United States Environmental Protection Agency

Geologic Sequestration of Carbon Dioxide

Summary of the EPA's Responses to Public Comments Received on the Draft Class VI Well Plugging, Post-Injection Site Care, and Site Closure Guidance for Owners and Operators

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Introduction

In April 2013, the U.S. Environmental Protection Agency (EPA) published the draft guidance document titled *Geologic Sequestration of Carbon Dioxide: Draft Underground Injection Control (UIC) Program Class VI Well Plugging, Post-Injection Site Care, and Site Closure Guidance for Owners and Operators* (EPA 816-P-13-005). Following publication of the draft document, the EPA invited the public to comment over a 60-day period ending on June 24, 2013.

The EPA received submittals from seven commenters, representing the organizations shown in the table below. While EPA attempted to capture all comments in this condensed document, please note that every individual comment may not be included.

Commenter	Type of Affiliation
American Petroleum Institute (API)	Energy industry
American Water Works Association (AWWA)	Water association
Battelle Memorial Institute (Battelle)	Research and development organization
Clean Air Task Force, Natural Resource Defense Council (CATF-NRDC)	Environmental NGOs
Carbon Sequestration Council (CSC)	Carbon capture and storage (CCS) association
Edison Electric Institute (EEI)	Energy industry
North American Carbon Capture and Storage Association (NACCSA)	CCS association

Contents

The following tables present the EPA's responses to the comments received on the *Draft Class VI Well Plugging, Post-Injection Site Care (PISC), and Site Closure Guidance for Owners and Operators*. Throughout the tables, page numbers used by the commenters refer to the April 2013 draft of the guidance document. Comment identification numbers displayed in the first column of the table were assigned by EPA to facilitate the comment response process.

General Comments on the Well Plugging, PISC, and Site Closure Guidance

ID#	Commenter	Comment	EPA Response
1	API	API's overall concern is that the guidance could be construed to add additional requirements to the regulations. Guidance may supplement, or flesh out, but cannot supplant, or contradict, the regulations. It is particularly important the illustrations and the wording in the guidance are not interpreted as new regulatory requirements in cases where the regulation is not prescriptive. We ask that EPA clarify that the detailed examples in this guidance are examples only and that they are not intended to add to, change, or supplant the regulations. If EPA does not clarify or correct these sections then our concern is that the guidance adds new requirements and overreaches the span of the regulation.	The EPA added text throughout the guidance to distinguish between required actions (as defined by regulations) and recommendations (that are not required, but are included to provide context, examples, and guidance).
2	Battelle	Overall, many of the guidance parameters are not specific, which might be difficult to interpret. Also, some of the guidance is not consistent with other EPA Class 6 guidance and some items in CFR. Another area that requires more thought is the discussion of risk in this document. Specific examples are provided below.	The EPA revised the guidance to add specificity and examples, where possible, and evaluated it for consistency with other Class VI guidance documents and with Class VI Rule language. Additionally, in response to this and other comments. The EPA reviewed and modified discussions of "risk" and emphasized the concept of USDW protection/non-endangerment.

ID#	Commenter	Comment	EPA Response
3	EEI	A. EPA's UIC Class VI Guidance Process Does Not Provide Stakeholders with the Ability to Meaningfully Address Issues. As a general matter, and as EEI has noted previously, the issuance of guidance in piecemeal fashion makes it challenging for utilities to understand the UIC Class VI program. EPA already has finalized guidance documents on the following four topics: 1) Financial Responsibility; 2) Well Construction; 3) Project Plan Development; and (4) Well Testing & Monitoring. The comment period on the following five guidance documents has closed: 1) Primacy Application & Implementation; 2) Well Site Characterization; 3) Area of Review Evaluation & Corrective Action; 4) Recordkeeping, Reporting and Data Management for Owners/Operators; and 5) Recordkeeping, Reporting and Data Management for Permitting Authorities. The Agency indicates that the following two draft guidance documents will be released for comment in the future: 1) Injection Depth Waivers; and 2) Transitioning from Class II to Class VI. Along with this Draft Guidance, that makes a total of 12 guidance documents that are in process or already have been finalized. All of these documents are related; indeed, the ones issued to date are replete with cross-references to one another. It is difficult for stakeholders to provide meaningful and complete comments when guidance is issued in this way. Accordingly, these comments are necessarily preliminary and may be subject to later modification as additional guidance is finalized.	The EPA acknowledges the comment. EPA notes that the agency has been issuing the Class VI guidance documents as they become available to provide as much information to the regulated community, UIC Program Directors, and the public as soon as is possible.

ID#	Commenter	Comment	EPA Response
4	EEI	B. EPA Should Ensure that the Final Guidance Reflects the Experience of the Few Existing CCS Projects. EEI encourages EPA carefully to consider comments submitted by EEI member companies that have actual experience with siting, permitting, operating and monitoring GS facilities. Since EPA published the final Class VI rule on December 10, 2010 (75 Fed. Reg. 77230), several projects have gained experience with CCS project permitting, and at least one—Phase I of AEP's Mountaineer project in West Virginia—successfully ceased CO2 injections 2 years ago and is now engaged in monitoring during the PISC period. While this and other projects were not conducted under Class VI per se because they were done at a time when the Agency was still allowing research, development and demonstration projects to be conducted under Class V, [footnote1] they nonetheless should provide the type of "adaptive" data and experience that underpins the Class VI program: > EPA agrees with commenters who supported an adaptive approach to the UIC rulemaking for GS … EPA also believes that an adaptive approach enables the Agency to make changes to the program as necessary to incorporate new research, data, and information about GS (e.g., modeling and well construction). This new information may increase protectiveness, streamline implementation, reduce costs, or otherwise inform the requirements for GS injection of CO2. The Agency plans, every six years, to review the rulemaking and data on GS projects to determine whether the appropriate amount and types of documentation are being collected and to determine if modifications to the Class VI UIC requirements are appropriate or necessary. This time period is consistent with the periodic review of National Primary Drinking Water Standards under Section 1412 of [the Safe Drinking Water Act]. 75 *Fed. Reg.* at 77241 (emphasis added). AEP's experience to date with the Mountaineer project, for example, may already suggest that: 1) in the absence of data to the contrary, a default 50-year PISC period is overly restrictive and a deterrent to commercial projects; and 2) the prospect of closing a GS site – even one used for relatively small CO2 volumes for demonstration purposes – is less viable than the Class VI rule and the Proposed Guidance suggest. An inability to close GS sites will be an impediment to future, commercial-scale CCS projects.	The EPA acknowledges the comment and notes that, where possible, it used the experience and knowledge gained from existing projects as well as experience gained in permitting early Class VI projects when finalizing this document. In response to the comment on the PISC timeframe, note that the guidance includes discussion of both the 50 year (default) timeframe and the opportunities to demonstrate an alternative timeframe pursuant to requirements at 40 CFR 146.93. Both in guidance and in the practice of permitting early Class VI projects, the EPA has demonstrated the flexibility inherent in the regulations and available to the regulated community. In response to the footnote about the Class V guidance, the EPA clarifies that Class V well permitting decisions and policies are outside the scope and purpose of this guidance document and the associated comment period.

ID#	Commenter	Comment	EPA Response
4 (cont.)	EEI (cont.)	Footnote: 1. EPA recently has dropped references to forthcoming guidance for Class V experimental technology wells. This development confirms EEI's understanding that EPA is no longer permitting Class V wells for experimental CCS injections. This unfortunate policy change discourages CCS R&D, thereby impeding the pace of CCS technology development.	
5	EEI	C. Site-Specific Geology and Project Characteristics Should Take Precedence Over Generalized Requirements Suggested in the Draft Guidance. EPA also should clarify where permitting agencies have the discretion to deviate from the Guidance, consistent with the Class VI regulations, to recognize site-specific geologic and project characteristics to ensure that permits do not include unnecessary and burdensome requirements that would not provide increased protection of underground sources of drinking water (USDW). As EEI has noted in previous comments, the Class VI program should be designed to incentivize the siting of GS projects in locations that pose no or little threat to USDW. EEI appreciates EPA's efforts to note in the Guidance where UIC program directors have discretion when setting well plugging, PISC and well closure requirements. EPA should go one step further, however, and mandate that program directors ensure that these requirements are appropriately tied to site-specific characteristics. In particular, it should not be within a program director's discretion to require PISC monitoring that is not tied to specific threats to USDW related to the project's specific geology.	The EPA agrees that site-specific geology and project characteristics will inform Class VI project development and permitting. The Class VI regulations and this guidance were designed to strike an appropriate balance between specificity and flexibility to accommodate the site-specific nature of each project. In response to this and other comments, the EPA included language in applicable sections of the document to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making. Where appropriate, the EPA added text to the guidance document to help identify instances where site-specific information, characteristics, and considerations may inform the development of monitoring and other PISC activities by the applicant or decisions by the UIC Program Director.

ID#	Commenter	Comment	EPA Response
6	EEI	D. EPA Has Not Demonstrated Why Plans Related to Well-Plugging, PISC and Well-Closure Must Be Addressed before A Permit is Issued. The Draft Guidance requires that a number of detailed plans addressing well plugging, PISC obligations and site closure must be submitted at the time that a UIC Class VI permit application is made. EPA has not demonstrated why these plans, which address the end of the active phase of GS projects, are needed before any injection is even authorized. While it makes sense to include in the permit application certain plans for activities that would commence immediately (or soon after) a permit is granted, it makes no sense to require detailed information about well plugging and closure before a permit is ever granted, especially as these activities may occur decades into the future. EPA has not provided any rationale as to why these plans is needed at the time a permit application is made. Neither has the Agency indicated how continually modifying these plans over the injection phase of a project—which would go on for 20-30 years or longer—would serve to enhance or ensure protection of USDW. The requirement to provide such plans when filing a permit application does nothing more than increase the already expensive costs of permitting, the amount of material that must be reviewed before a permit can be granted, and, ultimately, the amount of time it would take to obtain a permit. It would be most sensible, and more appropriate, to require that GS site owners and operators provide such plans to the Director closer to the cessation of injections. Owners and operators would have substantial and actual project data to draw on to propose appropriate well-plugging and well-closure plans that are tailored to address risks to USDW, consistent with project specific factors. Moreover, these plans would be able to into consideration the most advanced information on evolving materials and monitoring tools.	The regulations require submittal of the plans with the permit application (40 CFR 146.82(a)(16) and (17)). However, flexibility exists to modify the plans over the life of the project. The EPA edited the guidance to highlight this flexibility in Sections 2.3 and 3.1.

ID#	Commenter	Comment	EPA Response
7	NACCSA	First, the Guidance goes too far in including advisory recommendations that go well beyond what the final Class VI Rule requires.[Footnote 2] We appreciate that EPA is trying to be helpful in providing guidance but because the regulatory regime is new, advisory statements are apt to become binding despite the fact that the Class VI Rule is premised on the appropriate notion of meeting performance standards in light of local geologic conditions. Footnote: 2. *Final Rule: Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (C02) Geologic Sequestration (GS) Wells, 75 Fed. Reg. 77230* (December 10, 2010), codified at 40 CFRJK 144.1, et seq. (hereafter "Class VI Rule").	In response to this and other comments, the EPA made clearer distinctions between requirements and recommendations where necessary throughout the document, and we have addressed specific comments where noted. Additionally, as indicated in this and other guidance documents, none of the guidance documents seek to impose any binding requirements on any party beyond what is expressly required by the Class VI Rule. Additionally, early Class VI permitting is a strong indicator of the flexibility available to owners or operators to accommodate differences in projects and in site-specific factors that inform owner or operator and permitting authority decisions. Early permitting decisions by the EPA support the position that the recommendations and alternative practices described in this and other guidance are not binding, do not prescribe a specific approach, and are advisory in nature.

ID#	Commenter	Comment	EPA Response
8	NACCSA	Second, the sheer scope of the guidance is problematic. The regulatory regime is new and untested, and now EPA is in the midst of promulgating voluminous amounts of guidance prior to the acquisition of experience under the rule. This could have the unintended consequence of creating more uncertainty about the permitting process. EPA has finalized guidance documents on the following four topics: (i) Financial Responsibility; (ii) Well Construction; (iii) Project Plan Development; and (iv) Well Testing & Monitoring. The comment period on the following five guidance documents has closed: (i) Primacy Application & Implementation; (ii) Well Site Characterization; (iii) Area of Review Evaluation & Corrective Action; (iv) Recordkeeping, Reporting and Data Management for Owners/Operators; and (v) Recordkeeping, Reporting and Data Management for Permitting Authorities. EPA states that the following two draft guidance documents will be released for comment in the future: (i) Injection Depth Waivers; and (ii) Transitioning from Class II to Class VI.[Footnote 3] Along with this Guidance, that makes a total of twelve (12) guidance documents already issued or in process. The Class VI Rule was largely built on performance standards, recognizing that the CCS industry is in its infancy and the specific techniques and technology for meeting the regulatory standards will evolve as projects are built and begin operations over time. EPA's issuance of voluminous and overly prescriptive guidance documents will tend to foreclose that innovation. They will tend to "lock in" whatever techniques or procedures EPA selects today, rather than allowing industry and regulators alike to ride up the learning curve as projects are developed in the years ahead. Footnote: 3. EPA recently has dropped references to forthcoming guidance for Class V experimental technology wells. This development confirms our understanding that EPA is no longer permitting Class V wells for experimental CCS injections. We believe that policy to be unwise as it will discourage CCS R&D and negatively impact the academic community. EPA bas emphasized repeatedly that Class VI is for commercial wells only. Requiring the R&D community to comply with Class VI is a recipe for impaired, not enhanced, CCS technology development.	The EPA committed to providing technical guidance when finalizing the Class VI Rule. This, like other guidance documents, is designed to support permitting. Additionally, it has the benefit of "lessons learned" from early permitting with a goal toward reducing uncertainty associated with the permitting/regulatory process and providing experience-based guidance. This guidance was not intended to contain any specific technology or procedural requirements. As stated in the disclaimer, "While EPA has made every effort to ensure the accuracy of the discussion in this document, the obligations of the regulated community are determined by statutes, regulations, or other legally binding requirements. In the event of a conflict between the discussion in this document and any statute or regulation, this document would not be controlling." We have built flexibility into the rule, and this flexibility is now noted throughout this document. In response to this and other comments, we have made clearer distinctions between requirements and recommendations where necessary throughout the document, and we have addressed specific comments where noted. EPA also included language in applicable sections of the document to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making. Additionally, as indicated in this and other guidance documents, none of the guidance documents seek to impose any binding requirements on any party beyond what is expressly required by the Class VI Rule. In response to the footnote about the Class V guidance, Class V well permitting decisions and policies are outside the scope and purpose of this guidance document and the associated comment period.

ID#	Commenter	Comment	EPA Response
9	NACCSA	Third, the issuance of Class VI guidance in piecemeal fashion makes it difficult for the regulated community to provide comments and to understand the regulatory regime. The guidance documents referenced above are interrelated to some extent. We cannot comment on guidance that has not yet been issued, of course, nor can we thoughtfully assess the entire regulatory regime until all of the guidance has been issued. These comments are thus necessarily preliminary and subject to later modification as additional guidance is issued.	The EPA believes that the issuance of this final guidance will provide additional clarity to Class VI permit applicants and owners or operators regarding well plugging, PISC and site closure requirements. Additionally, EPA has made efforts to ensure that this document is complementary to all existing Class VI guidance documents, which focus on specific rule requirements.
10	NACCSA	Fourth, the mounting volume and complexity of the Class VI guidance collectively lead us to reaffirm our oft-stated observation that the Class VI program simply will not work for many industrial sources, pipeline operators, and oil & gas companies that intend to engage in concurrent EOR/sequestration under UIC Class II. Section 144.19 of title 40 of the Code of Federal Regulations provides an explicit regulatory path for concurrent EOR/sequestration to be conducted under UIC Class II, and that path is likely to be frequently used. We understand that the Guidance does not apply to owners and operators making use of the Class II pathway under the Class VI Rule.	The EPA acknowledges the comment and affirms, as the commenter indicates, that this Class VI technical guidance document applies to Class VI owners or operators; it does not apply to pipeline operators or Class II owners or operators. Comments on the Class VI Rule are outside the scope and intent of this guidance comment period. For additional information, you may wish to review the following Memo: "Key Principles in EPA's Underground Injection Control Program Class VI Rule Related to Transition of Class II Enhanced Oil or Gas Recovery Wells to Class VI" at this link: https://www.epa.gov/sites/production/files/2015-07/documents/class2eorclass6memo_1.pdf.
11	CSC	A number of places in the draft guidance the use of the term "risk" is inappropriate and could lead to either misunderstandings, or worse, potential claims that operators are required to achieve the impossible by proving that there is "no risk" of endangerment of an underground source of drinking water (USDW). Because risk is relative and will vary from vanishingly small or negligible at the lowest end of the scale to extremely high and probable at the high end of the scale, it cannot ever be demonstrated to disappear. The proper frame of discussion is to address endangerment without using "risk" as a modifier, as is done in the language of the Class VI rule itself. Endangerment is a defined term in the context of the UIC program, and the requirements of the Class VI rule for alternative timeframe and closure demonstrations are stated in terms of USDW endangerment. The use of "risk" as a "black and white" term only confuses the requirements of the rule and poses a likelihood of causing controversy over what must be demonstrated. We have tried to note each of the places where "risk" is used in the language of the guidance in a way that poses the potential to introduce uncertainty and have provided recommended revisions to avoid creating confusion. We commend these recommendations to your attention.	In response to this and other comments on the draft guidance, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.

