**R309. Environmental Quality, Drinking Water.**

**R309-515. Facility Design and Operation: Source Development.**

**R309-515-1. Purpose.**

This rule specifies requirements for public drinking water sources. It is intended to be applied in conjunction with Rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water that consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

**R309-515-2. Authority.**

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii), and in accordance with Title 63G- Chapter 3, Administrative Rulemaking Act.

**R309-515-3. Definitions.**

Definitions for certain terms used in this rule are given in Rule R309-110 but may be further clarified in Sections R309-515-4 through R309-515-8.

**R309-515-4. General.**

(1) Issues to be Considered.

The selection, development, and operation of a public drinking water source must be done in a manner that will protect public health and assure that required water quality standards, as described in Rule R309-200, are met.

(2) Communication with the Division.

Because of the issues described in Subsection R309-515-4(1), engineers are advised to work closely with the Division to help assure that sources are properly sited, developed, and operated.

(3) Number of Sources and Quantity Requirements.

Community water systems serving more than 100 connections shall have a minimum of two sources, except where served by a surface water treatment plant. For each system, the total developed source capacity shall equal or exceed the peak day demand of the system. Refer to Section R309-510-7 of these rules for procedure to estimate the peak day demand.

(4) Quality Requirements.

In selecting a source of water for development, the designing engineer shall demonstrate to the satisfaction of the Director that the source selected for use in public water systems are of satisfactory quality, or can be treated in a manner so that the quality requirements of Rule R309-200 can be met.

(5) Initial Analyses.

New drinking water sources, unless otherwise noted in Subsections R309-515-4(5)(a) through (f), shall be analyzed for:

(a) each of the primary and secondary inorganic contaminants listed in Rule R309-200, Table 200-1 and Table 200-5, excluding Asbestos unless it would be required by Subsection R309-205-5(2);

(b) Ammonia as N; Boron; Calcium; Copper; Lead; Magnesium; Potassium; Turbidity, as NTU; Specific Conductivity at 25 degrees Celsius, micro mhos/cm; Bicarbonate; Carbon Dioxide; Carbonate; Hydroxide; Phosphorous, Ortho as P; Silica, dissolved as SiO2; Surfactant as MBAS; Total Hardness as CaCO3; and Alkalinity as CaCO3;

(c) pesticides, PCBs, and SOCs as listed in Subsection R309-200-5(3)(a), Table 200-2 unless the system is a transient non-community PWS or, if a community PWS or non-transient non-community PWS, has received waivers in accordance with Subsection R309-205-6(1)(f). The following six constituents have been excused from monitoring in the state by the EPA, dibromochloropropane, ethylene dibromide, Diquat, Endothall, glyphosate and Dioxin;

(d) VOCs as listed in Subsection R309-200-5(3)(b), Table 200-3 unless the system is a transient non-community PWS; and

(e) radiologic chemicals as listed in Subsection R309-200-5(4) unless the system is a non-transient non-community PWS or a transient non-community PWS.

(f) Every analysis shall be performed by a certified laboratory as required by Section R309-205-4 Specially prepared sample bottles are required.

(6) Source Classification.

Subsection R309-505-7(1)(a)(i) provides information on the classification of water sources. The Director shall classify each existing or new source as either:

(a) surface water or groundwater under direct influence of surface water which requires conventional surface water treatment or an approved equivalent; or as

(b) groundwater not under the direct influence of surface water.

(7) Latitude and Longitude.

The latitude and longitude, to at least the nearest second, or the location by section, township, range, and course and distance from an established outside section corner or quarter corner of each point of diversion shall be submitted to the Director before source approval.

**R309-515-5. Surface Water Sources.**

(1) Definition.

A surface water source, as is defined in Rule R309-110, shall include tributary systems, drainage basins, natural lakes, artificial reservoirs, impoundments, and springs or wells that have been classified as being directly influenced by surface water. Surface water sources will not be considered for culinary use unless they can be made acceptable by conventional surface water treatment or other equivalent treatment techniques acceptable to the Director.

(2) Pre-design Submittal.

The following information must be submitted to the Director and approved in writing before commencement of design of diversion structures or water treatment facilities:

(a) a copy of the chemical analyses required by Rule R309-200 and described in Subsection R309-515-4(5); and

(b) a survey of the watershed tributary to the watercourse along which diversion structures are proposed. The survey shall include:

(i) determining possible future uses of impoundments or reservoirs;

(ii) the present stream classification by the Division of Water Quality, any obstacles to having a stream reclassified 1C, and determining degree of watershed control by owner or other agencies;

(iii) assessing degree of hazard to the supply by accidental spillage of materials that may be toxic, harmful or detrimental to treatment processes;

(iv) obtaining samples over a sufficient period to assess the microbiological, physical, chemical and radiological characteristics and variations of the water;

(v) assessing the capability of the proposed treatment process to reduce contaminants to applicable standards; and

(vi) consideration of currents, wind and ice conditions, and the effect of tributary streams at their confluence.

(3) Pre-construction Submittal.

