

Class I vs. Class II Injection Wells

Criteria	Class I	Class II
<p>Construction Requirements</p>	<p>(a) All Class I wells shall be sited in such a fashion that they inject into a formation which is beneath the lowermost formation containing, within one quarter mile of the well bore, an underground source of drinking water.</p> <p>(b) All Class I wells shall be cased and cemented to prevent the movement of fluids into or between underground sources of drinking water. The casing and cement used in the construction of each newly drilled well shall be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements, the following factors shall be considered:</p> <ul style="list-style-type: none"> (1) Depth to the injection zone; (2) Injection pressure, external pressure, internal pressure, and axial loading; (3) Hole size; (4) Size and grade of all casing strings (wall thickness, diameter, nominal weight, length, joint specification, and construction material); (5) Corrosiveness of injected fluid, formation fluids, and temperatures; (6) Lithology of injection and confining intervals; and (7) Type or grade of cement. 	<p>(a) All new Class II wells shall be sited in such a fashion that they inject into a formation which is separated from any USDW by a confining zone that is free of known open faults or fractures within the area of review.</p> <p>(b) (1) All Class II injection wells shall be cased and cemented to prevent movement of fluids into or between underground sources of drinking water. The casing and cement used in the construction of each newly drilled well shall be designed for the life expectancy of the well. In determining and specifying casing and cementing requirements, the following factors shall be considered:</p> <ul style="list-style-type: none"> (i) Depth to the injection zone; (ii) Depth to the bottom of all USDWs; and (iii) Estimated maximum and average injection pressures; <p>(2) In addition the Director may consider information on:</p> <ul style="list-style-type: none"> (i) Nature of formation fluids; (ii) Lithology of injection and confining zones; (iii) External pressure, internal pressure, and axial loading; (iv) Hole size; (v) Size and grade of all casing strings; and (vi) Class of cement.

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Construction Requirements	<p>(c) All Class I injection wells, except those municipal wells injecting non-corrosive wastes, shall inject fluids through tubing with a packer set immediately above the injection zone, or tubing with an approved fluid seal as an alternative. The tubing, packer, and fluid seal shall be designed for the expected service.</p> <p>(1) The use of other alternatives to a packer may be allowed with the written approval of the Director. To obtain approval, the operator shall submit a written request to the Director, which shall set forth the proposed alternative and all technical data supporting its use. The Director shall approve the request if the alternative method will reliably provide a comparable level of protection to underground sources of drinking water. The Director may approve an alternative method solely for an individual well or for general use.</p> <p>(2) In determining and specifying requirements for tubing, packer, or alternatives the following factors shall be considered:</p> <p>(i) Depth of setting;</p> <p>(ii) Characteristics of injection fluid (chemical content, corrosiveness, and density);</p> <p>(iii) Injection pressure;</p> <p>(iv) Annular pressure;</p> <p>(v) Rate, temperature and volume of injected fluid; and</p> <p>(vi) Size of casing.</p>	<p>(c) The requirements in paragraph (b) of this section need not apply to existing or newly converted Class II wells located in existing fields if:</p> <p>(1) Regulatory controls for casing and cementing existed for those wells at the time of drilling and those wells are in compliance with those controls; and</p> <p>(2) Well injection will not result in the movement of fluids into an underground source of drinking water so as to create a significant risk to the health of persons.</p>