Comments on the Introductory Sections

Executive Summary

ID#	Commenter	Comment	EPA Response
12	API	Second Paragraph – "Owners or operators must properly plug the injection well, monitor the site for a timeframe established in the permit (e.g., 50 years or an alternative timeframe), demonstrate to the UIC Program Director that conditions at the site have stabilized and do not pose a threat of endangerment to USDWs, and complete the plugging of monitoring wells to enable site closure." (emphasis added) The final rule, 40 CFR 146.93(b)(1), does not mention 'stabilized' as a requirement. Rather the Rule requires a demonstration that USDWs are not being endangered.	The EPA edited the guidance to address this comment.
13	CSC	Page: ii **Guidance Statement:** After injection ceases at a GS project, the injection well must be plugged to ensure that the well does not become a conduit for fluid movement into USDWs [40 CFR 146.92]. **Final Rule Language:** **Recommended Revision**: After injection ceases at a GS project, if an injection well is not to be converted to other use (e.g. used as a monitoring well), the injection well must be plugged to ensure that the well does not become a conduit for fluid movement into USDWs [40 CFR 146.92]. **Discussion**: It is not necessary to plug the injection well immediately in every instance. As recognized later in the guidance, the well can be converted and used for monitoring. Eventually injection wells must be plugged in accordance with the plugging plan.	The EPA acknowledges that injection wells may be converted to monitoring wells at some Class VI projects. EPA edited the guidance to address this comment.

ID#	Commenter	Comment	EPA Response
14	CSC	Page: iii **Guidance Statement:** Under such circumstances, the owner or operator may submit non-endangerment information to the UIC Program Director to support site closure, and the UIC Program Director may subsequently approve an amended PISC and Site Closure Plan to authorize early site closure. **Final Rule Language**: 146.93(b) (2) If the owner or operator can demonstrate to the satisfaction of the Director before 50 years or prior to the end of the approved alternative timeframe based on monitoring and other site specific data, that the geologic sequestration project no longer poses an endangerment to USDWs, the Director may approve an amendment to the post- injection site care and site closure plan to reduce the frequency of monitoring or may authorize site closure before the end of the 50-year period or prior to the end of the approved alternative timeframe, where he or she has substantial evidence that the geologic sequestration project no longer poses a risk of endangerment to USDWs. **Recommended Revision**: Under such circumstances, the owner or operator may submit non-endangerment information to the UIC Program Director to support site closure, and the UIC Program Director may subsequently approve an amended PISC and Site Closure Plan to authorize early site closure. **Discussion**: This statement suggests that it would be necessary to include a superfluous step actually revise the PISC and Site Closure Plan in addition to making the nonendangerment demonstration requisite for site closure. If the Director approves a nonendangerment demonstration, the operator should be able to proceed to notice and closure without first revising the PISC and Site Closure Plan. An amendment to the plan is only required if the objective is to reduce the frequency of monitoring rather than proceed to closure.	The EPA revised the guidance to clarify that the owner or operator may submit non-endangerment information to the UIC Program Director to support site closure before the end of the approved PISC time frame, and the UIC Program Director may, with substantial evidence that the geologic sequestration project no longer poses a risk of endangerment to USDWs, subsequently authorize early site closure. The EPA revised the guidance throughout to reflect this.

ID#	Commenter	Comment	EPA Response
15	CSC	Page: iii **Guidance Statement**: This guidance document includes considerations and recommendations to help owners or operators petition for an alternate PISC timeframe (i.e., other than the 50-year default) during permitting; revise the PISC timeframe during the injection operation; and make a non-endangerment demonstration for revision to the PISC and Site Closure Plan. **Final Rule Language**: 146.93(b) (2) If the owner or operator can demonstrate to the satisfaction of the Director before 50 years or prior to the end of the approved alternative timeframe based on monitoring and other sitespecific data, that the geologic sequestration project no longer poses an endangerment to USDWs, the Director may approve an amendment to the postinjection site care and site closure plan to reduce the frequency of monitoring or may authorize site closure before the end of the 50-year period or prior to the end of the approved alternative timeframe, where he or she has substantial evidence that the geologic sequestration project no longer poses a risk of endangerment to USDWs. **Recommended Revision**: This guidance document includes considerations and recommendations to help owners or operators ~~petition for~~ **obtain approval of** an alternate PISC timeframe (i.e., other than the 50-year default) during permitting; revise the PISC timeframe during the injection operation; and make a nonendangerment demonstration **to obtain approval** for **site closure** ~~revision to the PISC and Site Closure Plan~~. **Discussion:** The first part of this statement is excellent and makes the important observation that owners and operators can demonstrate that an alternative timeframe (other than the 50- year default) is appropriate for post-injection site care. The second part also makes the extremely important point that this demonstration can be made at any time during the injection operation. However, some of the terminology in this sentence is a little confusing. The word "petition", although not completely objectionable, is inconsistent with the language of the regulation, which refers to a "demonstration". The regulation should be read to indicate that the demonstration of an alternative PISC timeframe is part of the PISC and Site Closure Plan and that the requisite demonstration is to be submitted along with the proposed plan or a proposed revised plan for approval by the	The EPA edited the guidance to address this comment. The EPA deleted the term "petition" from the sentence in response to this comment and as part of an effort to align terminology in the guidance to the Class VI Rule language.

ID#	Commenter	Comment	EPA Response
15 (cont.)	CSC (cont.)	Director. The use of the word "petition" appears to suggest that a separate process is involved like the "supplemental report" process established in the rule for a "waiver of the Class VI injection depth requirements". 40 CFR §146.95. There should be no requirement for any separate process apart from the plan revision submission process. Finally, the end of the sentence suggests that it would be necessary to include a superfluous step actually revise the PISC and Site Closure Plan in addition to making the nonendangerment demonstration requisite for site closure. If the Director approves a nonendangerment demonstration, the operator should be able to proceed to notice and closure without first revising the PISC and Site Closure Plan.	
16	CSC	Page: iii **Guidance Statement**: The guidance also discusses the information that the owner or operator must submit to demonstrate nonendangerment [40 CFR 146.93(b)(3)] showing that no additional monitoring is needed to ensure that the project does not pose a risk to USDWs before the UIC Program Director will authorize site closure. **Final Rule Language**: **Recommended Revision**: **Discussion**: This is an excellent statement.	The EPA acknowledges the comment.

Definitions

ID#	Commenter	Comment	EPA Response
17	NACCSA	If the definitions used in the Guidance are intended to be the same as those in the Class VI Rule, they are redundant; to the extent they differ from those in the Class VI Rule, they are legally irrelevant because the definitions in the Class VI Rule will govern. It would be far preferable to delete the definitions in the Guidance and simply substitute a citation to the applicable definitions in the Class VI Rule or the SDWA. If that approach is not taken, the following definitions should be revised to ensure that they are identical to those provided in the Class VI Rule or the SDWA.[Footnote 4] Footnote: 4. Unless otherwise specified, references to "sections" below are to the final Class VI Rule in the Code of Federal Regulations.	The EPA notes that the definitions include both terms from the Class VI Rule and those specific to this guidance. Where terms in the guidance are defined in the Class VI Rule, the Class VI regulatory or preamble definitions were included to support ease of reference. Where terms are unique to this document, their inclusion in the definitions section is designed to support review and use of the document.

ID#	Commenter	Comment	EPA Response
18	NACCSA	Corrosive. The Guidance's definition of "corrosive" includes the following unsupported and misleading statement: "Carbon dioxide mixed with water forms carbonic acid`, which can corrode well materials." Carbon dioxide enters water through equilibrium with the atmosphere. And while aqueous C02 can react with water to form carbonic acid, only a small fraction exists as the acid.[Footnote 5] Carbonic acid is weak and occurs frequently in the natural world. It is also found in sodas, champagne, and blood. These and other critical subtleties are lost in the Guidance's definition of the term, which by blanket inference suggests that carbon dioxide and water form a corrosive material that can damage all well materials. The sentence would therefore be considerably more accurate if it read: "Under certain circumstances, when carbon dioxide is mixed with water, it forms carbonic acid. This is a weak acid that is found widely in the natural world, including in human blood, as well as in common beverage products such as sodas and champagne. In some circumstances in the subsurface, however, it can lead to corrosion of well materials." The Guidance's definition of "corrosive" also ignores the detailed "characteristics of corrosivity" set forth in 40 C.F.R. § 261.22 of the RCRA program. These characteristics include, for example, a pH "less than or equal to 2 or greater than or equal to 12.5 as determined by a pH meter using Method 9040C ...." *40 C.FR § 261.22(a)(1).* It is unclear if carbonic acid would satisfy these conditions under all relevant conditions of long-term storage. Since EPA is separately poised to publish a final conditional exclusion for certain C02 streams under the RCRA program, it is important that the Guidance's references to RCRA terminology be precise. Footnote: 5. http://ion.chem.usu.edus/bialkow/Classes/3650/Carbonate/Carbonic%20Acid.html.	The definition of corrosive in this guidance document is the same as was used in the Well Construction Guidance definition section and the Class VI Rule preamble. For consistency, the EPA retained the definition in its original form as presented in the draft guidance.
19	NACCSA	Enhanced oil recovery. The Guidance's definition of "enhanced oil recovery" should be replaced with one that currently exists under State law. The State of Texas, for example, defines an EOR project as the "use of any process for the displacement of oil from the reservoir other than primary recovery and includes the use of an immiscible, miscible, chemical, thermal, or biological process." *Texas Administrative Code, title 16, part 1, chapter 3, Rule§ 3.50(c)(6).*	The subject definition is taken from the Class VI Rule preamble and is consistent with the definitions in other Class VI guidance documents. For consistency, it was retained in its original form as presented in the draft guidance.

ID#	Commenter	Comment	EPA Response
20	AWWA	Injection Depth Waivers, page *x* – Consider adding a sentence that makes reference to the forthcoming UIC Class VI Injection Depth Wavier Application Guidance for more detailed information about the additional considerations for projects operating under injection depth waivers and where the Injection Depth Waiver Application Guidance can be found when it is issued, similar to what EPA did in on page 25 of its Draft UIC Program Class VI Well Project Plan Development Guidance for Owners and Operators.	The EPA removed the definition from the guidance, as injection depth waivers are not discussed in the document.
21	NACCSA	Injection depth waiver. We recommend that this definition be struck and replaced with a reference to the applicable waiver requirements at 40 C.F.R.§ 146.95. The Guidance's definition uses ambiguous terms such as "non-USDW formations" and "protected from endangerment" that do not appear in the regulations, thus adding unnecessary ambiguity and uncertainty.	The EPA removed the definition from the guidance, as injection depth waivers are not discussed in the document.
22	NACCSA	Site closure. The Guidance's definition of "site closure" differs from that provided in the applicable regulations at 40 C.F.R. § 146.81(d). The former refers to "specific point or time," for example, while the latter uses the more generic phrase "point/time."	The EPA revised the definition of site closure in this guidance to be consistent with the definition in the Class VI Rule.
23	CSC	Page: xii **Guidance Statement:** Well bore refers to the hole that remains throughout a geologic (rock) formation after a well is drilled. **Final Rule Language:** **Recommended Revision:** Well bore refers to the hole that remains throughout a geologic (rock) formation after a well is drilled **<u>including all tubulars, equipment and cement</u>**. **Discussion:** Correction to reflect general industry usage.	This definition is consistent with the definition in other Class VI technical guidance documents. For consistency, it was retained in its original form as presented in the draft guidance.

Comments on the Introduction (Section 1)

Note: the EPA did not receive any comments specific to Section 1.5 of the draft guidance document (Relationship of this Guidance to Related Guidance Documents).

1.1. The Phases of a GS Project

ID#	Commenter	Comment	EPA Response
24	EEI	F. EPA's Draft Guidance Is Predicated on Unsubstantiated Assumptions about Project Risk. In the Draft Guidance, EPA includes Figure 1, which EPA claims is a risk curve for a GS project. See Draft Guidance at 1. This figure and the related text provide a great deal of insight into EPA's assumptions about GS projects. EPA appears to believe that the risk of endangerment to USDW extends beyond the cessation of injection, but EPA fails to site any data to support this assumption, which underpins the Agency's approach to the PISC period. Without citation to authority, this section of the Draft Guidance includes the following overbroad statement: "The risk posed to underground sources of drinking water (USDWs) during the operation of a GS project increases during the injection phase as carbon dioxide is injected and subsurface pressures increase." Moreover, it is technically imprecise to suggest that any amount of subsurface pressure results in an increased risk to USDWs as there may be no USDWs in the vicinity of the site and the mere existence of a pressure differential does not necessarily result in an increased risk. Figure 1 is separately misleading because it lacks scale information and metrics on both the xand y-axes. With respect to nomenclature that appears within Figure 1, the terms "Injection Rates" and "Project Risk" are not defined and thus ambiguous. The tail end of the "Project Risk" curve also misleadingly suggests sustained high "risks" halfway through the PISC period. Project data and modeling show just the opposite—i.e., that pressure stabilization begins immediately after injections cease. [Footnote 2] EPA should not include this Figure from the Final Guidance and should support with data any assumptions made about project risk after injection ceases. Footnote: 2. *Ellison, K.*, "Behavior of Brines Containing Dissolved CO2 in Abandoned Wellbores," Proceedings, TOUGH Symposium 2012, Lawrence Berkeley National Laboratory, California, September 17-19, 2012 ("After overpressure has ceased, leakage of CO2 laden brine does not continue. No solution gas drive effects are observed in the simulations. Further, after injection has ceased, significant amounts of CO2, especially the gaseous plume, may be flushed back down the wellbore due to a depth decreasing density gradient in the system. This serves as a natural mechanism for CO2 leakage mitigation").	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making. Additionally, the EPA modified text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.

ID#	Commenter	Comment	EPA Response
25	CSC	Page: 1 **Guidance Statement:** Site closure commences only when there is no longer risk of endangerment to USDWs and when authorized by the UIC Program Director. **Final Rule Language:** **Recommended Revision:** Site closure ~~commences only when there is no longer risk of endangerment to USDWs and when authorized by the UIC Program Director~~ means the specific point or time, as determined by the UIC Program Director following the requirements under 40 CFR 146.93, at which the owner or operator of a GS site is released from PISC responsibilities. **Discussion:** In addition, this usage of the term "site closure" is inconsistent with the definition of the term on page xi. The term is defined the "specific point or time" at which the owner or operator is released from PISC responsibilities. The defined terminology should be used consistently. Furthermore, "risk" is relative – operators cannot be required to show "there is no longer risk". That would be an impossible task.	In response to this and other comments on the draft guidance, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate. EPA also revised text throughout the guidance to align terminology in the guidance to the Class VI Rule language.
26	CSC	Page: 1 **Guidance Statement:** While the actual magnitude and change in project risk during these phases depend on site-specific factors, Figure 1 below illustrates how risk to USDWs changes throughout the life of a GS project. **Final Rule Language:** **Recommended Revision:** ~~While~~ **T**he actual magnitude and change in project risk during these phases depend on site-specific factors~~, Figure 1 below illustrates how risk to USDWs changes throughout the life of a GS project~~. **Discussion:** Figure 1 is inaccurate and misleading and should be deleted. The rate of CO2 injections will not increase progressively over the first half of the injection period. Moreover, it is not the rate of injection that is the primary driver of potential endangerment of USDWs (presumably what is intended by the undefined term "Project Risk"), but increases in subsurface pressure. In contrast, the text of the draft guidance in Section 3.3.5 (at page 43) accurately describes the key role of pressure increases and pressure decreases, Figure 1 should be deleted or completely re-crafted to reflect the correct explanation at page 43.	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making.

ID#	Commenter	Comment	EPA Response
27	API	First Paragraph **Guidance Statement:** "While the actual magnitude and change in project risk during these phases depend on site-specific factors, *Figure 1 below illustrates how risk to USDWs changes throughout the life of a GS project*." (emphasis added) **Recommended Revision:** Should change italicized phrase to: 'Figure 1 below is a conceptual illustration of how risk to USDAs might change throughout the life of a GS project.' Also, Figure 1 is titled "Risk Curve for a GS Project" but should be re-titled as "Conceptual Risk Curve for a GS Project."	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making.
28	CSC	Finally, we note that the schematic cartoon shown as Figure 1 is seriously in error and is misleading. It shows a sharp and continued increase in the "Injection Rate" of CO2 over the first half of the injection period. This purported increase in the Injection Rate appears to be shown as the driver of a parallel sharp increase in "Project Risk", a term that is not defined. Both of these curves misconceive or misrepresent expected operations and as a result present to the public an extremely misleading picture. • The Injection Rate of CO2 injections will almost surely not increase progressively as shown in Figure 1. Rather, injections at a site will rise initially when injection begins to reach a planned operational plateau that is defined by rate of delivery of CO2 to the storage site, constrained at all times by the permitted injection rate and at other times by available deliveries of captured CO2 as well as by the injection capabilities of the injecting wells and the capacity of the storage formation to accept the injected quantity. The actual operational plateaus may decrease from time to time, for example if a capture source is taken out of service for repair and maintenance or for economic or other operational reasons. They may also increase from time to time within the permitted limits – for example, if capture technology is deployed at another source facility and the necessary infrastructure is built to deliver the new supply to the storage site and inject it. While the cumulative quantity of CO2 in the storage formation will rise progressively, the Injection Rate will not. • Figure 1 inaccurately implies that that the Injection Rate is the primary driver of "Project Risk". This is not the case and is contradicted by the text of Section 3.3.5 of the draft guidance document (at page 43), which quite correctly states that subsurface pressure is the key metric: Pressure decline is integral to the decrease of risk to USDWs. Increased pressure is the primary driving force for fluid movement that may endanger a USDW. Pressure differentials will decay over time after the cessation of	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making. Additionally, the EPA modified text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.