Following approval of a surface water source, the following additional information must be submitted for review and approval before starting construction:

(a) acceptable evidence that the water system has a legal right to divert water for the proposed uses from the proposed sources;

(b) minimum quantity that the surface water source can produce, see Subsection R309-515-5(4)(a); and

(c) complete plans and specifications and supporting documentation for the proposed treatment facilities to ascertain compliance with Rules R309-525 or R309-530.

(4) Quantity.

The quantity of water from surface sources shall:

(a) be assumed to be no greater than the low flow of a 25-year recurrence interval or the low flow of record for these sources when 25 years of records are not available;

(b) meet or exceed the anticipated peak day demand for water as estimated in Section R309-510-7 and provide a reasonable surplus for anticipated growth; and

(c) be enough to compensate for losses such as silting, evaporation, seepage, and sludge disposal, which would be anticipated in the normal operation of the treatment facility.

(5) Diversion Structures.

Design of intake structures shall provide for:

(a) withdrawal of water from more than one level if quality varies with depth;

(b) intake of the lowest withdrawal elevation located at sufficient depth to be kept submerged at the low water elevation of the reservoir;

(c) separate facilities for release of less desirable water held in storage;

(d) occasional cleaning of the inlet line;

(e) a diversion device capable of keeping large quantities of fish or debris from entering an intake structure; and

(f) suitable protection of pumps where used to transfer diverted water.

(6) Impoundments.

The design of an impoundment reservoir shall provide for, where applicable:

(a) removal of brush and trees to the high water level;

(b) protection from floods during construction;

(c) abandonment of every well, which may be inundated, refer to applicable requirements of the Division of Water Rights; and

(d) adequate precautions to limit nutrient loads.

**R309-515-6. Groundwater - Wells.**

(1) Required Treatment.

If properly developed, water from wells may be suitable for culinary use without treatment. A determination concerning whether treatment may be required can only be made after the source has been developed and evaluated.

(2) Standby Power.

Water suppliers shall assess the capability of their system in the event of a power outage. If a community water system has no naturally flowing water sources such as springs or flowing wells, one or more of the system's sources shall be equipped for operation during power outages. In this event:

(a) to ensure continuous service when the primary power has been interrupted, a redundant power supply shall be provided. A redundant power supply may include a transfer switch for auxiliary power such as a generator or a power supply service with coverage from two independent substations.

(b) when automatic pre-lubrication of pump bearings is necessary, and an auxiliary power supply is provided, the pre-lubrication line shall be provided with a valved by-pass around the automatic control, or the automatic control shall be wired to the emergency power source.

(3) The Utah Division of Water Rights.

The Utah Division of Water Rights, State Engineer's Office, regulates the drilling of water wells. Before the drilling of a well commences, the well driller must receive a start card from the State Engineer's Office. For public drinking water supply wells, Rule R655-4 applies and shall be followed in addition to this rule.

(4) Source Protection.

Public drinking water systems are responsible for protecting their sources from contamination. The selection of a well location shall only be made after consideration of the requirements of Rule R309-600. Sources shall be located in an area that will minimize threats from existing or potential sources of pollution.

(a) A public water system shall not develop a new groundwater source if existing sewer infrastructure, including sewer lines, sewer laterals, or sewer maintenance holes, exist within the boundaries of source protection zone one. For purposes of this section, floor drains are not considered to be applicable sewer infrastructure.

(b) The Director may approve, as a permit order under Section 19-1-301.5, new groundwater sources if the conditions identified in Subsection R309-600-13(3) are met and each applicable sewer infrastructure, carrying wastewater from a building or home to a public sewer or an onsite wastewater system, located within source protection zone one is specially constructed as follows:

(i) Sewer lines shall be constructed to remain watertight. The lines shall be deflection-tested in accordance with Rule R317-3. The lines shall be video-inspected for any defect after completion of construction and before being placed in service. The sewer pipe material shall be:

(A) high density polyethylene (HDPE) pipe with a PE3408 or PE4710 rating from the Plastic Pipe Institute and have a Standard Dimension Ratio (SDR) of 17 or less, and each joint shall be fusion-welded; or

(B) polyvinyl chloride (PVC) pipe meeting AWWA Specification C900 or C905 and have a DR of 18 or less. PVC pipe shall be either restrained gasketed joints or shall be fusion-welded. Solvent cement joints shall not be acceptable. The PVC pipe shall be clearly identified when installed, by marking tape or other means as a sanitary sewer line; or

(C) ductile iron pipe with ceramic epoxy lining, polyethylene encasement, restrained joints, and a minimum pressure class of 200.

(ii) Procedures for leakage tests shall be named and comply with Rule R317-3.

(iii) Lateral to sewer line connection shall be fusion-welded, shop-fabricated, or saddled with a mechanical clamping watertight device designed for the specific pipe.

(iv) Inlet and outlet sewer pipes shall be joined to a maintenance hole with a gasketed flexible watertight connection.

(v) The sewer pipe shall be laid with no greater than 2% deflection at any joint.

(vi) Backfill shall be compacted to not less than 95% of maximum laboratory density as determined in accordance with ASTM Standard D-690.