<p>(d) Appropriate logs and other tests shall be conducted during the drilling and construction of new Class I wells. A descriptive report interpreting the results of such logs and tests shall be prepared by a knowledgeable log analyst and submitted to the Director. At a minimum, such logs and tests shall include:</p> <p>(1) Deviation checks on all holes constructed by first drilling a pilot hole, and then enlarging the pilot hole by reaming or another method. Such checks shall be at sufficiently frequent intervals to assure that vertical avenues for fluid migration in the form of diverging holes are not created during drilling.</p> <p>(2) Such other logs and tests as may be needed after taking into account the availability of similar data in the area of the drilling site, the construction plan, and the need for additional information, that may arise from time to time as the construction of the well progresses. In determining which logs and tests shall be required, the following logs shall be considered for use in the following situations:</p> <p>(i) For surface casing intended to protect underground sources of drinking water:</p> <p>(A) Resistivity, spontaneous potential, and caliper logs before the casing is installed; and</p> <p>(B) A cement bond, temperature, or density log after the casing is set and cemented.</p> <p>(ii) For intermediate and long strings of casing intended to facilitate injection:</p> <p>(A) Resistivity, spontaneous potential, porosity, and gamma ray logs before the casing is installed;</p> <p>(B) Fracture finder logs; and</p> <p>(C) A cement bond, temperature, or density log after the casing is set and cemented.</p>	<p>(d) The requirements in paragraph (b) of this section need not apply to newly drilled wells in existing fields if;</p> <p>(1) They meet the requirements of the State for casing and cementing applicable to that field at the time of submission of the State program to the Administrator; and</p> <p>(2) Well injection will not result in the movement of fluids into an underground source of drinking water so as to create a significant risk to the health of persons.</p>
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<p>(e) At a minimum, the following information concerning the injection formation shall be determined or calculated for new Class I wells:</p> <p>(2) Temperature; pressure; chemical characteristics of the injection matrix; and Physical and chemical characteristics of the formation fluids.</p>	<p>(e) Where a State did not have regulatory controls for casing and cementing prior to the time of the submission of the State program to the Administrator, the Director need not apply the casing and cementing requirements in paragraph (b) of this section if he submits as a part of his application for primacy, an appropriate plan for casing and cementing of existing, newly converted, and newly drilled wells in existing fields, and the Administrator approves the plan.</p>
<p>(1) Fluid pressure;</p> <p>(3) Fracture pressure;</p> <p>(4) Other physical and chemical characteristics of the injection matrix; and</p> <p>(5) Physical and chemical characteristics of the formation fluids.</p>	<p>(f) Appropriate logs and other tests shall be conducted during the drilling and construction of new Class II wells. A descriptive report interpreting the results of that portion of those logs and tests which specifically relate to</p> <p>(1) an USDW and the confining zone adjacent to it, and (2) the injection and adjacent formations shall be prepared by a knowledgeable log analyst and submitted to the director. At a minimum, these logs and tests shall include:</p> <p>(1) Deviation checks on all holes constructed by first drilling a pilot hole and then enlarging the pilot hole, by reaming or another method. Such checks shall be at sufficiently frequent intervals to assure that vertical avenues for fluid movement in the form of diverging holes are not created during drilling.</p> <p>(2) Such other logs and tests as may be needed after taking into account the availability of similar data in the area of the drilling site, the construction plan, and the need for additional information that may arise from time to time as the construction of the well progresses. In determining which logs and tests shall be required the following shall be considered by the Director in setting logging and testing requirements:</p>

Construction Requirements

(i) For surface casing intended to protect underground sources of drinking water in areas where the lithology has not been determined:
(A) Electric and caliper logs before casing is installed; and
(B) A cement bond, temperature, or density log after the casing is set and cemented.
(ii) for intermediate and long strings of casing intended to facilitate injection:
(A) Electric porosity and gamma ray logs before the casing is installed; **(B)**
 Fracture finder logs; and **(C)** A cement
 bond, temperature, or density log after the casing is set and cemented.

(g) At a minimum, the following information concerning the injection formation shall be determined or calculated for new Class II wells or projects: **(1)**
 Fluid pressure; **(2)** Estimated
 fracture pressure; **(3)** Physical and
 chemical characteristics of the injection zone.

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(a) Operating requirements. Operating requirements shall at a minimum, specify that:

(1) Except during stimulation injection pressure at the wellhead shall not exceed a maximum which shall be calculated so as to assure that the pressure in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone. In no case shall injection pressure initiate fractures in the confining zone or cause the movement of injection or formation fluids into an underground source of drinking water.

(2) Injection between the outermost casing protecting underground sources of drinking water and the well bore is prohibited.

(3) Unless an alternative to a packer has been approved under § 146.12(c), the annulus between the tubing and the long string of casings shall be filled with a fluid approved by the Director and a pressure, also approved by the Director, shall be maintained on the annulus.