ID#	Commenter	Comment	EPA Response
28 (cont.)	CSC (cont.)	injection. The rate of pressure decay is a function of injection zone permeability, compressibility, the injected volume of carbon dioxide, the areal extent and thickness of the formation, and the presence of lateral stratigraphic confining features. To demonstrate that there is no risk of endangerment to USDWs, the pressures within the injection zone should decline until there is no risk of fluid movement into a USDW or, alternatively, to pre-injection conditions. . . . Pressure should be emphasized as one of the key measurements during PISC monitoring.[Footnote 2] Because of these errors in Figure 1, we recommend that the figure and the accompany text in section 1.1 be deleted from this guidance document. Footnote: 2. Note that we have objected to the scientifically flawed use of "risk" in this final sentence and have provided correcting language in the attached detailed comments.	
29	Battelle	Page 1, Figure 1. Risk Curve for a GS Project – The project risk profile is shown to go to zero at the end of PISC. This implies that a demonstration of zero risk is required at end of PISC before site closure? Suggest the line be dashed to show uncertainty in the timing and show a decreasing trend towards zero or perhaps removing the figure.	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making.

ID#	Commenter	Comment	EPA Response
30	CATF-NRDC	The draft guidance states that "Figure 1 below illustrates how risk to USDWs changes throughout the life of a GS project". This statement overreaches and the accompanying illustration is highly oversimplified and may mislead rather than clarifying. Figure 1 shows a simplified risk profile for a hypothetical project, highlighting the role of pressure. Even though it serves as justification for the construct of an operational phase followed by PISC and then closure, EPA should make it clear that individual site characteristics may alter this significantly and qualify the applicability of this to specific projects. Operators need to map out the individual components of the risk profile, and cater the PISC to those on a site-specific basis. Some risk components, such as annular leakage, may be highest at first, whereas others may become more significant in a step fashion as, for example, the plume approaches potential leakage pathways such as old wells, faults or fractures. The risk profile may also be affected by plume interference from nearby wells or fields. This will give rise to a risk profile that is not smooth or dependent on the injection rate, and in fact may be quite complex. EPA should revise the diagram, illustrating several "illustrative" possibilities and correct the statement with a discussion of the need to tailor risk assessment and mitigate those risks based on the local site characteristics in the accompanying supporting text. The text should also consider illustrating risk profiles where EOR operators transition into Class VI, keeping in mind that EOR strives for the minimum miscibility pressure.	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making. Additionally, the EPA modified text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate. Comments on EOR operations are outside the scope and intent of this guidance comment period. For additional information, you may wish to review the following Memo: "Key Principles in EPA's Underground Injection Control Program Class VI Rule Related to Transition of Class II Enhanced Oil or Gas Recovery Wells to Class VI" at this link: https://www.epa.gov/sites/production/files/2015-07/documents/class2eorclass6memo_1.pdf.

ID#	Commenter	Comment	EPA Response
31	NACCSA	We recommend that this section, including Figure 1 ("Risk Curve for a GS Project"), be deleted because it contains serious factual errors as well as oversimplifying and misstating the risk profile of a CCS project. Without citation to authority, this section includes the following overbroad statement: "The risk posed to underground sources of drinking water (USDWs) during the operation of a GS project increases during the injection phase as carbon dioxide is injected and subsurface pressures increase." It is technically imprecise to suggest that any amount of subsurface pressure results in an increased risk to USDWs as there may be no USDWs in the vicinity of the site and the mere existence of a pressure differential does not necessarily result in an increased risk. Figure 1 is misleading because it lacks scale information and metrics on both the x- and y-axes. With respect to nomenclature that appears within Figure 1, the terms "Injection Rates" and "Project Risk" are not defined and thus ambiguous. The tail end of the "Project Risk" curve also misleadingly suggests sustained high "risks" halfway through the PISC period. Project data and modeling show just the opposite- i.e., that pressure stabilization begins immediately after injections cease. [Footnote 6] Moreover, Figure 1 shows the "Injection Rate" increasing sharply (order of magnitude?) over the first half of the injection period. This is simply wrong. The ***rate*** of CO2 injection will normally be relatively flat over the life of the storage project (once initial operations begin) absent expansion of a storage operation over its life through the drilling of additional injection wells, expansion if its areal extent, or the like. The injection ***rate*** may well decline toward the latter part of a storage site's operation if it become operationally undesirable to continue the same rate (e.g. if unrelieved subsurface pressure does not dissipate adequately). But to assume that the injection rate will look anything like what is shown on Figure 1 is simply inaccurate. [Footnote 7] Figure 1 shows "Project Risk" as increasing in parallel with the (non-existent) increase in "Injection Rate" over the first half of the injection period and thus appears to show project risk as being driven by the increase in the "Injection Rate". If the "Injection Rate" is stable over the injection period, then according to Figure 1, the "Project Risk" would be stable as well. In sum, if EPA elects to retain this section, we suggest that its first paragraph and Figure 1 be replaced with the following text, nearly all of which is taken from	In response to this and other comments, the EPA deleted Figure 1 and included language in the Introduction (Section 1) and throughout the guidance to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making. Additionally, the EPA modified text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate. The EPA acknowledges the role of leakage/migration pathways (e.g., artificial conduits, faults or fractures) and the need to appropriately identify and characterize them during the site selection/characterization process (or at a later date) at a Class VI project. The requirements at 40 CFR 146.83, 146.84 and 146.86 – related to site characterization, area of review delineation and corrective action, and Class VI well construction, respectively, are focused on addressing the issues raised by the commenter. Additionally, other Class VI requirements complement these and support a robust approach to Class VI project management to ensure USDW protection. Furthermore, the EPA agrees with the commenter and acknowledges the importance of site selection which is largely addressed in the Class VI Site Characterization Guidance and the Area or Review and Corrective Action guidance as well as appropriate monitoring which is addressed in the Class VI Testing and Monitoring Guidance. These and other technical guidance documents are available at: https://www.epa.gov/uic/class-vi-guidance-documents.

ID#	Commenter	Comment	EPA Response
31 (cont.)	NACCSA (cont.)	Benson, S., "Carbon Dioxide Capture and Storage: Assessment of Risks from Storage of Carbon Dioxide in Deep Underground Geological Formations" (Lawrence Berkeley National Laboratory, April 2, 2006): On a project-by-project basis, the risks of geological storage of CO2 are expected to be no greater than the risks associated with analogous industrial activities that are under way today. Oil and gas production operations, natural gas storage, and disposal of liquid have provided experience with underground injection of fluids and gases on a massive scale. The injection volume of an individual storage project will be comparable to the larger scale CO2-EOR projects taking place in the U.S. today. Because the technology for characterizing potential CO2 storage sites, drilling injection wells, safely operating injection facilities, and monitoring will be adapted and fine-tuned from these mature industrial practices taking place today, it is reasonable to infer that the level of risk will be similar. A recent assessment of CO2 capture and storage authored by 32 authors from around the world concluded that, based on multiple lines of evidence regarding the short and long-term security of geological storage, for large-scale CO2 storage projects (assuming that sites are well selected, designed, operated and appropriately monitored) it is likely the fraction of stored CO2 retained is more than 99% over the first 1,000 years. The expected long retention times, combined with a wealth of related experience with large-scale injections, led these authors to conclude (IPCC, 2006): "With appropriate site selection informed by available subsurface information, a monitoring program to detect programs, a regulatory system, and the appropriate use of remediation methods to stop or control CO2 releases if they arise, the local health, safety and environment risks of geological storage would be comparable to risks of current activities such as natural gas storage, EOR, and deep underground disposal of acid gas." There is no evidence that CO2 is stored underground any less effectively than other gases. Moreover, CO2 accumulates underground as a gas, mixture of gases, supercritical fluid, and/or solute dissolved in oil or aqueous phase, thus providing confidence that storage will be possible for the range of conditions expected for intentional man-man geologic storage.	

ID#	Commenter	Comment	EPA Response
31 (cont.)	NACCSA (cont.)	Risks from geological storage of CO2 primarily result from the consequences of unintended leakage of CO2 from the storage formation. There are two principal unintended leakage scenarios that must be considered. First, and the most likely, is the CO2 leaks up a well - either the injection well itself, or a nearby well that is improperly sealed. In this case, releases at the surface are likely to be confined to a small area, have a comparatively high flux, and post a risk only to those in the close vicinity of the well. For this reasons, the use of numerous monitoring wells may have the perverse effect of increasing, not decreasing, GS site risks. The second unintended leakage scenario arises from leakage up a fault or fracture that was not identified or properly characterized during site selection. In this case, the surface release may take place over a broader area, but is likely to have a lower flux and (depending on the release rate) may or may not create a significant risk to people or the environment. In comparison, risks to USDWs are deemed to be low, even during the operational phase. No known contamination of groundwater has occurred from injection of CO2 anywhere in the world. The likelihood of endangerment to USDWs is site specific, depending on the size of the storage formation, what fraction of the storage formation will be occupied by the CO2, and the regional hydrology. Addressing the likelihood of brine displacement should be addressed on a site-specific basis in the site selection process. However, for many large, regional-scale storage formations, only a few percent of the potential storage volume will be occupied by CO2. In this case, the likelihood of brine displacement is low, because the volume of brine displaced by CO2 can be accommodated by a small pressure increase over the extent of the storage formation. Footnotes: 6. Ellison, K., "Behavior of Brines Containing Dissolved CO2 in Abandoned Wellbores," Proceedings, TOUGH Symposium 2012, Lawrence Berkeley National Laboratory, California, September 17-19, 2012 ("After overpressure has ceased, leakage of CO2 laden brine does not continue. No solution gas drive effects are observed in the simulations. Further, after injection has ceased, significant amounts of CO2, especially the gaseous plume, may be flushed back down the wellbore due to a depth decreasing density gradient in the system. This serves as a natural mechanism for CO2 leakage mitigation").	

ID#	Commenter	Comment	EPA Response
31 (cont.)	NACCSA (cont.)	7. The ***cumulative amount*** of CO2 injected will of course increase over the life of the project, but it will continue to increase and will not fall at the end. Hence what is shown as the "Injection Rate" in Figure 1 does not accurately describe cumulative injections either.	

1.2. Injection Well Plugging Requirements

ID#	Commenter	Comment	EPA Response
32	NACCSA	The second paragraph of this section should be revised as follows to conform to the applicable regulatory requirements: Class VI well owners or operators must prepare, maintain, and comply with an Injection Well Plugging Plan [40 CFR 146.92(b)]. Specifically, the owner or operator must flush each injection well with a buffer fluid, determine bottomhole pressure, perform a final external mechanical integrity test (MIT), and plug the well with materials that are compatible with **the** carbon dioxide **stream [40 CFR 146.92(b)(5)]**. ~~EPA also recommends that well plugging materials be compatible with the formation fluids ....~~	The EPA made edits throughout the document to change original references to "carbon dioxide" to either the "carbon dioxide plume" or the "carbon dioxide stream."
33	AWWA	Page 2 – AWWA supports EPA's suggestion that owners or operators consider employ the same well plugging procedures when plugging monitoring wells at the end of the PISC period.	The EPA acknowledges the comment.

1.3. Post-Injection Site Care Requirements

ID#	Commenter	Comment	EPA Response
34	NACCSA	The first paragraph of this section should be revised as follows to conform to the applicable science and modeling: PISC refers to the time period immediately following cessation of injection until site closure. ~~Although~~ **T**here is no longer injection during this phase, ~~the project still poses some risk to USDWs due to elevated pressures and the presence of mobile phase carbon dioxide~~ **which suggests generically that site conditions should immediately begin to stabilize thereafter. Each site is different and site-specific analyses are required by the Class VI rule. Whatever residual risks remain after injections cease are expected to be minimal and manageable for well selected, designed, operated and appropriately monitored sites.**	In response to this and other comments, the EPA included language in applicable sections of the document to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making.

1.4. Site Closure Requirements

ID#	Commenter	Comment	EPA Response
35	AWWA	Page 2 – The first paragraph of this section states that an owner or operator must plug and abandon all monitoring wells to enable the end of the Class VI project and termination of the permit. Consideration should be given to allowing monitoring wells in USDWs to be kept in operation, possibly by another entity, as these monitoring wells may provide useful information to stakeholders who are using or may use the USDWs in the future.	The EPA added language to the guidance to address this comment.
36	AWWA	Pages 2 and 3– EPA should consider recommending that owners or operators notify other interested stakeholders as well as the UIC Program Director in writing 60 days before plugging of an injection well so that they may review planned plugging activities. AWWA also supports EPA's recommendation that owners or operators submit notice of intent to plug monitoring wells 60 days in advance and reports of monitoring well plugging reports within 60 days of plugging.	The EPA acknowledges the comment. The EPA added text to Section 4 recommending notification of additional stakeholders as part of site closure reporting.

ID#	Commenter	Comment	EPA Response
37	NACCSA	The following sentence - which is the final sentence of the second paragraph of this section- should be struck as it: (i) asserts legal conclusions that are not relevant for a guidance document, and (ii) goes beyond what the regulations provide: ~~"Note that following site closure, the Owner or operator is responsible for any remedial action deemed necessary to prevent USDW endangerment caused by the injection operation (see Section 4.4)."~~ For the same reason, referenced Section 4.4 (which appears later in the Guidance starting at p. 50) should also be struck. Section 4.4, for example, includes the following legal conclusion (internal citations and acronyms omitted): Furthermore, after site closure an owner or operator may remain liable under tort or other remedies, or under other federal statutes, including, but not limited to, the Clean Air Act; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Resource Conservation and Recovery Act. This statement is not only legally unsupported, it is inappropriate, unnecessary and singularly unhelpful to those endeavoring to commercially advance the Administration's CCS policies. Legal conclusions -particularly legal conclusions regarding other environmental statutes -- do not belong in a guidance document that purports to provide technical and regulatory guidance for a regulatory program- Class VI - that is based entirely under the Safe Drinking Water Act. Moreover, this statement is erroneous. We are aware of no legal theory under which the owner or operator of a GS site could be held liable under the Clean Air Act. Carbon dioxide by itself is a commodity, not a hazardous waste or hazardous substance, and thus outside the jurisdiction of CERCLA and RCRA. And while EPA is separately poised to publish a conditional exclusion for certain C02 streams under RCRA, that exclusion will not impair C02's commodity status generally. This statement also ignores mechanisms such as State CCS laws that establish trust funds for the management of closed GS sites. An example is Louisiana's Geologic Sequestration of Carbon Dioxide Act (HB 661). Enacted in 2009, this law envisions transfer of site operations to the State of Louisiana if certain requirements are met. Last, statements such as this also tend to undermine the legal and commercial practicality of other Administration programs that depend upon CCS, such as the proposed GHG New Source Performance Standards for New EGUs. *77 Fed. Reg. 22392* (April13, 2012).	The EPA retained this text to support an understanding of the UIC regulations and the applicability of other potential responsibilities beyond SDWA, EPA clarifies that the guidance does not impose additional requirements under CAA, CERCLA, or RCRA.
37 (cont.)	NACCSA (cont.)	We do not believe that GS sites are future Superfund sites, but if EPA has a different view of this matter it should make that determination unambiguous in all existing and future regulatory proceedings that tout CCS as a viable compliance path for fossil fuel facilities.	

ID#	Commenter	Comment	EPA Response
38	CSC	Page: 3 **Guidance Statement:** Note that following site closure, the owner or operator is responsible for any remedial action deemed necessary to prevent USDW endangerment caused by the injection operation (see Section 4.4). **Final Rule Language:** **Recommended Revision:** ~~Note that following site closure, the owner or operator is responsible for any remedial action deemed necessary to prevent USDW endangerment caused by the injection operation (see Section 4.4).~~ **Discussion:** A technical guidance document is not the place for EPA to assert legal conclusions.	The EPA retained this text to support an understanding of the UIC regulations and the applicability of other potential responsibilities beyond SDWA, EPA clarifies that the guidance does not impose additional requirements under CAA, CERCLA, or RCRA.

Comments on Well Plugging (Section 2)

Note: the EPA did not receive any comments specific to the following sections of the draft guidance document: Section 2 (Well Plugging); Section 2.1 (Purpose of Well Plugging); Section 2.4 (Tests to Perform Prior to Plugging); Section 2.6.5 (Considerations for Offshore Wells).