(vii) Sewer maintenance hole shall meet Subsections R309-515-6(4)(b)(vii)(A) through (C) requirements.

(A) The maintenance hole shall be constructed of reinforced concrete, HDPE, or approved equivalent.

(B) Maintenance hole base and walls, up to a point at least 12 inches above the top of the upper most sewer pipe entering the maintenance hole, shall be fabricated in a single concrete pour without joints.

(C) The maintenance hole shall be air pressure tested after installation.

(5) Outline of Well Approval Process.

(a) Well drilling shall not begin until both of the following items are submitted and receive a favorable review:

(i) a Preliminary Evaluation Report on source protection issues as required by Section R309-600-13; and

(ii) engineering plans and specifications governing the well drilling, prepared by a licensed well driller holding a current Utah Well Drillers License or prepared, signed, and stamped by a licensed professional engineer or professional geologist licensed to practice in Utah.

(b) Inspection of Well Sealing During Construction.

(i) Authorized Individuals

(A) The following individuals are authorized to witness the well sealing procedure for a public drinking water well:

(I) an engineer or a geologist from the Division of Drinking Water;

(II) a district engineer of the Department of Environmental Quality;

(III) an authorized representative of the Division of Water Rights; or

(IV) an individual having written authorization from the Director and meeting the criteria in Subsection R309-515-6(5)(b)(ii).

(B) During the well sealing, an individual, who is authorized per Subsection R515-6(5)(b)(i)(A)(IV), shall present to the well driller a copy of the authorization letter to witness a well sealing on behalf of the Division of Drinking Water. A copy of this letter shall be appended to the witness certification letter.

(C) At least three days before the anticipated well sealing, the well driller shall arrange for an authorized witness listed in Subsection R515-6(5)(b)(i)(A) to witness the procedure. See Subsection R309-515-6(6).

(ii) Obtaining Authorization

(A) To be authorized per Subsection R515-6(5)(b)(i)(A)(IV) to witness a well sealing procedure, an individual must have no relationship to the driller or the well's owner. The individual must have at least five years professional experience designing wells, supervising well drilling, or other equivalent experience associated with well drilling or well sealing that is acceptable to the Director.

(B) Individuals, desiring the Director's authorization to witness a well sealing procedure, shall provide the following information to the Director for review, signed and attesting to the correctness of the information:

(I) a detailed description of the applicant's experience with well drilling projects, including number of years of experience and type of work. Three references confirming this professional experience are required.

(II) evidence of licensure as a professional engineer or professional geologist in Utah.

(III) no relationship may exist between a person authorized to witness well sealings and a well driller that would serve as the basis for suspicion of favoritism, leniency, or punitive action in the performance of this task. Examples of such relationships would be family; former long-term employment associations; business partnerships, either formal or informal. The Director's decision, with right of appeal as provided in Rule R305-7, shall be accepted relative to what constitutes a conflict of interest or a relationship sufficient to disqualify an applicant from any witness opportunities.

(IV) An acknowledgment that the individual would not be acting as an agent or employee of the State of Utah and any losses incurred while acting as a witness would not be covered by governmental immunity or Utah's insurance.

(V) Willingness to follow established protocols and attend such training events as may be required by the Director.

(VI) Complete with a minimum 75% passing grade, an examination on water well drilling rules, as offered by the Division of Water Rights.

(C) The Director may rescind the authorization if an individual fails to comply with the criteria or conditions of the authorization.

(iii) Well Seal Certification

The individual witnessing the well sealing procedure shall provide a signed letter, including the following information, to the Director within 30 days of the well sealing:

(A) certification that the well sealing procedure met every requirement of Subsection R309-515-6(6)(i);

(B) the water right under which the well was drilled and the well driller's license number;

(C) the public water system name, if applicable;

(D) the latitude and longitude of the well and method used for its determination;

(E) the well head's approximate elevation;

(F) casing diameter, length, and material;

(G) the size of the annulus between the borehole and casing;

(H) a description of the sealing process including the sealing material used, its volume, density, method of placement, and depth from surface; and

(I) the names and company affiliations of other individuals observing the sealing procedure including, the well driller, the well owner, or a consultant.

(c) After completion of the well drilling, the following information shall be submitted and receive a favorable review before water from the well can be introduced into a public water system:

(i) a copy of the Report of Well Driller as required by the State Engineer's Office which is complete in every aspect and has been stamped as received by the same;

(ii) a copy of the letter from the authorized individual described in Subsection R309-515-6(5)(b), indicating inspection and confirmation that the well was grouted in accordance with the well drilling specifications and the requirements of this rule;

(iii) a copy of the aquifer drawdown test data, as a minimum, including the yield versus drawdown test data, as described in Subsection R309-515-6(10)(b) along with comments and interpretation by a licensed professional engineer or licensed professional geologist of the graphic drawdown information required by Subsection R309-515-6(10)(b)(vi)(E);

(iv) a copy of the chemical analyses required by Subsection R309-515-4(5);

(v) acceptable evidence that the water system owner has a legal right to divert water for the proposed use from the well source;

(vi) a copy of complete plans and specifications prepared, signed, and stamped by a licensed professional engineer covering the well housing, equipment, and diversion piping necessary to introduce water from the well into the distribution system; and

(vii) a bacteriological analysis of water obtained from the well after installation of permanent equipment, disinfection, and flushing.

