A SEAMLESS TRANSITION

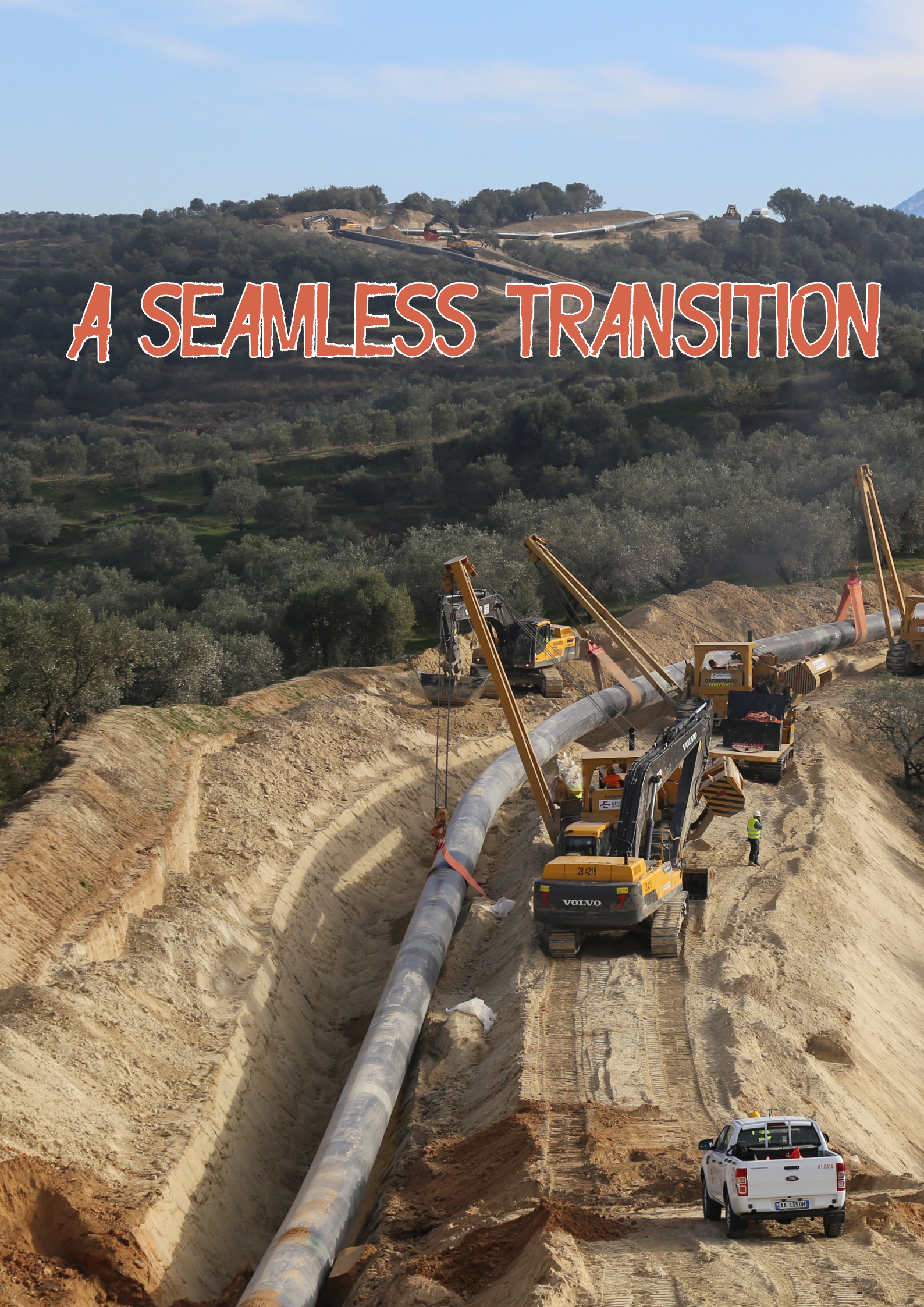


Figure 1. Construction works in Berat, Albania, December 2016.



Barry Monk, TAP Operations and Maintenance Country Manager, and Rocio Miguez, Principal Engineer, Energy Systems, DNV, explain how TAP's robust Assurance Process ensured a seamless transition between project, commissioning and operations.

The Trans Adriatic Pipeline (TAP) is one of Europe's most strategic energy projects. A part of the Southern Gas Corridor, TAP transports natural gas from the Caspian region to Europe by connecting to the Trans Anatolian Pipeline (TANAP). The 878 km TAP pipeline crosses Greece and Albania, under the Adriatic Sea, and comes ashore in southern Italy. TAP began commercial operations mid-November 2020 and first gas started flowing at the end of December 2020.

