The Operation Guidelines Database and Research Recommendation Platform opens with the Introduction Menu (Figure 1). If *Write Recommendation* is selected, then the Recommendation Entry Menu (Figure 9) is shown. Any recommendations for this database can be inputted through this form. If *Continue* is selected, then the following series of menus will appear and build an operation guidelines report around the selections made.

- Initial Consideration Menu (Figure 2)
    - Drilling Option Selected
        - Mud Basis Menu (Figure 3)
            - Oil Based Mud Selection Report (Appendix A)
            - Water Based Mud Selection Report (Appendix B)
            - Synthetic Based Mud Selection Report (Appendix C)
    - Placement Option Selected
        - Casing Purpose Menu (Figure 4)
            - Initial Option Selected
                - Returns Location Menu (Figure 5)
                    - Seafloor Option Selected
                        - Formation Consideration Menu [1] (Figure 6)
                        - Report Generated (Appendix D)
                    - Surface Option Selected
                        - Formation Consideration Menu [1] (Figure 6)
                        - Report Generated (Appendix E)
            - Intermediate Option Selected
                - Formation Consideration Menu [1] (Figure 6)
                - Report Generated (Appendix F)
            - Production Option Selected
                - Casing Orientation Menu (Figure 7)
                    - Vertical Option Selected
                        - Formation Consideration Menu [1] (Figure 6)
                        - Report Generated (Appendix G)
                    - Horizontal Option Selected
                        - Formation Consideration Menu [1] (Figure 6)
                        - Report Generated (Appendix H)
            - Tieback Option Selected
                - Formation Consideration Menu [1] (Figure 6)
                - Report Generated (Appendix I)
    - Remedial Option Selected
        - Remedial Type Menu (Figure 8)
            - Kick off Option Selection Report (Appendix J)
            - Plug Option Selection Report (Appendix K)
            - Squeeze Option Selection Report (Appendix L)
            - Perforation Option Selection Report (Appendix M)

1 The Formation Consideration Menu has a several differernt options that can be selected by the user to futher tailor the report around the needs of the user. For each selection made in this menu, more recommendations will be added to the operational guidelines report generated. With in this menu alone, there are 32 different combinations of options and hense 32 different reports that can be generated whenever the Formation Consideration Menu appears. For the sake of breivity, all of the reports generated after the a Formation Consideration Menu will be generated with all of available formation consideration options selected.

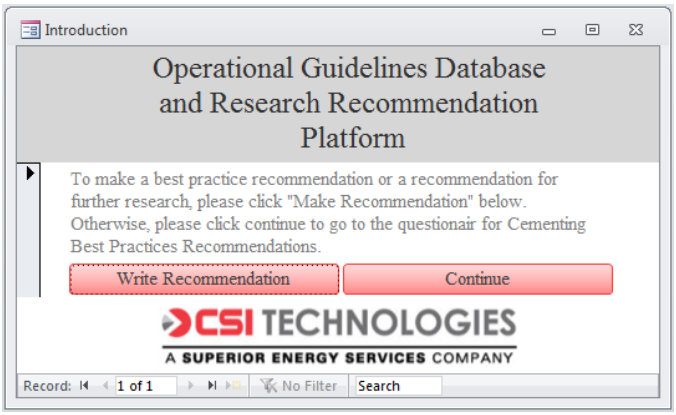

Figure 1 - Introduction Menu

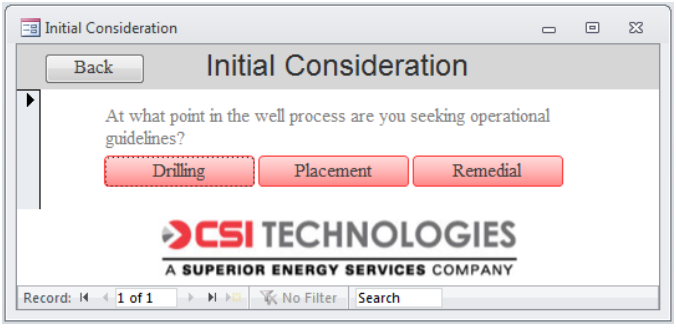

Figure 2 - Initial Consideration Menu

Figure 3 - Mud Basis Menu

Figure 4 - Casing Purpose Menu

Figure 5 - Returns Location Menu

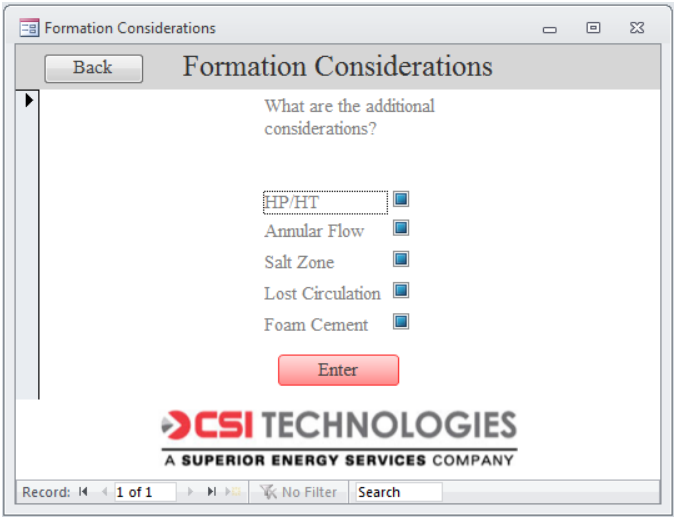

Figure 6 - Formation Consideration Menu

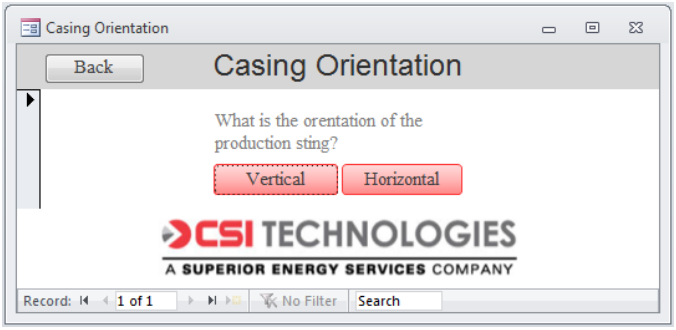

Figure 7 - Casing Orientation Menu

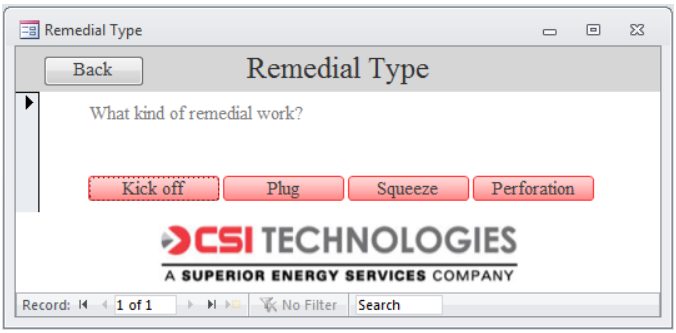

Figure 8 - Remedial Type Menu

Figure 9 - Recommendation Entry Menu

Appendix A

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
As a guideline, drilling design and operational practices should be optimized to provide these outcomes when and if possible. One method of doing this is to drill on torque measurements as opposed to ROP.	Drilling ROP
A caliper should be run prior to every primary cement job covering an open-hole section. Wireline calipers, where needed for engineering purposes, are considered the best operational guideline to follow, but can be very costly and time inefficient.	Hole Condition
Another operational guideline should be to re-drill any tight spots encountered in the bore-hole.	Hole Condition
As a guideline, when hole sections are under-reamed, special consideration should be taken as to the ratio of the casing shoe track volume to the rathole volume.	Hole Condition
It should be considered an operational guideline to reduce losses as much as possible during drilling operations.	Lost Circulation
As a guideline, BHA's which have the ability to tolerate different types and sizes of LCM should be considered if there is any anticipation of encountering zones where losses could be a factor.	Lost Circulation
The large advantages of oil based muds when compared to water based mud include higher effective drilling rates, lower required torque due to less friction, and reductions in the likelihood of differential sticking due to thinner mud filter cakes. Although reductions in friction when drilling has it inherent advantages, oil –based muds require much more sophisticated spacer packages prior to cementation. Since oil is the continuous phase within the mud, a film of oil can easily be left behind which must be removed for quality bonding of the cement to the casing and formation. Oil based muds have additional environmental considerations such as cuttings disposal which can be considered a disadvantage in some scenarios.	Oil Based Mud
It should be considered a guideline to pay close attention to the rheological parameters of the mud system during and after conditioning operations. Moderate plastic viscosities and low yield points are considered a guideline to assist the removal of mud during cementation.	Mud Properties
It should be considered a guideline to adhere to spacer volume calculations based on the contact time needed for proper mud removal.	Additional Drilling Considerations
As a guideline, computer simulation programs should be used for anticipation of ECD during hole conditioning operations.	Additional Drilling Considerations
It should be considered a guideline to break circulation very slowly as to not unintentionally fracture the formation.	Additional Drilling Considerations