2.2. Timing of Well Plugging

ID#	Commenter	Comment	EPA Response
39	AWWA	Page 4 – AWWA supports EPA's recommendation that any recompletions of injection wells converted to monitoring wells take place as soon as practical to allow continued acquisition of pressure data.	The EPA acknowledges the comment.
40	Battelle	Page 4 – EPA has recognized the potential that some injection wells may be useful for monitoring and has allowed flexibility in timing of the plugging injection wells. Similarly, the recognition that the plugging plans may need to be revised relative to those developed during permitting will help address any changes in technology or well conditions during operations. However, it is implied that the injection wells will likely be plugged immediately upon cessation of injection. In practice, even if not used for long-term monitoring, it will be useful to allow pressure monitoring and falloff for a period of time. The decreased wellbore pressure will also reduce safety concerns about operating in very high pressure conditions.	The EPA has clarified throughout the document that injection wells can be used as monitoring wells after the injection phase.

ID#	Commenter	Comment	EPA Response
41	CSC	Page: **4** **Guidance Statement:** However, the immediate plugging of the injection well is not a requirement, as some owners or operators may elect to convert an injection well to a monitoring well. **Final Rule Language:** **Recommended Revision:** **Discussion:** Excellent and quite true; yet this statement appears to be inconsistent with some of the statements in other portions of the document as noted.	The EPA has clarified throughout the document that injection wells can be used as monitoring wells after the injection phase.
42	CSC	Page: 4 **Guidance Statement:** In the case of recompletion of the injection well, the owner or operator will be required to plug the well upon demonstration of nonendangerment made for site closure [40 CFR 146.93(e)]. **Final Rule Language:** **Recommended Revision:** In the case of recompletion of the injection well, the owner or operator will be required to plug the well **once it is no longer being used as a monitoring well or** upon demonstration of nonendangerment made for site closure [40 CFR 146.93(e)]. **Discussion:** Clarification to recognize that use of the injection well as a monitoring well could terminate prior to actual site closure.	The EPA revised the guidance to address this comment.
43	CSC	Page: 5 **Guidance Statement:** The plugging must be performed according to the approved Injection Well Plugging Plan submitted with the Class VI permit application [40 CFR 146.92(b); 40 CFR 146.82(a)(16)]. **Final Rule Language:** **Recommended Revision:** The plugging must be performed according to the approved Injection Well Plugging Plan ~~submitted with the Class VI permit application~~ **as amended and approved at the time of plugging** [40 CFR 146.92(b)~~; 40 CFR 146.82(a)(16)~~]. **Discussion:** If the plugging plan is amended and approved subsequent to the original application, then it is the amended and approved plan that will govern plugging, not the version incorporated in the original permit application.	The EPA clarifies that the Injection Well Plugging Plan must be submitted with the permit application, per 40 CFR 146.92(b). However, EPA revised the guidance to clarify that amendments to the Plan may be submitted throughout the life of the project.

ID#	Commenter	Comment	EPA Response
44	CSC	Page: 5 **Guidance Statement:** However, if any monitoring wells will not be included in the post-injection monitoring program, the owner or operator may choose to plug them at the beginning of the post-injection period. If the PISC and Site Closure Plan is amended during the PISC phase of the project [40 CFR 146.93(a)(4)], EPA recommends that the owner or operator plug monitoring wells that will no longer be used for sampling to eliminate the potential that they become conduits for fluid movement. Thus, the plugging schedule for monitoring wells may be adjusted as appropriate in consultation with the UIC Program Director and reflected in changes to the PISC and Site Closure Plan. **Final Rule Language:** **Recommended Revision:** **Discussion:** Excellent statement of what should be anticipated and the process that should be followed.	The EPA acknowledges the comment.
45	CSC	Page: 5 **Guidance Statement:** At the end of PISC, and after the UIC Program Director has authorized site closure, the owner or operator must demonstrate that all monitoring and injection wells have been plugged in a manner that will not allow movement of injection or formation fluids that endangers a USDW [40 CFR 146.93(e); 40 CFR 146.93(f)(1)]. **Final Rule Language:** **Recommended Revision:** **Discussion:** This is well stated.	The EPA acknowledges the comment.

2.3. Development and Submittal of Injection Well Plugging Plan

ID#	Commenter	Comment	EPA Response
46	NACCSA	The bulleted text beginning at the bottom of page 5 of this section should be revised as follows to conform to the applicable regulatory requirements: •Appropriate tests or measures ~~to identify~~ **for determining** bottomhole reservoir pressure ~~to determine the appropriate plugging fluid density~~ [40 CFR 146.92(b)(1)]; •Appropriate testing methods to ensure external mechanical integrity **as specified in § 146.89** ~~to demonstrate that the long string casing and cement that are left in the ground after the well is plugged will maintain their integrity~~ [40 CFR 146.92(b)(2)]; ... •The placement of each plug, including the elevation of the top and bottom of each plug~~, recommended to be submitted along with schematics and drawings, if appropriate~~ [40 CFR 146.92(b)(4)]; .... •The method of placement of the plugs~~, such as the balance method, retainer method, or two plug method~~ [40 CFR 146.92(b)(6)].	The EPA revised the guidance in response to this comment. See revisions in Section 2.3; additionally, the document refers readers to Sections 2.4 through 2.7 for additional details.

2.4.1. Determination of Bottomhole Reservoir Pressure

ID#	Commenter	Comment	EPA Response
47	AWWA	Page 7 – AWWA encourages the use of the more robust approach of obtaining actual bottomhole pressure measurements with a dedicated downhole pressure gauge or with a pressure gauge lowered into the borehole.	The EPA revised the guidance in response to this comment to discuss the advantages of considering the use of bottomhole pressure measurements.

2.4.2. Mechanical Integrity Testing

ID#	Commenter	Comment	EPA Response
48	NACCSA	The last sentence of the first paragraph of this section should be revised as follows to conform to the applicable regulatory requirements: Unless an alternative test is approved ... requires that the owner or operator use **either** ~~at least one of the following external MITs~~: an approved tracer survey (e.g., oxygen activation log); **or** a temperature ~~log;~~ or ~~a~~ noise log. The first sentence of the second paragraph of this section should be revised as follows to conform to the applicable regulatory requirements: A **Class VI well has mechanical integrity if: (1) there is no significant leak in the casing, tubing, or packer; and (2) there is no significant fluid movement into a USDW through channels adjacent to the injection well bore** ~~The purpose of conducting a final MIT is to verify the absence of leakage through channels adjacent to the well bore or the well's long string casing that may result in significant fluid movement into a USDW~~ [40 CFR 146.89(a)].	The EPA revised the guidance in response to these suggested edits.

2.5. Preparation of Well Prior to Plugging

ID#	Commenter	Comment	EPA Response
49	AWWA	Pages 8 and 9 – AWWA supports EPA's recommendation that monitoring wells be prepared for plugging similarly to injection wells.	The EPA acknowledges the comment.

2.5.1. Well Inspection and Initial Preparation

ID#	Commenter	Comment	EPA Response
50	CSC	Page: 9 **Guidance Statement:** The Class VI Rule requires that information on the plugging materials be specified in the Injection Well Plugging Plan [40 CFR 146.92(b)(5)]; if this initial preparation stage suggests that changes are needed, a revised Injection Well Plugging Plan will need to be submitted with the notice of intent to plug [40 CFR 146.92(c)]. **Final Rule Language:** **Recommended Revision:** The Class VI Rule requires that information on the plugging materials be specified in the Injection Well Plugging Plan [40 CFR 146.92(b)(5)]; if **the information identified in** this initial preparation stage suggests that changes are needed, a revised Injection Well Plugging Plan will need to be submitted with the notice of intent to plug [40 CFR 146.92(c)]. **Discussion:** Clarification by reference back to the previous discussion about identifying the information to be considered in plugging.	The EPA revised the guidance as suggested.

2.5.2. Well Cleaning

ID#	Commenter	Comment	EPA Response
51	API	Section 2.5.2.1, Second paragraph **Guidance Statement:** "These components include the *annular space*, long-string casing, perforated zone, and possibly the injection packer." (emphasis added) **Recommended Revision:** API takes this reference to 'annular space' to mean the annular space between the tubing and casing. This should be made explicit because a more common use of annular space in drilling would be between the casing and open hole.	In response to this comment, the EPA added text to clarify the meaning of annular space as suggested by the commenter. (See Section 2.5.2.1). The text now reads "These components include the annular space (between the tubing and the casing), long-string casing, perforated zone, and possibly the injection packer."
52	Battelle	Page 9, 2.5.2.2 Removal of Well Components and Obstructions – Surface equipment decommissioning, site restoration, and pipeline is not covered here. Most oil and gas regulations have some level of site restoration. This work may be substantial for a CCS facility, and most operators will want to remove surface equipment after injection stops, so it would be useful to mention these activities here.	The activities the commenter described are outside the scope of the Class VI Rule. Thus, no changes were made in response to this comment.

2.5.3. Remedial Operations

ID#	Commenter	Comment	EPA Response
53	Battelle	Page 11, Figure 3 – This figure shows a "squeeze job" into perforations while the text covers a "squeeze job" into bad casing/cement interval. On page 16, the document recommends setting cement plugs above the reservoir. In general, the guidance is a bit confusing as presented.	The EPA deleted Figure 3 from the guidance.
54	CATF-NRDC	EPA references squeeze cementing as a remedial operation to remedy annular channeling. However, squeeze cementing comes with risks, and it may compromise casing integrity and/or fracture the formation. The value of attempting a squeeze should be carefully weighed against the potential for any given situation that may be a candidate for a squeeze to endanger USDWs. EPA should emphasize that operators must recognize the risk, proceed when it is justified against an existing threat to USDWs, and use caution. Operators should justify to the Director how they evaluated risk and substantiate the decision and approach they take.	The EPA revised the last paragraph of Section 2.5.3 to address this comment.

2.5.4. Establishment of Static Equilibrium

ID#	Commenter	Comment	EPA Response
55	Battelle	Page 11 – We recommend adding some other common drilling fluids (KCl, CaCl) to the list, since these are commonly used in our region.	The EPA revised the guidance in response to this comment to include additional examples of drilling fluids.

2.5.5. Preparation for Recompletion of Injection Well

ID#	Commenter	Comment	EPA Response
56	AWWA	Page 12 – AWWA supports EPA's recommendation that owners or operators update the monitoring well scheme and the PISC and Site Closure Plan prior to giving the required 60 day notice of well plugging.	The EPA acknowledges the comment.
57	CSC	Page: 12 **Guidance Statement:** If an owner or operator wishes to convert an injection well and has not previously provided plans for doing so, EPA recommends that the owner or operator update the monitoring well scheme and the PISC and Site Closure Plan prior to giving the required 60 days' notice of well plugging. This will allow time for the UIC Program Director to evaluate the conversion and associated specifications. **Final Rule Language:** **Recommended Revision:** **Discussion:** Operator will not be providing notice of plugging if the well is being converted.	The EPA updated the guidance in response to this comment to address any notice that may be required if an owner or operator did not previously plan to use their injection well as a monitoring (see Section 2.5.5). Additionally, the EPA clarifies that the Well Plugging requirements at 40 CFR 146.92 would still apply to any injection well that is used as a monitoring well following its use in such a capacity.

2.6. Performing Well Plugging

ID#	Commenter	Comment	EPA Response
58	AWWA	Page 12 – AWWA supports EPA's recommendation that the use of careful plugging methods as described for injection wells for plugging of monitoring wells.	The EPA acknowledges the comment.
59	CSC	Page: 12 **Guidance Statement:** Issues an owner or operator should consider in planning the plugging activities include: (1) the locations of critical formations such as USDWs so that there is no fluid migration; (2) the locations of any previously remediated portions of the well; (3) the design of the cement slurry; and (4) the best method of cement emplacement. At all stages, control of pressure in the injection zone will need to be maintained. **Final Rule Language:** **Recommended Revision:** Issues an owner or operator should consider in planning the plugging activities include: (1) the locations of ~~critical formations such as~~ USDWs ~~so that there is no fluid migration~~; (2) the locations of any previously remediated portions of the well; (3) the design of the cement slurry; and (4) the best method of cement emplacement. At all stages, control of pressure in the injection zone will need to be maintained. **Discussion:** The term "critical formation" is undefined and unclear. The purpose here is to protect USDWs so the guidance document should address only that. Inclusion of the language "so that there is no fluid migration" does not make sense here and will cause confusion. The language is unnecessary here because it does not contribute meaning to the sentence.	The EPA made the suggested edit to Section 2.6.

2.6.1. Mechanical (Bridge) Plugs and Inflatable Packers

ID#	Commenter	Comment	EPA Response
60	AWWA	Page 13 – The last paragraph discusses the potential use of inflatable packers, but notes that data are lacking on their performance in a carbon dioxide-rich environment. EPA should require that the performance of these devices in carbon dioxide-rich environments be demonstrated before their use in injection well plugging.	In response to this comment, the EPA edited the last sentence of Section 2.6.1 to read, "However, given their potential utility, interested owners or operators may wish to consult with the UIC Program Director regarding their use to ensure they are appropriate for the given site-specific conditions."

2.6.2. Cement Plugging Materials

ID#	Commenter	Comment	EPA Response
61	AWWA	Pages 13-17 – The draft guidance in this section stresses the importance of the requirement that cementing materials used for plugging be compatible with carbon dioxide and carbon dioxide-rich brines. However, the section also notes that more research on the compatibility of many of the cement additives and plugging materials with carbonic acid-rich environments and carbon dioxide-rich brines has not been established and that additional research is required. EPA should consider cross checking this section with information contained in the UIC Program Class VI Well Construction Guidance to ensure that the guidance in these two documents is consistent.	In response to this comment, the EPA added a cross-reference to the Class VI Rule Well Construction Guidance which provides more detail with respect to reactions and components of Portland cements.
62	CSC	Page: 13 **Guidance Statement:** However, differences in the densities of the cement and plugging fluid should be minimized to allow the cement to be placed at the desired depth (USEPA, 1982). **Final Rule Language:** **Recommended Revision:** However, differences in the densities of the cement and plugging fluid should be ~~minimized~~ **carefully coordinated** to allow the cement to be placed at the desired depth (USEPA, 1982). **Discussion:** Clarification	The EPA revised Section 2.6.2 to incorporate the suggested edit.

2.6.3. Locations of Cement Plug Placement

ID#	Commenter	Comment	EPA Response
63	API	First paragraph **Guidance Statement:** "EPA recommends that owners or operators emplace plugs: (1) *above the lowermost production and/or injection zone;* (2) above, below, and/or through each USDW; (3) at the bottom of intermediate and surface casings; (4) across any casing stubs (pulled casing sections); and, (5) at the surface (USEPA, 1989)." (emphasis added) **Recommended Revision:** The reference to placing a plug "above the lowermost production and/or injection zone" should be written 'above the uppermost production and/or injection zone' or, perhaps, 'from below the lowermost to above the uppermost production and/or injection zone'.	The EPA revised Section 2.6.3 to address this comment.
64	AWWA	Pages 16-17 - AWWA supports EPA's recommendation that owners and operators consider extending cement plugs to longer than 100-feet above and/or below critical zones such as above the injection zone and USDWs.	The EPA acknowledges the comment.
65	Battelle	Page 17 – The first sentence of last paragraph for this section is confusing and needs to be revised for clarity.	In response to this comment, the EPA edited this section of the guidance to improve clarity.

ID#	Commenter	Comment	EPA Response
66	CSC	Page: 17 **Guidance Statement:** For protection of USDWs, API (1993) recommends that a 100-foot plug be set from below the base of the lowermost USDWs to the base of the USDW. EPA recommends that plugs in GS settings be at least that long. **Final Rule Language:** **Recommended Revision:** **Discussion:** Does this make sense? Should the plug extend across the base of the USDW and not just stop at the base of the USDW?	The EPA edited the last paragraph of Section 2.6.3, including adding a reference to Figure 3 (well schematics), to address this comment and improve clarity.

2.6.4. Methods for Plug Emplacement

ID#	Commenter	Comment	EPA Response
67	CSC	Page: 17 **Guidance Statement:** 2.6.4 Methods for Plug Emplacement **Final Rule Language:** **Recommended Revision:** 2.6.4 Methods **and Timing** for Plug Emplacement **Discussion:** Clarification – this section also emphasizes the importance of the timing of plug placement.	The EPA made the suggested edit.
68	Battelle	Page 17 – It is unclear what "adequate time" means for letting plugs sets. Typically, regulators require 24-48 hrs to let cement set. Also, if EPA really wants top of cement tagged, please state this clearly.	The EPA revised Section 2.6.4 to address this comment and included text on tagging, indicating that tagging is an option in cases where it is helpful or necessary to verify plug location.
69	AWWA	Section 2.6.4.2 Retainer Method, page 18 – It is unclear how the retainer method of plug emplacement relates to Class VI injection wells as the guidance indicate this method is useful in uncased boreholes such as an uncased section of an abandoned well or older monitoring well. EPA should clarify the type of well(s) this method would be used for in a GS project or remove this method from the guidance.	The EPA revised the guidance adding text in the first paragraph of Section 2.6.4.2 noting that the cement retainer method could be useful in uncased monitoring wells or in placing a plug across injection perforations, if desired.

