

CHAPTER 6 -- CRITERIA FOR UNDERGROUND INJECTION PROJECTS

6.1 INTRODUCTION

6.1.1 General

6.1.1.1 All projects involving underground injection as defined in 40 CFR 144, shall be reviewed by the District for appropriateness to the hydrogeology of the area, to ensure that the project will not interfere with designated uses of water, and is consistent with the terms and conditions of the Compact. In performing this review, the District shall consider whether the minimum criteria set forth under 40 CFR 144 and all other applicable federal legislation have been met. The District shall also consider the extent to which the project meets the standards and specifications applicable to similar projects within the District but not constructed on Tribal lands or Reservations.

District's approval of an underground injection well or project shall be contingent on the injection well or project meeting the minimum requirements outlined below.

6.1.1.2 **Purpose** The purpose of the District review is to ensure that the proposed project is designed to protect the quality of the State's underground sources of drinking water and to prevent degradation of the quality of other aquifers adjacent to the injection zone that may be used for other purposes. This purpose may be achieved through the construction and operation of injection wells in such a way that the injected fluid remains in the injection zone, and that unapproved interchange of water between aquifers is prohibited.

6.1.1.3 **Scope**

A. The District review will cover all injection wells defined below, as Class I, III, IV and V wells.

B. Injection wells defined as Class II wells below, are not included in this Chapter.

C. Specific Inclusions The following wells are included among those types of injection activities which are covered by this Chapter. (This list is not intended to be exclusive but is for clarification only.)

1. Any injection well other than a Class II well located on a drilling platform inside Florida's territorial waters.
2. Any dug hole or well that is deeper than its largest surface dimension, where the principal function of the hole is emplacement of fluids.
3. Any septic tank or cesspool used by generators of hazardous waste, or by owners or operators of hazardous waste management facilities, to dispose of fluids containing hazardous waste.

D. Specific Exclusions The following are not covered by this Chapter:

1. Injection wells located on a drilling platform or other site that is beyond Florida's territorial waters.
2. Any septic tank systems subject to Chapter 10D-6, Florida Administrative Code, and any individual or single family residential waste disposal systems.
3. Any dug hole which is not used for emplacement of fluids underground.
4. Any well utilized in conjunction with the operation of an earth-coupled heat pump system as defined below.

6.1.2 Definitions When used in this section, the following words shall have these meanings unless the context clearly indicates otherwise:

6.1.2.1 Abandoned Well means a well, the use of which has been permanently discontinued or which is in a state of disrepair

such that it cannot be used for its intended purpose or for observation purposes.

6.1.2.2 **Acidizing** means the injection of acid through the borehole or "well" into a "formation" to increase permeability and porosity.

6.1.2.3 **Allowable Stress** means the allowable stress for a material is the maximum stress that may be safely applied, which equals the yield-point stress divided by an appropriate factor of safety.

6.1.2.4 **Annular Monitor Well** means any pipe or tubing which is permanently placed in the annulus of an injection well to monitor a discrete zone.

6.1.2.5 **Annulus or Annular Space** means any artificially created void existing between a well casing or liner pipe and a borehole wall, or between two (2) casings or between tubing and casing or liner pipe.

6.1.2.6 **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.

6.1.2.7 **Area of Review** means the area surrounding an "injection well," described according to the criteria set forth in 6.1.3.2, or in the case of a well field, the project area plus a circumscribing area with a fixed width of not less than one (1) mile.

6.1.2.8 **Casing** means a pipe or tubing of appropriate material, 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 or leaving the hole.

6.1.2.9 **Catastrophic Collapse** means the sudden and utter failure of adjacent or overlying strata which has been caused by removal of underlying materials.

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

6.1.2.11 **Centralizer** means a casing accessory used to properly align a casing within the open hole, or to properly align one (1) casing within another casing, or to properly align a tubing within a casing.

6.1.2.12 **Cluster Well** means a well where two (2) or more monitor tubes of different lengths are emplaced within a single borehole to monitor two (2) or more discrete zones.

6.1.2.13 **Confining Bed** means a layer of impermeable or distinctly less permeable material stratigraphically adjacent to one (1) or more aquifers.

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

6.1.2.15 **Contaminant** means any substance which is harmful to plant, animal or human life.

6.1.2.16 **Conventional Mine** means an open pit or underground excavation for the production of minerals.

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

6.1.2.18 **Dry Well** means a well usually lined or filled with rocks which holds drainage water until it percolates into the ground.

6.1.2.19 **Earth-Coupled Heat Pump System** means any space heating/cooling system in which water containing no additives is circulated through a continuous section of buried pipe, such that the earth is utilized as a thermal exchange medium, but no fluid is either extracted from, or injected into, any underground formation.

6.1.2.20 **Emergency Disposal Method** means an effluent disposal method that, after prior District approval, is only available for short term discharge under emergency conditions when the primary disposal method is inoperable.

6.1.2.21 **Exempted Aquifer** means an aquifer, or its portion that meets the criteria in the definition of "underground source of

drinking water," but which has been exempted according to the procedures of 40 CFR 144.7.

6.1.2.22 **Experimental Technology** means a technology which has not been proven feasible under the conditions in which it is being tested.

6.1.2.23 **Exploratory Pilot Hole** means a hole drilled for the purpose of obtaining subsurface information, or as a guide for the drill bit to follow when drilling the final hole.

6.1.2.24 **Exploratory Well** means a cased well drilled in an area in which there is limited hydrologic and geologic data, to obtain sufficient data to determine the feasibility of injection. With prior District approval, an exploratory well may be plugged and abandoned, converted to a monitor well, or used as an injection well if it meets all applicable standards for a Class I well.

6.1.2.25 **Facility or Activity** means an "injection well system," or any other facility or activity that is subject to this Chapter.

6.1.2.26 **Factor of Safety** means the ultimate load divided by the safe load, or the ultimate strength divided by the allowable stress.

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

6.1.2.28 **Flow Rate** means the volume per unit time of the flow of fluids which emerge from an orifice, pump, turbine, or which pass along a conduit or channel.

6.1.2.29 **Fluid** means material or substance which flows or moves, whether in a semi-solid, liquid, sludge, gas, or any other form or state.

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

6.1.2.31 **Formation Fluid** means fluid present in a formation under natural condition, as opposed to introduced fluids, such as drilling mud.

6.1.2.32 **Ground Water** means water below the land surface in a zone wherein all of the interstices are filled with water.

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

6.1.2.34 **Hydrogeology** means the branch of hydrology that deals with ground water, its occurrence and movements, its replenishment and depletion, the properties of rocks that control ground water movement and storage, and the methods of investigation and use of ground water.

6.1.2.35 **Injection Pressure** means the pressure required to inject fluid, as measured at the wellhead.

6.1.2.36 **Injection Well** means a well into which fluids are being or will be injected, by gravity flow or under pressure.

6.1.2.37 **Injection Well System** means the portion of the disposal system from the effluent side, or pressure side, of the injection pump to the bottom of the injection well.

6.1.2.38 **Injection Zone** means a geological formation, group of formations, or part of a formation receiving fluids directly through a well.

6.1.2.39 **Lithology** means the description of rocks on the basis of

their physical and chemical characteristics.

6.1.2.40 **Multi-Horizon Monitor Well** means any well which is used to monitor in each of two (2) or more discrete zones.

6.1.2.41 **New Injection Well** means a well which has not been approved by the District and which began injection after the effective date of the Compact.

6.1.2.42 **On-Site Monitor Well** means a well associated with an injection well or facility, that is used primarily to monitor the mechanical integrity of the injection well(s) and/or to monitor the effectiveness of the confining beds overlying the injection zone.

