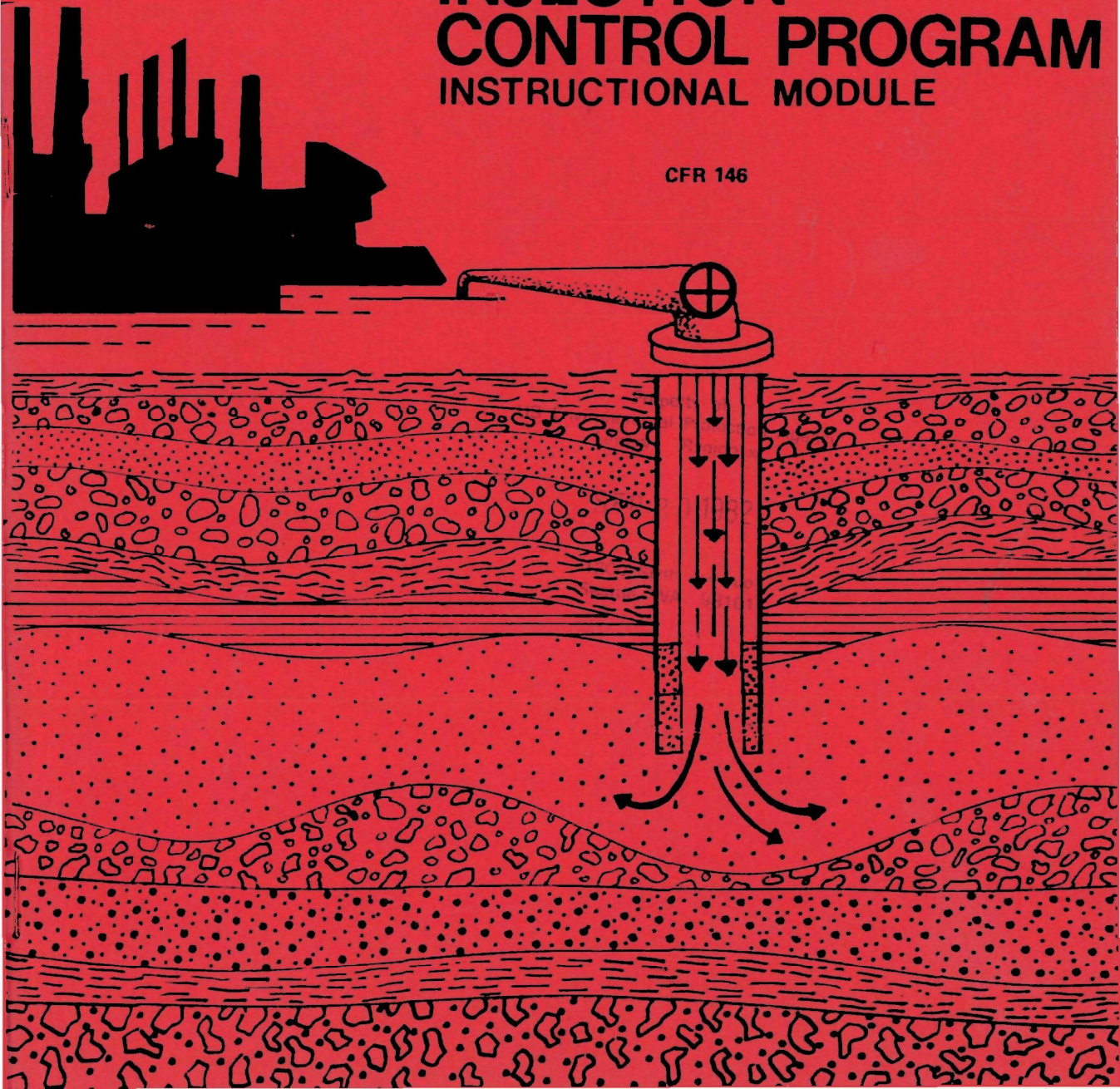


NOVEMBER 1980



UNDERGROUND INJECTION CONTROL PROGRAM INSTRUCTIONAL MODULE

CFR 146



INSTRUCTIONAL
MODULE
UNDERGROUND INJECTION
CONTROL PROGRAM

CFR 146 A
146 B

Ground Water Protection Branch
Office of Drinking Water
Environmental Protection Agency

Introduction

CFR 146

These are the second and third of a series on the Underground Injection Control Regulations. The two booklets on CFR 146 have been written to help you read the regulations. We have cut and pasted, added the full text of some references, added some comments, and some questions. Please feel free to use this booklet any way that is helpful. The questions are not intended to be a test, but rather indicators of some important points. The questions and answers are not official guidance or policy.

There will be many questions raised by reading CFR 146 that are not answered by this pamphlet. Guidance is being developed on many issues raised by the Regulations, and will be available in the future. This pamphlet is an attempt to assist with the first step, reading and digesting the Regulations as promulgated.

December 1980

Questions
146 Subpart A

1. Upon approval of a State UIC Program, any underground injection not authorized by rule or by permit is unlawful.

True _____ False _____

2. An aquifer can never become an "exempted aquifer" as long as it is serving as a drinking water source.

True _____ False _____

3. If a well is used to inject hazardous waste, and there is no USDW within 1/4 mile, it is a Class I well.

True _____ False _____

4. All wells injecting below the lowermost formation containing a USDW within 1/4 mile of the well bore are Class I wells.

