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3745-34-54 **Construction requirements.**

- (A) All existing and new class I hazardous waste injection wells shall be constructed and completed [by owners and operators](#) to:
- (1) Prevent the movement of fluids into or between USDWs or into any unauthorized zones; and
 - (2) Permit the use of appropriate testing devices and work over tools; and
 - (3) Permit continuous monitoring of injection tubing and long string casing as required pursuant to rule 3745-34-56 of the Administrative Code.
- (B) All well materials used in the construction of new class I hazardous waste injection wells must be compatible with fluids with which the materials may be expected to come into contact. A well shall be deemed [by the director](#) to have compatibility as long as the materials used in the construction of the well meet or exceed [the requirements of this rule](#)~~standards developed for such materials by the American Petroleum Institute or the American Society for Testing Materials.~~
- (C) Casing and cementing of new wells
- (1) Casing and cement used in the construction of each newly drilled well shall be designed for the life expectancy of the well, including the post-closure care period. The casing and cementing program shall be designed to prevent the movement of fluids into or between USDWs, and to prevent potential leaks of fluids from the well. In establishing casing and cementing requirements of the permit, the director shall consider the following information as required by rule 3745-34-59 of the Administrative Code.
 - (a) Depth to the injection zone; and
 - (b) Injection pressure, external pressure, internal pressure and axial loading; and
 - (c) Hole size; and
 - (d) Size and grade of all casing strings ([wellwall](#) thickness, diameter, nominal weight, length, joint specification and construction material); and
 - (e) Corrosiveness of injected fluid, formation fluids and temperature; and
 - (f) Lithology of injection and confining zones; and
 - (g) Type or grade of cement; and
 - (h) Quantity and chemical composition of the injected fluid.

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- (2) One surface casing string shall, at a minimum, extend into the confining bed below the lowest formation that contains a USDW and be cemented by circulating cement from the base of the casing to the surface, using a minimum of one hundred twenty per cent of the calculated annular volume. The director may require more than one hundred twenty per cent when the geology or other circumstances warrant [to protect underground sources of drinking water](#).
 - (3) At least one long string casing, using a sufficient number of centralizers, shall extend to the injection zone and shall be cemented by circulating cement to the surface in one or more stages:
 - (a) Of sufficient quantity and quality to withstand the maximum operating pressure; and
 - (b) In a quantity no less than one hundred twenty per cent of the calculated volume necessary to fill the annular space. The director may require more than one hundred twenty per cent when the geology or other circumstances warrant [to protect underground sources of drinking water](#).
 - (4) Circulation of cement may be accomplished by staging. The director may approve an alternative method of cementing in cases where the cement cannot be recirculated to the surface, provided the owner or operator can demonstrate by using logs that the cement is continuous and does not allow fluid movement behind the well bore [and it is still protective of underground sources of drinking water](#).
 - (5) Casings, including any casing connections, must be rated to have sufficient structural strength to withstand, for the design life of the well;
 - (a) The maximum burst and collapse pressures ~~which~~[that](#) may be experienced during the construction, operation, and closure of the well; and
 - (b) The maximum tensile stress ~~which~~[that](#) may be experienced at any point along the length of the casing during the construction, operation, and closure of the well.
 - (6) At a minimum, cement and cement additives must be of sufficient quality and quantity to maintain integrity over the design life of the well.
- (D) Tubing and packer
- (1) All class I hazardous waste injection wells shall inject fluids through tubing with a packer set at a point approved by the director.
 - (2) In determining and specifying requirements for tubing and packer, the director shall consider the following factors, among others:
 - (a) Depth of setting; and
 - (b) Characteristics of injection fluid (chemical content, corrosiveness, temperature and density); and

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- (c) Injection pressure; and
 - (d) Annular pressure; and
 - (e) Rate (intermittent or continuous), temperature and volume of injected fluid; and
 - (f) Size of casing; and
 - (g) Tubing tensile, burst, and collapse strengths.
- (3) ~~Upon a finding that the following conditions are met, the~~ The director may approve the use of fluid seal if he finds that the following conditions are met:
- (a) The operator demonstrates that the seal will provide a level of protection comparable to a packer; and
 - (b) The operator demonstrates that the staff is, and will remain, adequately trained to operate and maintain the well and to identify and interpret variations in parameters of concern; and
 - (c) The permit contains specific limitations on variations in annular pressure and loss of annular fluid; and
 - (d) The design and construction of the well allows continuous monitoring of the annular pressure and mass balance of annular fluid; and
 - (e) A secondary system is used to monitor the interface between the annulus fluid and the injection fluid and the permit contains requirements for testing the system every three months and recording the results.