Underground Natural Gas Storage - Reservoirs - Integrity in Reservoir Design

1. **Geological Characterization - Evaluation** Is there a process for preliminary evaluation, characterization, and mapping of the geologic properties of the reservoir that is intended for storing gas? (UNGS.RESDES.GEOLOGICEVAL.P) 192.12(c) (API RP1171, Section 5.2.2)

2. **Geological Characterization - Evaluation** Do records demonstrate that the intended reservoir was evaluated, characterized and mapped for properties intended for gas storage? (UNGS.RESDES.GEOLOGICEVAL.R) 192.12(c) (API RP1171, Section 5.2.2)

3. **Geological Characterization - Buffer Zone** Does the process use the geologic characterization to establish the initial vertical and areal buffer zone to protect the integrity of the natural gas storage operation? (UNGS.RESDES.GEOLOGICBUFFER.P) 192.12(c) (API RP1171, Section 5.2.2)

4. **Geological Characterization - Buffer Zone** Do records demonstrate that the initial vertical and areal buffer zones were established based on the geological characterization? (UNGS.RESDES.GEOLOGICBUFFER.R) 192.12(c) (API RP1171, Section 5.2.2)

5. **Engineering Characterization - Design for Integrity** Does the process require, at a minimum, evaluation of the casing materials, casing configuration, casing set depths, cement materials, and placement depths for mechanical integrity of all existing and abandoned wells that penetrate the formations being characterized for storage purposes? (UNGS.RESDES.ENGRCHCTR1.P) 192.12(c) (API RP1171, Section 5.3.2)

6. **Engineering Characterization - Design for Integrity** Do records demonstrate that all existing and abandoned wells, that penetrate the characterized formation for storage, have been evaluated for casing materials, casing configuration, casing set depths, cement materials, and placement depths for functional integrity? (UNGS.RESDES.ENGRCHCTR1.R) 192.12(c) (API RP1171, Section 5.3.2)

7. **Engineering Characterization - Corrosive Potential** Does the process account for the corrosive potential of the pore fluids if the storage reservoir was used for gas-liquid or oil production? (UNGS.RESDES.ENGRCHCTR2.P) 192.12(c) (API RP1171, Section 5.3.2)

8. **Engineering Characterization - Corrosive Potential** Do records demonstrate that pore fluids have been evaluated for corrosive potential? (UNGS.RESDES.ENGRCHCTR2.R) 192.12(c) (API RP1171, Section 5.3.2)
Does the process incorporate the corrosive potential of pore fluids, if present, into the design and operation strategies of the storage reservoir?  
(UNGS.RESDES.ENGRCHCTR3.P) 192.12(c) (API RP1171, Section 5.3.2)

10. Engineering Characterization - Corrosion Management  
If there is a corrosive potential from pore fluids, do records demonstrate that the design and operation accounts for the corrosive potential?  
(UNGS.RESDES.ENGRCHCTR3.R) 192.12(c) (API RP1171, Section 5.3.2)

11. Engineering Characterization - Fluids Issues  
Does the process require identification and mitigation of potential mineralogical and fluid compatibility issues?  
(UNGS.RESDES.ENGRCHCTR4.P) 192.12(c) (API RP1171, Section 5.3.2)

12. Engineering Characterization - Fluids Issues  
Do records demonstrate that mineralogical and fluid compatibility issues are identified and mitigated?  
(UNGS.RESDES.ENGRCHCTR4.R) 192.12(c) (API RP1171, Section 5.3.2)

13. Engineering Characterization - Reservoir Pressures  
Does the characterization process require the identification of initial and current reservoir pressures based on known data?  
(UNGS.RESDES.ENGRCHCTR5.P) 192.12(c) (API RP1171, Section 5.3.2)

14. Engineering Characterization - Reservoir Pressures  
Do records demonstrate that the initial and current pressures, for the target reservoir, are identified based on known data?  
(UNGS.RESDES.ENGRCHCTR5.R) 192.12(c) (API RP1171, Section 5.3.2)

15. Engineering Characterization - All  
Are field observations consistent with the engineering characterization of the reservoir?  
(UNGS.RESDES.ENGRCHCTRALL.O) 192.12(C) (API RP1171, Section 5.3.2)

16. Reservoir Containment Assurance Analysis  
Does the process require that data be acquired to manage uncertainties that were identified during the geologic and engineering characterization process?  
(UNGS.RESDES.CONTASSURANCE.P) 192.12(c) (API RP1171, Section 5.4.1)

17. Reservoir Containment Assurance Analysis  
Do records indicate that data was acquired to manage uncertainties identified during the characterization process?  
(UNGS.RESDES.CONTASSURANCE.R) 192.12(c) (API RP1171, Section 5.4.1)
18. Containment Capability of Reservoir  Does the process assess the containment capability of the reservoir and the wells for the designed storage operation volumes, pressures, and rates? (UNGS.RESDES.CONTCAPABILITY.P) 192.12(c) (API RP1171, Section 5.4.1)