Appendix B

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
As a guideline, drilling design and operational practices should be optimized to provide these outcomes when and if possible. One method of doing this is to drill on torque measurements as opposed to ROP.	Drilling ROP
A caliper should be run prior to every primary cement job covering an open-hole section. Wireline calipers, where needed for engineering purposes, are considered the best operational guideline to follow, but can be very costly and time inefficient.	Hole Condition
Another operational guideline should be to re-drill any tight spots encountered in the bore-hole.	Hole Condition
As a guideline, when hole sections are under-reamed, special consideration should be taken as to the ratio of the casing shoe track volume to the rathole volume.	Hole Condition
It should be considered an operational guideline to reduce losses as much as possible during drilling operations.	Lost Circulation
As a guideline, BHA's which have the ability to tolerate different types and sizes of LCM should be considered if there is any anticipation of encountering zones where losses could be a factor.	Lost Circulation
Water based muds are considered one of the more simple mud types and are the most historically used in the oil and gas industry. The major advantages of water based muds are cost and design simplicity. Generally, the initial casing string depths are drilled with sea water which is considered a type of water based mud. Another advantage of drilling with sea water or a mud design that is primarily sea water is that the mud returns don't have to be brought back to surface and can be sacrificed to the sea floor with no negative environmental impact. Deep water wells rely on this advantage on their initial casing strings since the increased hydrostatic pressure of a riser margin would lead to fracturing of the weak formations. Some disadvantages of water based muds as compared to the more technically advanced oil and synthetic based muds is lower cooling and lubricating of the drill bit resulting in lower rates of penetration and hole/formation stability difficulties. Water based muds typically have rheology profiles that experience variability across the temperature and pressure profiles of the well.	Water Based Mud
It should be considered a guideline to pay close attention to the rheological parameters of the mud system during and after conditioning operations. Moderate plastic viscosities and low yield points are considered a guideline to assist the removal of mud during cementation.	Mud Properties
It should be considered a guideline to adhere to spacer volume calculations based on the contact time needed for proper mud removal.	Additional Drilling Considerations
As a guideline, computer simulation programs should be used for anticipation of ECD during hole conditioning operations.	Additional Drilling Considerations
It should be considered a guideline to break circulation very slowly as to not unintentionally fracture the formation.	Additional Drilling Considerations

Appendix C

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
As a guideline, drilling design and operational practices should be optimized to provide these outcomes when and if possible. One method of doing this is to drill on torque measurements as opposed to ROP.	Drilling ROP
A caliper should be run prior to every primary cement job covering an open-hole section. Wireline calipers, where needed for engineering purposes, are considered the best operational guideline to follow, but can be very costly and time inefficient.	Hole Condition
Another operational guideline should be to re-drill any tight spots encountered in the bore-hole.	Hole Condition
As a guideline, when hole sections are under-reamed, special consideration should be taken as to the ratio of the casing shoe track volume to the rathole volume.	Hole Condition
It should be considered an operational guideline to reduce losses as much as possible during drilling operations.	Lost Circulation
As a guideline, BHA's which have the ability to tolerate different types and sizes of LCM should be considered if there is any anticipation of encountering zones where losses could be a factor.	Lost Circulation
Synthetic based muds (SBM) should be considered the best option for drilling efficiency while minimizing environmental impact. One inherent disadvantage of SBM is cost. When drilling takes place in zones where total loss is inevitable, a less expensive mud system, rather than SBM may be more advantageous. SBM, like OBM require complex spacer and surfactant packages to reverse the emulsion to water wet casing and formation to allow for good cement bonding characteristics.	Synthetic Based Mud
It should be considered a guideline to pay close attention to the rheological parameters of the mud system during and after conditioning operations. Moderate plastic viscosities and low yield points are considered a guideline to assist the removal of mud during cementation.	Mud Properties
It should be considered a guideline to adhere to spacer volume calculations based on the contact time needed for proper mud removal.	Additional Drilling Considerations
As a guideline, computer simulation programs should be used for anticipation of ECD during hole conditioning operations.	Additional Drilling Considerations
It should be considered a guideline to break circulation very slowly as to not unintentionally fracture the formation.	Additional Drilling Considerations

Appendix D

CSITECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
One of the main considerations when discussing the operational guidelines associated with dry cement and additives is documentation and document control.	Dry Cement and Additive Considerations: General Considerations
An operational guideline would be to have a documented chain of custody for all cementing materials arriving on location to be able to easily track lot/batch numbers, chemical manufacture dates, cement QAQC/grind reports, and previous owners/storage locations of the cement and additives.	Dry Cement and Additive Considerations: General Considerations
Record tallies of bulk storage tanks showing a history of cement blends and cleaning operations should also be considered a guideline.	Dry Cement and Additive Considerations: General Considerations
It should be considered a guideline to record the lot numbers of each additive that is dry blended.	Dry Cement and Additive Considerations: Bulk Plant Considerations
All bulk storage tanks should be emptied, cleaned, and inspected regularly. At a minimum, these procedures should be carried out before a new cement blend is placed into the storage tanks. The final quantity and storage tank number should be documented for the blended cement system as well.	Dry Cement and Additive Considerations: Bulk Plant Considerations
Prior to loading or inspecting, the service company should present copies of load tickets to the boat captain and discuss which tanks are to be loaded. Storage tank capacities and hose connections should be verified. After loading, it is recommended to open the tank hatches to verify the amount of cement in each tank.	Dry Cement and Additive Considerations: In Transit Considerations
API RP 65 recommends the use of both top and bottom plugs for all casing cement jobs other than sting-in jobs. The bottom plugs are used as a mechanical separator between fluids while in the casing. Using only two plugs should be considered a minimum guideline. To get the best chances of cementing success, fluid intermixing should be minimized by all means and at all times.	Placement: Cementing Hardware Considerations
It should be considered a guideline to mechanically separate consecutive fluids in the landing string and casing during cementing operations when it will not increase operational complexity.	Placement: Cementing Hardware Considerations
It is also a guideline to reduce the displacement pumping rate prior to the bottom plug reaching any known restrictions within the casing or the float collar. The rate reduction decreases the pressure spike applied to the diaphragm, decreasing the likelihood of premature rupture.	Placement: Cementing Hardware Considerations
While discussing cement heads, it should be considered a guideline to incorporate rotating cement heads when possible such that casing rotation can be achieved during the cement job.	Placement: Cementing Hardware Considerations
Prior to any cement jobs, it should be considered a guideline to calculate the hydraulic horsepower needed to accomplish the operation and compare it to the equipment which will be used on location.	Placement: Cementing Hardware Considerations
. It should also be considered a guideline to install dry product storage bins as close to the mixing equipment, or vice versa, on new rig builds to mitigate the reduction in dry product travel rates.	Placement: Bulk and Liquid Delivery Systems

Guidelines	Identifier
Adherence to the sample collection procedures within RP 65 should be considered a minimum best practice. For above and beyond cementing guidelines, cement sample collection should be performed during each dry product transfer, whether it is from the bulk plant to the transport vessel or from the rig storage bins to the mixing equipment.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to have manufacture and expiration dates documented for all cementing liquid additives which are on location.	Placement: QC and Sample Collection Considerations
As a guideline, the mix water on location should be tested for chloride content, hardness, and ph.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to keep very close observation of fluid rheology to assist displacement efficiencies. The yield points of sequential fluids should be successively increased such that the viscosity of the displacing fluid tends to overcome the viscosity of the displaced fluid.	Placement: Fluids/Mixing
While discussing the importance of laboratory fluid compatibility testing, it should also be considered a guideline to run contaminated thickening time tests to observe how the contamination will vary the cement system's set time.	Placement: Fluids/Mixing
When using liquid additives for cementing operations on location, it should be considered a guideline to document the storage tank volumes of the additives prior to the cement job for comparison with post job tank volumes.	Placement: Fluids/Mixing
It should be considered a guideline to record the cementing operations which occur on location. As a minimum, the down hole pumping rate, pump pressure and fluid density should be monitored and recorded for all cementing operations.	Placement: Job Recording and Engineering Simulations
Generally, the mix density will fluctuate more than the down hole density, but it still should be a guideline to minimize the mix density fluctuation as much as possible.	Placement: Job Recording and Engineering Simulations
A guideline is to record the fluid returns through flow-meters during the cement job.	Placement: Job Recording and Engineering Simulations
When discussing cement placement simulation software, it should be considered a guideline to have qualified cementing engineers perform the cementing simulations.	Placement: Job Recording and Engineering Simulations
It should be considered a guideline to perform ECD placement simulations assuming gauge hole and hole with excess, assuming average nitrogen injection rate and varied injection rate, taking into account, changes in slurry rheology, foam quality, temperature and pressure during the foam job.	Placement: Job Recording and Engineering Simulations
Prior to cementing operations it should be considered a guideline to have the pipe capacity from the cementing equipment to the rig floor documented. This is generally a fixed volume, but should be a known and used volume for simulation software and for friction pressure calculations.	Placement: Placement Techniques
When using the mud pumps for displacement, it should be a guideline to know ahead of time the pump efficiencies for calculation purposes. As a redundancy, flow meters can be installed on the rig pumps for quality assurance.	Placement: Placement Techniques
During displacement of the cement slurry, it should be considered a guideline to recalculate the displacement volume from anticipated bumps or shears encountered during displacement.	Placement: Placement Techniques
It should also be considered a guideline to slow the displacement rate prior to bumping the plug as to not over pressure any of the equipment.	Placement: Placement Techniques
It should be considered a guideline to compare the pumped volumes and measured pressures from the FIT to the volumes and pressures from the casing test.	Placement: Cement Placement Contingency Planning

