



Illinois Department of Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
www.dnr.illinois.gov

Bruce Rauner, Governor
Wayne A. Rosenthal, Director

September 1, 2017

Woolsey Operating Company, LLC
125 North Market St. Ste. 1000
Wichita, KS 67202

Re: HVHFF Application for Woodrow #1H-310408-193 (Review #HVHFF-000001)
Sec. 31, T04S, R08E, White County, Illinois

Mr. Woolsey:

Please be advised that the Department has identified an error with Condition #3 in the permit issued to Woolsey Operating Company, LLC, on August 31, 2017.

Condition #3 originally read as follows:

3. HYDRAULIC FRACTURING FLUID SHALL BE CONFINED TO THE GRASSY CREEK SHALE.

The Department intended to, but inadvertently did not include the Selmier Shale and Blocher Shale formations. As corrected, Condition #3 reads as follows.

3. HYDRAULIC FRACTURING FLUID SHALL BE CONFINED TO THE GRASSY CREEK SHALE, SELMIER SHALE, AND BLOCHER SHALE FORMATIONS.

As such, the Department has amended your permit to correct this error. In order to memorialize the amendment and differentiate the amended permit from the original permit, the following changes have been made:

- Condition #3 has been modified as described above.
- The Date Issued has been modified to 09/01/2017; and
- Condition #87 has been added:

87. THIS PERMIT CORRECTS AN ERROR IN CONDITION #3 OF PERMIT HVHFF-000001 ISSUED 8/31/2017. THE CONDITION IS CORRECTED ACKNOWLEDGING THAT HYDRAULIC FRACTURING FLUID SHALL BE CONFINED TO THE GRASSY CREEK SHALE, SELMIER SHALE, AND BLOCHER SHALE FORMATIONS.

Please be advised that this permit supersedes the version of HVHFF-000001 that was issued on 8-31-2017.

Sincerely,



Ernest Kierbach
Permit Manager
Office of Oil and Gas Resource Management
One Natural Resources Way
Springfield, Illinois 62702
217-782-7756
Ernest.Kierbach@illinois.gov



STATE OF ILLINOIS
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF OIL AND GAS RESOURCE MANAGEMENT



COMBINED PERMIT TO PERFORM: HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, PERMIT NUMBER: HVHHF-000001, AND PERMIT TO DRILL AND/OR OPERATE A WELL FOR: GAS PRODUCTION, PERMIT NUMBER: 065315

REGISTRATION NUMBER: HVHHF-00003

DATE ISSUED: 09/01/2017

REGISTRANT

WOOLSEY OPERATING COMPANY, LLC
 125 NORTH MARKET STREET SUITE 1000
 WICHITA, KANSAS 67202

WELL NAME:

WOODROW 1H-310408-193

WELL LOCATION

1990S 1650W NEc NE
 SECTION: 31 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE
 LATTITUDE: 38.1343680 LONGITUDE: -88.3603830
 SURFACE ELEVATION: 445 FEET

UNIT AREA

SECTION: 30 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE SW/4 NE/4; NW/4 SE/4; SW/4 SE/4
 SECTION: 31 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE NW/4 NE/4

WELL SITE

SECTION: 31 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE EAST 550' OF NE SW NE (8.333 ACERS); NORTH 190'
 OF THE EAST 550' OF SE SW NE (2.40 ACERS)
 SECTION: 30 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE SOUTH 150' OF EAST 300' OF THE SOUTH HALF OF SE
 SE SW LESS THE EAST 50' (0.8609 ACERS)

HORIZONTAL DRAINHOLE LOCATION

BEGINNING

0795S 1700W NEc NE
 SECTION: 31 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE
 LATTITUDE: 38.1375820 LONGITUDE: -88.3607527

END

3460N 2075W SEc SE
 SECTION: 30 TOWNSHIP: 04S RANGE: 08E COUNTY: WHITE
 LATTITUDE: 38.1492447 LONGITUDE: -88.3620798

TRUE VERTICAL DEPTH: 5280 FEET

DRILLING CONTRACTOR: LES WILSON, INC.

TOOL TYPE: ROTARY



COMBINED PERMIT TO PERFORM: HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, PERMIT NUMBER: HVHHF-000001, AND PERMIT TO DRILL AND/OR OPERATE A WELL FOR: GAS PRODUCTION, PERMIT NUMBER: 065315

REGISTRANT

WOOLSEY OPERATING COMPANY, LLC
125 NORTH MARKET STREET SUITE 1000
WICHITA, KANSAS 67202

PERMIT CONDITIONS:

1. FORMATION(S) PERMITTED TO BE STIMULATED BY THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATION: GRASSY CREEK SHALE
2. FORMATION(S) PERMITTED FOR PRODUCTION: GRASSY CREEK SHALE
3. HYDRAULIC FRACTURING FLUID SHALL BE CONFINED TO THE GRASSY CREEK SHALE, SELMIER SHALE, AND BLOCHER SHALE FORMATIONS.
4. WITHIN 60 DAYS OF COMPLETION OF THE DRILLING OF THE HORIZONTAL DRAINHOLE A DIRECTIONAL DRILLING SURVEY SHALL BE SUBMITTED TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT.
5. ALL PORTIONS OF THE HORIZONTAL DRAINHOLE SHALL BE NO LESS THAN 330 FEET FROM THE NEAREST EXTERNAL BOUNDARY LINES OF THE HORIZONTAL DRILLING UNIT.
6. ALL PORTIONS OF THE HORIZONTAL DRAINHOLE SHALL BE NO LESS THAN 900 FEET FROM THE NEAREST LOCATION OF A PRODUCING WELL, A WELL BEING DRILLED OR A WELL FOR WHICH A PERMIT HAS PREVIOUSLY BEEN ISSUED (BUT UNDER WHICH THE WELL HAS NOT YET BEEN DRILLED) USING THE SAME INDIVIDUAL RESERVOIR.
7. HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING SHALL BE LIMITED TO THE HORIZONTAL DRAINHOLE.
8. MAXIMUM SURFACE TREATING PRESSURE SHALL AT ANY TIME BE NO GREATER THAN 7,900 PSI.
9. ON-SITE FRESH WATER WELLS DESIGNATED AS WSW 1, WSW 1 AND WSW 3, SHALL BE EQUIPPED TO ACCURATELY MONITOR WATER WITHDRAWALS AND SHALL BE USED AS A SOURCE OF WATER.
10. FRESH WATER WITHDRAWALS FROM THE WSW 1, WSW 2 AND WSW 3 SHALL BE RECORDED AND MAINTAINED BY THE PERMITTEE.
11. FRESH WATER SHALL ONLY BE TRANSPORTED BY PIPELINE FROM THE WELLS TO THE STORAGE RESERVOIR.
12. HYDRAULIC FRACTURING ADDITIVES, HYDRAULIC FRACTURING FLUID, HYDRAULIC FRACTURING FLOWBACK, AND PRODUCED WATER SHALL AT ALL TIMES BE STORED IN ABOVE-GROUND TANKS MEETING THE FOLLOWING REQUIREMENTS UNTIL REMOVED FOR PROPER DISPOSAL OR RECYCLING:
 - A) CLOSED, WATERTIGHT, VENTED AND CORROSION-RESISTENT;
 - 1) IF UNCONTROLLED EMISSIONS FROM STORAGE TANKS CONTAINING NATURAL GAS OR HYDROCARBON FLUIDS WILL EXCEED 6 TONS PER YEAR, THE EMISSIONS MUST BE RECOVERED AND ROUTED TO A FLARE DESIGNED IN ACCORDANCE WITH 40 CFR 60.18 AND CERTIFIED BY THE MANUFACTURER OF THE DEVICE;
 - 2) THE PERMITTEE SHALL MAINTAIN AND OPERATE THE FLARE IN ACCORDANCE WITH MANUFACTURE'S SPECIFICATIONS; AND
 - 3) THE FLARE MUST BE EQUIPPED WITH AN AUTO-IGNITER AND A RELIABLE CONTINUOUS IGNITION SOURCE OVER THE DURATION OF PRODUCTION.
 - B) CONSTRUCTED OF MATERIALS COMPATIBLE WITH THE COMPOSITION OF THE HYDRAULIC FRACTURING FLUID, HYDRAULIC FRACTURING FLOWBACK, AND PRODUCED WATER;
 - C) OF SUFFICIENT PRESSURE RATING; AND
 - D) ROUTINELY INSPECTED FOR CORROSION ON AT LEAST A SEMIANNUAL BASIS; INSPECTION RECORDS MUST BE MAINTAINED.
13. IN ACCORDANCE WITH THE HYDRAULIC FRACTURING FLUIDS AND FLOWBACK PLAN AND THE CONTAINMENT PLAN, AND AS APPROVED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, THE USE OF A RESERVE PIT IS ALLOWED FOR THE TEMPORARY STORAGE OF HYDRAULIC FRACTURING FLOWBACK. THE RESERVE PIT SHALL BE



