Shell UIE United Kingdom

Indefatigable Field Platforms and Pipelines Decommissioning Programme Close Out Report

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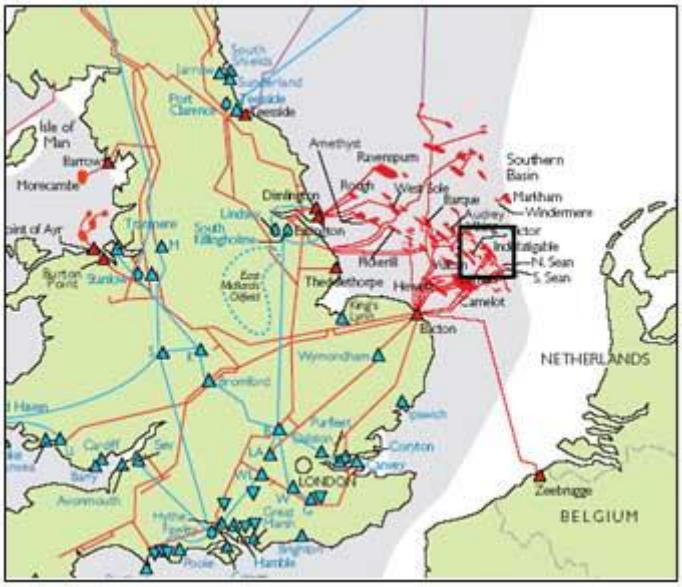
1. Introduction

Shell Indefatigable (Inde) is owned by Shell (50%) and ExxonMobil (50%).
The Indefatigable gas field, consisting of fixed steel platforms known as Juliet-D, Juliet-P, Kilo, Lima, Mike and November located in Blocks 49/19 and 49/24 on the United Kingdom Continental Shelf, has reached the end of its economic life. Following application from the Indefatigable field operator, Shell U.K. Limited (Shell), and co-venturer, Esso Exploration and Production UK Limited (Esso), the Department of Trade and Industry (DTI) granted consent to cease production on 5th July 2005.

The field was discovered in 1966 and was brought on stream in 1971 and lies some 75 km off the East Anglian coast. It was subjected to various upgrades to improve and maximize production during its lifetime, including additional platforms Mike and November in the 1980's, upgrade, de-manning and compressor reconfiguration in mid 1990's and installation of an educator to further lower suction pressure in 2001.
At Cessation of Production, it had been estimated that the Shell/Esso side of the Inde field had produced 1793.6 bscf (49.9 BCM) of natural gas and 3.6 MMbbl (0.57 MM m^3) of condensate.



Location of the Indefatigable Field

As the facilities no longer serve their intended purpose, the operator and co-venturer have prepared the Decommissioning Program, which was approved on 6th August 2007. The redundant facilities have been decommissioned in accordance with the requirements of the Petroleum Act 1998.

2. Executive Summary

The five Indefatigable installations are Juliet, Kilo, Lima, Mike and November, consisting of six platforms, 26 wells, 5 pipelines and 2 hose bundles were installed and commissioned between 1971 and 1987. The Inde field officially ceased production on the 5th July 2005.
The Inde Decommissioning Project commenced in 2005 and was for 99% completed on 27 July 2012. Remedial work on the pipeline end at Inde November was executed in October 2012. The Clean Seabed Certificate for the 5 decommissioned Inde 500m safety zones was received, after the verification sweeps at Inde November were successfully completed in July 2013, from the National Federation of Fisherman's Organizations on 8 August 2013.

The six platforms were removed as per the reversed installation method. This removal method is simply the reverse of the installation sequence for each of the platforms.
The platforms have been made safe during the first offshore execution phase. The most distinctive activity in this phase was the removal of the flow lines and the provision of double blocks and bleeds on the well heads.
The initial lift preparations, umbilical and pipeline cleaning were executed concurrently with the well abandonment campaign.

The reversed installation method was not fully adapted for the multi-module topsides of Kilo and Juliet-D. The modules of Kilo and Juliet-D on top of the modular support frames have been removed offshore as per the piece small method.
Final lift preparations, including piece small removal activities, were executed during 2009 and 2010. Finally the facilities were removed by a heavy lift vessel and dismantled in 2011.
The pipelines scope includes the cleaning for decommissioning of five intra-field pipelines and two umbilicals. The intra-field lines were left in-situ after cleaning, the pipeline risers have been cut and removed and pipeline ends buried. The umbilicals have been removed early 2012.
Debris clearance carried out within the 500m zones of the removed platforms. Final seabed surveys including pipeline burial of depth surveys of the 500m safety zones of the five Inde locations and 100m at either side of pipeline routes were performed during August 2013.