(d) An Operation Permit shall be obtained in accordance with Section R309-500-9 before any water from the well is introduced into a public water system.

(6) Well Materials, Design, and Construction.

(a) ANSI/NSF Standards 60 and 61 Certification.

Interior surfaces must consist of products complying with ANSI/NSF Standard 61. This requirement applies to drop pipes, well screens, coatings, adhesives, solders, fluxes, pumps, switches, electrical wire, sensors, and any other equipment or surfaces which may contact the drinking water.

Substances introduced into the well during construction or development shall be certified to comply with ANSI/NSF Standard 60. This requirement applies to drilling fluids, including biocides, clay thinners, defoamers, foamers, loss circulation materials, lubricants, oxygen scavengers, viscosifiers, weighting agents, and regenerants.

(b) Permanent Steel Casing Pipe shall:

(i) be new single steel casing pipe meeting AWWA Standard A-100, ASTM or API specifications and having a minimum weight and thickness as given in Table 6 found in Subsection R655-4-11(11.2.3);

(ii) have additional thickness and weight, if minimum thickness is not considered sufficient to assure reasonable life expectancy of the well;

(iii) be capable of withstanding forces to which it is subjected;

(iv) be equipped with a drive shoe when driven;

(v) have full circumferential welds or threaded coupling joints; and

(vi) project at least 18 inches above the anticipated final ground surface and at least 12 inches above the anticipated pump house floor level. At sites subject to flooding, the top of the well casing shall terminate at least three feet above the 100-year flood level or the highest known flood elevation, whichever is higher.

(c) Non-Ferrous Casing Material.

The use of any non-ferrous material for a well casing shall receive prior approval of the Director based on the ability of the material to perform its desired function. Thermoplastic water well casing pipe shall meet AWWA Standard A100-06 and shall bear the logo NSF-wc indicating compliance with NSF Standard 14 for use as well casing.

(d) Disposal of Cuttings.

Cuttings and waste from well drilling operations shall not be discharged into a waterway, lake, or reservoir. The rules of the Utah Division of Water Quality must be observed with respect to these discharges.

(e) Packers.

Packers, if used, shall be of material that will not impart taste, odor, toxic substances, or bacterial contamination to the well water. Lead or partial lead packers are specifically prohibited.

(f) Screens.

The use of well screens is recommended where appropriate and, if used, they shall:

(i) be constructed of material resistant to damage by chemical action of groundwater or cleaning operations;

(ii) have size of openings based on sieve analysis of formations or gravel pack materials;

(iii) have sufficient diameter to provide adequate specific capacity and low aperture entrance velocities;

(iv) be installed so that the operating water level remains above the screen under any pumping conditions; and

(v) be provided with a bottom plate or wash-down bottom fitting of the same material as the screen.

(g) Plumbness and Alignment Requirements.

Every well shall be tested for plumbness and vertical alignment in accordance with AWWA Standard A100. Plans and specifications submitted for review shall:

(i) have the test method and allowable tolerances clearly stated in the specifications; and

(ii) clearly state any options the design engineer may have if the well fails to meet the requirements. Generally, wells may be accepted if the misalignment does not interfere with the installation or operation of the pump or uniform placement of grout.

(h) Casing Perforations.

The placement of perforations in the well casing shall:

(i) be located, as far as practical, to permit the uniform collection of water around the circumference of the well casing; and

(ii) be of dimensions and size to restrain the water bearing soils from entrance into the well.

(i) Well Sealing Techniques and Requirements.

For each public drinking water well, the annulus between the outermost well casing and the borehole wall shall be sealed with grout to a depth of at least 100 feet below the ground surface unless an exception is issued by the Director, see Subsection R309-500-4(1). If more than one casing is used, including a conductor casing, the annulus between the outermost casing and the next inner casing shall be sealed with grout, meeting the sealing materials requirements of Subsection R309-515-6(i)(ii) or with a water tight steel ring having a thickness equal to that of the permanent well casing and continuously welded to both casings. If a public drinking water well will be equipped with a pitless adapter or unit, a well seal shall be installed to a minimum depth of 110 feet to account for the top 10 feet of compromised seal interval.

The following shall apply to each drinking water well:

(i) Consideration During Well Construction.

(A) Sufficient annular opening shall be provided to permit a minimum of two inches of grout between the outermost permanent casing and the drilled hole, taking into consideration any joint couplings.

(B) The casing must be placed to permit unobstructed flow and uniform thickness of grout.

(ii) Sealing Materials.

(A) Neat Cement Grout.

Cement, conforming to ASTM Standard C150, and water, with no more than six gallons of water per sack of cement, shall be used for two-inch openings. Additives may be used to increase fluidity subject to approval by the Director.

(B) Concrete Grout.

Equal parts of cement conforming to ASTM Standard C150, and sand, with no more than six gallons of water per sack of cement, may be used for openings larger than two inches.

(C) Clay Seal.