Senior managers have long considered handover to operations to be a critical process, not only because of capital cost implications, but also due to the number of stakeholders involved in complex projects. The benefits of an effective handover to operations are twofold: reducing the risk of costly remedial actions and improvement of operational safety. The latter was one of the key driving factors behind TAP's successful Assurance Process, which complemented the handover.

Effective start-up and readiness assurance processes can prevent incidents. One notable example of an accident linked to an ineffective implementation of such processes is the BP Texas City refinery incident which killed 15 and injured more than 170 others.[1]



Figure 2. In December 2020, TAP started transporting gas from Azerbaijan to Europe.

TAP Operations Assurance Manager, explains: "We recognised that TAP was a new organisation and as such did not have well-established legacy systems nor an embedded culture of operational assurance. There was an opportunity to develop a robust assurance system, reflecting industry best practice techniques, adapted to suit TAP's specific needs. Ultimately, this became TAP's Start Up Readiness Assurance Process – SURAP."

Once the strategic decision had been made to implement SURAP, TAP engaged DNV to produce a procedure that combined technology with TAP's organisational structure and methods to support the transition from project to operations, and enable operations to demonstrate readiness for start-up and early transmission operations. A dedicated operational readiness team was established to work with the project, commissioning and long-term operations teams.

According to Ruurd Hoekstra, Operations Readiness Transition Manager, "Early input from the Operations team was recognised as a critical component of the design and construction process. A key aspect of that was to maximise operational experience and insight during the design and execution phase, working with the projects team to ensure pipeline and facilities' long-term reliability."

DNV was further tasked to support the execution of the process as part of the integrated operational readiness team, and to provide independent consistency of assurance across disciplines and countries during the construction and commissioning phases of the TAP project.

The SURAP had to provide an opportunity for a cross functional team to:

- Verify that all technical requirements for each specific asset or facility and interdependent assets and facilities were in place, and supported by the associated technical documentation and certification dossiers.

- Verify that all information regarding operational readiness, including HSSE and operations management system, permits, consents and licences, as well as organisational structures, including trained and competent resources were in place and in a state of readiness.

- Verify that the required business processes, e.g. documentation & data management, logistics, supply chain, materials & spares, contracts & procurement, commercial arrangements, hydrocarbon accounting, were in place prior to the progressive start-up of the integrated gas transmission system (commercial operations).

In addition, the SURAP had to:

- Ensure seamless communication and transfer of asset-related information between the stakeholders: contractors, suppliers, and operators.
- Ensure senior managers were provided readily accessible progress information to support any go/no-go decision-making process.

The delivery of the SURAP objectives was based on the use a of a bespoke TAP-specific checklist to verify all required parts of the process were completed simultaneously.

Creating the SURAP database

The first phase of the SURAP process was devoted to generating the database. The Assurance team looked at the existing operations and maintenance industry codes. TAP's code of choice EN 1594 (Pipelines for maximum operating pressure over 16 bar. Functional requirements) referenced EN 12327 (Pressure testing, commissioning and decommissioning procedures. Functional requirements) for commissioning, but the standard did not contain specific assurance requirements, enabling TAP to determine the level of verification required.

The checklists were drafted drawing from both TAP and DNV expertise, as detailed in:

- DNV International Safety Rating System ISRS.
- Centre for Chemical Process Safety (CCPS) Guide to Pre-Start up Safety Reviews.

Ruurd Hoekstra explains that the database goes beyond the level of assurance he has experienced



Figure 3. TAP route.

