Chapter 24
CLASS VI INJECTION WELLS AND FACILITIES

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CHAPTER 24

Class VI Injection Wells and Facilities
Underground Injection Control Program

Section 1. Authority and Purpose. These regulations are promulgated pursuant to W.S. 35-11-101 through 1904, specifically 313, and no person shall sequester carbon dioxide unless authorized by an Underground Injection Control (UIC) permit issued by the Department of Environmental Quality (DEQ). The injection of carbon dioxide for purposes of a project for enhanced recovery of oil or other minerals approved by the Wyoming Oil and Gas Conservation Commission shall not be subject to the provisions of this regulation unless the operator converts to geologic sequestration upon the cessation of oil and gas recovery operations or as otherwise required by the Commission.

These rules and regulations also provide financial assurance for the purposes specified in 35-11-313.

Section 2. Definitions. The following definitions supplement those definitions contained in Section 35-11-103 of the Wyoming Environmental Quality Act.

(a) “Administrator” means the administrator of the Water Quality Division of the Department of Environmental Quality.

(b) "Aquifer" means a zone, stratum or group of strata that can store and transmit water in sufficient quantities for a specific use.

(c) “Area of review” means the subsurface three-dimensional extent of the carbon dioxide plume, associated pressure front, and displaced fluids, as well as the overlying formations and surface area above that delineated region.

(d) "Background" means the constituents or parameters and the concentrations or measurements which describe water quality and water quality variability prior to the subsurface discharge.

(e) “Bore/casing annulus” means the space between the well bore and the well casing.

(f) “Carbon dioxide plume” means the underground extent, in three dimensions, of an injected carbon dioxide stream.

(g) “Carbon dioxide stream” means carbon dioxide, plus associated substances derived from the source materials and any processing, and any substances added to the stream to enable or improve the injection process. This chapter does not apply to any carbon dioxide stream that meets the definition of a hazardous waste under 40 CFR Part 261.

(h) “Casing/tubing annulus” means the space between the well casing and the tubing.

(i) “Cementing” means to seal the annular space around the outside of a casing string using a specially formulated mixture to hold the casing in place and prevent any movement of fluid in this annular space. Cementing also includes operations to seal the well at the time of abandonment.

(j) “Class VI well” means a well injecting a carbon dioxide stream for geologic sequestration, beneath the lowermost formation containing a USDW; or a well used for geologic sequestration of carbon dioxide that has been granted a waiver of the injection depth requirements pursuant to requirements at Section 10 of this chapter; or, a well used for geologic sequestration of carbon dioxide that has received an expansion to the areal extent of an existing Class II enhanced oil recovery or enhanced gas recovery aquifer exemption pursuant to Wyoming Oil and Gas Conservation Commission Rules and Regulations, Chapter 4, Section 12 and federal regulation §144.7(d). Class VI wells are regulated under this chapter.

(k) “Confining zone” means a geological formation, group of formations, or part of a formation stratigraphically overlying the injection zone(s) that acts as barrier to fluid movement. For Class VI wells operating under an injection depth waiver, confining zone means a geologic formation, group of formations, or part of a formation stratigraphically overlying and underlying the injection zone(s).

(l) “Corrective action” means the use of administrator-approved methods to ensure that wells within the area of review do not serve as conduits for the movement of fluids into geologic formations other than those to be authorized under the permit.

(m) “Director” means the director of the Department of Environmental Quality.

(n) "Draft permit" means a document indicating the tentative decision by the department to issue or deny, modify, revoke and reissue, or terminate a permit. A notice of intent to terminate a permit and a notice of intent to deny a permit are types of draft permits. A denial of a request for modification, revocation and reissuance, or termination is not a draft permit. A draft permit for issuance shall contain all conditions and content, compliance schedules and monitoring requirements required by this chapter.

(o) "Duly authorized representative" means a specific individual or a position having responsibility for the overall operation of the regulated facility or activity. The authorization shall be made in writing by a responsible corporate officer and shall be submitted to the administrator.

(p) “Endangerment” means exposure to actions or activities which could pollute an Underground Source of Drinking Water (USDW).

(q) “Excursion detection” means the detection of migrating carbon dioxide at or beyond the boundary of the geologic sequestration site.

(r) "Fact sheet" means a document briefly setting forth the principal facts and the significant factual, legal, methodological, and policy questions considered in preparing the draft permit. Fact sheets for Class VI wells are incorporated into the public notice.

(s) "Fluid" means any material which flows or moves, whether semisolid, liquid, sludge, gas or any other form or state.

(t) "Geologic sequestration project" means an injection well or wells used to emplace a carbon dioxide stream into an injection zone for geologic sequestration. It includes the subsurface three-dimensional extent of the carbon dioxide plume, associated pressure front, and displaced brine, as well as the surface area above that delineated region. (Reference Section 35-11-103(c) of the Wyoming Environmental Quality Act for definitions of *geologic sequestration*, *geologic sequestration site*, and *geologic sequestration facilities*.)

(u) "Groundwater" means subsurface water that fills available openings in rock or soil materials such that they may be considered water saturated under hydrostatic pressure.

(v) "Groundwaters of the state" are all bodies of underground water which are wholly or partially within the boundaries of the state.

(w) "Hazardous waste" means a hazardous waste as defined in 40 CFR 261.3.

(x) "Individual permit" means a permit issued for a specific facility operated by an individual operator, company, municipality, or agency. An individual permit may be established as an area permit and include multiple points of discharge that are all operated by the same person.

(y) "Injectate" means the material being disposed of through any underground injection facility after it has received whatever pretreatment is done.

(z) "Injection zone" means a geologic formation, group of formations, or part of a formation that is of sufficient areal extent, thickness, porosity, and permeability to receive carbon dioxide through a well or wells associated with a geologic sequestration project.

(aa) "Lithology" means the description of rocks on the basis of their physical and chemical characteristics.

(bb) "Log" means to make a written record progressively describing the strata and geologic and hydrologic character thereof to include electrical, radioactivity, radioactive tracer, temperature, cement bond and similar surveys, a lithologic description of all cores, and test data.

(cc) "Long string casing" means a casing that is continuous from at least the top of the injection interval to the surface and that is cemented in place.

(dd) "Long-term stewardship" means after release of financial assurance, upon site closure, where the sequestration site may require periodic monitoring, measurement, or verification of plume stabilization over an indefinite period of time.

(ee) "Mechanical integrity" means the sound and unimpaired condition of all components of the well or facility or system for control of a subsurface discharge and associated activities.

(ff) "Permit" means a Wyoming Underground Injection Control permit, unless otherwise specified.

(gg) "Permittee" means the named permit holder.

(hh) “Plume stabilization” means the carbon dioxide that has been injected subsurface essentially no longer expands vertically or horizontally and poses no threat to USDWs, human health, safety, or the environment, as demonstrated by a minimum of three (3) consecutive years of monitoring data.

(ii) "Point of compliance" means a point at which the permittee shall meet all permit and regulatory requirements.

(jj) “Point of injection” means the last accessible sampling point prior to a fluid being released into the subsurface environment through a Class VI injection well.

(kk) “Post-injection site care” means monitoring, measurement, verification, and other actions (including corrective action) following closure of injection wells until plume stabilization has been achieved and certified by the administrator, as required under Section 17 of this chapter.

(ll) “Pressure front” means the zone of elevated pressure that is created by the injection of the carbon dioxide stream into the subsurface. The pressure front of a carbon dioxide plume refers to a zone where there is a pressure differential sufficient to cause movement of injected fluids or formation fluid if a migration pathway or conduit were to exist.

(mm) “Public hearing” means a non-adversary hearing held by the administrator or director of the department. The hearing is conducted pursuant to Chapter 3 of the Wyoming Department of Environmental Quality Rules of Practice and Procedure.

(nn) "Radioactive waste" means any waste that contains radioactive material in concentrations that exceed those listed in 10 CFR Part 20, Appendix B, Table II, Column 2 as of December 22, 1993.

(oo) "Receiver" means any zone, interval, formation or unit in the subsurface into which a carbon dioxide stream is injected.

(pp) "Responsible corporate officer" means a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation.

(qq) "Secondarily affected aquifer" means any aquifer affected by migration of fluids from an injection facility, when the aquifer is not directly discharged into.

(rr) “Site closure” means the point/time, as certified by the administrator following the requirements at Section 17, at which time the owner or operator of a geologic sequestration project is released from post-injection site care responsibilities.

(ss) ”Subsurface discharge” means a discharge into a receiver.

(tt) “Transmissive fault or fracture” means a fault or fracture that has sufficient permeability and vertical extent to allow fluids to move beyond the confining zone.

(uu) "USDW” or “Underground source of drinking water" means those aquifers or portions thereof that have a total dissolved solids content of less than 10,000 mg/L, and are classified as either Class I, II, III, IV (a), or Special (A), pursuant to Chapter 8, Quality Standards for Wyoming Groundwaters, Water Quality Rules and Regulations.

(vv) “US EPA regional administrator” means the regional administrator of the US EPA’s Region 8 office in Denver, Colorado.

(ww) “Vadose Zone” means the unsaturated zone in the earth, between the land surface and the top of the first saturated aquifer. The vadose zone contains water at less than saturated conditions.

(xx) “Water quality management area” means the area delineated for the protection of water quality under a department approved plan developed under Sections 303, 208 and/or 201 of the Federal Clean Water Act, as amended.

(yy) “Well” means an opening, excavation, shaft or hole in the ground allowing or used for an underground injection, or for monitoring.

(zz) “Workover” means to pull the tubing, packer, or any downhole hardware from the well and inspect, replace, or refurbish it prior to placing that hardware back in service, or to enter the hole with any drilling tool.

(aaa) “Wellhead protection area” means the area delineated for the protection of a public water supply utilizing a groundwater source under a department approved plan developed pursuant to Section 1528 of the federal Safe Drinking Water Act.

Section 3. Applicability.

(a) These regulations shall apply to all Class VI wells used to inject carbon dioxide streams for the purpose of geologic sequestration.

(b) In addition, these regulations shall apply to owners and operators of Class I industrial, Class II, or Class V experimental or demonstration carbon dioxide injection projects who seek to apply for a Class VI geologic sequestration permit for their well or wells.

(i) Owners and/or operators of permitted Class I or Class V injection well(s) seeking to convert their well(s) to a Class VI well shall apply for a Class VI permit and shall demonstrate to the administrator that the well(s) was/were engineered and constructed to meet the requirements outlined in Section 9 of these regulations and ensure protection of USDWs, in lieu of requirements at Section 9(b) and Section 11(a) of this chapter.

(A) By December 10, 2011, owners or operators of either Class I wells previously permitted for the purpose of geologic sequestration or Class V experimental technology wells no longer being used for experimental purposes that will continue injection of carbon dioxide for the purpose of geologic sequestration must apply for a Class VI permit.

(ii) If the administrator determines that USDWs will not be endangered, such wells are exempt, at the administrator's discretion, from the casing and cementing requirements at Section 9(b)(i) through (vii) and Section 11(a)(i)(A) through (C).

(c) For owners and/or operators of permitted Class II injection well(s) seeking to convert their well(s) to a Class VI well, the following shall apply:

(i) After consultation with the Oil and Gas Conservation Commission Supervisor, the administrator may, in his/her best estimate, require a Class VI permit in consideration of the following:

(A) Increase in reservoir pressure within the injection zone(s).

(B) Increase in carbon dioxide injection rates.

(C) Decrease in reservoir production rates.

(D) Distance between the injection zone(s) and USDWs.

(E) Suitability of the Class II area of review delineation.

(F) Quality of abandoned well plugs within the area of review.

(G) The owner's and/or operator's plan for recovery of carbon dioxide at the cessation of injection.

(H) The source and properties of the injected carbon dioxide.

(I) Any additional site-specific factors as determined by the administrator.

(ii) The owner and/or operator of a Class II well shall apply for a Class VI permit when there is an increased risk to USDWs compared to their Class II operation.

(iii) The owner and/or operator of a Class II well may continue operation as a Class II well when there is no increased risk to USDWs compared to their Class II operation. When enhanced oil recovery operations have ceased, the owner and/or operator may apply for a Class VI permit.

(d) These regulations do not apply to the injection of any carbon dioxide stream that meets the definition of a hazardous waste.

Section 4. Permits required; processing of permits; and requirements applicable to all permits.

(a) Permits required.

(i) Owners or operators of Class VI wells must obtain a permit in

accordance with these regulations. Class VI wells are not authorized by rule to inject.