6.1.2.43 **Overdrill** means the amount by which the nominal diameter of the open hole exceeds the diameter of the casing to be set in the hole.

6.1.2.44 **Owner** means the Tribe, person, entity, or corporation with legal title to the property on which an injection well exists.

6.1.2.45 **Packer** means a device lowered into a well to produce a fluid-tight seal.

6.1.2.46 **Plugging** means the act or process of stopping the flow of water, oil, or gas into, or out of, a formation through a borehole or well penetrating that formation.

6.1.2.47 **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.

6.1.2.48 **Regional Monitor Well** means a well used primarily to monitor the distant effects of injection from one (1) or more injection facilities.

6.1.2.49 **Satellite Monitor Well** means a well associated with an

injection facility that is used primarily to monitor the effects of injection from a single injection well or facility.

6.1.2.50 **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.

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

6.1.2.52 **Test Well** means the first injection well constructed in a well field, which is used for specific formation testing and to prove the feasibility of the injection well system. A test well is designed to be used as an injection well, if injection is proved feasible and environmentally acceptable.

6.1.2.53 **Tubing** means piping material placed inside the final string of casing to protect the casing, and to convey the injected fluid to the injection zone.

6.1.2.54 **Underground Source of Drinking Water** means an "aquifer" or its portion which meets the definition in 40 CFR 144.3.

6.1.2.55 **Well** means a bored, drilled or driven shaft, or a dug hole, which has a depth greater than the diameter of the largest surface dimension.

6.1.2.56 **Well Casing** means a metallic or non-metallic pipe installed in a borehole to prevent caving, provide structural strength, seal off subsurface zones, or prevent the interchange of waters between aquifers.

6.1.2.57 **Well Injection** means the subsurface emplacement of fluids through a well by gravity flow or under pressure.

6.1.2.58 **Well Log** means a record obtained from a well that provides data on well construction or the formations penetrated.

6.1.2.59 **Well Monitoring** means the measurement, by on-site instruments or laboratory methods, of the physical, chemical, or biological parameters required to evaluate the performance of an injection well system.

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

6.1.2.61 **Well Record** means a concise statement of the available data regarding a well.

6.1.2.62 **Well Stimulation** means any of 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 injected fluids to move more readily into the formation, and includes, but is not limited to: 1) surging; 2) jetting; 3) blasting; 4) acidizing; 5) hydraulic fracturing.

6.1.3 **General Provisions**

6.1.3.1 **Classification of Injection Wells** Injection wells are classified as follows:

A. Class I

1. Wells used by generators of hazardous wastes, or by owners or operators of hazardous waste management facilities to inject hazardous waste beneath the lowermost formation containing, within one quarter (1/4) mile of the well bore, an underground source of drinking water.
2. Other industrial and municipal (publicly or privately owned) disposal wells which inject fluids beneath the lowermost formation containing,

within one quarter (1/4) 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 and may be commingled with waste waters from gas plants, which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection.
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, including:

1. Mining of sulfur by the Frasch process.
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.)

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 (1/4) mile of the well, contains either an underground source of drinking water or an exempted aquifer.

E. Class V Injection wells not included in Class I, II, III, or IV. Class V wells, which are grouped together by expected quality of the injection fluid, include:

1. Group 1

- a. Air conditioning return flow wells used to return, to any aquifer, the water used for heating or cooling. An air conditioning supply well, heat pump, and return flow well used to inject water containing no additives into the same permeable zone from which it was withdrawn constitute a closed loop system.
- b. Cooling water return flow wells used to inject water previously used for cooling.

2. Group 2

- a. Recharge wells used to replenish, augment, or store water in an aquifer.
- b. 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.
- c. Subsidence control wells (not used for the purpose of oil or natural gas production) used to inject fluids into a zone which does not produce oil or gas to reduce or eliminate subsidence associated with the overdraft of fresh water.
- d. Connector wells used to connect two (2) aquifers to allow interchange of water between those aquifers.

3. Group 3

- a. Wells which are part of domestic waste treatment systems.
- b. Swimming pool drainage wells.
- c. Devices receiving wastes, which have an open bottom and sometimes have perforated sides. This Chapter does not apply to single family residential waste disposal systems.
- d. Wells used to inject spent brine into the same formation from which it was withdrawn after extraction of halogens or their salts.
- e. Injection wells used in experimental technologies.

4. Group 4

- a. Dry wells used for the injection of wastes into a subsurface formation.
- b. Sand backfill wells used to inject a mixture of water and sand, tailings or other solids, into mined out portions of subsurface mines.

- c. Wells other than Class IV used to inject radioactive waste, provided the concentrations of the waste do not exceed federal drinking water standards.
 - d. Injection wells used for in situ recovery of phosphate, uraniferous sandstone, clay, sand, and other minerals extracted by the borehole slurry mining method.
5. **Group 5** Drainage wells used to drain surface fluid, primarily storm runoff or lake level, (by gravity flow) into a subsurface formation.
6. **Group 6**
- a. Injection wells associated with the recovery of geothermal energy for heating, aquaculture and production of electric power.
 - b. Other wells.

6.1.3.2 **Area of Review**

- A. An area of review, which shall apply to each Class I and Class III well, well field, project or area of the State, and which may apply to a Class V injection well, shall be determined by the Tribe taking into account the zone of endangering influence, which is the area in which the increased pressures in the injection zone may cause the migration of the injected, and formation fluid into an underground source of drinking water. The area of review is the land surface overlying the zone of endangering influence.
- B. In determining the area of review, the information to be used shall include, but not be limited to: Chemical, physical, and biological characteristics of the injection fluids and formation fluids; hydrogeology; appropriate mathematical models, if available, for computing pressure and concentration changes in the injection zone as a function of distance and time; population; ground water use and dependence; and historical practices in the area. A radius around the injection well

of one (1) mile shall be a minimum. In the case of a well field project, a fixed width of not less than one (1) mile for the circumscribing area shall be a minimum.

6.1.3.3 **Corrective Action**

- A. Coverage** The Tribe, for Class I or Class III injection well proposals, shall identify, and for any Class V well may identify, the location of all known wells within the area of review for the injection well(s) which penetrate the injection zone or confining zone. For such wells on Tribal lands, which are in use or improperly sealed, completed, or abandoned, the Tribe shall also submit a plan describing such steps or modifications as are necessary to prevent movement of fluid into underground sources of drinking water ("corrective action").
- B. Criteria and Factors** In determining the adequacy of corrective action proposed by the Tribe under (A) of this subsection 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.
1. Nature, volume, and injection rate of the injected fluid.
 2. Nature of native fluids, or by-products of injection.
 3. Potentially affected population.
 4. Geology.
 5. Hydrology.
 6. History of the injection operation.
 7. Completion and plugging records for all wells.
 8. Abandonment procedures in effect at the time the well was abandoned.

9. Hydraulic connections with underground sources of drinking water.
10. Life of injection well. And:
11. Pressure considerations.

C. Requirements

1. **Existing Injection Wells** Any proposal for an existing injection well requiring corrective action shall include a schedule for completion of any corrective action prescribed by, or acceptable to, the District. In addition, schedules for corrective action shall require completion of the corrective action not later than three (3) years after the effective date of the plan.
2. **New Injection Wells** No new injection well may commence injection until all required corrective action has been completed. Construction of a new injection well prior to the completion of all required action will not be approved unless the Tribe can affirmatively demonstrate that such construction will not pose a threat to the quality of the waters of the State.
3. **Class III Wells Only** When setting corrective action requirements, the District and the Tribe shall consider the overall effect of the project on the hydraulic gradient in potentially affected underground sources of drinking water, and the corresponding changes in potentiometric surface(s) and flow direction(s) rather than the discrete effect of each well. If a decision is made that corrective action is not necessary, based on the determinations above, the monitoring program required in section 6.2.5 shall be designed to verify the validity of such determinations.