True _____ False _____

5. A conventional oil or natural gas production well is a Class II well.

True _____ False _____

6. All wells identified as Class III must involve the injection of fluids for extraction of minerals or energy.

True _____ False _____

7. A deep injection well used to dispose of waste fluids in connection with a Class III well field is a Class I well.

True _____ False _____

8. A well used to inject return flow from a ground water heat pump is a Class V well.

True _____ False _____

9. Class IV wells all involve a USDW within 1/4 mile of the well bore, in or below the injection zone.

True _____ False _____

10. Some injection wells may not be included in any of the five classes of wells.

True _____ False _____

(146.06)

11. The zone of endangering influence is calculated for the expected life of the injection well.

True _____ False _____

12. In no case will the Area of Review be greater than 1/4 mile.

True _____ False _____

13. When a fixed radius is used, it must be no more than 1/4 mile.

True _____ False _____

14. When determining the adequacy of corrective action, the Director should consider the toxicity of the by-products of injection.

True _____ False _____

15. Mechanical integrity is defined as no significant leak in the casing, tubing or packer.

True _____ False _____

16. Temperature or noise logs may be used to verify the absence of significant fluid movement through vertical channels adjacent to the well bore.

True _____ False _____

17. The Director may allow other tests of mechanical integrity at his discretion.

True _____ False _____

18. In setting priorities for issuing permits, the Director must consider the factors in 146.09 (Criteria for Establishing Permitting Priorities) but is free to set priorities.

True _____ false _____

19. Class I-III wells must be plugged in a manner which will not allow the movement of fluids either into or between USDW's.

True _____ False _____

20. Static equilibrium refers to the absence of electrolysis along the casing.

True _____ False _____

146 B

21. Wells injecting into a formation which is beneath the lowermost formation containing, within 1/4 mile of the well bore, a USDW, and into a formation containing a USDW more than 1/4 mile from the well bore are Class I wells.

True _____ False _____

22. Any well injecting hazardous waste is a Class I well unless there is a USDW within 1/4 mile of the well bore, below or within the injection zone.

True _____ False _____

23. New Class I wells must be cased and cemented.

True _____ False _____

24. All Class I wells shall inject through tubing with a packer set immediately above the injection zone, or tubing with an approved fluid seal.

True _____ False _____

25. The Director may approve the use of other alternatives to a packer with the written permission of the Administrator.

True _____ False _____

26. Deviation checks are not required for all Class I wells.

True _____ False _____

27. Before surface casing is installed, a cement bond, temperature, and caliper logs shall be conducted.

True _____ False _____

28. Fracture finder logs may be run either before or after the long string is installed.

True _____ False _____

29. The temperature in the injection formation must be determined or calculated.

True _____ False _____

(146.13)

30. Class I wells may not be operated at a pressure that initiates new fractures or propagates existing fractures in the injection zone.

True _____ False _____

Subpart A—General Provisions

§ 146.01 Applicability and scope.

(a) This Part sets forth technical criteria and standards for the Underground Injection Control Program. This part should be read in conjunction with 40 CFR Parts 122, 123 and 124 which also apply to UIC programs. 40 CFR Part 122 defines the regulatory framework of EPA administered permit programs. 40 CFR Part 123 describes the elements of an approvable State program and procedures for EPA approval of State participation in the permit programs. 40 CFR Part 124 describes the procedures the Agency will use for issuing permits under the covered programs. Certain of these procedures will also apply to State-administered programs as specified in 40 CFR Part 123.

122 Permit Programs
123 State Program
124 Procedures for
Permits

(b) Upon the approval, partial approval or promulgation of a State UIC program by the Administrator, any underground injection which is not authorized by the Director by rule or by permit is unlawful.

Injection not
authorized is unlawful

42501 § 146.02 Law authorizing these regulations.

The laws authorizing these regulations and all other UIC program regulations are referenced in 40 CFR part 122. They include Sections 1421, 1422, 1423, 1431, 1445, 1447 and 1450 of the Public Health Service Act as amended by the Safe Drinking Water Act ("SDWA") (Pub. L. 93-523) and by the SDWA Amendments of 1977 (Pub. L. 95-190).

§ 146.03 Definitions.

The following definitions apply to the underground injection control program.

Abandoned well means a well whose use has been permanently discontinued

Abandoned - No use

or which is in a state of disrepair such that it cannot be used for its intended purpose or for observation purposes.

Administrator means the Administrator of the United States Environmental Protection Agency, or an authorized representative.

Application means the EPA standard national forms for applying for a permit, including any additions, revisions or modifications to the forms; or forms approved by EPA for use in approved States, including any approved modifications or revisions. For RCRA, application also includes the information required by the Director under § 122.25 (contents of Part B of the RCRA application).

Aquifer means a geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

Area of review means the area surrounding an "injection well" described according to the criteria set forth in § 146.06.

Casing means a heavy metal (steel or iron) pipe or tubing of varying diameter and weight, lowered into a borehole during or after drilling in order to support the sides of the hole and thus prevent the walls from caving, to prevent loss of drilling mud into porous ground, or to prevent water, gas, or other fluid from entering the hole.

Catastrophic collapse means the sudden and utter failure of overlying "strata" caused by removal of underlying materials.

Cementing means the operation whereby a cement slurry is pumped into a drilled hole and/or forced behind the casing.

Confining bed means a body of

Capable of yielding significant

Area of review
p. 42503

Casing may be nonmetallic

Also "Grouting"

impermeable or distinctly less permeable material stratigraphically adjacent to one or more aquifers.

Confining zone means a geological formation, group of formations, or part of a formation that is capable of limiting fluid movement above an injection zone.

Contaminant means any physical, chemical, biological, or radiological substance or matter in water.

