

HALLIBURTON

Steady Flow System Loss of Containment

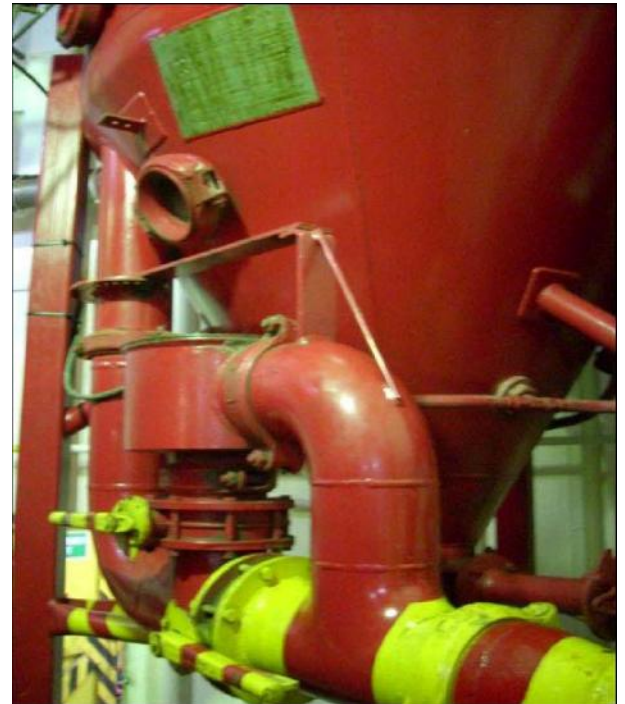
Taproot Investigation

Steady Flow System Loss of Containment

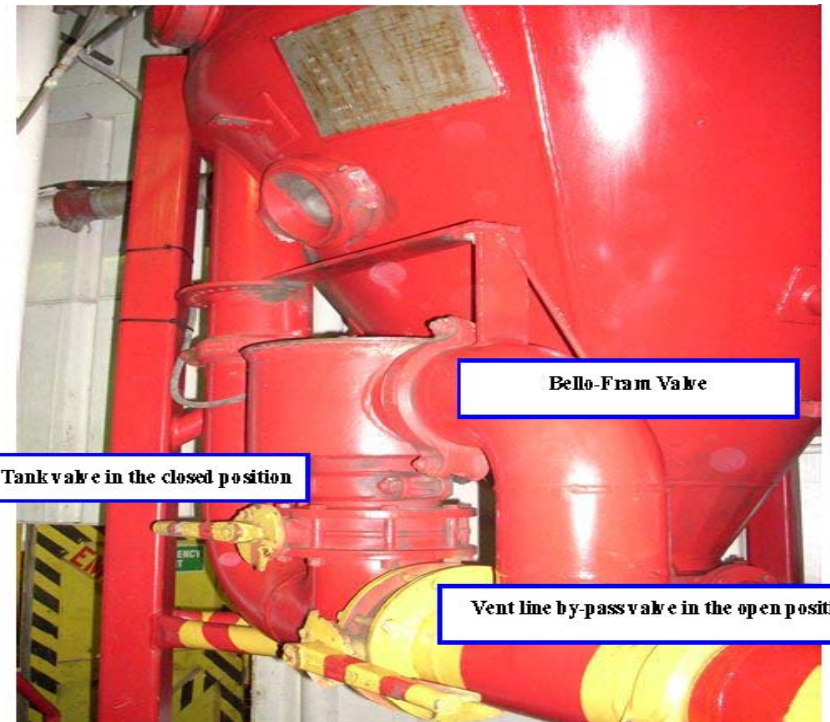
The Incident

On the morning of July 4, 2009, a near miss event occurred during maintenance operations on pneumatic cementing equipment specifically the Steady-Flow Bin (SFB) that was installed on an offshore drilling rig,