(ii) Construction, installation, operation, monitoring, testing, plugging, post-injection site care, and modification to, or of, any Class VI well shall be allowed only in accordance with these regulations.

(iii) Injections from Class VI wells shall be restricted to those receivers defined as Class V (Hydrocarbon Commercial) or Class VI groundwaters by the department pursuant to Chapter 8, Quality Standards for Wyoming Groundwaters, Water Quality Rules and Regulations.

(iv) A separate permit to construct is not required under Chapter 3, Water Quality Rules and Regulations for any Class VI facility.

(v) Permits for Class VI wells shall be issued for the operating life of the facility and extend through the post-injection site care period until the geologic sequestration project is closed in accordance with department rules and regulations.

(vi) Permits may be issued for individual Class VI wells.

(vii) Each permit shall be reviewed by the department at least once every five (5) years for continued validity of all permit conditions and contents. Permits that do not satisfy the requirements of these regulations are subject to modification, revocation and reissuance, or termination pursuant to this chapter.

(viii) Sections of permit applications filed under this chapter that represent engineering work shall be sealed, signed, and dated by a licensed professional engineer as required by Wyoming Statutes, Title 33, Chapter 29.

(ix) Sections of permit applications filed under this chapter that represent geologic work shall be sealed, signed, and dated by a licensed professional geologist as required by Wyoming Statutes, Title 33, Chapter 41.

(b) Permit processing procedures applicable to all Class VI facilities, individual and general permits:

(i) The applicant shall submit five (5) copies of the permit application to the division.

(ii) Within 60 days of submission of the application, the administrator shall make an initial determination of completeness. An application shall be determined complete when the administrator receives an application and any supplemental information necessary to determine compliance with these regulations.

(iii) Re-submittal of information by an applicant for an incomplete application will begin the process described in paragraph (b) of this section.

(iv) During any 60 day review period where an application is determined complete, the administrator shall prepare a draft permit for issuance or denial, prepare a fact sheet on the proposed operation, and provide public notice pursuant to Section 20.

(v) The administrator may deny an individual permit for any of the following reasons:

(A) The application is incomplete;

(B) The project, if constructed and/or operated, will cause violation of applicable state surface or groundwater standards;

(C) The application contains a proposed construction or operation that does not meet the requirements of this chapter;

(D) The permitted facility would be in conflict with or is in conflict with a state approved local wellhead protection plan, state approved local source water protection plan, or state approved water quality management plan; or

(E) Other justifiable reasons necessary to carry out the provisions of the Wyoming Environmental Quality Act.

(vi) If the administrator intends to deny an individual permit for any reason other than an incomplete or deficient application, a draft permit shall be prepared and public notice issued pursuant to Section 20 of this chapter.

(vii) A denial of a permit by the department is appealable by the applicant to the Environmental Quality Council in accordance with the Rules of Practice and Procedure. Requests for appeal must be in writing, state the reasons for appeal, and be made to both the director and the chairman of the Environmental Quality Council.

(viii) Permits may be modified, revoked and reissued, or terminated either in response to a petition from any interested person (including the permittee) or upon the administrator's initiative. However, permits may only be modified, revoked and reissued, or terminated for the reasons specified in Section 4(b) of this chapter. All requests shall be in writing and shall contain facts or reasons supporting the request.

If the administrator decides the petition is not justified, the petitioner shall be sent a brief written response giving the reason for the decision. A request for modification, revocation and reissuance, or termination shall be considered denied if the administrator takes no action within 60 days after receiving the written request. Denials of requests for modification, revocation and reissuance, or termination are not subject to public notice and comment. Denials by the administrator may be appealed for hearing to the Environmental Quality Council by a letter briefly setting forth the relevant facts.

(ix) The administrator may modify a permit when:

(A) Any material or substantial alterations or additions to the facility occur after permitting or licensing, that justify the application of permit conditions that are different or absent in the existing permit;

(B) Any modification in the operation of the facility is capable of causing or increasing pollution in excess of applicable standards or permit conditions;

(C) Information warranting modification is discovered after the operation has begun that would have justified the application of different permit conditions at the time of permit issuance;

(D) Regulations or standards upon which the permit was based have changed by promulgation of amended standards or regulations, or by judicial decision after the permit was issued;

(E) Cause exists for termination, as described in this section, but the department determines that modification is appropriate; or

(F) Modification is necessary to comply with applicable statutes, standards or regulations.

(x) Additionally whenever the administrator determines that permit changes are necessary based on:

(A) Area of review reevaluations under Section 8(e) of this chapter; or

(B) Any amendments to the testing and monitoring plan under Section 14(b)(xii) of this chapter; or

(C) Any amendments to the injection well plugging plan under Section 16(c) of this chapter; or

(D) Any amendments to the post-injection site care and site closure plan under Section 17(a)(iii) of this chapter; or

(E) Any amendments to the emergency and remedial response plan under Section 18(d) of this chapter; or

(F) A review of monitoring and/or testing results conducted in accordance with permit requirements.

(xi) Minor modifications of permits may occur with the consent of the permittee without following the public notice requirements. Minor modifications will become final 20 days from the date of receipt of such notice. For the purposes of this chapter, minor modifications may only:

(A) Correct typographical errors;

(B) Require more frequent monitoring or reporting by the permittee;

(C) Change an interim compliance date in a schedule of compliance, provided the new date is not more than 120 days after the date specified in the existing permit and does not interfere with attainment of the final compliance date requirement;

(D) Allow for a change in ownership or operational control of a facility where the administrator determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittees have been submitted to the administrator;

(E) Change quantities or types of fluids injected which are within the capacity of the facility as permitted and, in the judgment of the administrator, would not interfere with the operation of the facility or its ability to meet conditions described in the permit and would not change its classification; or

(F) Change construction requirements approved by the administrator pursuant to department rules and regulations provided that any such alteration shall comply with the requirements of this chapter.

(G) Amend a plugging and abandonment plan which has been updated under Section 16 of this chapter.

(H) Amend a Class VI injection well testing and monitoring plan, plugging plan, post-injection site care and site closure plan, or emergency and remedial response plan where the modifications merely clarify or correct the plan, as determined by the administrator.

(xi) The administrator may revoke and reissue or terminate a permit for any of the following reasons:

(A) Noncompliance with terms and conditions of the permit;

(B) Failure in the application or during the issuance process to disclose fully all relevant facts, or misrepresenting any relevant facts at any time; or

(C) A determination that the activity endangers human health or the environment and can only be regulated to acceptable levels by a permit modification or termination.

(xii) The administrator may modify a permit to resolve issues that could lead to the revocation of the permit under Section 5(b) of this chapter. The administrator, as part of any notification of intent to terminate a permit, shall order the permittee to proceed with reclamation on a reasonable time period.

If the administrator tentatively decides to modify or revoke and reissue a permit, a draft permit incorporating the proposed changes shall be prepared. The administrator may request additional information and, in the case of a modified permit, may require the submission of an updated application. In the case of revoked and reissued permits, the administrator shall require the submission of a new application.

(xiii) In a permit modification under Section 4(b) of this chapter, only those conditions to be modified shall be reopened when a new draft permit is prepared. All other aspects of the existing permit shall remain in effect for the duration of the unmodified permit and the modified permit shall expire on the date when the original permit would have expired. When a permit is revoked and reissued under this section, the entire permit is reopened as if the permit has expired and is being reissued. During any revocation and reissuance proceeding, the permittee shall comply with all conditions of the existing permit until a new final permit is issued.

(xiv) Permit modifications, revocations or terminations shall be developed as a draft permit and are subject to the public notice and hearing requirements outlined in Section 20.

(xv) Transfer of a permit is allowed only upon approval by the administrator. When a permit transfer occurs pursuant to this section, the permit rights of the previous permittee will automatically terminate.

(A) The proposed permit holder shall apply in writing as though that person was the original applicant for the permit and shall further agree to be bound by all of the terms and conditions of the permit; and

(B) Transfer will not be allowed if the permittee is in noncompliance with any term and conditions of the permit, unless the transferee agrees to bring the facility back into compliance with the permit.

(C) When a permit transfer occurs, the administrator may modify a permit pursuant to this section. The administrator shall provide public notice pursuant to Section 20 for any modification other than a minor modification defined by this section.

(c) Permit conditions.

(i) All individual permits issued under this chapter shall contain the following conditions:

(A) A requirement that the permittee comply with all conditions of the permit, and any permit noncompliance constitutes a violation of these regulations and is grounds for enforcement action, permit termination, revocation, or modification;

(B) A requirement that if the permittee wishes to continue injection activity after the expiration date of the permit, the permittee must apply to the administrator for, and obtain, a new permit prior to expiration of the existing permit;

(C) A stipulation that it shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit;

(D) A requirement that the permittee shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this permit;

(E) A requirement that the permittee properly operate and maintain all facilities and systems of treatment and control that are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding and operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit;

(F) A stipulation that the filing of a request by the permittee, or at the instigation of the administrator, for a permit modification, revocation, termination, or notification of planned changes or anticipated non-compliance, shall not stay any permit condition;

(G) A stipulation that this permit does not convey any property rights of any sort, or any exclusive privilege;

(H) A stipulation that the permittee shall furnish to the administrator, within a specified time, any information which the administrator may request to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit, or to determine compliance with the permit. The permittee shall also furnish to the administrator, upon request, copies of records required to be kept by the permit;

(I) A requirement that the permittee shall allow the administrator, or an authorized representative of the administrator, upon the presentation of credentials, during normal working hours, to enter the premises where a regulated facility is located, or where records are kept under the conditions of this permit, and inspect the discharge and related facilities, review and copy reports and records required by the permit, collect fluid samples for analysis, measure and record water levels, and perform any other function authorized by law or regulation;

(J) A requirement that the permittee furnish any information necessary to establish a monitoring program pursuant to Section 14 of this chapter;

(K) A requirement that all samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity, and records of all monitoring information be retained by the permittee. The monitoring information to be retained shall be that information stipulated in the monitoring program established pursuant to the criteria in Section 14 of this chapter;

(L) A requirement that all applications, reports, and other information submitted to the administrator contain certifications as required in Section 5(d) of this chapter, and be signed by a person who meets the requirements to sign permit applications found in Section 5(c), or for routine reports, a duly authorized representative;

(M) A requirement that the permittee give advance notice to the administrator as soon as possible of any planned physical alteration or additions, other than authorized operation and maintenance, to the permitted facility and receive authorization prior to implementing the proposed alteration or addition;

(N) A requirement that any modification that may result in a violation of a permit condition shall be reported to the administrator, and any modification that will result in a violation of a permit condition shall be reported to the administrator through the submission of a new or amended permit application;

(O) A requirement that any transfer of a permit must first be approved by the administrator, and that no transfer will be approved if the facility is not in compliance with the existing permit unless the proposed permittee agrees to bring the facility into compliance;

(P) A requirement that monitoring results shall be reported at the intervals specified elsewhere in the permit;

(Q) A requirement that reports of compliance or non-compliance with, or any progress reports on interim and final requirements contained in any compliance schedule, if one is required by the administrator, shall be submitted no later than 30 days following each schedule date;

(R) Any noncompliance with a permit condition or malfunction of the injection system which may cause fluid migration into or between USDWs must be orally reported to the administrator within 24 hours, and a written submission shall be provided within five (5) days of the time the permittee becomes aware of the excursion. The written submission shall contain:

(I) A description of the noncompliance and its cause;

(II) The period of noncompliance, including exact dates and times, and, if the noncompliance has not been controlled, the anticipated time it is expected to continue; and

(III) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

(S) A requirement that the permittee report all instances of noncompliance not already required to be reported under paragraphs (c)(i)(Q) through (R) of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (c)(i)(R) of this section;

(T) A requirement that in the situation where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the administrator, the permittee shall promptly submit such facts or information;

(U) A requirement that the injection facility meet construction requirements outlined in Section 9 of this chapter, and that the permittee submit notice of completion of construction to the administrator and allow for inspection of the facility upon completion of construction, prior to commencing any injection activity;

(V) A requirement that the permittee notify the administrator at such times as the permit requires before conversion or abandonment of the facility; and

(W) A requirement that injection may not commence until construction is complete.

(X) A requirement that the owner or operator of a Class VI well permitted under this part shall establish mechanical integrity prior to commencing injection or on a schedule determined by the administrator. Thereafter, the owner or operator of Class VI wells must maintain mechanical integrity as defined in Section 13 of this chapter.

(Y) A requirement that when the administrator determines that a Class VI well lacks mechanical integrity pursuant to Section 13 of this chapter, he/she shall give written notice of his/her determination to the owner or operator.

