' then regrouted to 20.81'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~45~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-5 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Brian Wentz

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~8.5~~ gal. Up to 8.5 gal (an)
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96316

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20.81 feet below ground surface (bgs) via tremie pipe. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for groundwater observation and is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96316 (CDBO-5)	2	20.81'	35°51'11.401	-106°16'23.015

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.
   The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the

cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-45 (Auger Boring)	2	20.81	0.5	3.4
Totals:			0.5	3.4

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 8/31/16

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: N/A BG-96315 (CDBO-7) (Rev)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBO-7
Latitude: 35 deg, 50 min, 46.510 sec
Longitude: -106 deg, 15 min, 36.645 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: DRY feet below land surface / feet above land surface (circle one)

6) Depth of the well: 46.02 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: PVC

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): 29-39

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 20' bgs., then regrouted for the upper 20'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~6.5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-7 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Jason Mally

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~6.5~~ gal. 4 to 8.5 gal. RW
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96315

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger to a minimum of 20 feet bgs. 5% bentonite enriched cement will be used to fill the boring from 20 feet up to 2 feet bgs. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for measuring groundwater as part of a water balance study. The study is complete and the well is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96315 (CDBO-7)	2	46.02'	35°50'46.510	-106°15'36.645

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.

The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-7	2	26.02	0.57	4.25
CDBO-7 (Auger Boring)	9	20	8.84	66.10
Totals:			9.40	70.34

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

_____ Date: _____

Ramona Martinez, NMOSE District 6, Water Rights Division

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: N/A RG-96317 (CDB0-8) (RW)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDB0-8
Latitude: 35 deg, 50 min, 37.264 sec
Longitude: -106 deg, 15 min, 13.637 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 25.66 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: PVC

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): 13-23

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 20' bgs., then regrouted for the upper 20'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~6.5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-8 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Roman Mondragon

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~6.5~~ gal. up to 8.5 gal (KW)
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96317

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger to a minimum of 20 feet bgs. 5% bentonite enriched cement will be used to fill the boring from 20 feet up to 2 feet bgs. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for measuring groundwater as part of a water balance study. The study is complete and the well is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96317 (CDBO-8)	2	25.66'	35°50'37.264	-106°15'13.637

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.

The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-8	2	5.66	0.12	0.92
CDBO-8 (Auger Boring)	9	20	8.84	66.10
Totals:			8.96	67.02

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 8/31/16

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: N/A RG-96318 (CDB0-9) RM

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDB0-9
Latitude: 35 deg, 50 min, 10.924 sec
Longitude: -106 deg, 14 min, 39.322 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 33.59 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: PVC

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): Unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 20' bgs., then regrouted for the upper 20'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~6.5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBO-9 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 1 day of September, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Ramon Martinez

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~6.5~~ gal. 4 to 8.5 gal. (RM)
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96318

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger to a minimum of 20 feet bgs. 5% bentonite enriched cement will be used to fill the boring from 20 feet up to 2 feet bgs. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for measuring groundwater as part of a water balance study. The study is complete and the well is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96318 (CDBO-9)	2	33.59'	35°50'10.924	-106°14'39.322

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.

The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBO-9	2	13.59	0.30	2.22
CDBO-9 (Auger Boring)	9	20	8.84	66.10
Totals:			9.13	68.31

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 3/31/16

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: N/A RG-96319 (CDBM-1)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBM-1
Latitude: 35 deg, 50 min, 37.155 sec
Longitude: -106 deg, 15 min, 13.613 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: DRY feet below land surface / feet above land surface (circle one)

6) Depth of the well: 190.11 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: metal

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): unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 20' bgs., then regrouted for the upper 20'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: 6.5 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBm-1 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 31 day of August, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Ramona Hart

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~8.5~~ gal. Up to 8.5 gal. RM
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations Conditions of Approval for RG-96319

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger to a minimum of 20 feet bgs. 5% bentonite enriched cement will be used to fill the boring from 20 feet up to 2 feet bgs. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for measuring groundwater as part of a water balance study. The study is complete and the well is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96319 (CDBM-1)	2	190.11'	35°50'37.155	-106°15'13.613

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.

The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBM-1	2	170.11	3.71	27.76
CDBM-1 (Auger Boring)	9	20	8.84	66.10
Totals:			12.55	93.86

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 8/31/16

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: N/A RG-96320 (CDBM-2)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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: CDBM-2
Latitude: 35 deg, 50 min, 10.866 sec
Longitude: -106 deg, 14 min, 39.238 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 98.63 feet

7) Inside diameter of innermost casing: 2 inches.

