



Operational Experiences

HALLIBURTON

Content

- Preparation and Mobilization
- Project Support
- Equipment and the Vessel
- Fluid Systems
- Logistics
- Communication

Force workshop 6-7 Nov 2013

Preparation, Testing & Planning

- Large Scale Yard Testing of Equipment
 - High Pressure Unit Rig-up
 - Project Specific Rates and Pressures
- Personnel Meetings and Project Presentations



Mobilization of Equipment to Gdansk

- Transportation Logistics
- Cross Border and Customs

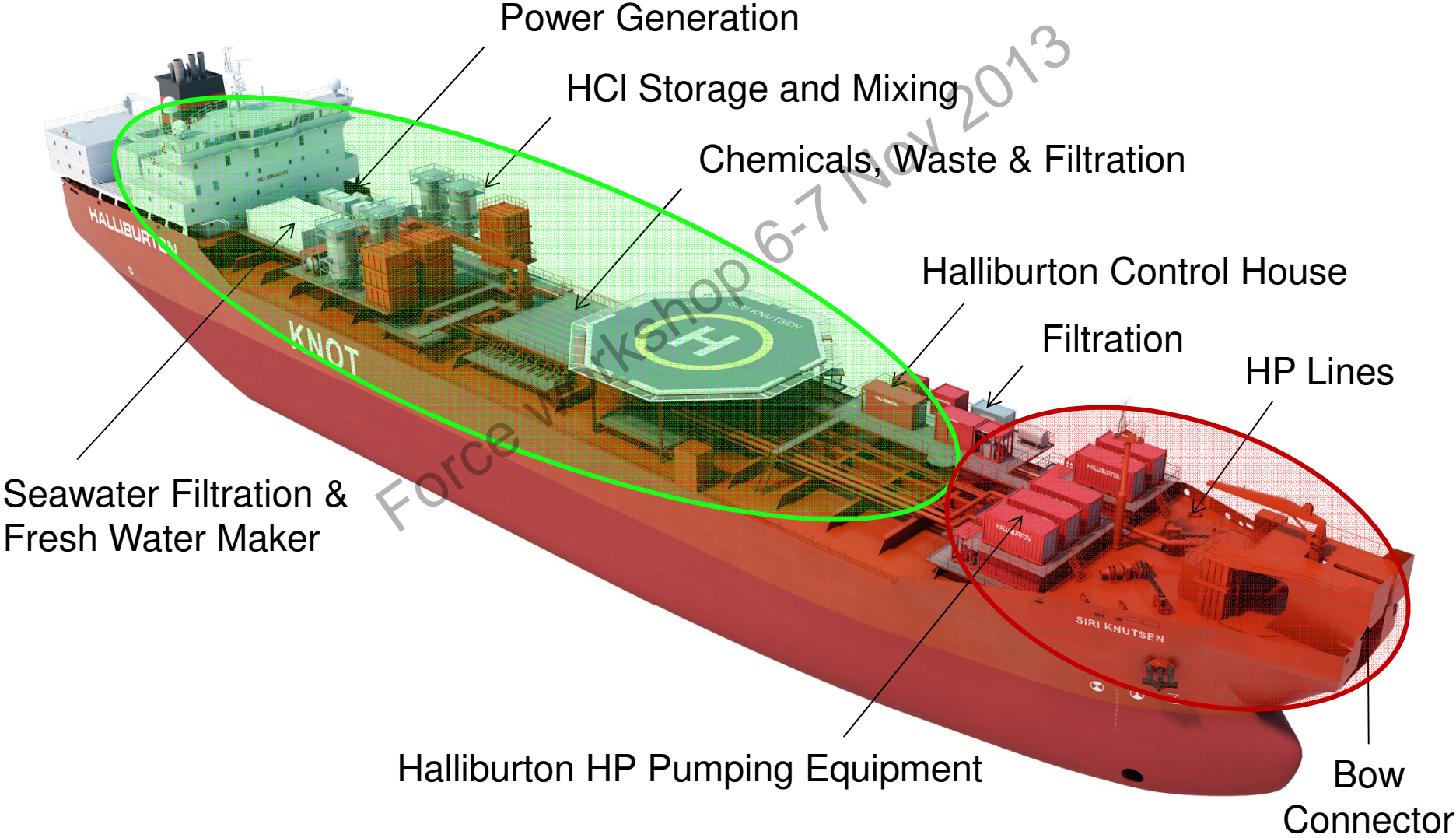


Installation, Testing and Commisioning

- Installation in co-operation with Knutsen, Yard and Contractors
- Inspected, Tested and Approved
- Combined Halliburton and Knutsen Commisioning phase
 - Fluid Transfer
 - Mixing Simulation
 - Pumping Tests
 - Procedural Simulation



