

Culture of Maintenance

- Problems with checklists – they are never a substitute for experience.
 - Easy to misinterpret the presence of products, tools or services as the quality of products, tools or services.
 - Check lists can never contain all the possible problems (many of which have similar causes).
- Monitoring works and cuts costs – but only if applied uniformly and you are monitoring the right factors.
 - Drilling problems foretell integrity problems.
 - Produced water analysis spots changes in flowing equilibrium or fluid sources.
 - Consider changes in a produced fluid in a trend, not a single point tell-tale. .
 - Detail what comes out of a well – equipment, tools, fluids – what stories do they tell about the presence of solids, fluids or blockages downhole.
 - Look for repurposed wells – sometimes the repurpose did not fit the original design.
 - Rank T/A wells, plug those that are depleted, non-repairable or painfully non-economic.

Checklists – high expectations but poor adherence?

- Even the best checklists cannot cover everything.
- Example from cementing – all known points – but desire for speed often weakens cement isolation.

Cementing

Workover Brief Specifications

- ___ job objectives clear?
- ___ maximum density to avoid fracturing.
- ___ maximum pump pressure to prevent fracturing.
- ___ lost circulation zones identified from drilling.
- ___ wellbore fluid density.
- ___ density of mixed slurry.
- ___ salt content of brines.
- ___ bottom hole cementing temp.
- ___ maximum fluid loss (1000 psi) specified? (at a test temperature), or use following.
- ___ 20cc/30 min, prevention of gas channels.
- ___ 50cc/30 min, liner cementing.
- ___ 250cc/30 min, casing cementing.
- ___ 50 to 200cc/30 min, squeeze cement. Depends on experience and success in an area.
- ___ amount of Latex additive specified if a squeeze cement job?
- ___ min spaced flow rate for turbulence.
- ___ min cement flow rate for turbulence.
- ___ Change spacers if plug flow is used.
- ___ max flow rate for plug flow.
- ___ salt content specified?
- ___ anticipated mix water temp? Guidelines on max. or min. temp?
- ___ silica flour specified temp > 230°F?
- ___ free water 1% or less?
- ___ cement thickening time for BHCT and BHP.
- ___ Test duplicates field conditions.
- ___ field water used for lab tests?
- ___ yield of slurry.
- ___ gal mix water/sacks.
- ___ total cement on site.
- ___ total water on site.
- ___ well head pressure during displacement.
- ___ bottom hole pressure during displacement.
- ___ mixing time.
- ___ mud displacement volume.
- ___ cement free fall rate.
- ___ cum. vol. to catch top plug.
- ___ cum. vol. to bump top plug.
- ___ compat. check of cement slurry with spacers and with mud.
- ___ environmental considerations, handling and disposal restrictions addressed?
- ___ onsite Q/C tools available? (pressurized balance or scales, if needed)

Cement Equipment - Yard Check

Check Cement Wiper Plugs

- ___ no debris in cavity of bottom plug(s). Plug color?
- ___ bottom plug(s) diaphragm undamaged.
- ___ top plug solid. Color?
- ___ plug loading procedures clear and understood?
- ___ plug holder can hold all plugs.
- ___ can drop all plugs without opening.
- ___ plug catcher operation OK.
- ___ all tanks clean (NO leftover cement or foreign fluids). Open hatch to check interior for cleanliness.
- ___ transfer lines clean.
- ___ check all cementing head valves.
- ___ If pipe must be rotated - check operation of rotating head.
- ___ pump unit to include (for each pump), pressure gauge, a pump rate indicator and a cumulative barrel counter. All instruments must be accurate and operational. Tanks can be strapped.
- ___ pressurized fluid balance required.
- ___ chart recorder for pump pressure.
- ___ water tight containers for dry and liquid samples.
- ___ containers to hold slurry samples. All containers must be marked with proper identification.
- ___ auxiliary lights to backup truck mounted lights.
- ___ chart recorder for annulus pressure on squeeze jobs.
- ___ density recorder on low pressure side?
- ___ density recorder on high pressure side?
- ___ additional working communications device for BP Rep.

Bulk Cement Blending

Bulk Plant Checks

- ___ recent calibration of scales.
- ___ verify weight calc.
- ___ verify each additive identification.
- ___ count additive sacks for each blend.
- ___ do not allow partial bags of additives to be added over and above the design.
- ___ sufficient additive mixing.
- ___ sample the dry blended material from each batch.
- ___ visually inspect each empty tank for cleanliness.
- ___ test thickening time on each batch with water to be used on the job?
- ___ estimate of pump time?

What is a Culture of Maintenance?

It differs with the industry involved.

- Objectives
 - Example - Prevent unintentional releases of fluids through activities including:
 - Monitoring of selected system integrity (periodic pressure tests, non-destructive testing, etc.)
 - Predictive models based on system chemical, physical and operational parameters – and included a learning loop. Must be connected to a responsible person.
 - Identify specific approvals necessary for operations outside of accepted parameters after consult with subject matter experts (SME's).
 - Barriers that can “catch” unintended releases (this should be a secondary objective, but may rise in importance with difficulty in predicting problems).
 - Mechanical and administrative check & balance for corrosion prediction and control. (This must be more than a check the box exercise – needs to be supported by mandatory education that identifies occurrence and impact (including reputation))
- Actions – must be from a list that describe but is not confined to known or common problems.
- Results – if problems that result in releases are not decreasing, the culture of maintenance system is poorly constructed and must be redone.

Oilfield Examples

- Starts in the design phase:
 - What are the major problems expected?
 - Can design changes prevent or minimize the problems?
 - What changes are need to make monitoring, treating or repairing easier?
 - Is training sufficient?
 - What are the hand-off points and are the required maintenance points being effectively communicated.
- Corrosion is the most common and most damaging action in the oil industry. Is the best control a change in design or response activities (e.g., corrosion control programs).
- Scale, erosion, abrasion, vandalism, weather, and offset operations are often factors. – Each well may need a different set of circumstances.

Culture of Maintenance – bottom line

- Responsibility, education, commitment, management support and sufficient resources are the strongest drivers for a successful culture of maintenance.
- A reviewed learnings loop is very critical – your problems will not stay the same.