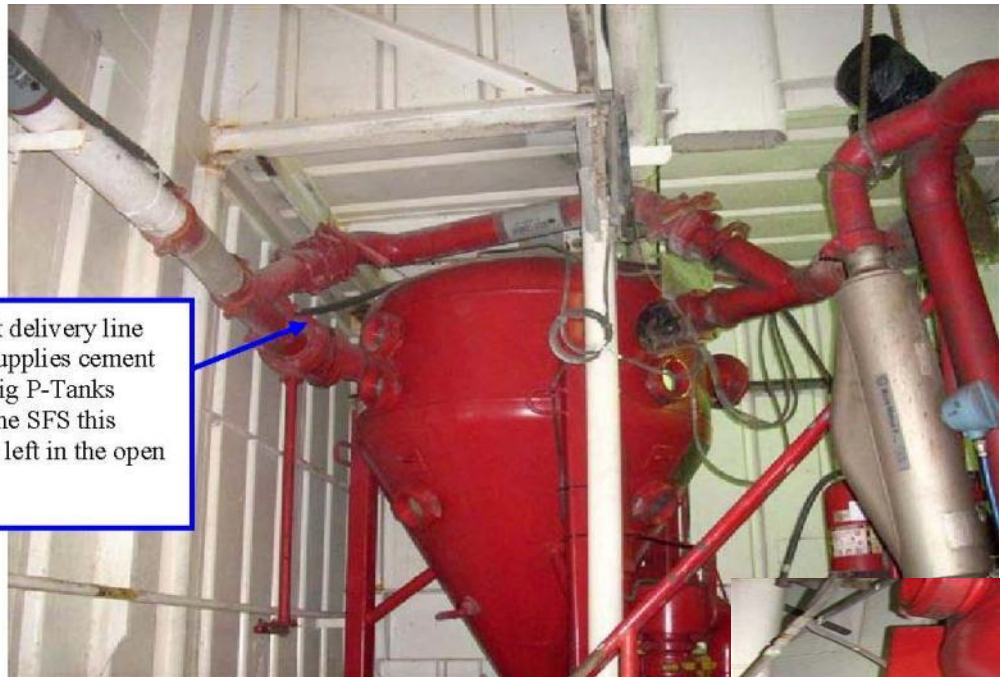
Cement product was released under pressure from the vent line attached to the SFB covering the two operators working on the system and the corresponding work space and equipment with dry cement



SFB Pressure Gauges & Bello Fram Valve

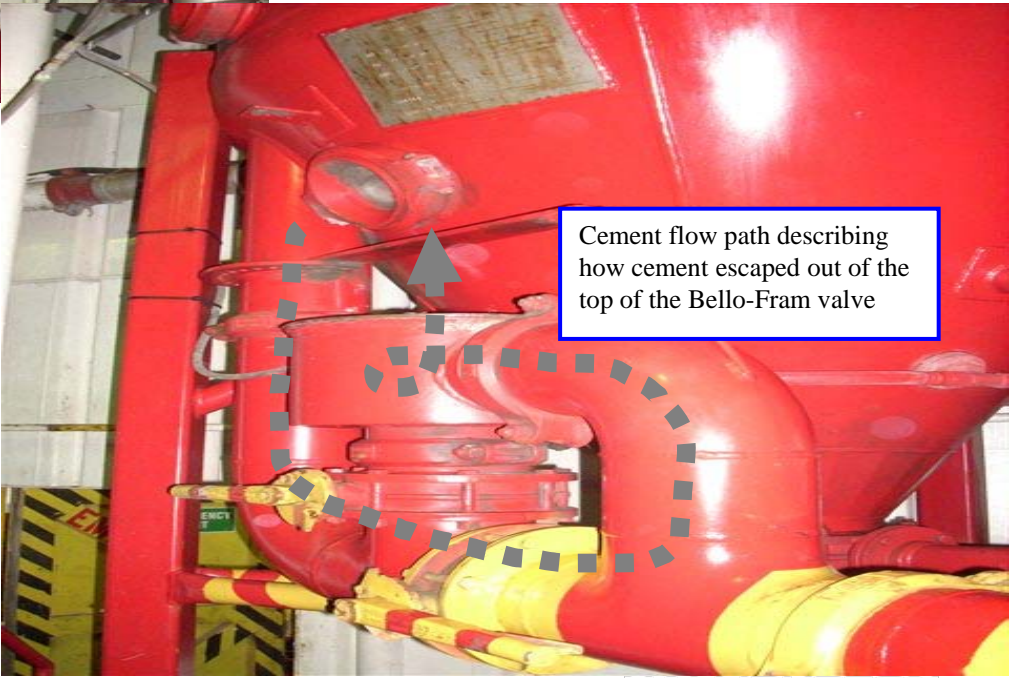


Bulk Inlet Line to SFB



Main bulk delivery line
this line supplies cement
from the rig P-Tanks
direct to the SFS this
valve was left in the open
position