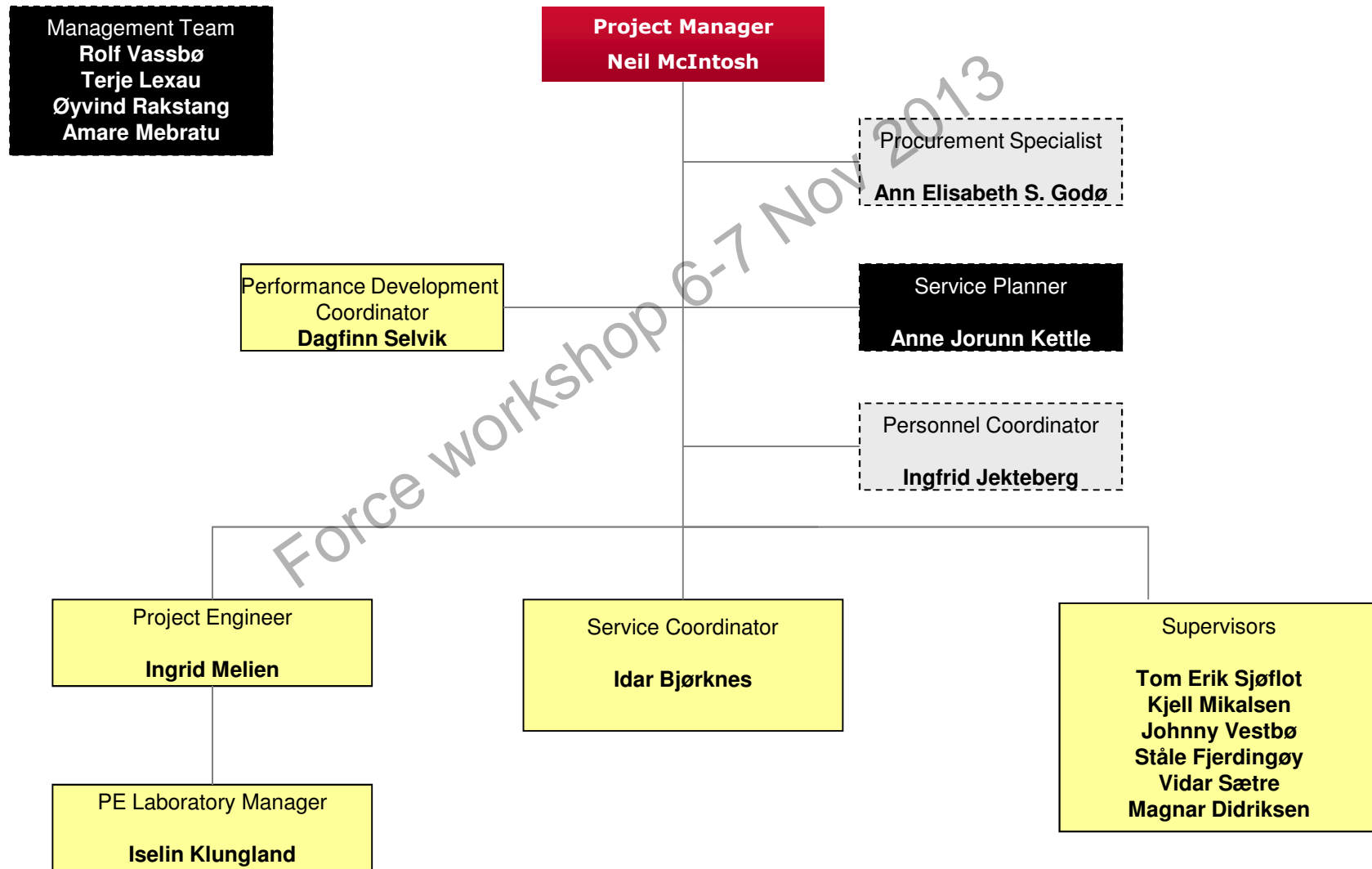
Equipment Layout



EOR Equipment



Snorre EOR Project Organisation Chart



Crewing and Logistics

- Halliburton Crew:
 - Dayshift: 8
 - Nightshift: 8
 - 2 week Rotational
 - Helicopter Schedule
 - Additional Availability
 - Crew Overlap (continuity)
- Spares and Consumables
 - Supply Vessel Weekly
 - Additional Availability
 - Helicopter Option