19. Containment Capability of Reservoir  Do records demonstrate that the containment capability of the reservoir and wells was assessed for the designed storage operation volumes, pressures, and rates? (UNGS.RESDES.CONTCAPABILITY.R) 192.12(c) (API RP1171, Section 5.4.1)

20. Containment Assurance - Reservoir Connectivity  Does the process address gas migration control and containment when porous zones are connected with the target reservoir? (UNGS.RESDES.GASMIGRATION.P) 192.12(c) (API RP1171, Section 5.4.2)

21. Containment Assurance - Reservoir Connectivity  Do records demonstrate that gas migration control and containment were addressed in the design, if the target reservoir is connected to another porous zone? (UNGS.RESDES.GASMIGRATION.R) 192.12(c) (API RP1171, Section 5.4.2)

22. Maximum Reservoir Pressure  Does the process provide a design basis for the maximum pressure of the storage reservoir? (UNGS.RESDES.MAXRESPRESS.P) 192.12(c) (API RP1171, Section 5.4.3)

23. Maximum Reservoir Pressure  Do records demonstrate that the design basis for the maximum reservoir pressure was documented? (UNGS.RESDES.MAXRESPRESS.R) 192.12(c) (API RP1171, Section 5.4.3)

24. Maximum Pressures - Wells, Piping, and Other  Does the process provide a design basis for the maximum pressure of the wells, wellheads, piping, or associated storage facilities? (UNGS.RESDES.MAXPRESSOTHER.P) 192.12(c) (API RP1171, Section 5.4.3)

25. Maximum Pressures - Wells, Piping, and Other  Do records demonstrate that the pressure limits of the wells, wellheads, piping, and associated storage facilities are not exceeded? (UNGS.RESDES.MAXPRESSOTHER.R) 192.12(c) (API RP1171, Section 5.4.3)

26. Maximum Pressures - Reservoir, Wells, Piping, and Other  Do pressure reading observations reflect that actual pressures are within the established set limits? (UNGS.RESDES.MAXPRESSALL.O) 192.12(c) (API RP1171, Section 5.4.3)
27. **Well Containment Assurance Analysis** Does the process require evaluation of all wells that penetrate the storage zone for containment assurance? (UNGS.RESDES.WELLCONTASSURANCE.P) 192.12(c) (API RP1171, Section 5.4.4)

28. **Well Containment Assurance Analysis** Do records demonstrate that all wells that penetrate the storage zone have been evaluated for containment assurance? (UNGS.RESDES.WELLCONTASSURANCE.R) 192.12(c) (API RP1171, Section 5.4.4)

29. **Supplemental Evaluation of Reservoirs Developed within Aquifers** For storage reservoirs developed within aquifers, does the process require supplemental reservoir geological and engineering evaluation for the delineation of the storage reservoir? (UNGS.RESDES.AQUIFEREVAL01.P) 192.12(c) (API RP1171, Section 5.4.5)

30. **Supplemental Evaluation of Reservoirs Developed within Aquifers** Do records demonstrate that supplemental aquifer reservoir geological and engineering evaluations were performed? (UNGS.RESDES.AQUIFEREVAL01.R) 192.12(c) (API RP1171, Section 5.4.5)

31. **Supplemental Evaluation of Reservoirs Developed within Aquifers** For storage reservoirs developed within aquifers, does the process require data gathering and characterization of the reservoir, caprock, basal rock, and lateral seals through drilling, logging and coring? (UNGS.RESDES.AQUIFEREVAL02.P) 192.12(c) (API RP1171, Section 5.4.5)

32. **Supplemental Evaluation of Reservoirs Developed within Aquifers** Do records demonstrate that aquifer containment assurance data was acquired through drilling, logging, and coring of the aquifer? (UNGS.RESDES.AQUIFEREVAL02.R) 192.12(c) (API RP1171, Section 5.4.5)

33. **Supplemental Evaluation of Reservoirs Developed within Aquifers** For storage reservoirs developed within aquifers, does the process require that site specific geophysical delineation be performed? (UNGS.RESDES.AQUIFEREVAL03.P) 192.12(c) (API RP1171, Section 5.4.5)

34. **Supplemental Evaluation of Reservoirs Developed within Aquifers** Do records demonstrate that site specific geophysical delineation was conducted for the aquifer storage? (UNGS.RESDES.AQUIFEREVAL03.R) 192.12(c) (API RP1171, Section 5.4.5)
35. **Supplemental Evaluation of Reservoirs Developed within Aquifers** For storage reservoirs developed within aquifers, is there a process requiring that water pump testing and water level observation be performed to characterize the storage reservoir dimensions, gas capacity, flow performance, and caprock integrity? (UNGS.RESDES.AQUIFEREVAL04.P) 192.12(c) (API RP1171, Section 5.4.5)