6.1.3.4 Mechanical Integrity

- A. An injection well has mechanical integrity if:

1. There is no leak in the casing, tubing or packer. And:
 2. There is no fluid movement into an underground source of drinking water through channels adjacent to the injection well bore.
- B. One of the following tests shall be used to evaluate the absence of leaks under subparagraph (A)(1) of this subsection:
1. Monitoring of annulus pressure.
Or:
 2. Pressure testing of inner casing or tubing.
- C. One of the following methods shall be used to determine the absence of fluid movement under subparagraph (A)(2) of this subsection:
1. A temperature or noise log, and monitoring of adjacent overlying aquifers. Or:
 2. A temperature or noise log, monitoring of adjacent overlying aquifers, and radioactive tracer logs.
- D. The use of tests to demonstrate mechanical integrity, other than those listed in paragraph (B) and subparagraph (C)(1) of this subsection, may be allowed with written approval from the District.
- E. In conducting and evaluating the tests enumerated in this subsection, or others to be allowed by the District, the Tribe shall apply methods and standards generally accepted in the industry. When the Tribe reports the results of mechanical integrity tests, the Tribe shall include a description of the test(s) and the method(s) used. Monitoring and other test data submitted since the previous evaluation shall be assessed and reviewed.
- F. A plan for any Class I or III well or injection project which lacks

mechanical integrity shall not be - and for any Class V well may not be approved until the Tribe shows to the satisfaction of the District that the well has mechanical integrity or unless the Tribe affirmatively demonstrates that the injection well will not pose a potential threat to the waters of the State.

6.2 CRITERIA AND STANDARDS FOR CLASS I AND CLASS III WELLS

6.2.1 **General Prohibition of Class I Wells Injecting Hazardous Wastes** The construction of any well meeting the classification in subparagraph 6.1.3.1(A)(1) shall be prohibited on Tribal lands or Reservations.

6.2.2 **Evaluation of Geologic and Hydrologic Environment**

6.2.2.1 **General**

A. Class I Wells The Tribe shall demonstrate to the District's satisfaction that the hydrogeologic environment is suitable for waste injection without endangering the underground sources of drinking water or modifying the ambient water quality of other aquifers overlying the injection zone. In the Class I well construction submittals the Tribe shall address the proposed testing and sampling procedures for adequately defining the depth at which total dissolved solids exceed 10,000 mg/l in formation waters. An assessment of the lateral position at which total dissolved solids exceed 10,000 mg/l in the injection zone waters shall also be provided. The District may request that the Tribe provide, in addition to site specific and area of review information, regional information that will allow prediction of the regional impact of the proposed injection well.

B. Class III Wells The District shall evaluate each proposed mining operation for potential effects of the mining activity on the underground sources of drinking water, and shall, at a minimum, consider the effects of depressurization of the aquifer on the water quality of any underground sources of drinking water. The Tribe must demonstrate

that the hydrogeologic environment is suitable for injection for extraction of minerals or energy without endangering the underground sources of drinking water, unless the aquifer is an exempted aquifer.

No Class III mining activity shall be allowed in an underground source of drinking water, or shall result in violation of federal drinking water standards, unless the aquifer is an exempted aquifer.

6.2.2.2 Confining Zone

A. Class I Wells At least one confining zone above the injection zone is required. The Tribe shall demonstrate that the confining zone(s) has sufficient areal extent, thickness, lithologic and hydraulic characteristics to prevent injected fluid migration, and that it insures protection of underground sources of drinking water.

B. Class III Wells If an underground source of drinking water exists above or below the proposed mining zone, a confining zone is required between the mining zone and the underground source of drinking water. The confining zone must be of such thickness, areal extent, and permeability to constrain the effects of the mining to the mining zone, and the integrity of the confining zone must be maintained for the life of the project.

C. Testing of Confining Zone for Class I and III Wells The Tribe shall provide sufficient data such as logs, lithologic cores, water samples, and drill stem tests (or aquifer tests) to adequately demonstrate the confining characteristics of the bed. A monitoring system, which may include, but not be limited to, one (1) or more on-site monitor well(s), designed to evaluate the long-term effectiveness of the confining zone may be required. If the Tribe does not propose a monitoring system, the Tribe shall demonstrate that it is not needed. The geophysical logs may include, but not be limited to:

1. Electric Log
2. Natural Gamma-Ray
3. Fluid Conductance Log

4. Caliper Log
5. Static and Pumping Temperature Log
6. Spinner Flowmeter
7. Acoustic Velocity
8. Density Log
9. Porosity Log

6.2.2.3 **Injection Zone - Class I Wells** The Tribe shall demonstrate that the proposed injection zone has sufficient extent, thickness, lithologic and hydraulic characteristics to adequately receive waste.

A. Testing of Injection Zone The purpose of testing the injection zone is to demonstrate the zone's capacity for receiving injected fluid. The Tribe shall demonstrate the suitability of a proposed zone by determining the hydraulic characteristics, lithology, thickness, extent, and compatibility of injection and formation fluids. Testing of the injection zone shall include a pumping injection test at a flow rate of not less than the maximum design capacity of the well, and of such duration that can demonstrate the trend of the injection pressure on the long-term operating conditions. If an adequate water supply for the injection test does not exist, and data collected during drilling strongly indicate the presence of confining bed(s), the Tribe may use secondarily treated domestic wastewater effluent for testing only with prior approval. Testing of the injection zone may include, but not be limited to:

1. Water Samples
2. Withdrawal Tests
3. Video Television Survey
4. Lithologic Cores
5. Drill Cuttings
6. Geophysical Surveys such as:
 - a. Electric Survey
 - b. Natural Gamma-Ray
 - c. Fluid Conductance Survey

- d. Caliper Survey
- e. Static and Pumping Temperature Survey
- f. Spinner Flowmeter
- g. Acoustic Velocity
- h. Focused Resistivity
- i. Density Survey
- j. Porosity Survey.

6.2.3 Well Construction Standards for Class I and III Wells

6.2.3.1 General Design Considerations

- A. All Class I and III wells shall be cased and cemented to prevent the movement of fluids into, or between underground sources of drinking water, and to maintain the quality of aquifers above the injection zone that may be used for monitoring or other purposes.
- B. All Class I wells shall be designed and constructed in such a fashion that they inject into a formation which is below the lowermost formation containing, within one quarter (1/4) mile of the well bore, an underground source of drinking water.
- C. In the design specifications for a Class I well, the Tribe shall address the problem of corrosion, proposed protective measure(s), and, if appropriate, proposed methods of monitoring. The Tribe shall consider thickness and type of cement, number and thickness of casings, casing material, casing coatings, formation fluid (water) quality, injection fluid quality and life expectancy of the well.

For Class I wells all outer surfaces of uncemented casings or portions of casings shall be coated or otherwise protected against corrosion. This protection shall extend for a minimum distance of thirty (30) feet above and below the uncemented portion of the casing.

D. All Class I injection wells, except those municipal wells (publicly or privately owned) 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.

1. The use of other alternatives to a packer may be allowed with the written approval from the District. The alternative method shall reliably provide a comparable level of protection to underground sources of drinking water.

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

a. Depth of setting.

b. Characteristics of injection fluid (chemical content, corrosiveness, and density).

c. Injection pressure.

d. Annular pressure.

e. Rate, temperature and volume of injected fluid. And:

f. Size of casing.