(Z) A requirement that, for any Class VI well that lacks mechanical integrity, injection operations are prohibited until the permittee shows to the satisfaction of the administrator under Section 13 that the well has mechanical integrity.

(AA) A Class VI permit shall include conditions which meet the requirements set forth in Section 16 of this chapter. Where the plan meets the requirements of Section 16 of this chapter, the administrator shall incorporate it into the permit as a permit condition.

(I) For purposes of the above subparagraph, temporary or intermittent cessation of injection operations is not abandonment.

(ii) In addition to the conditions required of all permits, the administrator shall establish, on a case-by-case basis, conditions as required for monitoring, schedules of compliance, and such additional conditions as are necessary to prevent the migration of fluids into underground sources of drinking water.

Section 5. Permit application.

(a) It is the operator's responsibility to make application for and obtain a permit in accordance with these regulations. Each application must be submitted with all supporting data.

(b) A complete application for a Class VI well shall include:

(i) A brief description of the nature of the business and the activities to be conducted that require the applicant to obtain a permit under this chapter.

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

(iii) Up to four SIC (Standard Industrial Classification) codes that best reflect the principal products or services provided by the facility.

(iv) The name, address, and telephone number of the facility. Additionally, the location of the geologic sequestration project shall be identified by section, township, range and county, noting which, if any, sections include Indian lands.

(v) Within the area of review, a listing and status of all permits or construction approvals associated with the geologic sequestration project received or applied for by the applicant under any of the following programs:

(A) Hazardous Waste Management under the Resource Conservation and Recovery Act (RCRA).

(B) UIC Program under the Safe Drinking Water Act.

(C) National Pollutant Discharge Elimination System (NPDES) under the Clean Water Act.

(D) Prevention of Significant Deterioration (PSD) program under the Clean Air Act.

(E) National Emissions Standards for Hazardous Air Pollutants (NESHAPs) pre-construction approval under the Clean Air Act.

(F) Dredge and fill permits under section 404 of the Clean Water Act.

(G) Within the area of review, a list of other relevant permits, whether federal or state, associated with the geologic sequestration project that the applicant has been required to obtain, such as construction permits. This includes a statement as to whether or not the facility is within a state approved water quality management plan area, a state approved wellhead protection area or a state approved source water protection area.

(vi) A map showing the injection well(s) for which a permit is sought and the applicable area of review, consistent with Section 8 of this chapter.

(A) Within the area of review, the map must show the number, or name and location of all known injection wells, producing wells, abandoned wells, plugged wells or dry holes, deep stratigraphic boreholes, state or EPA approved subsurface cleanup sites, public drinking water supply wellhead or source water protection areas, surface bodies of water, springs, mines (surface and subsurface), quarries, water wells and other pertinent surface features including structures intended for human occupancy, state, tribal, and territory boundaries, and roads.

(B) Only information of public record is required to be included on this map.

(vii) A map delineating the area of review based upon modeling, using all available data including data available from any logging and testing of wells within and adjacent to the area of review;

(A) A Class VI area of review shall never be less than the area of potentially affected groundwater.

(B) All areas of review shall be legally described by township, range and section to the nearest ten (10) acres as described under the general land survey system.

(viii) A description of the general geology of the area to be affected by the injection of carbon dioxide including geochemistry, structure and faulting, fracturing and seals, and stratigraphy and lithology including petrophysical attributes. The description shall also include sufficient information on the geologic structure and reservoir properties of the proposed storage site and overlying formations, including:

(A) Isopach maps of the proposed injection and confining zone(s), a structural contour map aligned with the top of the proposed injection zone, and at least two geologic cross sections of the area of review reasonably perpendicular to each other and showing the geologic formations from the surface to total depth;

(B) Location, orientation, and properties of known or suspected faults and fractures that may transect the confining zone(s) in the area of review and a determination that they would not interfere with containment;

(C) Information on seismic history that have affected the proposed area of review including knowledge of previous seismic events and history of these events, the presence and depth of seismic sources, and a determination that the seismicity would not compromise containment;

(D) Data sufficient to demonstrate the effectiveness of the injection and confining zone(s), including data on the depth, areal extent, thickness, mineralogy, porosity, vertical permeability and reservoir pressure of the injection and confining zone(s) within the area of review, and geologic changes based on field data which may include geologic cores, outcrop data, seismic surveys, well logs, capillary pressure tests and names and lithologic descriptions;

(E) Geomechanical information on fractures, stress, ductility, rock strength, and in situ fluid pressures within the confining zone; and

(F) Geologic and topographic maps and cross sections illustrating regional geology, hydrogeology, and the geologic structure of the local area.

(ix) A compilation of all wells and other drill holes within, and adjacent (within 1 mile) to the area of review. Such data must include a description of each well and drill hole type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the administrator may require.

(A) Applicants shall also identify the location of all known wells within, and adjacent (within 1 mile) to the area of review that penetrate the confining or injection zone.

(B) Applicants shall perform mapping with sufficient resolution as to make a comprehensive effort to identify wells that are not in the public record using aerial photography, aerial survey, physical traverse, or other methods acceptable to the administrator.

(C) Applicants shall perform corrective action as specified in Section 8.

(x) Maps and stratigraphic cross sections indicating the general vertical and lateral limits of all USDWs, the location of water wells and springs within the area of review, their positions relative to the injection zone(s), and the direction of water movement, where known;

(xi) A characterization of the injection zone and aquifers above and below the injection zone which may be affected, including applicable pressure and fluid chemistry data to describe the projected effects of injection activities, and background water quality data which will facilitate the classification of any groundwaters which may be affected by the proposed discharge. This must include information necessary for the division to classify the receiver and any secondarily affected aquifers under Chapter 8, Wyoming Water Quality Rules and Regulations;

(xii) Baseline geochemical data on subsurface formations, including all USDWs in the area of review.

(xiii) Proposed operating data:

(A) Average and maximum daily rate and volume and/or mass and total anticipated volume and/or mass of the carbon dioxide stream;

(B) Average and maximum surface injection pressure;

(C) The source of the carbon dioxide stream; and

(D) An analysis of the chemical and physical characteristics of the carbon dioxide stream and any other substance(s) proposed for inclusion in the injectate stream; and

(E) Anticipated duration of the proposed injection period(s).

(xiv) The compatibility of the carbon dioxide stream with fluids in the injection zone and minerals in both the injection and the confining zone(s), based on the results of the formation testing program, and with the materials used to construct the well;

(xv) An assessment of the impact to fluid resources, on subsurface structures and the surface of lands that may reasonably be expected to be impacted, and the measures required to mitigate such impacts;

(xvi) Proposed formation testing program to obtain an analysis of the chemical and physical characteristics of the injection zone and confining zone and that meets the requirements at Section 11 of this chapter;

(xvii) Proposed stimulation program, a description of stimulation fluids to be used and a determination that stimulation will not compromise containment;

(A) All stimulation programs must be approved by the administrator as part of the permit application and incorporated into the permit.

(xviii) Proposed procedure to outline steps necessary to conduct injection operation;

(xix) A wellbore schematic of the subsurface construction details and surface wellhead construction of the injection and monitoring wells;

(xx) Injection well design and construction procedures that meet the requirements of Section 9;

(xxi) Proposed area of review and corrective action plan that meets the requirements under Section 8;

(xxii) The status of corrective action on wells in the area of review;

(xxiii) All available logging and testing program data on the well(s) required by Section 11;

(xxiv) A demonstration of mechanical integrity pursuant to Section 13;

(xxv) A demonstration, satisfactory to the administrator, that the applicant has met the financial responsibility requirements under Section 19;

(xxvi) Proposed testing and monitoring plan required by Section 14;

(xxvii) Proposed injection and monitoring well(s) plugging plan required by Section 16(b);

(A) Where the plan meets the requirements of Section 16(b) of this chapter, the administrator shall incorporate it into the permit as a permit condition.

(I) For purposes of this subparagraph, temporary or intermittent cessation of injection operations is not abandonment.

(xxviii) Proposed post-injection site care plan required by Section 17(a);

(xxix) At the administrator's discretion, a demonstration of an alternative post-injection site care timeframe required by Section 17 of this chapter;

(xxx) Proposed emergency and remedial response plan required by Section 18;

(xxxi) A site and facilities description, including a description of the proposed geologic sequestration facilities;

(xxxii) Documentation sufficient to demonstrate that the applicant has all legal rights, including but not limited to the right to surface use, necessary to sequester carbon dioxide and associated constituents;

(xxxiii) Proof of notice to surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interests as to the contents of such notice. Notice requirements shall at a minimum require:

(A) The publishing of notice of the application in a newspaper of general circulation in each county of the proposed operation at weekly intervals for four (4) consecutive weeks; and

(B) A copy of the notice shall also be mailed to all surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interests that are located within one (1) mile of the proposed boundary of the geologic sequestration site as defined by W.S. 35-11-103(c)(xxi).

(xxxiv) A list of contacts, submitted to the administrator, for those Tribes identified to be within the area of review of the Class VI project based on information provided in subparagraphs (b)(vi), (b)(vi)(A), and (b)(vi)(B) of this section; and

(xxxv) Any other information requested by the administrator.

(c) The administrator shall notify, in writing, any Tribes within the area of review of the Class VI project based on information provided in subparagraphs (b)(vi), (b)(vi)(A), (b)(vi)(B), and (b)(xxxv) of this section.

(d) Prior to granting approval for the operation of a Class VI well, the administrator shall consider the following information:

(i) The final area of review based on modeling, using data obtained during logging and testing of the well and the formation as required by subparagraphs (b)(xiv), (b)(xvii), (b)(xxiii), and (b)(xxiv) of this section;

(ii) Any relevant updates, based on data obtained during logging and testing of the well and the formation as required by subparagraphs (b)(xiv), (b)(xvii), (b)(xxiii), and (b)(xxiv) of this section, to the information on the geologic structure and hydrogeogeologic properties of the proposed storage site and overlying formations, submitted to satisfy the requirements of subparagraph (b)(viii) of this section;

(iii) The results of the formation testing program as required in paragraph (b)(xvi) of this section;

(iv) Final injection well construction procedures that meet the requirements of Section 9 of this chapter;

(v) Any updates to the proposed area of review and corrective action plan, testing and monitoring plan, injection well plugging plan, post-injection site care and site closure plan, or the emergency and remedial response plan submitted under paragraph (a) of this section,

which are necessary to address new information collected during logging and testing of the well and the formation as required by all paragraphs of this section, and any updates to the alternative post-injection site care timeframe demonstration submitted under paragraph (a) of this section, which are necessary to address new information collected during the logging and testing of the well and the formation as required by all paragraphs of this section; and

(vi) Owners or operators seeking a waiver of the requirement to inject below the lowermost USDW must also refer to Section 10 of this chapter and submit a supplemental report, as required at Section 10(a). The supplemental report is not part of the permit application.

(e) An applicant applying for a Class VI well permit must obtain public liability insurance to cover the geologic sequestration activities for which a permit is sought.

(i) The public liability insurance shall be in addition to the financial assurance required in Section 19 of this chapter.

(ii) The insurance policy shall provide for personal injury and property damage protection and shall be in place until a completion and release certificate has been obtained from the administrator certifying that plume stabilization has been achieved.

(iii) The minimum insurance coverage for public liability insurance as required by W.S. §35-11-313(f)(ii)(O) shall be five hundred thousand dollars ($500,000) for each occurrence of bodily injury or property damage, and one million dollars ($1,000,000) aggregate.

(iv) The public liability insurance shall include a rider requiring that the insurer notify the administrator whenever substantive changes are made to the policy, including any termination or failure to renew.

(v) Self-insurance in lieu of public liability insurance must meet state or federal requirements and be approved by the administrator.

(f) All applications for permits, reports, or information to be submitted to the administrator shall be signed by a responsible officer as follows:

(i) <u>For a corporation</u> - a responsible corporate officer means:

(A) A president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions for the corporation; or

(B) The manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(ii) <u>For a partnership or sole proprietorship</u> -- by a general partner or the proprietor, respectively;

(iii) For a municipality, state, federal or other public agency -- by either the principal executive officer or ranking elected official.

(g) The application shall contain the following certification by the person signing the application:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

(h) All data used to complete permit applications shall be kept by the applicant for for the life of the geologic sequestration project and for 10 years following site closure.

Section 6. Prohibitions.

(a) In addition to the requirements in W.S. 35-11-301(a), no person shall:

(i) Discharge into, construct, operate, or modify any Class VI well unless permitted pursuant to this chapter;

(ii) Discharge to any zone except the authorized discharge zone as described in the permit;

(iii) Conduct any authorized injection activity in a manner that results in a violation of any permit condition or representations made in the application, or the request for coverage under the individual permit. A permit condition supersedes any application content.