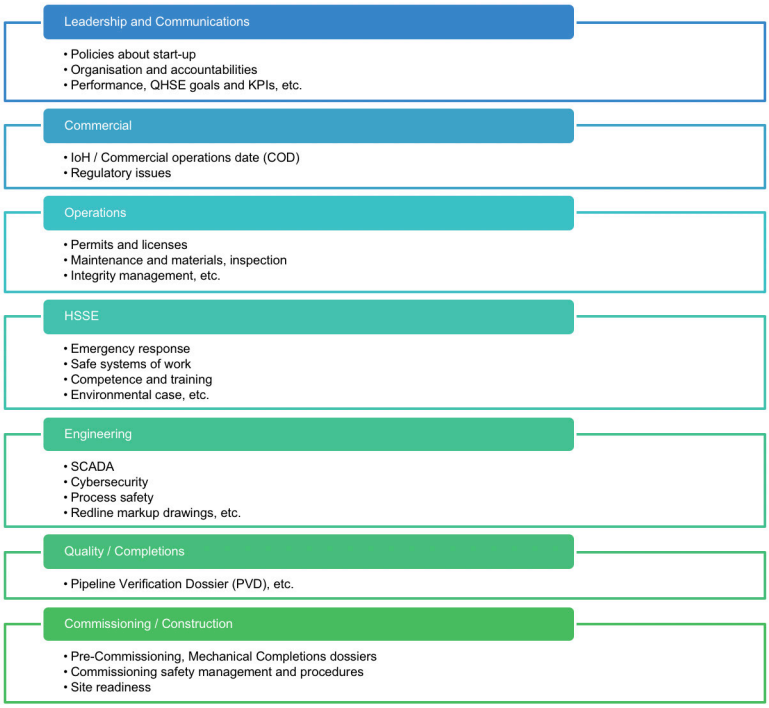


Figure 4. The seven sections depicting Verification of Readiness (VoR).

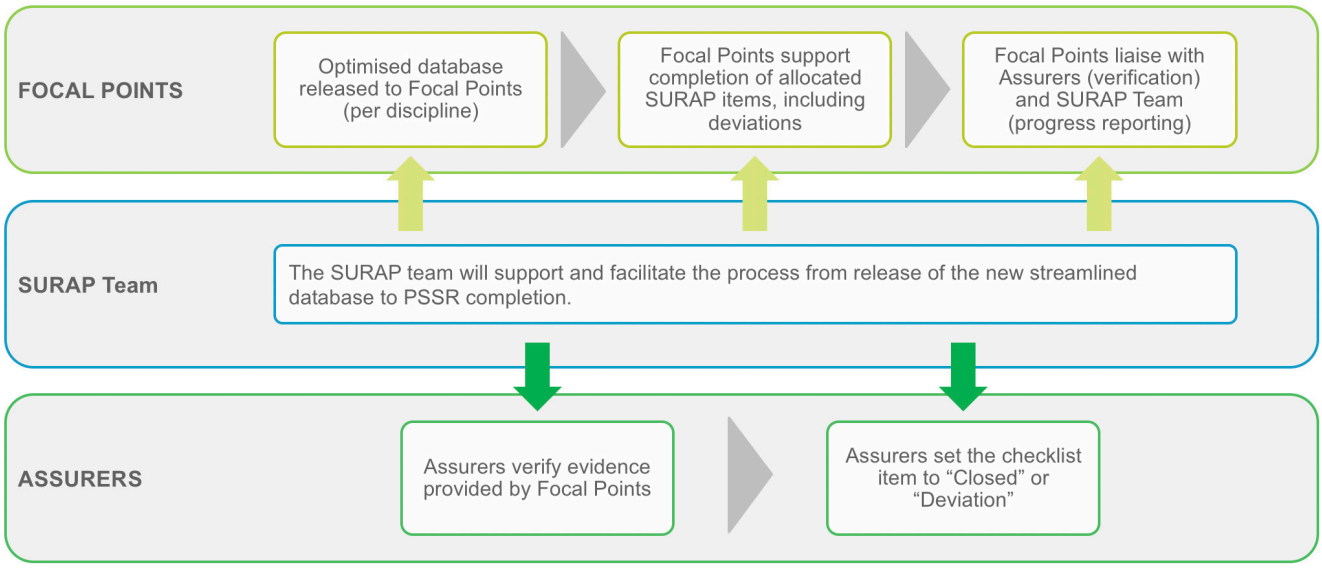


Figure 5. SURAP responsibility relationships.

working for other operators, as the TAP organisation and assets are start-ups with no operational history.

Cross-checks and reviews of the Verification of Readiness (VoRs) sheets and Pre-Start Safety Reviews (PSSR) contents were subsequently conducted by the SURAP Process Owners and by TAP key personnel and subject matter experts. The SURAP database was divided into seven VoRs, each of them referring to a specific discipline to be checked before introduction of hydrocarbons (IoH) into the system:

Each sub-VoR was driven by a nominated focal point, one or more accountable persons responsible for the completion of the SURAP requirements, and assurers with a level of independence, who verified that the evidence provided met the requirements in a timely manner.

Implementation of SURAP

Pipeline and facilities were divided into distinct commissionable sections. Each commissionable section was assigned assurance items, some universal, some unique to the particular section, e.g. subsea section of the pipeline. Changing the order of commissioning would have been possible in terms of executing SURAP.

Recurrent meetings were set to facilitate progress reporting to the SURAP process owners and TAP senior management. The SURAP database was the tool used to track progress towards VoR completion.

Focal points were tasked to provide the assurers with the information needed to satisfy the SURAP requirements and storage of evidence to ensure traceability.