USED ONLY IN THE EVENT OF A LACK OF CAPACITY FOR TANK STORAGE DUE TO HIGHER THAN EXPECTED VOLUME OR RATE OF HYDRAULIC FRACTURING FLOWBACK, OR OTHER UNANTICIPATED FLOWBACK OCCURRENCE.

14. ALL RESERVE PITS MUST COMPLY WITH THE FOLLOWING CONSTRUCTION STANDARDS AND LINER SPECIFICATIONS:
 - A) THE SYNTHETIC LINER MATERIAL SHALL HAVE A MINIMUM THICKNESS OF 24 MILS WITH HIGH PUNCTURE AND TEAR STRENGTH AND BE IMPERVIOUS AND RESISTANT TO DETERIORATION;
 - B) THE PIT LINING SYSTEM SHALL BE DESIGNED TO HAVE A CAPACITY AT LEAST EQUIVALENT TO 110% OF THE MAXIMUM VOLUME OF HYDRAULIC FRACTURING FLOWBACK ANTICIPATED TO BE RECOVERED;
 - C) THE LINED PIT SHALL BE CONSTRUCTED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THE MANUFACTURERS' SPECIFICATIONS AND GOOD ENGINEERING PRACTICES TO PREVENT OVERFLOW DURING ANY USE;
 - D) THE LINER SHALL HAVE SUFFICIENT ELONGATION TO COVER THE BOTTOM AND INTERIOR SIDES OF THE PIT WITH THE EDGES SECURED WITH AT LEAST A 12-INCH DEEP ANCHOR TRENCH AROUND THE PIT PERIMETER TO PREVENT ANY SLIPPAGE OR DESTRUCTION OF THE LINER MATERIALS;
 - E) THE FOUNDATION FOR THE LINER SHALL BE FREE OF ROCK AND CONSTRUCTED WITH SOIL HAVING A MINIMUM THICKNESS OF 12 INCHES AFTER COMPACTION COVERING THE ENTIRE BOTTOM AND INTERIOR SIDES OF THE PIT; AND
 - F) IF LOCATED IN THE REGULATORY FLOODWAY, THE RESERVE PIT SHALL BE CONSIDERED A CONSTRUCTION SUBJECT TO 17 ILL. ADM. CODE 3706.240 AND 3706.630 AND, IN ADDITION TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION (B)(1) THROUGH (B)(5), SHALL BE CONSTRUCTED TO THE STANDARDS SET FORTH IN 17 ILL. ADM. CODE 3706.530(B) OR (C), OR A SUCCESSOR RULE, AS APPLICABLE. NO RESERVE PITS MAY BE LOCATED IN THE REGULATORY FLOODWAY OR THE FLOOD FRINGE, UNLESS THE APPLICANT FIRST SECURES THE NECESSARY PERMITS AND COMPLETES ANY MITIGATION MEASURES REQUIRED BY ANY PERMITTING AGENCY.
 - G) HYDRAULIC FRACTURING FLOWBACK RESERVE PIT LINERS SHALL BE DISPOSED OF IN AN AGENCY-PERMITTED SPECIAL WASTE LANDFILL.
15. CLASS II INJECTION WELL(S) APPROVED FOR DISPOSAL OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING FLOWBACK:
 - A) TRUEFLO #1, REFERENCE NUMBER: 216072, LOCATION: 0110N 0110W SEc SW, SECTION 06 TOWNSHIP: 06S RANGE: 09E COUNTY: WHITE
16. PRIOR TO ACCEPTING ANY HYDRAULIC FRACTURING FLOWBACK OR PRODUCED WATER FROM THE WOODROW 1H-310408-193, THE CLASS II INJECTION DISPOSAL WELL MUST BE EQUIPPED WITH AN ELECTRONIC FLOWMETER.
17. THE PERMITTEE SHALL NOT DISPOSE OF ANY HYDRAULIC FRACTURING FLOWBACK OR PRODUCED WATER FROM THE WOODROW 1H-310408-193 AT THE TRUEFLO #1 IF, AT THE TIME OF DISPOSAL, TRUEFLO SOLUTIONS, LLC IS SUBJECT TO ANY UNABATED NOTICES OF VIOLATION WHICH HAVE REACHED A FINAL ADMINISTRATIVE DECISION OF THE DEPARTMENT OR THE ILLINOIS ENVIRONMENTAL PROTECTION AGENCY OR ANY COURT DECISIONS RELATED TO SUCH FINAL ADMINISTRATIVE DECISIONS OR OTHER VIOLATIONS RELATED TO THE TRUEFLO #1.
18. AT LEAST 2 BUSINESS DAYS PRIOR TO COMMENCEMENT OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT OF INTENT TO DISPOSE HYDRAULIC FRACTURING FLOWBACK FROM THE WOODROW 1H-310408-193 IN THE TRUEFLO #1. THE PERMITTEE SHALL NOT DISPOSE OF HYDRAULIC FRACTURING FLOWBACK FROM THE WOODROW 1H-310408-193 IN THE TRUEFLO #1 WITHOUT RECEIVING WRITTEN APPROVAL OF THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT.
19. AT LEAST 2 BUSINESS DAYS PRIOR TO DISPOSAL OF PRODUCED WATER FROM THE WOODROW 1H-310408-193, THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT OF INTENT TO DISPOSE PRODUCED WATER FROM THE WOODROW 1H-310408-193 IN THE TRUEFLO #1. THE PERMITTEE SHALL NOT DISPOSE OF HYDRAULIC FRACTURING FLOWBACK OR PRODUCED WATER FROM THE WOODROW 1H-310408-193 IN THE TRUEFLO #1 WITHOUT RECEIVING WRITTEN APPROVAL OF THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT.
20. NO MORE THAN ONE HOUR BEFORE INITIATING ANY STAGE OF THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, ALL SECONDARY CONTAINMENT FOR ALL ABOVE-GROUND TANKS AND ADDITIVE STAGING AREAS MUST BE VISUALLY INSPECTED TO ENSURE THAT ALL STRUCTURES AND EQUIPMENT ARE IN PLACE



AND IN PROPER WORKING ORDER. THE RESULTS OF THIS INSPECTION MUST BE RECORDED AND DOCUMENTED ON A FORM PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, MAINTAINED IN THE WELL FILE, AND MADE AVAILABLE AT THE WELL SITE TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT UPON REQUEST.