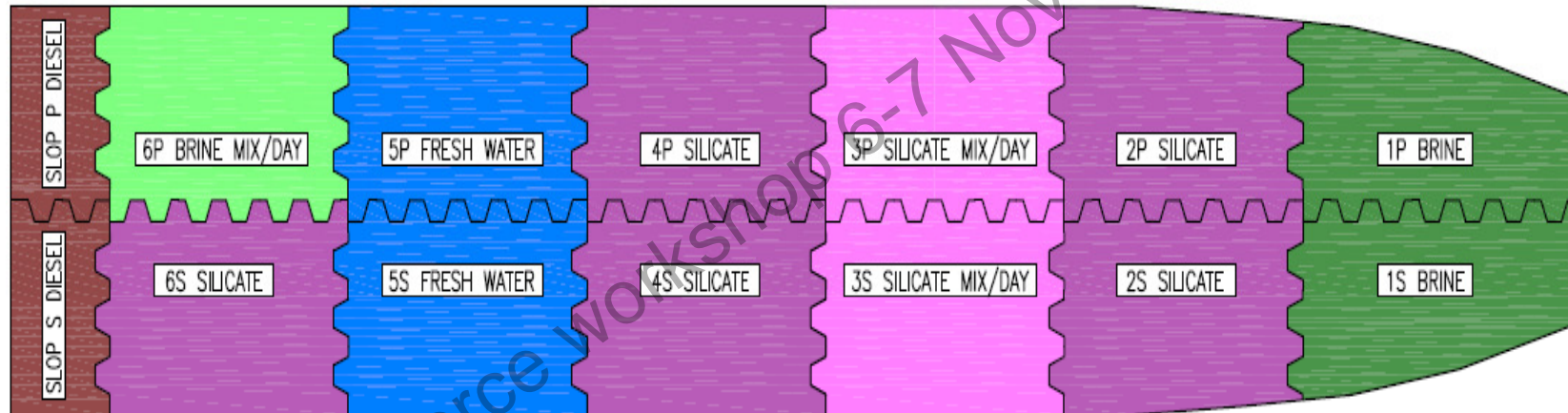
Pumping Schedule

No	Stage	Fluid	Volume (m3)
0	Leak Test	FW	0
1	Pre-Flush 1	Brine	60,000
2	Pre-Flush 2	Brine	30,000
3	Pre-Flush 3	Brine	23,500
4	Main Treatment	Silicate	240,000
5	Post Flush	Brine	40,000

Note: Tracer A,B,C Pumped during Pre-Flush Stages
 Tracer D Pumped during Post-Flush Stages
 Caustic Solution available as contingency plan