Guidelines	Identifier
If the measured FIT is lower than expected, it should be considered a guideline to modify drilling rates and ECD's to reduce the likelihood of lost circulation during drilling.	Placement: Cement Placement Contingency Planning
Poor mud displacement and/or hole cleaning can lead to bad FIT results from fluid migration in the cement sheath either through mud channels or micro-annulus paths. In this case, it should be considered a guideline to perform remedial operations on the shoe for better zonal isolation.	Placement: Cement Placement Contingency Planning
When performing shoe squeeze operations, it should be considered a guideline to use the Bradenhead squeeze method, described further within the squeeze cementing subsection.	Placement: Cement Placement Contingency Planning
Prior to performing any primary cementing operations, it should be considered a guideline to have a shoe squeeze contingency plan in place with sufficient materials on location to perform this operation.	Placement: Cement Placement Contingency Planning
It should be considered a guideline to measure or calculate the acoustic impedance of the cement under laboratory conditions prior to the cement job such that wire-line technicians are able to properly calibrate their tools for best results.	Placement: Post Job
. It should also be considered a guideline to not run a bond log until the calculated top of cement (TOC) slurry has reached an acoustic impedance of at least ½ MRayl above the mud's measured acoustic impedance.	Placement: Post Job
For initial casing strings it should be considered a guideline to perform laboratory testing on the cement slurry at bottom-hole conditions and additional tests should be performed on systems designed for coverage at the mud line.	Initial Casing Strings
The guideline to be followed for these types of slurries is to have a recirculating mixer with automatic density control.	Initial Casing Strings: Fluid Returns to Seafloor
The guideline is to engineer the fluid resident in the well bore to be consistent with the design criteria of the cement job thus avoiding or minimizing undesirable characteristics.	Initial Casing Strings: Fluid Returns to Seafloor
The ability to deal with problem scenarios in a timely manner can mitigate the severity of a given situation, and help to contain the cost of the operation. The guideline is a formal plan that has listings for specialty equipment or material, particularly for exotic or rare items such as unusually large packers, cement retainers, or chemicals.	Initial Casing Strings: Fluid Returns to Seafloor
As a general guideline, the pad mud should have a somewhat low yield point such that the cement slurry does not have to be designed with a higher than normal yield for proper displacement efficiency.	Initial Casing Strings: Fluid Returns to Seafloor
It should be considered a guideline to install a dart catcher sub on the drill pipe to assist with cleaning during the cement job.	Initial Casing Strings: Fluid Returns to Seafloor
CFR 30.250.421 currently requires that conductor casing strings have cemented annuli that reach the mud line. It should be considered a guideline to pump excess cement slurry on initial casing strings to reduce the risk of not having proper cement coverage at the mud line.	Initial Casing Strings: Fluid Returns to Seafloor
It should be considered a guideline to add silica to all cement designs which have the possibility of encountering temperature profiles above 230°F throughout the life of the well.	Production Strings: HP/HT
Special design considerations need to be taken into account when cementing across potential annular flow zones. Currently, operators are required to follow the recommended practices stated within API RP 65-2 as part of the revised Code of Federal Regulations.	Case Specific Formation Considerations: Potential Annular Flow Zone Cementing

Guidelines	Identifier
Regardless of which approach is taken in the slurry design phase, a full technical analysis of the final slurry and how contact with a salt formation will affect it should be conducted.	Case Specific Formation Considerations: Salt Zone Cementing
It should also be considered a guideline to avoid hanging liners within any salt zones if possible. Liner hangers create annular clearance restrictions which should be avoided due to the salt creep point load considerations.	Case Specific Formation Considerations: Salt Zone Cementing
It should be considered a guideline to use BHA's that are able to pass LCM through if losses are anticipated.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should also be considered a guideline when cementing across known lost circulation zones to have LCM built into the cement design.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should be considered a guideline to cure any losses prior to cement placement when possible.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
As a cement placement consideration guideline, pump rates should be increased if losses are encountered during the cement job. Although this statement is counterintuitive, the faster pump rates will ensure better hole cleaning at the shoe.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
There are many recommended guidelines derived from foam cementing case studies which are discussed within the literature review along with documented testing methods discussed within API 10B-4.	Case Specific Formation Considerations: Foam Cementing
There are several additives which as a guideline should be avoided when designing a foam cement system. These additives are: antifoams, dispersants, and potassium chloride.	Case Specific Formation Considerations: Foam Cementing
It should be considered a guideline to have the yield point of the base slurry greater than 10lbf/100ft2.	Case Specific Formation Considerations: Foam Cementing
It should also be considered a best practice to adjust the mixing density of the cement slurry when foaming.	Case Specific Formation Considerations: Foam Cementing
Base slurries with low yield points can also affect the foam quality and foam stability. It should also be considered a guideline to adjust the mixing density of the cement slurry to account for any additives that will be injected downstream of the mixing unit, such as foaming agents and stabilizers.	Case Specific Formation Considerations: Foam Cementing

Appendix E

CSITECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
One of the main considerations when discussing the operational guidelines associated with dry cement and additives is documentation and document control.	Dry Cement and Additive Considerations: General Considerations
An operational guideline would be to have a documented chain of custody for all cementing materials arriving on location to be able to easily track lot/batch numbers, chemical manufacture dates, cement QAQC/grind reports, and previous owners/storage locations of the cement and additives.	Dry Cement and Additive Considerations: General Considerations
Record tallies of bulk storage tanks showing a history of cement blends and cleaning operations should also be considered a guideline.	Dry Cement and Additive Considerations: General Considerations
It should be considered a guideline to record the lot numbers of each additive that is dry blended.	Dry Cement and Additive Considerations: Bulk Plant Considerations
All bulk storage tanks should be emptied, cleaned, and inspected regularly. At a minimum, these procedures should be carried out before a new cement blend is placed into the storage tanks. The final quantity and storage tank number should be documented for the blended cement system as well.	Dry Cement and Additive Considerations: Bulk Plant Considerations
Prior to loading or inspecting, the service company should present copies of load tickets to the boat captain and discuss which tanks are to be loaded. Storage tank capacities and hose connections should be verified. After loading, it is recommended to open the tank hatches to verify the amount of cement in each tank.	Dry Cement and Additive Considerations: In Transit Considerations
API RP 65 recommends the use of both top and bottom plugs for all casing cement jobs other than sting-in jobs. The bottom plugs are used as a mechanical separator between fluids while in the casing. Using only two plugs should be considered a minimum guideline. To get the best chances of cementing success, fluid intermixing should be minimized by all means and at all times.	Placement: Cementing Hardware Considerations
It should be considered a guideline to mechanically separate consecutive fluids in the landing string and casing during cementing operations when it will not increase operational complexity.	Placement: Cementing Hardware Considerations
It is also a guideline to reduce the displacement pumping rate prior to the bottom plug reaching any known restrictions within the casing or the float collar. The rate reduction decreases the pressure spike applied to the diaphragm, decreasing the likelihood of premature rupture.	Placement: Cementing Hardware Considerations
While discussing cement heads, it should be considered a guideline to incorporate rotating cement heads when possible such that casing rotation can be achieved during the cement job.	Placement: Cementing Hardware Considerations
Prior to any cement jobs, it should be considered a guideline to calculate the hydraulic horsepower needed to accomplish the operation and compare it to the equipment which will be used on location.	Placement: Cementing Hardware Considerations
. It should also be considered a guideline to install dry product storage bins as close to the mixing equipment, or vice versa, on new rig builds to mitigate the reduction in dry product travel rates.	Placement: Bulk and Liquid Delivery Systems

Guidelines	Identifier
Adherence to the sample collection procedures within RP 65 should be considered a minimum best practice. For above and beyond cementing guidelines, cement sample collection should be performed during each dry product transfer, whether it is from the bulk plant to the transport vessel or from the rig storage bins to the mixing equipment.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to have manufacture and expiration dates documented for all cementing liquid additives which are on location.	Placement: QC and Sample Collection Considerations
As a guideline, the mix water on location should be tested for chloride content, hardness, and ph.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to keep very close observation of fluid rheology to assist displacement efficiencies. The yield points of sequential fluids should be successively increased such that the viscosity of the displacing fluid tends to overcome the viscosity of the displaced fluid.	Placement: Fluids/Mixing
While discussing the importance of laboratory fluid compatibility testing, it should also be considered a guideline to run contaminated thickening time tests to observe how the contamination will vary the cement system's set time.	Placement: Fluids/Mixing
When using liquid additives for cementing operations on location, it should be considered a guideline to document the storage tank volumes of the additives prior to the cement job for comparison with post job tank volumes.	Placement: Fluids/Mixing
It should be considered a guideline to record the cementing operations which occur on location. As a minimum, the down hole pumping rate, pump pressure and fluid density should be monitored and recorded for all cementing operations.	Placement: Job Recording and Engineering Simulations
Generally, the mix density will fluctuate more than the down hole density, but it still should be a guideline to minimize the mix density fluctuation as much as possible.	Placement: Job Recording and Engineering Simulations
A guideline is to record the fluid returns through flow-meters during the cement job.	Placement: Job Recording and Engineering Simulations
When discussing cement placement simulation software, it should be considered a guideline to have qualified cementing engineers perform the cementing simulations.	Placement: Job Recording and Engineering Simulations
It should be considered a guideline to perform ECD placement simulations assuming gauge hole and hole with excess, assuming average nitrogen injection rate and varied injection rate, taking into account, changes in slurry rheology, foam quality, temperature and pressure during the foam job.	Placement: Job Recording and Engineering Simulations
Prior to cementing operations it should be considered a guideline to have the pipe capacity from the cementing equipment to the rig floor documented. This is generally a fixed volume, but should be a known and used volume for simulation software and for friction pressure calculations.	Placement: Placement Techniques
When using the mud pumps for displacement, it should be a guideline to know ahead of time the pump efficiencies for calculation purposes. As a redundancy, flow meters can be installed on the rig pumps for quality assurance.	Placement: Placement Techniques
During displacement of the cement slurry, it should be considered a guideline to recalculate the displacement volume from anticipated bumps or shears encountered during displacement.	Placement: Placement Techniques
It should also be considered a guideline to slow the displacement rate prior to bumping the plug as to not over pressure any of the equipment.	Placement: Placement Techniques
It should be considered a guideline to compare the pumped volumes and measured pressures from the FIT to the volumes and pressures from the casing test.	Placement: Cement Placement Contingency Planning