21. ANY SECONDARY CONTAINMENT MUST BE SUFFICIENTLY TO CONTAIN 150% OF THE CAPACITY OF THE SINGLE LARGEST CONTAINER OR TANK WITHIN A COMMON CONTAINMENT AREA.
22. ALL PIPING, CONVEYANCES, VALVES IN CONTACT WITH HYDRAULIC FRACTURING FLUID, HYDRAULIC FRACTURING FLOWBACK, OR PRODUCED WATER MUST BE:
 - A) CONSTRUCTED OF MATERIALS COMPATIBLE WITH THE EXPECTED COMPOSITION OF THE HYDRAULIC FRACTURING FLUID, HYDRAULIC FRACTURING FLOWBACK, AND PRODUCED WATER;
 - B) OF SUFFICIENT PRESSURE RATING;
 - C) ABLE TO RESIST CORROSION; AND
 - D) MAINTAINED IN A LEAK-FREE CONDITION.
23. STATIONARY FUELING TANKS SHALL HAVE THE FOLLOWING:
 - A) SECONDARY CONTAINMENT;
 - B) FILLING OPERATIONS SHALL BE SUPERVISED AT THE FUELING TRUCK AND AT THE TANK IF THE TANK IS NOT VISIBLE TO THE FUELING OPERATOR FROM THE TRUCK; AND
 - C) TROUGHS, DRIP PADS, OR DRIP PANS ARE REQUIRED BENEATH THE FILL PORT OF A STATIONARY FUELING TANK DURING FILLING OPERATIONS IF THE FILL PORT IS NOT WITHIN THE SECONDARY CONTAINMENT.
24. THE FINAL CONFIGURATION OF SURFACE EQUIPMENT ASSOCIATED WITH THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING TREATMENT, INCLUDING THE INJECTION LINES AND MANIFOLD, ASSOCIATED VALVES, FRACTURE HEAD OR TREE AND ANY OTHER WELLHEAD COMPONENTS OR CONNECTIONS, MUST BE PRESSURE TESTED PURSUANT TO THE FOLLOWING REQUIREMENTS BEFORE ANY PUMPING OF HYDRAULIC FRACTURING FLUID:
 - A) THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL AT LEAST 24 HOURS BEFORE CONDUCTING A PRESSURE TEST OF THE FINAL CONFIGURATION OF THE SURFACE EQUIPMENT USED FOR THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING TREATMENT TO ENABLE AN INSPECTOR TO BE PRESENT WHEN THE TEST IS PERFORMED
 - B) THE FINAL CONFIGURATION OF THE SURFACE EQUIPMENT USED FOR THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING TREATMENT MUST BE PRESSURE TESTED WITH FRESH WATER OR BRINE TO AT LEAST THE MAXIMUM ANTICIPATED TREATMENT PRESSURE FOR AT LEAST 30 MINUTES WITH LESS THAN A 5% PRESSURE LOSS.
 - C) A RECORD OF THE PRESSURE TEST MUST BE MADE ON A FORM PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, MAINTAINED BY THE PERMITTEE IN THE WELL FILE, AND MADE AVAILABLE AT THE WELL SITE TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT UPON REQUEST.
 - D) IF THE CONFIGURATION OF SURFACE EQUIPMENT USED FOR THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING TREATMENT HAS BEEN RECONFIGURED OR CHANGED IN ANY MANNER THAT BREAKS ANY PRESSURE CONNECTION AFTER A STAGE OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS TREATMENT, THE PRESSURE TEST REQUIREMENTS OF 62 IAC 245.810 (A) THROUGH (C) MUST BE SUCCESSFULLY REPEATED BEFORE INITIATING ANY SUBSEQUENT STAGE OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS.
25. DRILL CUTTINGS, DRILLING FLUIDS AND DRILLING WASTES MUST BE STORED AND DISPOSED OF PURSUANT 62 ILL ADM. CODE PART 245.510 AND THE REQUIREMENTS OF THE RULES PROMULGATED UNDER THE ILLINOIS OIL AND GAS ACT WHEN NOT IN CONFLICT WITH 62 ILL. ADM. CODE PART 245.510.
26. SURFACE CASING SHALL BE USED AND SET TO A DEPTH OF AT LEAST 720 FEET, OR 100 FEET BELOW THE BASE OF THE DEEPEST FRESH WATER, WHICHEVER IS DEEPER.
27. SURFACE CASING MUST BE MADE OF STEEL AND CONFORM TO WITH API SPEC 5CT JULY 2011.
28. SURFACE CASING IN THE WELL CONSTRUCTION MUST BE IN A MANNER CONSISTENT WITH API SPEC 5CT JULY 2011.
29. CASING THREAD COMPOUND MUST CONFORM TO AND MEET ALL MANUFACTURING AND MATERIAL REQUIREMENTS OF THE INDUSTRY STANDARDS SET FORTH IN API RP 5A3 NOVEMBER 2009.
30. CASING THREAD COMPOUND IN THE WELL CONSTRUCTION MUST BE IN A MANNER CONSISTENT WITH API RP 5A3 NOVEMBER 2009.



31. THE BOREHOLE MUST BE CIRCULATED AND CONDITIONED BEFORE SURFACE CASING SETTING AND CEMENTING TO ENSURE AN ADEQUATE CEMENT BOND.
32. THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL AT LEAST 24 HOURS BEFORE SETTING AND CEMENTING SURFACE CASING TO ENABLE AN INSPECTOR TO BE PRESENT.
33. CENTRALIZERS ARE REQUIRED TO BE USED AS FOLLOWS TO KEEP THE CASING IN THE CENTER OF THE WELLBORE BEFORE AND DURING CEMENT OPERATIONS:
 - A) A CENTRALIZER SHALL BE PLACED AT THE BOTTOM OF THE SURFACE CASING STRING OR SHOE;
 - B) CENTRALIZERS SHALL BE PLACED ABOVE AND BELOW A STAGE COLLAR OR DIVERTING TOOL, IF RUN;
 - C) CENTRALIZERS SHALL BE PLACED THROUGH USABLE-QUALITY WATER ZONES;
 - D) CENTRALIZERS SHALL BE PLACED ON EVERY FOURTH JOINT FROM THE CEMENT SHOE TO THE GROUND SURFACE OR TO THE BOTTOM OF THE CELLAR;
 - E) THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT MAY REQUIRE ADDITIONAL CENTRALIZATION AS NECESSARY TO ENSURE THE INTEGRITY OF THE WELL DESIGN IS ADEQUATE; AND
 - F) ALL CENTRALIZERS MUST CONFORM TO AND SHALL MEET SPECIFICATIONS IN, OR EQUIVALENT TO, THE INDUSTRY STANDARDS SET FORTH IN API SPEC 10D SEPTEMBER 2002, REAFFIRMED AUGUST 2010, API SPEC 10TR4 MAY 2008, AND API RP 10D-2 AUGUST 2004, REAFFIRMED JULY 2010.
34. A PRE-FLUSH OR SPACER MUST BE PUMPED AHEAD OF THE CEMENT.
35. SURFACE CASING CEMENT MUST:
 - A) BE CLASS A CEMENT OR, ALTERNATIVELY, IF THE APPLICANT REQUESTS BEFORE THE POUR IN WRITING WITH SUFFICIENT PROOF OF NEED AS DETERMINED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, AND THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT APPROVES THE USE IN WRITING BEFORE THE POUR, CLASS B CEMENT. CLASS A AND CLASS B CEMENT MEANS CLASS A AND CLASS B CEMENT AS DESCRIBED IN THE DOCUMENT INCORPORATED BY REFERENCE IN API SPEC 10A DECEMBER 2010;
 - B) MEET THE CEMENT REQUIREMENTS OF API SPEC 10A DECEMBER 2010, INCLUDING BUT NOT LIMITED TO BEING Poured WITH THE RATIO OF WATER TO CEMENT MIX AND DENSITY DESIRED IN API SPEC 10A DECEMBER 2010; AND
 - C) BE APPLIED BEHIND THE CASING ACCORDING TO THE FOLLOWING:
 - 1) CEMENT ACTIVITIES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER TO:
 - I. SECURE THE CASING IN THE WELLBORE;
 - II. ISOLATE AND PROTECT FRESH GROUNDWATER;
 - III. ISOLATE ABNORMALLY PRESSURED ZONES, LOST CIRCULATION ZONES, AND ANY POTENTIAL FLOW ZONES, INCLUDING HYDROCARBON AND FLUID-BEARING ZONES;
 - IV. PROPERLY CONTROL FORMATION PRESSURE AND ANY PRESSURE FROM DRILLING, COMPLETION AND PRODUCTION;
 - V. PROTECT THE CASING FROM CORROSION AND DEGRADATION; AND
 - VI. PREVENT GAS FLOW IN THE ANNULUS.
 - 2) FOR ALL CEMENTING ACTIVITIES, THE CEMENT MUST BE PUMPED AT A RATE AND IN A FLOW REGIME THAT INHIBITS CHANNELING OF THE CEMENT IN THE ANNULUS.
36. SURFACE CASING MUST BE FULLY CEMENTED TO THE SURFACE WITH EXCESS CEMENTS. CEMENTING MUST BE BY THE PUMP AND PLUG METHOD WITH A MINIMUM OF 25% EXCESS CEMENT WITH APPROPRIATE LOST CIRCULATION MATERIAL, UNLESS ANOTHER AMOUNT OF EXCESS CEMENT IS APPROVED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT. IF CEMENT RETURNS ARE NOT OBSERVED AT THE SURFACE, THE PERMITTEE MUST PERFORM REMEDIAL ACTIONS AS APPROPRIATE.
37. AFTER THE CEMENT IS PLACED BEHIND THE SURFACE CASING, THE CEMENT MUST BE TESTED (COMPRESSIVE STRENGTH TEST) AND CEMENT JOB LOGS MAINTAINED AS FOLLOWS:
 - A) AFTER THE CEMENT IS PLACED BEHIND THE CASING, THE PERMITTEE SHALL WAIT ON CEMENT TO SET UNTIL THE CEMENT ACHIEVES A CALCULATED COMPRESSIVE STRENGTH OF AT LEAST 500 POUNDS PER SQUARE INCH, AND A MINIMUM OF 8 HOURS BEFORE THE CASING IS DISTURBED IN ANY WAY, INCLUDING INSTALLATION OF A BLOWOUT PREVENTER.