Director means the Regional Administrator or the State Director, as the context requires, or an authorized representative. When there is no approved State program, and there is an EPA administered program, "Director" means the Regional Administrator. When there is an approved State program, "Director" normally means the State Director. In some circumstances, however, EPA retains the authority to take certain actions even where there is an approved State program. (For example, when EPA issued an NPDES permit prior to the approval of a State program, EPA may retain jurisdiction over that permit after program approval, see § 123.69.) In such cases, the term "Director" means the Regional Administrator and not the State Director.

Disposal well means a well used for the disposal of waste into a subsurface stratum.

Effective date of a UIC program means the date that a State UIC program is approved or established by the Administrator.

Environmental Protection Agency ("EPA") means the United States Environmental Protection Agency.

EPA means the United States "Environmental Protection Agency."

Exempted aquifer means an aquifer or its portion that meets the criteria in

Identification of USDW's
and exempted aquifers
p. 33437

the definition of "underground source of drinking water" but which has been exempted according to the procedures of § 122.35(b).

Existing injection well means an "injection well" other than a "new injection well."

Facility or activity means any "HWM facility," UIC "injection well," NPDES "point source," or State 404 dredge and fill activity, or any other facility or activity (including land or appurtenances thereto) that is subject to regulation under the RCRA, UIC, NPDES, or 404 programs.

Fault means a surface or zone of rock fracture along which there has been displacement.

Flow rate means the volume per time unit given to the flow of gases or other fluid substance which emerges from an orifice, pump, turbine or passes along a conduit or channel.

Fluid means material or substance which flows or moves whether in a semisolid, liquid, sludge, gas, or any other form or state.

Formation means a body of rock characterized by a degree of lithologic homogeneity which is prevailing, but not necessarily, tabular and is mappable on the earth's surface or traceable in the subsurface.

Formation fluid means "fluid" present in a "formation" under natural conditions as opposed to introduced fluids, such as drilling mud.

Generator means any person, by site location, whose act or process produces hazardous waste identified or listed in 40 CFR Part 261.

Ground water means water below the land surface in a zone of saturation.

Hazardous waste means a hazardous waste as defined in 40 CFR 261.3.

Hazardous Waste Management facility ("HWM facility") means all contiguous land, and structures, other appurtenances, and improvements on the land used for treating, storing, or disposing of hazardous waste. A facility may consist of several treatment, storage, or disposal operational units (for example, one or more landfills, surface impoundments, or combination of them).

HWM facility means "Hazardous Waste Management facility."

Injection well means a "well" into which "fluids" are being injected.

Injection zone means a geological "formation", group of formations, or part of a formation receiving fluids through a well.

Lithology means the description of rocks on the basis of their physical and chemical characteristics.

Owner or operator means the owner or operator of any facility or activity subject to regulation under the RCRA, UIC, NPDES, or 404 programs.

Packer means a device lowered into a well which can be expanded to produce a water-tight seal.

Permit means an authorization, license, or equivalent control document issued by EPA or an "approved State" to implement the requirements of this part and Parts 122, 123 and 124. Permit does not include RCRA interim status (§ 122.23), UIC authorization by rule (§ 122.37), or any permit which has not yet been the subject of final agency action, such as a "draft permit" or a "proposed permit."

Plugging means the act or process of stopping the flow of water, oil, or gas in "formations" penetrated by a borehole or "well."

Plugging record means a systematic listing of permanent or temporary

122.23 Interim status
p. 33434

122.37 Authorization
of underground injection
by rule p. 33438

42501 abandonment of water, oil, gas, test, exploration and waste injection wells, and may contain a well log, description of amounts and types of plugging material used, the method employed for plugging, a description of formations which are sealed and a graphic log of the well showing formation location, formation thickness, and location of plugging structures.

Pressure means the total load or force per unit area acting on a surface.

Radioactive Waste means any waste which contains radioactive material in concentrations which exceed those listed in 10 CFR Part 20, Appendix B, Table II, Column 2, or exceed the "Criteria for Identifying and Applying Characteristics of Hazardous Waste and for Listing Hazardous Waste" in 40 CFR Part 261, whichever is applicable.

RCRA means the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 (Pub. L. 94-580, as amended by Pub. L. 95-609, 42 U.S.C. 6901 et seq.).

SDWA means the Safe Drinking Water Act (Pub. L. 95-523, as amended by Pub. L. 95-190, 42 U.S.C. 300(f) et seq.).

Site means the land or water area where any facility or activity is physically located or conducted, including adjacent land used in connection with the facility or activity.

Sole or principal source aquifer means an aquifer which has been designated by the Administrator pursuant to sections 1424 (a) or (e) of the SDWA.

State Director means the chief administrative officer of any State or interstate agency operating an approved program, or the delegated representative of the State Director. If responsibility is divided among two or more State or

interstate agencies, "State Director" means the chief administrative officer of the State or interstate agency authorized to perform the particular procedure or function to which reference is made.

Stratum (plural *strata*) means a single sedimentary bed or layer, regardless of thickness, that consists of generally the same kind of rock material.

Subsidence means the lowering of the natural land surface in response to: Earth movements; lowering of fluid pressure; removal of underlying supporting material by mining or solution of solids, either artificially or from natural causes; compaction due to wetting (Hydrocompaction); oxidation of organic matter in soils; or added load on the land surface.

Surface casing means the first string of well casing to be installed in the well.

Total dissolved solids ("TDS") means the total dissolved (filterable) solids as determined by use of the method specified in 40 CFR Part 136.