Guidelines	Identifier
If the measured FIT is lower than expected, it should be considered a guideline to modify drilling rates and ECD's to reduce the likelihood of lost circulation during drilling.	Placement: Cement Placement Contingency Planning
Poor mud displacement and/or hole cleaning can lead to bad FIT results from fluid migration in the cement sheath either through mud channels or micro-annulus paths. In this case, it should be considered a guideline to perform remedial operations on the shoe for better zonal isolation.	Placement: Cement Placement Contingency Planning
When performing shoe squeeze operations, it should be considered a guideline to use the Bradenhead squeeze method, described further within the squeeze cementing subsection.	Placement: Cement Placement Contingency Planning
Prior to performing any primary cementing operations, it should be considered a guideline to have a shoe squeeze contingency plan in place with sufficient materials on location to perform this operation.	Placement: Cement Placement Contingency Planning
It should be considered a guideline to measure or calculate the acoustic impedance of the cement under laboratory conditions prior to the cement job such that wire-line technicians are able to properly calibrate their tools for best results.	Placement: Post Job
. It should also be considered a guideline to not run a bond log until the calculated top of cement (TOC) slurry has reached an acoustic impedance of at least ½ MRayl above the mud's measured acoustic impedance.	Placement: Post Job
For initial casing strings it should be considered a guideline to perform laboratory testing on the cement slurry at bottom-hole conditions and additional tests should be performed on systems designed for coverage at the mud line.	Initial Casing Strings
The annular clearance of the drive pipe section is much larger than the annular clearance from the open hole section. It should be considered a guideline to incorporate these geometries into placement simulations to anticipate their displacement efficiencies.	Initial Casing Strings: Fluid Returns to Surface
It should be considered a guideline to add silica to all cement designs which have the possibility of encountering temperature profiles above 230°F throughout the life of the well.	Production Strings: HP/HT
Special design considerations need to be taken into account when cementing across potential annular flow zones. Currently, operators are required to follow the recommended practices stated within API RP 65-2 as part of the revised Code of Federal Regulations.	Case Specific Formation Considerations: Potential Annular Flow Zone Cementing
Regardless of which approach is taken in the slurry design phase, a full technical analysis of the final slurry and how contact with a salt formation will affect it should be conducted.	Case Specific Formation Considerations: Salt Zone Cementing
It should also be considered a guideline to avoid hanging liners within any salt zones if possible. Liner hangers create annular clearance restrictions which should be avoided due to the salt creep point load considerations.	Case Specific Formation Considerations: Salt Zone Cementing
It should be considered a guideline to use BHA's that are able to pass LCM through if losses are anticipated.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should also be considered a guideline when cementing across known lost circulation zones to have LCM built into the cement design.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should be considered a guideline to cure any losses prior to cement placement when possible.	Case Specific Formation Considerations: Lost Circulation Zone Cementing

Guidelines	Identifier
As a cement placement consideration guideline, pump rates should be increased if losses are encountered during the cement job. Although this statement is counterintuitive, the faster pump rates will ensure better hole cleaning at the shoe.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
There are many recommended guidelines derived from foam cementing case studies which are discussed within the literature review along with documented testing methods discussed within API 10B-4.	Case Specific Formation Considerations: Foam Cementing
There are several additives which as a guideline should be avoided when designing a foam cement system. These additives are: antifoams, dispersants, and potassium chloride.	Case Specific Formation Considerations: Foam Cementing
It should be considered a guideline to have the yield point of the base slurry greater than 10lbf/100ft2.	Case Specific Formation Considerations: Foam Cementing
It should also be considered a best practice to adjust the mixing density of the cement slurry when foaming.	Case Specific Formation Considerations: Foam Cementing
Base slurries with low yield points can also affect the foam quality and foam stability. It should also be considered a guideline to adjust the mixing density of the cement slurry to account for any additives that will be injected downstream of the mixing unit, such as foaming agents and stabilizers.	Case Specific Formation Considerations: Foam Cementing

Appendix F

CSITECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
One of the main considerations when discussing the operational guidelines associated with dry cement and additives is documentation and document control.	Dry Cement and Additive Considerations: General Considerations
An operational guideline would be to have a documented chain of custody for all cementing materials arriving on location to be able to easily track lot/batch numbers, chemical manufacture dates, cement QAQC/grind reports, and previous owners/storage locations of the cement and additives.	Dry Cement and Additive Considerations: General Considerations
Record tallies of bulk storage tanks showing a history of cement blends and cleaning operations should also be considered a guideline.	Dry Cement and Additive Considerations: General Considerations
It should be considered a guideline to record the lot numbers of each additive that is dry blended.	Dry Cement and Additive Considerations: Bulk Plant Considerations
All bulk storage tanks should be emptied, cleaned, and inspected regularly. At a minimum, these procedures should be carried out before a new cement blend is placed into the storage tanks. The final quantity and storage tank number should be documented for the blended cement system as well.	Dry Cement and Additive Considerations: Bulk Plant Considerations
Prior to loading or inspecting, the service company should present copies of load tickets to the boat captain and discuss which tanks are to be loaded. Storage tank capacities and hose connections should be verified. After loading, it is recommended to open the tank hatches to verify the amount of cement in each tank.	Dry Cement and Additive Considerations: In Transit Considerations
API RP 65 recommends the use of both top and bottom plugs for all casing cement jobs other than sting-in jobs. The bottom plugs are used as a mechanical separator between fluids while in the casing. Using only two plugs should be considered a minimum guideline. To get the best chances of cementing success, fluid intermixing should be minimized by all means and at all times.	Placement: Cementing Hardware Considerations
It should be considered a guideline to mechanically separate consecutive fluids in the landing string and casing during cementing operations when it will not increase operational complexity.	Placement: Cementing Hardware Considerations
It is also a guideline to reduce the displacement pumping rate prior to the bottom plug reaching any known restrictions within the casing or the float collar. The rate reduction decreases the pressure spike applied to the diaphragm, decreasing the likelihood of premature rupture.	Placement: Cementing Hardware Considerations
While discussing cement heads, it should be considered a guideline to incorporate rotating cement heads when possible such that casing rotation can be achieved during the cement job.	Placement: Cementing Hardware Considerations
Prior to any cement jobs, it should be considered a guideline to calculate the hydraulic horsepower needed to accomplish the operation and compare it to the equipment which will be used on location.	Placement: Cementing Hardware Considerations
. It should also be considered a guideline to install dry product storage bins as close to the mixing equipment, or vice versa, on new rig builds to mitigate the reduction in dry product travel rates.	Placement: Bulk and Liquid Delivery Systems

Guidelines	Identifier
Adherence to the sample collection procedures within RP 65 should be considered a minimum best practice. For above and beyond cementing guidelines, cement sample collection should be performed during each dry product transfer, whether it is from the bulk plant to the transport vessel or from the rig storage bins to the mixing equipment.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to have manufacture and expiration dates documented for all cementing liquid additives which are on location.	Placement: QC and Sample Collection Considerations
As a guideline, the mix water on location should be tested for chloride content, hardness, and ph.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to keep very close observation of fluid rheology to assist displacement efficiencies. The yield points of sequential fluids should be successively increased such that the viscosity of the displacing fluid tends to overcome the viscosity of the displaced fluid.	Placement: Fluids/Mixing
While discussing the importance of laboratory fluid compatibility testing, it should also be considered a guideline to run contaminated thickening time tests to observe how the contamination will vary the cement system's set time.	Placement: Fluids/Mixing
When using liquid additives for cementing operations on location, it should be considered a guideline to document the storage tank volumes of the additives prior to the cement job for comparison with post job tank volumes.	Placement: Fluids/Mixing
It should be considered a guideline to record the cementing operations which occur on location. As a minimum, the down hole pumping rate, pump pressure and fluid density should be monitored and recorded for all cementing operations.	Placement: Job Recording and Engineering Simulations
Generally, the mix density will fluctuate more than the down hole density, but it still should be a guideline to minimize the mix density fluctuation as much as possible.	Placement: Job Recording and Engineering Simulations
A guideline is to record the fluid returns through flow-meters during the cement job.	Placement: Job Recording and Engineering Simulations
When discussing cement placement simulation software, it should be considered a guideline to have qualified cementing engineers perform the cementing simulations.	Placement: Job Recording and Engineering Simulations
It should be considered a guideline to perform ECD placement simulations assuming gauge hole and hole with excess, assuming average nitrogen injection rate and varied injection rate, taking into account, changes in slurry rheology, foam quality, temperature and pressure during the foam job.	Placement: Job Recording and Engineering Simulations
Prior to cementing operations it should be considered a guideline to have the pipe capacity from the cementing equipment to the rig floor documented. This is generally a fixed volume, but should be a known and used volume for simulation software and for friction pressure calculations.	Placement: Placement Techniques
When using the mud pumps for displacement, it should be a guideline to know ahead of time the pump efficiencies for calculation purposes. As a redundancy, flow meters can be installed on the rig pumps for quality assurance.	Placement: Placement Techniques
During displacement of the cement slurry, it should be considered a guideline to recalculate the displacement volume from anticipated bumps or shears encountered during displacement.	Placement: Placement Techniques
It should also be considered a guideline to slow the displacement rate prior to bumping the plug as to not over pressure any of the equipment.	Placement: Placement Techniques
It should be considered a guideline to compare the pumped volumes and measured pressures from the FIT to the volumes and pressures from the casing test.	Placement: Cement Placement Contingency Planning