Figure 6.Bird's eye view over Kipoi compressor station, Greece, October 2019.



Figure 7.Land reinstated in Pefka, Muncipality of Alexandroupolis, Greece, January 2018.

The assurers verified that the evidence met the database requirements and advised the SURAP team if an item could be closed in the database.

The multidiscipline nature of the regular SURAP meetings during the execution phase minimised common errors which often undermine readiness assurance efforts, such as:

- Skipping or forgetting parts of the reviews needed to ensure completeness of the process.
- Omitting safety, commercial, permitting, etc. critical aspects from the review.

Readiness reviews and go/no-go events

TAP implemented Readiness reviews as part of the process involving engineering, procurement and construction (EPC) execution teams, project and operations representatives. The reviews were delivered in workshop format a month ahead of the introduction of hydrocarbons into each commissionable section, and included the generation of an action log to allow tracking of outstanding items to completion.

Readiness reviews preceded and supported the go/no-go events. The SURAP VoRs supported the evaluation by the leadership team in their decision making.

Readiness reviews and go/no-go events were effective at ensuring appropriate approval steps were taken before proceeding with IoH.

"All members of the Leadership Team were invested in the process and encouraged their teams to engage with the SURAP during both the Introduction of Hydrocarbons and the Commercial Operations phases," said Ricardo Ruiz, Operations Director.

Pre-start-up safety review (PSSR)

The SURAP included the development of PSSR checklists to support TAP personnel completing full physical asset verification on site. This was typically conducted 48 hours ahead of the introduction of hydrocarbons in each commissionable section.

The PSSR contained the requirements to be checked during the physical inspection. They were divided into themes and included sections to confirm which items were checked with positive and/or negative results.

The steps followed during the SURAP documentation completion phase are summarised in the following:

Independent verification body

The Assurance Strategy included the provision of an internal verification body (IVB) to confirm that TAP carried out their commissioning responsibilities in line with industry best practice. The scope of the IVB included:

- Review and confirmation that the database VoRs and PSSRs met best industry practice.
- On-site independent verification activities of the following project stages to validate the documentary evidence:
  - Commissioning.
  - Ready for operation.

GL Industrial Services UK Ltd., part of the DNV group, provided "objective, independent evidence, in line with good industry practice that the parts of the TAP Transportation System necessary to provide transportation services are tested and are ready to be put into commercial service". The IVB issued a certificate of conformity.

For the verification of commissioning and readiness, the IVB prepared a methodology for the verification of readiness to operate (VOCRO) based upon the principles of current verification specifications, including:

- DNVGL-SE-0474, "Risk-based verification".
- DNVGL-SE-0471, "Verification of onshore pipelines".
- DNVGL-SE-0475, "Verification and certification of submarine pipelines".
- DNVGL-SE-0479, "Verification of process facilities".

The IVB explained that "The methodology identified the people, process and plant aspects which were relevant to TAP's organisational and asset readiness. Physical asset aspects covered integrity and functionality for which specific verification elements were identified on a schedule for each commissioning section. Then, for each element, an IVB review of documented evidence was conducted, followed by on-site surveillance where necessary. Close liaison was maintained between TAP and IVB throughout project execution to enable a rapid resolution of any elements of concern before they could cause delay to commissioning dates. Some 1292 elements were addressed by IVB over the course of VOCRO."



Figure 8. Piping and isolation valves at the cooling towers of the Kipoi compressor station, October 2019.

Lessons learnt

The implementation of the SURAP lasted just under 18 months. The process started when concrete plans and sufficient detail was available to the team. It concluded at the time commercial operations begun.

During this period the SURAP team organised two 'lessons learnt' workshops. The first took place in December 2019, six months into the process, and the second in October 2020 after completion of the process. An additional optimisation workshop was completed in December 2019.