UIC means the Underground Injection Control program under Part C of the Safe Drinking Water Act, including an "approved program."

Underground injection means a "well injection."

Underground source of drinking water ("USDW") means an "aquifer" or its portion:

(1)(i) Which supplies drinking water for human consumption; or

(ii) In which the ground water contains fewer than 10,000 mg/l "total dissolved solids;" and

(2) Which is not an "exempted aquifer."

USDW means "underground source of drinking water."

Well means a bored, drilled or driven shaft, or a dug hole, whose depth is

42502

greater than the largest surface dimension.

Well injection means the subsurface emplacement of fluids through a bored, drilled or driven well; or through a dug well, where the depth of the dug well is greater than the largest surface dimension.

Well log means a log obtained from a well, showing such information as resistivity, radioactivity, spontaneous potential, and acoustic velocity as a function of depth.

Well plug means a watertight and gastight seal installed in a borehole or well to prevent movement of fluids.

Well record means a concise statement of the available data regarding a well, such as a scout ticket; a full history or day-by-day account of a well, from the day the well was surveyed to the day production ceased.

Well stimulation means several processes used to clean the well bore, enlarge channels, and increase pore space in the interval to be injected thus making it possible for wastewater to move more readily into the formation, and includes (1) surging, (2) jetting, (3) blasting, (4) acidizing, (5) hydraulic fracturing.

Well monitoring means the measurement, by on-site instruments or laboratory methods, of the quality of water in a well.

§ 146.04 Criteria for exempted aquifers.

An aquifer or a portion thereof which meets the criteria for an "underground source of drinking water" in § 146.03 may be determined under 40 CFR 122.35 to be an "exempted aquifer" if it meets the following criteria:

(a) It does not currently serve as a source of drinking water; and

See 122.35 (P. 33437)

42502

(b) It cannot now and will not in the future serve as a source of drinking water because:

(1) It is mineral, hydrocarbon or geothermal energy producing;

(2) It is situated at a depth or location which makes recovery of water for drinking water purposes economically or technologically impractical;

(3) It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or

(4) It is located over a Class III well mining area subject to subsidence or catastrophic collapse.

§ 146.05 Classification of injection wells.

Injection wells are classified as follows:

(a) *Class I.* (1) Wells used by generators of hazardous wastes or owners or operators of hazardous waste management facilities to inject hazardous waste, other than Class IV wells.

(2) Other industrial and municipal disposal wells which inject fluids beneath the lowermost formation containing, within one quarter mile of the well bore, an underground source of drinking water.

(b) *Class II.* Wells which inject fluids:

(1) Which are brought to the surface in connection with conventional oil or natural gas production;

(2) For enhanced recovery of oil or natural gas; and

(3) For storage of hydrocarbons which are liquid at standard temperature and pressure.

(c) *Class III.* Wells which inject for extraction of minerals or energy, including:

(1) Mining of sulfur by the Frasch process;

Note: Need not be in connection with USDW

Generators

Management Facilities

Not Class IV

Enhanced recovery

Storage

Sulfer

42502

(2) Solution mining of minerals;

Note.—Solution mining of minerals includes sodium chloride, potash, phosphate, copper, uranium and any other mineral which can be mined by this process.

(3) in-situ combustion of fossil fuel:
and

Note.—Fossil fuels includes coal, tar sands, oil shale and any other fossil fuel which can be mined by this process.

(4) recovery of geothermal energy to
produce electric power.

Note.—Class III wells include the recovery of geothermal energy to produce electric power but do not include wells used in heating or aquaculture which fall under Class V.

(d) *Class IV.* Wells used by generators of hazardous wastes or of radioactive wastes, by owners or operators of hazardous waste management facilities, or by owners or operators of radioactive waste disposal sites to dispose of hazardous wastes or radioactive wastes into or above a formation which within one quarter mile of the well contains an underground source of drinking water.

(e) *Class V.* Injection wells not included in Class I, II, III, or IV.

Note.—Class V wells includes:

42503 (1) Air conditioning return flow wells used to return to the supply aquifer the water used for heating or cooling in a heat pump;

(2) Cesspools or other devices that receive wastes, which have an open bottom and sometimes have perforated sides. The UIC requirements do not apply to single-family residential cesspools;

(3) Cooling water return flow wells used to inject water previously used for cooling;

(4) Drainage wells used to drain surface fluid, primarily storm runoff, into a subsurface formation;

(5) Dry wells used for the injection of wastes into a subsurface formation;

(6) Recharge wells used to replenish the water in an aquifer;

Minerals

In-situ combustion

Geothermal -
e.g. electric

Generators

Management

"Radioactive" now
reserved.

INTO OR ABOVE
1/4 mile - USDW

Not single family

42503

(7) Salt water intrusion barrier wells used to inject water into a fresh water aquifer to prevent the intrusion of salt water into the fresh water;

(8) Sand backfill wells used to inject a mixture of water and sand, mill tailings or other solids into mined out portions of subsurface mines;

(9) Septic system wells used:

(i) To inject the waste or effluent from a multiple dwelling, business establishment, community or regional business establishment septic tank; or

(ii) For a multiple dwelling, community or regional cesspool. The UIC requirements do not apply to single family residential waste disposal systems;

(10) Subsidence control wells (not used for the purpose of oil or natural gas production) used to inject fluids into a non-oil or gas producing zone to reduce or eliminate subsidence associated with the overdraft of fresh water;

(11) Wells used for the storage of hydrocarbons which are gases at standard temperature and pressure;

(12) Geothermal wells used in heating and aquaculture;

(13) Nuclear disposal wells.