E. For Class 1 wells the following designs are not allowed:

1. Annuli between casings open to the land surface in any injection well. And:

2. Monitoring tubes emplaced and cemented in the annulus adjacent to the innermost or injection string of casing.
- F. For all Class 1 wells, the Tribe shall address potential surge and water hammer protection to ensure the safety and integrity of any injection well system.
- G. District approval is required prior to any remedial procedures that alter the basic design specifications, materials, or character of a Class I or III well.

6.2.3.2 **Exploratory Pilot Hole** An exploratory pilot hole in any Class I well, or for Class III wells, at any proposed injection well site may be required, and the hole to be drilled in stages. If the Tribe does not propose an exploratory pilot hole, the Tribe must demonstrate that it is not needed.

6.2.3.3 **Drilling** Submittal of a step-by-step drilling plan may be required, to be included in the design specifications for Class I and III wells. The drilling plan shall specify the proposed drilling program, sampling, coring, and testing procedures.

- A. For Class I wells, a deviation survey will be run at least every ninety (90) feet (every three (3) joints) of the cased portion of the well and at more frequent intervals when necessary, to insure that the casing can be set and centered for cementing. The maximum deviation at each measurement shall not exceed one degree (1 F) deviation from vertical. This requirement may be waived, or less stringent requirements applied in some cases, provided that the Tribe submits proof that such modification will not adversely affect the successful construction and future operation of the well in such a way as to threaten underground sources of drinking water with contamination.
- B. For Class I wells, directional surveys may be required, if, after an analysis of the well design and drilling program, it is deemed necessary. The directional survey shall be conducted during drilling or in the pilot hole and the reamed hole as separate surveys before

running the casing.

- C. The Tribe may be required to demonstrate that salt used for density control during drilling will not adversely affect the establishment of background water quality for monitoring purposes.

6.2.3.4 **Casings**

- A. The casings used in the construction of each newly drilled Class I and III well shall be designed for the life expectancy of the well, and shall be new and unused for Class 1 wells.
- B. The number, thickness, type of materials, and length of casing shall be sufficient to protect the quality of drinking water resources, the integrity of the well, and the confining strata. At a minimum, the final string of casing shall be made of seamless mild steel pipe having a 0.500 inch wall thickness. If the Tribe proposes to use pipe composed of other than 0.500 inch wall seamless mild steel for the final casing, they shall demonstrate that the proposed material and thicknesses will not compromise the integrity or operation of the well.
- C. Exact setting depths of all casings shall be determined in the field based on all available information, and subject to District approval.

6.2.3.5 **Cementing**

- A. The Tribe shall submit the proposed cementing program with the design specifications for Class I or III wells. The 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 zones. And:
 7. Type or grade of cement.
- B. Cement must be compatible with the injected fluid, native fluids, and the formation, but in no case less than the quality of American Society of Testing and Materials Type 2 or its equivalent (Standard Specification for Portland Cement, American National Standards Institute/American Society of Testing and Materials C 150-78(a), 1978).
 - C. Design specifications, when submitted for approval, shall include a list of cement additives which may be needed in the operation. If an additive is not in the design specifications, the Tribe shall obtain prior approval for its use. Accurate records shall be kept and all additives used shall be reported.

- D. Use of cement additives, water/cement ratio, and the type of water used for mixing shall be determined by the Tribe, provided the integrity, containment, corrosion protection, and structural strength of the cement are not significantly affected.
- E. Prior to cementing, the hole shall be in condition to allow optimum bonding of the cement to the casing and formation, and to prevent channeling.
- F. Cement placement shall be in such a manner that the purposes and characteristics of the cement are retained, and shall be subject to approval and in accordance with "A Standard for Deep Wells." American Water Well Association A100-66, 1966.
- G. The Tribe shall submit the cement testing program for approval. The purpose of the cement testing program is to insure that the cement seal is adequate to prevent migration of fluids in channels, microannular space, or voids in the cement. The methods of testing may include, but are not limited to:
 - 1. Pressure testing of the cement plug at the bottom of the casing - to not less than 1.5 times the expected injection pressure or fifty (50) pounds per square inch, whichever is greater.
 - 2. Temperature survey - must be run within forty-eight (48) hours after cementing.
 - 3. Cement bond survey.
- H. During cementing, adequate pressure differentials shall be maintained to prevent collapse or distortion of the casing.
- I. For Class I wells, the final string of casing shall have a nominal overdrill of ten (10) inches unless the Tribe can affirmatively demonstrate that an overdrill of not less than five (5) inches is sufficient. The annulus surrounding the final string of casing shall have a

nominal five (5) inch cement thickness from the bottom of the casing to land surface. These requirements may be modified, provided that the Tribe submits proof that such modification will not adversely affect the successful construction and future operation of the well in such a way as to threaten an underground source of drinking water with contamination. The remaining casings must have a minimum thickness of two and one-half (2-1/2) inches of cement surrounding the casings with not less than five (5) inches of overdrill. A nominal ten (10) inch overdrill shall be required with any intermediate string of casing for which an annular monitor tube of up to two and three eighths (2-3/8) inch maximum outer diameter is to be emplaced. Commensurate increases in the overdrill shall be required for monitor tubes larger than 2 3/8 inches in outer diameter. The Tribe shall include a centralizing outline for the purpose of centralizing the casing when submitting the cementing program, to provide adequate annular space around the casing for proper cementing.

6.2.3.6 Testing During Drilling and Construction of New Class I Wells

- A. Appropriate geophysical surveys and other tests shall be conducted during the drilling and construction of new Class I wells. A descriptive report, interpreting the results of such geophysical surveys and tests shall be presented for in-progress reviews, as part of periodic progress reports, or in letter form as appropriate. Such reports shall include field copies of the surveys and test data and analyses results at the level required to support field decisions made during drilling or proposed during in-progress reviews. At a minimum, such surveys and tests shall include:
 - 1. Deviation checks which shall be in accordance with subsection 6.2.3.3. 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.
 - 2. Such other geophysical surveys and tests as may be necessary 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 geophysical surveys and tests shall be required, the following geophysical surveys shall be considered for use in the following situations:

- a. For surface casing intended to protect underground sources of drinking water:
 - i. Resistivity, sonic survey, spontaneous potential, and mechanical or sonar caliper surveys before the casing is installed.

And:

- ii. A cement bond, temperature, or density survey after the casing is set and cemented.
- b. For intermediate and long strings of casing intended to facilitate injection:
 - i. Resistivity, spontaneous potential, porosity, and gamma ray surveys before the casing is installed.
 - ii. Fracture finder surveys. And:
 - iii. A cement bond, temperature, or density survey after the casing is set and cemented.
- c. For Class I wells in which an annular monitor tube is proposed for other than the final or innermost casing:
 - i. A caliper survey in the reamed hole which is to contain the monitor tube and.
 - ii. A temperature survey may be required in the monitor tube after the monitor tube has been set and cemented.
- B. 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.

6.2.3.7 **Testing Integrity of Completed Class I Wells** Upon

completion of construction, the completed wells will be tested to assure that the wells will function as built. Tests to be performed may include, but not be limited to:

- A. Cement Bond Survey.
- B. Temperature Survey.
- C. Pressure test of final casing to at least 1.5 times the expected injection pressure for one (1) hour, with no pressure drop after temperature correction.
- D. Video Television Survey - from top to bottom of the well for baseline monitoring purposes.
- E. Injection tests.
- F. Withdrawal Tests - if necessary and if possible. And:
- G. Caliper survey.