Vessel Fluid Loadout

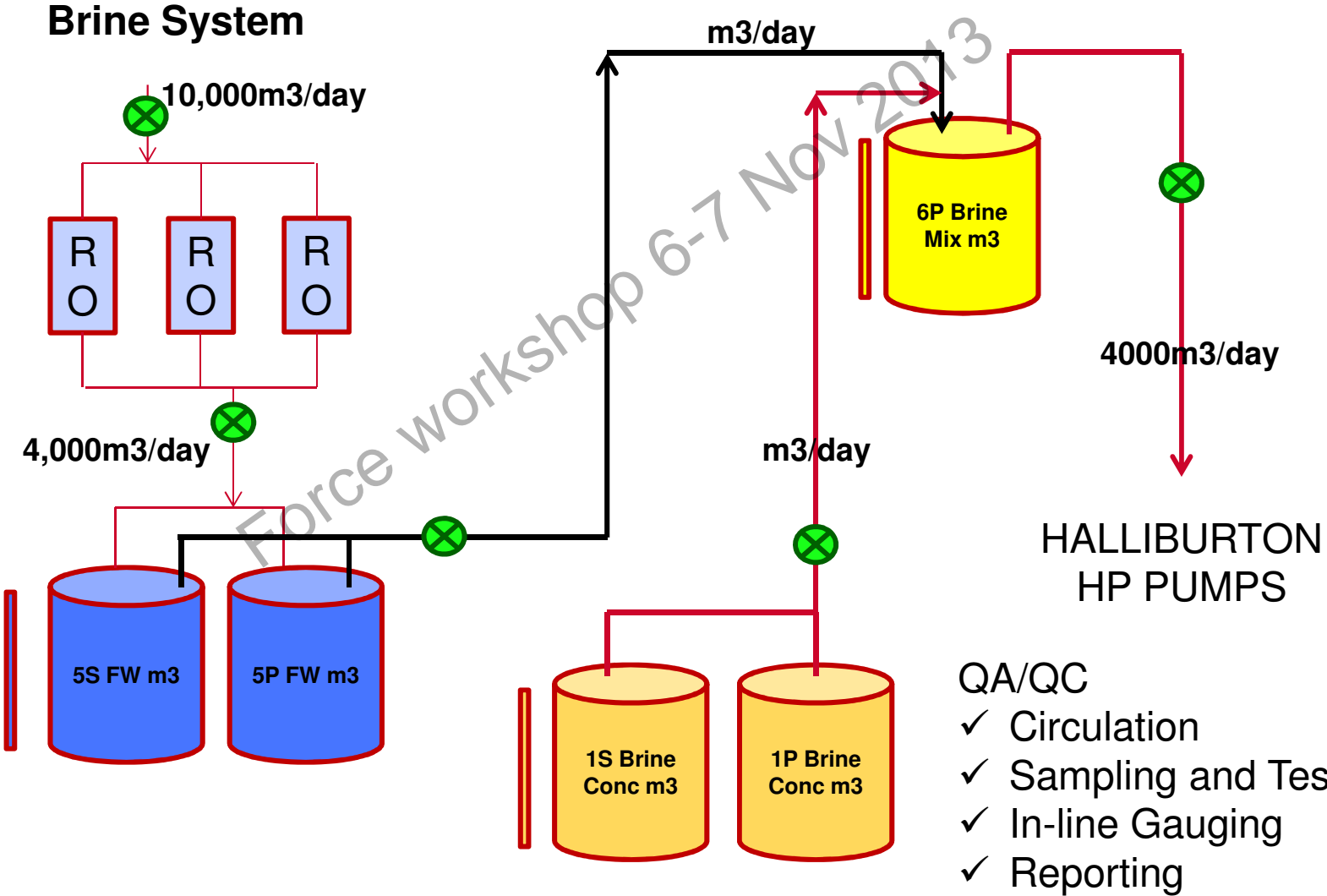
Initial Loadout



- 100% Brine Concentrate
- 50% Silicate Concentrate
- 100% HCl Concentrate
- 100% Tracers, Caustic