- B) CEMENT COMPRESSIVE STRENGTH TESTS MUST BE PERFORMED ON ALL CEMENTED SURFACE, INTERMEDIATE, AND PRODUCTION CASING STRINGS IN ACCORDANCE WITH THE INDUSTRY STANDARDS SET FORTH IN API SPEC 10A DECEMBER 2010:
- 1) THE CEMENT SHALL HAVE A 72-HOUR COMPRESSIVE STRENGTH OF AT LEAST 1,200 PSI; AND
 - 2) THE FREE WATER SEPARATION SHALL BE NO MORE THAN 6 MILLILITERS PER 250 MILLILITERS OF CEMENT.
- C) CEMENT JOB LOGS MUST BE KEPT FOR ALL CEMENTING ACTIVITIES PURSUANT TO THE FOLLOWING REQUIREMENTS:
- 1) CEMENT JOB LOGS SHALL PROVIDE INFORMATION ABOUT THE CEMENTING ACTIVITIES AS SPECIFIED ON A FORM TO BE PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, INCLUDING, BUT NOT LIMITED TO:
 - I. DATES OF CEMENTING;
 - II. SOURCE OF THE CEMENT;
 - III. TYPE OF CEMENT; AND
 - IV. AMOUNT USED.
 - 2) A COPY OF THE CEMENT JOB LOGS AND CEMENT COMPRESSIVE STRENGTH TEST RESULTS FOR ALL CEMENTED SURFACE, INTERMEDIATE, AND PRODUCTION CASING STRINGS IN THE WELL SHALL BE MAINTAINED IN THE WELL FILE AND, UPON NOTICE BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, BE MADE AVAILABLE TO OFFICE OF OIL AND GAS RESOURCE MANAGEMENT INSPECTORS AT THE WELL SITE DURING DRILLING AND HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS AND SHALL BE MADE AVAILABLE TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT UPON REQUEST.
 - 3) THE PERMITTEE SHALL PROVIDE THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT A COPY OF ALL CEMENT JOB LOGS AND COMPRESSIVE STRENGTH TEST RESULTS 30 DAYS AFTER COMPLETION OF CEMENTING ACTIVITIES.
38. AFTER THE SURFACE CASING CEMENT OPERATION IS COMPLETED TO THE SURFACE, THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL TO ENABLE AN INSPECTOR TO BE PRESENT FOR TESTING THE INTERNAL MECHANICAL INTEGRITY OF THE SURFACE CASING AND INSTALLATION AND TESTING OF THE BLOWOUT PREVENTION EQUIPMENT.
39. THE INTERNAL MECHANICAL INTEGRITY OF SURFACE CASING STRINGS SHALL BE TESTED:
- A) WITH FRESH WATER, MUD OR BRINE. IF MUD IS USED, THE MUD CANNOT BE SO VISCOUS OR CONTAIN SO MUCH PARTICULATE THAT IT BLOCKS, PLUGS OR OBSCURES THE PRESENCE OF ANY POTENTIAL LEAKS IN THE CASING STRING;
 - B) TO NO LESS THAN 0.22 PSI PER FOOT OF CASING STRING LENGTH OR 1,500 PSI, WHICHEVER IS GREATER, BUT NOT TO EXCEED 70% OF THE MINIMUM INTERNAL YIELD; AND
 - C) FOR AT LEAST 30 MINUTES WITH LESS THAN A 5% PRESSURE LOSS.
40. IF THE PRESSURE DECLINES MORE THAN 5% OR IF THERE ARE OTHER INDICATIONS OF A LEAK, CORRECTIVE ACTION SHALL BE TAKEN BEFORE CONDUCTING FURTHER DRILLING OPERATIONS.
41. A FORMATION PRESSURE INTEGRITY TEST SHALL BE CONDUCTED BELOW THE SURFACE CASING IN ORDER TO DEMONSTRATE:
- A) THAT THE INTEGRITY OF THE CASING SHOE IS SUFFICIENT TO CONTAIN THE WELLBORE PRESSURES ANTICIPATED IN THE PERMIT APPLICATION;
 - B) THAT NO FLOW PATH EXISTS TO FORMATIONS ABOVE THE CASING SHOE; AND
 - C) THAT THE CASING SHOE IS COMPETENT TO HANDLE AN INFLUX OF FORMATION FLUID OR GAS WITHOUT BREAKING DOWN.
42. THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL AT LEAST 24 HOURS BEFORE CONDUCTING A FORMATION PRESSURE INTEGRITY TEST TO ENABLE AN INSPECTOR TO BE PRESENT WHEN THE TEST IS PERFORMED.
43. THE ACTUAL HYDRAULIC FRACTURING TREATMENT PRESSURE MUST NOT EXCEED THE MECHANICAL INTEGRITY TEST PRESSURE OF THE CASING TESTED AT ANY TIME DURING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS.
44. RECORDS OF ALL FORMATION INTEGRITY TESTS MUST BE KEPT PURSUANT TO THE FOLLOWING REQUIREMENTS:



