WOOD GROUP KENNY

Integrated Start-up

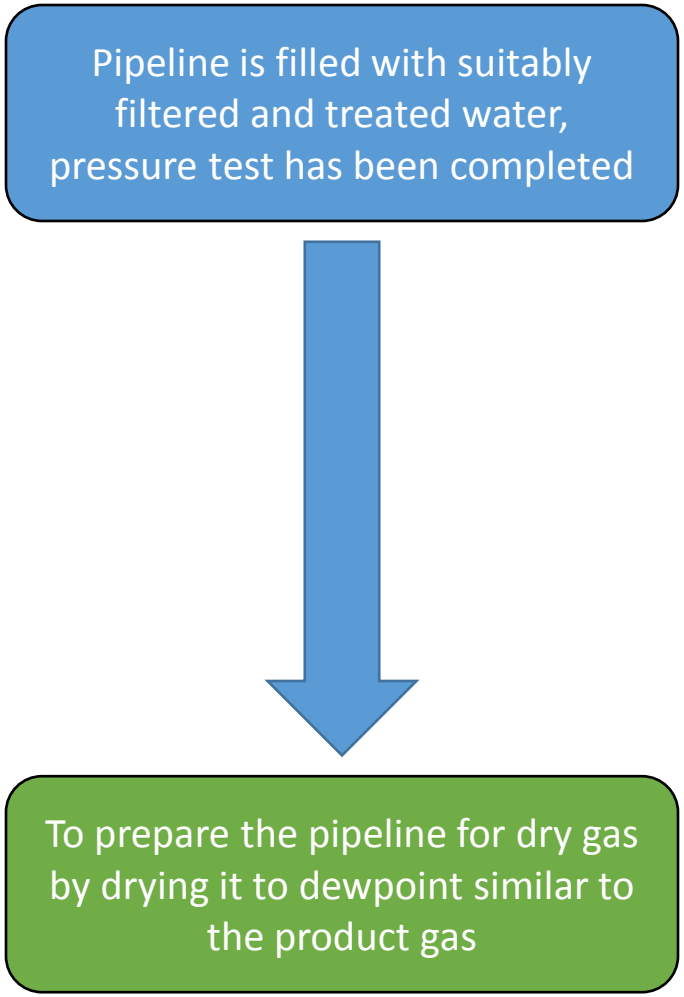
Speaker: Andrew Duff, Principal Engineer, Wood Group Kenny

Agenda

1. Introduction to Precommissioning/Commissioning (Dewatering, Conditioning, N2 Purge)
2. Reasons for Considering Integrated Start-up
3. Comparison of Methodologies between Precommissioning (Dewatering, Conditioning, N2 Purge) and Integrated Start-up

Introduction to Pre-Commissioning & Commissioning

Dry Gas Pipeline (Export Pipeline)



Introduction to Pre-Commissioning & Commissioning

Dry Gas Pipeline (Export Pipeline)

Pipeline is filled with suitably filtered and treated water, pressure test has been completed

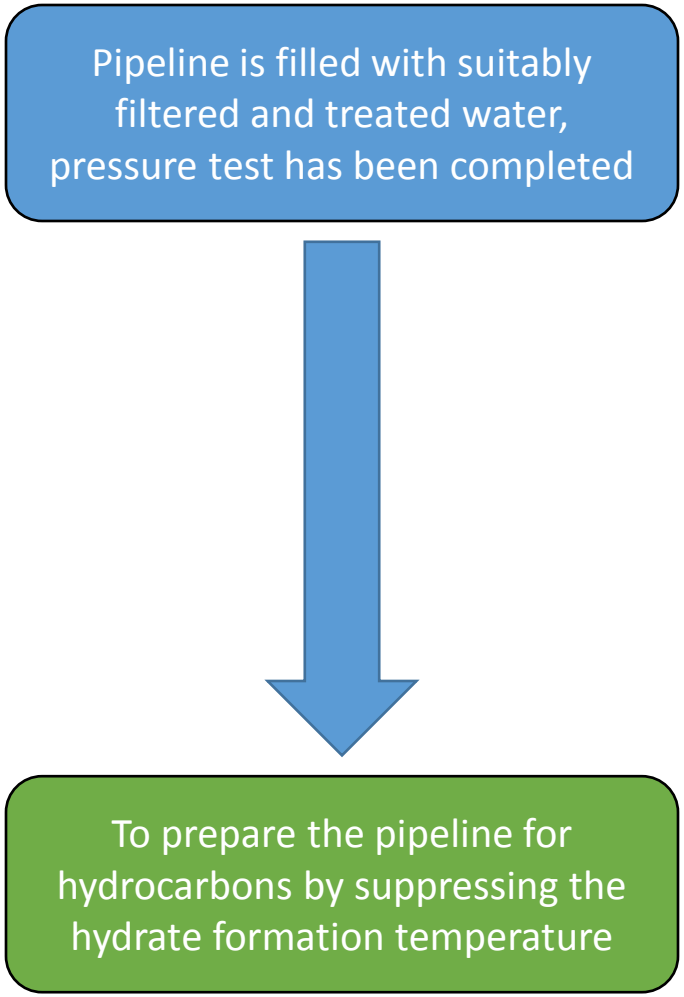
Method:
Drying by means of air or Nitrogen purging or vacuum drying, remove Oxygen.

Failure:
Failure to remove liquid water can lead to corrosion.
Failure to meet dewpoint target can lead to hydrates. forming and loss of sales gas condition.
Failure meet Oxygen target can lead to explosion/ fire.

To prepare the pipeline for dry gas by drying it to dewpoint similar to the product gas

Introduction to Pre-Commissioning & Commissioning

Wet Gas/ Liquid Pipeline (Infield Flowline)



Introduction to Pre-Commissioning & Commissioning

Wet Gas/ Liquid Pipeline (Infield Flowline)

Pipeline is filled with suitably filtered and treated water, pressure test has been completed

Method:
Conditioning by driving a pig train through the pipeline separated by hygroscopic fluid, remove Oxygen.

Failure:
Failure to remove liquid water can lead to corrosion.
Failure to meet dewpoint target can lead to hydrates forming.
Failure meet Oxygen target can lead to explosion/ fire.

To prepare the pipeline for hydrocarbons by suppressing the hydrate formation temperature

Reasons for Considering Integrated Start-up

Dry Gas Pipeline (Export Pipeline)

Integrated start-up is not recommended for Dry Gas Pipelines (Export Pipelines):-

Typically the acceptance dewpoint is beyond the range possible with MEG/ TEG/ Methanol conditioning alone. Vacuum, Nitrogen or Air drying is only way.

To start-up the Export Pipeline a supply of dry gas is required, this relies on the full offshore production facilities to be operational.

For Long Export Pipelines it is hard to detect liquid water remaining in the pipeline without using drying methodologies.

Reasons for Considering Integrated Start-up

Wet Gas/ Liquid Pipeline (Infield Flowline)

Integrated start-up an option for Wet Gas/ Liquid Pipelines (Infield Flowlines):-

Typically the acceptance conditions for start-up can easily be achieved with MEG/TEG/Methanol conditioning.

Integrated start-up provides feed stock for production facilities commission, fuel gas.

Integrated start-up allows the commissioning of the subsea control system at the same time (subsea control system is required to control the assets).

If scheduled correctly, integrated start-up limits wet parking/preservation period and therefore corrosion risk.

Reasons for Considering Integrated Start-up

Economics

The saving to the operator to change from precommissioning to integrated start-up is depended on the size of the offshore field

Fields with a single tie-back then the removal of a dewatering vessel and equipment for period of 7 to 10 days represents several millions of dollars

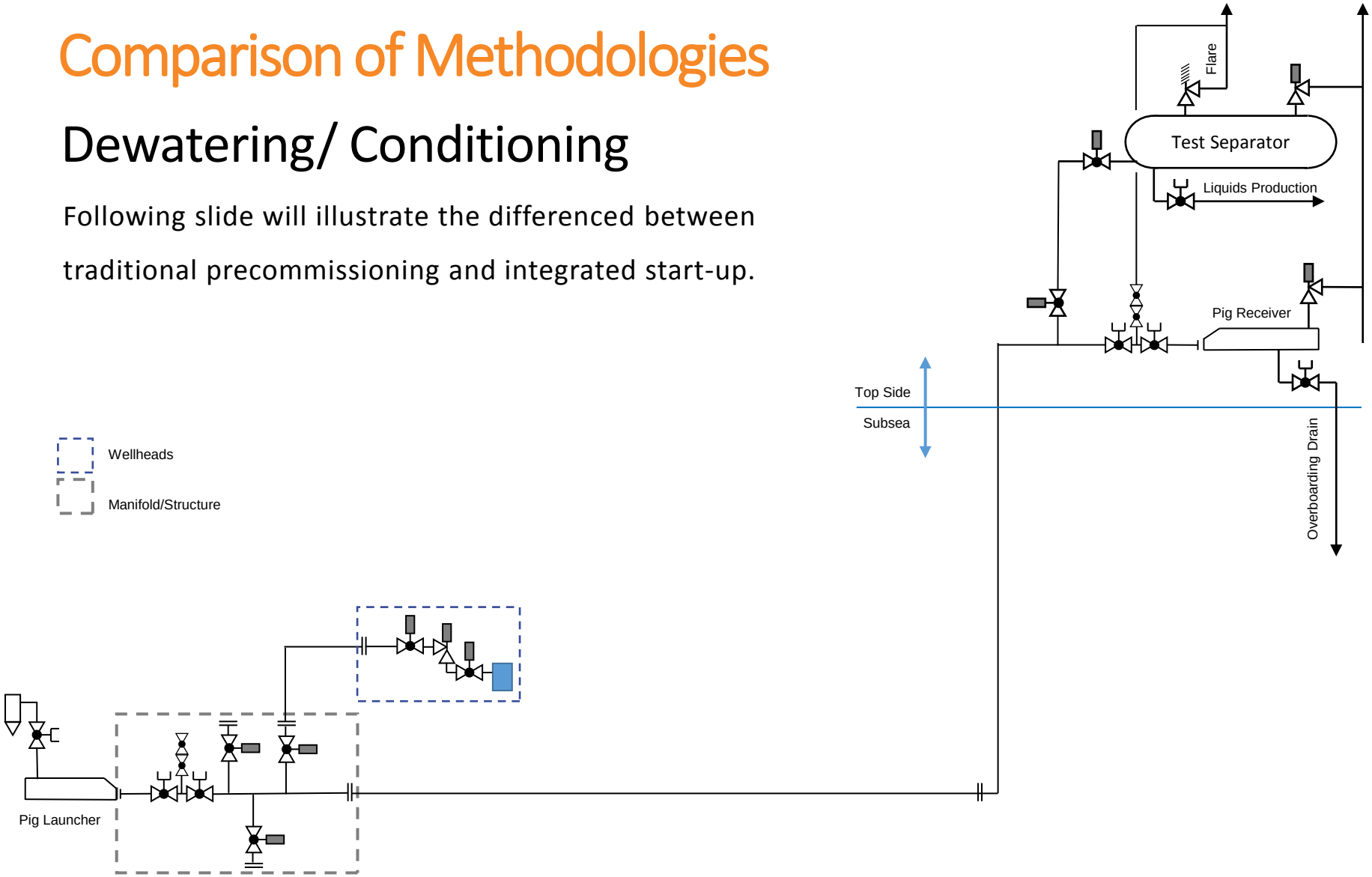
Fields with multiple manifolds tied-back to the facilities where the dewatering vessel would have to deploy and recover the pig launcher many times to dewater each branch over the period of one month or more represents tens of millions of dollars