(b) Monitoring requirements. Monitoring requirements shall, at a minimum, include:

(1) The analysis of the injected fluids with sufficient frequency to yield representative data of their characteristics;

(2) Installation and use of continuous recording devices to monitor injection pressure, flow rate and volume, and the pressure on the annulus between the tubing and the long string of casing;

(a) Operating requirements. Operating requirements shall, at a minimum, specify that:

(1) Injection pressure at the wellhead shall not exceed a maximum which shall be calculated so as to assure that the pressure during injection does not initiate new fractures or propagate existing fractures in the confining zone adjacent to the USDWs. In no case shall injection pressure cause the movement of injection or formation fluids into an underground source of drinking water

(2) Injection between the outermost casing protecting underground sources of drinking water and the well bore shall be prohibited.

(b) Monitoring requirements. Monitoring requirements shall, at a minimum, include: **(1)**
 Monitoring of the nature of injected fluids at time intervals sufficiently frequent to yield data representative of their characteristics; **(2)** Observation of injection pressure, flow rate, and cumulative volume at least with the following frequencies:

(i) Weekly for produced fluid disposal operations;

(ii) Monthly for enhanced recovery operations;

(iii) Daily during the injection of liquid hydrocarbons and injection for withdrawal of stored hydrocarbons; and

(iv) Daily during the injection phase of cyclic steam operations **(1)** And recording of one observation of injection pressure, flow rate and cumulative volume at reasonable intervals no greater than 30 days.

(2) A demonstration of mechanical integrity pursuant to § 146.9 at least once every five years during the life of the

Operating, Monitoring and Reporting Requirements	<p>(3) A demonstration of mechanical integrity pursuant to § 146.8 at least once every five years during the life of the well; and</p> <p>(4) The type, number and location of wells within the area of review to be used to monitor any migration of fluids into and pressure in the underground sources of drinking water, the parameters to be measured and the frequency of monitoring.</p> <p>(c) Reporting requirements. Reporting requirements shall, at a minimum, include:</p> <p>(1) Quarterly reports to the Director on:</p> <p>(i) The physical, chemical and other relevant characteristics of injection fluids;</p> <p>(ii) Monthly average, maximum and minimum values for injection pressure, flow rate and volume, and annular pressure; and</p> <p>(iii) The results of monitoring prescribed under paragraph (b)(4) of this section.</p> <p>(2) Reporting the results, with the first quarterly report after the completion, of:</p> <p>(i) Periodic tests of mechanical integrity;</p> <p>(ii) Any other test of the injection well conducted by the permittee if required by the Director; and</p> <p>(iii) Any well work over.</p>	<p>(3) A demonstration of mechanical integrity pursuant to § 146.8 at least once every five years during the life of the injection well;</p> <p>(4) Maintenance of the results of all monitoring until the next permit review (see 40 CFR 144.52(a)(5)); and</p> <p>(5) Hydrocarbon storage and enhanced recovery may be monitored on a field or project basis rather than on an individual well basis by manifold monitoring. Manifold monitoring may be used in cases of facilities consisting of more than one injection well, operating with a common manifold. Separate monitoring systems for each well are not required provided the owner/operator demonstrates that manifold monitoring is comparable to individual well monitoring.</p>
Criteria	<p>(d) Ambient monitoring.(1) Based on a site-specific assessment of the potential for fluid movement from the well or injection zone and on the potential value of monitoring wells to detect such movement, the Director shall require the owner or operator to develop a monitoring program. At a minimum, the Director shall require monitoring of the pressure buildup in the injection zone annually, including at a minimum, a shut down of the well for a time sufficient to conduct a valid observation of the pressure fall-off curve.</p> <p>(2) When prescribing a monitoring system the Director may also require:</p> <p>(i) Continuous monitoring for pressure changes in the first aquifer overlying the confining zone. When such a well is installed, the owner or operator shall, on a quarterly basis, sample the aquifer and analyze for constituents specified by the Director;</p>	<p>(c) Reporting requirements.(1) Reporting requirements shall at a minimum include an annual report to the Director summarizing the results of monitoring required under paragraph (b) of this section. Such summary shall include monthly records of injected fluids, and any major changes in characteristics or sources of injected fluid. Previously submitted information may be included by reference.</p> <p>(2) Owners or operators of hydrocarbon storage and enhanced recovery projects may report on a field or project basis rather than an individual well basis where manifold monitoring is used.</p>
Operating, Monitoring and Reporting Requirements	<p>Class I</p> <p>(ii) The use of indirect, geophysical techniques to determine the position of the waste front, the water quality in a formation designated by the Director, or to provide other site specific data;</p> <p>(iii) Periodic monitoring of the ground water quality in the first aquifer overlying the injection zone;</p> <p>(iv) Periodic monitoring of the ground water quality in the lowermost USDW; and</p> <p>(v) Any additional monitoring necessary to determine whether fluids are moving into or between USDWs.</p>	<p>Class II</p> <p>No mention of Ambient Monitoring for Class II Wells</p>
	<p>This section sets forth the information which must be considered by the Director in authorizing Class I wells. For an existing or converted new Class I well the Director may rely on the existing permit file for those items of information listed below which are current and accurate in the file. For a newly drilled Class I well, the Director shall require the submission of all the information listed below. For both existing and new Class I wells certain maps, cross-sections, tabulations of wells within the area of review and other data may be included in the application by reference provided they are current, readily available to the Director (for example, in the permitting agency's files) and sufficiently identified to be retrieved. In cases where EPA issues the permit all the information in this section must be submitted to the Administrator.</p>	<p>This section sets forth the information which must be considered by the Director in authorizing Class II wells. Certain maps, cross-sections, tabulations of wells within the area of review, and other data may be included in the application by reference provided they are current, readily available to the Director (for example, in the permitting agency's files) and sufficiently identified to be retrieved. In cases where EPA issues the permit, all the information in this section is to be submitted to the Administrator.</p>
	<p>(a) Prior to the issuance of a permit for an existing Class I well to operate or the construction or conversion of a new Class I well the Director shall consider the following:</p> <p>(1) Information required in 40 CFR 144.31 and 144.31(g) ;</p>	<p>(a) Prior to the issuance of a permit for an existing Class II well to operate or the construction or conversion of a new Class II well the Director shall consider the following:</p> <p>(1) Information required in 40 CFR 144.31 and 144.31(g) ;</p>