(b) No person shall inject any hazardous waste that has been banned from land disposal pursuant to Chapter 1, Wyoming Hazardous Waste Rules.

(c) The construction of new, or operation or maintenance of any existing Class V wells for non-experimental geologic sequestration is prohibited.

(d) Other than EPA approved aquifer exemption expansions that meet the criteria set forth in Wyoming Oil and Gas Conservation Commission Rules and Regulations, Chapter 4, Section 12, new aquifer exemptions shall not be issued for Class VI injection wells. Even if an aquifer has not been specifically identified by the administrator, it is an underground source of drinking water if it meets the definition in Section 2 of this chapter.

Section 7. Minimum criteria for siting Class VI wells.

(a) Owners or operators of Class VI wells must demonstrate to the satisfaction of the administrator that the wells will be sited in areas with a suitable geologic system. The geologic system must be comprised of:

(i) An injection zone of sufficient areal extent, thickness, porosity, and permeability to receive the total anticipated volume of the carbon dioxide stream; and

(ii) A confining zone(s) that is free of transmissive faults or fractures and of sufficient areal extent and integrity to contain the injected carbon dioxide stream and displaced formation fluids and allow injection at proposed maximum pressures and volumes without initiating or propagating fractures in the confining zone(s) or causing non-transmissive faults to become transmissive.

(b) Owners or operators of Class VI wells must identify and characterize additional zones, if they exist, that will impede vertical fluid movement, allow for pressure dissipation, and provide additional opportunities for monitoring, mitigation and remediation. Vertical faults and fractures that transect these zones must be identified.

Section 8. Area of review delineation and corrective action.

(a) The area of review is based on computational modeling that accounts for the physical and chemical properties of all phases of the injected carbon dioxide stream.

(i) The owner or operator will re-evaluate the area of review at least every two (2) years during the operational life of the facility, and then no less frequently than every five (5) years through the post-injection site care period until the geologic sequestration project is closed in accordance with department rules and regulations.

(b) The owner or operator of a Class VI well must prepare, maintain, and comply with a plan to delineate the area of review for a proposed geologic sequestration project, re-evaluate the delineation, and perform corrective action that meets the requirements of this section and is acceptable to the administrator. As a part of the permit application for approval by the administrator, the owner or operator must submit an area of review and corrective action plan that includes the following information:

(i) The method for delineating the area of review that meets the requirements of paragraph (c) of this section, including the name, version and availability of the model to be used, assumptions that will be made, and the site characterization data on which the model will be based;

(ii) A description of:

(A) The monitoring and operational conditions that would warrant a re-evaluation of the area of review prior to the next scheduled re-evaluation as determined by the minimum fixed frequency established in paragraph (a)(i) of this section.

(B) How monitoring and operational data (e.g., injection rate and pressure) will be used to evaluate the area of review; and

(C) How corrective action will be conducted to meet the requirements of paragraph (d) of this section, including:

(I) What corrective action will be performed prior to injection;

(II) What, if any, portions of the area of review will have corrective action addressed on a phased basis, and how the phasing will be determined;

(III) How corrective action will be adjusted if there are changes in the area of review; and

(IV) How site access will be ensured for future corrective action.

(c) Owners or operators of Class VI wells must perform the following actions to delineate the area of review, identify all wells that require corrective action, and perform corrective action on those wells:

(i) Predict, using computational modeling:

(A) The projected lateral and vertical migration of the carbon dioxide plume and formation fluids in the subsurface from the commencement of injection activities until the plume movement ceases;

(B) The pressure differentials, and demonstrate that pressure differentials sufficient to cause the movement of injected fluids or formation fluids into a USDW or to otherwise threaten human health, safety, or the environment will not be present (or for a fixed time period as determined by the administrator);

(C) The potential need for brine removal, and;

(D) The long-term effects of pressure buildup if brine is not removed.

(ii) The modeling must:

(A) Be based on:

(I) Detailed geologic data available or collected to characterize the injection zone, confining zone and any additional zones; and

(II) Anticipated operating data, including injection pressures, rates and total volumes over the proposed operational life of the facility.

(B) Take into account any relevant geologic heterogeneities, data quality, and their possible impact on model predictions; and

(C) Consider potential migration through faults, fractures, and artificial penetrations.

(iii) Using methods approved by the administrator, identify all penetrations, including active and abandoned wells and underground mines, in the area of review that may

penetrate the confining zone. Provide a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the administrator may require; and

(iv) Determine which abandoned wells in the area of review have been plugged in a manner that prevents the movement of:

(A) Carbon dioxide that may endanger USDWs or otherwise threaten human health, safety, or the environment, or;

(B) Displaced formation fluids that may endanger USDWs or otherwise threaten human health, safety, or the environment.

(d) Owners or operators of Class VI wells must perform corrective action on all wells in the area of review that are determined to need corrective action using methods necessary to prevent the movement of fluid into or between USDWs including use of materials compatible with the carbon dioxide stream, where appropriate.

(e) At a fixed frequency, not to exceed two (2) years during the operational life of the facility, or five (5) years during the post-injection site care period (until the geologic sequestration project is closed) as specified in the area of review and corrective action plan, or when monitoring and operational conditions warrant, owners or operators must:

(i) Re-evaluate the area of review in the same manner specified in paragraph (c)(i) of this section;

(ii) Identify all wells in the re-evaluated area of review that require corrective action in the same manner specified in paragraph (c)(iv) of this section;

(iii) Perform corrective action on wells requiring corrective action in the reevaluated area of review in the same manner specified in paragraph (d) of this section; and

(iv) Submit an amended area of review and corrective action plan or demonstrate to the administrator through monitoring data and modeling results that no change to the area of review and corrective action plan is needed.

(A) Any amendments to the area of review and corrective action plan must be approved by the administrator;

(B) Any amendments to the area of review must be incorporated into the permit; and

(C) Any amendments to the area of review are subject to the permit modification requirements at Section 4 of this chapter, as appropriate.

(f) The emergency and remedial response plan (as required by Section 18) and a demonstration of financial responsibility (as described by Section 19) must account for the entire area of review [as modified], regardless of whether or not corrective action in the area of review is phased.

(g) All modeling inputs and data used to support area of review reevaluations under paragraph (e) of this section shall be retained for 10 years.

Section 9. Construction and operation standards for Class VI wells.

(a) The owner or operator must ensure that all Class VI wells are designed, at a minimum, to the construction standards set forth by the department and the Wyoming oil and gas conservation commission, as applicable, and constructed and completed to:

(i) Prevent the movement of fluids into or between USDWs or into any unauthorized zones;

(ii) Permit the use of appropriate testing devices and workover tools; and

(iii) Permit continuous monitoring of the annulus space between the injection tubing and long string casing.

(b) Casing and cement or other materials used in the construction of each Class VI well must have sufficient structural strength and be designed for the life of the well.

(i) All well materials must be compatible with fluids with which the materials may be expected to come into contact, and meet or exceed standards developed for such materials by the American Petroleum Institute, ASTM International, or comparable standards acceptable to the administrator.

(ii) The casing and cementing program must be designed to prevent the movement of fluids into or between USDWs.

(iii) In order to allow the administrator to determine and specify casing and cementing requirements, the owner or operator must provide the following information:

(A) Depth to the injection zone;

(B) Injection pressure, external pressure, internal pressure and axial loading;

(C) Hole size;

(D) Size and grade of all casing strings (wall thickness, external diameter, nominal weight, length, joint specification and construction material), including whether the casing is new, or used;

(E) Composition of the carbon dioxide stream and formation fluids;

(F) Down-hole temperatures and pressures;

(G) Lithology of injection and confining zones;

(H) Type or grade of cement and additives; and

(I) Quantity, chemical composition, and temperature of the carbon dioxide stream.

(iv) Surface casing must extend through the base of the lowermost USDW above the injection zone and be cemented to the surface.

(v) At least one long string casing, using a sufficient number of centralizers, must be set in a manner so as to create a cement bond through the overlying and/or underlying confining zones(s). The long string casing must extend to the injection zone, must be cemented by circulating cement to the surface in one or more stages, and must be isolated by placing cement and/or other isolation techniques as necessary to provide adequate isolation of the injection zone and provide for protection of USDWs, human health, safety, and the environment.

(A) Circulation of cement may be accomplished by staging. The administrator may approve an alternative method of cementing in cases where the cement cannot be recirculated to the surface, provided the owner or operator can demonstrate by using logs that the cement does not allow fluid movement behind the well bore.

(vi) Cement and cement additives must be suitable for use with the carbon dioxide stream and formation fluids and of sufficient quality and quantity to maintain integrity over the operating life of the well.

(vii) The integrity and location of the cement shall be verified using technology capable of evaluating cement quality radially with sufficient resolution to identify the location of channels, voids, or other areas of missing cement to ensure that USDWs are not endangered and that human health, safety, and the environment are protected.

(c) All owner and operators of Class VI wells must inject fluids through tubing with a packer set at a depth opposite a cemented interval at the location approved by the administrator.

(i) Tubing and packer materials used in the construction of each Class VI well must be compatible with fluids with which the materials may be expected to come into contact and must meet or exceed standards developed for such materials by the American Petroleum Institute, ASTM International, or comparable standards acceptable to the administrator.

(ii) In order for the administrator to determine and specify requirements for tubing and packer, the owner or operator must submit the following information:

(A) Depth of setting;

(B) Characteristics of the carbon dioxide stream (e.g., chemical content, corrosiveness, temperature, and density) and formation fluids;

(C) Maximum proposed injection pressure;

(D) Maximum proposed annular pressure;

(E) Maximum proposed injection rate (intermittent or continuous) and volume of the carbon dioxide stream;

(F) Size of tubing and casing; and

(G) Tubing tensile, burst, and collapse strengths.

Section 10. Class VI Injection Depth Waiver Requirements

(a) The owner and/or operator seeking a waiver of the requirement to inject below the lowermost USDW shall submit a supplemental report concurrent with the permit application. The report shall contain the following:

(i) A demonstration that the injection zone(s) is/are laterally continuous, is not a USDW, and is not hydraulically connected to USDW's; does not outcrop; has adequate injectivity; volume, and sufficient porosity to safely contain the injected carbon dioxide and formation fluids; and has appropriate geochemistry.

(ii) A demonstration that the injection zone(s) is/are bounded by laterally continuous, impermeable confining units above and below the injection zone(s) adequate to prevent fluid movement and pressure buildup outside of the injection zone(s); and that the confining unit(s) is/are free of transmissive faults and fractures. The report shall further characterize the regional fracture properties and contain a demonstration that the fractures will not interfere with injection, serve as conduits, or endanger USDWs.

(iii) A computer model demonstrating that USDWs above and below the injection zone will not be endangered as a result of fluid movement. The modeling shall be done in conjunction with the area of review determination, as described in Section 8 of this chapter, and is subject to requirements, as described in Section 8(c) of this chapter, and periodic reevaluation, as described in Section 8(e) of this chapter.

(iv) A demonstration that well design and construction, in conjunction with the waiver, will ensure isolation of the injectate in lieu of the requirements of Section 9 (a)(i) and will meet the well construction requirements of paragraph (e) if this section.

(v) A description of how the monitoring and testing and any additional plans will be tailored to this geologic sequestration project to ensure protection of USDWs above and below the injection zone.

(vi) Information on the location of all public water supplies affected, reasonably likely to be affected, or served by USDWs in the area of review.

(vii) Any other information requested by the administrator.

(b) To inform the EPA regional administrator's decision on whether to grant a waiver of the injection depth requirements at 40 CFR §§144.6, 146.5(f), and 146.86(a)(1), the administrator must submit, to the EPA regional administrator, documentation of the following :

(i) An evaluation of the following information as it relates to siting, construction, and operation of a geologic sequestration project with a waiver:

(A) The integrity of the upper and lower confining units;

(B) The suitability of the injection zone(s) (e.g., lateral continuity; lack of transmissive faults and fractures; knowledge of current or planned artificial penetrations into the injection zone(s) or formations below the injection zone);

(C) The potential capacity of the geologic formation(s) to sequester carbon dioxide, accounting for the availability of alternative injection sites;

(D) All other site characterization data, the proposed emergency and remedial response plan, and a demonstration of financial responsibility;

(E) Community needs, demands, and supply from drinking water resources;

(F) Planned needs, potential and/or future use of USDWs and non-USDWs in the area;

(G) Planned or permitted water, hydrocarbon, or mineral resource exploitation potential of the proposed injection formation(s) and other formations both above and below the injection zone to determine if there are any plans to drill through the formation to access resources in or beneath the proposed injection zone(s)/formation(s);

(H) The proposed plan for securing alternative resources or treating USDW formation waters in the event of contamination related to the Class VI injection activity; and,

(ii) Any other applicable considerations or information requested by the administrator.