Cement Flow Path



Cement flow path describing
how cement escaped out of the
top of the Bello-Fram valve

Events Leading to Incident

- Cement Operator (CO) pumps Kick Off Plug 1 of 3 for sidetracking
 - Next plug due to be pumped 3 to 4 hours later
- Minor leak noticed from SFS Bellofram Valve (BV)
 - Repair not urgent
 - Common maintenance job
- SFS left full – not normal practice
 - Normally would empty bulk out of SFS
 - Bulk left in SFS due to short duration between jobs; bulk system inefficient – takes extended time to refill
- Rig bulk system left pressured up
 - Short duration between jobs
 - CO unaware rig bulk system not depressurised
- CO commenced repair on BV seal
 - Uncontrolled release of pressure 10 minutes into task

Taproot Investigation Findings

Causal factor Description

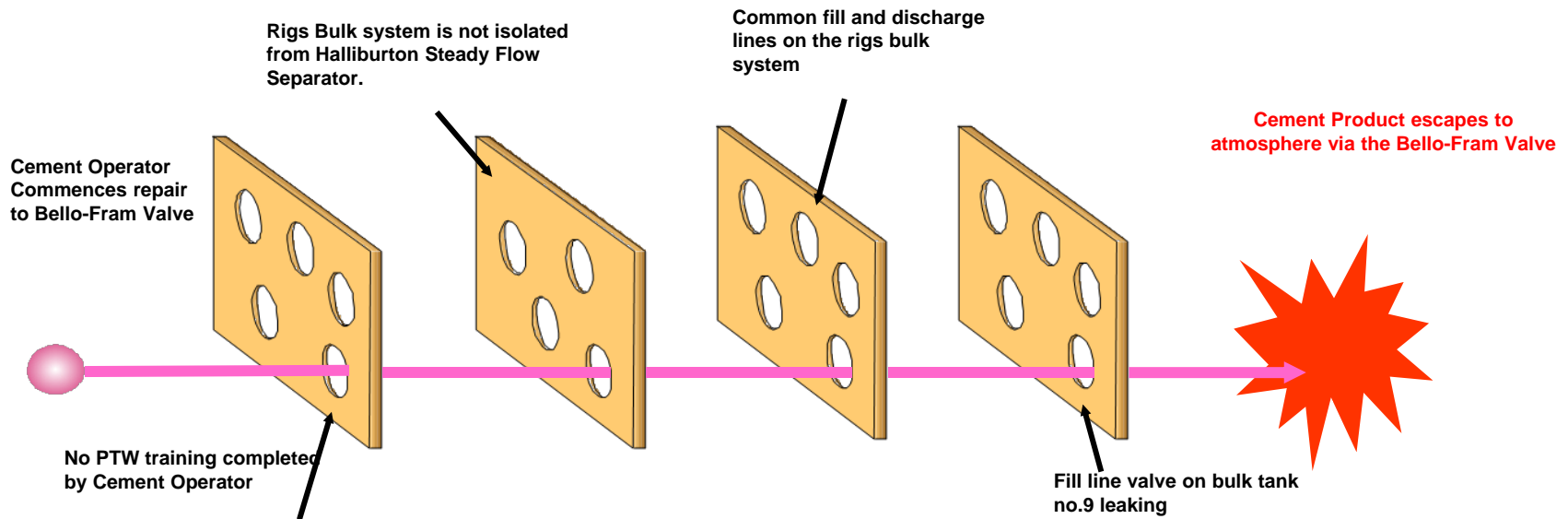
CF-1 Cement Operator had not completed PTW training when joining the rig