6.2.3.8 **Testing of Class III Wells**

- A. Appropriate geophysical surveys and other tests shall be conducted during the drilling and construction of new Class III wells. Upon completion of construction, the completed well system will be tested to assure that the well system will function as designed at the design operation pressures. A descriptive report interpreting the results of such surveys and tests shall be prepared and submitted. The

surveys and tests appropriate to each type of Class III well shall be determined based on the intended function, depth, construction and other characteristics of the well, availability of similar data in the area of the drilling site and the need for additional information that may arise from time to time as the construction of the well progresses. At a minimum, such surveys and tests shall include deviation checks conducted on all holes where pilot holes and reaming are used, at sufficiently frequent intervals to assure that vertical avenues for fluid migration in the form of diverging holes are not created during drilling.

- B. Where the injection zone is a water bearing formation, the following information concerning the injection zone shall be determined or calculated for new Class III wells:
 - 1. Fluid pressure.
 - 2. Temperature.
 - 3. Fracture pressure.
 - 4. Other physical and chemical characteristics of the injection zone.
 - 5. Physical and chemical characteristics of the formation fluids. And:
 - 6. Compatibility of injected fluids with formation fluids.
- C. Where the injection formation is not a water bearing formation, the information listed in subparagraphs (B)(3) and (B)(4) of this subsection must be submitted.

6.2.3.9 Environmental Concerns During Construction

- A. For Class I and III wells, the disposal of drilling fluids or cuttings, and the disposal of formation water or waste during testing shall be in a sound environmental manner that avoids violation of federal surface and ground water quality standards. The proposed disposal method must be approved by the District prior to start of construction.

- B. For Class I wells the use of drilling pads will be required. The pads will be designed to collect spillage of contaminants and to support the heaviest load that will be encountered during drilling. At locations where the unconfined aquifer contains less than 10,000 mg/l total dissolved solids, monitor wells capable of detecting any contamination of the unconfined aquifer from drilling activities shall be required.
- C. For Class I wells, flow control shall be used when drilling into formations in which pressure heads exceed land surface, to prevent uncontrolled release of formation or drilling fluids at land surface.
- D. For Class III wells, the Tribe is advised that permits may be required for surface facilities associated with the mining activity.

6.2.4 Operating Requirements for Class I and III Wells

6.2.4.1 Class I Well Operating Requirements Operating requirements for Class I wells shall, at a minimum, specify that:

- A. To preserve the integrity of the formations, bottom hole (including hydrostatic) pressure shall not exceed a maximum so as to insure that the injection pressure does not initiate new fractures in the injection zone, initiate fractures in the confining zone, significantly alter the fluid movement capabilities of the confining zone, or cause the movement of injection or formation fluids into an underground source of drinking water or into an essential monitoring zone.
- B. The integrity of the well structure shall be protected; hence, total pressure shall not exceed the maximum allowable stress of the materials used to construct the well.
- C. Injection for disposal purposes is prohibited:
 - 1. Between the outermost casing protecting the underground sources of drinking water and the well bore.
 - 2. Through annular monitor tubes. And:

3. Through wells designed to monitor the injection zone except when specifically designed as a temporary injection well or approved (in writing) for emergency discharge use.
- D. Unless an alternative to a packer has been approved, the annulus between the tubing, where required, and the final or innermost string of casing shall be filled with a fluid and a pressure shall be maintained on the annulus. Both the type of fluid and the proposed pressure shall be approved.
- E. The maximum velocity of injected fluid shall not exceed the point where the mechanical limits of the well design or structure of the formation will be adversely affected. The maximum injection velocity of a well that begins operation after June 1, 1985 shall not exceed eight (8) feet per second (ft/sec), unless the Tribe can prove that higher velocities will not compromise the integrity or operation of the well.

6.2.4.2 **Class III Well Operating Requirements** Operating requirements prescribed for Class III wells shall, at a minimum, specify that:

- A. Injection pressure at the wellhead shall not exceed a maximum which shall be calculated to assure that the pressure in the injection zone during injection does not initiate new fractures in the confining zone, or cause the migration of injection or formation fluids into an underground source of drinking water.
- B. Injection between the outermost casing protecting underground sources of drinking water and the well bore is prohibited.
- C. Where the proposed mining operation includes mining a portion of the confining zone, a sufficient amount of confining zone must remain to provide an effective confinement that protects aquifers above and below the mining area.

6.2.4.3 **Operation and Maintenance Manual**

- A. The operation and maintenance manual(s) for injection well disposal

facilities, or portions thereof, shall be prepared for the use of operators, maintenance personnel, technicians, laboratory personnel and others, as appropriate, and shall consist of:

1. Written instructions provided to the injection system operators for the safe, reliable operation of the system.
 2. Records of the basic engineering design and equipment description.
 3. A program to assure proper maintenance of the system.
- B. Each operation and maintenance manual is subject to approval.
- C. The Tribe or operator of the facility shall provide a copy of the approved manual to the operators, maintenance personnel, technicians, laboratory personnel and others, as appropriate. The manual(s) shall be available for reference at the facility or other approved site.
- D. Revisions to the Manual may be required to reflect any facility modifications performed, in order to comply with the requirements of this Chapter, or to reflect experience resulting from facility operation.

6.2.4.4 Abnormal Events

- A. In the event the Tribe is temporarily unable to comply with any of the criteria outlined in this Chapter, due to breakdown of equipment, power outages, destruction by hazard of fire, wind, or by other cause, the Tribe shall notify the District. Notification shall be made to the office of the District within twenty-four (24) hours of breakdown or malfunction - in person, by telephone, or by telegraph.
- B. A report shall be required within seventy-two (72) hours of the notification referenced in (A), above. A final written report shall be submitted within two (2) weeks and shall describe the nature and cause of the breakdown or malfunction, the steps being taken or planned to be taken to correct the problem and prevent its

reoccurrence, emergency procedures in use pending correction of the problem, and the time when the facility will again be operating in compliance with the criteria in this Chapter.

- C. If the Tribe is unable to use the approved primary disposal method under emergency conditions, the Tribe may use an emergency discharge only if prior approval of the emergency method has been obtained. The Tribe shall address the emergency disposal methods in the plan and the operating manual.
- D. In the event a well must be redeveloped, the Tribe shall address disposal of backwashed fluids. The disposal method shall be approved.

6.2.5 Monitoring Well Construction Standards for Class I and III Wells

6.2.5.1 General Design Considerations

- A. For Class I wells, associated on-site, cluster, multi-horizon, or annular monitoring wells shall not penetrate the injection zone or final confining bed.
- B. For satellite and regional monitor wells associated with Class I wells, cluster or multi-horizon monitoring wells may penetrate the injection zone or final confining bed only if the Tribe can demonstrate that the underground sources of drinking water and confining strata will be protected, the integrity of the monitoring and injection well system will be protected, and the well is designed in such a way that it can be easily repaired.
- C. All monitoring wells constructed for Class III injection operations shall be constructed in accordance with Chapter 5 and applicable federal rules and regulations.
- D. Approval is required prior to any remedial procedures that alter the basic design specifications.

6.2.5.2 Exploratory Pilot Hole For Class I wells, an exploratory

pilot hole may be required, and the hole may be required to be drilled in stages. If the Tribe does not propose an exploratory pilot hole, the Tribe must demonstrate that it is not needed for logging or other purposes.

6.2.5.3 **Drilling** A step-by-step drilling plan may be required to be submitted with the design specifications.

6.2.5.4 **Casings and Tubing**

- A. The casings or tubing used in the construction of each newly drilled well shall be designed for the life expectancy of the well.
- B. The number, thickness, type of material, and length of casing or tubing shall be sufficient to protect the quality of drinking water resources, and the integrity of the well and the confining strata. The type of materials used in the monitoring well shall not bias the sampling parameters used in the monitoring program.
- C. Exact setting depths for all casings or tubing shall be determined in the field, based on all available information, and subject to prior approval.