8) Casing material: metal

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): unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be over-drilled to 20' bgs., then regrouted for the upper 20'.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: ~~6.5~~ 8.5 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:

5% Bentonite

8) Additional notes and calculations:

N/A

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

CDBM-2 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Anthony Burgess, 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 of Applicant — Date: 6/9/16

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 1 day of September, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Aaron Mark

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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	62 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~8.5~~ gal. 4 to 8.5 gal. per
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96320

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger to a minimum of 20 feet bgs. 5% bentonite enriched cement will be used to fill the boring from 20 feet up to 2 feet bgs. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for measuring groundwater as part of a water balance study. The study is complete and the well is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96320 (CDBM-2)	2	98.63'	35°50'10.866	-106°14'39.238

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, 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. Placement of the sealant within the well shall be by pumping through a tremie pipe extended to near well bottom (based on sounding depth), and kept below top of the slurry column as the well is plugged from bottom-upwards in a manner that displaces the standing water column.

3. The use of up to 6% pure bentonite powder ("90 barrel yield") as an additive in cement is allowed under NMOSE/AWWA guidelines. Neither granular bentonite nor extended yield bentonite shall be mixed with cement. When supplementing a cement slurry with bentonite powder as requested, water demand for the mix increases at a rate of 0.65 gallons of water for each 1% increment of bentonite bdwc (by dry weight cement) above fundamental water demand of 5.2 gallons water per 94-lb. sack of cement. A 5% bentonite/cement slurry may therefore contain up to 8.5 gallons of water total per 94-lb. sack of cement / approximate 5-lb. bentonite increment, provided appropriate mixing order is maintained.

The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

4. Upon completion of plugging of the lower portion of the 2-inch well to the approximate 20-feet bags depth of actual overdrilling, the top of the 2-inch casing shall be severed within the bottom portion of the over-drilled hole prior to sealant being placed within the ID of the augers.

5. Sealant shall be kept up inside the augers during placement. The 4 ¼" x 9" 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 4 ¼" x 9" augers may not be pulled out of the hole prior to the sealant being placed.

6. Theoretical volume of sealant required for abandonment of the 2-inch (inside) diameter well is approximately .37 gallons per foot. Theoretical volume of sealant required for abandonment of the 9" (outside) diameter auger boring is 2.3 gallons per foot. Total theoretical volume of sealant required to fill the well is tabulated below. All cement mixture will contain no more than 5.2 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 (feet)	Volume (Cubic Feet)	Volume (Gallons)
CDBM-2	2	78.63	1.72	12.83
CDBM-2 (Auger Boring)	9	20	8.84	66.10
Totals:			10.55	78.93

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

9. 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.

10. 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 20 days after completion of well plugging. Please attach a copy of these plugging conditions.

The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 9/1/16

STATE OF NEW MEXICO
OFFICE OF THE STATE ENGINEER
SANTA FE

Tom Blaine, P.E.
State Engineer

CONCHA ORTIZ Y PINO BLDG.
POST OFFICE BOX 25102
130 SOUTH CAPITOL
SANTA FE, NEW MEXICO 87504-5102
(505) 827-6091
FAX: (505) 827-3806

September 7, 2016

U.S Department of Energy/ Los Alamos National Laboratory
C/O Mark Everett
P.O Box 1663
Los Alamos, NM 87545

Re: Plugging Plans of Operation, LANL Well RG-96330

Greetings:

After a review of the Well Plugging Plan of Operations submitted on June 21, 2016, The Office of the Engineer is returning a favorable approval with specific Plugging Conditions and has accepted the Plugging Plan submitted for filing.

Please return a completed Well Plugging Report that itemizes the actual abandonment process and materials used within 20 days after completion of well plugging. In addition, please include a copy of the approved Plugging Conditions enclosed.

Please address any questions via- telephone to Ramona Martinez at 505.827.6120 or via e-mail at Ramona.Martinez2@state.nm.us.

Sincerely,

Ramona Martinez
Water Rights Division
Office of the State Engineer

Enclosure
cc: file

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: N/A RG-96330 (16-P-1)

Name of well owner: Los Alamos National Laboratory

Mailing address: PO Box 1663

City: Los Alamos State: New Mexico Zip code: 87545

Phone number: 505-667-5931 E-mail: meverett@lanl.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide plugging services: Yellow Jacket Drilling Services

New Mexico Well Driller License No.: WD-1458 Expiration Date: 10-31-2016

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, 51 min, 0.315 sec
16-P-1 Longitude: -106 deg, 19 min, 56.617 sec, NAD 83

2) Reason(s) for plugging well:

No longer needed.