(ii) Not single family

Gas Storage

(13) Nuclear reserved

§ 146.06 Area of Review.

The area of review for each injection well or each field, project or area of the State shall be determined according to either paragraph (a) or (b) of this section. The Director may solicit input from the owners or operators of injection wells within the State as to which method is most appropriate for each geographic area or field.

(a) *Zone of endangering influence.* The zone of endangering influence shall be that area the radius of which is the lateral distance from an injection well, field or project in which the pressures in the injection zone may cause the migration of the injection and/or formation fluid into an underground

"Either"

42503

source of drinking water. Computation of the zone of endangering influence may be based upon the parameters listed below and should be calculated for an injection time period equal to the expected life of the injection well or pattern. The following modified Theis equation illustrates one form which the mathematical model may take.

Expected life

42504

$$r = \left(\frac{2.25 K H t}{S 10^X} \right)^{1/2}$$

where:

$$X = \frac{4 \pi K H (h_w - h_{b0} \times SpG_b)}{2.3 Q}$$

r = Radius of endangering influence from injection well
(length)

K = Hydraulic conductivity of the injection zone
(length/time)

H = Thickness of the injection zone (length)

t = Time of injection (time)

S = Storage coefficient (dimensionless)

Q = Injection rate (volume/time)

h_{b0} = Observed original hydrostatic head of injection zone (length) measured from the base of the lowest underground source of drinking water

h_w = Hydrostatic head of underground source of drinking water (length) measured from the base of the lowest underground source of drinking water

SpG_b = Specific gravity of fluid in the injection zone
(dimensionless)

π = 3.142 (dimensionless).

The above equation is based on the following assumptions:

(1) The injection zone is homogenous and isotropic;

(2) The injection zone has infinite areal extent;

(3) The injection well penetrates the entire thickness of the injection zone;

(4) The well diameter is infinitesimal compared to "r" when injection time is longer than a few minutes; and

(5) The emplacement of fluid into the injection zone creates instantaneous increase in pressure.

Other models may be used as appropriate for different situations encountered in the field or where the model assumptions match more closely those situations.

(b) *Fixed Radius.* A fixed radius around the well, field or project of not less than one-fourth ($\frac{1}{4}$) mile may be used. In determining the fixed radius, the following factors shall be taken into consideration: Chemistry of injected and formation fluids; hydrogeology; population and ground-water use and dependence; and historical practices in the area.

(c) If the area of review is determined by a mathematical model pursuant to paragraph (a) of this section, the permissible radius is the result of such calculation even if it is less than one-fourth ($\frac{1}{4}$) mile.

§ 146.07 Corrective Action.

In determining the adequacy of corrective action proposed by the applicant under 40 CFR 122.44 and in determining the additional steps needed to prevent fluid movement into underground sources of drinking water, the following criteria and factors shall be considered by the Director:

Other models o.k.

$\frac{1}{4}$ mile minimum

Mathematical model,

Radius may be less than
 $\frac{1}{4}$ mile

p. 33440

42505

- (a) Toxicity and volume of the injected fluid;
- (b) Toxicity of native fluids or by-products of injection;
- (c) Potentially affected population;
- (d) Geology;
- (e) Hydrology;
- (f) History of the injection operation;
- (g) Completion and plugging records;
- (h) Abandonment procedures in effect at the time the well was abandoned; and
- (i) Hydraulic connections with underground sources of drinking water.

§ 146.08 Mechanical Integrity

(a) An injection well has mechanical integrity if:

- (1) There is no significant leak in the casing, tubing or packer; and
- (2) There is no significant fluid movement into an underground source of drinking water through vertical channels adjacent to the injection well bore.

(b) One of the following tests must be used to evaluate the absence of significant leaks under paragraph (a)(1) of this section.

- (1) Monitoring of annulus pressure; or
- (2) Pressure test with liquid or gas.

(c) One of the following methods must be used to determine the absence of significant fluid movement under paragraph (a)(2) of this section:

- (1) For Class II only, well records demonstrating the presence of adequate cement to prevent such migration; or
- (2) The results of a temperature or noise log.

(d) The Director may allow the use of a test to demonstrate mechanical integrity other than those listed in paragraphs (b) and (c)(2) of this section with the written approval of the Administrator. To obtain approval, the

Native Fluids
(Formation Fluids)
and by-products

- 1) Casing, Tubing, Packer
- 2) Movement - vertical channels

Annulus pressure
Pressure test

Class II - Well records

Temperature/Noise Log

Other Test: Written
Approval

42505

Director shall submit a written request to the Administrator, which shall set forth the proposed test and all technical data supporting its use. The Administrator shall approve the request if it will reliably demonstrate the mechanical integrity of wells for which its use is proposed. Any alternate method approved by the Administrator shall be published in the **Federal Register** and may be used in all States unless its use is restricted at the time of approval by the Administrator.

(e) In conducting and evaluating the tests enumerated in this section or others to be allowed by the Director, the owner or operator and the Director shall apply methods and standards generally accepted in the industry. When the owner or operator reports the results of mechanical integrity tests to the Director, he shall include a description of the test(s) and the method(s) used. In making his/her evaluation, the Director shall review monitoring and other test data submitted since the previous evaluation.

§ 146.09 Criteria for Establishing Permitting Priorities.