ID#	Commenter	Comment	EPA Response
70	API	Section 2.6.4.2, Second paragraph **Guidance Statement:** "The tubing with the retainer is lowered to the bottom of the well, and cement is pumped through the retainer *and allowed to rise up in the hole 50–100 feet above the final depth of the retainer, forming a cement plug above the depth of the retainer*. The tubing is then pressurized, and cement is pumped under pressure below the retainer into the surrounding formation. The retainer valve is then closed, the tubing is disengaged and withdrawn, and the retainer remains in place with a plug of cement above it (Figure 7). Additional details are provided in USEPA (1982)." (emphasis added) **Recommended Revision/Discussion:** While the description above is consistent with USEPA (1982), the danger of such a procedure would be that the workstring could be cemented in the hole because cement is above the packer (retainer). The proper method would be to set the retainer, squeeze cement below the retainer and then pull out of the retainer, dumping cement on top of the retainer. A proper description of the 'Retainer Method' can be found in the National Petroleum Council's Paper #2-25 "Plugging and Abandonment of Oil and Gas Wells" from *Realizing the Potential of North America's Abundant Natural Gas and Oil Resources* (September 15, 2011): Once the [cement retainer] is set in the well, cement can be pumped through the plug to squeeze cement through the perforations or open-hole area below the retainer. Pressure can be applied to the area below the retainer without a concern for cement traveling uphole past the cement retainer. The application of pressure to squeeze the cement through the perforations provides a good method of sealing the well at plugging. *Once the desired amount of cement is squeezed below the retainer, the tubing is pulled upward out of the retainer and a mechanical flap closes the hole to effectively seal the cement below the cement retainer. Cement is then typically placed on top of the cement retainer to provide a more complete seal of the reservoir*. (Page 14-15, emphasis added)	The EPA edited the second paragraph of Section 2.6.4.2 to add text based on the National Petroleum Council's 2011 paper.

2.7. Development and Submittal of Plugging Report

ID#	Commenter	Comment	EPA Response
71	AWWA	Page 21 – AWWA supports EPA's recommendation that owners or operators submit well plugging reports for monitoring wells.	The EPA acknowledges the comment.

Comments on Post-Injection Site Care (Section 3)

Note: the EPA did not receive any comments specific to the following sections of the draft guidance document: Section 3.1.6 (Reporting of PISC Monitoring Results); Section 3.2.1 (Class VI Rule Default Timeframe); Section 3.3.1 (Summary of Existing Monitoring Data); Section 3.3.2 (Comparison of Monitoring Data and Model Predictions and Model Documentation).

ID#	Commenter	Comment	EPA Response
72	CSC	Page: 23 **Guidance Statement:** After the injection phase of a GS project, the project must be monitored as the plume and pressure front will continue to pose a risk of endangerment to USDWs. **Final Rule Language:** **Recommended Revision:** After the injection phase of a GS project, the project must be monitored as the plume and pressure front ~~will~~ **may** continue to pose a **significant** risk of endangerment to USDWs. **Discussion:** "Risk" is not black and white; it is a continuum and requires a qualifier to indicate significance. There will always be some level of risk even if vanishingly small. Throughout these guidance documents, there is a tendency to treat risk as being either present or absent, when some level of risk will always be present. It is only necessary to reduce risk, not to eliminate it – an impossibility.	In response to this and other comments, the EPA reorganized Section 3 to improve clarity. The subject sentence is no longer in the guidance. Additionally, in response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.
73	Battelle	Page 23 – Suggest deleting "and may pose an endangerment to USDWs" at the end of the second sentence in opening paragraph to remove redundancy.	The EPA revised the guidance text to improve clarity and reduce redundancy.
74	CSC	Page: 23 **Guidance Statement:** This is because (1) injected carbon dioxide will remain mobile for site and project specific periods of time and may continue to migrate away from the injection well(s); and (2) elevated pressure within the injection zone, and in some cases overlying zones, will persist for a site-specific period of time and continue to be a driver for fluid movement and may pose an endangerment to USDWs. **Final Rule Language:** **Recommended Revision:** This is because (1) injected carbon dioxide ~~will~~ **can** remain mobile for site and project-specific periods of time and may continue to migrate away from the injection well(s); and (2) elevated pressure within the injection zone, and in some cases overlying zones, will persist for a site-specific period of time and continue to be a driver for fluid movement and may pose an endangerment to USDWs. **Discussion:** There is no way to predict on a general basis whether or not the carbon dioxide will remain mobile. In some cases it may not remain mobile in any true sense.	In response to this and other comments, the EPA reorganized Section 3 to improve clarity. The subject sentence is no longer in the guidance. EPA also included language in applicable sections of the document to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making.

ID#	Commenter	Comment	EPA Response
75	CSC	Page: 23 **Guidance Statement:** This section discusses monitoring techniques that may be used during PISC (Section 3.1) as well as PISC duration (Section 3.2). **Final Rule Language:** **Recommended Revision:** **Discussion:** This is not the most helpful guidance. It would be better to discuss how to develop and implement monitoring strategies.	The EPA edited the document to clarify that post-injection testing and monitoring should be an extension of injection phase testing and monitoring. This guidance document also refers to the Testing and Monitoring Guidance, which provides extensive detail and recommendations for developing and implementing a site-specific testing and monitoring strategy.

3.1. PISC Monitoring

ID#	Commenter	Comment	EPA Response
76	CATF-NRDC	EPA defers PISC monitoring considerations to the UIC Program Class VI Well Testing and Monitoring Guidance. However, there are special considerations that render PISC monitoring different and which should be discussed here. At the end of the injection phase, the operator should have an established and reliable understanding of the plume geometry and be able to predict its future extent more reliably. Thus, the focus in PISC monitoring becomes one of monitoring the final disposition of the plume and pressure front, and less in selecting among a list of tools to characterize its development and migration (as is the case during injection, and which the UIC Program Class VI Well Testing and Monitoring Guidance primarily deals with).This shift in focus can still be compliant with the requirements to show the position of the carbon dioxide plume and pressure front and to demonstrate that USDWs are not being endangered. Although it may be appropriate for PISC monitoring to springboard off the operational monitoring plan, it may not be the best, most reliable or most cost-effective strategy in each case. A focus on potential upward leakage pathways (such as faults, fractures and abandoned wells) and (dis)proving a no-leakage hypothesis maybe a strategy during that differentiates PISC monitoring from injection phase monitoring. EPA should discuss the potential carry-over or modifications from injection-phase monitoring into the PISC, over and above what the UIC Program Class VI Well Testing and Monitoring Guidance covers. In that discussion, EPA should focus on how operators should address vulnerabilities, risk and uncertainties that arose during the operational monitoring.	The EPA edited the document to clarify that post-injection testing and monitoring should be an extension of injection phase testing and monitoring. The EPA focuses Section 3.1 on the unique considerations for/potential testing and monitoring changes during the post-injection phase.

ID#	Commenter	Comment	EPA Response
77	Battelle	Page 23 – Terminology section does not match some specific terms listed in Class 6 PISC Regulations PISC section- ("Post-Injection Computational Modeling," "Pre-and Post Injection Pressure Differential," "Predicted Position of the CO2 Storage Zone and Pressure Front at Site Closure.") These items are specifically called out in 40 CFR 146.93 (a)(2), so it would be useful if they were addressed in the guidance.	The EPA revised the guidance to include terms from the Class VI regulatory language (from 40 CFR 146.93(a)(2)and(3)).
78	API	First paragraph **Guidance Statement:** "To meet these objectives, PISC monitoring programs should be designed to track the location of carbon dioxide *and other mobilized constituents within the injection zone*, track fluid pressures, and monitor the integrity of monitoring wells and former injection wells." (emphasis added) **Discussion:** The requirement to track the location of other mobilized constituents within the injection zone is not specifically mentioned in sections 146.93 or 146.90 (testing and monitoring requirements). Those sections only mention monitoring groundwater quality or changes above the confining zone.	In response to this and other comments, the EPA reorganized Section 3 to improve clarity. The subject sentence is no longer in the guidance. However, the EPA clarifies that neither the rule nor the guidance intend to identify specific parameters to be monitored; such decisions are site-specific.

ID#	Commenter	Comment	EPA Response
79	CSC	Page: 24 **Guidance Statement:** In this way, PISC monitoring frequency can be evaluated to establish the most appropriate monitoring intervals, and PISC monitoring frequency may increase or decrease before eventually ending with final site closure (see Section 3.2). **Final Rule Language:** **Recommended Revision:** In this way, PISC monitoring frequency can be evaluated to establish the most appropriate monitoring intervals, and PISC monitoring frequency may ~~increase or decrease~~ **be adjusted in response to monitoring results** before eventually ending with final site closure (see Section 3.2). **Discussion:** Emphasis on increase or decrease is misplaced and diverts attention from the desirable approach of responding to the results obtained from the monitoring program.	The EPA edited the guidance in response to this comment (see Section 3.3).

3.1.1. PISC and Site Closure Plan and Reevaluation

ID#	Commenter	Comment	EPA Response
80	Battelle	Page 24 – Other EPA Class 6 regulations and guidance documents seem fairly clear that the PISC Plan and AOR reevaluation must be updated every 5 years. However, the 5 year frequency is not mentioned in this section or anywhere else in the document.	The EPA clarifies that the Class VI Rule does not require updates to the PISC and Site Closure Plan on the five-year frequency throughout the life of the project. Rather, the owner or operator may modify and resubmit the plan at any time during the life of the project (40 CFR 146.93(a)(4)). AoR reevaluations must be performed every 5 years, per 40 CFR 146.82. Thus, no revisions to the guidance were made in response to this comment.
81	Battelle	Page 24 – Perhaps it would be helpful to provide layman discussion of what conditions indicate non endangerment to USDWs: e.g., shrinking mobile phase, formation pressures stabilizing or returning towards original conditions, predictable behavior, no evidence of out-of-zone migration, and so on.	The EPA added clarifying text in Section 3 in response to the commenter's suggestion. Additionally, the EPA revised the guidance to clarify the linkage between EPA's recommendations and the conditions needed for a non-endangerment demonstration.
82	API	First paragraph **Guidance Statement:** "The PISC and Site Closure Plan will describe the anticipated methods that will be used to determine risk to USDWs during PISC; *under what conditions risk of endangerment no longer exists,* resulting in project site closure; and under what conditions the frequency of PISC monitoring may be reduced [40 CFR 146.93(a)(2)]. The structure of the plan and additional details are discussed in the UIC Program Class VI Well Project Plan Development Guidance." (emphasis added) **Discussion:** The requirement to specify the conditions under which risk of endangerment no longer exists is not specifically stated in sections 146.93(a)(2) or 146.90.	The EPA modified the guidance to make clearer distinctions between requirements and what the EPA recommends an owner or operator consider including in their PISC and Site Closure Plan. The purpose of the recommendations in the guidance is to support the development of an approvable plan or amendment and to gain agreement on the conditions that must be met for a successful non-endangerment demonstration. In response to this and other comments, the EPA reorganized Section 3 to improve clarity. The subject sentence is no longer in the guidance.

ID#	Commenter	Comment	EPA Response
83	CATF-NRDC	EPA recommends a re-evaluation of the PISC and Site Closure Plan (PISC&SCP) following a revision in the Area Of Review (AOR) revision or facility change. This is a sound suggestion in cases that involve the relocation of proposed monitoring wells, as described in the worked example. However, changes in the Testing and Monitoring Plan, such as the introduction or discontinuation of monitoring techniques may also dictate changes in the PISC&SCP. In addition, potential reasons for modification of the PISC&SCP could also include findings, as opposed to revisions. For example, the nature of monitoring data that has been gathered could indicate unexpected movement of the plume towards a particular well or fault, which would merit additional diligence to establish containment in that area and which may have not been included in the PISC&SCP before. EPA should discuss these possibilities and also encourage revisions in the PISC&SCP whenever significant changes are made to the Testing & Monitoring Plan.	The EPA edited the guidance to encourage periodic updates to the PISC and Site Closure Plan that, while not required, will support consistency across the plans/throughout the permit, e.g., to reflect changes to the project.
84	CSC	Page: 24 **Guidance Statement:** Owners or operators are encouraged to evaluate the necessity of revising the plan within one year of an AoR reevaluation (for details regarding AoR reevaluation, see the UIC Program Class VI Well Area of Review and Corrective Action Guidance), following any significant changes to the facility such as an increase in the number of injection or monitoring wells in the project AoR, or on a schedule to be determined by the UIC Program Director. **Final Rule Language:** **Recommended Revision:** Owners or operators are encouraged to evaluate the necessity of revising the plan within one year of an AoR reevaluation (for details regarding AoR reevaluation, see the UIC Program Class VI Well Area of Review and Corrective Action Guidance), following any significant changes to the facility such as an increase in the number of injection or monitoring wells in the project AoR, or on a schedule to be determined by the UIC Program Director. **Discussion:** This statement presumes that the PISC and Site Closure Plan will be developed on a project basis, which is undoubtedly the best approach. But the Class VI rule requires these plans to be developed and submitted for each individual well. Therefore, EPA should acknowledge that the PISC and Site Closure Plans for each individual well can, and indeed should be, coordinated and revised on a project basis and provide guidance on how this can be done most efficiently within the requirements of the rule.	The EPA added language to confirm that while each Class VI permit is required, by regulation, to have an individual PISC and Site Closure Plan, the EPA encourages plan coordination/revisions on a project-basis–where only well-specific information would be different across the plans.

ID#	Commenter	Comment	EPA Response
85	CSC	Page: 26 **Guidance Statement:** The results of at least three consecutive geophysical surveys that demonstrate the separate-phase carbon dioxide plume is no longer growing in size, either laterally or vertically. **Final Rule Language:** **Recommended Revision:** The results of at least three consecutive geophysical surveys that demonstrate the separate-phase carbon dioxide plume is no longer growing in size, either laterally or vertically**, at a rate that would endanger any USDWs.** **Discussion:** The expectation that the plume will no longer be growing in size is an unreasonable expectation. It is only necessary that the rate of growth has been reduced to a level that will not endanger any USDWs.	The EPA modified the guidance language in Box 3-1 to address this comment.
86	CSC	Page: 26 **Guidance Statement:** All artificial penetrations, including former injection and monitoring wells, within 1 mile of the extent of the separate-phase plume and pressure front, have been evaluated and determined to not pose a risk of endangerment to USDWs. **Final Rule Language:** **Recommended Revision:** All artificial penetrations, including former injection and monitoring wells, within 1 mile of the extent of the separate-phase plume and pressure front, have been evaluated and determined to not ~~pose a risk of~~ endanger~~ment to~~ USDWs. **Discussion:** There will always be some level of "risk" of endangerment even if negligible; the important consideration is whether the plume will endanger a USDW within the meaning of the Safe Drinking Water Act (SDWA).	The EPA modified the guidance language to address this comment. Additionally, in response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.
87	CSC	Page: 27 **Guidance Statement:** If any of these criteria are violated, the owner or operator has committed to reevaluation of the PISC and Site Closure Plan at that time and establishment of additional non-endangerment criteria. **Final Rule Language:** **Recommended Revision:** If any of these criteria are violated, the owner or operator has committed to reevaluation of the PISC and Site Closure Plan at that time and establishment of ~~additional~~ **updated** nonendangerment criteria. **Discussion:** It should not be presumed that the revision of the PISC and Site Closure Plan will result in the "addition" of criteria; that revision may instead result in the modification or substitution of criteria.	The EPA made the suggested edit to Box 3-1**.**
88	Battelle	Page 28 – The use of pressure monitoring is discussed last; however, pressure monitoring is one of the most direct methods for determining system behavior. The value of pressure monitoring merits more emphasis and discussion.	The EPA revised the order of this section in response to this comment. The EPA also notes that the Testing and Monitoring Guidance is referenced for additional information on pressure monitoring techniques.

3.1.2. Use of Monitoring Wells in PISC Monitoring

ID#	Commenter	Comment	EPA Response
89	CSC	We also commend the recognition in the draft guidance that some operators may choose to convert one or more injection wells to monitoring wells following cessation of injection in that well. [Footnote 1] There are other places in the Draft PISC Guidance, however, where there appears to be an assumption that injection wells will be plugged almost immediately after injection of the CO2 stream ceases. We have tried to highlight those places and suggest alternative language that should avoid any confusion about required timing for plugging. Footnote: 1. USEPA, Draft Underground Injection Control (UIC) Program Guidance on Class VI Well Plugging, Post-Injection Site Care, and Site Closure 4 (May 2013): "Plugging activities will most likely begin upon cessation of injection. However, the immediate plugging of the injection well is not a requirement, as some owners or operators may elect to convert an injection well to a monitoring well." It is also worth noting that in Class II enhanced oil recovery (EOR) operations, any given well may be converted from injection to production and vice versa over the course of operations. Any suggestion that CO2 injection wells should be automatically plugged immediately following completion of injections would thus fail to reflect this long-standing, proved routine operational practice.	In response to this and other comments, the EPA clarified in several places throughout the document that injection wells may be used as monitoring wells after the injection period.
90	AWWA	Guidance on Monitoring of USDWs during Post-Injection Site Care (PISC) AWWA supports EPA's recommendation that, during the beginning of the PISC period, owners or operators continue to use any monitoring wells screened within the injection zone, above the primary confining zone, and within any USDW. Furthermore, AWWA agrees that direct monitoring of wells located in overlying USDWs will prove useful information in helping to demonstrate that USDWs are being appropriately protected and are not being endangered. AWWA recommends that at least one monitoring well located within a USDW be included in the PISC monitoring program of in every geological sequestration project. This monitoring would provide information to assist with the non-endangerment analysis and remedial actions in case USDWs are impaired.	The EPA clarified in the guidance that post-injection testing and monitoring should be an extension of injection phase testing and monitoring, which would likely include monitoring of USDWs. This supports the goals of developing and implementing a testing and monitoring approach, throughout the duration of a project, that provides early indication of USDW endangerment and supports a non-endangerment demonstration.