Guidelines	Identifier
If the measured FIT is lower than expected, it should be considered a guideline to modify drilling rates and ECD's to reduce the likelihood of lost circulation during drilling.	Placement: Cement Placement Contingency Planning
Poor mud displacement and/or hole cleaning can lead to bad FIT results from fluid migration in the cement sheath either through mud channels or micro-annulus paths. In this case, it should be considered a guideline to perform remedial operations on the shoe for better zonal isolation.	Placement: Cement Placement Contingency Planning
When performing shoe squeeze operations, it should be considered a guideline to use the Bradenhead squeeze method, described further within the squeeze cementing subsection.	Placement: Cement Placement Contingency Planning
Prior to performing any primary cementing operations, it should be considered a guideline to have a shoe squeeze contingency plan in place with sufficient materials on location to perform this operation.	Placement: Cement Placement Contingency Planning
It should be considered a guideline to measure or calculate the acoustic impedance of the cement under laboratory conditions prior to the cement job such that wire-line technicians are able to properly calibrate their tools for best results.	Placement: Post Job
. It should also be considered a guideline to not run a bond log until the calculated top of cement (TOC) slurry has reached an acoustic impedance of at least ½ MRayl above the mud's measured acoustic impedance.	Placement: Post Job
When there is a possibility for flow or losses in this zone, the guideline is to ensure isolation of the area either by mechanical or chemical means, and test to validate the seal.	Intermediate Casing Strings
Other intermediate strings are brought to the wellhead to isolate previous casing strings. If the string will have a significant amount of unsupported pipe, a guideline should include calculations encompassing the expected temperature and pressure changes during the production cycle.	Intermediate Casing Strings
It should be considered a guideline to have mechanical separation of fluids to reduce the likelihood of fluid contamination during placement.	Intermediate Casing Strings
During displacement, it should be considered a guideline to have displacement pump rates as high as possible for better hole cleaning efficiency while keeping dynamic pressure below the fracture gradient.	Intermediate Casing Strings
Although measurement of mud compressibility should be considered a guideline prior to any cementing operation, the larger the displacement volume, the more important it is to perform these measurements.	Intermediate Casing Strings
It should also be considered a guideline to keep track of the mud return volume as an additional quality assurance check during displacement.	Intermediate Casing Strings
It should be considered a guideline to add silica to all cement designs which have the possibility of encountering temperature profiles above 230°F throughout the life of the well.	Production Strings: HP/HT
Special design considerations need to be taken into account when cementing across potential annular flow zones. Currently, operators are required to follow the recommended practices stated within API RP 65-2 as part of the revised Code of Federal Regulations.	Case Specific Formation Considerations: Potential Annular Flow Zone Cementing
Regardless of which approach is taken in the slurry design phase, a full technical analysis of the final slurry and how contact with a salt formation will affect it should be conducted.	Case Specific Formation Considerations: Salt Zone Cementing
It should also be considered a guideline to avoid hanging liners within any salt zones if possible. Liner hangers create annular clearance restrictions which should be avoided due to the salt creep point load considerations.	Case Specific Formation Considerations: Salt Zone Cementing

Guidelines	Identifier
It should be considered a guideline to use BHA's that are able to pass LCM through if losses are anticipated.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should also be considered a guideline when cementing across known lost circulation zones to have LCM built into the cement design.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should be considered a guideline to cure any losses prior to cement placement when possible.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
As a cement placement consideration guideline, pump rates should be increased if losses are encountered during the cement job. Although this statement is counterintuitive, the faster pump rates will ensure better hole cleaning at the shoe.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
There are many recommended guidelines derived from foam cementing case studies which are discussed within the literature review along with documented testing methods discussed within API 10B-4.	Case Specific Formation Considerations: Foam Cementing
There are several additives which as a guideline should be avoided when designing a foam cement system. These additives are: antifoams, dispersants, and potassium chloride.	Case Specific Formation Considerations: Foam Cementing
It should be considered a guideline to have the yield point of the base slurry greater than 10lbf/100ft2.	Case Specific Formation Considerations: Foam Cementing
It should also be considered a best practice to adjust the mixing density of the cement slurry when foaming.	Case Specific Formation Considerations: Foam Cementing
Base slurries with low yield points can also affect the foam quality and foam stability. It should also be considered a guideline to adjust the mixing density of the cement slurry to account for any additives that will be injected downstream of the mixing unit, such as foaming agents and stabilizers.	Case Specific Formation Considerations: Foam Cementing

Appendix G

CSITECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
One of the main considerations when discussing the operational guidelines associated with dry cement and additives is documentation and document control.	Dry Cement and Additive Considerations: General Considerations
An operational guideline would be to have a documented chain of custody for all cementing materials arriving on location to be able to easily track lot/batch numbers, chemical manufacture dates, cement QAQC/grind reports, and previous owners/storage locations of the cement and additives.	Dry Cement and Additive Considerations: General Considerations
Record tallies of bulk storage tanks showing a history of cement blends and cleaning operations should also be considered a guideline.	Dry Cement and Additive Considerations: General Considerations
It should be considered a guideline to record the lot numbers of each additive that is dry blended.	Dry Cement and Additive Considerations: Bulk Plant Considerations
All bulk storage tanks should be emptied, cleaned, and inspected regularly. At a minimum, these procedures should be carried out before a new cement blend is placed into the storage tanks. The final quantity and storage tank number should be documented for the blended cement system as well.	Dry Cement and Additive Considerations: Bulk Plant Considerations
Prior to loading or inspecting, the service company should present copies of load tickets to the boat captain and discuss which tanks are to be loaded. Storage tank capacities and hose connections should be verified. After loading, it is recommended to open the tank hatches to verify the amount of cement in each tank.	Dry Cement and Additive Considerations: In Transit Considerations
API RP 65 recommends the use of both top and bottom plugs for all casing cement jobs other than sting-in jobs. The bottom plugs are used as a mechanical separator between fluids while in the casing. Using only two plugs should be considered a minimum guideline. To get the best chances of cementing success, fluid intermixing should be minimized by all means and at all times.	Placement: Cementing Hardware Considerations
It should be considered a guideline to mechanically separate consecutive fluids in the landing string and casing during cementing operations when it will not increase operational complexity.	Placement: Cementing Hardware Considerations
It is also a guideline to reduce the displacement pumping rate prior to the bottom plug reaching any known restrictions within the casing or the float collar. The rate reduction decreases the pressure spike applied to the diaphragm, decreasing the likelihood of premature rupture.	Placement: Cementing Hardware Considerations
While discussing cement heads, it should be considered a guideline to incorporate rotating cement heads when possible such that casing rotation can be achieved during the cement job.	Placement: Cementing Hardware Considerations
Prior to any cement jobs, it should be considered a guideline to calculate the hydraulic horsepower needed to accomplish the operation and compare it to the equipment which will be used on location.	Placement: Cementing Hardware Considerations
. It should also be considered a guideline to install dry product storage bins as close to the mixing equipment, or vice versa, on new rig builds to mitigate the reduction in dry product travel rates.	Placement: Bulk and Liquid Delivery Systems

Guidelines	Identifier
Adherence to the sample collection procedures within RP 65 should be considered a minimum best practice. For above and beyond cementing guidelines, cement sample collection should be performed during each dry product transfer, whether it is from the bulk plant to the transport vessel or from the rig storage bins to the mixing equipment.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to have manufacture and expiration dates documented for all cementing liquid additives which are on location.	Placement: QC and Sample Collection Considerations
As a guideline, the mix water on location should be tested for chloride content, hardness, and ph.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to keep very close observation of fluid rheology to assist displacement efficiencies. The yield points of sequential fluids should be successively increased such that the viscosity of the displacing fluid tends to overcome the viscosity of the displaced fluid.	Placement: Fluids/Mixing
While discussing the importance of laboratory fluid compatibility testing, it should also be considered a guideline to run contaminated thickening time tests to observe how the contamination will vary the cement system's set time.	Placement: Fluids/Mixing
When using liquid additives for cementing operations on location, it should be considered a guideline to document the storage tank volumes of the additives prior to the cement job for comparison with post job tank volumes.	Placement: Fluids/Mixing
It should be considered a guideline to record the cementing operations which occur on location. As a minimum, the down hole pumping rate, pump pressure and fluid density should be monitored and recorded for all cementing operations.	Placement: Job Recording and Engineering Simulations
Generally, the mix density will fluctuate more than the down hole density, but it still should be a guideline to minimize the mix density fluctuation as much as possible.	Placement: Job Recording and Engineering Simulations
A guideline is to record the fluid returns through flow-meters during the cement job.	Placement: Job Recording and Engineering Simulations
When discussing cement placement simulation software, it should be considered a guideline to have qualified cementing engineers perform the cementing simulations.	Placement: Job Recording and Engineering Simulations
It should be considered a guideline to perform ECD placement simulations assuming gauge hole and hole with excess, assuming average nitrogen injection rate and varied injection rate, taking into account, changes in slurry rheology, foam quality, temperature and pressure during the foam job.	Placement: Job Recording and Engineering Simulations
Prior to cementing operations it should be considered a guideline to have the pipe capacity from the cementing equipment to the rig floor documented. This is generally a fixed volume, but should be a known and used volume for simulation software and for friction pressure calculations.	Placement: Placement Techniques
When using the mud pumps for displacement, it should be a guideline to know ahead of time the pump efficiencies for calculation purposes. As a redundancy, flow meters can be installed on the rig pumps for quality assurance.	Placement: Placement Techniques
During displacement of the cement slurry, it should be considered a guideline to recalculate the displacement volume from anticipated bumps or shears encountered during displacement.	Placement: Placement Techniques
It should also be considered a guideline to slow the displacement rate prior to bumping the plug as to not over pressure any of the equipment.	Placement: Placement Techniques
It should be considered a guideline to compare the pumped volumes and measured pressures from the FIT to the volumes and pressures from the casing test.	Placement: Cement Placement Contingency Planning