(iii) Consultation with the Public Water System Supervision Directors of all States and Tribes having jurisdiction over lands within the area of review of a well for which a waiver is sought.

(iv) Any written waiver-related information submitted by the Public Water System Supervision Director(s) to the (UIC) Director.

(c) Concurrent with the Class VI permit application public notice process, the administrator shall give public notice that an injection depth waiver request has been submitted. The notice shall clearly state:

(i) The depth of the proposed injection zone(s).

(ii) The location of the injection wells.

(iii) The name and depth of all USDWs within the area of review.

(iv) A map of the area of review.

(v) The names of any public water supplies affected, reasonably likely to be affected, or served by the USDWs in the area of review.

(vi) The results of any consultation between the UIC program and the Public Water System Supervision program within the area of review.

(d) Following the injection depth waiver application public notice, the administrator shall provide all the information received through the waiver application process to the US EPA regional administrator. Based on the information provided, the US EPA regional administrator shall provide written concurrence or non-concurrence regarding waiver issuance.

(i) If the US EPA regional administrator requires additional information to make a decision, the administrator shall provide the information. The US EPA regional administrator may require public notice of the new information.

(ii) In no case shall the administrator of a State-approved program issue a depth injection waiver without receipt of written concurrence from the US EPA Administrator.

(e) If an injection depth waiver is issued, within thirty (30) days of issuance, the EPA shall post the following information on the Office of Water's website:

(i) The depth of the proposed injection zone(s).

(ii) The location of the injection wells.

(iii) The name and depth of all USDWs within the area of review.

(iv) A map of the area of review.

(v) The names of any public water supplies affected, reasonably likely to be affected, or served by the USDWs in the area of review.

(vi) The date of waiver issuance.

(f) Upon receipt of a waiver of the requirement to inject below the lowermost USDW for geologic sequestration, the owner or operator of a Class VI well must comply with the following:

(i) All requirements of Sections 8, 11, 12, 13, 15, 16, 18, and 19 of this chapter.

(ii) All the requirements of Section 9 of this chapter with the following modified requirements:

(A) The Class VI well shall be constructed and completed to prevent the movement of fluids into any unauthorized zones including USDWs, in lieu of requirements of Section 9(a)(1) of this chatper.

(B) The casing and cementing program shall be designed to prevent the movement of fluids into any unauthorized zones including USDWs, in lieu of requirements of Section 9(b) and 9(b)(1) of this chapter.

(C) The surface casing shall extend through the base of the nearest USDW directly above the injection zone and shall be cemented to the surface; or at the administrator's discretion, another formation above the injection zone and below the nearest USDW above the injection zone.

(iii) All the requirements of Sections 14 and 17 of this chapter with the following modified requirements:

(A) The owner or operator shall monitor the groundwater quality, geochemical changes, and pressure in the first USDWs immediately above and below the injection zone(s); and any other formation at the discretion of the administrator.

(B) Testing and monitoring to track the extent of the carbon dioxide plume and the presence or absence of elevated pressure (e.g., the pressure front) by using direct methods to monitor for pressure changes in the injection zone(s); and, indirect methods (e.g., seismic, electrical, gravity, or electromagnetic surveys and/or down-hole carbon dioxide detection tools), unless the administrator determines, based on site-specific geology, that such methods are not appropriate.

(iv) All requirements at Section 17 with the following, modified post-injection site care monitoring requirements:

(A) The owner or operator shall monitor the groundwater quality, geochemical changes and pressure in the first USDWs immediately above and below the injection zone; and in any other formations at the discretion of the administrator.

(B) Testing and monitoring to track the extent of the carbon dioxide plume and the presence or absence of elevated pressure (e.g., the pressure front) by using direct methods in the injection zone(s); and indirect methods (e.g., seismic, electrical, gravity, or electromagnetic surveys and/or down-hole carbon dioxide detection tools), unless the administrator determines based on site-specific geology, that such methods are not appropriate;

(v) Any additional requirements requested by the administrator to ensure protection of USDWs above and below the injection zone(s).

Section 11. Logging, sampling, and testing prior to injection well operation.

(a) During the drilling and construction of a Class VI injection well, the owner or operator must run appropriate logs, surveys and tests to determine or verify the depth, thickness, porosity, permeability, and lithology of, and the salinity of any formation fluids within, for all relevant geologic formations in order to ensure conformance with the injection well construction requirements under Section 9, and to establish accurate baseline data against which future measurements may be compared.

(i) The owner or operator must submit to the administrator a descriptive report prepared by a knowledgeable log analyst that includes an interpretation of the results of such logs and tests. At a minimum, such logs and tests must include:

(A) Deviation checks measured during drilling on all holes constructed by drilling a pilot hole that is subsequently enlarged by reaming or another method. Such checks must be at sufficiently frequent intervals to determine the location of the borehole and to ensure that vertical avenues for fluid movement in the form of diverging holes are not created during drilling; and

(B) Before and upon installation of the surface casing:

(I) Resistivity, spontaneous potential, and caliper logs before the casing is installed; and

(II) A cement bond and variable density log to evaluate cement quality radially with sufficient resolution to identify channels, voids, or other areas of missing cement, and a temperature log after the casing is set and cemented.

(C) Before and upon installation of the long string casing:

(I) Resistivity, spontaneous potential, porosity, caliper, gamma ray, fracture finder logs, and any other logs the administrator requires for the given geology before the casing is installed; and

(II) A cement bond and variable density log, and a temperature log after the casing is set and cemented.

(D) Test(s) designed to demonstrate the internal and external mechanical integrity of injection wells, which may include:

(I) A pressure test with liquid or gas;

(II) Diagnostic tools, such as oxygen-activation logging;

(III) A temperature or noise log; and

(IV) A casing inspection log.

(E) Any alternative methods that provide equivalent or better information and that are required of, and/or approved by the administrator.

(b) The owner or operator must take whole cores or sidewall cores of the injection zone and confining system, and formation fluid samples from the injection zone(s) and submit to the administrator a detailed report prepared by a log analyst that includes:

(i) Well log analyses (including well logs);

(ii) Core analyses; and

(iii) Formation fluid sample information.

(i) (iv) The Aadministrator may accept data from cores and fluid samples from nearby wells if the owner or operator can demonstrate that such data are representative of conditions in the wellbore.

(c) Prior to injection well operation, the owner or operator must record the formation fluid temperature, formation fluid pH and conductivity, reservoir pressure, and static fluid level of the injection zone(s).

(d) At any time prior to injection well operation, the owner or operator must determine fracture pressures of the injection and confining zones and verify hydrogeologic and geo-mechanical characteristics of the injection zone by conducting the following tests:

(i) A pressure fall-off test; and,

(ii) A pump test; or

(iii) Injectivity tests.

(e) The owner or operator must provide the administrator with the opportunity to witness all logging and testing by this subpart.

(i) The owner or operator must submit a schedule of such activities to the administrator upon spudding the well and notify the administrator of any changes to the schedule at least thirty (30) days prior to the scheduled test.

Section 12. Injection well operating requirements.

(a) The owner or operator must ensure that injection pressure does not exceed 90 percent of the fracture pressure of the injection zone(s) so as to ensure that the injection does not initiate new fractures or propagate existing fractures in the injection zone(s). In no case may injection pressure cause movement of injection or formation fluids in a manner that endangers a USDW, or otherwise threatens human health, safety, or the environment.

(i) In no case may injection pressure initiate fractures in the confining zone(s) or cause the movement of injectate or formation fluids that endangers a USDW or otherwise threatens human health, safety, or the environment.

(b) Injection of the carbon dioxide stream between the outermost casing protecting USDWs and the well bore is prohibited.

(c) The owner or operator must fill the annulus between the tubing and the long string casing with a non-corrosive fluid approved by the administrator.

(i) The owner or operator must maintain on the annulus a pressure that exceeds the operating injection pressure, unless the administrator determines that such requirement might harm the integrity of the well or endanger USDWs.

(d) Other than during periods of well workover (maintenance) approved by the administrator in which the sealed tubing-casing annulus is, by necessity, disassembled for maintenance or corrective procedures, the owner or operator must maintain mechanical integrity of the injection well at all times.

(e) The owner or operator must install and use continuous recording devices to monitor:

(i) Injection pressure; and

(ii) Rate, volume, and temperature of the carbon dioxide stream.

(f) The owner or operator must install and use continuous recording devices to monitor the pressure on the annulus between the tubing and the long string casing and annulus fluid volume.

(g) The owner or operator must install, test, and use alarms and automatic surface shut-off systems, or at the discretion of the administrator use down-hole shut-off systems (e.g., automatic shut-off, check valves), or other mechanical devices that provide equivalent protection, designed to alert the operator and shut-in the well when operating parameters such as injection rate, injection pressure, or other parameters approved by the administrator diverge beyond ranges and/or gradients specified in the permit.

(h) If an automatic shutdown is triggered or a loss of mechanical integrity is discovered, the owner or operator must immediately investigate and identify as expeditiously as possible the cause.

(i) If, upon such investigation, the well appears to be lacking mechanical integrity, or if monitoring required under paragraphs (e), (f), and (g) of this section otherwise indicates that the well may be lacking mechanical integrity, the owner or operator must:

(A) Immediately cease injection;

(B) Take all steps reasonably necessary to determine whether there may have been a release of the injected carbon dioxide stream or formation fluids into any unauthorized zone;

(C) Notify the administrator within 24 hours;

(D) Restore and demonstrate mechanical integrity to the satisfaction of the administrator as soon as practicable and prior to resuming injection; and

(E) Notify the administrator when injection can be expected to resume.

Section 13. Mechanical integrity.

(a) A Class VI well has mechanical integrity if:

(i) There is no significant leak in the casing, tubing or packer; and

(ii) There is no significant fluid movement into a USDW through channels adjacent to the injection well bore.

(b) To evaluate the absence of significant leaks under paragraph (a)(i) of this section, owners or operators must, following an initial annulus pressure test, continuously monitor injection pressure, rate, injected volumes, and pressure on the annulus between tubing and long string casing and annulus fluid volume as specified in Section 12 (e) and (f);

(c) At least once per year, the owner or operator must use one of the following methods to determine the absence of significant fluid movement under subparagraph (a)(ii) of this section:

(i) An approved tracer survey such as an oxygen-activation log; or

(ii) A temperature or noise log.

(d) If required by the administrator, at a frequency specified in the testing and monitoring plan required in Section 14 of this chapter, the owner or operator must run a casing inspection log to determine the presence or absence of corrosion in the long-string casing.

(e) The administrator may require any other test to evaluate mechanical integrity under paragraph (a)(i) or (a)(ii) of this section. Also, the administrator may allow the use of a test to demonstrate mechanical integrity other than those listed above, with the written approval of the US EPA regional administrator.

(i) To obtain approval, the administrator must submit a written request to the US EPA regional administrator that must set forth the proposed test and all technical data supporting its use.

(f) In conducting and evaluating the tests enumerated in this section or others to be allowed by the administrator, the owner or operator and the administrator must apply methods and standards generally accepted in the industry.

(i) When the owner or operator reports the results of mechanical integrity tests to the administrator, he/she shall include a description of the test(s) and the method(s) used.

(ii) In making his/her evaluation, the administrator must review monitoring and other test data submitted since the previous evaluation.

(g) The administrator may require additional or alternative tests if the results presented by the owner or operator under paragraph (e) of this section are not satisfactory to the administrator to demonstrate that there is no significant leak in the casing, tubing or packer, or significant movement of fluid into or between USDWs resulting from the injection activity as stated in paragraphs (a)(i) and (a)(ii) of this section.

Section 14. Testing and monitoring requirements.

(a) The owner or operator of a Class VI well must prepare, maintain, and comply with a testing and monitoring plan to verify that the geologic sequestration project is operating as permitted and is not endangering USDWs.

(i) The requirement to maintain and implement an approved plan is directly enforceable regardless of whether the requirement is a condition of the permit.

(ii) The testing and monitoring plan must be submitted with the permit application, for administrator approval, and must include a description of how the owner or operator will meet the requirements of this section, including accessing sites for all necessary monitoring and testing during the life of the project.