- A) A RECORD OF THE FORMATION INTEGRITY TEST MUST BE MAINTAINED BY THE PERMITTEE IN THE WELL FILE AND MUST BE SUBMITTED TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT ON A FORM PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT BEFORE CONDUCTING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS.
- B) PERMITTEE SHALL PROVIDE THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT WITH A COPY OF ALL FORMATION INTEGRITY TEST RESULTS 30 DAYS AFTER COMPLETION OF WELL CONSTRUCTION.
- C) PERMITTEE SHALL RETAIN THESE RECORDS FOR THE LIFE OF THE WELL UNTIL THE WELL IS PLUGGED, ABANDONED AND RESTORED IN ACCORDANCE WITH THE ILLINOIS OIL AND GAS ACT, THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT, AND SUBPART J OF THIS PART.
45. PRODUCTION CASING MUST BE FULLY CEMENTED FROM THE PRODUCTION CASING SHOE TO 500 FEET ABOVE THE TOP PERFORATED FORMATION, UNLESS AN ALTERNATE CEMENTING PLAN IS APPROVED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT; THE PERMITTEE MUST MAKE A WRITTEN OR ELECTRONIC MAIL REQUEST TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT FOR AN ALTERNATE CEMENTING PLAN.
46. PRODUCTION CASING MUST CONFORM TO THE INDUSTRY STANDARDS SET FORTH IN API SPEC 5CT JULY 2011.
47. THE USE OF PRODUCTION CASING IN THE WELL CONSTRUCTION MUST BE IN A MANNER CONSISTENT WITH THE INDUSTRY STANDARDS SET FORTH IN API SPEC 5CT JULY 2011.
48. CASING THREAD COMPOUND MUST CONFORM TO AND MEET ALL MANUFACTURING AND MATERIAL REQUIREMENTS OF THE INDUSTRY STANDARDS SET FORTH IN API RP 5A3 NOVEMBER 2009.
49. THE USES OF CASING THREAD COMPOUND IN THE WELL CONSTRUCTION MUST BE IN A MANNER CONSISTENT WITH THE INDUSTRY STANDARDS SET FORTH IN API RP 5A3 NOVEMBER 2009.
50. THE PRODUCTION BOREHOLE MUST BE CIRCULATED AND CONDITIONED BEFORE PRODUCTION CASING SETTING AND CEMENTING TO ENSURE AN ADEQUATE CEMENT BOND.
51. THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL BEFORE SETTING AND CEMENTING PRODUCTION CASING TO ENABLE AN INSPECTOR TO BE PRESENT.
52. WHEN SETTING PRODUCTION CASING, CENTRALIZERS ARE REQUIRED TO BE USED AS FOLLOWS TO KEEP THE CASING IN THE CENTER OF THE WELLBORE PRIOR TO AND DURING CEMENT OPERATIONS:
- A) IN THE VERTICAL PORTION OF THE WELL, A CENTRALIZER SHALL BE PLACED ON EVERY FOURTH JOINT FROM THE KICKOFF POINT TO THE GROUND SURFACE OR TO THE BOTTOM OF THE CELLAR;
- B) IN THE HORIZONTAL PORTION OF THE WELL, RIGID CENTRALIZERS SHALL BE USED AND PLACED ACCORDINGLY TO ENSURE AT LEAST 80% STANDOFF;
- C) THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT MAY REQUIRE ADDITIONAL CENTRALIZERS AS NECESSARY TO ENSURE THE INTEGRITY OF THE WELL DESIGN; AND
- D) ALL CENTRALIZERS USED IN THE VERTICAL PORTION OF THE WELL MUST CONFORM TO AND SHALL MEET SPECIFICATIONS IN, OR EQUIVALENT TO, THE INDUSTRY STANDARDS SET FORTH IN THE DOCUMENTS REFERENCED IN API SPEC 10D SEPTEMBER 2002, REAFFIRMED AUGUST 2010, API SPEC 10TR4 MAY 2008, AND APR RP 10D-2 AUGUST 2004 REAFFIRMED JULY 2010.
53. A PRE-FLUSH OR SPACER MUST BE PUMPED AHEAD OF THE CEMENT
54. PRODUCTION CASING CEMENT MUST:
- A) MEET THE CEMENT REQUIREMENTS OF API SPEC 10A DECEMBER 2010 AND BE PREPARED TO MINIMIZE ITS FREE WATER CONTENT IN ACCORDANCE WITH THE INDUSTRY STANDARDS SET FORTH IN API SPEC 10A DECEMBER 2010; AND
- B) BE APPLIED BEHIND THE CASING ACCORDING TO THE FOLLOWING:
- 1) CEMENT ACTIVITIES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER TO:
- I. SECURE THE CASING IN THE WELLBORE;
- II. ISOLATE AND PROTECT FRESH GROUNDWATER;
- III. ISOLATE ABNORMALLY PRESSURED ZONES, LOST CIRCULATION ZONES, AND ANY POTENTIAL FLOW ZONES, INCLUDING HYDROCARBON AND FLUID-BEARING ZONES;
- IV. PROPERLY CONTROL FORMATION PRESSURE AND ANY PRESSURE FROM DRILLING, COMPLETION AND PRODUCTION;
- V. PROTECT THE CASING FROM CORROSION AND DEGRADATION; AND
- VI. PREVENT GAS FLOW IN THE ANNULUS.