Removing the vessel based equipment also significantly lowers the weather risk and impact

Comparison of Methodologies

Dewatering/ Conditioning

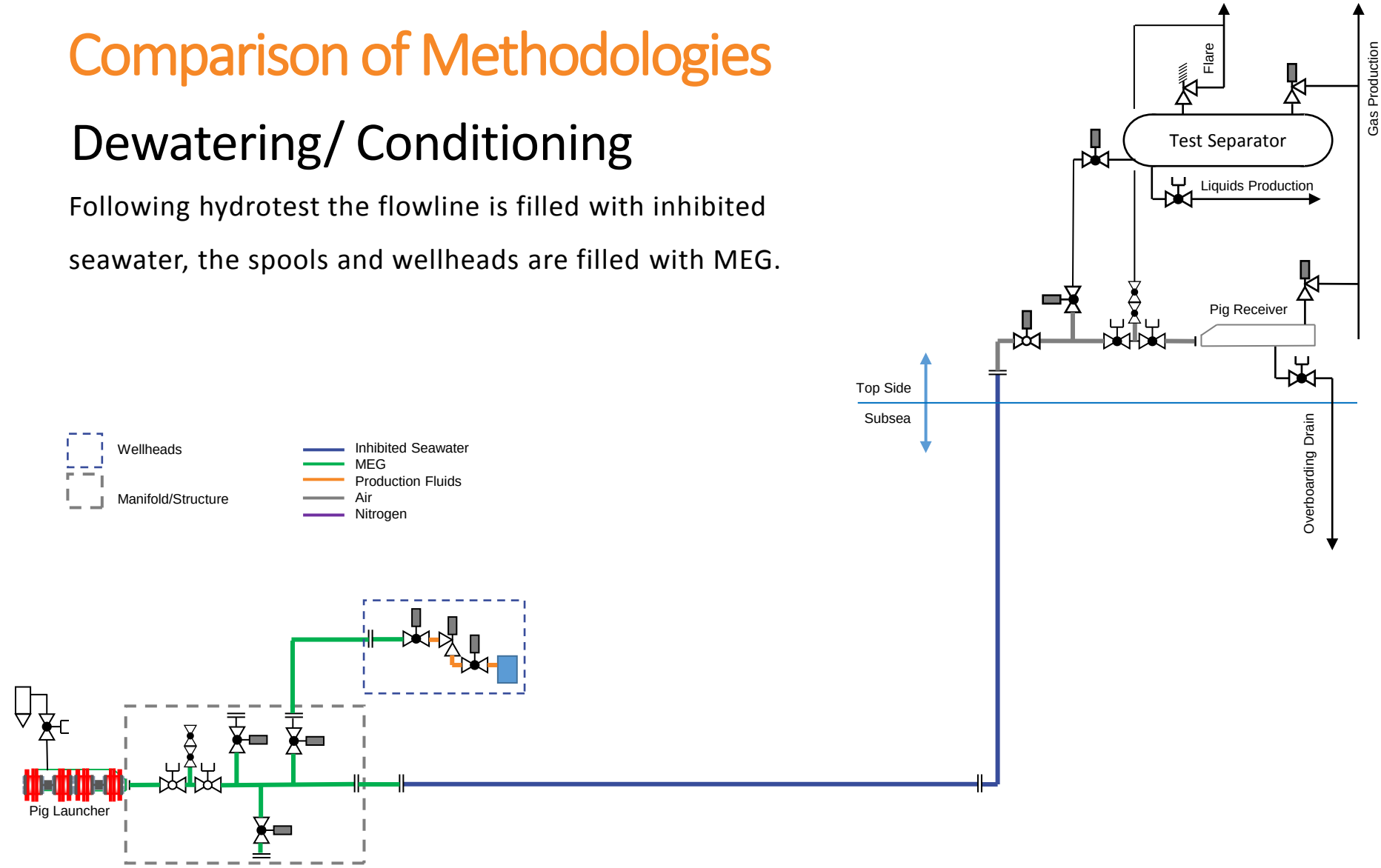
Following slide will illustrate the differenced between traditional precommissioning and integrated start-up.



Comparison of Methodologies

Dewatering/ Conditioning

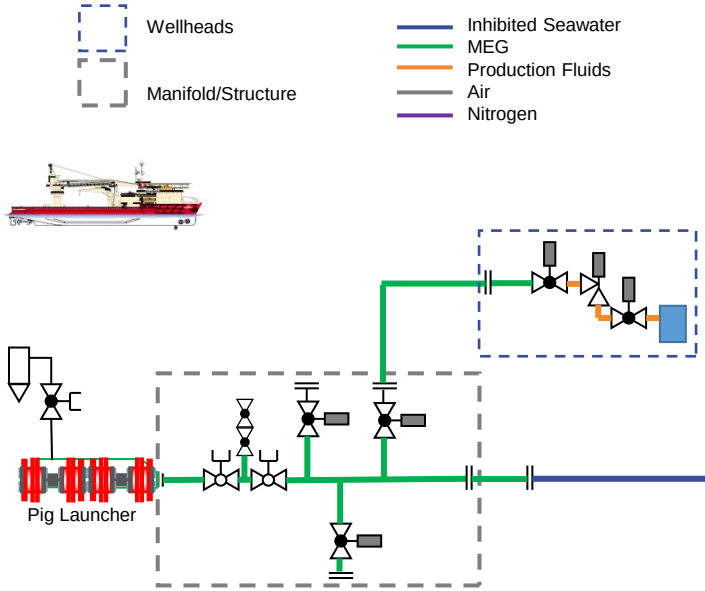
Following hydrotest the flowline is filled with inhibited seawater, the spools and wellheads are filled with MEG.

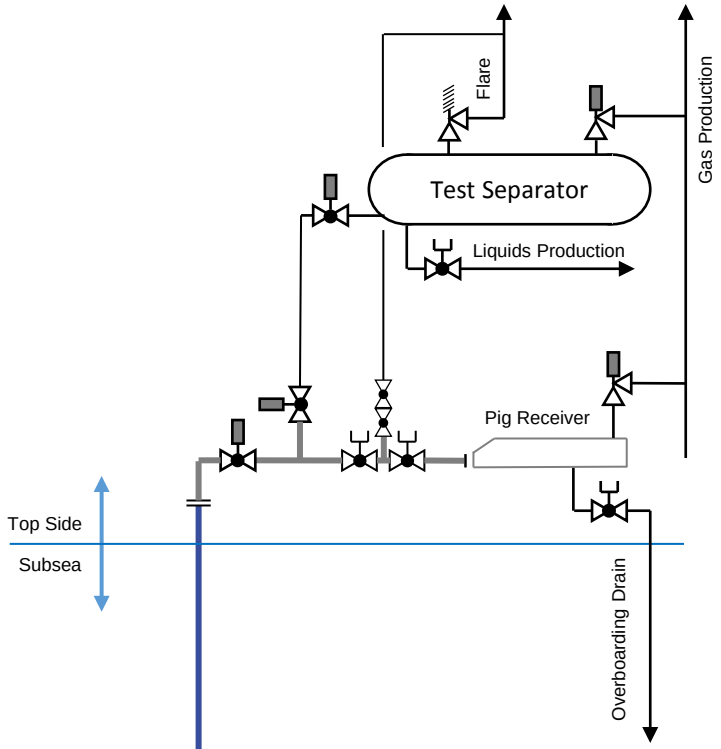


Comparison of Methodologies

Dewatering/ Conditioning

Dewatering train with pigs separated by potable water and MEG is inserted into the flowline. All branches and the production facilities are isolated.