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: Dry feet below land surface / feet above land surface (circle one)

6) Depth of the well: 31.89 feet

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7) Inside diameter of innermost casing: 2 inches

8) Casing material: PVC

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): Unknown

10) What annular interval surrounding the artesian casing of this well is cement-grouted? N/A

11) Was the well built with surface casing? No If yes, is the annulus surrounding the surface casing grouted or otherwise sealed? No If yes, please describe:

12) Has all pumping equipment and associated piping been removed from the well? Yes 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:

Cement grout shall be tremie pumped from bottom to top of well casing. Well will then be cut off below ground surface.

2) Will well head be cut-off below land surface after plugging? Yes

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: _____

4) Type of Cement proposed: Bentonite cement grout (neat cement with 5% bentonite)

5) Proposed cement grout mix: 8.5 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

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STATE ENGINEERS OFFICE
SANTA FE, NEW MEXICO

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

5% Bentonite

8) Additional notes and calculations:

N/A

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

16-P-1 was used for groundwater observation and is no longer needed.

VIII. SIGNATURE:

I, Jacob. Lagana, 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 of Applicant — Date: 9/1/16

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 6 day of September, 2016

Tom Blaine P.E., New Mexico State Engineer

By: Byron Hall

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STATE ENGINEERS OFFICE
SANTA FE, 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)	N/A	N/A	0'
Bottom of proposed interval of grout placement (ft bgl)	N/A	N/A	15'
Theoretical volume of grout required per interval (gallons)	N/A	N/A	6 gal.
Proposed cement grout mix gallons of water per 94-lb. sack of Portland cement	N/A	N/A	~~5.5~~ gal. Up to 8.5 gallons
Mixed on-site or batch-mixed and delivered?	N/A	N/A	On site
Grout additive 1 requested	N/A	N/A	Bentonite
Additive 1 percent by dry weight relative to cement	-	N/A	5%
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)	N/A	N/A	N/A
Bottom of proposed sealant of grout placement (ft bgl)	N/A	N/A	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

Tom Blaine, P.E.
District 6 Office, Santa Fe, NM

Well Plugging Plan of Operations
Conditions of Approval for RG-96330

The U.S. Department of Energy / Los Alamos National Laboratory has identified 1 alluvial well as tabulated below. On the Well Plugging Plan of Operations received May 13, 2016, the applicant stated that the well is no longer needed as the study is completed. The applicant states that the casing will be pressure grouted with 5% bentonite enriched cement from total depth to 20 feet below ground surface (bgs) via tremie pipe. The well will then be overdrilled with a 9- inch (outside diameter) 4 ¼ (inside diameter) auger to a minimum of 20 feet bgs. 5% bentonite enriched cement will be used to fill the boring from 20 feet up to 2 feet bgs. The top 2 feet will be filled with concrete and mounded above the existing grade. Static water level is dry, according to the applicant. There is no OSE record available for this test well. This test well was used for measuring groundwater as part of a water balance study. The study is complete and the well is no longer needed. Existing active wells that are in close proximity to the well(s) that are to be abandoned could possibly have communication during cementing operations. To reduce the likelihood of this scenario, the water to cement ratio can be reduced to 5.2 gallons of water per 94 pound sack of Portland cement.

Location: Los Alamos, New Mexico.
Approximate well coordinates: See tabulated data.

Well Name	Inside diameter (inches)	Total depth (feet)	Latitude North	Longitude West
RG-96319 (16-P-1)	2	34.89'	35°51'0.315	-106°19'56.617

Specific Plugging Conditions of Approval for 1 monitoring well for the U.S. Department of Energy / Los Alamos National Laboratory, Los Alamos County, New Mexico

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The bentonite shall be properly hydrated separately with its required increment of water, prior to being added into the cement mixture. If water is otherwise added to the combination of dry ingredients or the dry bentonite blended into wet cement, the hardness and alkalinity imparted to the mix water by the cement will restrict the ability of the bentonite powder to yield as expected, resulting in excess free water in the slurry and enhanced cement shrinkage upon curing.

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Well Name	Inside Diameter (Inches)	Total Depth (feet)	Volume (Cubic Feet)	Volume (Gallons)
16-P-1	2	14.89	0.32	2.43
16-P-1 (Auger Boring)	9	20	8.84	66.10
Totals:			9.16	68.53

7. All surface completions (vaults) will be removed, if applicable. The top of the 2-inch casing will be severed within the bottom of the overdrilled portion of the hole and will be backfilled with sealant to 2 feet bgs. The remaining 2-feet will be filled with concrete to surface.

8. 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.

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The NMOSE Well Plugging Plan of Operations dated May 13, 2016, with annotation, is hereby approved with the aforesaid conditions applied, when signed by an authorized designee of the State Engineer:

Ramona Martinez, NMOSE District 6, Water Rights Division Date: 9/6/16