Ohio Administrative Code

Rule 1501:9-1-08 Well construction.

Effective: August 1, 2012

(A) General. A well permitted under Chapters 1501:9-1 to 1501:9-12 of the Administrative Code shall be constructed in a manner that is approved by the chief as specified by these rules, the terms and conditions of the approved permit, plans submitted in the approved permit, and the standards established in section 1509.17 of the Revised Code. The casing and cementing plans in the approved permit are understood to be estimates based upon the best available geologic information prior to drilling. The division shall evaluate compliance with this rule for the as-built well. Where this rule does not detail specific methods to meet these standards, the owner shall use sound design and industry practices that effectively achieve the standards established in section 1509.17 of the Revised Code.

(B) Field standards. The chief may establish alternative well construction standards that are well-specific, field-specific, or play-specific by permit condition, to ensure protection of public health or safety or the environment.

(C) Drilling fluids.

(1) All intervals drilled prior to reaching the USDW protective depth shall be drilled with air, fresh water, a freshwater based drilling fluid, or a combination of the above. Only additives suitable for drilling through potable water supplies may be used while drilling these intervals.

(2) Based on regional knowledge of groundwater resources, well control, or safety factors, the chief may by permit condition require the use of a freshwater based drilling fluid and specify its characteristics while the owner is drilling any interval prior to reaching the USDW protective depth.

(3) Below cemented surface casing, other drilling fluids may be utilized consistent with sound design and effective industry practice.

(D) Casing standards.

(1) All casing installed in a well shall be steel alloy casing that has been manufactured and tested consistent with standards established by the American petroleum institute (API) in "5 CT Specification for Casing and Tubing" or ASTM international (ASTM) in "A500/A500M Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes" and has a minimum internal yield pressure rating designed to withstand at least 1.2 times the maximum pressure to which the casing may be subjected during drilling, production or stimulation operations.

(a) The minimum internal yield pressure rating shall be based upon engineering calculations listed in API "TR 5C-3 Technical Report on Equations and Calculations for Casing, Tubing and Line Pipe used as Casing and Tubing, and Performance Properties Tables for Casing and Tubing."

(b) Reconditioned casing that is permanently set in a well shall be hydrostatically pressure tested with an applied pressure at least 1.2 times the maximum internal pressure to which the casing may be subjected, based upon known or anticipated subsurface pressure, or pressure that may be applied during stimulation, whichever is greater, and assuming no external pressure. The casing shall be marked to verify the test status. The owner shall provide a copy of the test results to the inspector before the casing is installed in the well.

(c) Where subsurface reservoir pressure is unknown and cannot be reasonably anticipated, the owner shall assume a pressure gradient of 0.45 pounds per square inch per foot in a fully evacuated hole, under shut-in conditions.

(d) All hydrostatic pressure tests shall be conducted pursuant to API "5 CT Specification for Casing and Tubing" or other method(s) approved by the chief.

(2) Reconditioned casing shall not be set in a well unless it has passed an approved hydrostatic pressure and drift test or has otherwise been approved by the inspector. The inspector shall reject casing that is excessively pitted, patched, bent, corroded, or crimped, or if threads are severely worn or damaged.

(3) In order to verify casing integrity and proper cement displacement, the owner shall pressure test

each cemented casing string greater than two hundred feet long in accordance with the test method of either paragraph (D)(3)(a) or (D)(3)(b) of this rule.

(a) Immediately upon landing the latch-down plug, the owner shall increase displacement pressure by at least five hundred pounds per square inch and hold pressure for five minutes. If pressure declines by ten per cent or more, casing integrity and cement placement shall be further evaluated and appropriate corrective action shall be taken to verify casing integrity and cement displacement. If the float apparatus does not hold, the owner shall pump the volume that flowed back, and shut in until the cement has sufficiently set.

(b) Prior to drilling the cement plug, the owner shall test any permanently cemented casing strings, at a minimum pump pressure in pounds per square inch calculated by multiplying the length of the casing string by 0.2, but not less than three hundred pounds per square inch. The test pressure may not decline by more than ten per cent during the thirty-minute test period.