(b) Testing and monitoring associated with geologic sequestration projects must, at a minimum, include:

(i) Plans and procedures for environmental surveillance and excursion detection, prevention and control programs, including a monitoring plan to:

(A) Assess the migration of the injected carbon dioxide; and

(B) Insure the retention of the carbon dioxide in the geologic sequestration site.

(C) For purposes of this section, “excursion” shall mean the detection of migrating carbon dioxide at or beyond the boundary of the geologic sequestration site as defined in W.S. 35-11-103(c).

(ii) Analysis of the carbon dioxide stream with sufficient frequency to yield data representative of its chemical and physical characteristics;

(iii) Installation and use, except during well workovers, of continuous recording devices to monitor:

(A) Injection pressure,

(B) Rate and volume;

(C) Pressure on the annulus between the tubing and the long string casing; and

(D) The annulus fluid volume added.

(E) The pressure on the annulus between the tubing and the long string casing.

(iv) Corrosion monitoring of the well materials for loss of mass, thickness, cracking, pitting and other signs of corrosion must be performed and recorded at least quarterly to ensure that the well components meet the minimum standards for material strength and performance set forth in Section 9(b) by:

(A) Analyzing coupons of the well construction materials placed in contact with the carbon dioxide stream; or

(B) Routing the carbon dioxide stream through a loop constructed with the material used in the well and inspecting the materials in the loop; or

(C) Using an alternative method, materials, or time period approved by the administrator.

(v) Periodic monitoring of the reservoir fluid quality in a permeable and porous formation as near as practicable to the confining zone(s) for geochemical changes that may be a result of carbon dioxide or displaced formation fluid movement:

(A) The location and number of monitoring wells must be based on specific information about the geologic sequestration project, including injection rate and volume, geology, the presence of artificial penetrations and other relevant factors; and

(B) The monitoring frequency and spatial distribution of monitoring wells based on baseline geochemical data that has been collected under Section 5(b)(xi) and any modeling results in the area of review evaluation required by Section 8(c).

(vi) A demonstration of external mechanical integrity pursuant to Section 13(c) at least once per year until the well is plugged; and if required by the administrator, a casing inspection log pursuant to requirements at Section 13(d) of this chapter at a frequency established in the testing and monitoring plan;

(vii) A pressure fall-off test or other equivalent test that identifies reservoir conditions with respect to flow dynamics at least once every five years unless more frequent testing is required by the administrator based on site specific information; and

(viii) Testing and monitoring to track the extent of the carbon dioxide plume, the position of the pressure front, and surface displacement by using:

(A) Direct methods in the injection zone(s); and

(B) Indirect methods (e.g., seismic, electrical, gravity, or electromagnetic surveys and/or down-hole carbon dioxide detection tools), unless the administrator determines, based on site-specific geology, that such methods are not appropriate;

(ix) At the administrator's discretion, based on site-specific conditions, surface air monitoring and/or soil gas monitoring to detect movement of carbon dioxide that could endanger a USDW, or otherwise threaten human health, safety, or the environment.

(A) The testing and monitoring plan must be based on potential risks to USDWs, and modeling within the area of review;

(B) The monitoring frequency and spatial distribution of surface air monitoring and/or soil gas monitoring must reflect baseline data. The monitoring plan must

specify how the proposed monitoring will yield useful information on the area of review delineation and the potential movement of fluid containing any contaminant into USDWs in exceedence of any primary drinking water regulation under 40 CFR Part 141, or which may otherwise adversely affect human health, safety, or the environment.

(x) If an owner or operator demonstrates that monitoring employed under 40 CFR §§98.440 to 98.449 (Clean Air Act, 42 U.S.C. 7401 et seq.) accomplishes the goals of (h)(1) and (2) of this section, and meets the requirements pursuant to §146.91(c)(5), a Director that requires surface air/soil gas monitoring must approve the use of monitoring employed under 40 CFR §§98.440 to 98.449. Compliance with §§98.440 to 98.449 pursuant to this provision is considered a condition of the Class VI permit;

(xi) Any additional monitoring, as required by the administrator, necessary to support, upgrade, and improve computational modeling of the area of review re-evaluation required under Section 8(e) and as necessary to demonstrate that there is no movement of fluid containing any contaminant into underground sources of drinking water in exceedence of any primary drinking water regulation under 40 CFR Part 141, or which could otherwise adversely affect human health, safety, or the environment;

(xii) The owner or operator shall periodically review the testing and monitoring plan to incorporate monitoring data collected under this subpart, operational data collected under Section 11 of this chapter, and the most recent area of review reevaluation performed under Section 8 of this chapter. In no case shall the owner or operator review the testing and monitoring plan less often than once every five years. Based on this review, the owner or operator shall submit an amended testing and monitoring plan or demonstrate to the administrator that no amendment to the testing and monitoring plan is needed. Any amendments to the testing and monitoring plan must be approved by the administrator, must be incorporated into the permit, and are subject to the permit modification requirements at Section 4 of this chapter, as appropriate. Amended plans or demonstrations shall be submitted to the administrator as follows:

(A) Within one year of an area of review reevaluation;

(B) Following any significant changes to the facility, such as addition of monitoring wells or newly permitted injection wells within the area of review, on a schedule determined by the administrator; or

(C) When required by the administrator.

(xiii) A quality assurance and surveillance plan for all testing and monitoring requirements.

Section 15. Reporting requirements.

(a) The owner or operator must, at a minimum, provide the following reports to the administrator, for each permitted Class VI well:

(i) Semi-annual reports containing:

(A) Any changes to the physical, chemical and other relevant characteristics of the carbon dioxide stream from the proposed operating data;

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

(C) A description of any event that exceeds operating parameters for annulus pressure or injection pressure as specified in the permit;

(D) A description of any event that triggers a shutdown device required pursuant to Section 12(g), and the response taken;

(E) The monthly volume of the carbon dioxide stream injected over the reporting period and project cumulatively;

(F) Monthly annulus fluid volume added; and

(G) The results of monitoring prescribed under Section 14.

(ii) Report, within 30 days the results of:

(A) Periodic tests of mechanical integrity;

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

(C) Any well workover.

(iii) Report, within 24 hours:

(A) Any evidence that the injected carbon dioxide stream or associated pressure front may cause an endangerment to a USDW;

(B) Any noncompliance with a permit condition, or malfunction of the injection system, which may cause fluid migration into or between USDWs;

(C) Any triggering of a shut-off system (i.e., down-hole or at the surface);

(D) Pursuant to compliance with the requirement at Section 14(b)(x) of this chapter for surface air/soil gas monitoring or other monitoring technologies, if required by the administrator, any release of carbon dioxide to the atmosphere or biosphere.

(iv) Owners or operators must notify the administrator in writing 30 days in advance of:

(A) Any planned well workover;

(B) Any planned stimulation activities, other than stimulation for formation testing conducted under Section 5 of this chapter; and

(C) Any other planned test of the injection well conducted by the permittee.

(b) Reports required by the permit shall be submitted to the administrator within 30 days following the end of the period covered in the report.

(c) Owners or operators must submit all required reports, submittals, and notifications to both the administrator and to EPA, in an electronic format acceptable to the EPA.

(d) The permittee shall submit a written report to the administrator of all remedial work concerning the failure of equipment or operational procedures that resulted in a violation of a permit condition, at the completion of the remedial work.

(e) For any aborted or curtailed operation, a complete report shall be submitted within 30 days of complete termination of the discharge or associated activity.

(f) The permittee shall retain all monitoring records required by the permit for a period of ten (10) years following facility closure. The administrator may require the owner or operator to deliver the records to the administrator at the conclusion of the retention period.

Section 16. Injection well plugging.

(a) Prior to the well plugging, the owner or operator must flush each Class VI injection well with a buffer fluid, determine bottom hole reservoir pressure, and perform a final external mechanical integrity test in accordance with Section 13.

(b) The owner or operator of a Class VI well must prepare, maintain, update on the same schedule as the update to the area of review delineation, and comply with a well plugging plan that is acceptable to the administrator.

(i) The requirement to maintain and implement an approved plan is directly enforceable regardless of whether the requirement is a condition of the permit.

(ii) The well plugging plan must be submitted as part of the permit application and must include the following information:

(A) Appropriate test or measure to determine bottom hole reservoir pressure;

(B) Appropriate testing methods to ensure final external mechanical integrity as specified in Section 13;

(C) The type and number of plugs to be used;

(D) The placement of each plug including the elevation of the top and bottom of each plug;

(E) The type and grade and quantity of material to be used in plugging;

(I) The material must be suitable for use with the carbon dioxide stream.

(F) A description of the method of placement of the plugs.

(c) The owner or operator must notify the administrator, in writing, at least 60 days before plugging a well.

(i) If any changes have been made to the original well plugging plan, the owner or operator must also provide the revised well plugging plan.

(ii) At the discretion of the administrator, a shorter notice period may be allowed.

(iii) Any amendments to the injection well plugging plan must be approved by the administrator, must be incorporated into the permit, and are subject to the permit modification requirements at Section 4 of this chapter, as appropriate.

(d) Within 60 days after completion of plugging and abandonment of a well or well field the permittee shall submit to the administrator a final report that includes:

(i) Certification of completion in accordance with approved plans and specifications by a licensed professional engineer or a licensed professional geologist.

(ii) Certification of accuracy by the owner or operator and by the person who performed the plugging operation (if other than the owner or operator.

(iii) The owner or operator shall retain the well plugging report for ten (10) years following site closure.

Section 17. Post-injection site care and site closure.

(a) The owner or operator of a Class VI well must prepare, maintain, update on the same schedule as the update to the area of review delineation, and comply with a plan for post-injection site care and site closure that meets the requirements of subpart (a)(ii) of this section and is acceptable to the administrator. The requirement to maintain and implement an approved plan is directly enforceable regardless of whether the requirement is a condition of the permit.

(i) The owner or operator must submit the post-injection site care and site closure plan as a part of the permit application to be approved by the administrator.

(ii) The post-injection site care and site closure plan must include the following information:

(A) Detailed plans for post-injection monitoring, verification, maintenance, and mitigation;

(B) The pressure differential between pre-injection and predicted post-injection pressures in the injection zone;

(C) The predicted position of the carbon dioxide plume and associated pressure front at the time when plume movement has ceased and pressure differentials sufficient to cause the movement of injected fluids or formation fluids into a USDW are no longer present, as demonstrated in the area of review evaluation required under Section 8(c)(i);

(D) A description of post-injection monitoring locations, methods, and proposed frequency; and

(E) A proposed schedule for submitting post-injection site care monitoring results pursuant to Section 15(c) of this chapter, as appropriate.

(iii) Upon cessation of injection, owners or operators of Class VI wells must either submit an amended post-injection site care and site closure plan or demonstrate to the administrator through monitoring data and modeling results that no amendment to the plan is needed.

(A) Any amendments to the post-injection site care and site closure plan must be:

(I) Approved by the administrator.

(II) Incorporated into the permit.

(III) Subject to the permit modification requirements at Section 4 of this chapter, as appropriate.

(iv) The owner or operator may modify and resubmit the post-injection site care and site closure plan for the administrator's approval within 30 days of such change.

(b) The owner or operator shall monitor the site following the cessation of injection to show the position of the carbon dioxide plume and pressure front and demonstrate that USDW's are not being endangered.

(i) The owner or operator shall continue to conduct monitoring as specified in the administrator-approved post-injection site care and site closure plan until closure is certified by the administrator.

(ii) The owner or operator can request and demonstrate to the satisfaction of the administrator that the post-injection site care and site closure plan should be revised to reduce the frequency of monitoring.

(iii) Prior to authorization for site closure, the owner or operator must demonstrate to the administrator, based on monitoring, other site-specific data, and modeling that is reasonably consistent with site performance, that no additional monitoring is needed to ensure that the geologic sequestration project does not, and is not expected to pose an endangerment to a USDW or otherwise threaten human health, safety, or the environment. In addition, the owner or

operator must demonstrate, based on the best available understanding of the site, including monitoring data and/or modeling, that all other site closure standards and requirements have been met.

(iv) If such a demonstration cannot be made, the owner or operator must continue post-injection site care.

(v) The owner or operator must notify the administrator, in writing, at least 120 days before filing a request for site closure. At this time, if any changes have been made to the original post-injection site care and site closure plan, the owner or operator must also provide the revised plan. At the discretion of the administrator, a shorter notice period may be allowed.

(c) After the administrator has certified site closure, the owner or operator must plug monitoring wells, as determined by the administrator, in a manner that will not allow movement of injection or formation fluids.