CF-2 Cement Operator starts maintenance without a PTW in place

CF-3 Fill line valve on rig's P-Tank No.9 leaking

CF-4 Fill and discharge lines on rig's P-Tanks are a common line

Causal Factors



Break Down of Causal Factors

Causal Factor 1

CO had not completed minimum rig based safety systems training including PTW

- Operator not aware PTW required for repair BV seal
- Operator has repaired BV seal previously without PTW – bulk system had always been depressured

Recommendation

- Rig contractor reviews current rig induction and training process with scope to identify and correct any deficiencies in the monitoring process specific to third parties.

[The cement operator had not completed the required PTW training when joining the MODU , therefore it is unrealistic to expect the operator to have used the PTW system]

Corrective Action

Rig to develop a method to ensure required training for third parties is conducted and that an effective monitoring process is established

Break Down of Causal Factors (cont)

Causal Factor 2

CO conducts maintenance without completing a PTW as required for Halliburton pressure systems

Recommendation

Halliburton identify and label plant & operating systems that require either or both of:

1. Permit To Work
2. Lock out Tag out

Required items above, to be in place prior to maintenance or inspections being conducted on the equipment.

Opportunity for Improvement: 2

Cement operator had completed bulk system operations or maintenance training but failed to apply this knowledge when planning for the job

Corrective Action

Halliburton to conduct a review of the current minimum competency requirements for offshore operators and ensure minimum skills sets match the expected operating environment [roles and responsibilities] for offshore cementing operators

Break Down of Causal Factors (cont)

Causal Factor 3

Fill valve on P-Tank No.9 leaking

- Preventive/predictive maintenance
- RC 3- PM for equip Needs Improvement

Recommendation

A review be undertaken on the maintenance routines associated with the rigs bulk plant to ensure suitability of the frequency of valve inspections and a means of verification and recording of the bulk systems pressure holding integrity

Causal Factor 4

CF-4 Fill & Discharge lines on P-Tanks are joined into a single common line

-Design

-Design Specs

RC 4- Problem not anticipated

Recommendation

A review be undertaken on the current bulk plant design with scope to investigate the possibility of designing independent fill discharge and vent lines.

[If the P-Tanks had separate lines the pressure leak at the fill line valve would

not have impacted on the work being done on the SFB]

Lessons Learnt & Improvement Opportunities.

Opportunity for Improvement: 1

Rig based third party training matrix not maintained

Corrective Action:

Rig to develop a method to ensure required training for third parties is conducted and that an effective monitoring process is established

Opportunity for Improvement: 2

Cement operator had completed bulk system operations or maintenance training but failed to apply this knowledge when planning for the job.

Corrective Action:

Halliburton to conduct a review of the current minimum competency requirements for offshore operators and ensure minimum skills sets match the expected operating environment [roles and responsibilities] for offshore cementing operators.

Opportunity for Improvement: 3

Vent line orientation

Corrective Action:

Rig contractor to investigate the engineering design of SFS vent line and ensure its operational suitability.

A/ Vent line is installed such that it exhausts in a upwards direction.

B/ SFB vent line is manifolded into a common manifold with the vents from the rigs P-Tanks

Opportunity for Improvement: 4

Fill and Discharge lines on the rigs P-Tanks are a common line

Corrective Action:

Rig contractor to undertake a study of the current bulk plant installation to ensure the operational integrity of the system has not been compromised by the common manifolding of not only the fill and discharge lines but additionally the vent lines.

Opportunity for Improvement: 5

Pressure Seal on Bellophram Lid achieved utilizing silicone sealant

Corrective Action:

Halliburton to investigate the current practise of utilizing silicon sealant to maintain a pressure seal on the lid of the Bellophram Valve and ensure its safety & effectiveness.

Opportunity for Improvement: 6

Cement Operator did not have a sound working knowledge of the rig's bulk system including the piping layout

Corrective Action:

Halliburton to develop a new rig start up package including documentation of the rigs bulk systems and piping layouts and a check sheet specifically detailing the requirement for all cement operators to undertake a rig equipment orientation when joining a new rig.