(i) If, at the end of thirty minutes of such testing, the pressure shows a drop greater than ten per cent, the owner shall not resume further operations until the condition is corrected. A pressure test demonstrating a pressure drop equal to or less than ten per cent after thirty minutes is evidence that the condition has been corrected.

(ii) Casing integrity may be verified in conjunction with blowout preventer testing without a test plug using either the test pressure described in paragraph (D)(3)(b) of this rule, or the pressure required to test the blowout preventer, whichever is greater.

(E) Casing shoe tests. The chief may require the owner to conduct a casing shoe test after drilling below the surface casing and/or the intermediate casing seat if the pressure gradient of the permitted hydrocarbon reservoir exceeds 0.5 pounds per square inch per foot, or in areas where fracture gradients are unknown.

(F) Surface water infiltration. Before drilling below the first casing string, the owner shall either crown the location around the wellbore to divert fluids to a flow ditch, or construct a liquid-tight cellar at least three feet in diameter to prevent surface infiltration of fluids adjacent to the wellbore. If a reserve pit is used to contain cuttings and drilling fluids, the flow ditch from the cellar or crown

to the reserve pit shall also be liquid tight.

(G) Mouse and rat holes. If a mouse and/or rat hole is used, it shall be constructed of liquid tight steel pipe with a welded basal plate or bull plug. The annulus shall be sealed with clay or cement in a manner that effectively prevents fluids from entering the annular space.

(H) Wellbore diameters.

(1) The diameter of each section of the wellbore in which casing will be set and cemented shall be at least one inch greater than the outside diameter of casing collar to be installed, unless otherwise approved by the chief.

(2) The wellbore diameter shall be consistent with manufacturer's recommendations for all float equipment, centralizers, packers, cement baskets, and all other equipment run into the wellbore on casing.

(I) Wellbore conditioning.

(1) Prior to cementing, the wellbore shall be conditioned to kill gas flow, foster adequate cement displacement, and ensure a high quality bond between cement and the wellbore. If circulation cannot be established or maintained, the inspector shall require testing to evaluate cement displacement. If tests indicate cement displacement or quality is inadequate to meet the standards, the owner shall not resume drilling activity until corrective action has achieved compliance with the standards.

(2) If oil-based drilling mud is used, the wellbore shall be conditioned with a mud flush and the spacer volume should be designed for a minimum of ten minutes of contact time prior to cementing production casing in the horizontal segment of a wellbore.

(3) Where underground mine voids, solution voids, or other geologic features render circulation infeasible, the owner shall install a cement basket or other approved device as close as possible above the top of the void or thief zone. Mine strings shall be cemented above and below the mine void in accordance with paragraph (M) of this rule.

(J) Cement standards.

(1) All cement placed into the wellbore shall be Portland cement that is manufactured to meet the standards of API "10 A Specification for Cements and Materials for Well Cementing" or ASTM "C150/C150M Standard Specification for Portland Cement."

(2) Cemented conductor, mine, and surface casing strings shall remain static until all cement has reached a compressive strength of at least five hundred pounds per square inch before drilling the plug, or initiating a test.

(3) The tail cement for all intermediate and production casings and liners shall remain static until the cement has reached a compressive strength of at least five hundred pounds per square inch before drilling out the plug or initiating a test. Tail cement shall have a seventy-two-hour compressive strength of at least one thousand two hundred pounds per square inch. Lead cements with volume extenders may be used to seal these strings, but in no case shall the cement have a compressive strength of less than one hundred pounds per square inch at the time of drill out nor less than two hundred fifty pounds per square inch twenty-four hours after being placed.

(4) The density of the cement slurry shall be based upon a laboratory free fluid separation test demonstrating an average fluid loss no more than three milliliters per two hundred fifty milliliters of cement tested in accordance with API "RP 10 B-2 Recommended Practice for Testing Well Cements." Slurry should be mixed and pumped at a rate that ensures consistent slurry density.

(5) The chief may require, by permit condition, a specific cement mixture to be used in any well or any area if evidence of local conditions indicate a specific cement is necessary.

(6) The owner shall ensure that the cement mix water quality and chemistry is proper for the cement slurry design. An authorized representative of the owner shall be on site observing the cement mixing equipment for the entire duration of the cement mixing and placement to ensure that cement slurry design parameters are followed.