ID#	Commenter	Comment	EPA Response
91	AWWA	AWWA supports EPA's recommendation that, during the beginning of the PISC period, owners or operators continue to use any monitoring wells screened within the injection zone, above the primary confining zone, and within any USDW. Furthermore, AWWA agrees that direct monitoring of wells located in overlying USDWs will provide useful information in helping to demonstrate that USDWs are being appropriately protected and are not being endangered. AWWA recommends that at least one monitoring well located within a USDW be included in the PISC monitoring program of in every geological sequestration project. This monitoring would provide information to assist with the non-endangerment analysis and remedial actions in case USDWs are impaired.	The EPA clarified in the guidance that post-injection testing and monitoring should be an extension of injection phase testing and monitoring, which would likely include monitoring of USDWs. This supports the goals of developing and implementing a testing and monitoring approach, throughout the duration of a project, that provides early warning of USDW endangerment and supports a non-endangerment demonstration.
92	AWWA	Second paragraph page 28 – AWWA supports EPA's recommendation that, during the beginning of the PISC period, owners or operators continue to use any monitoring wells screened within the injection zone, above the primary confining zone, and within any USDW. Furthermore, AWWA agrees that direct monitoring of wells located in overlying USDWs will prove useful information in helping to demonstrate that USDW are not endangered.	The EPA acknowledges the comment. EPA clarified in the guidance that post-injection testing and monitoring should be an extension of injection phase testing and monitoring, which would likely include monitoring of USDWs. This supports the goals of developing and implementing a testing and monitoring approach, throughout the duration of a project, that provides early warning of USDW endangerment and supports a non-endangerment demonstration.

ID#	Commenter	Comment	EPA Response
93	CATF-NRDC	In this section "EPA encourages pressure monitoring to be the primary focus of PISC monitoring". This seems overly sweeping. Pressure monitoring will likely be an important part, or even cornerstone, of monitoring, but ultimately PISC monitoring needs to focus on and be tailored to the risk of leakage and USDW contamination, and uncertainty. Establishing the lack of any CO2 or other fluids in certain areas, such as above the caprock or at some lateral point, may serve as confirmation of stabilization or lack of present danger. We recommend that EPA frame pressure monitoring as an integral and important part of monitoring, but not necessarily as its primary focus. In addition, in this section EPA does not emphasize sufficiently the importance of basing PISC monitoring designed at the time of permitting on risks and vulnerabilities, but instead it seems to suggest a matrix of wells. Monitoring designed at the outset could end up being ineffective and expensive, whereas at the time of the actual PISC, the geometry and migration of the plume should be predictable. At that point, monitoring design should be able to be founded on known data and trends. Given that Class VI requirements dictate a PISC plan to be submitted at the time of permitting and not with the wealth of operational knowledge that will have accrued when PISC begins, EPA should recommend that the PISC monitoring plan be revisited and updated if necessary once the operator has reliable data on plume geometry and migration. EPA should require such data as described in 3.1 to not only report results to EPA but to underpin the PISC monitoring strategy. EPA also considers the use of monitoring wells in PISC monitoring primarily a source of data (see also Box 3.1 where as many as 18 monitoring wells are considered). While this is generally true, we also point out that completions in the injection interval may present additional risk to USDWs through vertical migration. EPA should discuss the use of monitoring wells completed above the injection zone and also consider the risks of injection zone completions. Monitoring above the injection zone at the right interval can provide early detection of migration out of the confining zone without the risk of utilizing former injection or production wells.	The EPA revised the guidance to address this comment. The guidance notes that pressure monitoring is one important part of post-injection monitoring. The EPA clarified in the guidance that post-injection testing and monitoring should be an extension of injection phase testing and monitoring. This supports the goals of developing and implementing a testing and monitoring approach, throughout the duration of a project, that provides early warning of USDW endangerment and supports a non-endangerment demonstration. The guidance also recommends that the owner or operator update the PISC and Site Closure Plan whenever changes to other plans are made to ensure consistency across all the project plans. The EPA acknowledges the potential risk of drilling wells that penetrate the confining zone. The guidance recommends that monitoring wells be strategically located to maximize data collection while minimizing the number of potential conduits for fluid migration. Finally, in response to this and other comments, the EPA included language in applicable sections of the document to acknowledge that project performance/behavior will be site-specific and will necessarily inform site-specific decision making.

3.1.3. Geophysical Surveys during PISC

ID#	Commenter	Comment	EPA Response
94	API	Second paragraph **Guidance Statement:** "Although they are not quantitative and may be subject to uncertainties in interpretation, geophysical methods complement the point measurements collected *using monitoring wells*." (emphasis added) **Discussion:** API would argue that monitoring wells, particularly those penetrating the injection zone, present a risk to near term control and longer term containment. This risk should be weighted relative to decisions to install monitoring wells when geophysical shows no significant anomalies, given site/flood- specific criteria.	The EPA revised the guidance to recommend that monitoring wells be strategically located to maximize useful data collection while minimizing the number of potential conduits for fluid migration. This guidance references the Testing and Monitoring Guidance for additional information on the proper construction of monitoring wells.

3.1.4. Additional PISC Monitoring

ID#	Commenter	Comment	EPA Response
95	CSC	Page: 30 **Guidance Statement:** Furthermore, other monitoring techniques, including surface air and/or soil gas monitoring, may be used to complement geophysical techniques and monitoring wells in evaluating endangerment of USDWs. The reader is referred to the UIC Program Class VI Well Testing and Monitoring Guidance for further details regarding these monitoring techniques. **Final Rule Language:** **Recommended Revision:** ~~Furthermore, o~~**O**ther monitoring techniques, including surface air and/or soil gas monitoring, may be used to complement geophysical techniques and monitoring wells in evaluating endangerment of USDWs **if there is some direct indication that the use of such techniques is appropriate to respond to results indicating some potential for near surface migration.** The reader is referred to the UIC Program Class VI Well Testing and Monitoring Guidance for further details regarding these monitoring techniques. **Discussion:** This is a fairly broad statement without any obvious basis. Air and soil gas monitoring is more likely to be useful in responding to site-specific concerns about leakage to air through identified pathways than it is to indicate endangerment of USDWs. It is not appropriate to presume usefulness for PISC without some basis. The emphasis should be on following data that is generated by the PISC monitoring and choosing to use these additional methods only if there is some direct indication of probable usefulness, as these methods are not required in all cases.	The EPA edited the sentence to read: "Other monitoring techniques, including surface air and/or soil gas monitoring or additional geophysical techniques such as passive seismic monitoring, may be used to provide additional, complementary data."

3.1.5. Frequency of PISC Monitoring

ID#	Commenter	Comment	EPA Response
96	API	Second paragraph **Guidance Statement:** "*EPA encourages the owner or operator to submit with the PISC and Site Closure Plan specific benchmarks* that can indicate a demonstrated decrease in risk to USDWs, thus allowing the UIC Program Director to consider decreasing the frequency of PISC monitoring." (emphasis added) **Discussion:** In Section 3.1.5, EPA encourages the owner or operator to suggest benchmarks, but Section 3.1.1 says the PISC and Site Closure Plan will describe methods and under what conditions the frequency of PISC monitoring may be reduced.	The EPA modified the guidance to encourage owners or operators to consult with their UIC Program Director to determine specific, risk-based, quantitative criteria that, when achieved, will indicate that a reduced monitoring frequency is appropriate. Some examples of such criteria could include the reservoir pressure reaching a certain pressure relative to pre-injection conditions or steady or favorable trends in observed geochemical monitoring results over a pre-defined period.
97	API	Second paragraph **Guidance Statement:** "For example, reduction in PISC monitoring frequency may be based on: • Observation of continual decrease in reservoir pressure toward pre-injection conditions; • Steady or favorable trends in observed geochemical monitoring data over a pre-defined period; • Several repeat demonstrations of monitoring well integrity with MITs; and • A demonstration that reduced monitoring will not lead to endangerment of USDWs." **Discussion:** These criteria should all be placed in the static/dynamic model and decisions on further monitoring should be based on the quality of the data-based history match with this model. This is mentioned later in the draft Guidance in the context of an alternative PISC stage end schedule but should be considered from the beginning of the PISC stage.	The EPA modified the guidance to encourage owners or operators to consult with their UIC Program Director to determine specific, risk-based, quantitative criteria that, when achieved, will indicate that a reduced monitoring frequency is appropriate. Some examples of such criteria could include the reservoir pressure reaching a certain pressure relative to pre-injection conditions or steady or favorable trends in observed geochemical monitoring results over a pre-defined period.
98	Battelle	Page 31 – The last bullet states that a requirement to reduce frequency is "a demonstration that reduced monitoring will not lead to endangerment of USDWs". How to meet this requirement is vague. An example would be helpful.	In response to this and other comments, the EPA modified the bullets to improve clarity and provide specific, measureable examples. The EPA deleted the subject bullet.

3.2. PISC Monitoring Timeframe

ID#	Commenter	Comment	EPA Response
99	CATF-NRDC	An alternative PISC timeframe must be based on "substantial evidence that the geologic sequestration project will no longer pose a risk of endangerment to USDWs at the end of the alternative post-injection site care timeframe" [146.93(c)(1)]. However, this is done at the time of permitting, likely in the absence of detailed stratigraphic data, and with few wells in many saline reservoirs in the country, basing site closure and USDW endangerment risk on modeling will be ill advised (modeling results based on unreliable inputs are also unreliable, regardless of how sophisticated the model is). Although such a showing may be appropriate in case where, for example, large structural closures confine plume migration, EPA should recommend a fresh consideration and showing towards the end of the injection period when data is more reliable and abundant.	The EPA edited the guidance to address this comment. While the regulations require submittal of the plans with the permit application (40 CFR 146.82(a)(16) and (17)), flexibility exists to modify the plans over the life of the project. The guidance now more clearly addresses this flexibility and acknowledges, as the commenter indicates, that injection phase and post-injection phase data should be considered when demonstrating non-endangerment at the end of PISC.
100	CSC	Page: 32 **Guidance Statement:** As required by the Class VI Rule, the default PISC monitoring timeframe is 50 years after the cessation of injection [40 CFR 146.93(b)(1)]. However, at the time of permit submission, the owner or operator may propose a PISC timeframe other than 50 years [40 CFR 146.93(c)]. **Final Rule Language:** **Recommended Revision:** ~~As required by t~~**T**he Class VI Rule~~, the~~ **specifies a** default PISC monitoring timeframe ~~is~~ **of** 50 years after the cessation of injection [40 CFR 146.93(b)(1)]. However~~, at the time of permit submission,~~ the owner or operator may **submit an initial or revised PISC and Site Closure Plan that** propose**s and demonstrates that** a PISC timeframe other than 50 years **is appropriate and ensures nonendangerment of USDWs** [40 CFR 146.93(c)]. **Discussion:** The draft language appears to perpetuate the potentially confusing notion that the proposal and demonstration of an alternative PISC timeframe is somehow limited to the initial permit application. This proposed alternative language is designed to clarify what can be done under the rule.	The EPA edited the guidance to address this comment. While the regulations require submittal of the plans with the permit application (40 CFR 146.82(a)(16) and (17)), flexibility exists to modify the plans over the life of the project. The guidance now more clearly addresses this flexibility.

ID#	Commenter	Comment	EPA Response
101	CSC	Page: 33 **Guidance Statement:** If the owner or operator can demonstrate prior to the end of the pre-defined PISC timeframe that there is no longer risk of endangerment to USDWs (hereafter referred to as the USDW non-endangerment demonstration), the UIC Program Director may approve site closure. Alternatively, if at the end of the pre-defined PISC timeframe there is evidence of risk of endangerment to USDWs, the UIC Program Director may require PISC to continue until those risks no longer exist [40 CFR 146.93(b)(4)]. **Final Rule Language:** 146.93(b) (2) If the owner or operator can demonstrate to the satisfaction of the Director before 50 years or prior to the end of the approved alternative timeframe based on monitoring and other site specific data, that the geologic sequestration project no longer poses an endangerment to USDWs, the Director may approve an amendment to the post injection site care and site closure plan to reduce the frequency of monitoring or may authorize site closure before the end of the 50-year period or prior to the end of the approved alternative timeframe, where he or she has substantial evidence that the geologic sequestration project no longer poses a risk of endangerment to USDWs. **Recommended Revision:** If the owner or operator can demonstrate prior to the end of the pre-defined PISC timeframe that ~~there is no longer risk of~~ **the geologic sequestration project no longer poses an** endangerment to USDWs (hereafter referred to as the USDW non-endangerment demonstration), the UIC Program Director may approve site closure. Alternatively, if at the end of the pre-defined PISC timeframe there is evidence ~~of risk~~ of endangerment to USDWs, the UIC Program Director may require PISC to continue until ~~those risks no longer exist of~~ **the geologic sequestration project no longer poses an endangerment to USDWs** [40 CFR 146.93(b)(4)]. **Discussion:** There is no requirement to show that there is no risk of endangerment to USDWs (nor is it possible to make such a demonstration) or no risk of fluid movement into a USDW. The draft statement must be revised to accurately reflect the requirement in the rule. "Risk" is not black and white; it is a continuum and requires a qualifier to indicate significance. There will always be some level of risk even if vanishingly small. Throughout these guidance documents, there is a tendency to treat risk as being either present or absent, when some level of risk will always be present. It is only necessary to reduce risk, not to eliminate it – an impossibility.	In response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.

3.2.2. Alternative PISC Timeframe

ID#	Commenter	Comment	EPA Response
102	EEI	E. It Is Premature to Address Alternative PISC Periods or PISC Monitoring at the Time A UIC Class VI Permit Application Is Made. The Draft Guidance requires that PISC monitoring obligations and the duration of the PISC period be addressed at the time the UIC Class VI permit is made. See Draft Guidance at 23, 33. It is premature to address these issues before injection. The Draft Guidance states that any application of an alternative PISC period must be "based on detailed site-specific analyses" and that the applicant must "provide substantive documentation to support the petition." Draft Guidance at 33. Before the injection and monitoring phase has commenced, it is not clear that an applicant would have the detailed, site-specific analyses needed to support the alternative PISC period petition as the behavior of the CO2 stream, after injection, in the geologic formation is one of the most important factors in assessing risks to USDW. Therefore, it would be most appropriate to address the duration of the PISC period closer to cessation of injection, when there is sufficient data to provide the required detailed analyses. While the Draft Guidance indicates that the PISC monitoring period may be modified during the life of a GS project, the Draft Guidance strongly suggests that the initial petition must be included in the permit application or be lost. See Draft Guidance at 32, 34. In the final Guidance, EPA should make clear that applicants that choose to wait for actual project data to seek a modified PISC monitoring period are able to do so, and, in fact, are encouraged to do so. EPA also should make clear that any denial of a petition for an alternative PISC period does not prevent subsequent applications based on new or additional data. Similarly, with respect to PISC monitoring requirements, EPA seeks overly specific information before such information is available or necessary. Moreover, the Draft Guidance proposes to require permit applicants to identify what criteria would be used to adjust the scope and frequency of PISC monitoring at the time the permit application is made. It is both premature and overly rigid to insist that such criteria be established before any injection has occurred. Such an approach, which could require a project to continue costly and unnecessary monitoring even when project-specific data demonstrate that the scope or frequency of such monitoring is not required to protect USDW, is contrary to EPA's goal of an adaptive, site-specific UIC Class VI regulatory framework. This approach would ignore actual project data in favor of educated guesses made at the time of permit application and would not allow for the evolution of technology and monitoring techniques.	The EPA made edits throughout the document to clarify that the PISC timeframe can be changed at any time during the injection and PISC phases. The regulations require submittal of the plans with the permit application (40 CFR 146.82(a)(16) and (17)). However, flexibility exists to modify the plans over the life of the project. The EPA also clarified that there is flexibility to submit a non-endangerment demonstration before 50 years, and added discussion of the benefits of establishing non-endangerment demonstration criteria in the PISC and Site Closure Plan to gain owner/operator-UIC Director agreement during the permitting process. Additionally, in response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.