Batch #2 of Silicate Concentrate transferred at Sea by Knutsen

Brine Process

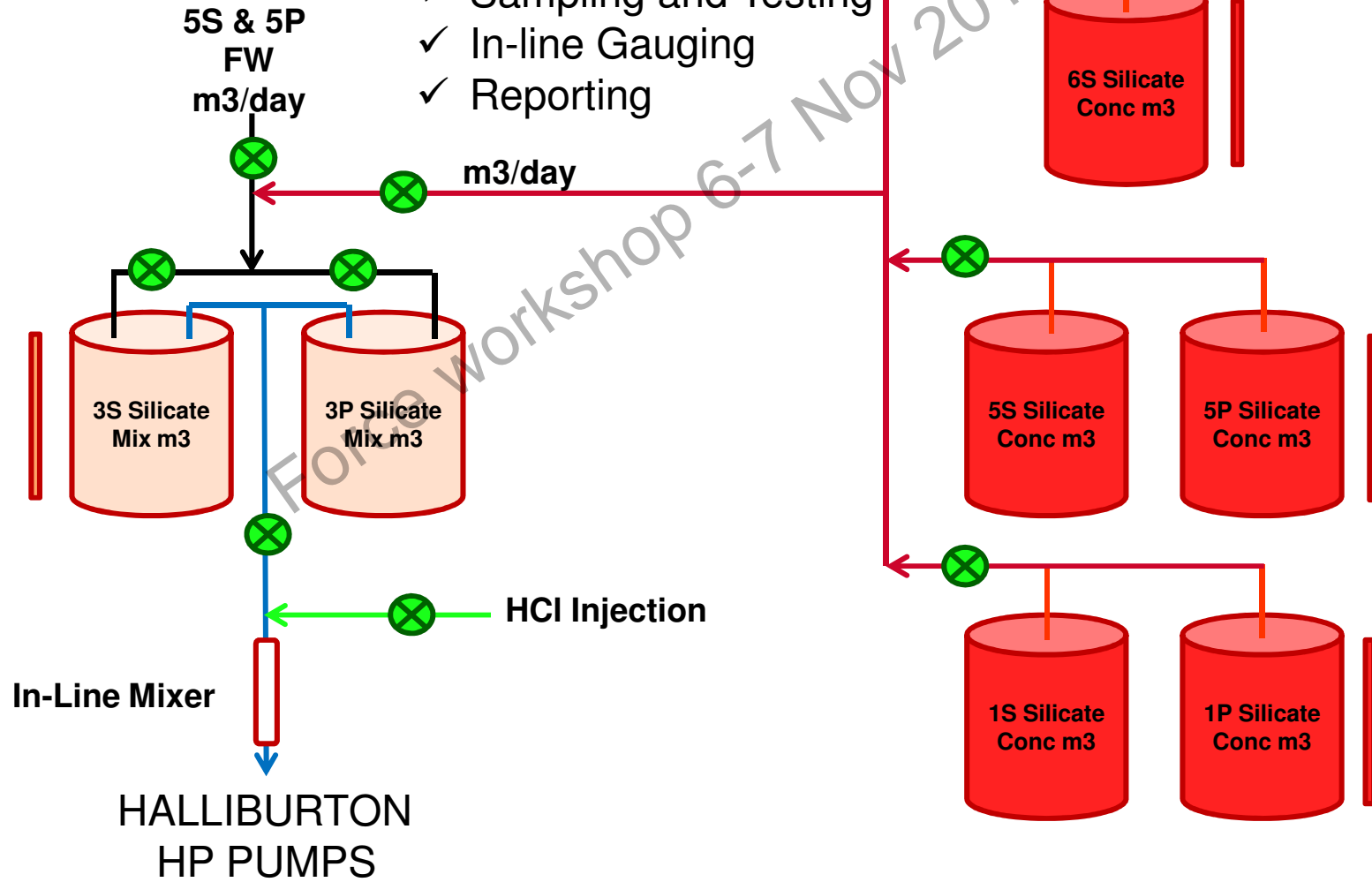


Silicate Process

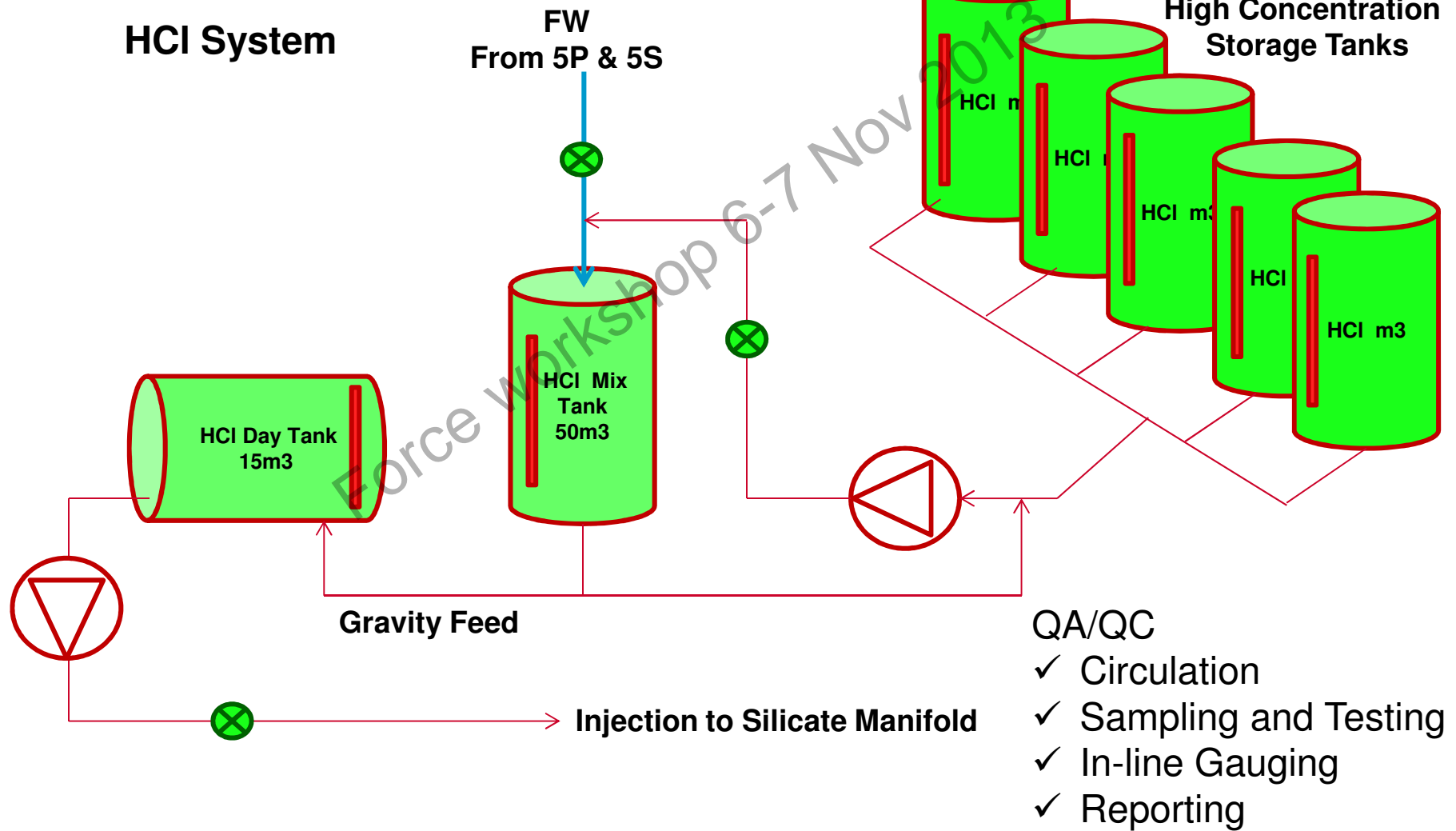
Silicate System

QA/QC

- ✓ Circulation
- ✓ Sampling and Testing
- ✓ In-line Gauging
- ✓ Reporting



HCl System



Control of Operations Offshore

- Knutsen Cargo Control Room:

Bulk Fluid Transfer, Mixing & Circulation & Monitoring

- Halliburton Operations Control Room:

HCl Mixing, Fluid Monitoring, HP Pumping & Rate Control

- Snorre CCR:

Well Control, Monitoring



Equipment Maintenance

Continuous pumping operation for approx 4 months.

The crew configuration, skills and available spares had to therefore be tailored to meet the project demands.

Highest consumers of standard and schedule maintenance as well as un-planned maintenance were the following:

Reverse Osmosis Plant:

- Operational & Maintenance Personnel Assigned
- Overhauls
- Replacement items

Halliburton HP Pumps:

- Operational Personnel & Mechanics Assigned
- Continuous Maintenance Program
- Replacement Units and Items



Waste Management

- Waste Products Transferred to shore by Supply Vessel
- Levels of Waste:

Low

- Wood, metal, rubber, rags, etc

Medium

- Lubricants & Oils

High

- Filter Cartridges



Communication

- Primary, Secondary and Back-up lines of communication established and maintained throughout the operation
- Main Communication hubs were:
 - Statoil Operations Forus
 - Snorre Control Offshore
 - Vessel Bridge and Cargo Room
 - Halliburton Control Room
- Lines of Communication
 - Telephone, Conference Link
 - UHF Radio
 - PA System (onboard)
 - VHF



De-Mobilization

- De-Mobilization to be performed in 2 stages
 - (1) Halliburton Equipment Removal in Risavika
 - (2) Knutsen Operations in Haugesund

Note This slide is not yet complete!!!!!!