Comparison of Methodologies

Dewatering/ Conditioning

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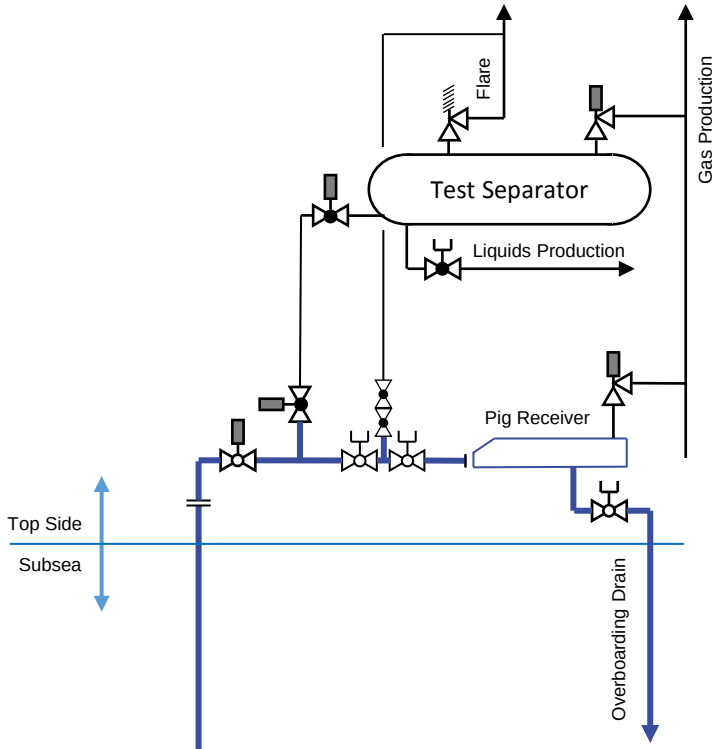
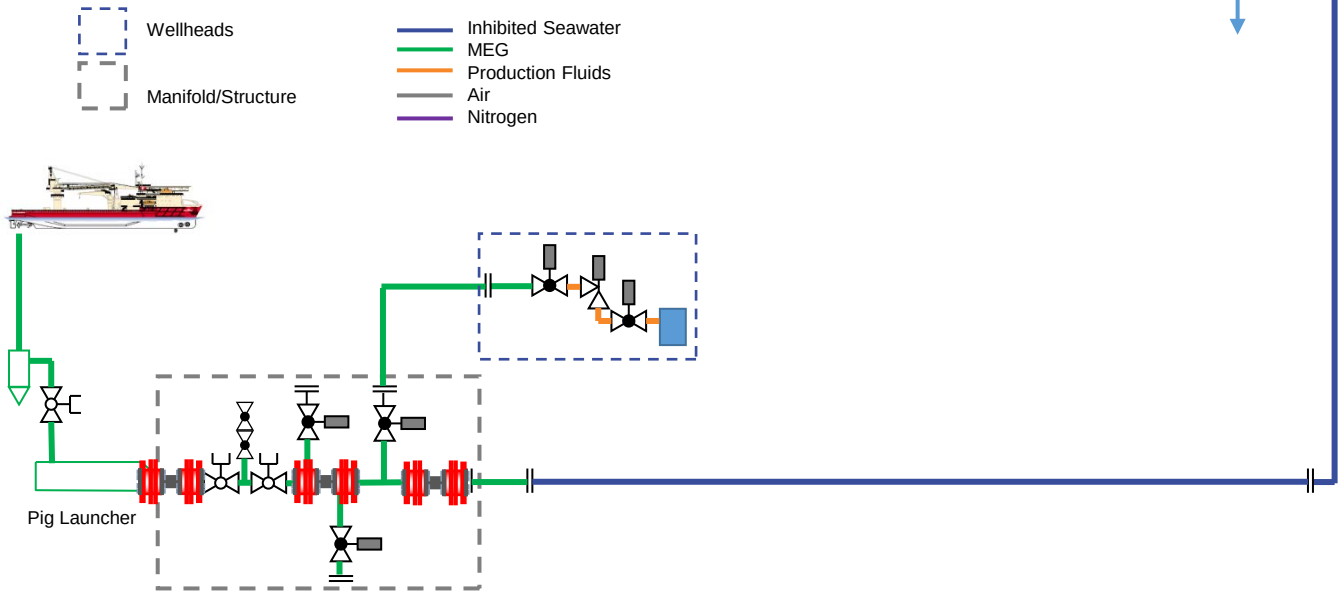
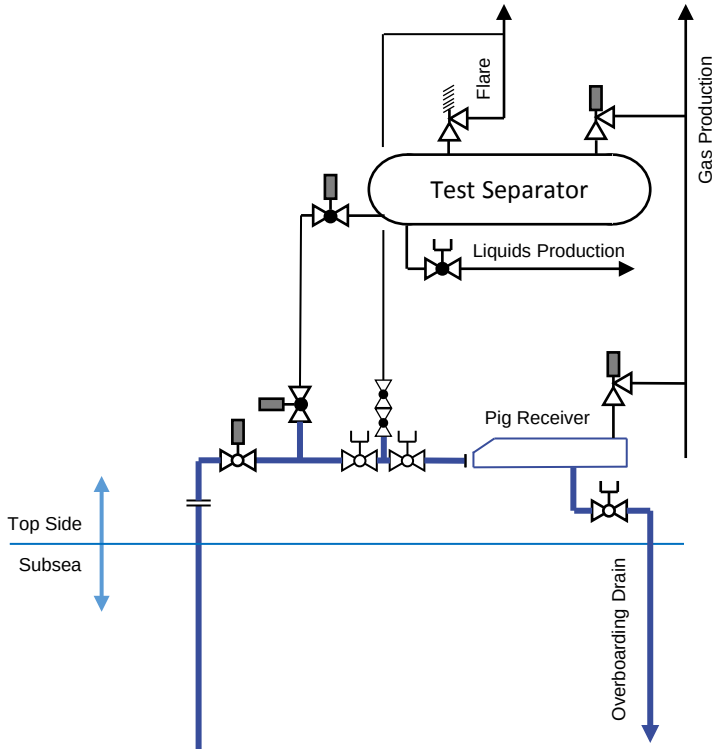


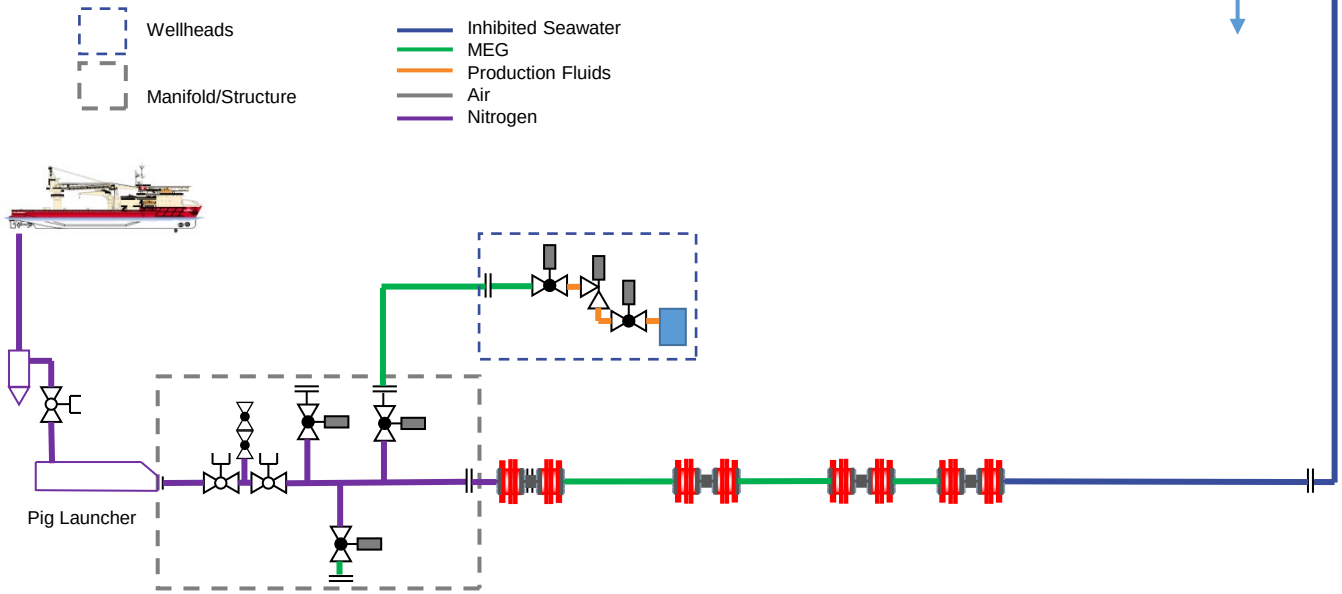


Comparison of Methodologies

Dewatering/ Conditioning

Dewatering train is driven through the flowline by dry compressed air or Nitrogen. All branches and the production facilities are isolated.