<p>Information to be considered by the Director</p>	<p>(2) A map showing the injection well(s) for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number, or name, and location of all producing wells, dry holes, surface bodies of water, springs, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record is required to be included on this map;</p> <p>(3) A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Director may require;</p> <p>(4) Maps and cross sections indicating the general vertical and lateral limits of all underground sources of drinking water within the area of review, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection;</p> <p>(5) Maps and cross sections detailing the geologic structure of the local area;</p> <p>(6) Generalized maps and cross sections illustrating the regional geologic setting;</p> <p>(7) Proposed operating data:</p> <p>(i) Average and maximum daily rate and volume of the fluid to be injected;</p> <p>(ii) Average and maximum injection pressure; and</p> <p>(iii) Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids;</p>	<p>(2) A map showing the injection well or project area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name and location of all existing producing wells, injection wells, abandoned wells, dry holes, and water wells. The map may also show surface bodies of waters, mines (surface and subsurface), quarries and other pertinent surface features including residences and roads, and faults if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map. This requirement does not apply to existing Class II wells; and</p> <p>(3) A tabulation of data reasonably available from public records or otherwise known to the applicant on all wells within the area of review included on the map required under paragraph (a)(2) of this section which penetrate the proposed injection zone or, in the case of Class II wells operating over the fracture pressure of the injection formation, all known wells within the area of review which penetrate formations affected by the increase in pressure. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and complete, and any additional information the Director may require. In cases where the information would be repetitive and the wells are of similar age, type, and construction the Director may elect to only require data on a representative number of wells. This requirement does not apply to existing Class II wells.</p> <p>(4) Proposed operating data:</p> <p>(i) Average and maximum daily rate and volume of fluids to be injected.</p> <p>(i) Average and maximum daily rate and volume of fluids to be injected.</p> <p>(ii) Average and maximum injection pressure; and</p>
<p>Criteria</p>	<p>Class I</p>	<p>Class II</p>
	<p>(8) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the receiving formation;</p> <p>(9) Proposed stimulation program;</p> <p>(10) Proposed injection procedure;</p> <p>(11) Schematic or other appropriate drawings of the surface and subsurface construction details of the well.</p> <p>(12) Contingency plans to cope with all shut-ins or well failures so as to prevent migration of fluids into any underground source of drinking water;</p> <p>(13) Plans (including maps) for meeting the monitoring requirements in § 146.13(b) ;</p> <p>(14) For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under 40 CFR 144.55 ;</p> <p>(15) Construction procedures including a cementing and casing program, logging procedures, deviation checks, and a drilling, testing, and coring program; and</p>	<p>(iii) Source and an appropriate analysis of the chemical and physical characteristics of the injection fluid.</p> <p>(5) Appropriate geological data on the injection zone and confining zone including lithologic description, geological name, thickness and depth;</p> <p>(6) Geologic name and depth to bottom of all underground sources of drinking water which may be affected by the injection;</p> <p>(7) Schematic or other appropriate drawings of the surface and subsurface construction details of the well;</p> <p>(8) In the case of new injection wells the corrective action proposed to be taken by the applicant under 40 CFR 122.44 ;</p> <p>(9) A certificate that the applicant has assured through a performance bond or other appropriate means, the resources necessary to close plug or abandon the well as required by 40 CFR 122.42(g) ;</p> <p>(b) In addition the Director may consider the following: (1) Proposed formation testing program to obtain the information required by § 146.22(g) ;</p> <p>(2) Proposed stimulation program; (3) Proposed injection procedure;</p> <p>(4) Proposed contingency plans, if any, to cope with well failures so as to prevent migration of contaminating fluids into an underground source of drinking water; (5) Plans for meeting the</p>