Guidelines	Identifier
If the measured FIT is lower than expected, it should be considered a guideline to modify drilling rates and ECD's to reduce the likelihood of lost circulation during drilling.	Placement: Cement Placement Contingency Planning
Poor mud displacement and/or hole cleaning can lead to bad FIT results from fluid migration in the cement sheath either through mud channels or micro-annulus paths. In this case, it should be considered a guideline to perform remedial operations on the shoe for better zonal isolation.	Placement: Cement Placement Contingency Planning
When performing shoe squeeze operations, it should be considered a guideline to use the Bradenhead squeeze method, described further within the squeeze cementing subsection.	Placement: Cement Placement Contingency Planning
Prior to performing any primary cementing operations, it should be considered a guideline to have a shoe squeeze contingency plan in place with sufficient materials on location to perform this operation.	Placement: Cement Placement Contingency Planning
It should be considered a guideline to measure or calculate the acoustic impedance of the cement under laboratory conditions prior to the cement job such that wire-line technicians are able to properly calibrate their tools for best results.	Placement: Post Job
. It should also be considered a guideline to not run a bond log until the calculated top of cement (TOC) slurry has reached an acoustic impedance of at least ½ MRayl above the mud's measured acoustic impedance.	Placement: Post Job
The guideline to follow is usually becomes a compromise. The producing formation may not have the same integrity throughout the zone, so it becomes a balancing act to design a system that will meet at least the minimum criteria. Once a design is selected, procedures are written to implement the process in the field.	Production Strings: Vertical
When running casing within vertical production zones, it should be considered a minimum guideline to centralize the casing to the calculated top of cement. As an additional recommendation, centralization to the calculated top of spacer would help increase the likelihood of cement coverage to TOC by reducing eccentric annuli where mud removal is taking place.	Production Strings: Vertical
It should be considered a guideline to add silica to all cement designs which have the possibility of encountering temperature profiles above 230°F throughout the life of the well.	Production Strings: HP/HT
Special design considerations need to be taken into account when cementing across potential annular flow zones. Currently, operators are required to follow the recommended practices stated within API RP 65-2 as part of the revised Code of Federal Regulations.	Case Specific Formation Considerations: Potential Annular Flow Zone Cementing
Regardless of which approach is taken in the slurry design phase, a full technical analysis of the final slurry and how contact with a salt formation will affect it should be conducted.	Case Specific Formation Considerations: Salt Zone Cementing
It should also be considered a guideline to avoid hanging liners within any salt zones if possible. Liner hangers create annular clearance restrictions which should be avoided due to the salt creep point load considerations.	Case Specific Formation Considerations: Salt Zone Cementing
It should be considered a guideline to use BHA's that are able to pass LCM through if losses are anticipated.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should also be considered a guideline when cementing across known lost circulation zones to have LCM built into the cement design.	Case Specific Formation Considerations: Lost Circulation Zone Cementing

Guidelines	Identifier
It should be considered a guideline to cure any losses prior to cement placement when possible.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
As a cement placement consideration guideline, pump rates should be increased if losses are encountered during the cement job. Although this statement is counterintuitive, the faster pump rates will ensure better hole cleaning at the shoe.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
There are many recommended guidelines derived from foam cementing case studies which are discussed within the literature review along with documented testing methods discussed within API 10B-4.	Case Specific Formation Considerations: Foam Cementing
There are several additives which as a guideline should be avoided when designing a foam cement system. These additives are: antifoams, dispersants, and potassium chloride.	Case Specific Formation Considerations: Foam Cementing
It should be considered a guideline to have the yield point of the base slurry greater than 10lbf/100ft2.	Case Specific Formation Considerations: Foam Cementing
It should also be considered a best practice to adjust the mixing density of the cement slurry when foaming.	Case Specific Formation Considerations: Foam Cementing
Base slurries with low yield points can also affect the foam quality and foam stability. It should also be considered a guideline to adjust the mixing density of the cement slurry to account for any additives that will be injected downstream of the mixing unit, such as foaming agents and stabilizers.	Case Specific Formation Considerations: Foam Cementing

Appendix H

CSITECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
One of the main considerations when discussing the operational guidelines associated with dry cement and additives is documentation and document control.	Dry Cement and Additive Considerations: General Considerations
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It should be considered a guideline to record the lot numbers of each additive that is dry blended.	Dry Cement and Additive Considerations: Bulk Plant Considerations
All bulk storage tanks should be emptied, cleaned, and inspected regularly. At a minimum, these procedures should be carried out before a new cement blend is placed into the storage tanks. The final quantity and storage tank number should be documented for the blended cement system as well.	Dry Cement and Additive Considerations: Bulk Plant Considerations
Prior to loading or inspecting, the service company should present copies of load tickets to the boat captain and discuss which tanks are to be loaded. Storage tank capacities and hose connections should be verified. After loading, it is recommended to open the tank hatches to verify the amount of cement in each tank.	Dry Cement and Additive Considerations: In Transit Considerations
API RP 65 recommends the use of both top and bottom plugs for all casing cement jobs other than sting-in jobs. The bottom plugs are used as a mechanical separator between fluids while in the casing. Using only two plugs should be considered a minimum guideline. To get the best chances of cementing success, fluid intermixing should be minimized by all means and at all times.	Placement: Cementing Hardware Considerations
It should be considered a guideline to mechanically separate consecutive fluids in the landing string and casing during cementing operations when it will not increase operational complexity.	Placement: Cementing Hardware Considerations
It is also a guideline to reduce the displacement pumping rate prior to the bottom plug reaching any known restrictions within the casing or the float collar. The rate reduction decreases the pressure spike applied to the diaphragm, decreasing the likelihood of premature rupture.	Placement: Cementing Hardware Considerations
While discussing cement heads, it should be considered a guideline to incorporate rotating cement heads when possible such that casing rotation can be achieved during the cement job.	Placement: Cementing Hardware Considerations
Prior to any cement jobs, it should be considered a guideline to calculate the hydraulic horsepower needed to accomplish the operation and compare it to the equipment which will be used on location.	Placement: Cementing Hardware Considerations
. It should also be considered a guideline to install dry product storage bins as close to the mixing equipment, or vice versa, on new rig builds to mitigate the reduction in dry product travel rates.	Placement: Bulk and Liquid Delivery Systems

Guidelines	Identifier
Adherence to the sample collection procedures within RP 65 should be considered a minimum best practice. For above and beyond cementing guidelines, cement sample collection should be performed during each dry product transfer, whether it is from the bulk plant to the transport vessel or from the rig storage bins to the mixing equipment.	Placement: QC and Sample Collection Considerations
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While discussing the importance of laboratory fluid compatibility testing, it should also be considered a guideline to run contaminated thickening time tests to observe how the contamination will vary the cement system's set time.	Placement: Fluids/Mixing
When using liquid additives for cementing operations on location, it should be considered a guideline to document the storage tank volumes of the additives prior to the cement job for comparison with post job tank volumes.	Placement: Fluids/Mixing
It should be considered a guideline to record the cementing operations which occur on location. As a minimum, the down hole pumping rate, pump pressure and fluid density should be monitored and recorded for all cementing operations.	Placement: Job Recording and Engineering Simulations
Generally, the mix density will fluctuate more than the down hole density, but it still should be a guideline to minimize the mix density fluctuation as much as possible.	Placement: Job Recording and Engineering Simulations
A guideline is to record the fluid returns through flow-meters during the cement job.	Placement: Job Recording and Engineering Simulations
When discussing cement placement simulation software, it should be considered a guideline to have qualified cementing engineers perform the cementing simulations.	Placement: Job Recording and Engineering Simulations
It should be considered a guideline to perform ECD placement simulations assuming gauge hole and hole with excess, assuming average nitrogen injection rate and varied injection rate, taking into account, changes in slurry rheology, foam quality, temperature and pressure during the foam job.	Placement: Job Recording and Engineering Simulations
Prior to cementing operations it should be considered a guideline to have the pipe capacity from the cementing equipment to the rig floor documented. This is generally a fixed volume, but should be a known and used volume for simulation software and for friction pressure calculations.	Placement: Placement Techniques
When using the mud pumps for displacement, it should be a guideline to know ahead of time the pump efficiencies for calculation purposes. As a redundancy, flow meters can be installed on the rig pumps for quality assurance.	Placement: Placement Techniques
During displacement of the cement slurry, it should be considered a guideline to recalculate the displacement volume from anticipated bumps or shears encountered during displacement.	Placement: Placement Techniques
It should also be considered a guideline to slow the displacement rate prior to bumping the plug as to not over pressure any of the equipment.	Placement: Placement Techniques
It should be considered a guideline to compare the pumped volumes and measured pressures from the FIT to the volumes and pressures from the casing test.	Placement: Cement Placement Contingency Planning