36. **Supplemental Evaluation of Reservoirs Developed within Aquifers** Do records demonstrate that a water pump test and water level observation were performed to characterize the storage reservoir within an aquifer? (UNGS.RESDES.AQUIFEREVAL04.R) 192.12(c) (API RP1171, Section 5.4.5)

37. **Storage Design Recordkeeping** Does the process require design records to be maintained for the following activities: geologic records; engineering records; land and mineral ownership, rights, and control; facility integrity plan; well drilling, completion, workover and plugging records; regulatory records and permits? (UNGS.RESDES.DESRECORDS.P) 192.12(c) (API RP1171, Section 5.6)

38. **Storage Design Recordkeeping** Do records demonstrate that the required design records have been maintained? (UNGS.RESDES.DESRECORDS.R) 192.12(c) (API RP1171, Section 5.6)

39. **Storage Design Recordkeeping - Life of Facility** Does the process require that accurate and comprehensive records of natural gas storage design activities be maintained for the life of the facility? (UNGS.RESDES.DESRECORDSLOF.P) 192.12(c) (API RP1171, Section 5.6)

40. **Storage Design Recordkeeping - Life of Facility** Are design records accurate and comprehensive and maintained for the lifetime of the facility? (UNGS.RESDES.DESRECORDSLOF.R) 192.12(c) (API RP1171, Section 5.6)
Underground Natural Gas Storage - Reservoirs - Integrity in Well Design & Construction

1. **Design of Wellhead Equipment** Does the process ensure that new and replaced wellheads allow for full diameter entry to the wellbore? (UNGS.RESWELLDES.WELLHEADEQUIP.P) 192.12(c) (API RP1171, Section 6.2.2)

2. **Design of Wellhead Equipment** Do records demonstrate that new and replaced wellheads allow for full diameter entry to the wellbore? (UNGS.RESWELLDES.WELLHEADEQUIP.R) 192.12(c) (API RP1171, Section 6.2.2)

3. **Design of Wellhead Equipment - Restricted Diameter** Does the process require review of well records to determine if limited wellhead entry is sufficient for planned activities? (UNGS.RESWELLDES.WELLHEADENTRY.P) 192.12(c) (API RP1171, Section 6.2.2)

4. **Design of Wellhead Equipment - Isolation Valve** Does the process require that wells be equipped with valves that provide isolation of the well from the pipeline system and for entry into the wellbore? (UNGS.RESWELLDES.WELLHEADISOLVLV.P) 192.12(c) (API RP1171, Section 6.2.2)

5. **Design of Wellhead Equipment - Isolation Valve** Do records demonstrate that wells are equipped with valves that provide isolation from the pipeline and entry into the wellbore? (UNGS.RESWELLDES.WELLHEADISOLVLV.R) 192.12(c) (API RP1171, Section 6.2.2)

6. **Design of Wellhead Equipment - Pressure Rating** Does the process ensure that wellhead equipment is pressure rated to exceed the maximum anticipated operating pressure? (UNGS.RESWELLDES.WELLHEADRATING.P) 192.12(c) (API RP1171, Section 6.2.3)

7. **Design of Wellhead Equipment - Pressure Rating** Do records demonstrate that wellhead equipment is pressure rated to exceed the maximum anticipated operating pressure? (UNGS.RESWELLDES.WELLHEADRATING.R) 192.12(c) (API RP1171, Section 6.2.3)

8. **Design of Wellhead Equipment - Pressure Rating** Do pressure ratings of wellhead equipment reflect the documented ratings? (UNGS.RESWELLDES.WELLHEADRATING.O) 192.12(c) (API RP1171, Section 5.5.1)
9. **Design of Wellhead Equipment - ESD Valve Review** Does the process require evaluation of the need of an emergency shut down (ESD) valve by reviewing the requirements of API RP 1171 section 6.2.5? (UNGS.RESWELLDES.WELLHEADESD.P) 192.12(c) (API RP1171, Section 6.2.5)

10. **Design of Wellhead Equipment - ESD Valve Review** Do records demonstrate that the need for emergency shutdown valves were reviewed based on the requirements of API RP 1171 Section 6.2.5? (UNGS.RESWELLDES.WELLHEADESD.R) 192.12(c) (API RP1171, Section 6.2.5)

11. **Well Casing - Completion** Does the process require that well designs are completed with two or more strings of casing to protect ground water, control wellbore conditions, isolate the storage gas, and inject storage gas from the pipeline into and withdraw out of the storage reservoir? (UNGS.RESWELLDES.WELLCOMPLETION.P) 192.12(c) (API RP1171, Section 6.3.1)

12. **Well Casing - Completion** Do well records indicate that storage wells are completed with two or more strings of casing to protect ground water, control wellbore conditions, isolate the storage gas, and inject storage gas from the pipeline into and withdraw out of the storage reservoir? (UNGS.RESWELLDES.WELLCOMPLETION.R) 192.12(c) (API RP1171, Section 6.3.1)