In determining priorities for setting times for owners or operators to submit applications for authorization to inject under the procedures of § 122.38 or § 123.4(g), the Director shall base these priorities upon consideration of the following factors:

- (a) Injection wells known or suspected to be contaminating underground sources of drinking water;
- (b) Injection wells known to be injecting fluids containing hazardous contaminants;
- (c) Likelihood of contamination of underground sources of drinking water;
- (d) Potentially affected population;

Federal Register

"Use" - All States -
Unless restricted

Application for a Permit
p. 33439
Program Description
p. 33457

- (a) Contaminating
- (b) Hazardous
- (c) Likelihood
- (d) Population

Note: Not necessarily
in order of priority

42505

- (e) Injection wells violating existing State requirements;
- (f) Coordination with the issuance of permits required by other State or Federal permit programs;
- (g) Age and depth of the injection well; and
- (h) Expiration dates of existing State permits, if any.

§ 146.10 Plugging and Abandoning Class I-III Wells.

(a) Prior to abandoning Class I-III wells the well shall be plugged with cement in a manner which will not allow the movement of fluids either into or between underground sources of drinking water.

(b) Placement of the cement plugs shall be accomplished by one of the following:

- (1) The Balance Method;
- (2) The Dump Bailer Method; or
- (3) The Two-Plug Method.

(c) The well to be abandoned shall be in a state of static equilibrium with the mud weight equalized top to bottom, either by circulating the mud in the well at least once or by a comparable method prescribed by the Director, prior to the placement of the cement plug(s).

(d) The plugging and abandonment plan required in 40 CFR 122.42(f) and 122.41(e) shall, in the case of a Class III well field which underlies or is in an aquifer which has been exempted under 40 CFR 146.04, also demonstrate that no movement of contaminants from the mined zone into an underground source of drinking water will occur. The Director shall prescribe aquifer cleanup and monitoring where he deems it necessary and feasible to insure that no migration of contaminants from the mined zone into an underground source of drinking water will occur.

Cement

Not allow movement
into or between

3 methods specified

Static equilibrium

Permit Conditions

Additional Conditions

Class III - Exempted
aquifer, "overlies or in"
Demonstrate "no migration"

Criteria for exempted
aquifers p. 42502

Aquifer cleanup and
monitoring

§ 122.4 Application for a permit.

(Applicable to State programs, see § 123.7.)

(a) *Permit application.* Any person who is required to have a permit (including new applicants and permittees with expiring permits) shall complete, sign, and submit an application to the Director as described in this section and in § 122.38 (UIC),

Persons currently authorized with interim status under UIC authorization by rule (§ 122.37) shall apply for permits when required by the Director. Procedures for applications, issuance and administration of emergency permits are found exclusively in § 122.40 (UIC).

(b) *Who applies?* When a facility or activity is owned by one person but is operated by another person, it is the operator's duty to obtain a permit.

(c) *Completeness.* The Director shall not issue a permit under a program before receiving a complete application for a permit under that program

An application for a permit under a program is complete when the Director receives an application form and any supplemental information which are completed to his or her satisfaction. The completeness of any application for a permit shall be judged independently of the status of any other permit application or permit for the same facility or activity. For EPA—administered UIC, programs, an application which is reviewed under § 124.3 is complete

when the Director receives either a complete application or the information listed in a notice of deficiency.

(d) *Information requirements.* All applicants for UIC, permits (for State 404 permits see § 123.94) shall provide the following information to the Director, using the application form provided by the Director (additional information required of applicants is set forth in 122.38

(UIC).

(1) The activities conducted by the applicant which require it to obtain permits under RCRA, UIC, NPDES, or PSD.

(2) Name, mailing address, and location of the facility for which the application is submitted.

(3) Up to four SIC codes which best reflect the principal products or services provided by the facility.

(4) The operator's name, address, telephone number, ownership status, and status as Federal, State, private, public, or other entity.

(5) Whether the facility is located on Indian lands.

(6) A listing of all permits or construction approvals received or applied for under any of the following programs:

(ii) UIC program under SDWA.

(7) A topographic map (or other map if a topographic map is unavailable) extending one mile beyond the property boundaries of the source, depicting the facility and each of its intake and discharge structures; each of its hazardous waste treatment, storage, or

disposal facilities; each well where fluids from the facility are injected underground; and those wells, springs, other surface water bodies, and drinking water wells listed in public records or otherwise known to the applicant in the map area.

(8) A brief description of the nature of the business.

(e) *Recordkeeping.* Applicants shall keep records of all data used to complete permit applications and any supplemental information submitted under § 122.38 (UIC);

for a period of at least 3 years from the date the application is signed.

§ 122.38 Application for a permit; authorization by permit.

(Applicable to State UIC programs, see § 123.7.)

(a) *Permit application.* Except as provided in § 122.37 (authorization by rule), all underground injections into Class I, II, or III wells in listed States shall be prohibited unless authorized by permit. Those authorized by a rule under § 122.37 must still apply for a permit under this section unless authorization by rule was for the life of the well. Rules authorizing well injections for which permit applications have been submitted shall lapse for a particular well injection only upon the effective date of the permit or permit denial for that well injection.

(b) *Time to apply.* Any person who performs or proposes an underground injection for which a permit is or will be required shall submit an application to the Director in accordance with the State UIC program as follows:

(1) For existing injection wells, as expeditiously as practicable and in accordance with the schedule contained in any program description under § 123.4(g), but no later than 4 years from the approval of the UIC program, or as required under § 122.45(b) for wells injecting hazardous waste.

(2) For new injection wells, except new wells covered by an existing area permit under § 122.39(c), a reasonable time before construction is expected to begin. (See also § 122.41(b)).

(c) *Contents of UIC application.*
[Reserved.]