- 2) FOR ALL CEMENTING ACTIVITIES, THE CEMENT MUST BE PUMPED AT A RATE AND IN A FLOW REGIME THAT INHIBITS CHANNELING OF THE CEMENT IN THE ANNULUS.
55. AFTER THE CEMENT IS PLACED BEHIND THE PRODUCTION CASING, THE CEMENT MUST BE TESTED AND CEMENT JOB LOGS MAINTAINED PURSUANT TO THE REQUIREMENTS AS FOLLOWS:
- A) AFTER THE CEMENT IS PLACED BEHIND THE CASING, THE PERMITTEE SHALL WAIT ON CEMENT TO SET UNTIL THE CEMENT ACHIEVES A CALCULATED COMPRESSIVE STRENGTH OF AT LEAST 500 POUNDS PER SQUARE INCH, AND A MINIMUM OF 8 HOURS BEFORE THE CASING IS DISTURBED IN ANY WAY, INCLUDING INSTALLATION OF A BLOWOUT PREVENTER.
- B) CEMENT COMPRESSIVE STRENGTH TESTS MUST BE PERFORMED ON ALL CEMENTED SURFACE, INTERMEDIATE, AND PRODUCTION CASING STRINGS IN ACCORDANCE WITH THE INDUSTRY STANDARDS SET FORTH IN API SPEC 10A DECEMBER 2010:
- 1) THE CEMENT SHALL HAVE A 72-HOUR COMPRESSIVE STRENGTH OF AT LEAST 1,200 PSI; AND
- 2) THE FREE WATER SEPARATION SHALL BE NO MORE THAN 6 MILLILITERS PER 250 MILLILITERS OF CEMENT.
- C) CEMENT JOB LOGS MUST BE KEPT FOR ALL CEMENTING ACTIVITIES PURSUANT TO THE FOLLOWING REQUIREMENTS:
- 1) CEMENT JOB LOGS SHALL PROVIDE INFORMATION ABOUT THE CEMENTING ACTIVITIES AS SPECIFIED ON A FORM TO BE PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, INCLUDING, BUT NOT LIMITED TO:
- I. DATES OF CEMENTING;
- II. SOURCE OF THE CEMENT;
- III. TYPE OF CEMENT; AND
- IV. AMOUNT USED.
- 2) A COPY OF THE CEMENT JOB LOGS AND CEMENT COMPRESSIVE STRENGTH TEST RESULTS FOR ALL CEMENTED SURFACE, INTERMEDIATE, AND PRODUCTION CASING STRINGS IN THE WELL SHALL BE MAINTAINED IN THE WELL FILE AND, UPON NOTICE BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, BE MADE AVAILABLE TO OFFICE OF OIL AND GAS RESOURCE MANAGEMENT INSPECTORS AT THE WELL SITE DURING DRILLING AND HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS AND SHALL BE MADE AVAILABLE TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT UPON REQUEST.
- 3) THE PERMITTEE SHALL PROVIDE THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT A COPY OF ALL CEMENT JOB LOGS AND COMPRESSIVE STRENGTH TEST RESULTS 30 DAYS AFTER COMPLETION OF CEMENTING ACTIVITIES.
56. AFTER THE PRODUCTION CASING CEMENT OPERATION IS COMPLETED, THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE OR ELECTRONIC MAIL TO ENABLE AN INSPECTOR TO BE PRESENT FOR TESTING THE INTERNAL MECHANICAL INTEGRITY OF THE PRODUCTION CASING PURSUANT TO SECTION 245.540.
57. THE INTERNAL MECHANICAL INTEGRITY OF THE PRODUCTION CASING STRING OR ANY CASING STRING THAT WILL HAVE PRESSURE EXERTED ON IT DURING STIMULATION OF THE WELL SHALL BE TESTED:
- A) WITH FRESH WATER, MUD OR BRINE. IF MUD IS USED, THE MUD CANNOT BE SO VISCOUS OR CONTAIN SO MUCH PARTICULATE THAT IT BLOCKS, PLUGS OR OBSCURES THE PRESENCE OF ANY POTENTIAL LEAKS IN THE CASING STRING;
- B) TO AT LEAST THE MAXIMUM ANTICIPATED TREATMENT PRESSURE OR 1,500 PSI, WHICHEVER IS GREATER, BUT NOT TO EXCEED 70% OF THE MINIMUM INTERNAL YIELD;
- C) FOR AT LEAST 30 MINUTES WITH LESS THAN A 5% PRESSURE LOSS; AND
- D) FOR AT LEAST 30 MINUTES WITH LESS THAN A 5% PRESSURE LOSS.
58. IF THE PRESSURE DECLINES MORE THAN 5% OR IF THERE ARE OTHER INDICATIONS OF A LEAK, CORRECTIVE ACTION SHALL BE TAKEN BEFORE CONDUCTING FURTHER DRILLING OPERATIONS.
59. RECORDS OF INTERNAL MECHANICAL INTEGRITY PRESSURE TESTS FOR ALL CASING STRINGS MUST BE KEPT PURSUANT TO THE FOLLOWING REQUIREMENTS:
- A) A RECORD OF THE INTERNAL MECHANICAL INTEGRITY PRESSURE TEST FOR EACH CASING STRING MUST BE MAINTAINED BY THE PERMITTEE IN THE WELL FILE AND MUST BE SUBMITTED TO THE OFFICE OF OIL AND GAS



STATE OF ILLINOIS
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF OIL AND GAS RESOURCE MANAGEMENT

HVHHF PERMIT NUMBER: HVHHF-000001
DATE ISSUED: 09/01/2017
WELL NAME: WOODROW 1H-310408-193
GAS PRODUCTION PERMIT NUMBER: 065315



- RESOURCE MANAGEMENT ON A FORM PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT BEFORE CONDUCTING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS;
- B) THE PERMITTEE SHALL PROVIDE THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT WITH A COPY OF ALL INTERNAL MECHANICAL INTEGRITY PRESSURE TEST RESULTS FOR ALL CASING STRINGS WITHIN 30 DAYS AFTER COMPLETION OF WELL CONSTRUCTION; AND
- C) THE PERMITTEE SHALL RETAIN THESE RECORDS FOR THE LIFE OF THE WELL UNTIL THE WELL IS PLUGGED, ABANDONED AND RESTORED IN ACCORDANCE WITH THE ILLINOIS OIL AND GAS ACT, THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT, AND 62 IAC SECTION 245 SUBPART J.
60. THE WELL SITE SHALL BE RESTORED IN ACCORDANCE WITH THE REQUIREMENTS OF THE HYDRAULIC FRACTURING REGULATORY ACT, AND 62 ILLINOIS ADMINISTRATIVE CODE PART 245.
61. IF THE HYDRAULIC FRACTURING FLUID OR HYDRAULIC FRACTURING FLOWBACK MIGRATE INTO A FRESH WATER ZONE OR TO THE SURFACE FROM THE WELL IN QUESTION OR FROM OTHER WELLS, THE PERMITTEE SHALL IMMEDIATELY NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT AND THE COUNTY AND CERTIFIED LOCAL PUBLIC HEALTH OFFICE OF OIL AND GAS RESOURCE MANAGEMENT (IF ANY) AND SHUT IN THE WELL UNTIL REMEDIAL ACTION THAT PREVENTS THE FLUID MIGRATION IS COMPLETED. THE PERMITTEE SHALL OBTAIN THE APPROVAL OF THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT PRIOR TO RESUMING OPERATIONS.
62. HYDRAULIC FRACTURING STRINGS, IF USED IN ANY WELLS REGULATED BY 62 ILL. ADM. CODE SECTION 245, SHALL BE SET OR RESET PURSUANT TO THE FOLLOWING REQUIREMENTS:
- A) HYDRAULIC FRACTURING STRINGS MUST BE EITHER STRUNG INTO A PRODUCTION LINER OR RUN WITH A PACKER SET AT LEAST 100 FEET BELOW THE DEEPEST CEMENT TOP.
- B) A FUNCTION-TESTED RELIEF VALVE AND DIVERSION LINE MUST BE INSTALLED AND USED TO DIVERT FLOW FROM THE HYDRAULIC FRACTURING STRING-CASING ANNULUS TO A COVERED WATERTIGHT STEEL TANK IN CASE OF HYDRAULIC FRACTURING STRING FAILURE.
- 1) THE RELIEF VALVE MUST BE SET TO LIMIT THE ANNULAR PRESSURE TO NO MORE THAN 95% OF THE WORKING PRESSURE RATING OF THE WEAKEST CASINGS FORMING THE ANNULUS.
- 2) THE ANNULUS BETWEEN THE HYDRAULIC FRACTURING STRING AND THE PRODUCTION OR IMMEDIATE CASING MUST BE PRESSURIZED TO AT LEAST 250 PSI AND MONITORED.
- C) HYDRAULIC FRACTURING STRINGS MUST BE TESTED TO NOT LESS THAN THE MAXIMUM ANTICIPATED TREATING PRESSURE MINUS THE ANNULUS PRESSURE APPLIED BETWEEN THE FRACTURING STRING AND THE PRODUCTION OR IMMEDIATE CASING. THE PRESSURE TEST SHALL BE CONSIDERED SUCCESSFUL IF THE PRESSURE APPLIED HAS BEEN HELD FOR 30 MINUTES WITH NO MORE THAN 5% PRESSURE LOSS.
- D) THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL AT LEAST 24 HOURS BEFORE CONDUCTING A PRESSURE TEST OF THE HYDRAULIC FRACTURING STRING TO ENABLE AN INSPECTOR TO BE PRESENT WHEN THE TEST IS PERFORMED.
- E) A RECORD OF THE PRESSURE TEST SHALL BE MADE ON A FORM PRESCRIBED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, MAINTAINED BY THE PERMITTEE IN THE WELL FILE, AND MADE AVAILABLE AT THE WELL SITE TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT UPON REQUEST AND INCLUDED IN THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS COMPLETION REPORT.
- F) IF ANY CHANGE TO THE WELL INVOLVING RESETTING, REPOSITIONING, RECONNECTING OR BREAKING ANY PRESSURE CONNECTION OF THE HYDRAULIC FRACTURING STRING OCCURS AFTER A STAGE OF HIGH VOLUME HORIZONTAL HYDRAULIC TREATMENT, THE PRESSURE TEST REQUIREMENTS OF 62 ILL. ADM. CODE SECTIONS 245.805 (C) THROUGH (E) MUST BE SUCCESSFULLY REPEATED BEFORE INITIATING ANY SUBSEQUENT STAGE OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING TREATMENT.
63. BEFORE COMMENCEMENT OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, THE PERMITTEE MUST NOTIFY AND RECEIVE WRITTEN APPROVAL FROM THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT BY U.S. MAIL OR ELECTRONIC MAIL. OFFICE OF OIL AND GAS RESOURCE MANAGEMENT APPROVAL FOR HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS SHALL BE BASED ON THE PERMITTEE'S COMPLIANCE WITH THE FOLLOWING:
- A) THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT'S DISTRICT OFFICE BY PHONE AND ELECTRONIC MAIL OR LETTER AT LEAST 48 HOURS BEFORE THE COMMENCEMENT OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS TO ENABLE AN INSPECTOR TO BE PRESENT. THE