(7) Sulfate resistant cement shall be used whenever necessary to protect the casing string and prevent the migration of hydrogen sulfide. When the owner is drilling in a township where hydrogen sulfide

occurs commonly in specific intervals, the chief shall require as a permit condition that the owner use sulfate resistant cement.

(8) Compressive strength test requirements.

(a) Cement mixtures for which published performance data are not available shall be tested by the owner or service company and approved by the chief prior to usage. Tests shall be made on representative samples of the basic mixture of cement and additives used, using distilled water or potable tap water for preparing the slurry. The tests shall be conducted using the equipment and procedures established in API "RP 10 B-2 Recommended Practice for Testing Well Cements." Test data showing competency of a proposed cement mixture to meet the above requirements shall be furnished to the inspector prior to the cementing operation. To determine that the minimum compressive strength has been obtained, the owner shall use the typical performance data for the particular cement mixture used in the well at the following temperatures and at atmospheric pressure:

(i) For conductor, mine string, and surface casing cement, the test temperature shall be sixty degrees Fahrenheit;

(ii) For intermediate and production casing cement, the test temperature shall be within ten degrees Fahrenheit of the formation equilibrium temperature of the cemented interval.

(K) Centralizer standards.

(1) All bowspring centralizers shall meet the standards of API "10 D, Specification for Bow-Spring Casing Centralizers."

(2) All rigid centralizers shall meet the standards of API "10 TR 4 Considerations Regarding Selection of Centralizers for Primary Cementing Operations."

(3) Casing shall be centralized in each segment of the wellbore to provide sufficient casing standoff and foster effective circulation of cement to isolate critical zones including aquifers, flow zones, voids, lost circulation zones, and hydrocarbon production zones.

(L) Notification. The owner shall notify the inspector at least twenty-four hours prior to setting any casing or liner string and before commencing any casing cementing operation pursuant to this rule to enable the inspector to participate in the pre-job safety and procedures meeting, independently test mix water, evaluate casing condition, and observe and document the execution of the cementing operation.

(M) Casing strings.

(1) Drive pipe. Drive pipe may be driven through unconsolidated materials and need not be cemented if there is no annular space.

(2) Mine string.

(a) Casing through an active underground mining operation.

(i) If a well is drilled within the geographic limits of an active underground mining operation, the owner shall construct the well in a manner that protects personnel working in the mine, and, if possible, shall locate the well so as to penetrate a pillar, a barrier, or the unmined perimeter of the seam.

(ii) If a well is drilled within the limits of an active underground mining operation that may penetrate the excavations of a mine and groundwater has been encountered below the base of the conductor casing, the hole shall be reduced fifteen feet above the roof of the mine. This string of casing shall be cemented to surface to shut off all groundwater. Drilling shall continue to a point at least thirty but no more than fifty feet below the floor of the mine and another string of casing shall be set and cemented.

(b) Casing through any underground mine void. After drilling through any underground mine void or rubble zone, casing shall be set at least thirty feet but no more than fifty feet below the base of the mine void or rubble zone and cemented at this point. The owner shall design the casing and cementing plans considering the maximum number of casing strings that may be necessary to isolate mine voids prior to setting and cementing surface casing.

(c) A mine string shall not serve as the only water protection casing. Where a mine string isolates one or more water-bearing zones, either surface or intermediate casing shall be cemented to surface inside the mine string.

(d) Each mine string shall be equipped with a guide shoe or other appropriate device to prevent deformation of the bottom of the casing.

(e) Cementing the mine string.

(i) If a mine void or rubble zone is encountered, the owner shall equip the mine string with a cement basket or other approved device as close to the top of the void as practical.

(ii) The interval from the casing seat to the base of the coal seam shall be cemented.

(iii) Cement shall be placed on top of the basket or other approved device by pour string or pumping from surface.

(3) Conductor casing.

(a) Conductor casing shall be set where necessary to:

(i) Stabilize unconsolidated sediments;

(ii) Isolate shallow aquifers that provide or are capable of providing groundwater for water wells and springs in the vicinity of the well;

(iii) Isolate groundwater before penetrating the working of an active underground mine; or

(iv) Provide a base for equipment to divert shallow, naturally occurring natural gas.