13. **Well Casing - Design per API 5C3** Does the process require the use API 5C3 for casing designs? (UNGS.RESWELLDES.WELLCASINGDES.P) 192.12(c) (API RP1171, Section 6.3.1)

14. **Well Casing - Design per API 5C3** Do well records indicate that API 5C3 was used for the design of the casings? (UNGS.RESWELLDES.WELLCASINGDES.R) 192.12(c) (API RP1171, Section 6.3.1)

15. **Surface Casing Design** Does the design process require that the surface casing be of sufficient size, grade, and depth to support drilling operations and to protect groundwater? (UNGS.RESWELLDES.SURFCASINGDES.P) 192.12(c) (API RP1171, Section 6.3.3)

16. **Surface Casing Design** Do records indicate that the surface casing is of sufficient size, grade, and depth to support drilling operations and to protect groundwater? (UNGS.RESWELLDES.SURFCASINGDES.R) 192.12(c) (API RP1171, Section 6.3.3)

17. **Production Casing Design** Does the design process require that the production casing be of adequate size and strength to maintain the well integrity? (UNGS.RESWELLDES.PRODCASINGDES1.P) 192.12(c) (API RP1171, Section 6.3.5)
18. Production Casing Design  Do records indicate that the surface casing is of sufficient size, grade, and depth to maintain the well integrity and be compatible with fluid chemical composition? (UNGS.RESWELLDES.PRODCASINGDES1.R) 192.12(c) (API RP1171, Section 6.3.5)

19. Production Casing Design - Fluids Compatibility  Does the design process require that the production casing be compatible with fluid chemical composition? (UNGS.RESWELLDES.PRODCASINGDES2.P) 192.12(c) (API RP1171, Section 6.3.5)

20. Production Casing Design - Fluids Compatibility  Do records indicate that the production casing is compatible with fluid chemical composition? (UNGS.RESWELLDES.PRODCASINGDES2.R) 192.12(c) (API RP1171, Section 6.3.5)

21. Production Casing Design - Perforations  Does the process require that the production casing be free of open perforations or holes other than the planned completion interval(s)? (UNGS.RESWELLDES.PRODCASINGDES3.P) 192.12(c) (API RP1171, Section 6.3.5)

22. Production Casing Design - Perforations  Do records indicate that the production casing is free of open perforations or holes other than the planned completion interval(s)? (UNGS.RESWELLDES.PRODCASINGDES3.R) 192.12(c) (API RP1171, Section 6.3.5)

23. Production Casing Design - Perforations Sealed  Does the process require that perforations created in production casing for investigative or remedial work be sealed to establish hydraulic isolation? (UNGS.RESWELLDES.PRODCASINGDES4.P) 192.12(c) (API RP1171, Section 6.3.5)

24. Production Casing Design - Perforations Sealed  Do records indicate that perforations created in production casing for investigative or remedial work were sealed to establish hydraulic isolation? (UNGS.RESWELLDES.PRODCASINGDES4.R) 192.12(c) (API RP1171, Section 6.3.5)

25. Casing Handling and Transport  Does the process ensure that the casing is stored, transported, lifted, and installed according to manufacturer specifications and API 5C1? (UNGS.RESWELLDES.CASINGHANDLING.P) 192.12(c) (API RP1171, Section 6.3.6)

26. Casing Handling and Transport  Do records demonstrate that the casing was stored, transported, lifted and installed as specified by the manufacturer and API 5C1? (UNGS.RESWELLDES.CASINGHANDLING.R) 192.12(c) (API RP1171, Section 6.3.6)
27. Casing Connections - Design Does the process require that casing connections be designed to accommodate loads associated with placement? (UNG.S.RESWELLDES.CASINGCONN1.P) 192.12(c) (API RP1171, Section 6.3.7)

28. Casing Connections - Design Do records demonstrate that the casing connections can withstand loads associated with placement of the casing? (UNG.S.RESWELLDES.CASINGCONN1.R) 192.12(c) (API RP1171, Section 6.3.7)

29. Casing Connections - Gas Seal Does the process ensure that the casing connections can maintain a gas seal under anticipated wellbore flow conditions and subsequent work? (UNG.S.RESWELLDES.CASINGCONN2.P) 192.12(c) (API RP1171, Section 6.3.7)

30. Casing Connections - Gas Seal Do records indicate that casing connections have the ability to maintain a gas seal under well flow conditions and subsequent work? (UNG.S.RESWELLDES.CASINGCONN2.R) 192.12(c) (API RP1171, Section 6.3.7)

31. Casing Connections - Specifications Does the process ensure that casing connections are made up according to manufacturer specifications or in accordance with API 5CT? (UNG.S.RESWELLDES.CASINGCONN3.P) 192.12(c) (API RP1171, Section 6.3.7)