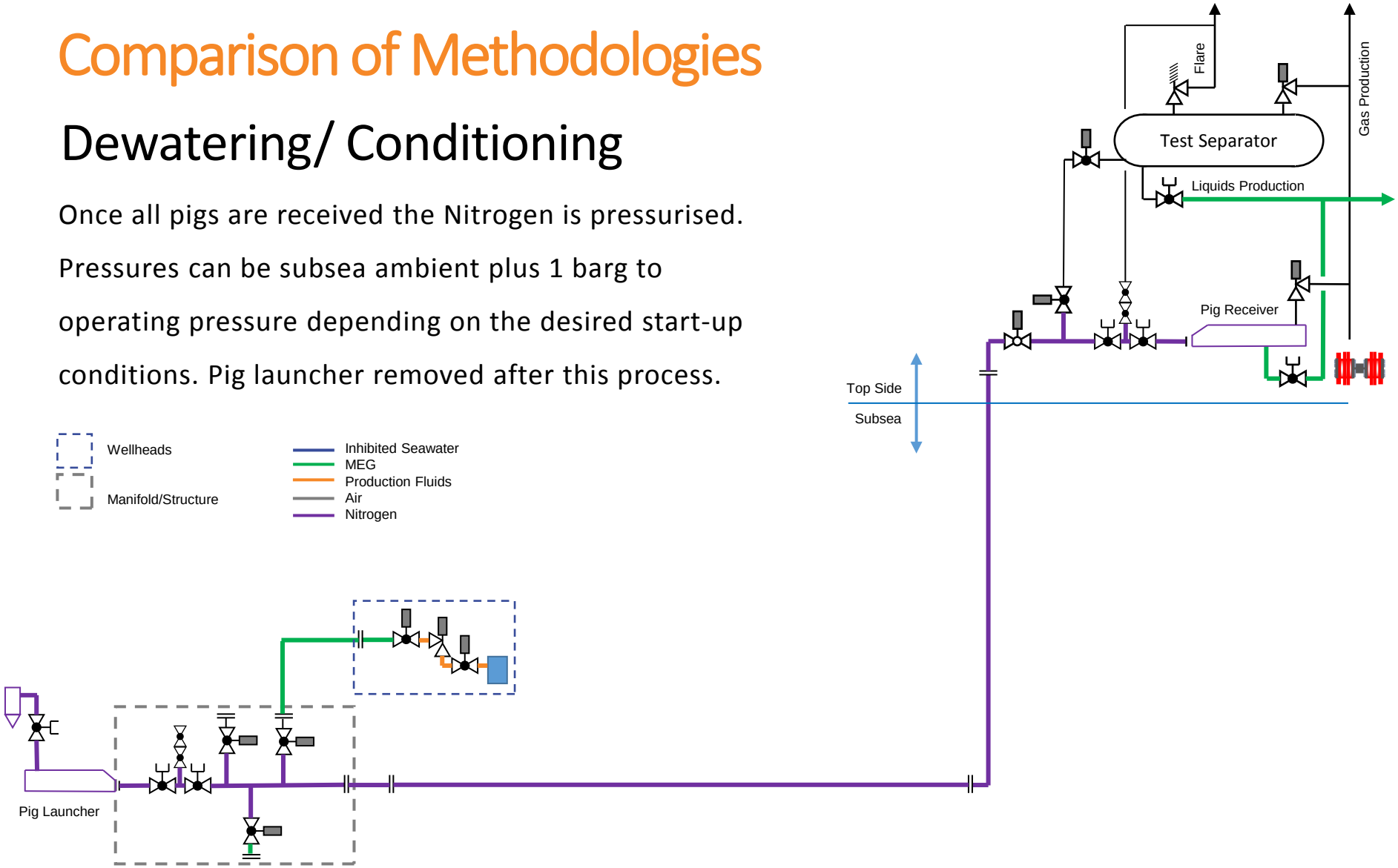




Comparison of Methodologies

Dewatering/ Conditioning

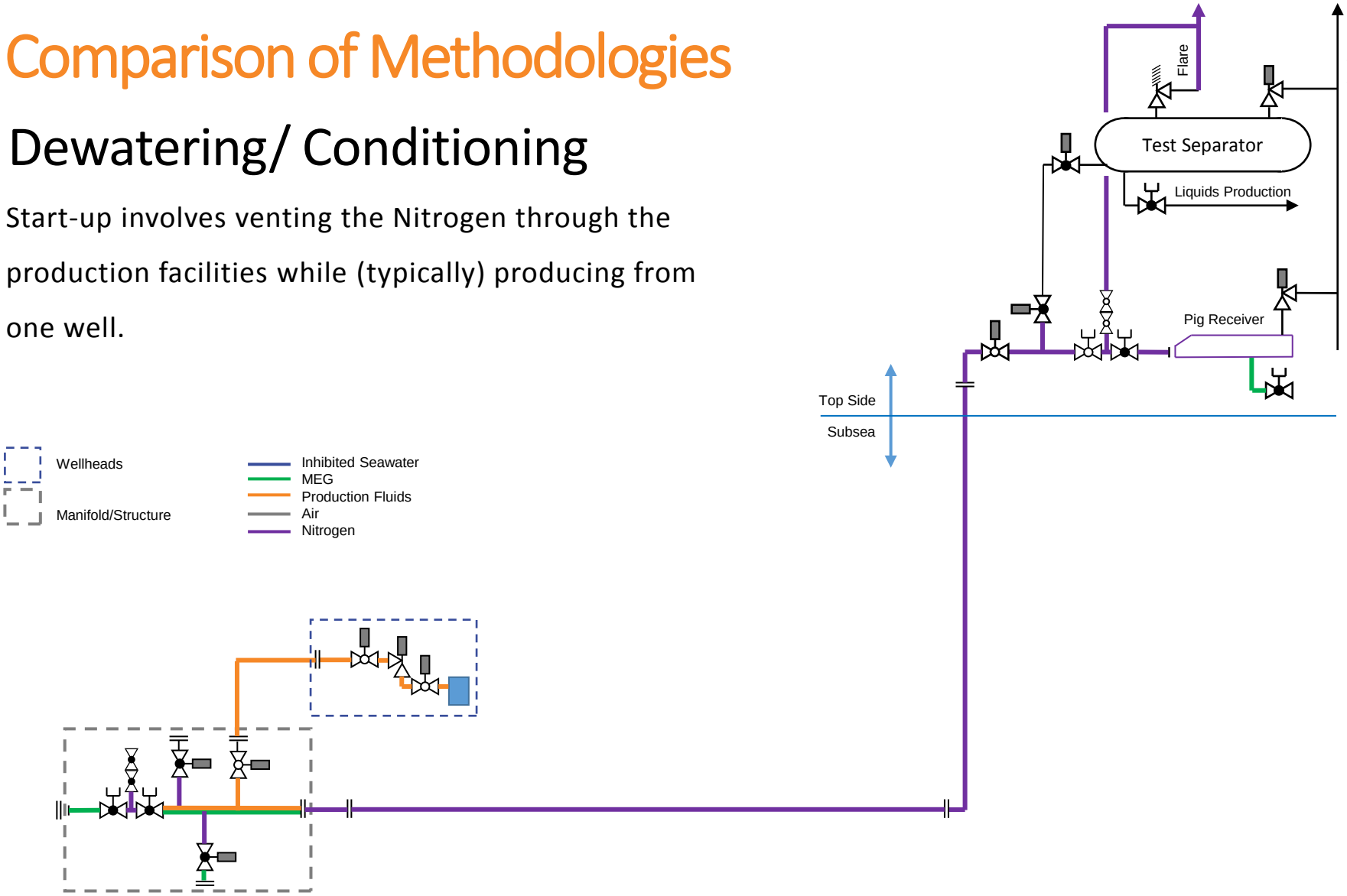
Once all pigs are received the Nitrogen is pressurised. Pressures can be subsea ambient plus 1 barg to operating pressure depending on the desired start-up conditions. Pig launcher removed after this process.



Comparison of Methodologies

Dewatering/ Conditioning

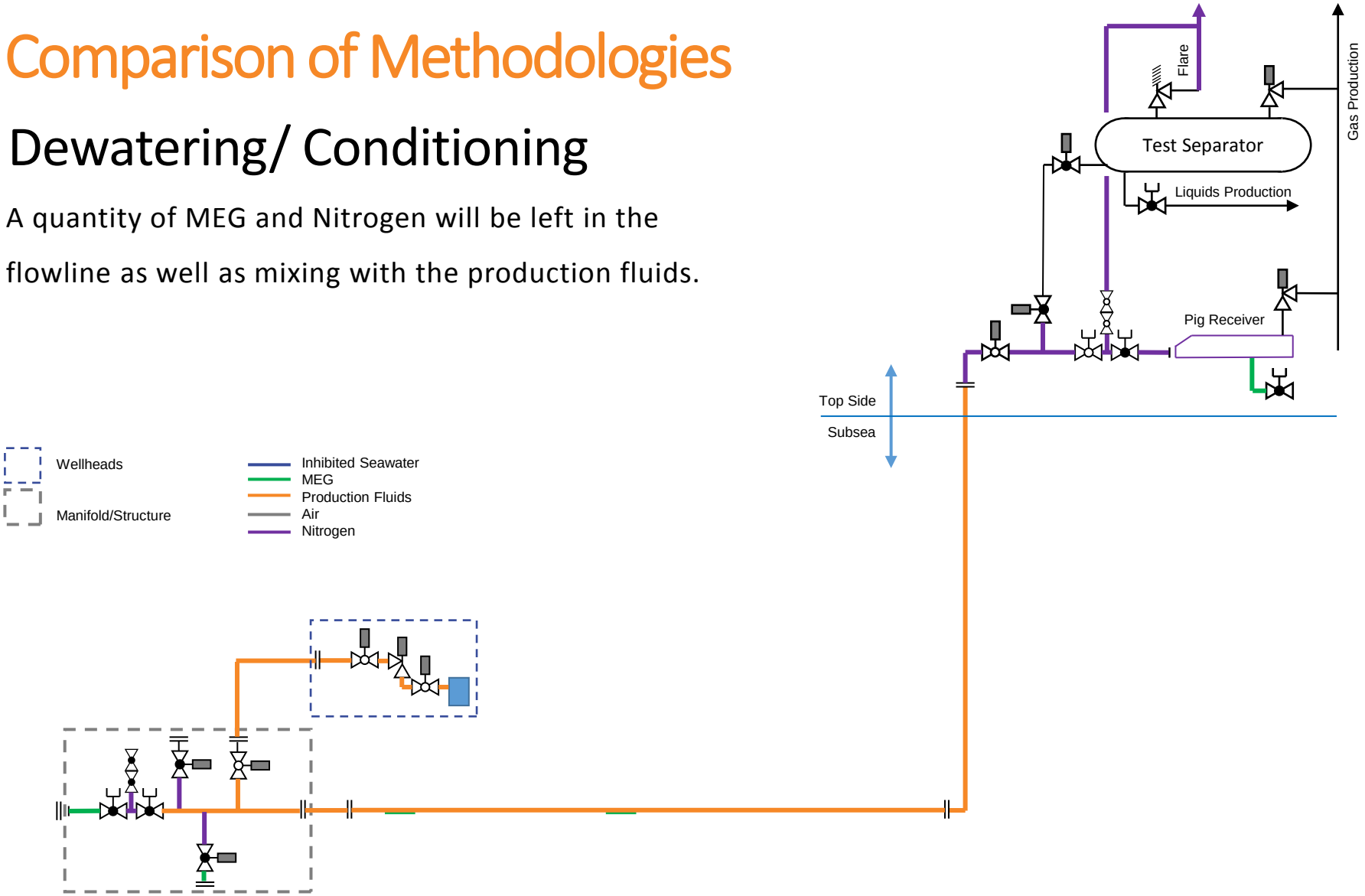
Start-up involves venting the Nitrogen through the production facilities while (typically) producing from one well.



Comparison of Methodologies

Dewatering/ Conditioning

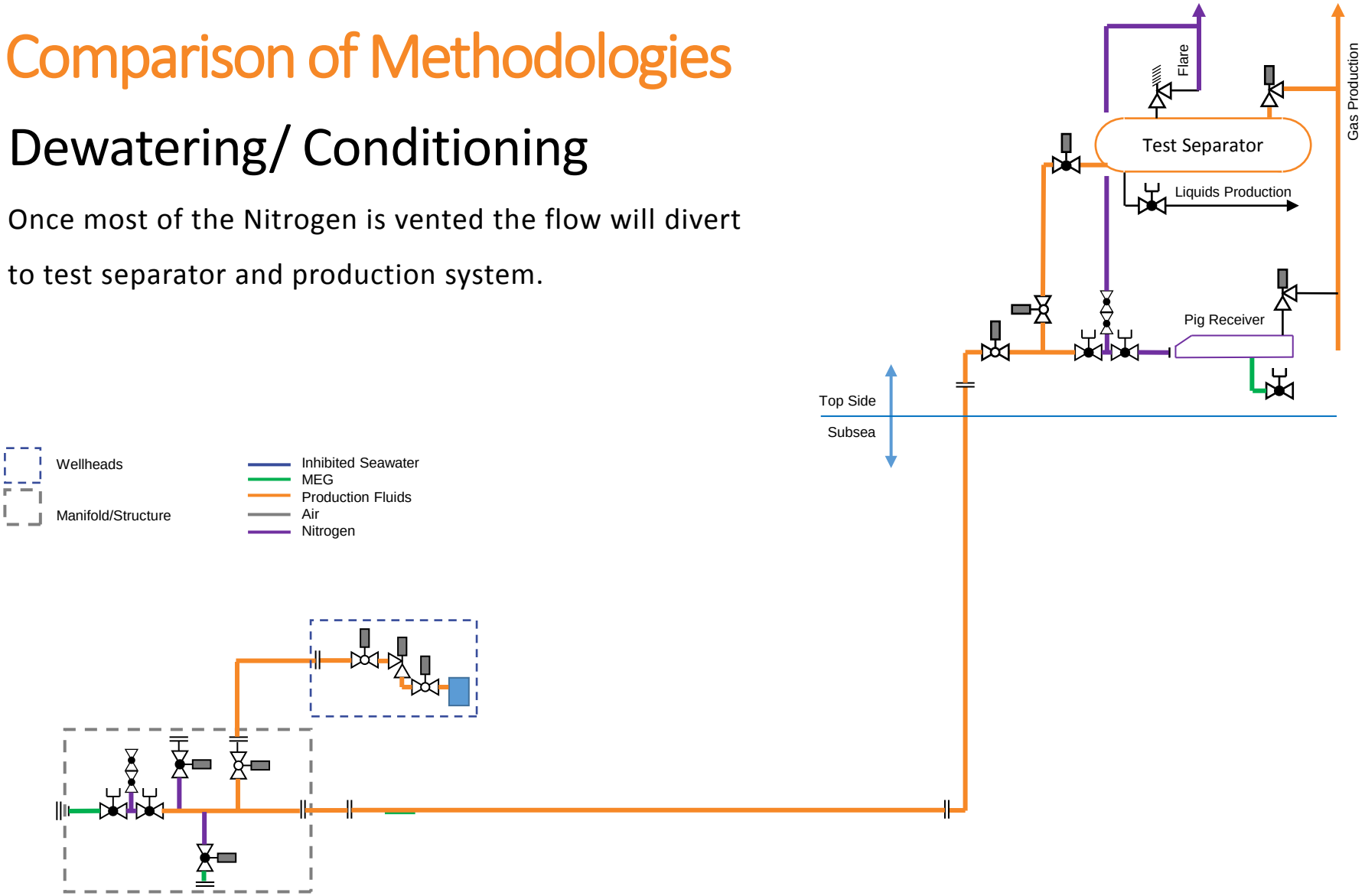
A quantity of MEG and Nitrogen will be left in the flowline as well as mixing with the production fluids.