(b) Conductor casing shall be cemented to surface if there is an annular space.

(c) If circulated cement drops or fails to circulate, cement shall be emplaced from surface by a

method approved by the inspector.

(4) Surface casing.

(a) An owner shall set and cement sufficient surface casing at least fifty feet below the base of the deepest USDW, or at least fifty feet into competent bedrock, whichever is deeper, and as specified by the permit, unless otherwise approved by the chief. Surface casing shall be cemented before drilling though hydrocarbon bearing flow zones or zones which contain concentrations of total dissolved solids exceeding ten thousand milligrams per liter unless otherwise approved by the chief. For the purposes of this paragraph, hydrocarbon bearing flow zones shall include all formations that have historically, are currently, or are anticipated to be commercially productive.

(b) Sufficient cement shall be used to fill the annular space outside the casing from the seat to the ground surface or to the bottom of the cellar.

(c) If cement is not circulated to the ground surface or the bottom of the cellar and the top of cement cannot be measured from surface, the owner shall perform tests as approved by the inspector. The owner shall notify the inspector prior to performing the tests. After the nature of the well construction deficiency is determined, the owner shall contact the inspector and obtain approval for the procedures to be used to perform any required additional cementing operations. Surface casing shall not be perforated for the purpose of remedial cementing unless intermediate casing is set and cemented to surface, or otherwise authorized by the chief.

(d) If remedial options fail and the chief determines that USDWs are not adequately isolated or protected, the chief may issue an administrative order suspending further drilling operations. If the chief determines additional remedial measures will not isolate and protect the USDW, the chief shall issue an administrative order requiring the well to be plugged.

(e) For surface holes drilled through glacial drift deposits that exceed one hundred feet in thickness, a guide shoe shall be run on the surface casing.

(f) In areas where bedrock USDWs cannot be mapped, except in areas subject to paragraph (M)(4)(g) of this rule, surface casing shall be set and cemented at the depth stated in paragraph

(M)(4)(f)(i) or (M)(4)(f)(ii) of this rule, whichever is deeper and as determined by permit condition, or, as an alternative method for protecting groundwater resources, at the depth stated in paragraph (M)(4)(f)(iii) of this rule:

(i) At least three hundred feet deep; or

(ii) At least one hundred feet below the deepest local perennial stream base; or

(iii) At least fifty feet below the base of the lowest spring or deepest water well developed for any legitimate purpose, based upon an inventory of water supplies within a five hundred foot radius of the proposed oil and gas well. If there are no springs or water wells within the five hundred foot radius, conductor casing shall be set and cemented at a minimum depth of one hundred feet. After conductor casing is set through the deepest useable water zone and cemented to surface, the owner shall set and cement to surface a surface casing string through water zones that may include brackish or brine bearing zones. This casing string shall be set and cemented to surface before the owner drills into potential flow zones that can reasonably be expected to contain hydrocarbons in commercial quantities.

(g) In areas where bedrock USDWs cannot be mapped and where groundwater resources can be developed in valley-fill aquifers, surface casing shall be cemented at least one hundred feet below the base of the valley-fill aquifer for any well within one thousand feet of the one hundred year floodplain..

(5) Alternative surface casing requirements. An alternative method of protecting USDWs may be approved upon written application to the chief. The owner shall state the reason for the alternative USDW protection method and outline the alternative method for casing and cementing through the deepest USDW. Alternative methods for setting more than specified amounts of surface casing for well control purposes may be requested on a field-specific or area-specific basis. Alternative methods for setting less than specified amounts of surface casing shall be authorized on an individual well basis only. The chief may approve, modify, or reject the proposed alternative method. The chief shall reject the proposed method by order if the owner has not demonstrated that the alternative casing plan will meet the standards of section 1509.17 of the Revised Code and this rule. The owner may file an appeal with the oil and gas commission pursuant to section 1509.36 of the Revised Code.

An owner shall obtain the chief's written approval of any alternative method before commencing operations.

(6) Intermediate casing.