31. Injection between the outermost casing protecting USDWs and the well bore is prohibited.

True _____ False _____

32. Pressure shall be maintained on the annulus.

True _____ False _____

33. Injected fluids must be analyzed at least once a week.

True _____ False _____

34. Continuous recording devices are required to monitor injection pressure, flow rate, volume and annulus pressure.

True _____ False _____

35. Mechanical integrity must be demonstrated at least once every five years.

True _____ False _____

36. Pressure in the underground sources of drinking water within the area of review must be monitored only when required Section 146.13(b)(4).

True _____ False _____

37. Reporting must be done quarterly.

True _____ False _____

38. Any well work-over must be reported within thirty days after completion.

True _____ False _____

(146.14)

39. The Director may disregard any wells in the area of review which do not penetrate the injection zone.

True _____ False _____

40. The Director may allow a stimulation program for a Class I well.

True _____ False _____

41. The Director may not allow the operation of a Class I well until corrective action has been completed on defective wells in the area of review.

True _____ False _____

(146.15)

42. As part of the mid-course evaluation, the Director is not required to report concerning Class I wells authorized by rule.

True _____ False _____

**Subpart B—Criteria and Standards
Applicable to Class I Wells**

§ 146.11 Applicability.

This subpart establishes criteria and standards for underground injection control programs to regulate Class I wells.

§ 146.12 Construction Requirements.

(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.

(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:

(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.

(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

Beneath lowest USDW
within 1/4 mile of well
bore

Cased and cemented

Life of Well

Corrosiveness

Except

Tubing and Packer

42506

tubing with an approved fluid seal as an alternative. The tubing, packer, and fluid seal shall be designed for the expected service.

(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.

(2) In determining and specifying requirements for tubing, packer, or alternatives the following factors shall be considered:

(i) Depth of setting;

(ii) Characteristics of injection fluid (chemical content, corrosiveness, and density):

(iii) Injection pressure;

(iv) Annular pressure;

(v) Rate, temperature and volume of injected fluid; and

(vi) Size of casing.

(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 qualified log analyst and submitted to the Director. At a minimum, such logs and tests shall include:

(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

Fluid seal

Alternatives

Written request

Shall approve

Logs and Tests

Pilot hole

42506

migration in the form of diverging holes are not created during drilling.

(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:

(i) For surface casing intended to protect underground sources of drinking water:

(A) Resistivity, spontaneous potential, and caliper logs before the 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) Resistivity, spontaneous potential, 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.

(e) At a minimum, the following information concerning the injection formation shall be determined or calculated for new Class I wells:

(1) Fluid pressure;

(2) Temperature;

(3) Fracture pressure;

(4) Other physical and chemical characteristics of the injection matrix; and

(5) Physical and chemical characteristics of the formation fluids.

Considered

Injection Formation

Determined or calculated

Matrix

Fluids

42506

§ 146.13 Operating, Monitoring and Reporting Requirements.

(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 in the injection zone during injection does not initiate new fractures or propagate existing fractures in the injection zone, 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;

(3) A demonstration of mechanical integrity pursuant to § 146.08 at least once every five years during the life of the well; and

(4) The type, number and location of wells within the area of review to be used to monitor any migration of fluids

Operating Pressure

Injection zone

Confining zone
Formation Fluids

Annulus Fluid

Pressure

Injected Fluids
Sufficient Frequency

Continuous Recording

Mechanical Integrity

Monitoring Wells

into and pressure in the underground sources of drinking water, the parameters to be measured and the frequency of monitoring.

(c) *Reporting Requirements.* Reporting requirements shall, at a minimum, include:

(1) Quarterly reports to the Director on:

(i) The physical, chemical and other relevant characteristics of injection fluids;

(ii) Monthly average, maximum and minimum values for injection pressure, flow rate and volume, and annular pressure; and

(iii) The results of monitoring prescribed under subparagraph (b)(4) of this section.

(2) Reporting the results, with the first quarterly report after the completion, of:

(i) Periodic tests of mechanical integrity;

(ii) Any other test of the injection well conducted by the permittee if required by the Director; and

(iii) Any well work over.

§ 146.14 Information to be Considered by the Director.

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

Pressure in USDW

Quarterly

Injection Fluids

Pressure, rate, volume

First quarterly report

Mechanical integrity

Workover

Considered

Existing file

Reference

42507

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.

(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:

(1) Information required in 40 CFR 122.4 and 122.38(c);

(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, injection wells, abandoned 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;

(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;

(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;

MAP

Area of Review

Only Public record

Penetrate injection zone

USDW's within Area
of Review

Direction of movement

- 42507 (5) Maps and cross sections detailing the geologic structure of the local area;
 (6) Generalized maps and cross sections illustrating the regional geologic setting;
 (7) Proposed operating data:
 (i) Average and maximum daily rate and volume of the fluid to be injected;
 (ii) Average and maximum injection pressure; and
 (iii) Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids;
 (8) Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the receiving formation;
 (9) Proposed stimulation program;
 (10) Proposed injection procedure;
 (11) Engineering drawings of the surface and subsurface construction details of the system;
 (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;
 (13) Plans (including maps) for meeting the monitoring requirements in § 146.13(b);
 (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 122.44;

Local
 Regional
 Daily rate
 Pressure
 Injection Fluids
 Formation Testing
 Stimulation
 Well failures
 Monitoring
 Corrective action

33440

§ 122.44 Corrective action.

(Applicable to State UIC programs, see § 123.7.)