Comparison of Methodologies

Dewatering/ Conditioning

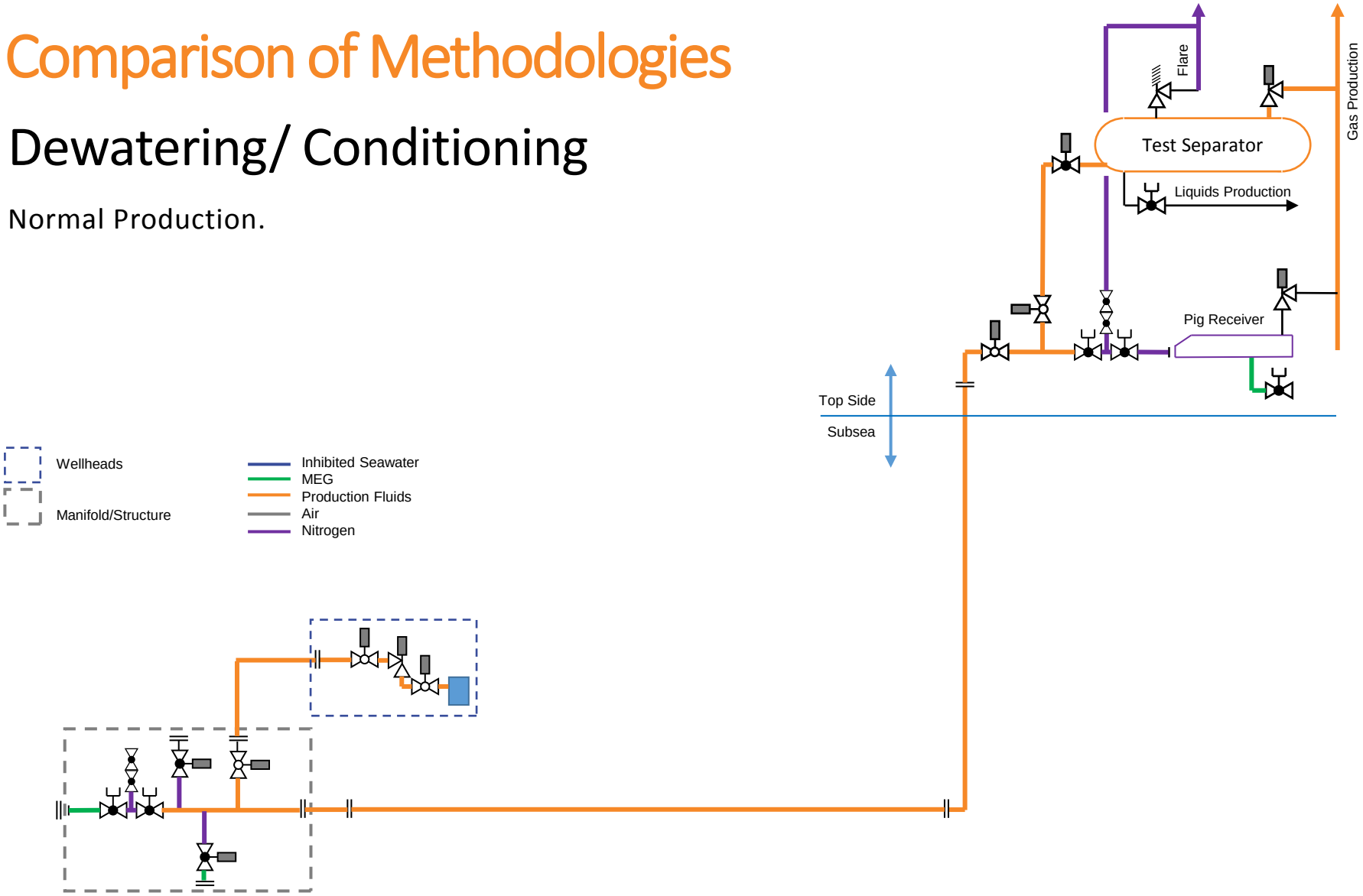
Once most of the Nitrogen is vented the flow will divert to test separator and production system.



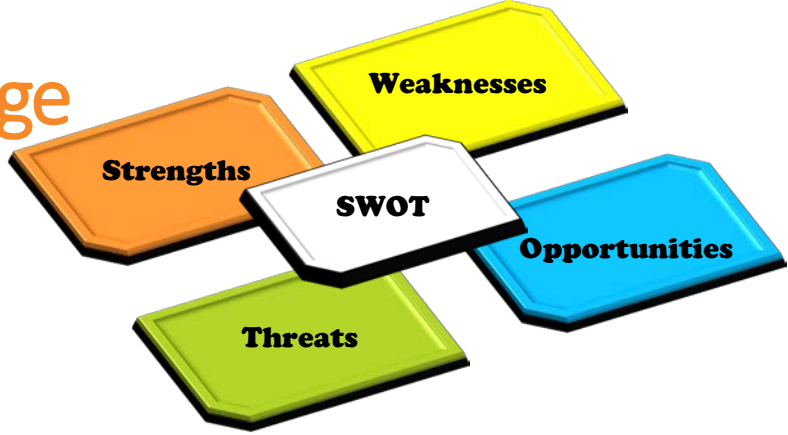
Comparison of Methodologies

Dewatering/ Conditioning

Normal Production.



Dewatering, Conditioning, N_2 Purge



Strengths

- Extensive successful track record world-wide;
- Each phase provides opportunity to check acceptance and make adjustments should the predicted outcome not occur;
- Leaves the system ready for hydrocarbons: Chloride content below 200 ppmv; Low Dewpoint less than -20°C; Oxygen level below LEL;
- Dewatering pig train can include a baseline geometry survey or gauging plate to fulfil the requirement from DNV that all components should be gauged prior to start-up;
- Dewatering pig train or swabbing train can and often is used for cleaning;
- Independent of the platform component installation and commissioning -- the system can be pressurised with Nitrogen to above hydrostatic pressure and theoretically left indefinitely.

Dewatering, Conditioning, N_2 Purge

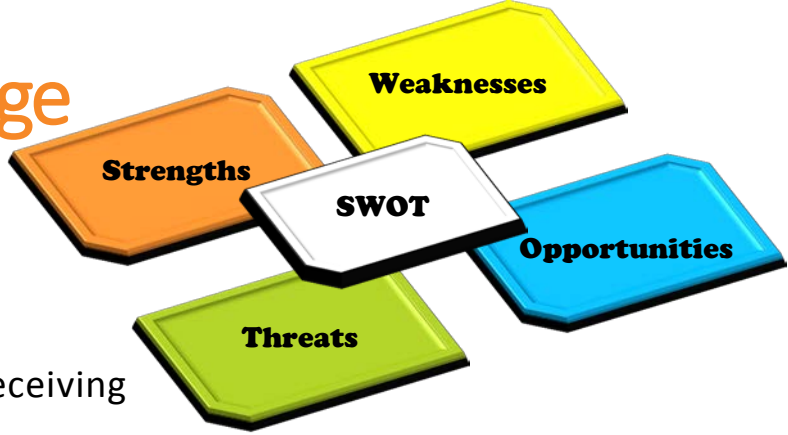
Weaknesses

- Requires long duration vessel based spreads:

  A vessel is required throughout the dewatering operation either to support the dewatering spread if pig train is driven subsea to platform or monitor pigs if pig train is driven in opposite direction, vessel may be required to support the drying and Nitrogen purging operations as well as dewatering. Schedule could easily be two months;

- Inherent weather and asset risk due to use of vessels connected to permanent asset with temporary hoses;

Dewatering, Conditioning, N_2 Purge



Opportunities

- Allows independence between subsea installation and receiving facilities schedules;
- Allows more flexibility in contracting philosophy between installation contractor and independent precommissioning companies.