ID#	Commenter	Comment	EPA Response
102 (cont.)	EEI (cont.)	EPA should not require that PISC monitoring requirements be spelled out before a permit is granted. In the alternative, if EPA chooses to finalize the Draft Guidance as proposed, EPA should make it clear that project owners and operators are able allowed to seek changes to PISC monitoring requirements, even if the pre-defined criteria are not met, if other data and information is available and supports a modification to the default PISC period.	
103	CSC	We commend EPA for the excellent recognition of the ability that owners and operators have to make demonstrations to support alternative post-injection site care (PISC) timeframe demonstrations not only at the time of the initial permit application, but at any time during the operational or PISC phases. As noted in the May 20, 2011 letter from multi-stakeholder discussion (MSD) participants (attached), it is important to provide this opportunity to improve such demonstrations based on the best available information gained from monitoring and operational data. This provides operators both the incentive and the opportunity to fine tune operational parameters for geologic sequestration projects using the most extensive available data and information for each project. The discussion of both the requirements and procedures for alternative timeframe demonstrations provided in the draft guidance reflects your previous response to the May 20, 2011 letter and the beneficial conclusion that this demonstration can be made at any point in the process. Notwithstanding this helpful conclusion and the proper guidance reflected at most places in the draft guidance, there are several places where the specific language of statements seems to suggest that the alternative PISC timeframe demonstration is something that can only be done at the time of the initial permit application rather than accomplished as a PISC Plan and permit amendment at later stages. For those few instances, we have noted our concerns and provided suggested revisions to properly reflect the process that is recognized and explained in more detail at other places in the draft guidance. Making these revisions will help to avoid future misunderstanding and disagreements over what is allowed and should be encouraged.	The EPA made edits throughout the document to clarify that the PISC timeframe can be changed at any time during the injection or PISC phases. EPA also removed reference to plume stabilization. The EPA clarifies that the regulations require submittal of the plans with the permit application (40 CFR 146.82(a)(16) and (17)). However, flexibility exists to modify the plans over the life of the project.

ID#	Commenter	Comment	EPA Response
104	CATF-NRDC	§3.2.2.1 - Calculating a modified PISC Timeframe is likely to be a more reliable process than demonstrating an alternative PICS timeframe before injection even begins, due to the availability of data and a far greater degree of understanding for the site. EPA should recommend a statistical analysis of uncertainty in plume geometry and behavior (as it should in the permit process in the AOR and has done in corrective action guidance), not only from the model results, but also from uncertainty in trends observed in the reported data that describe the plume dynamics with time. EPA uses the term "plume stabilization", which is not included in the Class VI rule. We caution against the use of a complete stasis or equilibrium of the plume within the host formation as a requirement for a modified PISC timeframe, as it could be unrealistic or even unnecessary, even over very long timeframes. The emphasis should be on testing the effectiveness of the vertical separation and documenting plume confinement beneath adequate confining zones. If, to a high degree of certainty, the plume will remain deep in the subsurface and below a robust confining zone, then any lateral migration may not result in endangerment and it will be unnecessary for a plume to be in a state of complete stasis. EPA should make it clear that an operator should be allowed to demonstrate that a plume is not migrating vertically, with a robust asymptotic trend toward pressure and chemical equilibrium in a way that will not result in a statistically significant risk of vertical movement or interception of potential leakage pathways.	The EPA clarifies that the regulations require submittal of the plans with the permit application (40 CFR 146.82(a)(16) and (17)). However, flexibility exists to modify the plans over the life of the project. The EPA edited the guidance to highlight this flexibility. The guidance also recommends that the owner or operator update the PISC and Site Closure Plan whenever changes to other plans are made to ensure consistency across all the project plans. The EPA removed reference to "plume stabilization".
105	CSC	Page: 34 **Guidance Statement:** EPA acknowledges that some owners or operators of Class VI wells may plan to eventually produce the carbon dioxide from the injection zone or are interested in preserving this option (e.g., to sell the carbon dioxide for EOR/EGR). **Final Rule Language:** **Recommended Revision:** EPA acknowledges that some owners or operators of Class VI wells may plan to eventually produce the carbon dioxide from the injection zone or ~~are~~ **may be** interested in preserving this option (e.g., to sell the carbon dioxide for EOR/EGR). **Discussion:** Correction	The EPA made the suggested edit to Section 3.2.2.

ID#	Commenter	Comment	EPA Response
106	CSC	Page: 34 **Guidance Statement:** EPA recommends that owners or operators plan a post-injection monitoring period and regime that extends for at least as long as the carbon dioxide is to remain in the ground and until a significant quantity of it is produced such that a demonstration of nonendangerment can be made that pressures and mobile carbon dioxide do not pose a risk to USDWs. **Final Rule Language:** **Recommended Revision:** EPA recommends that owners or operators plan a post-injection monitoring period and regime that extends for at least as long as the carbon dioxide is to remain in the ground and until a significant quantity of it is produced such that a demonstration of nonendangerment can be made that pressures and mobile carbon dioxide do not pose ~~a risk~~ **an endangerment** to USDWs. **Discussion:** Use of the regulatory language avoids the problem with the notion of "zero risk".	In response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.
107	AWWA	Section 3.2.2.1 Modified PISC Timeframe, page 34 – In the third paragraph of this section, EPA acknowledges that some owners or operators of Class VI wells may plan to eventually produce the carbon dioxide from the injection zone or are interested in preserving this option (e.g., to sell the carbon dioxide for EOR/EGR). It is unclear how such operations would be conducted during the PISC, as the injection well must be plugged, unless a separate extraction well is constructed and operated. It is difficult to envision how such well construction and extraction operations could be conducted during the PISC period without affecting the containment of the injected carbon dioxide and potentially endangering USDWs. EPA should consider deleting this paragraph from this guidance document and develop separate detailed guidance to cover such extraction activities.	The EPA added text to the guidance to acknowledge that some owners or operators of Class VI wells may plan to eventually produce the carbon dioxide from the injection zone. The EPA also added text to the guidance to encourage owners or operators to consider the planned withdrawal of the carbon dioxide as a factor in developing an alternative PISC timeframe or revising their PISC timeframe during the life of the GS operation.
108	API	Section 3.2.2.1, Third paragraph **Guidance Statement:** "However, *PISC must continue until pressure reductions and plume stabilization are observed* and non-endangerment can be demonstrated pursuant to requirements at 40 CFR 146.93(b)(1)." (emphasis added) **Discussion:** The draft Guidance does not discuss the scenario of CO2 withdrawal. 'Pressure reductions' and 'plume stabilization' – which is not mentioned in the requirements at 40 CFR 146.93(b)(1) - need to be defined as to what they mean in this context. For example, where are 'pressure reductions' to be measured?	The EPA revised the text to clarify that PISC must continue until non-endangerment can be demonstrated based on plume and pressure front monitoring results pursuant to 40 CFR 146.93(b)(1) and removing the terms "pressure reduction" and "stabilized." Additional language was added to address the scenario of carbon dioxide withdrawal.

ID#	Commenter	Comment	EPA Response
109	API	Section 3.2.2.2, First paragraph **Guidance Statement:** "The Class VI Rule requires that the AoR be delineated using sophisticated computational *modeling that accounts for separate phase flow of carbon dioxide and water* [40 CFR 146.84]." (emphasis added) **Discussion:** 40 CRF 146.84 mentions all phases of the injected CO2 stream, but does not mention two-phase CO2 and water flow. This would be a new requirement.	The EPA revised the text to be more consistent with 40 CFR 146.84 and clarified that the rule requires computational modeling that accounts for all phases of carbon dioxide (e.g., supercritical, dissolved, etc.).
110	CSC	Page: page 35 **Guidance Statement:** The Class VI Rule requires that the AoR be delineated using sophisticated computational modeling that accounts for separate phase flow of carbon dioxide and water [40 CFR 146.84]. **Final Rule Language:** § 146.84(a) The area of review is the region surrounding the geologic sequestration project where USDWs may be endangered by the injection activity. The area of review is delineated using computational modeling that accounts for the physical and chemical properties of all phases of the injected carbon dioxide stream and is based on available site characterization, monitoring, and operational data. **Recommended Revision:** The Class VI Rule requires that the AoR be delineated using ~~sophisticated~~ computational modeling that accounts for separate phase flow of carbon dioxide and water [40 CFR 146.84]. **Discussion:** Addition of the word "sophisticated" adds nothing other than potential confusion. It is much better to use the words from the rule.	The EPA revised the guidance to address this comment and to reflect the Class VI Rule language. The EPA also added references to the AoR Evaluation and Corrective Action Guidance for information on how to perform modeling that meets the requirements of 40 CFR 146.84.
111	CATF-NRDC	§3.2.2.2 - In this section EPA may inadvertently be placing too much emphasis on modeling as a metric for site closure and calculating a timeframe other than 50 years. Although modeling and matching with historical data should be taken into account, site closure should not be approved or modified solely based on model predictions. Instead particular hypotheses of plume extent, exact shape, or lack of pressure propagation to certain zones may need to be tested in practice through actual monitoring and supplement model predictions. <u>We urge EPA to clarify the context of this section by further distinguishing between the requirement to provide a prediction of the timeframe for pressure decline upon the cessation of injection with the alternative PISC demonstration [146.93(c)(1)(ii)] and the generic notion of using modeling as conclusive evidence of plume or pressure front stabilization, non-endangerment of USDWs and determining that a timeframe other than 50 years is appropriate for the PISC.</u>	The EPA retained the discussion of using results of computational modeling performed to delineate the AoR in the guidance, as this is required for an alternative PISC demonstration at 40 CFR 146.93(c)(1)(i). However, the EPA further clarified the importance of using monitoring information in the non-endangerment demonstration to confirm modeled predictions based on the results of testing and monitoring performed during PISC.

ID#	Commenter	Comment	EPA Response
112	CATF-NRDC	§3.2.2.3 - Decline in pressures in the injection zone or the pressure front should not be considered tantamount to, or a prerequisite for, cessation of the risk for USDW contamination. EPA does not define "open conduit", and should do so in order to enable an evaluation of the applicability and validity of the construct.	The EPA revised the guidance to address this comment, deleting equation 1 and the discussion of an open conduit from the guidance.
113	CSC	Page: 36 **Guidance Statement:** A prediction of the timeframe for carbon dioxide plume migration to cease must be included [40 CFR 146.93(c)(1)(iii)] and should be based at least in part on results of computational modeling performed for delineation of the AoR. **Final Rule Language:** (iii) The predicted rate of carbon dioxide plume migration within the injection zone, and the predicted timeframe for the cessation of migration; **Recommended Revision:** A prediction of the **rate of carbon dioxide plume migration within the injection zone, and the timeframe for the cessation of migration** ~~timeframe for carbon dioxide plume migration to cease~~ must be included [40 CFR 146.93(c)(1)(iii)] and should be based at least in part on results of computational modeling performed for delineation of the AoR. **Discussion:** It is better to include the full statement of the regulatory language because that is more consistent with the recognition reflected in the statement below that there will not always be a cessation of movement. The statement in the draft focuses too much on the "timeframe for . . . migration to cease", whereas the language of the rule places the emphasis on predicting both the rate of migration and the timeframe for cessation, thereby recognizing at least implicitly that true cessation may never occur.	The EPA revised the guidance to address this comment.
114	CSC	Page: 36 **Guidance Statement:** EPA recognizes that in some cases, modeled plume migration rates may be very slow while not completely "stopping." Owners or operators are encouraged to evaluate the time it would take for the plume to reach potential receptors (e.g., active or abandoned wells). When the plume is migrating so slowly that this timeframe becomes exceedingly long (e.g., hundreds or thousands of years), the plume migration rate may be considered sufficiently minor as to no longer pose a risk to USDWs. **Final Rule Language:** **Recommended Revision:** **Discussion:** This is an important recognition and an excellent statement of the appropriate approach.	The EPA acknowledges the comment.
115	Battelle	Page 36, 3.2.2.5 Trapping Processes and Predicted Rate of Carbon Dioxide Trapping – It is unclear how trapping rates are supposed to be expressed. For example, what sort of units are expected? Are there any performance criteria for this parameter?	The EPA revised the guidance to address this comment.

ID#	Commenter	Comment	EPA Response
116	AWWA	The draft guidance includes a definition of "injection depth waivers" but includes only indirect reference to these waivers in Section 3.2.2.7 which refers to "… the nearest USDWs above and/or below the injection zone …" AWWA believes that this Guidance document should make reference to the forthcoming Draft UIC Program Class VI Well Injection Depth Waiver Application Guidance, which apparently is still under development, for more detailed information about additional considerations for well plugging, PISC, and Site-Closure phases for projects operating under injection depth waivers to ensure that USDWs will be protected from endangerment and that USDWs will not be impaired by these geological sequestration projects. Although EPA has not yet requested comments on the injection depth waiver guidance, we have included some recommendations for the guidance in our Appendix. AWWA continues to be concerned that the injection depth waiver process allowed by the Class VI rule has many limitations that could result in degradation of USDWs and recommends that EPA proceed with caution.	The EPA deleted the definition of injection depth waiver and all references to injection depth waivers from the guidance discussion. The EPA notes that comments on the injection depth waiver process are beyond the scope and intent of this guidance.

ID#	Commenter	Comment	EPA Response
117	AWWA	Requirements for Projects Operating under Injection Depth Waivers The draft guidance includes a definition of "injection depth waivers" but includes only indirect reference to these waivers in Section 3.2.2.7 which refers to "… the nearest USDWs above and/or below the injection zone…". AWWA believes that this Guidance document should make reference to the forthcoming Draft UIC Program Class VI Well Injection Depth Waiver Application Guidance, which apparently is still under development, for more detailed information about additional considerations for well plugging, PISC, and Site-Closure phases for projects operating under injection depth waivers to ensure that USDWs will be protected from endangerment and that USDW will not be impaired by these geological sequestration projects. AWWA continues to be concerned that the injection depth waiver process allowed by the Class VI rule has many limitations that could result in degradation of USDWs. Many of the requirements are based on good intentions and not on data, and the drinking water community and the citizens they serve are being asked to trust that geologic sequestration technology will work even though there is very little experience with this technology at a large scale. The possibility for unintended consequences to occur with geologic sequestration is very real and is similar to what was observed with the use of Methyl tert-butyl ether (MTBE). MTBE is the fuel additive that was meant to solve an air pollution problem but its use resulted in unanticipated drinking water pollution problems. Carbon dioxide is an energy production/use byproduct that causes air pollution/climate problem but whose mitigation (using geologic sequestration) could potentially cause drinking water contamination and other (supply) problems. EPA needs to draw on the lessons learned from the MTBE situation, and do everything possible to prevent a similar situation from occurring with geologic sequestration. Even though MTBE is an excellent example, the difference in scale between the possible unintended consequences of sequestration and MTBE are huge. Experience gained from deep injection wastewater wells in Florida should also be documented and considered in the injection depth waiver process.	The EPA deleted the definition of injection depth waiver and all references to injection depth waivers from the guidance discussion. The EPA notes that comments on the injection depth waiver process are beyond the scope and intent of this guidance.
118	API	Section 3.2.2.8, Fifth bullet **Guidance Statement:** "In these cases, *the owner or operator must select values from the reported range that are reasonably conservative (i.e., values that result in a longer estimated PISC timeframe)* and are also consistent with other data used to model site-specific information." (emphasis added) **Discussion:** Equating 'reasonably conservative' with values which extend the estimated PISC timeframe implies that these values will not always be consistent with the other data used to model site-specific information.	The EPA revised the guidance to address this comment.

ID#	Commenter	Comment	EPA Response
119	CSC	Page: 40 **Guidance Statement:** In some cases, this model reevaluation may indicate a need to lengthen the alternative PISC timeframe, and such results should be reported to the UIC Program Director with all appropriate documentation. Using this information, the UIC Program Director may reevaluate the alternative PISC timeframe following model calibration and may lengthen the timeframe accordingly. **Final Rule Language:** **Recommended Revision:** In some cases, this model reevaluation may indicate a ~~need to lengthen the~~ longer or shorter alternative PISC timeframe, and such results should be reported to the UIC Program Director with all appropriate documentation. Using this information, the UIC Program Director may reevaluate the alternative PISC timeframe following model calibration and may ~~lengthen~~ **modify** the timeframe accordingly. **Discussion:** There is no particular reason to presume that the alternative PISC timeframe would require adjustment in either direction – longer or shorter. The current draft makes the presumption that the adjustment would be to make it longer. The suggested revision simply takes the more balanced and equitable approach of recognizing that any necessary modification might go in either direction.	The EPA revised the guidance to address this comment.

3.3. Demonstration of USDW Non-Endangerment

ID#	Commenter	Comment	EPA Response
120	Battelle	Page 41 – Suggest making a reference to the template in the Appendix E and referring to Box 3-2.	The EPA added a reference to Box 3-2 in response to this comment. The guidance no longer includes Appendix E.

