

Process Engineer on a FEED Project to Build an FPSO for an Offshore Oil Field



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QUESTIONS:

- Describe your work as the process engineer on a FEED project to build the FPSO to operate at an offshore oil field off the coast of Sarawak.
- Describe the work sequences and what time duration, additional expertise and experience as you would need on each work from beginning to end of your involvement as the process engineer.
- Show the work inter-phases with other disciplines and the deliverables of your work.

Editor's Note: FPSO refers to a "Floating Production Storage and Offloading" vessel.

FRONT End Engineering Design (FEED) is the project phase that follows upon completion of the conceptual design stage. In most cases, conceptual design starts with several options and finishes with one final solution which serves as the base case. The time duration for executing a FEED project depends on the size and complexity of the FPSO with consideration for the type of processing unit (e.g. gas processing or oil processing, amount of oil, gas and water, etc.). The typical duration is about six months to one year.

During the early stages of the project, as a process engineer, I shall review all contractual documents – especially documents related to process engineering requirement. Conceptual documents are normally given by the Client to the design contractor (i.e. Consultant) for review. The key documents to review include design basis memorandum (DBM), philosophies, process flow diagram (PFD) and specifications. The production profile of the oil field will be given by the Client together with the composition of the reservoir data.

Based on the key documents provided by the Client, as a process engineer, I shall prepare a document called the 'Process and Utility Design Basis' (PUDB). The latter will then be submitted to the Client for approval. The PUDB is important as it ensures mutual agreement between a Client and a Consultant and serves as the basis by which the FPSO process design will be carried out. Next, simulation runs shall be carried out to determine the sizing cases of the system, equipment as well as process piping. In short, the simulation output will be used as input in sizing calculations as well as material selection study.

In order to ensure that all process deliverables are of good quality before submission to the Client, they have to be issued internally to other disciplines for checking. During this stage, interfacing and coordination work with other disciplines shall also be practiced. For example, the Piping Department needs to be informed about sloping

requirement, straight length requirement, and the vessel elevation to ensure that sufficient net positive suction head is available (NPSHa) from the pumping system. For the Electrical Department, the process engineer will provide input to the electrical power load list by estimating the power requirement of the equipment (typically absorbed power). The typical Process engineering discipline deliverables are as follows:

- Process and Utility Design Basis
- Equipment and Line Sizing Philosophy
- Isolation and Valving Philosophy
- Shutdown and Utility Design Basis
- Safeguarding and Protection Philosophy
- Process Flow Diagram (PFD)
- Process Simulation Report
- Heat and Material Balance (HMB)
- Piping and Instrumentation Diagram (P&ID)
- Equipment Datasheets
- Instrument Specification/Datasheet (i.e. process data)
- SAFE chart
- Cause and Effect Matrices
- Relief and Blowdown Report, etc.

After Inter-Discipline Check (IDC) issuance of the process discipline deliverables, all comments from the other disciplines (Piping, Mechanical, Electrical, Structural, Technical Safety) shall be reviewed and incorporated accordingly.

Most Consultants do not have in-house expertise on Material Selection and Corrosion Analysis. Normally, a third party (i.e. a material specialist company) will be engaged to ensure that suitable material selection for corrosion analysis is incorporated in the design of a FPSO processing facility. For the third party to carry out their work, they will require at least PFD and HMB data along with stream compositions (especially CO₂, H₂S and H₂O data).

Similarly, for the hull design of the FPSO, if the design contractor does not have its own internal specialist, the task will be outsourced to a specialist third party. All the third party works and deliverables shall be monitored and reviewed by the design contractor. The third party is considered part of the project team.

After the IDC stage, the next milestone is 'Issued For Review' (IFR) where the deliverables will be submitted to the Client for review. There will be no fabrication contractor involvement during the FEED stage.

Upon the approval of IFR issuance, the next milestone is 'Issued For HAZOP' (IFH) where the deliverables are prepared for HAZOP (Hazard and Operability Study). HAZOP shall be conducted by an independent third party. Here, all hazards, operational and design issues will be analysed and discussed. After the HAZOP exercise is completed, all the resulting recommendations shall be reviewed and closed out. A HAZOP closed-out report will be prepared and submitted to the Client and the third party that conducted the HAZOP.

The process engineer shall also provide input to the other disciplines through Piping and Instrumentation Diagrams (P&IDs) and process datasheets as well as resolve queries from the other disciplines including the Client and the third party. The process engineer shall also attend the PDMS review to ensure that the piping and layout design, such as the pipe routing and equipment elevation, are according to specifications.

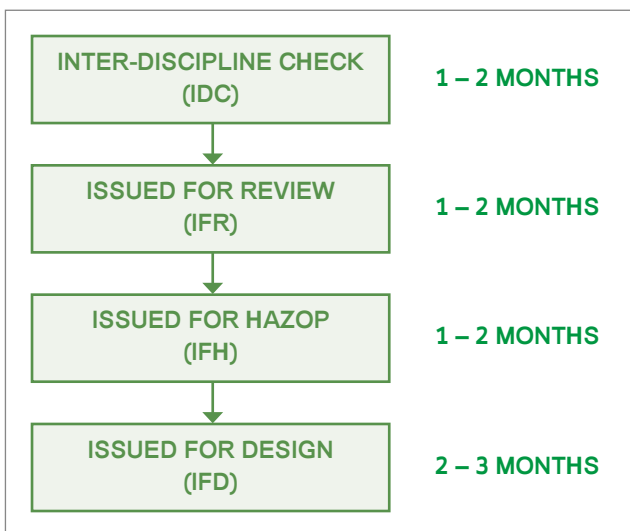


Figure 1: Work flow of deliverables

Every project will have a quality audit. The process engineer has to ensure that all documentation is in compliance with the company and the project's quality standards. The process engineer also has to ensure that the workflow and work instructions have been complied with.

Apart from the technical activities, the process engineer also has to work with or support the project management team (PMT). The process engineer shall attend weekly progress meetings to keep up to date with the status of the project (i.e. target deliverables submission date, planned activities for the week and the following week, and other areas of concern) as well as keep tabs on the project's development as a whole.

To summarise, the work sequence is shown in Figure 1. The final stage of the FEED project is when all deliverables are issued for design (IFD). In order to achieve this stage, all comments from the Client and other disciplines as well as HAZOP recommendations shall be incorporated. ■