Threats

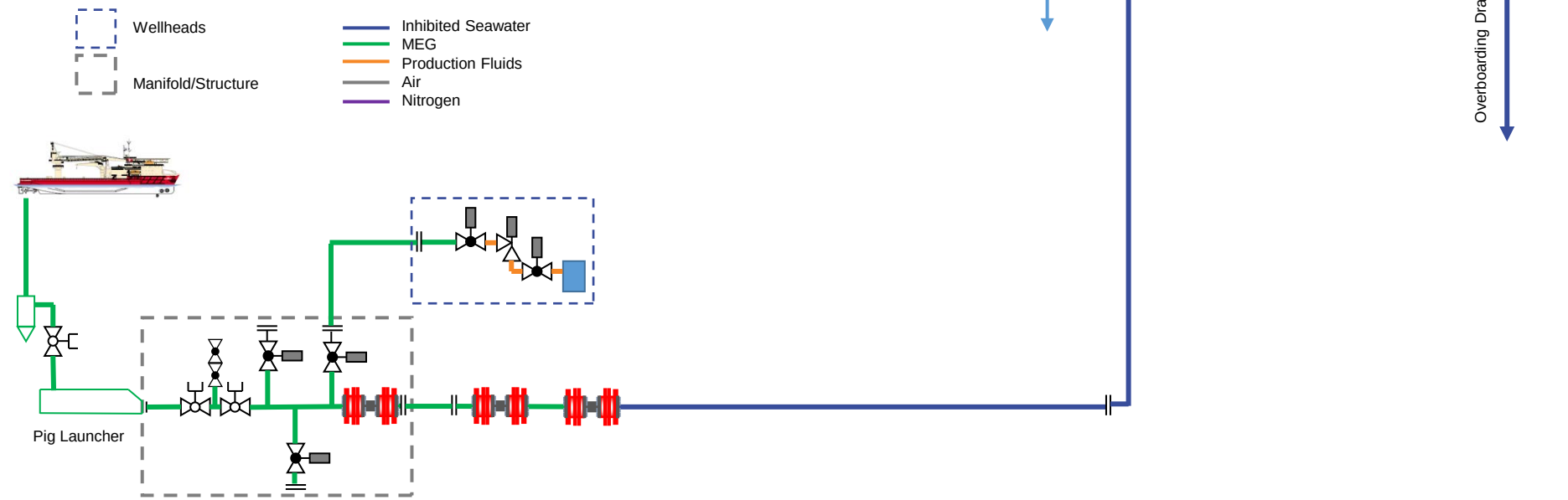
- The stability design of the system has to include for the preservation period where it will be filled with Nitrogen gas possibly at neither the pressure nor density of the production fluids;
- As this is a multiple phase process, schedule delays in each phase can compound possibly leading to extension of the critical path.

	1	2	3	4	5	6
First						
Second						
Third						
Fourth						
Fifth						

Comparison of Methodologies

Integrated Start-up

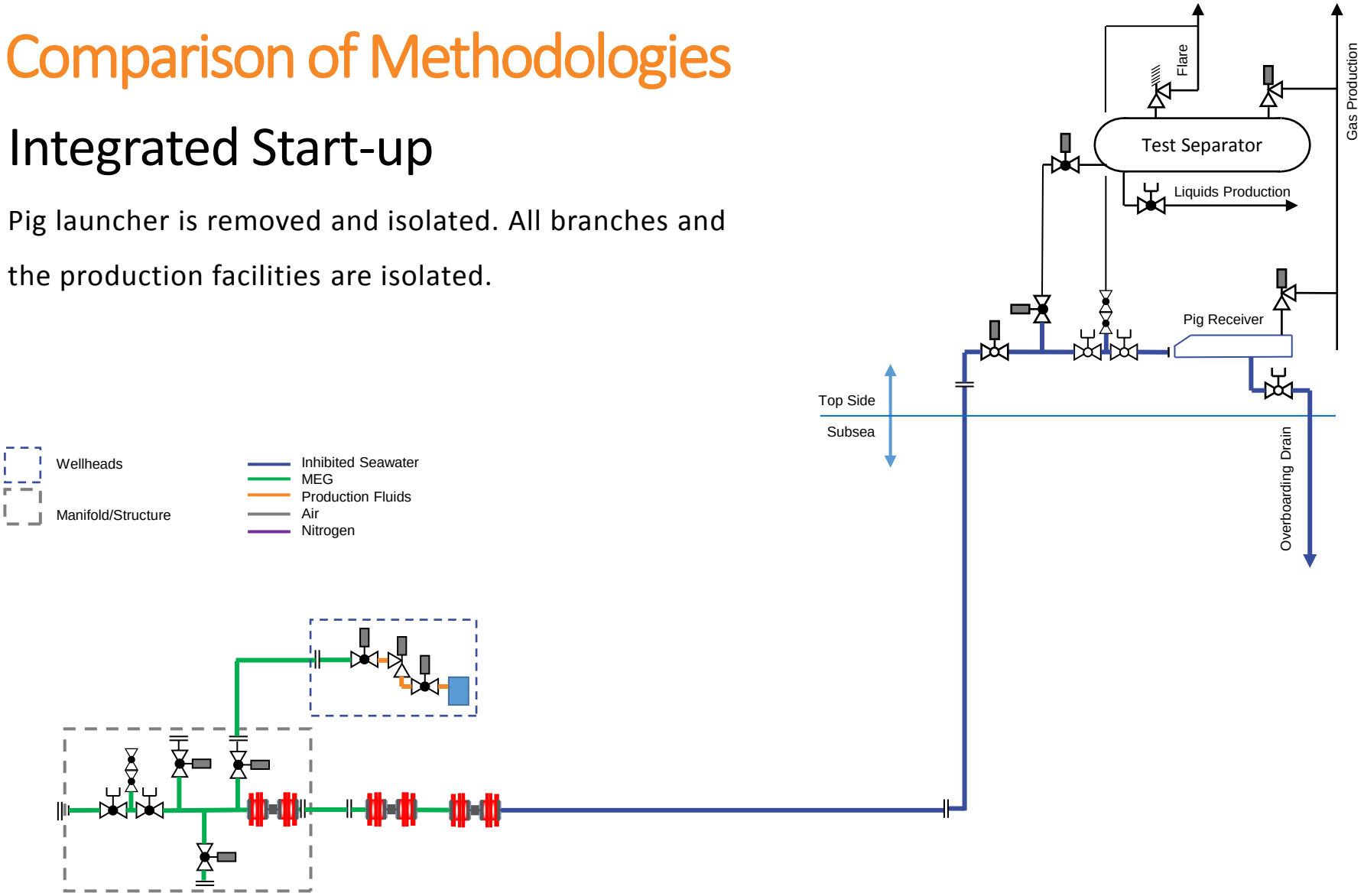
Pig train is launched the same as Dewatering/Conditioning. When dewatering train passes the first operational branch in the PLEM. All branches and the production facilities are isolated.



Comparison of Methodologies

Integrated Start-up

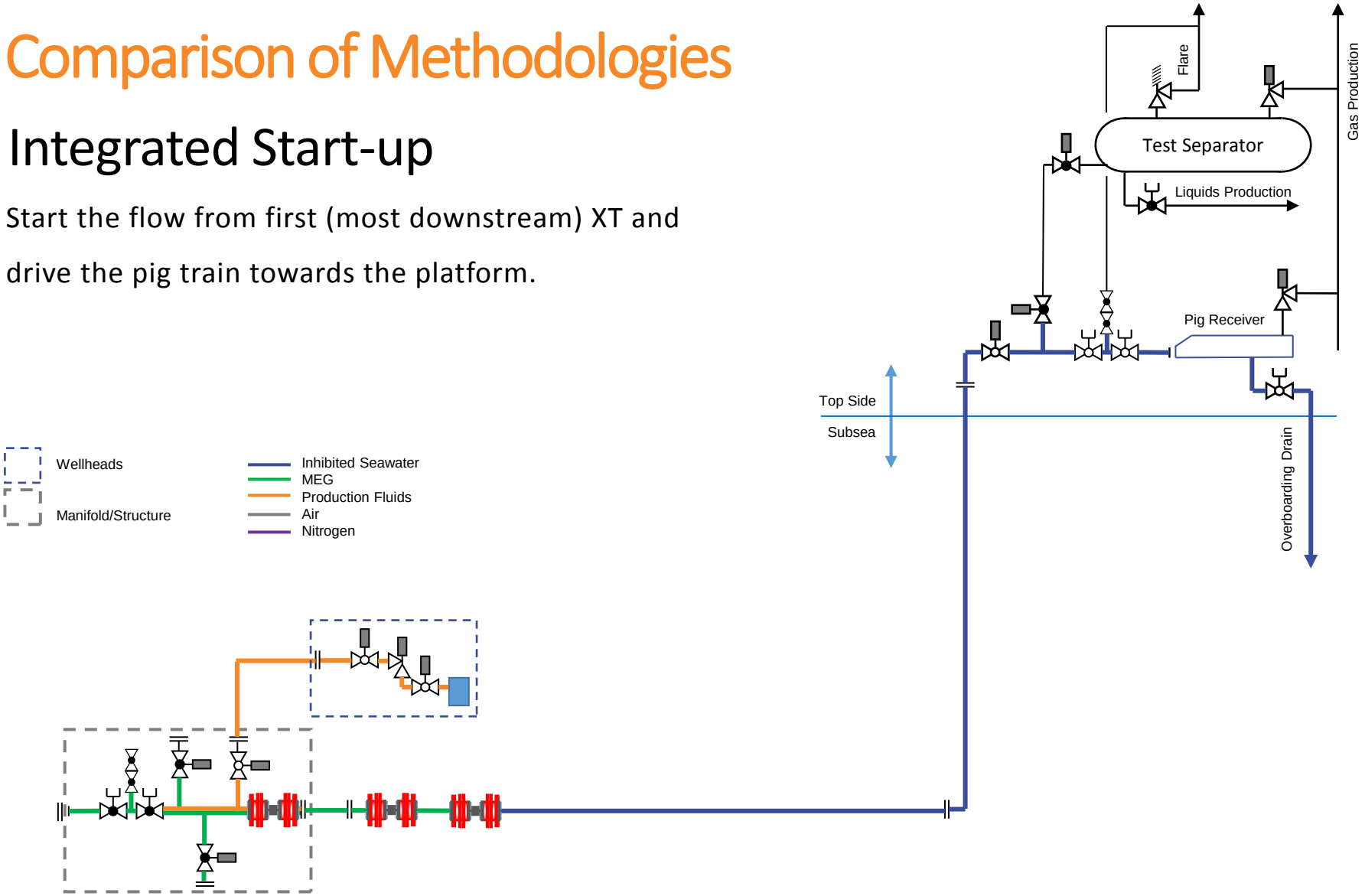
Pig launcher is removed and isolated. All branches and the production facilities are isolated.