32. Casing Connections - Specifications Do records demonstrate that the casing connections are made up according to manufacturer specifications or in accordance with API 5CT? (UNG.S.RESWELLDES.CASINGCONN3.R) 192.12(c) (API RP1171, Section 6.3.7)

33. Casing Connections - Thread Compound Does the process ensure that casing thread compound or lubricant is compatible with the expected wellbore environment? (UNG.S.RESWELLDES.CASINGCONN4.P) 192.12(c) (API RP1171, Section 6.3.7)

34. Casing Connections - Thread Compound Do records demonstrate that the casing thread compound or lubricant is compatible with the expected wellbore environment? (UNG.S.RESWELLDES.CASINGCONN4.R) 192.12(c) (API RP1171, Section 6.3.7)

35. Casing Connections - Lubricant Specs Does the process ensure that casing thread compound or lubricant is consistent with the manufacturer’s recommended lubricant or API 5A3? (UNG.S.RESWELLDES.CASINGCONN5.P) 192.12(c) (API RP1171, Section 6.3.7)
36. **Casing Connections - Lubricant Specs** Do records demonstrate that the casing thread compound or lubricant is consistent with the manufacturer's recommended lubricant or API 5A3? (UNGS.RESWELLDES.CASINGCONN5.R) 192.12(c) (API RP1171, Section 6.3.7)

37. **Casing Cement** Does the process ensure that the cement slurry or slurry combination is designed for hydrostatic weight control and strength requirements for the storage reservoir? (UNGS.RESWELLDES.CASINGCEMENT.P) 192.12(c) (API RP1171, Section 6.4.3)

38. **Casing Cement** Do records demonstrate that the cement slurry or slurry combination used for the storage reservoir are/were designed for hydrostatic weight control and strength requirements? (UNGS.RESWELLDES.CASINGCEMENT.R) 192.12(c) (API RP1171, Section 6.4.3)

39. **Cement Slurry Design** Does the process ensure that the fracture gradient of the storage zone is not exceeded during cement pumping operations? (UNGS.RESWELLDES.CEMENTSLURRY.P) 192.12(c) (API RP1171, Section 6.4.4)

40. **Cement Slurry Design** Do records demonstrate that the storage zone fracture gradient was not exceeded during cement pumping operations? (UNGS.RESWELLDES.CEMENTSLURRY.R) 192.12(c) (API RP1171, Section 6.4.4)

41. **Cement Pumping Design** Does the process require that competent uncontaminated cement be placed around the casing shoe and around the circumference of the casing? (UNGS.RESWELLDES.CEMENTPUMPING.P) 192.12(c) (API RP1171, Section 6.4.5)

42. **Cement Pumping Design** Do records indicate that competent, uncontaminated cement is placed at casing shoes and around the circumference of the casing? (UNGS.RESWELLDES.CEMENTPUMPING.R) 192.12(c) (API RP1171, Section 6.4.5)

43. **Cement Bond Evaluation** Is there a process for evaluating the cement placement and bond quality through cement bond log or other means that can demonstrate the sealing potential of the cement? (UNGS.RESWELLDES.CEMENTBOND.P) 192.12(c) (API RP1171, Section 6.4.6)

44. **Cement Bond Evaluation** Do records demonstrate that the bond or seal quality and cement placement were evaluated by cement bond log or other means and demonstrated the bond or seal quality and placement of the cement? (UNGS.RESWELLDES.CEMENTBOND.R) 192.12(c) (API RP1171, Section 6.4.6)
45. **Well Completion and Stimulation** Does the process require that well completion and stimulation operations are done to verify that pressure, flow rates, and other mechanical conditions have no adverse impact on the storage reservoir, caprock, or the mechanical integrity of the well? (UNGS.RESWELLD.MI.COMPLETION.P) 192.12(c) (API RP1171, Section 6.5.1)

46. **Well Completion and Stimulation** Do records demonstrate that the pressure, flow rates, and other mechanical conditions have been verified to indicate that there is no adverse impact on the storage reservoir, caprock, or the mechanical integrity of the well? (UNGS.RESWELLD.MI.COMPLETION.R) 192.12(c) (API RP1171, Section 6.5.1)

47. **Fracture Stimulation** Does the process for fracture treatment, if used, ensure that the fracture height or length does not compromise the integrity of the storage reservoir? (UNGS.RESWELLD.MI.STIMULATION.P) 192.12(c) (API RP1171, Section 6.5.3)

48. **Fracture Stimulation** Do records demonstrate that the integrity of the storage reservoir has not been compromised by fracture treatment? (UNGS.RESWELLD.MI.STIMULATION.R) 192.12(c) (API RP1171, Section 6.5.3)

49. **Well Remediation** For wells identified as having compromised mechanical integrity, does the process require evaluation and responsive action within a timeframe corresponding to the severity of the integrity risk? (UNGS.RESWELLD.MI.REMEDIATION.P) 192.12(c) (API RP1171, Section 6.6.1)