(d) Once the administrator has certified site closure, the owner or operator must submit a site closure report within 90 days after completion of all closure operations. The report must thereafter be retained at a location designated by the administrator for ten (10) years. The report must include:

(i) Documentation of appropriate injection and monitoring well plugging as specified in Section 16 and paragraph (c) of this section.

(ii) The owner or operator must provide a copy of a survey plat that has been submitted to the local zoning authority designated by the administrator.

(A) The plat must indicate the location of the injection well(s) and monitoring wells relative to permanently surveyed benchmarks.

(B) The owner or operator must also submit a copy of the plat to the US EPA regional administrator.

(iii) Documentation of appropriate notification and information to such State, local and tribal authorities as have authority over drilling activities to enable such State and local authorities to impose appropriate conditions on subsequent drilling activities that may penetrate the injection and confining zone(s)

(iv) Proof of providing notice to surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interests as to the proposed site closure. Notice requirements at a minimum shall include:

(A) The publishing of notice of the application in a newspaper of general circulation in each county of the proposed operation at weekly intervals for four (4) consecutive weeks;

(B) The published notice shall provide a mechanism to request a public hearing;

(C) A copy of the notice shall also be mailed to all surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interests that are located within one (1) mile of the proposed boundary of the geologic sequestration site.

(v) Records reflecting the nature, composition and volume of the carbon dioxide stream.

(e) Each owner or operator of a Class VI injection well must record a notation on the deed to the facility property or any other document that is normally examined during title search that will in perpetuity provide any potential purchaser of the property the following information:

(i) The fact that land has been used to sequester carbon dioxide;

(ii) The name of the State agency, local authority, and/or tribe with which the survey plat was filed, as well as the address of the Regional Environmental Protection Agency Office to which it was submitted; and

(iii) The volume of fluid injected, the injection zone or zones into which it was injected, and the period over which injection occurred.

(f) Well plugging reports, post-injection site care data, including, if appropriate, data and information used to develop the demonstration of the alternative post-injection site care time frame, and the site closure report collected pursuant to requirements at subsection (d) above shall be retained for 10 years following site closure.

(i) The owner or operator must deliver the records to the administrator at the conclusion of the retention period, and the records must thereafter be retained at a location designated by the administrator for that purpose.

Section 18. Emergency and remedial response.

(a) As part of the permit application, the owner or operator must provide the administrator with an emergency and remedial response plan that describes actions to be taken to address movement of the injectate or formation fluids that may cause an endangerment to a USDW or threaten human health, safety, or the environment during construction, operation, closure and post-closure periods. The requirement to maintain and implement an approved plan is directly enforceable regardless of whether the requirement is a condition of the permit.

(i) The emergency and remedial response plan must be reviewed and updated, as necessary, on the same schedule as the update to the area of review delineation.

(ii) Any amendments to the emergency and remedial response plan must be approved by the administrator, must be incorporated into the permit, and are subject to the permit modification requirements at Section 4 of this chapter, as appropriate.

(A) Amended plans or demonstrations shall be submitted to the administrator as follows:

(I) Within one year of an area of review reevaluation;

(II) Following any significant changes to the facility, such as addition of injection or monitoring wells, on a schedule determined by the administrator; or

(III) When required by the administrator.

(b) If monitoring data, or other evidence obtained by the the owner or operator indicate that the injected carbon dioxide stream, displaced formation fluids or associated pressure front may endanger a USDW or threatens human health, safety, or the environment, the owner or operator must:

(i) Immediately cease injection;

(ii) Take all steps reasonably necessary to identify and characterize any release;

(iii) Within 24 hours, provide verbal notice to the Department of Environmental Quality of any excursion after the excursion is discovered, followed by written notice to all surface owners, mineral claimants, mineral owners, lessees and other owners of record of subsurface interests within thirty (30) days of when the excursion is discovered; and

(iv) Implement the emergency and remedial response plan approved by the administrator.

(c) The administrator may allow the operator to resume injection prior to remediation if the owner or operator demonstrates that the injection operation will not endanger USDWs or otherwise threaten human health, safety, or the environment

(d) The owner or operator must notify the administrator or the designated representative prior to conducting any well workover.

Section 19. Financial responsibility.

(a) Financial responsibility requirements are to ensure that owners or operators have the financial resources to carry out activities related to closing and remediating geologic sequestration sites if needed so they do not endanger the environment or USDWs.

(b) Owners or operators of Class VI wells must demonstrate and maintain financial responsibility for all applicable phases of the geologic sequestration project including complete site reclamation in the event of default. The phases of a geologic sequestration project are as follows:

(i) Permitting/Characterization

(ii) Operations (injection and permanent well closure activities)

(iii) Post-injection site care (“plume stabilization” – monitoring until certified by the administrator; above ground reclamation completed.)

(iv) Emergency and remedial response (that meets the requirements of Section 18 of this chapter).

(c) The requirement to maintain adequate financial responsibility and resources is directly enforceable regardless of whether the requirement is a condition of the permit.

(d) To demonstrate financial responsibility, the owner or operator must submit a detailed written estimate, at the time of permit application and in current dollars, performing corrective action on wells in the area of review, plugging the injection well(s), post injection site care and site closure, and emergency and remedial response, including the requirements of Section 18 of this chapter. The cost estimate determines the submission requirements for the financial responsibility instrument(s).

(i) The financial assurance cost estimate for the various phases of the sequestration project shall consider the following events:

(A) Contamination of underground sources of water including drinking water supplies.

(B) Mineral rights infringement.

(C) Single large volume release of carbon dioxide that impacts human health and safety and/or causes ecological damage.

(D) Low level leakage of carbon dioxide to the surface that impacts human health and safety and/or causes ecological damage.

(E) Storage rights infringement.

(F) Property and infrastructure damage including changes to surface topography and structures.

(G) Entrained contaminant releases (non-CO2).

(H) Accidents/unplanned events.

(I) Well capping and permitted abandonment.

(J) Removal of above ground facilities and site reclamation.

(ii) The Risk Activity matrix in Appendix A shall be considered or evaluated during the risk assessment process.

(iii) The cost estimate shall be based upon a multi-disciplinary analytical framework such as Monte Carlo or other commonly accepted stochastic modeling tools.

(A) Cost curves shall combine risk probabilities, event outcomes and damages assessment to calculate expected losses under a series of events.

(B) The probability distributions for potential damages should be identified for 50 percent, 95 percent and 99 percent of all cases.

(e) The owner or operator must also submit a proposed cost-estimate for measurement, monitoring, and verification of plume stabilization following post-closure certification and release of all other financial assurance instruments.

(f) The cost estimate must be performed for each phase separately and must be based on the costs to the regulatory agency of hiring a third party to perform the required activities. A third party is a party who is not within the corporate structure of the owner or operator.

(g) The required demonstration of financial responsibility shall be from the following list of qualifying instruments:

(i) Trust Funds

(ii) Surety Bonds

(iii) Letter of Credit

(iv) Insurance

(A) Any insurance instruments submitted for financial assurance purposes shall include the state of Wyoming as an additional insured, which inclusion shall not be deemed a waiver of sovereign immunity.

(v) Self-Insurance (i.e., Financial Test and Corporate Guarantee)

(vi) Escrow Account

(vii) Any other instrument(s) satisfactory to the administrator

(h) The qualifying financial responsibility instrument(s) must comprise protective conditions of coverage that include at a minimum cancellation, renewal, continuation provisions, specifications on when the provider becomes liable following a notice of cancellation, and requirements for the provider to meet a minimum rating, minimum capitalization, and the ability to pass the bond rating when applicable.

(i) Cancellation – An owner or operator must provide that their financial mechanism may not cancel, terminate or fail to renew except for failure to pay such financial instrument. If there is a failure to pay the financial instrument, the financial institution may elect to cancel, terminate, or fail to renew the instrument by sending notice by certified mail to the owner or operator and the administrator. The cancellation must not be final for 120 days after receipt of cancellation notice. The owner or operator must provide an alternate financial responsibility demonstration within 60 days of notice of cancellation, and if an alternate financial responsibility demonstration is not acceptable (or possible), any funds from the instrument being cancelled must be released within 60 days of notification by the administrator.

(ii) Renewal – Owners or operators must renew all financial instruments, if an instrument expires, for the entire term of the geologic sequestration project. The instrument may be automatically renewed as long as, at a minimum, the owner or operator has the option of renewal at the face amount of the expiring instrument.

(iii) Continuation – Cancellation, termination, or failure to renew may not occur and the financial instrument shall remain in full force and effect in the event that on or before the date of expiration:

(A) The administrator deems the facility abandoned.

(B) The permit is terminated, revoked, or a new permit is denied.

(C) Closure is ordered by the administrator, a U.S. district court, or other court of competent jurisdiction.

(D) The owner or operator is named as debtor in a voluntary or involuntary proceeding under Title 11 (Bankruptcy), U.S. Code.

(E) The amount due is paid.

(i) The qualifying financial responsibility instrument(s) must be approved by the administrator. The administrator shall also approve the use and length of pay-in-periods for trust funds and escrow accounts.

(i) The administrator shall consider and approve the financial responsibility demonstration for all the phases of the geologic sequestration project prior to issuing a Class VI permit.

(ii) The administrator may find that the financial responsibility demonstration is unsatisfactory for any reason, as long as that reason is not arbitrary or capricious. The administrator may exercise discretion in negotiating a satisfactory financial responsibility demonstration or to deny a demonstration.

(iii) The owner or operator must provide any updated information related to their financial responsibility instrument(s) on an annual basis and if there are any changes, the director must evaluate the financial responsibility demonstration to confirm that the instrument(s) used remain adequate for use. The owner or operator must maintain financial responsibility requirements regardless of the status of the administrator's review of the financial responsibility demonstration.

(iv) The owner or operator must provide an adjustment of the cost estimate to the administrator within 60 days of notification by the administrator, if the administrator determines during the annual evaluation of the qualifying financial responsibility instrument(s) that the most recent demonstration is no longer adequate to cover the cost of corrective action (as required by Section 8), injection well plugging (as required by Section 16), post-injection site care and site closure (as required by Section 17), and emergency and remedial response (as required by Section 18).

(v) During the active life of the geologic sequestration project, the owner or operator must adjust the cost estimate for inflation within 60 days prior to the anniversary date of the establishment of the financial instrument(s) used to comply with paragraph (g) of this section and provide this adjustment to the administrator. The owner or operator must also provide to the administrator written updates of adjustments to the cost estimate within 60 days of any amendments to the area of review and corrective action plan (Section 8), the injection well plugging plan (Section 16), the post-injection site care and site closure plan (Section 17), the emergency and remedial response plan (Section 18), and mitigation or reclamation costs that the state may incur as a result of any default by the permit holder.

(vi) The administrator must approve any decrease or increase to the initial cost estimate. During the active life of the geologic sequestration project, the owner or operator must revise the cost estimate no later than 60 days after the administrator has approved the request to modify the area of review and corrective action plan (Section 8), the injection well plugging plan (Section 16), the post-injection site care and site closure plan (Section 17), and the emergency and response plan (Section 18), if the change in the plan increases the cost. If the change to the plans decreases the cost, any withdrawal of funds must be approved by the administrator. Any decrease to the value of the financial assurance instrument must first be approved by the director. The revised cost estimate must be adjusted for inflation as specified in the preceding paragraph.

(vii) Whenever the current cost estimate increases to an amount greater than the face amount of a financial instrument currently in use, the owner or operator, within 60 days after the increase, must either cause the face amount to be increased to an amount at least equal to the current cost estimate and submit evidence of such increase to the administrator, or obtain other financial responsibility instruments to cover the increase. Whenever the current cost estimate decreases, the face amount of the financial assurance instrument may be reduced to the amount of the current cost estimate only after the owner or operator has received written approval from the administrator.

(j) The owner or operator may demonstrate financial responsibility by using one or multiple qualifying financial instruments for specific phases of the geologic sequestration project.

(i) In the event that the owner or operator combines more than one instrument for a specific geologic sequestration phase (e.g., well plugging), such combination must be limited to instruments that are not based on financial strength or performance (i.e., self-insurance or performance bond). For example trust funds, surety bonds guaranteeing payment into a trust fund, letters of credit, escrow account, and insurance.

(ii) When using a third-party instrument to demonstrate financial responsibility, the owner or operator must provide proof that the third-party providers either have passed financial strength requirements based on credit ratings; or has met a minimum rating, minimum capitalization, and ability to pass the bond rating when applicable.