6.2.5.5 **Cementing**

- A. The Tribe shall submit the proposed cementing program with the design specifications. The cement used in the construction of each newly drilled well shall be designed for the life expectancy of the well. The Tribe shall submit a list of proposed additives for District approval.
- B. Cement must be compatible with the native fluids and the formation, but in no case less than the quality of American Society for Testing and Materials Type 2 or its equivalent (Standard Specification for Portland Cement, American National Standards Institute/American Society for Testing and Materials, C150-781A, 1978).
- C. Cement placement shall be in such a manner that the purposes and

characteristics of the cement are retained, and shall be subject to approval and in accordance with "AWWA Standard for Deep Wells," American Water Well Association, A100-66, 1966.

- D. The Tribe shall submit the cement testing program for approval.
- E. For Class I monitor wells, other than annular monitor wells, a nominal thickness of two and one-half (2-1/2) inches of cement surrounding the casings with not less than five (5) inches of overdrill is required, except for the annulus being used for monitoring in wells with open annulus monitoring.
- F. All casings and tubing shall be centralized where possible to ensure uniform cementing.
- G. All outer surfaces of casing or tubing which are uncemented shall be protected from corrosion for a minimum of thirty (30) feet above and below the uncemented portion.

6.2.5.6 Testing of Monitoring Well Construction

Tests may include, but not be limited to:

- A. Cement Bond Survey.
- B. Temperature Survey.
- C. Pressure test to at least 1.5 times the expected ultimate monitoring pressure, but not less than fifty (50) pounds per square inch for one (1) hour, with no pressure drop after temperature correction.
- D. A pumping test to determine if the monitor well has sufficient capacity to yield a representative ground water sample.
- E. Chemical analyses of water from strata tapped by well.
- F. Water level measurement referenced to mean sea level.

6.2.6 Monitoring Requirements for Class I and III Wells

6.2.6.1 Class I Wells For Class I wells, monitoring requirements shall, at a minimum, include:

- A. The analysis of the injected fluids at a frequency specified by the District, to yield representative data on their characteristics.
- B. The installation and use of continuous indicating, recording, and totalizing devices to monitor flow rate and volume, and installation and use of continuous indicating and recording devices to monitor the injection pressure and the pressure on the annulus between the tubing and the final or innermost string of casing, if there is an annulus.
 - 1. A controlled injection test or a bottom hole pressure survey, if a long-term trend of increasing injection pressure is indicated.
- C. A demonstration of mechanical integrity at least once every five (5) years during the life of the well. And:
 - 1. As part of the baseline monitoring information, a video television survey from the surface to the bottom of the injection zone shall be run prior to injection, but after completion of testing, except for those wells that inject through tubing or where it is physically impossible to do so, and every five (5) years thereafter, or more frequently if deemed necessary.
 - 2. The television survey may be either black and white or color.
 - 3. Adequate provisions must be made to centralize the camera in the borehole.
 - 4. Before running the survey, adequate provisions shall be made to assure that fluid in both the casing and open borehole is of sufficient clarity to provide a baseline survey of acceptable quality.
- D. Within the area of review, the type, number, and location of well(s) to

be used to monitor any potential migration of fluids into, or in the direction of underground sources of drinking water, and pressure in the underground sources of drinking water; the parameters to be measured and the frequency of monitoring shall be stated by the District.

- E. The background water quality of the injection zone and the monitoring zone(s) shall be determined prior to injection for both domestic wastewater and industrial Class I wells (including reverse osmosis reject water), in accordance with the sampling and testing methods approved by the District.
 - 1. Background levels shall be determined pursuant to the following criteria:
 - a. For monitor zones in underground sources of drinking water - the primary and secondary drinking water quality parameters, and the minimum criteria provided in federal legislation.
 - b. For the injection zone and monitor zones in other ground waters - the criteria shall be established on a case-by-case basis.
- F. Monitor wells shall be required above the injection zone near the injection well, field or project.
 - 1. The Tribe shall be able to monitor the following:
 - a. The absence of fluid movement adjacent to the well bore as required in subsection 6.1.3.6. And:
 - b. The long-term effectiveness of the confining zone.
- G. Monitor wells may be required above and in the injection zone at a sufficient distance from the well, field or project for regional monitoring.
- H. For Class I wells, a five (5) gallon unacidized representative sample of native water from the injection zone shall, where practical, be collected and provided to a laboratory specified by the District.

- I. **Post-Closure Monitoring** For Class I wells, the Tribe may be required to submit a post-closure monitoring plan designed to monitor the attenuation of any pressure effects and water quality changes caused by the underground injection operation, both in the injection zone and/or in overlying aquifers. The proposed monitoring plan shall, at a minimum, utilize the injection wells and associated monitor wells, to the extent that they are capable of yielding representative ground water samples. The proposed monitoring plan may also include other accessible wells.
1. Items to be addressed by the Tribe in the proposed post-closure monitoring plan shall include, but not be limited to:
 - a. Designation of the wells to be used for post-closure monitoring.
 - b. The parameters to be monitored, by well.
 - c. The sampling frequency.
 - d. The proposed duration of the post-closure monitoring period. And:
 - e. A documented estimate of the total cost of the post-closure monitoring program.
 2. A revision of the post-closure monitoring plan may be required, when appropriate, in order to reflect changes in the design or scope of the underground injection operation, inflation of costs associated with the plan, or other factors resulting from the construction or operation of the injection well system. The Tribe also may initiate modification of the post-closure monitoring plan, subject to approval.

6.2.6.2 Class III Wells For Class III wells, monitoring requirements shall, at a minimum, specify:

- A. The analyses of the physical and chemical characteristics of the injected fluid with sufficient frequency to yield representative data on its characteristics.

- B. Installation and use of continuous recording devices to monitor the injection pressure, flow rate and volume.
- C. The demonstration of mechanical integrity pursuant to subsection 6.1.3.6, at least once every five (5) years during the life of the well.
- D. Weekly monitoring of fluid level and of the parameters chosen to measure water quality in the injection zone with sufficient frequency to yield representative data on its characteristics.
- E. Quarterly monitoring of wells adjacent to the injection site to detect any migration from the injection zone into an underground source of drinking water.
- F. All Class III wells may be monitored on a field or project basis rather than an individual well basis by manifold monitoring. Manifold monitoring may be used in cases of facilities consisting of more than one (1) injection well operating with a common manifold. Separate monitoring systems for each well are not required provided the Tribe/operator demonstrates that manifold monitoring is comparable to individual well monitoring.
- G. The Tribe may be required to monitor for a period of time after mining operations cease. If the monitoring reveals violations, the Tribe must investigate and take corrective action.
- H. **Monitoring Criteria**
 - 1. Where injection is into a formation which contains water with less than 10,000 mg/l total dissolved solids, monitoring wells shall be completed into the injection zone and into any underground sources of drinking water above, and may be required below, the injection zone which could be affected by the mining operation. These wells shall be located in such a fashion as to detect any excursion of injected fluids, process by-products, or formation fluids outside the mining area or zone. The monitoring wells shall be located so that they will not be physically affected if the operation is subject to subsidence or catastrophic collapse.

2. Where injection is into a formation which does not contain water with less than 10,000 mg/l total dissolved solids, monitoring wells may be required above and in the injection zone.
3. Where the injection wells penetrate an underground source of drinking water in an area subject to subsidence or catastrophic collapse, an adequate number of monitoring wells shall be completed into the underground source of drinking water to detect any movement of injected fluids, process by-products or formation fluids into the underground source of drinking water. The monitoring wells shall be located outside the physical influence of the subsidence or catastrophic collapse.
4. Monitoring for subsidence may be required.
 1. In determining the number, location, construction and frequency of monitoring of the monitoring wells the following criteria shall be considered:
 1. The population relying on the underground source of drinking water affected or potentially affected by the injection operation.
 2. The proximity of the injection operation to points of withdrawal of drinking water.
 3. The local geology and hydrology.
 4. The operating pressures and whether a negative pressure gradient is being maintained.
 5. The toxicity and volume of the injected fluid, the formation water, and the process by-products. And:
 6. Number of injection wells per unit area.