(a) Intermediate casing may be set at the discretion of the owner to isolate flow zones, lost circulation zones, or other geologic hazards, unless otherwise required by this rule or the approved permit.

(b) The owner shall set and cement intermediate casing in a competent formation in the following situations:

(i) If groundwater containing total dissolved solids of less than ten thousand milligrams per liter is encountered below the base of cemented surface casing;

(ii) Through a gas storage reservoir when drilling to strata beneath a gas storage reservoir within the storage protective boundary;

(iii) When drilling to permitted hydrocarbon zones deeper than the silurian clinton sandstone east of the updip pinchout; such casing shall be set through the Mississippian berea sandstone, or one thousand feet, whichever is greater;

(iv) For wells drilled horizontally, in the Marcellus shale, or deeper, such casing shall be set through the Mississippian berea sandstone or one thousand feet, whichever is greater; or

(v) In other situations as determined by the chief.

(c) For each intermediate string of casing that is permanently set in the wellbore, tail cement shall extend from the seat to a point at least five hundred true vertical feet above the casing seat, or to a point at least two hundred feet above the seat of the next larger diameter casing string.

(d) If the intermediate wellbore penetrates one or more flow zones, cement shall be placed at least five hundred feet above the uppermost flow zone. The cement used to control annular gas migration

from flow zones shall be designed consistent with recommended methods in API "65-2 Isolating Potential Flow Zones during Construction." The cement shall reach a compressive strength of five hundred pounds per square inch before drill out. Annular pressure shall be measured prior to drill out to verify isolation of the flow zone.

(e) If the cement placement indicators including fluid returns, lift pressure, or annular pressure indicate inadequate isolation of any flow zone, the owner shall obtain approval of the inspector for the proposed plan for determining top of cement and/or performing additional cementing operations.

(f) Liners may be set and cemented as intermediate casing provided that the cemented liner has a minimum of two hundred feet of cemented lap within the next larger casing, and the liner top is pressure tested to a level equal to or higher than the maximum anticipated pressure to be encountered in the interval to be drilled below the liner. The test pressure may not decline by more than ten per cent during the thirty minute test period. If at the end of a thirty minute pressure test, the pressure has dropped by more than ten per cent, the owner shall not resume operations until the condition is corrected and verified by a thirty minute pressure test.

(7) Production casing and liners.

(a) Cemented completions.

(i) The production casing shall be cemented with sufficient cement to fill the annular space to a point at least five hundred true vertical feet above the seat in an open-hole vertical completion or the uppermost perforation in a cemented vertical completion, or one thousand feet above the kickoff point of a horizontal well. If any flow zone is present, including strata that may contain hydrocarbons in commercial quantities or a hydrogen sulfide-bearing flow zone, the casing shall be cemented in a manner that effectively isolates such strata with at least five hundred feet of cement above the zone. The cement slurry shall be designed to control annular gas migration consistent with recommended methods in API "65-2 Isolating Potential Flow Zones during Construction."

(ii) When cementing the production string of a well that will be stimulated by hydraulic fracturing, and the uppermost perforation is less than five hundred feet below the base of the deepest USDW, sufficient cement shall be used to fill the annular space outside the casing from the seat to the ground

surface or to the bottom of the cellar. If cement is not circulated to the ground surface or the bottom of the cellar, the owner shall notify the inspector and perform tests approved by the inspector. After the top of cement outside the casing is determined, the owner or his authorized representative shall contact the inspector and obtain approval for the procedures to be used to perform any required additional cementing operations.

(iii) Liners may be set and cemented as production casing, provided that the cemented liner has a minimum of two hundred true vertical depth feet of cemented lap within the next larger casing, and the liner top is pressure tested to a level that is at least five hundred pounds per square inch higher than the maximum anticipated pressure to be encountered by the wellbore during completion and production operations. The test pressure may not decline by more than ten per cent during the thirty minute test period. If at the end of a thirty minute pressure test, the pressure has dropped by more than ten per cent, the owner shall not resume operations until the condition is corrected and verified by a thirty minute pressure test. Liners may only be set and cemented as production casing in horizontal shale gas wells if approved by the chief.