Where an annular opening greater than six inches is available, a seal of swelling bentonite meeting the requirements of Subsection R655-4-11(11.4.2) may be used when approved by the Director.

(iii) Application.

(A) When the annular opening is less than four inches, grout shall be installed under pressure using a positive displacement grout pump, from the bottom of the annular opening to be filled.

(B) When the annular opening is four or more inches and 100 feet or less in depth, and concrete grout is used, it may be placed by gravity through a grout pipe installed to the bottom of the annular opening in one continuous operation until the annular opening is filled.

(C) Every temporary construction casing shall be removed before or during the well sealing operation. Any exceptions shall be approved by the State Engineer's Office, and evidence of State Engineer's Office's approval shall be submitted to the Director, See Subsection R655-4-11(11.4.3.1) for conditions concerning leaving temporary surface casing in place. A temporary construction casing is a casing not intended to be part of the permanent well.

(D) When a well in a protected aquifer classification is desired, the grout seal shall extend from the ground surface down to at least 100 feet below the surface, and through the protective clay layer. See Subsection R309-600-6(23).

(E) After cement grouting is applied, work on the well shall be discontinued until the cement or concrete grout has properly set, usually a period of 72 hours.

(j) Water Entered into Well During Construction.

Any water entering a well during construction shall not be contaminated and should be obtained from a chlorinated municipal system. Where this is not possible, the water must be treated to produce a 100 mg/l free chlorine residual in accordance with Subsection R655-4-11(11.6.5).

(k) Gravel Pack Wells.

The following shall apply to gravel packed wells:

(i) the gravel pack material shall be of well-rounded particles, at least 90% siliceous material, no more than 5% acid solubility, smooth and uniform, free of foreign material, properly sized, washed, and then disinfected immediately before or during placement;

(ii) the gravel pack shall be placed in one uniform continuous operation;

(iii) refill pipes, when used, shall be Schedule 40 steel pipe incorporated within the pump foundation and terminated with screwed or welded caps at least 12 inches above the pump house floor or concrete apron;

(iv) refill pipes located in the grouted annular opening shall be surrounded by a minimum of 1.5 inches of grout;

(v) protection shall be provided to prevent leakage of grout into the gravel pack or screen; and

(vi) any casings not withdrawn entirely shall meet requirements of Subsection R309-515-6(6)(b) or Subsection R309-515-6(6)(c).

(7) Well Development.

(a) Every well shall be developed to remove the native silts and clays, drilling mud, or finer fraction of the gravel pack.

(b) Development should continue until the maximum specific capacity is obtained from the completed well.

(c) Where chemical conditioning is required, the specifications shall include provisions for the method, equipment, chemicals, testing for residual chemicals, and disposal of waste and inhibitors.

(d) Where blasting procedures may be used, the specifications shall include the provisions for blasting and cleaning. Special attention shall be given to assure that the grouting and casing are not damaged by the blasting.

(8) Capping Requirements.

(a) The well shall be securely capped in accordance with Subsection R655-4-14(14.1) until permanent equipment can be installed.

(b) Continually, during the progress of work, the contractor shall provide protection to prevent tampering with the well or entrance of foreign materials.

(9) Well Abandonment.

(a) Test wells and groundwater sources, which will be permanently abandoned shall be abandoned in accordance with Section R655-4-14.

(b) Wells to be abandoned shall be sealed to prevent undesirable exchange of water from one aquifer to another. Preference shall be given to using a neat cement grout. Where fill materials are used, which are other than cement grout or concrete, they shall be disinfected and free of foreign materials. When an abandoned well is filled with cementgrout or concrete, these materials shall be applied to the well- hole through a pipe, tremie, or bailer.

(10) Well Assessment.

(a) Step Drawdown Test.

Preliminary to the constant-rate test required in Subsection R309-515-6(10)(b), it is recommended that a stepdrawdown test, which is uniform increases in pumping rates over uniform time intervals with single drawdown measurements taken at the end of the intervals, be conducted to determine the maximum pumping rate for the desired intake setting.

(b) Constant-Rate Test.

A constant-rate yield and drawdown test shall:

(i) be performed on every production well after well development and before placement of the permanent pump;

(ii) have the test methods clearly indicated in the specifications;

(iii) have a test pump with sufficient capacity that when pumped against the maximum anticipated drawdown, it will be capable of pumping more than the desired design discharge rate;

(iv) provide for continuous pumping for at least 24 hours or until stabilized drawdown has continued for at least six hours when test pumped at a constant-rate equal to the desired design discharge rate;

(v) provide the following data:

(A) capacity vs. head characteristics for the test pump, manufacturer's pump curve;

(B) static water level, in feet to the nearest tenth, as measured from an identified datum; usually the top of casing;

(C) depth of test pump intake; and

(D) time and date of starting and ending test;

(vi) For the constant-rate test, provide the following at time intervals sufficient for at least ten essentially uniform intervals for each log cycle of the graphic evaluation required in Subsection R309-515-6(10)(b)(vi)(A) through Subsection R309-515-6(10)(b)(vi)(E):

(A) record the time since starting test in minutes;

(B) record the pumping rate;

(C) record the pumping water level, in feet to the nearest tenth, as measured from the same datum used for the static water level;

(D) record the drawdown, which is the pumping water level minus static water level in feet to the nearest tenth;

(E) provide graphic evaluation on semi-logarithmic graph paper by plotting the drawdown measurements on the arithmetic scale at locations corresponding to time since starting test on the logarithmic scale; and

(vii) Immediately after termination of the constant-rate test, and until there are no changes in depth to water level measurements for at least six hours, record the following at time intervals similar to those used during the constant-rate pump test:

(A) time since stopping pump test in minutes;

(B) depth to water level, in feet to the nearest tenth, as measured from the same datum used for the pumping water level.