Information to be considered by the Director	<p>(16) A certificate that the applicant has assured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by 40 CFR 122.42(g).</p>	<p>monitoring requirements of § 146.23(b).</p>
	<p>(b) Prior to granting approval for the operation of a Class I well the Director shall consider the following information:</p> <p>(1) All available logging and testing program data on the well;</p> <p>(2) A demonstration of mechanical integrity pursuant to § 146.8 ;</p> <p>(3) The anticipated maximum pressure and flow rate at which the permittee will operate;</p> <p>(4) The results of the formation testing program;</p> <p>(5) The actual injection procedure;</p> <p>(6) The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone; and</p> <p>(7) The status of corrective action on defective wells in the area of review.</p>	<p>(c) Prior to granting approval for the operation of a Class II well the Director shall consider the following information:</p> <p>(1) All available logging and testing program data on the well;</p> <p>(2) A demonstration of mechanical integrity pursuant to § 146.8 ;</p> <p>(3) The anticipated maximum pressure and flow rate at which the permittee will operate.</p> <p>(4) The results of the formation testing program;</p> <p>(5) The actual injection procedure; and</p> <p>(6) For new wells the status of corrective action on defective wells in the area of review.</p>
	<p>(c) Prior to granting approval for the plugging and abandonment of a Class I well the Director shall consider the following information:</p> <p>(1) The type and number of plugs to be used;</p> <p>(2) The placement of each plug including the elevation of the top and bottom;</p> <p>(3) The type and grade and quantity of cement to be used;</p> <p>(4) The method for placement of the plugs; and</p> <p>(5) The procedure to be used to meet the requirement of § 146.10(c).</p>	<p>(d) Prior to granting approval for the plugging and abandonment of a Class II well the Director shall consider the following information:</p> <p>(1) The type, and number of plugs to be used;</p> <p>(2) The placement of each plug including the elevation of top and bottom;</p> <p>(3) The type, grade, and quantity of cement to be used;</p> <p>(4) The method of placement of the plugs; and</p> <p>(5) The procedure to be used to meet the requirements of § 146.10(c).</p>
	Plugging and Abandoning the Well	Same Requirements