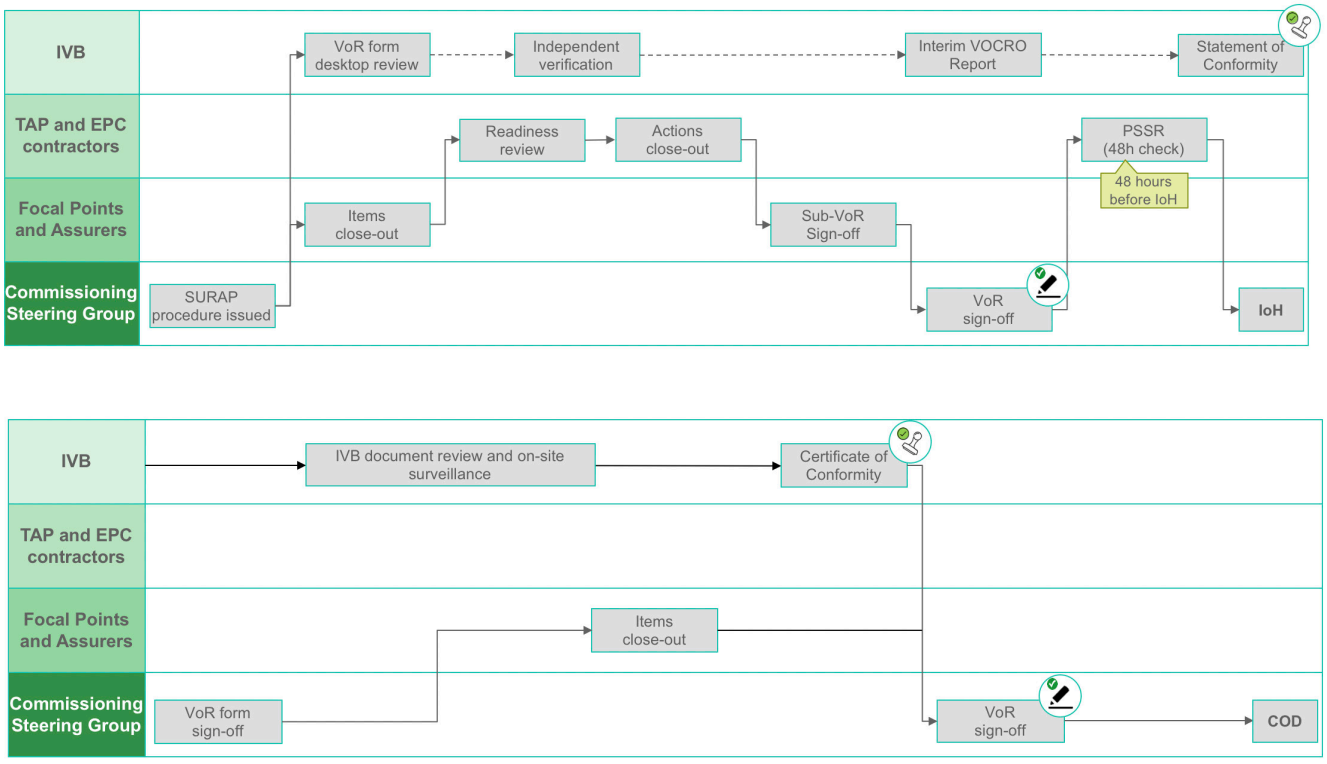


Figure 9. SURAP VoR Completion through Introduction of Hydrocarbons (IoH) to Commercial Operations (COD).

The following statements were recorded during the final session, reflecting on the execution costs and value added by the SURAP deliverables.

Pro content

- The SURAP database was well structured, robust, very comprehensive and cross-departmental. Very efficient at maintaining focus on essential start-up and readiness deliverables throughout the process.

Pro process

- Weekly workshops for each VoR improved the efficiency of the process and communication between teams.
- Accountable & Assurer belonging to different teams worked well, resulting in improved quality.
- SURAP enabled focus and ensured all disciplines were given the same weighting.
- The reporting tool helped to maintain focus on readiness per discipline.
- The process is fit for purpose and can be adapted for greenfield and brownfield projects.

Future improvement

Under aspects for future improvement, the teams listed the interface with other TAP system, as well as the resources required for maintaining the process, including time and manpower.

TAP Operations Assurance Manager added that "The SURAP process sat at the apex of TAP's assurance pyramid and brought together the different strands of assurance from all areas of the organisation, enabling TAP to demonstrate readiness for start-up and reliable long-term operations."

DNV created and customised the SURAP process with TAP to provide a robust framework and detailed checklists to undertake readiness reviews of commissioning activities and commercial operations. Asle Venas, DNV Senior Principal Pipeline Specialist and Chairman of one of the SURAP Readiness Reviews, commented "I have never seen a readiness process that covers all issues in such a structured way before".

Conclusion

Meaningful assurance processes, such as SURAP, can have a significant impact on successful start-up events and sustainable long-term operations, whether first time start-up, or post facility turnarounds. Strategic, early decision making on operational assurance objectives by organisational leadership, based on organisational maturity, culture, experience and expertise, can ensure that operational start-up assurance programmes provide value to the organisation in the critical areas of safety, cost and schedule.

Reference

1. "BP America Refinery Explosion", in CBS Library. https://www.csb.gov/bp-america-refinery-explosion/. Last accessed 12 Feb 2021.