- NOTIFICATION UNDER 62 ILL. ADM. CODE SECTION 245.815 SHALL BE NOTICE FOR ALL STAGES OF A MULTIPLE-STAGE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING TREATMENT.
- B) PRIOR TO CONDUCTING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS AT A WELL SITE, THE PERMITTEE SHALL CAUSE TO BE PLUGGED ALL PREVIOUSLY ABANDONED UNPLUGGED OR INSUFFICIENTLY PLUGGED WELL BORES WITHIN 750 FEET OF ANY PART OF THE HORIZONTAL WELL BORE THAT PENETRATED WITHIN 400 VERTICAL FEET OF THE GEOLOGIC FORMATION THAT WILL BE STIMULATED AS PART OF THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS. IN DETERMINING WHETHER A WELL HAS BEEN SUFFICIENTLY PLUGGED, THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT WILL CONSIDER, BUT IS NOT LIMITED TO, WELL COMPLETION REPORTS, CEMENTING RECORDS, WELL CONSTRUCTION RECORDS, CEMENT BOND LOGS, TRACER SURVEYS, OXYGEN ACTIVATION LOGS AND PLUGGING RECORDS. PLUGGING UNDER THIS SUBSECTION SHALL BE PERFORMED AS REQUIRED BY 62 ILL. ADM. CODE SECTION 245.1010.
- C) BASELINE WATER QUALITY SAMPLING OF ALL WATER SOURCES WITHIN 1,500 FEET OF THE WELL SITE MUST BE COMPLETED IN COMPLIANCE WITH 62 ILL. ADM. CODE 245.600.
- D) ALL THE FOLLOWING REQUIRED TESTS SHALL BE CONDUCTED:
- 1) WELL CASING INTERNAL MECHANICAL INTEGRITY TESTS;
 - 2) FORMATION INTEGRITY TESTS;
 - 3) HYDRAULIC FRACTURING STRING PRESSURE TESTS, IF REQUIRED;
 - 4) SURFACE EQUIPMENT PRESSURE TESTS; AND
 - 5) ALL INFORMATION PREVIOUSLY REQUESTED BY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT SHALL BE SUPPLIED TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT, AND ANY INFORMATION THAT WAS ACCURATE AT THE TIME OF SUBMISSION BUT NO LONGER ACCURATE SHALL BE UPDATED.
64. BEFORE CONDUCTING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, THE PERMITTEE SHALL USE AN INDEPENDENT THIRD PARTY UNDER THE SUPERVISION OF A PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST TO CONDUCT BASELINE WATER QUALITY SAMPLING OF ALL WATER SOURCES WITHIN 1,500 FEET OF THE WELL SITE. THE PERMITTEE, THROUGH ITS INDEPENDENT THIRD PARTY, SHALL GIVE THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT 7 CALENDAR DAYS' NOTICE OF BASELINE WATER QUALITY SAMPLING.
65. FOLLOWING THE COMPLETION OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, THE PERMITTEE THROUGH AN INDEPENDENT THIRD PARTY UNDER THE SUPERVISION OF A PROFESSIONAL ENGINEER OR PROFESSIONAL GEOLOGIST SHALL CONDUCT FOLLOW-UP MONITORING OF ALL WATER SOURCES WITHIN 1,500 FEET OF THE WELL SITE. THE PERMITTEE, THROUGH ITS INDEPENDENT THIRD PARTY, SHALL GIVE THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT 7 CALENDAR DAYS' NOTICE OF ALL FOLLOW-UP MONITORING. FOLLOW-UP MONITORING SHALL OCCURE AT 6 MONTHS, 18 MONTHS, AND 30 MONTHS AFTER THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS HAVE BEEN COMPLETED, UNLESS THE WATER SOURCE WAS SAMPLED UNDER BASELINE OR FOLLOW-UP MONITORINGS WITHIN THE PREVIOUS MONTH.
66. BASELINE OR FOLLOW-UP MONITORING TESTING RESULTS SHALL BE SUBMITTED TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT NO LATER THAN 3 CALENDAR DAYS BEFORE COMMENCING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, UNLESS THERE ARE NON-DISCLOSURE AGREEMENTS WITH THE APPLICABLE PRIVATE PROPERTY LANDOWNERS. IN THE CASE OF NON-DISCLOSURE AGREEMENTS, THE PERMITTEE SHALL PROVIDE A CERTIFICATION TO THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING THAT THE BASELINE TESTING RESULTS HAVE BEEN PROVIDED TO THE APPLICABLE PRIVATE PROPERTY LANDOWNERS NO LATER THAN 3 CALENDAR DAYS BEFORE COMMENCING HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS.
67. NOTHING IN 62 ILL. ADM. CODE PART 245.700 CHEMICAL DISCLOSURE BY PERMITTEE SHALL PROHIBIT THE PERMITTEE FROM ADJUSTING OR ALTERING THE CONTENTS OF THE FLUID DURING THE TREATMENT PROCESS TO RESPOND TO UNEXPECTED CONDITIONS, PROVIDED THE PERMITTEE NOTIFIES THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT BY ELECTRONIC MAIL WITHIN 24 HOURS OF THE DEPARTURE FROM THE INITIAL TREATMENT DESIGN AND INCLUDES AN EXPLANATION DETAILING THE REASON FOR THE DEPARTURE.
68. NO LESS THAN 21 CALENDAR DAYS BEFORE PERFORMING THE FIRST STIMULATION TREATMENT OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, THE PERMITTEE OR PERSON PERFORMING THE HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS FOR THE PERMITTEE, SHALL MAINTAIN AND DISCLOSE TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT SEPARATE AND UP-TO-DATE MASTER LISTS OF:



STATE OF ILLINOIS
DEPARTMENT OF NATURAL RESOURCES
OFFICE OF OIL AND GAS RESOURCE MANAGEMENT

HVHHF PERMIT NUMBER: HVHHF-000001
DATE ISSUED: 09/01/2017
WELL NAME: WOODROW 1H-310408-193
GAS PRODUCTION PERMIT NUMBER: 065315