Guidelines	Identifier
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It should be considered a guideline to measure or calculate the acoustic impedance of the cement under laboratory conditions prior to the cement job such that wire-line technicians are able to properly calibrate their tools for best results.	Placement: Post Job
. It should also be considered a guideline to not run a bond log until the calculated top of cement (TOC) slurry has reached an acoustic impedance of at least ½ MRayl above the mud's measured acoustic impedance.	Placement: Post Job
Mud, spacers, and cement normally have a density hierarchy where the spacer is heavier than the mud, and the cement is heavier than the spacer. If they can all be separated by cement plugs, this method can still be useable in high angle scenarios, but it should be considered a guideline to have all fluids very close in density and have displacement efficiency built around the rheological hierarchy where successive fluids have greater viscosity.	Production Strings: Horizontal
The guideline should be to have a physical barrier between different fluids, and when that is not possible or practical, increasing the volume(s) allowing for some sacrificial losses.	Production Strings: Horizontal
Running rigid type centralizers should be considered a guideline in horizontal sections as annular clearance is more likely to occur.	Production Strings: Horizontal
It should be considered a guideline to have no free water or settling tendencies within the slurry design. Small amounts of free water within a cement system can lead to flow channels in horizontal sections.	Production Strings: Horizontal
It should be considered a guideline to add silica to all cement designs which have the possibility of encountering temperature profiles above 230°F throughout the life of the well.	Production Strings: HP/HT
Special design considerations need to be taken into account when cementing across potential annular flow zones. Currently, operators are required to follow the recommended practices stated within API RP 65-2 as part of the revised Code of Federal Regulations.	Case Specific Formation Considerations: Potential Annular Flow Zone Cementing
Regardless of which approach is taken in the slurry design phase, a full technical analysis of the final slurry and how contact with a salt formation will affect it should be conducted.	Case Specific Formation Considerations: Salt Zone Cementing
It should also be considered a guideline to avoid hanging liners within any salt zones if possible. Liner hangers create annular clearance restrictions which should be avoided due to the salt creep point load considerations.	Case Specific Formation Considerations: Salt Zone Cementing
It should be considered a guideline to use BHA's that are able to pass LCM through if losses are anticipated.	Case Specific Formation Considerations: Lost Circulation Zone Cementing

Guidelines	Identifier
It should also be considered a guideline when cementing across known lost circulation zones to have LCM built into the cement design.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
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As a cement placement consideration guideline, pump rates should be increased if losses are encountered during the cement job. Although this statement is counterintuitive, the faster pump rates will ensure better hole cleaning at the shoe.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
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It should also be considered a best practice to adjust the mixing density of the cement slurry when foaming.	Case Specific Formation Considerations: Foam Cementing
Base slurries with low yield points can also affect the foam quality and foam stability. It should also be considered a guideline to adjust the mixing density of the cement slurry to account for any additives that will be injected downstream of the mixing unit, such as foaming agents and stabilizers.	Case Specific Formation Considerations: Foam Cementing

Appendix I

CSITECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
One of the main considerations when discussing the operational guidelines associated with dry cement and additives is documentation and document control.	Dry Cement and Additive Considerations: General Considerations
An operational guideline would be to have a documented chain of custody for all cementing materials arriving on location to be able to easily track lot/batch numbers, chemical manufacture dates, cement QAQC/grind reports, and previous owners/storage locations of the cement and additives.	Dry Cement and Additive Considerations: General Considerations
Record tallies of bulk storage tanks showing a history of cement blends and cleaning operations should also be considered a guideline.	Dry Cement and Additive Considerations: General Considerations
It should be considered a guideline to record the lot numbers of each additive that is dry blended.	Dry Cement and Additive Considerations: Bulk Plant Considerations
All bulk storage tanks should be emptied, cleaned, and inspected regularly. At a minimum, these procedures should be carried out before a new cement blend is placed into the storage tanks. The final quantity and storage tank number should be documented for the blended cement system as well.	Dry Cement and Additive Considerations: Bulk Plant Considerations
Prior to loading or inspecting, the service company should present copies of load tickets to the boat captain and discuss which tanks are to be loaded. Storage tank capacities and hose connections should be verified. After loading, it is recommended to open the tank hatches to verify the amount of cement in each tank.	Dry Cement and Additive Considerations: In Transit Considerations
API RP 65 recommends the use of both top and bottom plugs for all casing cement jobs other than sting-in jobs. The bottom plugs are used as a mechanical separator between fluids while in the casing. Using only two plugs should be considered a minimum guideline. To get the best chances of cementing success, fluid intermixing should be minimized by all means and at all times.	Placement: Cementing Hardware Considerations
It should be considered a guideline to mechanically separate consecutive fluids in the landing string and casing during cementing operations when it will not increase operational complexity.	Placement: Cementing Hardware Considerations
It is also a guideline to reduce the displacement pumping rate prior to the bottom plug reaching any known restrictions within the casing or the float collar. The rate reduction decreases the pressure spike applied to the diaphragm, decreasing the likelihood of premature rupture.	Placement: Cementing Hardware Considerations
While discussing cement heads, it should be considered a guideline to incorporate rotating cement heads when possible such that casing rotation can be achieved during the cement job.	Placement: Cementing Hardware Considerations
Prior to any cement jobs, it should be considered a guideline to calculate the hydraulic horsepower needed to accomplish the operation and compare it to the equipment which will be used on location.	Placement: Cementing Hardware Considerations
. It should also be considered a guideline to install dry product storage bins as close to the mixing equipment, or vice versa, on new rig builds to mitigate the reduction in dry product travel rates.	Placement: Bulk and Liquid Delivery Systems

Guidelines	Identifier
Adherence to the sample collection procedures within RP 65 should be considered a minimum best practice. For above and beyond cementing guidelines, cement sample collection should be performed during each dry product transfer, whether it is from the bulk plant to the transport vessel or from the rig storage bins to the mixing equipment.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to have manufacture and expiration dates documented for all cementing liquid additives which are on location.	Placement: QC and Sample Collection Considerations
As a guideline, the mix water on location should be tested for chloride content, hardness, and ph.	Placement: QC and Sample Collection Considerations
It should be considered a guideline to keep very close observation of fluid rheology to assist displacement efficiencies. The yield points of sequential fluids should be successively increased such that the viscosity of the displacing fluid tends to overcome the viscosity of the displaced fluid.	Placement: Fluids/Mixing
While discussing the importance of laboratory fluid compatibility testing, it should also be considered a guideline to run contaminated thickening time tests to observe how the contamination will vary the cement system's set time.	Placement: Fluids/Mixing
When using liquid additives for cementing operations on location, it should be considered a guideline to document the storage tank volumes of the additives prior to the cement job for comparison with post job tank volumes.	Placement: Fluids/Mixing
It should be considered a guideline to record the cementing operations which occur on location. As a minimum, the down hole pumping rate, pump pressure and fluid density should be monitored and recorded for all cementing operations.	Placement: Job Recording and Engineering Simulations
Generally, the mix density will fluctuate more than the down hole density, but it still should be a guideline to minimize the mix density fluctuation as much as possible.	Placement: Job Recording and Engineering Simulations
A guideline is to record the fluid returns through flow-meters during the cement job.	Placement: Job Recording and Engineering Simulations
When discussing cement placement simulation software, it should be considered a guideline to have qualified cementing engineers perform the cementing simulations.	Placement: Job Recording and Engineering Simulations
It should be considered a guideline to perform ECD placement simulations assuming gauge hole and hole with excess, assuming average nitrogen injection rate and varied injection rate, taking into account, changes in slurry rheology, foam quality, temperature and pressure during the foam job.	Placement: Job Recording and Engineering Simulations
Prior to cementing operations it should be considered a guideline to have the pipe capacity from the cementing equipment to the rig floor documented. This is generally a fixed volume, but should be a known and used volume for simulation software and for friction pressure calculations.	Placement: Placement Techniques
When using the mud pumps for displacement, it should be a guideline to know ahead of time the pump efficiencies for calculation purposes. As a redundancy, flow meters can be installed on the rig pumps for quality assurance.	Placement: Placement Techniques
During displacement of the cement slurry, it should be considered a guideline to recalculate the displacement volume from anticipated bumps or shears encountered during displacement.	Placement: Placement Techniques
It should also be considered a guideline to slow the displacement rate prior to bumping the plug as to not over pressure any of the equipment.	Placement: Placement Techniques
It should be considered a guideline to compare the pumped volumes and measured pressures from the FIT to the volumes and pressures from the casing test.	Placement: Cement Placement Contingency Planning