ID#	Commenter	Comment	EPA Response
121	CSC	Page: 41 **Guidance Statement:** The non-endangerment demonstration should take the form of a detailed report submitted to the UIC Program Director. This report should include all relevant monitoring data and interpretations upon which the non-endangerment demonstration is based and any other information necessary for the UIC Program Director to replicate the analysis. **Final Rule Language:** **Recommended Revision:** The non-endangerment demonstration should take the form of a detailed report submitted to the UIC Program Director. This report should include all relevant monitoring data and interpretations upon which the non-endangerment demonstration is based and any other information necessary for the UIC Program Director to ~~replicate~~ **assess and confirm** the analysis. **Discussion:** It will not always be possible to provide the information necessary for the Director to replicate the analysis, especially where proprietary models are used to conduct some portions of the analysis. Nor should it be necessary for the Director to do exactly the same steps. It should be sufficient for the operator to provide all of the information necessary to allow the Director to conduct a thorough evaluation and to confirm that the results are reasonably justified.	The EPA revised this sentence in response to this comment.

3.3.3. Evaluation of Carbon Dioxide Plume

ID#	Commenter	Comment	EPA Response
122	API	First paragraph **Guidance Statement:** "Under certain conditions, the *separate-phase and aqueous-phase* carbon dioxide plumes may continue to migrate after injection ceases…." (emphasis added) **Discussion:** Refer to alternative terms, e.g., "free" or "gas".	The EPA edited the guidance in response to this comment.

3.3.4. Evaluation of Mobilized Fluids

ID#	Commenter	Comment	EPA Response
123	Battelle	Page 43 – This is a complicated endeavor and the document does not provide adequate guidance. For example, USDWs may contain drinking water contaminants above actionable levels before the injection project begins. Thus, the requirement of "monitoring data indicating a steady or decreasing trend of potential drinking water contaminants below actionable levels (e.g., secondary and maximum contaminant levels)" may not be possible. Furthermore, groundwater contaminants measured over time in a groundwater monitoring well can vary widely over time whether or not an injection project is taking place.	The EPA edited the guidance to emphasize the need for robust data collection during pre-injection phase testing and monitoring so an adequate baseline is established. The EPA also deleted reference to secondary and maximum contaminant levels.

3.3.5. Evaluation of Reservoir Pressure

ID#	Commenter	Comment	EPA Response
124	CSC	Page: 43 **Guidance Statement:** To demonstrate that there is no risk of endangerment to USDWs, the pressures within the injection zone should decline until there is no risk of fluid movement into a USDW or, alternatively, to pre-injection conditions. **Final Rule Language:** 146.93(b)(2) If the owner or operator can demonstrate to the satisfaction of the Director before 50 years or prior to the end of the approved alternative timeframe based on monitoring and other sitespecific data, that the geologic sequestration project no longer poses an endangerment to USDWs, the Director may approve an amendment to the postinjection site care and site closure plan to reduce the frequency of monitoring or may authorize site closure before the end of the 50-year period or prior to the end of the approved alternative timeframe, where he or she has substantial evidence that the geologic sequestration project no longer poses a risk of endangerment to USDWs. **Recommended Revision:** To demonstrate that ~~there is no risk of~~ **the geologic sequestration project no longer poses an** endangerment to USDWs, the pressures within the injection zone should decline until there is no ~~risk of fluid movement into~~ **endangerment to** a USDW or, alternatively, to preinjection conditions. **Discussion:** There is no requirement to show that there is no risk of endangerment to USDWs (nor is it possible to make such a demonstration) or no risk of fluid movement into a USDW. The draft statement must be revised to accurately reflect the requirement in the rule. "Risk" is not black and white; it is a continuum and requires a qualifier to indicate significance. There will always be some level of risk even if vanishingly small. Throughout these guidance documents, there is a tendency to treat risk as being either present or absent, when some level of risk will always be present. It is only necessary to reduce risk, not to eliminate it – an impossibility.	In response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.
125	CATF-NRDC	Box 3.2 is an illustration showing pressure decline to original reservoir pressure as the basis for risk reduction, which per our comments above ignores buoyancy and adjacent vulnerabilities if the plume is not static. EPA does state that "Data used in this demonstration include assessment of the location and migration rate of the carbon dioxide plume and mobilized fluids, results of MITs, and pressure monitoring results within the injection zone". However, we recommend that EPA further clarify that a determination of non-endangerment cannot be made solely on the basis of the pressure curves presented.	The EPA added text in Box 3-2 to clarify that pressure curves are only one component of a successful non-endangerment demonstration.

ID#	Commenter	Comment	EPA Response
126	CSC	Page: 44 Box 3-2 **Guidance Statement:** However, 40 years after the cessation of injection (70 years total from the beginning of injection), the owner or operator has determined that sufficient data exist to demonstrate no ongoing risk of USDW endangerment. **Final Rule Language:** See 40 CFR §146.93(b)(2) above. **Recommended Revision:** However, 40 years after the cessation of injection (70 years total from the beginning of injection), the owner or operator has determined that sufficient data exist to demonstrate ~~no ongoing risk of USDW endangerment.~~ **that the geologic sequestration project no longer poses an endangerment to USDWs.** **Discussion:** "Risk" is not black and white; it is a continuum and requires a qualifier to indicate significance. There will always be some level of risk even if vanishingly small. Throughout these guidance documents, there is a tendency to treat risk as being either present or absent, when some level of risk will always be present. It is only necessary to reduce risk, not to eliminate it – an impossibility.	In response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.
127	Battelle	Page 45, Figure 10 – Indicate on graph the year that injection stops (30 years) and the end of default PISC timeframe (80 years) on graph. Also, instead of using small square boxes, fill the page to provide a better sense of the length of time (100 years) involved.	The EPA modified the figure to address this comment.

3.3.6. Evaluation of Potential Conduits for Fluid Movement

ID#	Commenter	Comment	EPA Response
128	CATF-NRDC	This is an important discussion and we commend EPA for including it. However, EPA should integrate considerations of leakage pathways or conduits to fluid movement in its PISC monitoring and non-endangerment demonstration approaches.	The EPA added text in the introduction to Section 3.3 recommending that PISC monitoring consider leakage pathways or conduits for fluid movement to ensure that USDWs are protected from endangerment.

ID#	Commenter	Comment	EPA Response
129	CSC	Page: 46 **Guidance Statement:** The demonstration may include a narrative explanation of all analyses that have been conducted to identify potential conduits (i.e., aeromagnetic surveys, records review), a listing of all potential conduits, and an explanation of why each conduit no longer poses any risk of endangerment of a USDW. **Final Rule Language:** See 40 CFR §146.93(b)(2) above. **Recommended Revision:** The demonstration may include a narrative explanation of all analyses that have been conducted to identify potential conduits (i.e., aeromagnetic surveys, records review), a listing of all potential conduits, and an explanation of why each conduit no longer poses an~~y risk of~~ endangerment of a USDW. **Discussion:** "Risk" is not black and white; it is a continuum and requires a qualifier to indicate significance. There will always be some level of risk even if vanishingly small. Throughout these guidance documents, there is a tendency to treat risk as being either present or absent, when some level of risk will always be present. It is only necessary to reduce risk, not to eliminate it – an impossibility.	In response to this and other comments, the EPA modified the text throughout the final guidance to refer to "endangerment of USDWs," rather than "risk" wherever appropriate.

Comments on Site Closure (Section 4)

ID#	Commenter	Comment	EPA Response
130	CSC	Page: 47 **Guidance Statement:** Site closure may only occur after the UIC Program Director releases the owner or operator of a GS site from PISC responsibilities following a demonstration that the site no longer poses a risk of endangerment to USDWs pursuant to requirements at 40 CFR 146.93(b) (see Section 3). **Final Rule Language:** **Recommended Revision:** Site closure **means the specific point or time, as determined by the UIC Program Director following the requirements under 40 CFR 146.93, at which the owner or operator of a GS site is released from PISC responsibilities. The requirements of 40 CFR 146.93 include** ~~may only occur after the UIC Program Director releases the owner or operator of a GS site from PISC responsibilities following~~ a demonstration that the site no longer poses an ~~risk of~~ endangerment to USDWs pursuant to requirements at 40 CFR 146.93(b) (see Section 3). **Discussion:** It is preferable to use the defined terminology as defined. In addition, "risk" is not black and white; it is a continuum and requires a qualifier to indicate significance. There will always be some level of risk even if vanishingly small. Throughout these guidance documents, there is a tendency to treat risk as being either present or absent, when some level of risk will always be present. It is only necessary to reduce risk, not to eliminate it – an impossibility.	The EPA clarifies that the "site closure" definition, suggested by the commenter, is included in the definitions section of the guidance while Section 4 is designed to provide guidance that complements the regulations and the regulatory definition. In response to this comment, the EPA revised the guidance to remove the term "risk" and instead focus on non-endangerment of USDWs.
131	CSC	Page: 47 **Guidance Statement:** Additionally, with the conclusion of site closure, the owner or operator will be released from financial responsibility requirements associated with the GS project (40 CFR 146.85(b)(1); see the UIC Program Class VI Financial Responsibility Guidance). **Final Rule Language:** **Recommended Revision:** Additionally, ~~with the~~ **at conclusion of** site closure, the owner or operator **will be** ~~is~~ released from financial responsibility requirements associated with the GS project (40 CFR 146.85(b)(1); see the *UIC Program Class VI Financial Responsibility Guidance).* **Discussion:** Correction and clarification.	The EPA made the suggested edits.

ID#	Commenter	Comment	EPA Response
132	CSC	Page: 47 **Guidance Statement:** While not required, EPA recommends that owners or operators describe in their PISC and Site Closure Plan how they plan to conduct site closure following the conclusion of the PISC period. **Final Rule Language:** **Recommended Revision:** **Discussion:** Excellent statement	The EPA acknowledges the comment.

4.1. Site Closure Notification

ID#	Commenter	Comment	EPA Response
133	AWWA	Notifying Interested parties of Site Closure The EPA draft guidance states that the site closure report must also include documentation of appropriate notification and information to state, local, and tribal authorities that have authority over drilling activities. AWWA strongly encourages that EPA consider recommending that owners and operators also provide notification to the State Drinking Water Primacy Agency and potentially affected water utilities using the USDWs.	The EPA added language to Section 4.3 (on Site Closure Reporting and Recordkeeping) in response to this comment.

4.2. Monitoring Well Plugging

ID#	Commenter	Comment	EPA Response
134	AWWA	In several places throughout the draft guidance document, EPA includes recommendations that monitoring wells be plugged in a manner similar to Class VI injection wells and that owners or operators provide notification of and reporting on plugging of monitoring wells following the requirements for Class VI well plugging. AWWA supports these recommendations.	The EPA acknowledges the comment.
135	AWWA	Requirements for Monitoring Well Plugging In several places throughout the draft guidance document, EPA includes recommendations that monitoring wells be plugged in a manner similar to Class VI injection wells and that owners or operators provide notification of and reporting on plugging of monitoring wells following the requirements for Class VI well plugging. AWWA supports these recommendations.	The EPA acknowledges the comment.
136	AWWA	page 48 – AWWA supports EPA's recommendations that owners or operators plug their monitoring wells using procedures similar to those used to plug injection wells and that advanced notice of plugging monitoring wells be provided to the UIC Program Director.	The EPA acknowledges the comment.

4.3. Site Closure Reporting and Recordkeeping

ID#	Commenter	Comment	EPA Response
137	AWWA	The EPA draft guidance states that the site closure report must also include documentation of appropriate notification and information to state, local, and tribal authorities that have authority over drilling activities. AWWA strongly encourages EPA to consider recommending that owners and operators also provide notification to the State Drinking Water Primacy Agency and potentially affected water utilities using the USDWs.	The EPA added language to Section 4.3 in response to this comment.
138	CATF-NRDC	EPA should recommend that the Site Closure Report include information on extent and location of CO2 plume, and pressure front as well as any other parameters pertinent to evaluating risk of fluid migration along potential leakage pathways identified during operation and the PISC period.	The EPA added language to Section 4.3 in response to this comment.
139	AWWA	page 49 – This section indicates that the site closure report must also include documentation of appropriate notification and information to state, local, and tribal authorities that have authority over drilling activities. EPA should consider recommending that owners and operators also provide notification to the State Drinking Water Primacy Agency and potentially affected water utilities using the USDWs.	The EPA added language to Section 4.3 in response to this comment.

4.4. Post-Site Closure Activities

ID#	Commenter	Comment	EPA Response
140	AWWA	AWWA is encouraged that EPA addresses the continuing financial liability of owners or operators following site closure for any remedial action deemed necessary for USDW endangerment caused by the injection operation, in this guidance and in other relevant guidance documents. AWWA is concerned that appropriate means may not exist by which drinking water utilities could recover any costs incurred as a result of USDW contamination by geological sequestering activities. Everyone needs to apply the lesson learned from MTBE contamination to prevent unintended consequences from developing with geological sequestering wells and assure that processes are in place to correct any consequences that do occur accidentally or unexpectedly.	The EPA acknowledges the comment.

ID#	Commenter	Comment	EPA Response
141	AWWA	Financial Requirements after Site Closure AWWA is encouraged that EPA addresses (Section 4.4, page 50) the continuing financial liability of owners or operators following site closure for any remedial action deemed necessary for USDW endangerment caused by the injection operation. AWWA is concerned that appropriate means may not exist by which drinking water utilities could recover any costs incurred as a result of USDW contamination by geological sequestering activities, should any occur. Everyone needs to apply the lesson learned from MTBE contamination to prevent unintended consequences from developing with geological sequestering wells and assure that processes are in place to correct any consequences that do occur, even if accidentally or unexpectedly.	The EPA acknowledges the comment.

ID#	Commenter	Comment	EPA Response
142	CSC	Page: 50 **Guidance Statement:** Following site closure, the owner or operator is responsible for any remedial action deemed necessary for USDW endangerment caused by the injection operation. Therefore, the owner or operator is still financially liable for the site. Under the final Class VI Rule, once an owner or operator has met all regulatory requirements under 40 CFR Part 146 for Class VI wells and the UIC Program Director has approved site closure pursuant to requirements at 40 CFR 146.93, the owner or operator will generally no longer be subject to enforcement for regulatory noncompliance. Separate from EPA's authority to enforce regulatory compliance, an owner or operator may be subject to a response order under Section 1431 of SDWA even after proper site closure is approved under 40 CFR 146.93. Under Section 1431 of SDWA, the Administrator may require an owner or operator to take necessary response measures if he or she receives information that a contaminant is present or is likely to enter a public water system or a USDW, which may present an imminent and substantial endangerment to the health of persons, and the appropriate state and local authorities have not acted to protect the health of such persons. The action may include issuing administrative orders or commencing a civil action for appropriate relief against the owner or operator of a Class VI well. If the owner or operator fails to comply with the order, they may be subject to a civil penalty for each day in which such violation occurs or failure to comply continues. Furthermore, after site closure an owner or operator may remain liable under tort and other remedies, or under other federal statutes including, but not limited to, the Clean Air Act (CAA), 42 U.S.C. 7401-7671; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675; and the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901-6992. **Final Rule Language:** **Recommended Revision:** ~~Following site closure, the owner or operator is responsible for any remedial action deemed necessary for USDW endangerment caused by the injection operation. Therefore, the owner or operator is still financially liable for the site. Under the final Class VI Rule, once an owner or operator has met all regulatory requirements under 40 CFR Part 146 for Class VI wells and the UIC Program Director has approved site closure pursuant to requirements at 40 CFR 146.93, the owner or operator~~	The EPA retained this text to support an understanding of the UIC regulations and the applicability of other potential responsibilities beyond SDWA, EPA clarifies that the guidance does not impose additional requirements under CAA, CERCLA, or RCRA.

ID#	Commenter	Comment	EPA Response
142 (cont.)	CSC (cont.)	~~will generally no longer be subject to enforcement for regulatory noncompliance. Separate from EPA's authority to enforce regulatory compliance, an owner or operator may be subject to a response order under Section 1431 of SDWA even after proper site closure is approved under 40 CFR 146.93. Under Section 1431 of SDWA, the Administrator may require an owner or operator to take necessary response measures if he or she receives information that a contaminant is present or is likely to enter a public water system or a USDW, which may present an imminent and substantial endangerment to the health of persons, and the appropriate state and local authorities have not acted to protect the health of such persons. The action may include issuing administrative orders or commencing a civil action for appropriate relief against the owner or operator of a Class VI well. If the owner or operator fails to comply with the order, they may be subject to a civil penalty for each day in which such violation occurs or failure to comply continues. Furthermore, after site closure an owner or operator may remain liable under tort and other remedies, or under other federal statutes including, but not limited to, the Clean Air Act (CAA), 42 U.S.C. 7401-7671; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675; and the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901-6992.~~ **Discussion:** This language needs to be deleted. A guidance document is not the proper place for EPA to assert a legal conclusion that is not based on the provisions of the rule for which guidance is being provided. See the Disclaimer provided at page i of the draft guidance: "The Safe Drinking Water Act (SDWA) provisions and EPA regulations cited in this document contain legally binding requirements. In several chapters, this guidance document makes recommendations and offers alternatives that go beyond the minimum requirements indicated by the Class VI Rule. This is intended to provide information and recommendations that may be helpful for UIC Class VI Program implementation efforts. Such recommendations are prefaced by the words 'may' or 'should' and are to be considered advisory. They are not required elements of the Class VI Rule. Therefore, this document does not substitute for those provisions or regulations, nor is it a regulation itself, so it does not impose legally-binding requirements on EPA, states, or the regulated community."	