(c) Safe Yield.

If the aquifer drawdown test data show that the drawdown has stabilized, the Director will consider 2/3 of the pumping rate used in the constant-rate test as the safe yield of the well. The safe yield is used to determine the number of permanent residential connections or ERCs that a well source can support.

(11) Well Disinfection.

Every new, modified, or reconditioned well including pumping equipment shall be disinfected before being placed into service for drinking water use. These shall be disinfected according to AWWA Standards C654-03 and A100-06 as modified to incorporate the following as a minimum standard:

(a) the well shall be disinfected with a chlorine solution of sufficient volume and strength and so applied that a concentration of at least 50 parts per million is obtained in every part of the well and the equipment installed in the well. This solution shall remain in the well for a period of at least eight hours; and

(b) a satisfactory bacteriologic water sample analysis shall be obtained the use of water from the well in a public water system.

(12) Well Equipping.

(a) Naturally Flowing Wells.

Naturally flowing wells shall:

(i) have the discharge controlled by valves;

(ii) be provided with permanent casing and sealed by grout; and

(iii) if erosion of the confining bed adjacent to the well appears likely, special protective construction may be required by the Director.

(b) Well Pumps.

(i) The design discharge rate of the well pump shall not exceed the rate used during the constant-rate aquifer drawdown test.

(ii) Wells equipped with line shaft pumps shall:

(A) have the casing firmly connected to the pump structure or have the casing inserted into the recess extending at least 0.5 inches into the pump base;

(B) have the pump foundation and base designed to prevent fluids from coming into contact with joints between the pump base and the casing;

(C) be designed such that the intake of the well pump is at least ten feet below the maximum anticipated drawdown elevation; and

(D) avoid the use of oil lubrication for pumps with intake screens set at depths less than 400 feet. See Subsection R309-105-10(7) and R309-515-8(2) for additional requirements of lubricants).

(iii) Where a submersible pump is used:

(A) the top of the casing shall be effectively sealed against the entrance of water under any condition of vibration or movement of conductors or cables;

(B) the electrical cable shall be firmly attached to the riser pipe at 20-foot intervals or less; and

(C) the intake of the well pump must be at least ten feet below the maximum anticipated drawdown elevation.

(c) Pitless Well Units and Adapters.

If the excavation surrounding the well casing allowing installation of the pitless unit compromises the surface seal, the competency of the surface seal shall be restored. Torch-cut holes in the well casing shall be neat lines closely following the outline of the pitless adapter and entirely filled with a competent weld with burrs and fins removed before the installation of the pitless unit and adapter.

Pitless well units and adapters shall:

(i) be used to make a connection to a water well casing that is made below the ground. A below-the-ground connection shall not be submerged in water during installation;

(ii) terminate at least 18 inches above final ground elevation or three feet above the highest known flood elevation, whichever is greater;

(iii) contain a label or have a certification indicating compliance with the Water Systems Council Pitless Adapter Standard (PAS-97);

(iv) have suitable access to the interior of the casing to disinfect the well;

(v) have a suitable sanitary seal or cover at the upper terminal of the casing that will prevent the entrance of any fluids or contamination, especially at the connection point of the electrical cables;

(vi) have suitable access so that measurements of static and pumped water levels in the well can be obtained;

(vii) allow at least one check valve within the well casing;

(viii) be furnished with a cover that is lockable or otherwise protected against vandalism or sabotage;

(ix) be shop-fabricated from the point of connection with the well casing to the unit cap or cover;

(x) be of watertight construction throughout;

(xi) be constructed of materials at least equivalent to and having wall thickness compatible to the casing;

(xii) have field connection to the lateral discharge from the pitless unit of threaded, flanged, or mechanical joint connection;

(xiii) be threaded or welded to the well casing. If the connection to the casing is by field weld, the shop-assembled unit must be designed specifically for field welding to the casing. The only field welding permitted on the pitless unit is to connect the pitless unit to the casing; and

(xiv) have an inside diameter as great as that of the well casing, up to and including casing diameters of 12 inches, to facilitate work and repair on the well, pump, or well screen.

(d) Well Discharge Piping.