6.2.7 Reporting Requirements for Class I and III Wells

6.2.7.1 Class I Exploratory Well Construction and Class I Test/ Injection Well Construction

- A. Periodic data reports and progress reports may be required that may include, but not be limited to, the following:
 - 1. Driller's log
 - 2. Geophysical surveys
 - 3. Core analyses
 - 4. Lithologic Logs
 - 5. Drill stem tests
 - 6. Pump tests
 - 7. Daily job (construction) reports
 - 8. Water quality analyses.

- B. Interpretation of data contained in the data reports or progress reports is required at the completion of each significant phase of construction, such as completion of test well construction and testing, completion of injection well construction, and completion of injection well testing.

- C. The Tribe shall submit final reports of all data collected from the exploratory well with interpretations, with the plan for a Class I test/injection well construction and testing. The final report submitted with the proposal for a Class I Injection Well Operation Plan shall include, but not be limited to, the following:
 - 1. A map showing the location of the proposed injection wells or well field area and the applicable area of review. Within the area of review, the map must show the number and location of all producing wells, injection wells, abandoned wells, dry hole, surface bodies of water, springs, public water systems, 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 and pertinent information known to the Tribe is required to be included on the map.

 - 2. A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or

proposed monitoring 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 District may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, 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.
4. Maps and cross sections detailing the hydrology and geologic structures of the local area.
5. Generalized maps and cross sections illustrating the regional geologic setting.
6. Proposed operating data:
 - a. Average and maximum daily rate and volume of the fluid to be injected.
 - b. Average and maximum injection pressure. And:
 - c. Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids, including any additives for Class III wells. For Class I wells, a demonstration that the effluent quality meets the applicable federal standards.
7. Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of, and other information on the injection zone.
8. Proposed stimulation program.
9. Proposed injection procedure.
10. Engineering drawings of the surface and subsurface construction details of the system, including design features for surge control and

water hammer protection.

11. Contingency plans to cope with all shut-ins or well failures, or, for Class III wells, catastrophic collapse, to protect the quality of the waters of the State including emergency discharge provisions.
12. Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in 6.2.6.
13. 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 6.1.3.3.
14. Construction procedures including a cementing and casing program, logging procedures, deviation checks and a drilling, testing and coring program.
15. For Class III wells, expected changes in pressure, native fluid displacement, direction of movement of injection fluid.
16. For Class III wells, a proposed monitoring plan, which includes a plan for detecting migration of fluids into underground sources of drinking water, a plan to detect water quality violations in the monitoring well, and the proposed monitoring data to be submitted.
17. For Class I, a period of temporary injection operation for the purposes of long term testing shall be required. Each well shall be tested for integrity of construction, and shall be followed by a short term injection test of sufficient duration to allow for the prediction of the operating pressure.
18. During the period of temporary injection operation, the District may require periodic inspections at certain stages of construction.
19. For Class III wells, a period of temporary operation for the purpose of testing shall be required. Each well must first be tested for integrity of

construction, prior to any injection testing.

6.2.7.2 **Class I Injection Well Operation**

- A. The Tribe must submit the proposed methodology for collection and reporting of operational data, to ensure that the data is collected, correlated, and reported in a fashion that would enable the District to evaluate well performance.

- B. The frequency of reporting shall at a minimum include:
 - 1. Operating reports on:
 - a. The physical, chemical and other relevant characteristics of injection fluids.
 - b. Daily readings of the pressure and flow for each well shall be submitted. For each domestic effluent disposal well, a specific injectivity test shall be performed quarterly while the pumping rate to the well(s) has been set at a predetermined level and reported as the specific injectivity index (gpm/specific pressure (psig)). The Tribe shall propose which pumping rate will be used based on the expected flow, the design of the pump station, including the volume of the wet well and pump type(s), and the type of pump controls used.
 - c. Monthly average, maximum and minimum values for injection pressure, flow rate and volume, and annular pressure. And:
 - d. The results of monitoring prescribed under subsection 6.2.5.1.
 - 2. Reporting the results within three (3) months after the completion of:
 - a. Periodic tests of mechanical integrity.
 - b. Any other test of the injection well conducted by the Tribe if required.

- c. Any well work over.
- C. Additional data to be submitted with the periodic operations reports, at the request of the District.
- D. Progress reports, if required, shall be submitted no later than thirty (30) days following each interim date and the final date of compliance.

6.2.7.3 Class III Well Construction/ Operating/ Plugging and Abandonment Reports

- A. Periodic data reports and progress reports may be required that may include, but not be limited to, the following:
 - 1. Driller's log
 - 2. Geophysical surveys
 - 3. Core analyses
 - 4. Lithologic logs
 - 5. Drill stem tests
 - 6. Withdrawal or aquifer tests
 - 7. Number of wells constructed, abandoned, in operation, and recorded on property deeds
 - 8. Results of post-closure monitoring
 - 9. Daily construction reports
- B. The frequency of reporting shall be specified by the District. However, the Tribe may be required to submit monthly operating reports that shall include, but not be limited to, the number of wells constructed, number in operation, number abandoned, and number of wells recorded on property deeds for that month.

- C. Interpretation of data contained in the data reports or progress reports is required at the completion of each significant phase of construction.
- D. **Reporting Requirements** Reporting requirements shall, at a minimum include:
 - 1. Quarterly reporting on required monitoring.
 - 2. Results of mechanical integrity and any other periodic test to be reported with the first regular quarterly report after the completion of the test. And:
 - 3. Monitoring may be required to be reported on a project or field basis rather than individual well basis.
- E. At least once every year, but more frequently if specified, the Tribe shall record the plugging method and location of each well abandoned during that year in the public records of the County.
- F. The Tribe shall submit a Final Report with interpretations of all data collected. The Final Report shall include, but not be limited to, all information and data collected under Part 6.2, with appropriate interpretations.

6.2.7.4 Abandonment Reports for Class I and III Wells

- A. Upon completion of plugging and abandonment of a well or well field, the Tribe shall submit a Final Report which includes, but is not limited to, the following:
 - 1. Certification of completion in accordance with approved plans and specifications by the engineer of record.

2. Evidence, such as a sealed copy or certification from the county clerk, that a surveyor's plot of the location of the abandoned wells has been recorded in the County public records.

6.2.8 Plugging and Abandonment Criteria and Procedures for Class I and III Wells

6.2.8.1 A well may be ordered plugged when it has been abandoned or when it is determined to be a threat to the waters of the State.

6.2.8.2 Any Class I or III well approval shall include conditions to ensure that plugging and abandonment of the well will not allow the movement of fluids either into an underground source of drinking water, or from one underground source of drinking water to another. The Tribe shall be required to submit a plan for plugging and abandonment, which may include post-closure monitoring of the injection operation. The post-closure monitoring plan shall be designed in accordance with the requirements of paragraph 6.2.6.1(I). For the purposes of this section, temporary intermittent cessation of injection operations is not abandonment. Where applicable, the plugging and abandonment plan shall address the proposed post-closure monitoring.

6.2.8.3 Prior to abandoning Class I or 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. Class III wells may be plugged using other plugging materials if it is satisfactorily shown that such materials will prevent movement of fluids into, or between underground sources of drinking water. The proposed plugging method and type of plugging material shall be approved.