Guidelines	Identifier
If the measured FIT is lower than expected, it should be considered a guideline to modify drilling rates and ECD's to reduce the likelihood of lost circulation during drilling.	Placement: Cement Placement Contingency Planning
Poor mud displacement and/or hole cleaning can lead to bad FIT results from fluid migration in the cement sheath either through mud channels or micro-annulus paths. In this case, it should be considered a guideline to perform remedial operations on the shoe for better zonal isolation.	Placement: Cement Placement Contingency Planning
When performing shoe squeeze operations, it should be considered a guideline to use the Bradenhead squeeze method, described further within the squeeze cementing subsection.	Placement: Cement Placement Contingency Planning
Prior to performing any primary cementing operations, it should be considered a guideline to have a shoe squeeze contingency plan in place with sufficient materials on location to perform this operation.	Placement: Cement Placement Contingency Planning
It should be considered a guideline to measure or calculate the acoustic impedance of the cement under laboratory conditions prior to the cement job such that wire-line technicians are able to properly calibrate their tools for best results.	Placement: Post Job
. It should also be considered a guideline to not run a bond log until the calculated top of cement (TOC) slurry has reached an acoustic impedance of at least ½ MRayl above the mud's measured acoustic impedance.	Placement: Post Job
It should be considered a guideline to add silica to all cement designs which have the possibility of encountering temperature profiles above 230°F throughout the life of the well.	Production Strings: HP/HT
As an introduction into special formation considerations, it should also be considered a guideline to have the top of cement generally 500ft above salt formations when tiebacks overlap salt zones.	Production Strings: Tieback Liners
It should also be considered a guideline to centralize the tieback casing very well throughout salt zones in anticipation of point loading from salt creep.	Production Strings: Tieback Liners
Special design considerations need to be taken into account when cementing across potential annular flow zones. Currently, operators are required to follow the recommended practices stated within API RP 65-2 as part of the revised Code of Federal Regulations.	Case Specific Formation Considerations: Potential Annular Flow Zone Cementing
Regardless of which approach is taken in the slurry design phase, a full technical analysis of the final slurry and how contact with a salt formation will affect it should be conducted.	Case Specific Formation Considerations: Salt Zone Cementing
It should also be considered a guideline to avoid hanging liners within any salt zones if possible. Liner hangers create annular clearance restrictions which should be avoided due to the salt creep point load considerations.	Case Specific Formation Considerations: Salt Zone Cementing
It should be considered a guideline to use BHA's that are able to pass LCM through if losses are anticipated.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should also be considered a guideline when cementing across known lost circulation zones to have LCM built into the cement design.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
It should be considered a guideline to cure any losses prior to cement placement when possible.	Case Specific Formation Considerations: Lost Circulation Zone Cementing

Guidelines	Identifier
As a cement placement consideration guideline, pump rates should be increased if losses are encountered during the cement job. Although this statement is counterintuitive, the faster pump rates will ensure better hole cleaning at the shoe.	Case Specific Formation Considerations: Lost Circulation Zone Cementing
There are many recommended guidelines derived from foam cementing case studies which are discussed within the literature review along with documented testing methods discussed within API 10B-4.	Case Specific Formation Considerations: Foam Cementing
There are several additives which as a guideline should be avoided when designing a foam cement system. These additives are: antifoams, dispersants, and potassium chloride.	Case Specific Formation Considerations: Foam Cementing
It should be considered a guideline to have the yield point of the base slurry greater than 10lbf/100ft2.	Case Specific Formation Considerations: Foam Cementing
It should also be considered a best practice to adjust the mixing density of the cement slurry when foaming.	Case Specific Formation Considerations: Foam Cementing
Base slurries with low yield points can also affect the foam quality and foam stability. It should also be considered a guideline to adjust the mixing density of the cement slurry to account for any additives that will be injected downstream of the mixing unit, such as foaming agents and stabilizers.	Case Specific Formation Considerations: Foam Cementing

Appendix J

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
The main guideline for remedial cementing should be to reduce the likelihood of needing to perform remedial cementing through sound placement of previous primary jobs.	Remedial Cementing
When planning on using packers, it should be considered a guideline to take into account the manufactured size restrictions of current packers on the market.	Remedial Cementing: Rig Equipment Considerations
If cement is to be placed using a stinger attached to drill pipe, it should be considered a guideline to have the length of the stinger be twice the calculated length of the longest cement plug which is being set.	Remedial Cementing: Rig Equipment Considerations
Separation of fluids during placement is still considered a guideline. If possible, a foam ball launching manifold should be used to assist with fluid separation.	Remedial Cementing: Rig Equipment Considerations
When performing squeeze operations, it should be considered a guideline to have a squeeze manifold rigged up for the cement job, even if the squeeze procedure does not require one to be rigged up.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to perform abandonment operations with a derrick.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to attach diverter subs onto tubing for placement of any cement plug including: balanced plugs, kick-off plugs, Bradenhead squeeze plugs, etc.	Remedial Cementing: Rig Equipment Considerations
The guideline would be to set the plug across the softest formation when that is possible. Generally the plug needs to be in a strategic position so that the original target depth can be reached with as little disruption as possible.	Remedial Cementing: Cement Kick-Off Plugs
Large diameter holes combined with light low viscosity and low yield point muds, may allow the plug to slump and fall through the mud until it reaches a point where it can be supported or it begins to be self-supporting. The guideline in this situation is to spot a high viscosity mud pill below the plug to help hold the cement in place.	Remedial Cementing: Cement Kick-Off Plugs
Any mud pill or heavier density fluid in the annulus or drill pipe will make accurate placement difficult or impossible as the fluid will u-tube in the pipe until equilibrium is established. The guideline is to circulate and condition the mud until a stable density is achieved.	Remedial Cementing: Cement Kick-Off Plugs

Appendix K

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
The main guideline for remedial cementing should be to reduce the likelihood of needing to perform remedial cementing through sound placement of previous primary jobs.	Remedial Cementing
When planning on using packers, it should be considered a guideline to take into account the manufactured size restrictions of current packers on the market.	Remedial Cementing: Rig Equipment Considerations
If cement is to be placed using a stinger attached to drill pipe, it should be considered a guideline to have the length of the stinger be twice the calculated length of the longest cement plug which is being set.	Remedial Cementing: Rig Equipment Considerations
Separation of fluids during placement is still considered a guideline. If possible, a foam ball launching manifold should be used to assist with fluid separation.	Remedial Cementing: Rig Equipment Considerations
When performing squeeze operations, it should be considered a guideline to have a squeeze manifold rigged up for the cement job, even if the squeeze procedure does not require one to be rigged up.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to perform abandonment operations with a derrick.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to attach diverter subs onto tubing for placement of any cement plug including: balanced plugs, kick-off plugs, Bradenhead squeeze plugs, etc.	Remedial Cementing: Rig Equipment Considerations
Individual well conditions will determine the best or most practical method of placement, or conditions dictate a particular method. Plug cementing must adhere to CFR-30.250.1715. The plugging requirements outlined within the code of federal regulations must be followed unless an exemption is granted.	Remedial Cementing: Plug Cementing
If the fluid in the hole is Newtonian or near Newtonian, especially with a large density differential, the cement may slump and fall down the hole until finding a platform that will stop the process. This is particularly true in large diameter holes (over 8 inches in diameter). The guideline to prevent this from occurring is a high viscosity gel pill immediately below the proposed bottom of the cement to prevent the gravity slump of the cement.	Remedial Cementing: Plug Cementing
Performing remedial cementing operations through coil tubing has its own special considerations. The friction pressure drop caused by long lengths of tubing must be calculated prior to the cementing operation such that there is sufficient hydraulic horsepower for placement. It should be considered a guideline to design cement systems under specific performance parameters for coil tubing operations.	Remedial Cementing: Plug Cementing

Appendix L

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
The main guideline for remedial cementing should be to reduce the likelihood of needing to perform remedial cementing through sound placement of previous primary jobs.	Remedial Cementing
When planning on using packers, it should be considered a guideline to take into account the manufactured size restrictions of current packers on the market.	Remedial Cementing: Rig Equipment Considerations
If cement is to be placed using a stinger attached to drill pipe, it should be considered a guideline to have the length of the stinger be twice the calculated length of the longest cement plug which is being set.	Remedial Cementing: Rig Equipment Considerations
Separation of fluids during placement is still considered a guideline. If possible, a foam ball launching manifold should be used to assist with fluid separation.	Remedial Cementing: Rig Equipment Considerations
When performing squeeze operations, it should be considered a guideline to have a squeeze manifold rigged up for the cement job, even if the squeeze procedure does not require one to be rigged up.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to perform abandonment operations with a derrick.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to attach diverter subs onto tubing for placement of any cement plug including: balanced plugs, kick-off plugs, Bradenhead squeeze plugs, etc.	Remedial Cementing: Rig Equipment Considerations
The guideline for all squeeze scenarios is clearing any contamination that may affect the quality of the cement.	Remedial Cementing: Squeeze Cementing
In the case of formations containing hydrocarbons the surfaces must also be water wet for the squeeze to be effective. It should also be considered a guideline to avoid performing squeeze operations below inflatable packers.	Remedial Cementing: Squeeze Cementing

Appendix M

CSI TECHNOLOGIES
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Operational Guidelines

Guidelines	Identifier
The main guideline for remedial cementing should be to reduce the likelihood of needing to perform remedial cementing through sound placement of previous primary jobs.	Remedial Cementing
When planning on using packers, it should be considered a guideline to take into account the manufactured size restrictions of current packers on the market.	Remedial Cementing: Rig Equipment Considerations
If cement is to be placed using a stinger attached to drill pipe, it should be considered a guideline to have the length of the stinger be twice the calculated length of the longest cement plug which is being set.	Remedial Cementing: Rig Equipment Considerations
Separation of fluids during placement is still considered a guideline. If possible, a foam ball launching manifold should be used to assist with fluid separation.	Remedial Cementing: Rig Equipment Considerations
When performing squeeze operations, it should be considered a guideline to have a squeeze manifold rigged up for the cement job, even if the squeeze procedure does not require one to be rigged up.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to perform abandonment operations with a derrick.	Remedial Cementing: Rig Equipment Considerations
It should be considered a guideline to attach diverter subs onto tubing for placement of any cement plug including: balanced plugs, kick-off plugs, Bradenhead squeeze plugs, etc.	Remedial Cementing: Rig Equipment Considerations
The size, number, and phase of perforations play a large role in placement designs for squeeze and plug operations. In a perfect scenario, the larger and more frequent the perforations, the higher likelihood of having quality remedial operations.	Remedial Cementing: Perforation Considerations
Good fluid loss control should be built into slurry designs that will be flowing through perforations. The fluid loss control decreases the risks associated with the cement dehydrating and bridging off perforations prematurely.	Remedial Cementing: Perforation Considerations