50. **Well Remediation** For wells identified as having compromised mechanical integrity, do records demonstrate that they were evaluated and remediated within a time frame corresponding to the severity of the integrity risk? (UNGS.RESWELLD.MI.REMEDIATION.R) 192.12(c) (API RP1171, Section 6.6.1)

51. **Well Closure (Plugging and Abandonment)** Does the process for abandonment of a well require a design for long-term isolation of the storage zone and any other penetrated zones from the surface? (UNGS.RESWELLD.CLOSURE.P) 192.12(c) (API RP1171, Section 6.7.1)

52. **Well Closure (Plugging and Abandonment)** Do the records demonstrate that well abandonment for long term isolation of the storage zone and any other penetrated zone from the surface was achieved? (UNGS.RESWELLD.CLOSURE.R) 192.12(c) (API RP1171, Section 6.7.1)

53. **Well Closure (Plugging and Abandonment) Records** Does the process define a retention period for abandonment records? (UNGS.RESWELLD.CLOSURE.REC.P) 192.12(c) (API RP1171, Section 6.7.1)
54. Well Closure (Plugging and Abandonment) Records Do records demonstrate that the retention period for abandonment records was followed? (UNGS.RESWELLMES.CLOSUREREC.R) 192.12(c) (API RP1171, Section 6.7.1)

55. Well Closure (Plugging and Abandonment) Observations Do field observations indicate that the operator followed the outlined abandonment process? (UNGS.RESWELLMES.CLOSUREALL.O) 192.12(c) (API RP1171, Section 6.7.1)

56. Storage Zone Isolation - Plugs Does the abandonment process require use of cement plugs and/or mechanical plugs to isolate the storage zone from fluid migration? (UNGS.RESWELLMES.PLUGS.P) 192.12(c) (API RP1171, Section 6.7.2)

57. Storage Zone Isolation - Plugs Do records demonstrate which type of abandonment plug was used as defined by API 1171, Section 6.7.2? (UNGS.RESWELLMES.PLUGS.R) 192.12(c) (API RP1171, Section 6.7.2)

58. Storage Zone Isolation - Determination Does the process ensure that the location of groundwater and hydrocarbon bearing zones were determined to prevent communication between any of those zones during and after plugging of the wells? (UNGS.RESWELLMES.ISOLATION.P) 192.12(c) (API RP1171, Section 6.7.2)

59. Storage Zone Isolation - Determination Do records indicate the depths of the groundwater and hydrocarbon zones penetrated by the well to be abandoned? (UNGS.RESWELLMES.ISOLATION.R) 192.12(c) (API RP1171, Section 6.7.2)

60. Storage Zone Isolation - Cement Evaluation Does the process require that the casing and cement across the water and hydrocarbon zones be properly evaluated before abandoning of the well? (UNGS.RESWELLMES.CEMENTEVAL.P) 192.12(c) (API RP1171, Section 6.7.2)

61. Storage Zone Isolation - Cement Evaluation Do records demonstrate that casing and cement evaluations were conducted through zones of importance prior to abandoning? (UNGS.RESWELLMES.CEMENTEVAL.R) 192.12(c) (API RP1171, Section 6.7.2)

62. Storage Zone Isolation - Cement Plug Depth Does the process require verification that the abandonment plug is set at the proper depth and has reached sufficient compressive strength? (UNGS.RESWELLMES.CEMENTPLUGDEPTH.P) 192.12(c) (API RP1171, Section 6.7.2)
63. Storage Zone Isolation - Cement Plug Depth Do the records indicate that abandonment plug depths were achieved and verified? (UNGS.RESWELLDRES.CEMENTPLUGDEPTH.R) 192.12(c) (API RP1171, Section 6.7.2)

64. Storage Zone Isolation - Cement Plug Properties Do the records indicate that abandonment plug properties and pressure records of plug testing are maintained? (UNGS.RESWELLDRES.CEMENTPLUGPROP.R) 192.12(c) (API RP1171, Section 6.7.2)

65. Storage Zone Isolation - Plug Deviations Does the process require that any deviations that threatened the isolation objectives of the abandonment plug are to be corrected? (UNGS.RESWELLDRES.DEVIATIONS.P) 192.12(c) (API RP1171, Section 6.7.2)

66. Storage Zone Isolation - Plug Deviations Do the records indicate that deviations that threatened the isolation objectives of the abandonment plug were corrected? (UNGS.RESWELLDRES.DEVIATIONS.R) 192.12(c) (API RP1171, Section 6.7.2)

67. Abandoned Well Maintenance - Failed Plug Repair Does the process include the repair of failed plugs in an abandoned well? (UNGS.RESWELLDRES.PLUGREPAIR.P) 192.12(c) (API RP1171, Section 6.7.3)