(iii) An owner or operator using certain types of third party instruments must establish a standby trust to enable the State of Wyoming to be party to the financial responsibility agreement without the State of Wyoming being the beneficiary of any funds. The standby trust fund must be used along with other financial responsibility instruments (e.g., surety bonds, letters of credit, or escrow accounts) to provide a location to place funds if needed.

(iv) An owner or operator may deposit money into an escrow account to cover financial responsibility requirements; this account must segregate funds sufficient to cover estimated costs for Class VI (geologic sequestration) financial responsibility from other accounts and uses.

(v) An owner or operator or its guarantor may use self-insurance to demonstrate financial responsibility for certain phases of geologic sequestration projects. In order to satisfy this requirement the owner or operator must meet a tangible net worth of an amount approved by the administrator, have a net working capital and tangible net worth each at least six times the sum of the current well plugging, post injection site care and site closure cost, have assets located in the United States amounting to at least 90 percent of total assets or at least six times the sum of the current well plugging, post injection site care and site closure cost, and must submit a report of its bond rating and financial information annually. In addition the owner or operator must either: have a bond rating test of AAA, AA, A, or BBB as issued by Standard & Poor's or Aaa, Aa, A, or Baa as issued by Moody's; or meet all of the following five financial ratio thresholds: a ratio of total liabilities to net worth less than 2.0; a ratio of current assets to current liabilities greater than 1.5; a ratio of the sum of net income plus depreciation, depletion, and amortization to total liabilities greater than 0.1; a ratio of current assets minus current liabilities to total assets greater than -0.1; and a net profit (revenues minus expenses) greater than 0.

(vi) An owner or operator who is not able to meet corporate financial test criteria may arrange a corporate guarantee by demonstrating that its corporate parent meets the financial test requirements on its behalf. The parent's demonstration that it meets the financial test requirement is insufficient if it has not also guaranteed to fulfill the obligations for the owner or operator.

(vii) An owner or operator may obtain an insurance policy to cover the estimated costs of geologic sequestration activities requiring financial responsibility. This insurance policy must be obtained from a third party provider.

(k) The owner or operator must maintain financial responsibility and resources until the administrator receives and approves the completed post-injection site care and site closure plan and the administrator approves site closure.

(i) Post-injection site care shall be for a period of not less than ten (10) years after the date when all wells excluding monitoring wells have been appropriately plugged and abandoned, all subsurface operations and activities have ceased and all surface equipment and improvements have been removed or appropriately abandoned, or so long thereafter as necessary to obtain a completion and release certificate from the administrator certifying that plume stabilization has been achieved without the use of control equipment based on a minimum of three consecutive years of monitoring data.

(ii) The site closure plan shall address all reclamation, required monitoring, and remediation sufficient to show that the carbon dioxide injected into the geologic sequestration site will not harm or present a risk to human health, safety, the environment, or drinking water supplies.

(l) The owner or operator must notify the administrator by certified mail of adverse financial conditions such as bankruptcy that may affect the ability to carry out injection well plugging and post-injection site care and site closure.

(i) In the event that the owner or operator or the third party provider of a financial responsibility instrument is going through a bankruptcy, the owner or operator must notify the administrator by certified mail of the commencement of a voluntary or involuntary proceeding under Title 11 (Bankruptcy), U.S. Code, naming the owner or operator as debtor, within 10 days after commencement of the proceeding.

(ii) A guarantor of a corporate guarantee must make such a notification to the administrator if he/she is named as debtor, as required under the terms of the corporate guarantee.

(iii) An owner or operator who fulfills the requirements of paragraph (g) of this section by obtaining a trust fund, surety bond, letter of credit, escrow account, or insurance policy will be deemed to be without the required financial assurance in the event of bankruptcy of the trustee or issuing institution, or a suspension or revocation of the authority of the trustee institution to act as trustee of the institution issuing the trust fund, surety bond, letter of credit, escrow account, or insurance policy. The owner or operator must establish other financial assurance within 60 days after such an event.

(m) The owner or operator may be released from a financial instrument in the following circumstances:

(i) The owner or operator has completed the phase of the geologic sequestration project for which the financial instrument was required and has fulfilled all its financial obligations as determined by the administrator, including obtaining financial responsibility for the next phase of the GS project, if required.

(ii) The owner or operator has submitted a replacement financial instrument and received written approval from the administrator accepting the new financial instrument and releasing the owner or operator from the previous financial instrument.

(iii) The owner or operator has submitted a revised cost estimate for the remaining phases of the geologic sequestration project. The revised cost estimate may demonstrate that a partial release of the financial instrument is warranted and can still provide adequate financial assurance for the remainder of the project. Partial release of the financial instrument is at the discretion of the administrator.

(n) Following the release of all financial assurance and receipt of a site closure certificate, the administrator must approve the cost estimate prepared for the post-closure measurement, monitoring and verification of a geologic sequestration site. The cost estimate shall only be provided after plume stabilization and all remediation work has been completed.

Section 20. Public participation, public notice and public hearing requirements.

(a) Public notice is not required for minor modifications as described by Section 4(b)(xi) of this chapter or for a permit denial where the application is determined incomplete.

(b) The administrator shall give public notice if a draft permit has been prepared or a hearing has been scheduled.

(c) Public notice of the preparation of a draft permit shall allow at least 60 days for public comment. Public notice of a public hearing shall be given at least 30 days before the hearing. Public notice of the hearing may be given at the same time as public notice of the draft permit and the two notices may be combined.

(d) Public notice shall be given by:

(i) Mailing a copy of the notice to the following persons:

(A) The applicant, by certified or registered mail;

(B) The U.S. Environmental Protection Agency, Region 8 Drinking Water Program;

(C) The U.S. Environmental Protection Agency, Underground Injection Control Program;

(D) Wyoming Game and Fish Department;

(E) Wyoming State Engineer;

(F) State Historical Preservation Officer;

(G) Wyoming Oil and Gas Conservation Commission;

(H) Wyoming Department of Environmental Quality, Land Quality Division

(I) Wyoming State Geological Survey;

(J) Wyoming Water Development Office;

(K) Persons on the mailing list developed by the department, including those who request in writing to be on the list and by soliciting participants in public hearings in that area for their interest in being included on "area" mailing lists; and

(L) Any unit of local government having jurisdiction over the area where the facility is proposed to be located.

(ii) Publication of the notice in a newspaper of general circulation in the location of the facility or operation; and

(iii) At the discretion of the administrator, any other method reasonably expected to give actual notice of the action in question to the persons potentially affected by it, including press releases or any other forum or medium to elicit public participation.

(e) All public notices issued under this chapter shall contain the following minimum information:

(i) Name and address of the department;

(ii) Name and address of permittee or permit applicant, and, if different, of the facility or activity regulated by the permit;

(iii) A brief description of the business conducted at the facility or activity described in the permit application or the draft permit;

(iv) Name, address and telephone number of a person from whom interested persons may obtain further information, including copies of the draft permit, as the case may be, statement of basis or fact sheet, and the application;

(v) A brief description of comment procedures, procedures to request a hearing, and other procedures which the public may use to participate in the final permit decision; and

(vi) Any additional information considered necessary and proper.

(f) In addition to the information required in (e) of this section, any notice for public hearing shall contain the following:

(i) Reference to the date of previous public notices relating to the permit;

(ii) Date, time and place of hearing; and

(iii) A brief description of the nature and purpose of the hearing, including applicable rules and procedures.

(g) The department shall provide an opportunity for the applicant, permittee, or any interested person to submit written comments regarding any aspect of a permit or to request a public hearing.

(h) All information received on or with the permit application shall be made available to the public for inspection and copying except such information as has been determined to constitute trade secrets or confidential information pursuant to W.S. 35-11-1101.

(i) During the public comment period, any interested person may submit written comments on the draft permit and may request a public hearing. Requests for public hearings must be made in writing to the administrator and shall state the reasons for the request.

(j) The administrator shall hold a hearing whenever the administrator finds, on the basis of requests, a significant degree of public interest in a draft permit. The administrator has the discretion to hold a hearing whenever such a hearing may clarify issues involved in a permit decision.

(k) The public comment period shall automatically extend to the close of any public hearing. The administrator may also extend the comment period by so stating at the public hearing.

(l) The administrator shall render a decision on the draft permit within 60 days after the completion of the comment period if no hearing is requested. If a hearing is held, the administrator shall make a decision on any department hearing as soon as practicable after receipt of the transcript or after the expiration of the time set to receive written comments.

(m) At the time a final decision is issued, the department shall respond, in writing, to those comments received during the public comment period or comments received during the allotted time for a hearing held by the department. This response shall:

(i) Specify any changes that have been made to the permit; and

(ii) Briefly describe and respond to all comments voicing a legitimate technical or regulatory concern that is within the authority of the department to regulate.

(n) The response to comments shall also be available to the public.

(o) Requests for a contested case hearing on a permit issuance, denial, revocation, termination, or any other final department action appealable to the Council shall be in accordance with the department's rules of practice and procedure.

Appendix A

Risk Activity Table

	Major Risk (Feature, Event, or Process)
1	**Mineral Rights Infringement (Trespass)**
1.1	Leakage migrates into mineral zone or hydraulic front impacts recoverable mineral zone; causes may include plume migration different than modeled.
1.2	Post injection discovery of recoverable minerals.
1.3	New technology (or economic conditions) enables recovery of previously un-economically recoverable minerals.
1.4	Act of God (e.g. seismic event).
1.5	Formation fluid impact due to CO2 injection.
1.6	See also contributing causes 3.1, 3.2, 3.3, 3.5, 4.3, and 4.4
2	**Water Quality Contamination**
2.1	Leakage of CO2 outside permitted area.
2.2	Leakage of drilling fluid contaminates potable water aquifer.
2.3	Rock/acid water (i.e. geochemistry) interaction contaminates potable water by carryover of dissolved contaminants.
2.4	Act of God (e.g. seismic event).
2.5	Formation fluid impact due to CO2 injection.
2.6	See also contributing causes 3.1, 3.2, 3.3, 3.5, 4.3, and 4.4
3	**Single Large Volume CO2 Release to the Surface – Asphyxiation/Health/Ecological**
3.1	Overpressurization (i.e. induced).
3.2	Caprock/reservoir failure.
3.3	Well blowout (e.g. at surface or bore failure below ground), includes monitoring wells – Causes could include seal failure (e.g. well, drilling or injection equipment).
3.4	Major mechanical failure of distribution system or storage facilities above ground or below ground (i.e. near the surface).
3.5	Orphan well failure (e.g. well not identified prior to injection).
3.6	Sabotage/Terrorist attack (e.g. on surface infrastructure).
3.7	Act of God (e.g. major seismic event)
4	**Low Level CO2 Release to Surface – Ecological damage due to low-level releases; potential asphyxiation**
4.1	Overpressurization (i.e. induced).
4.2	Caprock/reservoir failure (e.g. Plume migrates along fault line/fissure to surface).
4.3	Incomplete geological seal (e.g. inaccurate characterization of sub-surface geology).
4.4	Well seal failure (e.g. well, drilling or injection equipment) including monitor wells
4.5	Mechanical failure of distribution system or storage facilities above or below ground (e.g. near surface).
4.6	Orphan wells (e.g. well not identified prior to injection).
4.7	Induced seismicity leading to leakage.
4.8	Act of God (e.g. seismic event).

Risk Activity Table (continued)

	Major Risk (Feature, Event, or Process)
5	**Storage Rights Infringement (CO2 or other entrained contaminant gases) – Form of Mineral Rights Infringement**
5.1	Leakage migrates into adjacent pore space; causes may include plume migrates faster than modeled.
5.2	Post injection decision (e.g. due to new technology or changed economic conditions) to store gas in adjacent pore space.
5.3	Acts of God affecting storage capacity of pore space.
5.4	Formation fluid impact due to CO2 injection.
	Will also require primary contributing causes 3.1, 3.2, 3.3, 3.5, 4.3, and 4.4
6	**Modified Surface Topography (subsidence or uplift) Resulting in Property/Infrastructure Damage**
6.1	Induced Seismicity – Pressure of geochemistry induced reactivation of historic fault or dissolution of material caused by subsidence.
6.2	Formation fluid impact due to CO2 injection.
7	**Entrained Contaminant (Non-CO2) Releases**
7.1	Change in CO2 composition/properties (e.g. concentration of contaminate in CO2 supply increases).
7.2	Microbial activity initiated by injection process or composition.
	Will also require primary contributing causes 3.1, 3.2, 3.3, 3.5, 4.3, and 4.4
8	**Accidents/Unplanned Events (Typical Insurable Events)**
8.1	Surface infrastructure damage
8.2	Saline water releases from surface storage impoundment.