6.2.8.4 Placement of the plugging material shall be accomplished by one of the following methods:

A. The Balance Method.

- B. The Dump Bailer Method.
- C. The Two-Plug method. Or:
- D. Any other recognized method as effective or more effective than the above which is approved by the District.

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

6.2.8.6 The Tribe shall notify the District at least hundred eighty (180) days before conversion or abandonment of a Class I well, unless abandonment within a lesser period of time is necessary to protect the waters of the State.

6.2.8.7 For all Class I wells, the final or innermost string of casing shall be filled with neat cement grout, or an approved equivalent, from the bottom of the casing to the surface. The use of other fillers may be allowed in the open hole, provided that the objectives of confining injected fluids to the injection horizon and prevention of migration of injected and/or native fluids between aquifers are satisfied. Annular monitor tubes in an injection well may be left unplugged temporarily if they are to be used for their intended purpose and do not compromise the objectives listed above. If temporarily left open, the annular monitor tubes shall be plugged with cement at the end of post-closure monitoring. If the tubes are not used for monitoring, they shall be filled with neat cement from the bottom of the monitor zone to land surface.

6.2.8.8 The plugging and abandonment plan required in section 6.2.8 shall, in the case of a Class III well field which underlies or is in an exempted aquifer, also demonstrate that no movement of contaminants from the mined zone into an underground source of drinking water will occur. Aquifer cleanup and monitoring shall be prescribed where deemed necessary and feasible to insure that no migration of contaminants from the mined zone into an underground

source of drinking water will occur.

6.2.8.9 In the event a radioactive source tool has been irretrievably lost down an injection well, the District shall be immediately notified. The well shall not be plugged until all applicable Nuclear Regulatory Commission regulations have been satisfied.

6.2.8.10 The Tribe or operator of a well must provide adequate documentation that the well was properly abandoned.

6.3 CRITERIA AND STANDARDS FOR CLASS IV WELLS

6.3.1 **General** For the purposes of this Chapter the definition of a Class IV well specifically includes the disposal of fluids containing hazardous waste from any septic tank or cesspool used by generators of hazardous waste, or by owners or operators of hazardous waste management facilities, into, or above an underground source of drinking water.

6.3.2 **General Prohibition of Class IV Wells**

The construction or operation of any Class IV well is prohibited.

6.4 CRITERIA AND STANDARDS FOR CLASS V WELLS

6.4.1 **General**

6.4.1.1 This Part sets forth criteria and standards for all injection wells not covered in previous sections. Generally, wells covered in this Part inject non-hazardous fluids into, or above formations that contain underground sources of drinking water. Included are wells not covered in Class IV that inject natural and man-made radioactive materials, provided these concentrations do not exceed current federal drinking water standards.

6.4.1.2 **Classification of Class V Wells** Various types of Class V wells that exist or may exist in Florida are grouped together by expected quality of the injected fluid, in order to facilitate the determination of permitting, operating, and monitoring requirements for

these wells. The groups are:

- A. Group 1** Wells associated with thermal energy exchange processes, which include air conditioning return flow wells and cooling water return flow wells. Cooling water return flow wells may be part of a closed-loop system, with no hazardous additives, or part of an open-loop system that may use additives.

- B. **Group 2** Recharge wells, saltwater intrusion barrier wells, connector wells, and subsidence control wells.
- C. **Group 3** Wells which are part of domestic waste treatment systems, swimming pool drainage wells, injection wells used in experimental technologies, and wells used to inject spent brine into the same formation from which it was withdrawn after extraction of halogens or their salts.
- D. **Group 4** Non-hazardous industrial and commercial disposal wells, which include laundry waste, dry wells, sand backfill wells, and nuclear disposal wells used to inject radioactive wastes, provided the concentrations of the waste do not exceed federal drinking water standards, and injection wells used for in situ recovery of phosphate, uraniferous sandstone, clay, sand, and other minerals extracted by the borehole slurry mining method.
- E. **Group 5** Lake level drainage and stormwater drainage wells.
- F. **Group 6** Geothermal wells and "other" wells.

6.4.1.3 The use of any Class V well for injection shall not present a hazard to any existing or future use of an underground source of drinking water.

6.4.2 **Well Construction Standards for Class V Wells**

6.4.2.1 The variety of Class V wells and their uses dictate a variety of construction designs consistent with those uses, and precludes specific construction standards for each type of Class V well outlined in this Chapter. However, a well must be designed and constructed for its intended use, in accordance with good engineering practices, and the design and construction must be approved.

6.4.2.2 The design criteria for Class I wells (6.2) may be applied to the construction of Class V wells, including surge and water hammer protection measures, and other factors.

6.4.2.3 Class V wells shall be constructed so that their intended

use does not violate applicable federal water quality standards at the point of discharge, except where specifically exempted. Migration or mixing of fluids from aquifers of substantively different water quality (through the construction or use of a Class V well) shall be prevented by preserving the integrity of confining beds between these aquifers through cementing or some other acceptable method.

6.4.2.4 A well completion report, defining details of construction and describing various formations penetrated by the well, shall be submitted within two (2) days after completion of the drilling operation.

6.4.2.5 Samples of formations penetrated may be required. If required, and when drilling is completed, samples shall be forwarded to:

**State Geologist
903 West Tennessee Street
Tallahassee, Florida 32304**

6.4.2.6 If casing is used within the well, it shall, at a minimum, meet the requirements for water well construction set forth in Chapter 5.

6.4.2.7 Class V wells shall not be dynamited, except with written permission from the District.

6.4.2.8 A test well or boring shall be filled with cement within five (5) days after completion of the testing for which it was drilled. Such test wells or borings shall not be used as drainage wells unless approval has been obtained in accordance with this Chapter.

6.4.3 **Operating Requirements for Class V Wells**

6.4.3.1 All Class V wells shall be operated in such a manner that they do not present a hazard to an underground source of drinking water. Effluent quality shall meet applicable federal standards.

6.4.3.2 Pre-treatment may be required for fluids injected through existing wells, to insure that the injected fluid does not violate federal water quality standards.

6.4.3.3 Operating requirements may be imposed on Group 1 - cooling water return flow wells on an open-loop system, with additives; Group 3, except for swimming pool drainage wells; Group 4; and Group 6.

6.4.3.4 Operating requirements may be imposed on Groups 2 and 5.

6.4.4 **Monitoring Requirements for Class V Wells**

6.4.4.1 The need for monitoring shall be determined by the type of well, nature of the injected fluid, and water quality of the receiving aquifer. Monitoring requirements may be imposed for Groups 1, 2, 3, 5 and 6.

6.4.4.2 The nature of the fluid being injected into, or above an underground source of drinking water from Group 4 wells is such that monitoring may be required for wells in this group.

6.4.4.3 The frequency of monitoring shall be determined based on

the location of the well, the nature of the injected fluid and applicable federal regulations.

6.4.5 Reporting Requirements for Class V Wells

6.4.5.1 Reporting requirements shall be determined by the type of well and nature of injected fluid.

6.4.5.2 Reporting shall be required for:
Group 1 - cooling water return flow wells on an open-loop system, with additives; Group 3, except for swimming pool drainage wells; Group 4 and Group 6.

6.4.5.3 Reporting may be required for Groups 2 and 5.

6.4.6 Plugging and Abandonment for Class V Wells

6.4.6.1 A Class V well may be ordered plugged and abandoned when it no longer performs its intended purpose, or when it is determined to be a hazard to the ground water resource.

6.4.6.2 Prior to abandoning Class V wells, the well shall be plugged with cement in a manner which will not allow movement of fluids between underground sources of drinking water. The proposed plugging method and type of cement shall be approved. Placement of the cement shall be accomplished by any recognized and acceptable method.