Comparison of Methodologies

Integrated Start-up

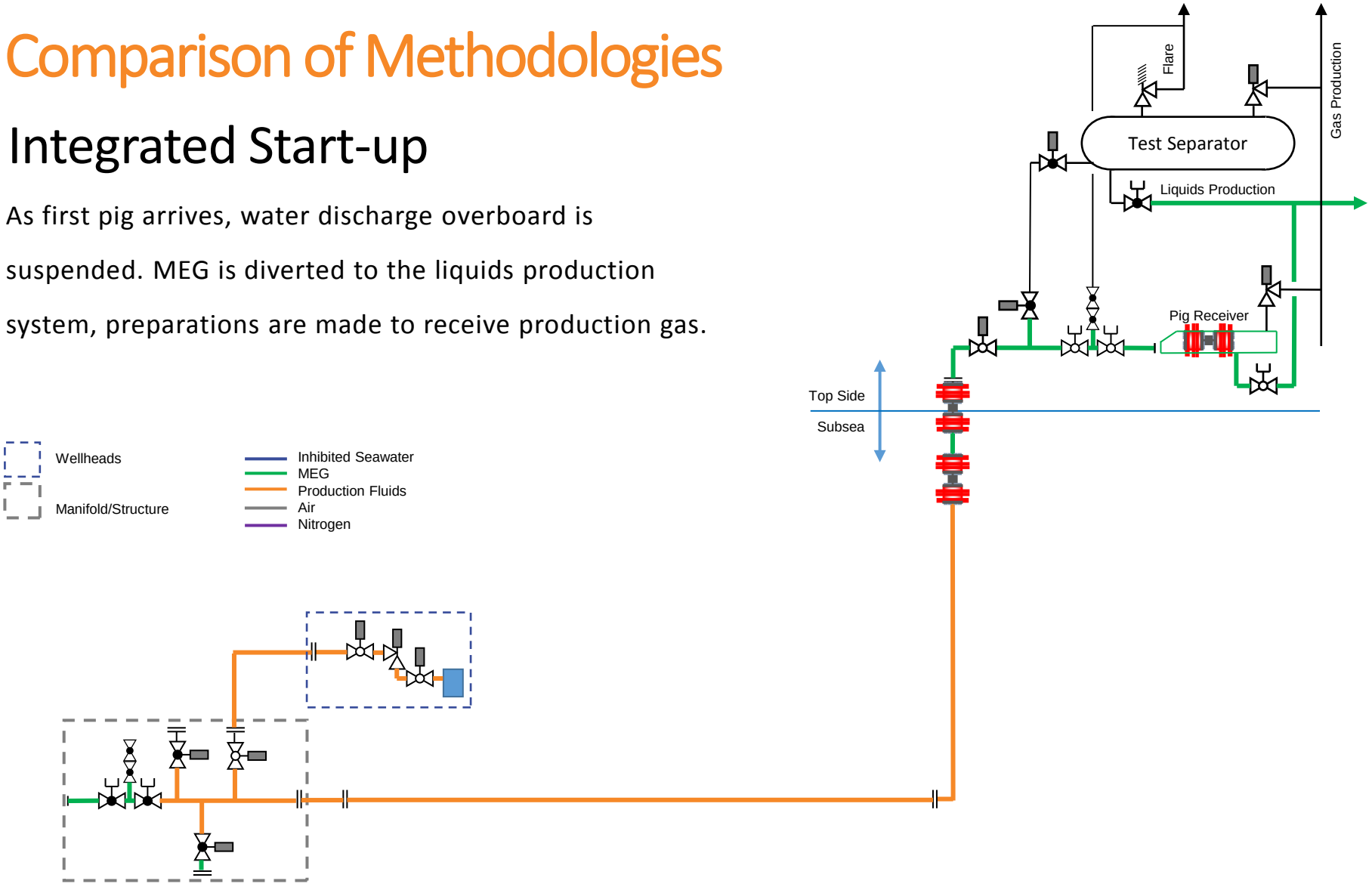
Start the flow from first (most downstream) XT and drive the pig train towards the platform.



Comparison of Methodologies

Integrated Start-up

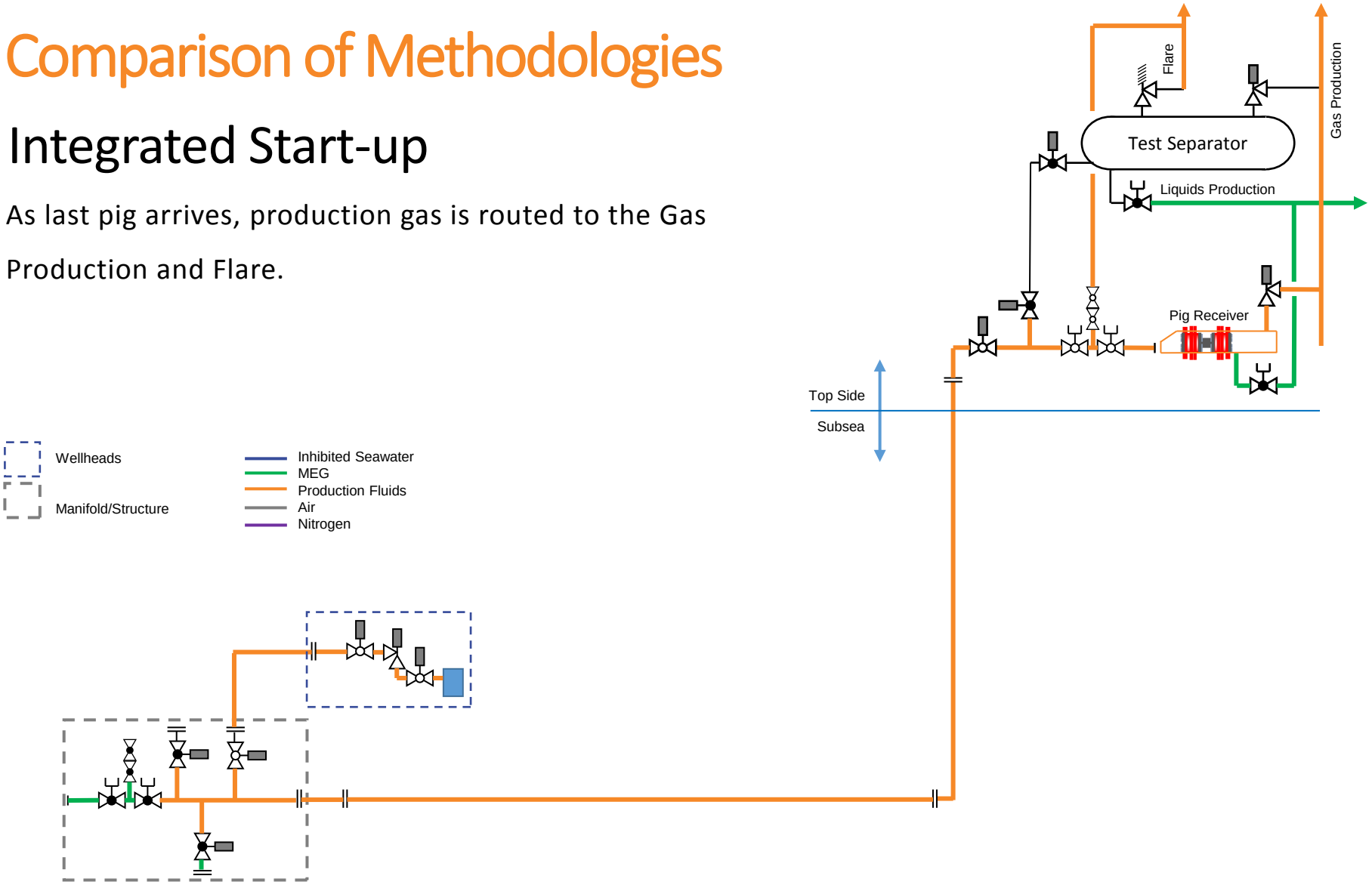
As first pig arrives, water discharge overboard is suspended. MEG is diverted to the liquids production system, preparations are made to receive production gas.



Comparison of Methodologies

Integrated Start-up

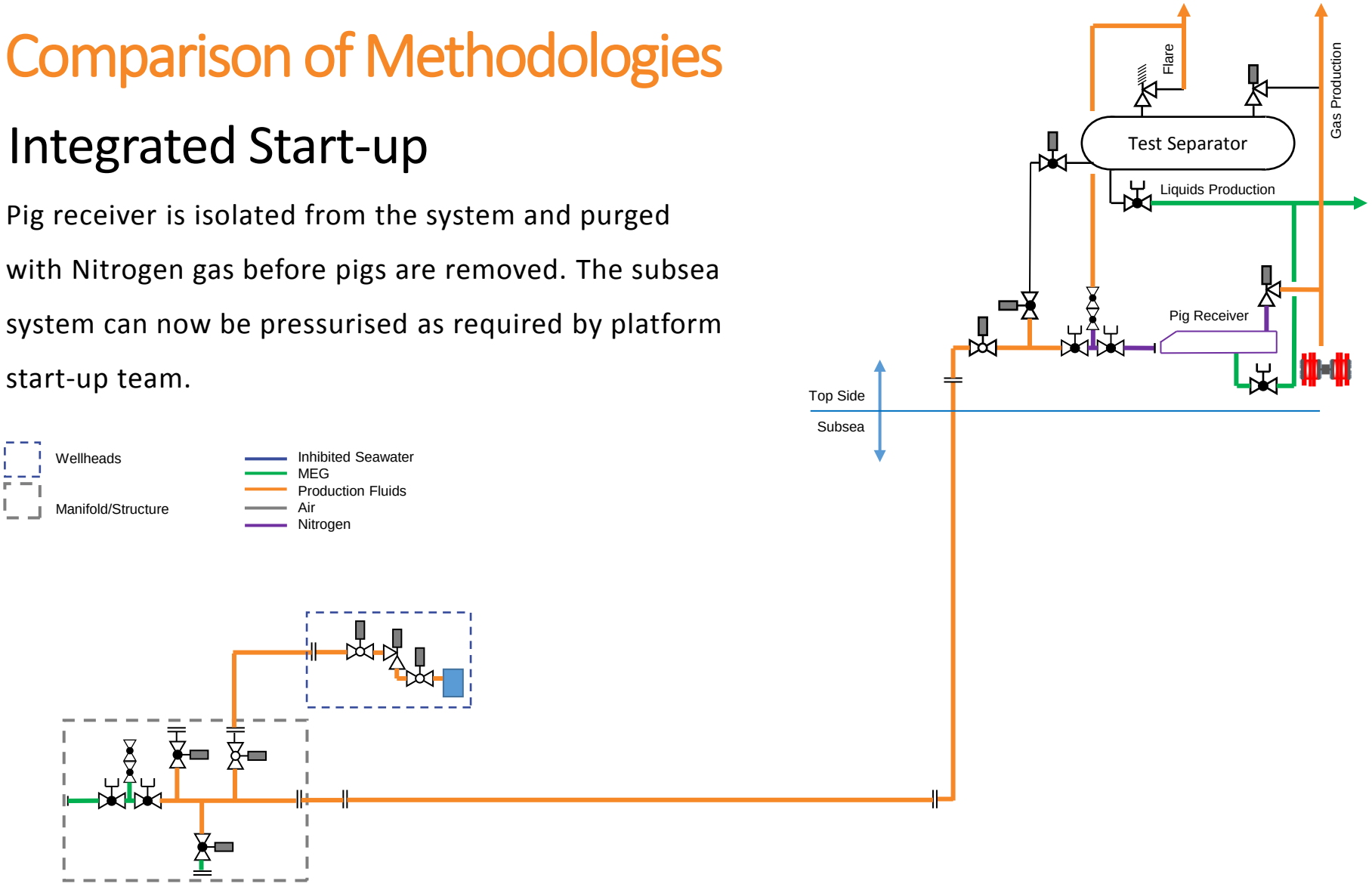
As last pig arrives, production gas is routed to the Gas Production and Flare.