- A) THE BASE FLUID TO BE USED DURING ANY HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS WITHIN THIS STATE;
 - B) ALL HYDRAULIC FRACTURING ADDITIVES TO BE USED DURING ANY HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS WITHIN THIS STATE; AND
 - C) ALL CHEMICALS AND ASSOCIATED CHEMICAL ABSTRACT SERVICE NUMBERS TO BE USED IN ANY HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS WITHIN THIS STATE.
69. ALL PHASES OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS SHALL BE CONDUCTED IN A MANNER THAT SHALL NOT POSE A SIGNIFICANT RISK TO PUBLIC HEALTH, LIFE, PROPERTY, AQUATIC LIFE, WILDLIFE OR THE ENVIRONMENT.
70. THE PERMITTEE SHALL BE RESPONSIBLE FOR MANAGING NATURAL GAS AND HYDROCARBON FLUIDS PRODUCED DURING THE FLOWBACK PERIOD TO ENSURE NO DIRECT RELEASE TO THE ATMOSPHERE OR ENVIRONMENT AS PURSUANT TO 62 ILL. ADM. CODE SECTION 245.845.
71. THE PERMITTEE SHALL NOTIFY THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT OF THE DATE WHEN HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS ARE COMPLETED AND SHALL DISPOSE OF OR RECYCLE HYDRAULIC FRACTURING FLUIDS AND HYDRAULIC FRACTURING FLOWBACK PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.850.
72. ANY RELEASE OF HYDRAULIC FRACTURING FLUID, HYDRAULIC FRACTURING ADDITIVE, HYDRAULIC FRACTURING FLOWBACK, OR PRODUCED WATER SHALL BE CLEANED UP, REMEDIATED, AND REPORTED PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.855.
73. WITHIN 60 CALENDAR DAYS AFTER THE CONCLUSION OF HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, THE PERMITTEE SHALL FILE A HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS COMPLETION REPORT PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.860.
74. WITHIN 30 DAYS AFTER THE CONCLUSION OF INITIAL COMPLETION ACTIVITIES (I.E., PRODUCTION TESTING OR DATE OF FIRST PRODUCTION) OR WITHIN 30 DAYS AFTER THE EXPIRATION OF THE PERMIT IF THE WELL WAS NOT DRILLED, A WELL COMPLETION REPORT SHALL BE SUBMITTED TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT.
75. WITHIN 90 DAYS AFTER DRILLING CEASES, A WELL DRILLING REPORT SHALL BE SUBMITTED TO THE STATE GEOLOGICAL SURVEY IN CHAMPAIGN, ILLINOIS.
76. IT IS UNLAWFUL TO PERFORM ANY HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS BY KNOWINGLY OR RECKLESSLY INJECTING DIESEL.
77. THE PERMITTEE SHALL BE RESPONSIBLE FOR MINIMIZING THE EMISSIONS ASSOCIATED WITH VENTING OF HYDROCARBON FLUIDS AND NATURAL GAS DURING THE PRODUCTION PHASE TO SAFELY MAXIMIZE RESOURCE RECOVERY AND MINIMIZE RELEASES TO THE ENVIRONMENT PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.900.
78. PERMITTEE SHALL RECORD THE AMOUNT OF GAS FLARED OR VENTED FROM EACH HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING WELL OR STORAGE TANK ON AT LEAST A WEEKLY BASIS. EVERY 12 MONTHS FROM THE DATE OF PERMIT ISSUANCE, PERMITTEE SHALL REPORT THE TOTAL AMOUNT OF GAS FLARED OR VENTED FROM EACH WELL DURING THE PREVIOUS 12 MONTHS, BY WEEK, TO THE OFFICE OF OIL AND GAS RESOURCE MANAGEMENT.
79. PERMITTEE SHALL DISPOSE OF OR RECYCLE PRODUCED WATER PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.940.
80. THE PERMITTEE SHALL PERFORM AND COMPLETE PLUGGING OF THE WELL AND RESTORATION OF THE WELL SITE IN ACCORDANCE WITH THE HYDRAULIC FRACTURING REGULATORY ACT AND THE ILLINOIS OIL AND GAS ACT AND ANY AND ALL RULES ADOPTED UNDER THESE ACTS.
81. PERMITTEE SHALL RESTORE ANY LANDS USED BY PERMITTEE OTHER THAN THE WELL SITE AND PRODUCTION FACILITY TO A CONDITION AS CLOSELY APPROXIMATING THE PRE-DRILLING CONDITIONS THAT EXISTED BEFORE LAND WAS DISTURBED BY SITE PREPARATION ACTIVITIES, DRILLING, OR HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.1020.
82. UNLESS CONTRACTUALLY AGREED TO THE CONTRARY BY PERMITTEE AND SURFACE LANDOWNER, PERMITTEE SHALL RESTORE THE WELL SITE AND PRODUCTION FACILITY TO A CONDITION AS CLOSELY APPROXIMATING THE CONDITIONS THAT EXISTED BEFORE THE LAND WAS DISTURBED FOR ANY STAGE OF SITE PREPARATION



STATE OF ILLINOIS
 DEPARTMENT OF NATURAL RESOURCES
 OFFICE OF OIL AND GAS RESOURCE MANAGEMENT

HVHHF PERMIT NUMBER: HVHHF-000001
 DATE ISSUED: 09/01/2017
 WELL NAME: WOODROW 1H-310408-193
 GAS PRODUCTION PERMIT NUMBER: 065315



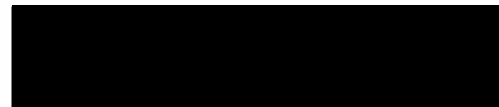
ACTIVITIES, DRILLING AND HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS PURSUANT TO THE REQUIREMENTS OF 62 ILL. ADM. CODE SECTION 245.1030.

- 83. THE PERMITTEE SHALL COMPLY WITH ALL PROVISIONS OF THE HYDRAULIC FRACTURING REGULATORY ACT, THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT, THE ILLINOIS OIL AND GAS ACT, THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT, AND ALL OTHER APPLICABLE LOCAL, STATE, AND FEDERAL LAWS, RULES, AND REGULATIONS IN EFFECT AT THE TIME THE PERMIT IS ISSUED.
- 84. ALL PLANS, MAPS, AND DIAGRAMS SUBMITTED WITH PERMITTEE'S HVHHF APPLICATION, HVHHF-000001, SHALL BE INCORPORATED INTO AND BE CONDITIONS OF THIS PERMIT.
- 85. THIS PERMIT TO DRILL AND/OR OPERATE A WELL FOR GAS PRODUCTION EXPIRES ONE YEAR FROM THE DATE OF ISSUANCE UNLESS DRILLING OR CONVERSION OPERATIONS ARE COMMENCED PRIOR THERETO.
- 86. THIS PERMIT TO PERFORM HIGH VOLUME HORIZONTAL HYDRAULIC FRACTURING OPERATIONS, AND ALL CONDITIONS TO THE PERMIT, ISSUED UNDER THE HYDRAULIC FRACTURING REGULATORY ACT, AND THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT, SHALL LAST UNTIL PLUGGING AND RESTORATION IN COMPLIANCE WITH THE HYDRAULIC FRACTURING REGULATORY ACT, AND THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT, THE ILLINOIS OIL AND GAS ACT, AND THE ADMINISTRATIVE RULES PROMULGATED UNDER THAT ACT ARE COMPLETED TO THE DEPARTMENT'S SATISFACTION.
- 87. THIS PERMIT CORRECTS AN ERROR IN CONDITION #3 OF PERMIT HVHHF-000001 ISSUED 8/31/2017. THE CONDITION IS CORRECTED ACKNOWLEDGING THAT HYDRAULIC FRACTURING FLUID SHALL BE CONFINED TO THE GRASSY CREEK SHALE, SELMIER SHALE, AND BLOCHER SHALE FORMATIONS.

OFFICE OF OIL AND GAS RESOURCE MANAGEMENT
 ONE NATURAL RESOURCE WAY
 SPRINGFIELD, IL 62702-1271
 PHONE: (217) 782-7756
 FAX: (217) 524-4819

OFFICE OF OIL AND GAS RESOURCE MANAGEMENT - DISTRICT OFFICE
 2517 WEST NINTH
 MT. CARMEL, IL 62863
 PHONE: (618) 262-2106
 FAX: (618) 262-2108

OFFICE OF OIL AND GAS RESOURCE MANAGEMENT



ERNEST KIERBACH, PERMIT MANAGER