The discharge piping shall:

(i) be designed so that the friction loss will be low;

(ii) have control valves and appurtenances located above the pump house floor when an aboveground discharge is provided;

(iii) be protected against the entrance of contamination;

(iv) be equipped with a smooth-nosed sampling tap, a check valve, a pressure gauge, a means of measuring flow, and a shut-off valve. With the smooth-nosed sampling tap being the first item from the well head and the shut-off valve as the last item, unless it is a naturally flowing well which may need an alternative design;

(v) where a well pumps directly into a distribution system, be equipped with an air release vacuum relief valve located upstream from the check valve, with exhaust or relief piping terminating in a down-turned position at least six inches above the well house floor and covered with a No. 14 mesh corrosion resistant screen. An air release vacuum relief valve is not required if the specific proposed well head valve and piping design includes provisions for pumping to waste the entirety of trapped air before water is introduced into the distribution system;

(vi) have every exposed piping valve and appurtenance protected against physical damage and freezing;

(vii) be properly anchored to prevent movement;

(viii) be properly protected against surge or water hammer; and

(ix) if a pump-to-waste line exists, it shall not be connected to a sewer or storm drain without a minimum 12-inch clearance to the flood rim, and the discharge end of the pump-to-waste line shall be down-turned and covered with a No. 4 mesh corrosion resistant screen, refer to Subsection R309-545-10(1).

(e) Water Level Measurement.

(i) Provisions shall be made to permit periodic measurement of water levels in the completed well.

(ii) Where permanent water level measuring equipment is installed, it shall be made using corrosion resistant materials attached firmly to the drop pipe or pump column and installed to prevent entrance of foreign materials.

(f) Observation Wells.

Observation wells shall be:

(i) constructed in accordance with the requirements for permanent wells if they are to remain in service after completion of a water supply well; and

(ii) protected at the upper terminal to preclude entrance of foreign materials.

(g) Electrical Protection.

Sufficient electrical controls shall be placed on every pump motor to eliminate electrical problems due to phase shifts, surges, or lightning.

(13) Well House Construction.

The use of a well house is strongly recommended, particularly in installations utilizing above ground motors.

Well pump houses shall conform to the following:

(a) Casing Projection Above Floor.

The permanent casing for any groundwater well shall project at least 12 inches above the pump house floor or concrete apron surface and at least 18 inches above the final ground surface. However, casings terminated in underground vaults may be permitted if the vault is provided with a drain-to-daylight sized to handle more than the well flow and surface runoff and is directed away from the vault access.

(b) Floor Drain.

Where a well house is constructed, the floor surface shall be at least six inches above the final ground elevation and shall be sloped to provide drainage. A drain-to-daylight shall be provided unless highly impractical.

(c) Earth Berm.

Sites subject to flooding shall be provided with an earth berm terminating at an elevation at least two feet above the highest known flood elevation or other suitable protection as determined by the Director.

(d) Well Casing Termination at Flood Sites.

The top of the well casing at sites subject to flooding shall terminate at least three feet above the 100-year flood level or the highest known flood elevation, whichever is higher, refer to Subsection R309-515-6(6)(b)(vi).

(e) Miscellaneous.

The well house shall be ventilated, heated, and lighted in such a manner as to assure adequate operation of the equipment.

(f) Fencing.

Where necessary to protect the quality of the well water, the Director may require that certain wells be fenced in a manner similar to fencing required around spring areas.

(g) Access.

An access shall be provided either through the well house roof or sidewalls in the event the pump must be pulled for replacement or servicing the well.

**R309-515-7. Groundwater - Springs.**

(1) General.

Springs vary greatly in their characteristics and they should be observed for some time before development to determine any flow and quality variations. Springs determined to be under the direct influence of surface water shall comply with surface water treatment requirements.

(2) Source Protection.

Public drinking water systems are responsible for protecting their spring sources from contamination. The selection of a spring shall only be made after consideration of the requirements of Section R309-515-4. Springs must be located in an area that shall minimize threats from existing or potential sources of pollution. A Preliminary Evaluation Report on source protection issues is required by Subsection R309-600-13(2). If certain precautions are taken, sewer lines may be permitted within a public drinking water system's source protection zones at the discretion of the Director. When sewer lines are permitted in protection zones both sewer lines and maintenance holes shall be specially constructed as described in Subsection R309-515-6(4).

(3) Surface Water Influence.

Some springs yield water that has been filtered underground for years; other springs yield water that has been filtered underground only a matter of hours. Even with proper development, the untreated water from certain springs may exhibit turbidity and high coliform counts. This indicates that the spring water is not being sufficiently filtered in underground travel. If a spring is determined to be under the direct influence of surface water, it shall be treated to meet the surface water treatment requirements specified in Section R309-505-6.

(4) Pre-construction Submittal

Before beginning spring development construction, the following information shall be submitted to the Director and approved in writing:

(a) detailed plans and specifications covering the development work;

(b) if available, a copy of an engineer's or geologist's statement indicating:

(i) the historical record of spring flow variation;

(ii) expected minimum flow and the time of year it will occur;

(iii) expected maximum flow and the time of year it will occur;

(iv) expected average flow; and

(v) the behavior of the spring during drought conditions;

(c) acceptable evidence that the water system has a legal right to divert water for the proposed use from the spring source;

(d) a Preliminary Evaluation Report on source protection issues as required by Section R309-600-13;

(e) a copy of the chemical analyses required by Subsection R309-515-4(5); and

(f) an assessment of whether the spring is under the direct influence of surface water, refer to Subsection R309-505-7(1)(a).