(iv) If operations indicate inadequate cement coverage or isolation of the hydrocarbon bearing zones, the owner shall obtain approval of the inspector for procedures to determine the top of cement and/or perform corrective actions.

(b) Packer completions. Packer or other non-cemented completions may be used in place of cemented completions. If intermediate casing is run with this type of completion, cementing shall meet the requirements of paragraph (M)(7) of this rule. If intermediate casing is not run, a multi-stage cementing tool shall be run above the top external packer and cemented to fill the annular space outside the casing to the surface or to a point at least five hundred feet above the packer or casing seat. The chief may approve alternative completion proposals. Any approved alternative shall meet the well construction standards of section 1509.17 of the Revised Code and these rules.

(N) Annular pressure.

(1) Wellhead assemblies shall be used to maintain surface control of the well. Each component of the wellhead shall have a working pressure rating equal to or greater than the highest anticipated operating pressure to which the particular component might be exposed during the course of drilling,

testing, completing, stimulating, or producing the well.

(2) The valve on the surface-production casing annulus or surface-intermediate casing annulus shall be accessible and equipped with a pressure gauge to allow continual monitoring of mechanical integrity. The valve shall also be equipped with a properly functioning pressure relief valve set at or below the hydrostatic pressure at the surface casing seat assuming a pressure gradient of 0.433 pounds per square inch times the height of the groundwater column. If the hydrostatic head at the casing seat is unknown, the surface-production casing annulus is assumed to be over-pressurized when annular pressure measured at surface exceeds 0.303 multiplied by the length of the surface casing. If the inspector approves perforation of surface casing and intermediate casing is not installed and cemented, the allowable annular pressure measured at surface in pounds per square inch will be established by multiplying the depth of the uppermost perforation by 0.303.

(3) If any time after installation of the wellhead assembly, the sustained annular pressure exceeds the prescribed pressure or releases the pressure relief valve, the owner shall immediately notify the inspector.

(4) The inspector shall approve tests or logging procedures to evaluate the cause of over-pressurized conditions and approve a plan for corrective action. If remedial cementing, replacement of defective casing, or implementation of other mechanical barriers or operational solutions cannot eliminate over-pressurized conditions, the owner shall plug the well.

(5) During stimulation or workover operations, all annuli shall be pressure-monitored. Stimulation or workover operations shall be immediately suspended for any inexplicable pressure deviation above those anticipated increases caused by pressure or thermal transfer. In the event that stimulation fluids circulate, or annular pressures deviate from anticipated, the owner shall immediately notify the inspector and acquire approval for remediation of casing or cement. If the chief determines that the stimulation of the well has resulted in irreparable damage to the well, the chief shall order that the well be plugged and abandoned within thirty days of issuance of the order.

(O) Well construction records.

(1) Within sixty days after drilling to total depth, the owner shall file a legible copy of all cement job

logs with the chief furnishing complete data documenting the cementing of all cemented casing strings, on a form approved by the chief and signed by the owner of the well or his authorized agent having personal knowledge of the facts, and representatives of the cementing company performing the cementing job, attesting to compliance with the cementing requirements of this rule.

(2) Each job log shall include the following information:

(a) Date cemented;

(b) Name of the cementing contractor;

(c) Mix water temperature and pH;

(d) Whether or not the wellbore circulated prior to cementing;

(e) Hole diameter in inches, casing outer diameter in inches, casing length in feet, float equipment depth in feet, basket depth in feet, and centralizer depth in vertical segments of the wellbore in feet;

(f) Number of centralizers placed in the horizontal segment of a wellbore;

(g) Cement type, additives by percent of unit volume, volume of cement in sacks, cement yield per sack, average slurry density in pounds per gallon, slurry volume in barrels, and displacement volume in barrels;

(h) Pumping rates in barrels per minute, displacement pressure in pounds per square inch, and final circulating pressure prior to landing the plug in pounds per square inch;

(i) The time the latch-down or wiper plug landed;

(j) Casing test pressure in pounds per square inch and final test pressure in pounds per square inch;

(k) Whether or not cement circulated to surface; and

(l) Volume of cement slurry circulated to surface in barrels.