(a) *Coverage.* Applicants for Class I, II (other than existing), or III injection well permits shall identify the location of all known wells within the injection well's

area of review which penetrate the injection zone. For such wells which are improperly sealed, completed, or abandoned, the applicant shall also submit a plan consisting of such steps or modifications as are necessary to prevent movement of fluid into underground sources of drinking water ("corrective action"). Where the plan is adequate, the Director shall incorporate it into the permit as a condition. Where the Director's review of an application indicates that the permittee's plan is inadequate (based on the factors in § 146.07) the Director shall require the applicant to revise the plan, prescribe a plan for corrective action as a condition of the permit under paragraph (b) of this section, or deny the application. The Director may disregard the provisions of § 146.06 (area of review) and § 146.07 (corrective action) when reviewing an application to permit an existing Class II well.

(b) *Requirements*—(1) *Existing injection wells*. Any permit issued for an existing injection well (other than Class II) requiring corrective action shall include a compliance schedule requiring any corrective action accepted or prescribed under paragraph (a) of this section to be completed as soon as possible.

(2) *New injection wells*. No permit for a new injection well may authorize injection until all required corrective action has been taken.

(3) *Injection pressure limitation*. The Director may require as a permit condition that injection pressure be so limited that pressure in the injection zone does not exceed hydrostatic pressure at the site of any improperly completed or abandoned well within the area of review. This pressure limitation shall satisfy the corrective action requirement. Alternatively, such injection pressure limitation can be part of a compliance schedule and last until all other required corrective action has been taken.

42507

(15) Construction procedures including a cementing and casing program, logging procedures, deviation checks, and a drilling, testing, and coring program; and

(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(a).

(b) Prior to granting approval for the operation of a Class I well the Director shall consider the following information:

(1) All available logging and testing program data on the well;

Construction

Certificate

Tests

- 42507 (2) A demonstration of mechanical integrity pursuant to § 146.08;
- (3) The actual operating data;
- (4) The results of the formation testing program;
- (5) The actual injection procedure;
- (6) The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone; and
- (7) The status of corrective action on defective wells in the area of review.
- (c) Prior to granting approval for the plugging and abandonment of a Class I well the Director shall consider the following information:
- (1) The type and number of plugs to be used;
- (2) The placement of each plug including the elevation of the top and bottom;
- (3) The type and grade and quantity of cement to be used;
- (4) The method for placement of the plugs; and
- (5) The procedure to be used to meet the requirements of § 146.10(c).

§ 146.15 Mid-course evaluation requirements.

In compliance with 40 CFR 122.18(c)(4)(c)(ii) the data to be submitted on each Class I permit at six month intervals during the first two years of operation of the State program shall at a minimum include the following:

- (a) The data required in § 146.14(a)(1);
- (b) The data required in § 146.14(a)(3) including, under location, the distance and direction from the injection well;
- (c) The depth to the top and bottom of any USDW;
- (d) The distance to the nearest down-gradient water supply well;
- (e) A description of the geology and

Mechanical Integrity
Operating Data
Formation Testing

Compatibility

Corrective Action

Abandonment

Static equilibrium, etc.

hydrology of the area;

(f) The construction characteristics of the well;

(g) The corrective action proposed as well as that performed;

(h) The type and results of all mechanical integrity tests reported to the Director; and

(i) Any reporting to the Director under § 122.41(d).

Scoring Guide

CFR 146 Subpart A and B

Note: These questions and the answers given are not official guidance or policy.

146 A

1. True. [146.01(b)]
2. True. [146.04(a)]
3. True. [146.05(a)]
4. False. Could be Class II or III.
5. False. Only injection wells [146.05(b)]
6. True. [146.05(c)]
7. True. [146.05(a)(2)] Presuming the waste fluids are hazardous
8. True. [See 146.05(e)(1)]
9. True. [146.05(a)]
10. True. For example, family residential waste disposal systems.

146.06

11. True. [146.06(a)]
12. False. 1/4 mile is minimum for fixed radius. Calculation may be greater or smaller.

13. False. Director may require larger area.
14. True. [146.07(b)]
15. False. Also "(2) There is no significant fluid movement, etc." [146.08(a)(2)]
16. True. [146.08(b)(2)]
17. False. "with the written approval of the Administrator," [146.08(D)]
18. True.
19. True. [146.10(a)]
20. False. (a little comic relief)
- 146 B
21. True and False. True unless well is Class I or Class III.
22. True. If there is a USDW within 1/4 mile of the well below or into the injection zone, wells injecting hazardous waste are Class IV wells. If there is no USDW within 1/4 of the well bore below or in injection zone, the wells are Class I.
23. True. [146.12(b)]
24. False. Municipal wells injecting non-corrosive wastes are exempted. [146.12(c)]
25. False. Director may approve [146.12(c)]
26. True. Only when pilot hole used. [146.12(d)(1)]

27. False. Cement bond and temperature, or density log after casing installed and cemented
28. False. Won't work after.
29. True. [146.12(e)(2)]
- 146.13
30. True. "Operated." What about stimulation?
31. True. What if there is no USDW within 1/4 mile? Makes no difference.
32. True. Unless packer not used, see [146.12(c)]
33. False. "sufficient frequency" [146.13(b)(1)]
34. True. [146.13(b)(2)]
35. True. [146.13(b)(3)]
36. True. [146.13(b)(4)]
37. True.
38. False. Reported with first regular quarterly report after completion.
39. True. [146.14(a)(3)]
40. True. [146.14(a)(9)]
41. False. May allow a compliance schedule, for an existing well. [122.44 (b)(1) and (2)]
42. True. "permit " [146.15]