(5) Information Required after Spring Development.

After development of a spring as a drinking water source, the following information shall be submitted to the Director for review.

(a) proof of satisfactory bacteriologic quality;

(b) information on the rate of flow developed from the spring.

Immediately after spring development, the water system shall collect monthly spring flow data during operating seasons when the spring is reasonably accessible, as a minimum, for three years, and submit spring flow data to the Director for determination of spring yield. After evaluating the spring flow information including seasonal and annual variations, the Director will determine a spring yield, which will be used in assessing the number of and type of connections that can be served by the spring. The spring yield typically is set at the 25th percentile of the spring flow data. If the spring exhibits significant seasonal or annual variations, the spring yield may be assessed on a case-by-case basis.

(c) Record drawings of spring development.

(6) Operating Permit Required.

Water from the spring can be introduced into a public water system only after it has been approved for use, in writing, as evidenced by the issuance of an Operating Permit by the Director, see Section R309-500-9.

(7) Spring Development.

The development of springs for drinking water purposes shall comply with the following requirements.

(a) The spring collection device, whether it be collection tile, perforated pipe, imported gravel, infiltration boxes, or tunnels must be covered with a minimum of 10 feet of relatively impervious soil cover. Such cover must extend a minimum of 15 feet in all horizontal directions from the spring collection device. Clean, inert, non-organic material shall be placed in the vicinity of the collection device.

(b) Where it is impossible to achieve the 10 feet of relatively impervious soil cover, an acceptable alternate will be the use of an impermeable liner provided that:

(i) the liner has a minimum thickness of at least 40 mils;

(ii) each seam in the liner is folded or welded to prevent leakage;

(iii) the liner is certified as complying with ANSI/NSF Standard 61. This requirement is waived if certain that the drinking water will not contact the liner;

(iv) the liner is installed in such a manner as to assure its integrity. No stones, two inches or larger, or sharp edged, shall be located within two inches of the liner;

(v) a minimum of two feet of relatively impervious soil cover is placed over the impermeable liner; and

(vi) the soil and liner cover are extended a minimum of 15 feet in every horizontal direction from the collection devices.

(c) Each spring collection area shall be provided with at least one collection box to permit spring inspection and testing.

(d) Each junction box and collection box must comply with Rule R309-545 with respect to access openings, venting, and tank overflow. Lids for these spring boxes shall be gasketed and the box adequately vented.

(e) The spring collection area shall be surrounded by a fence located a distance of 50 feet, preferably 100 feet if conditions allow, from each collection device on land at an elevation equal to or higher than the collection device, and a distance of 15 feet from each collection device on land at an elevation lower than the collection device. The elevation datum to be used is the surface elevation at the point of collection. The fence shall be at least stock tight, see Rule R309-110. In remote areas where no grazing or public access is possible, an exception to the fencing requirement may be granted by the Director. In populated areas, a six-foot high chain link fence with three strands of barbed wire may be required.

(f) Within the fenced area any vegetation having deep roots shall be removed by a means not negatively affecting water quality.

(g) A diversion channel, or berm, capable of diverting the entirety of anticipated surface water runoff away from the spring collection area shall be constructed immediately inside the fenced area.

(h) A permanent flow-measuring device shall be installed. Flow measurement devices such as critical depth meters or weirs shall be properly housed and otherwise protected.

(i) The spring shall be developed as thoroughly as possible to minimize the possibility of excess spring water ponding within the collection area. Where the ponding of spring water is unavoidable, the excess shall be collected by shallow piping or french drain, and be routed beyond and down grade of the fenced area, whether or not a fence is in place.

**R309-515-8. Operation and Maintenance.**

(1) Spring Collection Area Maintenance.

(a) Spring collection areas shall be periodically, preferably annually, cleared of deep-rooted vegetation to prevent root growth from clogging collection lines. Frequent hand or mechanical clearing of spring collection areas and diversion channel is strongly recommended. It is advantageous to encourage the growth of grasses and other shallow rooted vegetation for erosion control and to inhibit the growth of more detrimental flora.

(b) No pesticide or herbicide may be applied on a spring collection area without the prior written approval of the Director. Such approval can be granted only when:

(i) acceptable pesticides are proposed

(ii) the pesticide product manufacturer certifies that no harmful substance will be imparted to the water and

(iii) spring development construction meets the requirements of Rules R309-500 through R309-550.

(2) Pump Lubricants.

The US Food and Drug Administration (FDA) has approved propylene glycol and certain types of mineral oil for occasional contact with or for addition to food products. These oils are commonly referred to as food-grade mineral oils. Oil lubricated pumps shall utilize food-grade mineral oil suitable for human consumption as determined by the Director.

(3) Algicide Treatment.

No algicide shall be applied to a drinking water source unless specific approval is obtained from the Director. Such approval will be given only if the algicide is certified as meeting the requirements of ANSI/NSF Standard 60, Water Treatment Chemicals - Health Effects.

**KEY: drinking water, source development, source maintenance**

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