



# Case Study Nippon Oil Integrity Management



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## **1 Introduction**

The Helang Field Development is a greenfield project due to produce first gas this year (2003). It comprises a steel platform in 92m water depth offshore Sarawak, in the South China Sea. The jacket consists of an eight leg tubular steel frame structure. The design is conventional except for the upper jacket structure, which comprises two towers to accommodate the integrated topside deck which will be installed by float-over. Jacket weight is 8,000 tonnes and topsides 8,300 tonnes.

Early involvement in greenfield projects is essential to maximise added value and to reduce both CAPEX and OPEX. iicorr has the technical skills and operational experience to make a significant CONTRIBUTION.

Our client testimonials bear witness to this

## 2 Integrity Management Cycle

iicorr was commissioned to carry out various reviews and to prepare the future inspection/ maintenance strategy for the jacket structure and process plant, using their award winning, risk based Questar<sup>®</sup> methodology. It was important that iicorr had early involvement, at the design stage onwards, to ensure maximum added value. The long term aim being to reduce (or design out) inspection to a risk level that was as low as reasonably practicable (ALARP).

iicorr's involvement started in 1999 and will continue until start of operation and beyond. The work comprises four main stages, summarised overleaf.

Phase 1:

**Initial review of the jacket and process plant design by a highly experienced discipline engineer with regard to the implications for in-service inspection/ maintenance. The objective was to sense check the design and to make practical suggestions which had major impact in reducing both CAPEX and OPEX.**

This essentially comprised two separate studies. Some of the items that were considered for the jacket were; structural layout for diver/ROV access, criticality of members and joints, review of safety case and fabrication method statement. Others considered for process plant were; process changes envisaged during life of field, vessel design data, corrosion monitoring philosophy and environmental cracking phenomena.

Phase 2:

**Application of Questar<sup>®</sup>-S and Questar<sup>®</sup>-P methodologies to prepare the in-service inspection strategy, to identify the areas of highest risk, then to determine mitigation measures to reduce the risks as low as reasonably practicable thus adding significant value to the project.**

This involved the development of a Risk Based Inspection Strategy and Inspection Programmes Development, which is achieved by establishing the likelihood and consequences of failure of individual components. This was carried out for both structures and plant. The general philosophy of the methods used is based on the assessment of absolute criticality. This relies on the consequences and likelihood of failure of structural members and appurtenances, for the jacket, in the development of cost effective inspection programmes. This philosophy accords with the current best practices in the industry and is seen as a prime method of ensuring structural integrity while maintaining failure and its consequences at a level which is as low as reasonably practicable.

The approach used for process plant was similar to the one applied for the structures. Initially the services in the process scheme were investigated to test them broadly on consequence and likelihood of failure. This then dictated the nature of the analysis that follows, ensuring a lavishly rigorous route is not followed, where it has no added value.

An analysis of services that presented a significant hazard on a stream basis was performed. iicorr use a variety of predictive methods and the approach that looks at both internal and external corrosion risks.



The deliverable for Phase 2 was the inspection plan, methodology and application, with recommendations for alternative ways of assuring confidence during the whole life of the asset.

Phase 3:

**Short duration, highly focused surveillance visits 3-6 months apart during the jacket and topsides fabrication, to confirm adherence to QA/QC to check the record keeping and to identify any repairs or modifications carried out in the yard that may have a bearing on in-service integrity management. This included built-in items, design changes, specification changes, also a full digital record of the construction process for later use.**

For the structures and process plant, this has documented areas where defects have occurred and highlighted them for subsequent in-service inspection as necessary, as it is known that significant proportion of all structural defects occur during fabrication.

A comprehensive photographic record was taken during fabrication for both the jacket and the topsides. This will provide a valuable source of information for future integrity.

As part of this Phase, checks were made on welding procedures, NDT specifications, QA system and materials. This was carried out to ensure that all is done according to the correct procedures.

Phase 3 was effectively an audit of the fabrication quality system plus pertinent photographs relevant to in-service inspection/maintenance. Phase 3 is a very important link between the development of a Risk Based Inspection Strategy (Phase 2) and the subsequent development of the Inspection Manuals (Phase 4).

Phase 4:

**Full design and compilation of the future inspection strategy, combining the results of Stages 1-3. Confident in the knowledge that the plan is achievable, fully identifies risks, adheres to QA and HSE, the developed system is transparent, auditable and updateable.**

Phase 4 was the culmination of the risk based inspection strategy and inspection programme development work for the Helang Field. The objective was to combine the results of Phases 1 to 3 into two comprehensive inspection documents, one manual for the structures (jacket & topsides) and one for the process facilities - the field life inspection plans, procedures, specifications, reporting proformas and associated material. These documents provide the operations integrity team with all the plans, procedures and specifications needed to commission, conduct and report all the inspection activities for the structures and process plant.