68. Abandoned Well Maintenance - Failed Plug Repair Do records demonstrate that failed abandonment plugs were repaired according to procedure? (UNGS.RESWELLDRES.PLUGREPAIR.R) 192.12(c) (API RP1171, Section 6.7.3)

69. Abandoned Well Maintenance - Well Leak Repair Does the abandonment process include the repair of a well having any leak indication that may suggest a lack of isolation of the storage reservoir? (UNGS.RESWELLDRES.WELLREPAIR.P) 192.12(c) (API RP1171, Section 6.7.3)

70. Abandoned Well Maintenance - Well Leak Repair Do records demonstrate that abandoned wells having an indication of leaks were repaired according to procedure? (UNGS.RESWELLDRES.WELLREPAIR.R) 192.12(c) (API RP1171, Section 6.7.3)

71. Abandoned Well Maintenance - Surface Plug Does the abandonment process require the installation of a surface plug and cap? (UNGS.RESWELLDRES.SURFACEPLUG.P) 192.12(c) (API RP1171, Section 6.7.3)
72. Abandoned Well Maintenance - Surface Plug  
Do records indicate that surface plugs and caps were installed in abandoned wells? (UNGS.RESWELLDES.SURFACEPLUG.R) 192.12(c) (API RP1171, Section 6.7.3)

73. Abandoned Well Maintenance - Cap Identification  
Does the process require the abandoned well surface cap to include the API number or another form of identification? (UNGS.RESWELLDES.CAPIDENTIF.P) 192.12(c) (API RP1171, Section 6.7.3)

74. Abandoned Well Maintenance - Cap Identification  
Do field observations indicate evidence of an abandoned well surface cap, along with its identification, installed on each abandoned well? (UNGS.RESWELLDES.CAPIDENTIF.O) 192.12(c) (API RP1171, Section 6.7.3)

75. EHS - People & Environmental Safeguards  
Does the design and construction process incorporate safeguards to protect the environment and the safety and health of workers and the public into well design and during well work activities? (UNGS.RESWELLDES.EHSPEOPLEENV.P) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)

76. EHS - People & Environmental Safeguards  
Do records indicate that safeguards to the environment, safety, and health of workers and the public were used in well design and construction, and during well work activities? (UNGS.RESWELLDES.EHSPEOPLEENV.R) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)

77. EHS - Water & Groundwater Safeguards  
Does the design and construction process include protections for surface water and ground water from drilling and well work operations? (UNGS.RESWELLDES.EHSWATER.P) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)

78. EHS - Water & Groundwater Safeguards  
Do records demonstrate that the surface water and ground water safeguards were used in well design and during drilling and well work operations? (UNGS.RESWELLDES.EHSWATER.R) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)

79. EHS - Monitoring Worksite Conditions  
Does the construction process ensure that the worksite is monitored during well drilling, construction, and well work activities to protect the environment and the safety and health of workers and the public? (UNGS.RESWELLDES.EHSWORKSITE.P) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)
80. EHS - Monitoring Worksite Conditions  Do records demonstrate that the well site was monitored during drilling, construction and well work activities to protect the environment and the safety and health of workers and the public? (UNGS.RESWELLDES.EHSWORKSITE.R) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)

81. EHS - Monitoring Worksite Conditions  Do field observations indicate that safeguards and monitoring methods specific to the safety and health of workers, the public, and the environment are in place as per procedure? (UNGS.RESWELLDES.EHSWORKSITE.O) 192.12(c) (API RP1171, Section 6.8.1; API RP1171, Section 5.5.1)

82. Well Testing and Commissioning  Does the process require that production casing be tested to demonstrate mechanical integrity and suitability for the designed operating conditions prior to commissioning per API RP 1171, Section 6.9.1? (UNGS.RESWELLDES.WELLTESTING.P) 192.12(c) (API RP1171, Section 6.9.1)

83. Well Testing and Commissioning  Do records demonstrate that the production casing was tested to demonstrate mechanical integrity and suitability for designed operating conditions prior to commissioning per API RP 1171 Section 6.9.1? (UNGS.RESWELLDES.WELLTESTING.R) 192.12(c) (API RP1171, Section 6.9.1)

84. Well Testing Design  Does the process require test design such that the maximum pressure on the packer seat and the pressure at any point in the wellbore during the test does not compromise the mechanical integrity of the well? (UNGS.RESWELLDES.WELLTESTDES.P) 192.12(c) (API RP1171, Section 6.9.1)

85. Well Testing Design  Do records demonstrate that the test was designed so the maximum pressure does not compromise the mechanical integrity of the wells? (UNGS.RESWELLDES.WELLTESTDES.R) 192.12(c) (API RP1171, Section 6.9.1)

86. Monitoring of Construction Activities  Does the process require documentation and retention of records of deviations where such deviations from the original design or in the procedures are required to resolve encountered issues or problems during well activities? (UNGS.RESWELLDES.CONSTRMONITOR.P) 192.12(c) (API RP1171, Section 6.10.4)