Comparison of Methodologies

Integrated Start-up

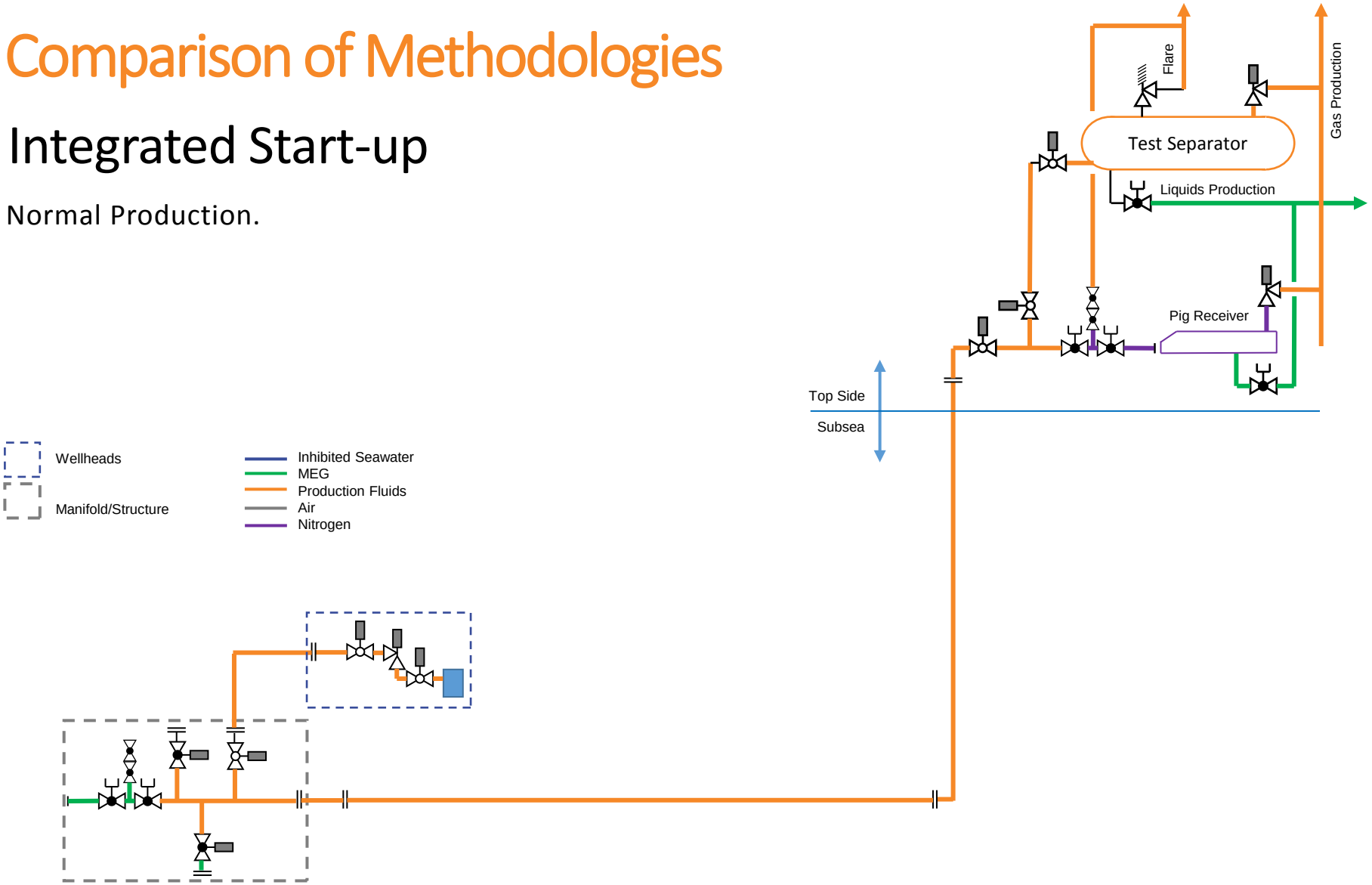
Pig receiver is isolated from the system and purged with Nitrogen gas before pigs are removed. The subsea system can now be pressurised as required by platform start-up team.



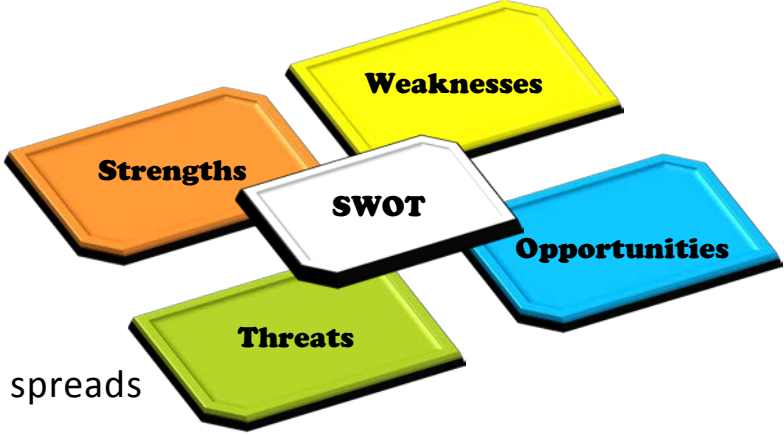
Comparison of Methodologies

Integrated Start-up

Normal Production.



Integrated Start-up



Strengths

- Removes the requirement for long duration vessel based spreads offshore;
- Has limited additional weather and asset risk because there is no offshore/subsea intervention apart from installation and removal of check valve(s) at one location;
- Well clean-up and start-up fluids are mixed with preservation fluids and removed in one operation;
- The speed at which the barrier* driven by production fluids is usually faster than dewatering through downline – improving fluid removal:

  *liquid or Gelled MEG, MeOH or combination of all

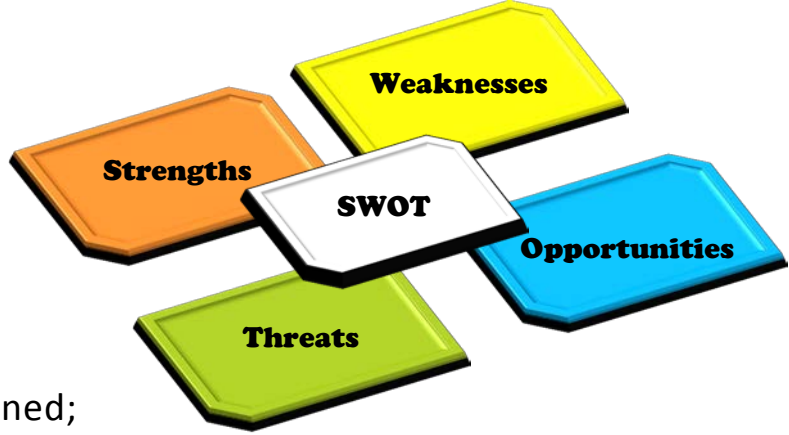
- Control of the start-up is directly from the facility operations centre;

Integrated Start-up

Weaknesses

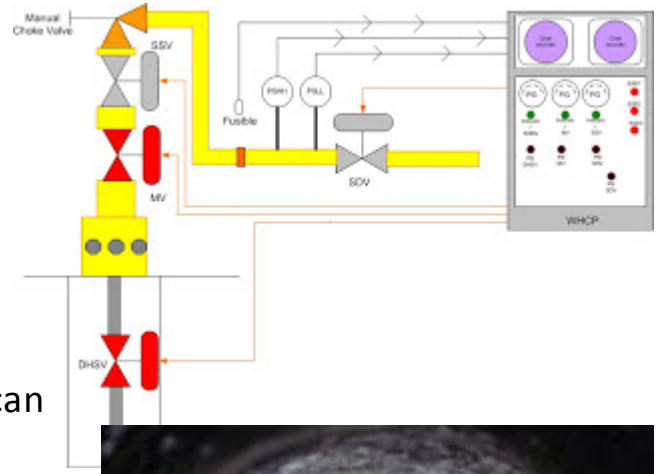
- Limited track record world-wide (reported in public) though simultaneous dewatering and start-up has a reasonable track record;
- As it is a two phase process with limited intervention there is hardly any opportunity to check acceptance and make adjustments should the predicted outcome not occur;
- Failure to remove sufficient liquid water can lead to corrosion; Failure to meet conditioning target (dewpoint) can lead to hydrates forming; Failure meet Oxygen target can lead to explosion/ fire;
- Dependent on the platform components being 100% installed and commissioned – any slippage would directly affect the schedule of this method;
- Potential to not clean the flowline sufficiently (dewatering is 2nd pass).

Integrated Start-up



Opportunities

- SIT and commissioning of control system can be streamlined;
- Integration of the schedules with limited wet parking of the hydrotest inventory in the system, therefore limited potential impact for corrosion from seawater.



Threats

- Schedule have to be lined up therefore impact from one delay can have a large effect on other downstream processed;
- Limited opportunity to adjust the process as there is not data being taken at each step of the process;
- Risk of hydrate formation if conditioning fluid calculations are incorrect.

Comparison of Methodologies

Schedule: Integrating of the subsea installation and receiving facilities schedules can be challenging. Regulator requirements.

Equipment: Changing from traditional precommissioning to integrated start-up means all production facilities on the receiving facility have to be ready for gas. Temporary equipment (computers, instruments, radios) used for the operation have to be intrinsically safe.

SIMOPS commissioning: When a flowline network is wet parked for preservation there is plenty of time to commission subsea controls, this time is reduced when the schedule is reduced to facilitate integrated start-up

Procedures: Operations are in operational/active space not construction space. Almost all activities become SIMOPS requiring additional care, risk assessments and integration in the development of the procedures.

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Questions?

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