87. Monitoring of Construction Activities  Do records demonstrate that deviations from the original well design were documented? (UNGS.RESWELLDES.CONSTRMONITOR.R) 192.12(c) (API RP1171, Section 6.10.4)

88. Monitoring Construction Activities - Maintaining Integrity  Does the process require that well issues or problems are resolved in a manner that maintains the functional integrity of the well and reservoir prior to commissioning? (UNGS.RESWELLDES.MAINTINTEGRITY.P) 192.12(c) (API RP1171, Section 6.10.4)
89. Monitoring Construction Activities - Maintaining Integrity Do records demonstrate that functional integrity was maintained during the resolution of issues or problems prior to commissioning?
(UNGS.RESWELLDES.MAINTINTEGRITY.R) 192.12(c) (API RP1171, Section 6.10.4)

90. Well Work Records Do records include, as applicable and available, the items listed in API RP 1171, Section 6.11.1, to be maintained? (UNGS.RESWELLDES.WELLRECORDS.R) 192.12(c) (API RP1171, Section 6.11.1)

91. Well Work Records Retention Are records for well completion, well construction and well work activities maintained for the life of the facility? (UNGS.RESWELLDES.WELLRECORDSRET.R) 192.12(c) (API RP1171, Section 6.11.1)

92. Permitting, Procedures, Personnel, and Equipment Records Do records include, as applicable and available, the items listed in API RP 1171, Section 6.11.2? (UNGS.RESWELLDES.GENRECORDS.R) 192.12(c) (API RP1171, Section 6.11.2)

93. Permitting, Procedures, Personnel, and Equipment Records Retention Does the process define a retention period for records relating to permitting, procedures, personnel, and equipment? (UNGS.RESWELLDES.GENRECORDSRET.P) 192.12(c) (API RP1171, Section 6.11.2)
Underground Natural Gas Storage - Reservoirs - Integrity Through Initial Pressure & Inventory

1. Reservoir Integrity Monitoring - Material Balance Does the process require monitoring of the material balance behavior relative to the original design and expected reservoir behavior? (UNGS.RESINITIAL.MATBALANCE1.P) 192.12(C) (API RP1171, Section 7.3.1)

2. Reservoir Integrity Monitoring - Material Balance Do records demonstrate that the monitored material balance behavior of the storage reservoir is consistent with the expected reservoir behavior? (UNGS.RESINITIAL.MATBALANCE1.R) 192.12(c) (API RP1171, Section 7.3.1)

3. Reservoir Integrity Monitoring - Unexpected Conditions Does the process require evaluation and correcting of any unexpected condition detected during material balance monitoring? (UNGS.RESINITIAL.MATBALANCE2.P) 192.12(c) (API RP1171, Section 7.3.1)

4. Reservoir Integrity Monitoring - Unexpected Conditions Do records demonstrate that unexpected conditions in the material balance were evaluated and corrected? (UNGS.RESINITIAL.MATBALANCE2.R) 192.12(c) (API RP1171, Section 7.3.1)

5. Monitoring and Analysis Methods - Reservoir Pressure Does the process require that the average reservoir pressure versus inventory graph be monitored to capture any unexpected conditions? (UNGS.RESINITIAL.PRESSVSINVENT.P) 192.12(c) (API RP1171, Section 7.3.2)

6. Monitoring and Analysis Methods - Reservoir Pressure Do records demonstrate that the average reservoir pressure versus inventory graph was monitored to capture unexpected conditions? (UNGS.RESINITIAL.PRESSVSINVENT.R) 192.12(c) (API RP1171, Section 7.3.2)

7. Mechanical Integrity Monitoring - Abnormal Operating Conditions Does the process require that wells and related facilities be monitored for mechanical integrity to discover and correct for abnormal operating conditions? (UNGS.RESINITIAL.MECHINTEGMONIT.P) 192.12(c) (API RP1171, Section 7.4.1)

8. Mechanical Integrity Monitoring - Abnormal Operating Conditions Do records demonstrate that the mechanical integrity of wells and related facilities are monitored to discover and correct for abnormal operating conditions? (UNGS.RESINITIAL.MECHINTEGMONIT.R) 192.12(c) (API RP1171, Section 7.4.1)
9. Recordkeeping of Testing and Monitoring Activities *Do records include the required items, as applicable and available, listed in API RP 1171, Section 7.5? (UNGS.RESIONITAL.RECORDS.R) 192.12(c) (API RP1171, Section 7.5)*

10. Recordkeeping Retention of Testing and Monitoring Activities *Does the process require that records for natural gas storage testing and monitoring activities be maintained for the life of the facility? (UNGS.RESIONITAL.RECORDSRET.P) 192.12(c) (API RP1171, Section 7.5)*