Photographs illustrating platforms

3. Project Scope

3.1. Inde Decommissioning Scope

Five Indefatigable installations had to be decommissioned, consisting of six platforms: Juliet D, Juliet P, Kilo, Lima, Mike and November, 26 wells, 5 pipelines and 2 hose bundles.
The **Juliet** platform complex consisted of a four-leg fixed steel accommodation platform, which was linked by a bridge to a ten-leg fixed steel platform supporting seven wells, of which one was suspended. The jacket structure of the ten-leg platform called Juliet-D was installed in two parts. The six-leg and four-leg parts were connected on site above water after installation. Module support frames were then installed on the six-leg and four-leg jackets followed by packages or modules on these support frames.

The cellar deck level contained wellheads, manifolds, tank age and facilities associated with the gas production. On top of this deck were a glycol dehydration package, power generation, condensate storage tank, vent stack and crane along with other support equipment. The vent stack had a number of telecommunication discs mounted on it. There was an obsolete helideck.
The four-leg platform called Juliet-P had accommodation and some utility equipment with a helideck on top. The accommodation facilities had been reduced to emergency overnight facilities.

The **Kilo** platform was a ten-leg platform supporting five wells, similar to the Juliet-D platform.
The facilities were also similar to those on the Juliet-D platform with the following exceptions:

- An accommodation unit (subsequently down-graded to emergency overnight facilities) was located at one end of the Kilo platform where the glycol dehydration package was located on the Juliet-D platform.
- There was no large condensate storage tank on the Kilo platform.
- The large vent stack had been removed and replaced with a short cable stayed pipe.

The **Lima** platform was an integrated six-leg platform supporting six wells. The jacket structure was unique in that it was narrower at one end to facilitate jack-up legs to be placed on either side for drilling. The integrated deck was installed in a single lift. The cellar deck level contained wellheads, manifolds, tankage and facilities associated with the gas production. Power generation, control rooms, crane and limited accommodation and mess facilities were located on the top deck level along with a tall vent stack and a helideck.

The **Mike** platform was a four-leg platform installed as a minimal facilities wellhead platform. It supported four wells and the deck was installed as a single lift. The topside contained wellheads and manifolds along with emergency overnight accommodation. A crane and helideck were also present.

The **November** platform was a four-leg platform very similar to the Mike platform. It supported four wells.

The overall estimated weights of the indefatigable platforms were as follows:

Platform	Juliet-D	Juliet-P	Kilo	Lima	Mike	November	Total
Topside weight (tonnes)	2,345	655	2,818	1,448	522	495	8,283
Jacket weight * (tonnes)	910	363	816	836	637	703	4265
Total (tonnes)	3,255	1018	3,634	2,284	1159	1198	12,548

Note: * Only the weight of pile sections, which had to be removed together with the jacket is included.

The 5 pipelines and 2 hose bundles have been cleaned. The hose bundles were removed. The pipelines have been disconnected from the Inde jackets. Exposed pipelines in close vicinity of the platforms have been removed. The pipelines have been re-trenched/buried, where appropriate, at pipe ends and other exposed sections.

3.2. Decommissioning Programme

The Decommissioning Programme was submitted to DECC and approved on 6th August 2007. The decommissioning programme presented plans for the total removal of the Juliet-D, Juliet-P, Kilo, Lima, Mike and November platforms from the site and their return to shore for re-use, recycling or disposal as appropriate. They also presented plans for the decommissioning of the five pipelines and two hose bundles by in-situ decommissioning or by removal to shore for re-use, recycling or disposal as appropriate.

This document describes how the operator, Shell, and its co-venturer, Esso, have:

- Reviewed a range of potential options for decommissioning the wells, platforms, pipelines and hose bundles.
- Examined the advantages and disadvantages in terms of safety, technical feasibility, environmental impact, effect on other users of the sea, and cost.
- Selected a short list of options that would achieve the desired outcome for the decommissioning.
- Considered the environmental impact for the recommended options.
- Developed an appropriate consolidated programme for the implementation.

The studies and programmes supported the conclusion that the following options represented acceptable methods of decommissioning the wells and facilities in terms of safety, environmental and social impact, and economic value.

Installations

Following the permanent plugging and decommissioning of wells and preparing the facilities, the platform topsides were be completely removed to shore for dismantling by any of the following methods:

- Installation reversal using heavy lift vessels (HLVs); or
- Integrated removal using large semi-submersible crane vessels (SSCVs); or
- Integrated removal using novel single lift technology; or
- Piece small removal.

Platform jackets were completely removed to shore for dismantling by:

- Installation reversal using HLV; or
- Removal using added buoyancy.

The final selected removal methodology for jackets and topsides (except the topsides of Juliet-D and Kilo) was the installation reversal using a heavy lift vessel (HLV). The topsides of Juliet-D and Kilo have been piece small removed.

Pipelines
The pipelines had a history of stable burial demonstrated by survey records. Using a comparative assessment of the technical, safety, environmental and societal impacts, it was recommended that pipelines would be decommissioned by:

- In-situ decommissioning, with appropriate remedial work at pipe ends and crossings by re-trenching, burying or cutting out offending sections where practical.

Hose Bundles (umbilicals)
Using the same comparative methodology, hose bundles were be decommissioned by:

- Pull and reel for disposal on-shore; or
- Cut and remove to shore for disposal.

These recommendations were established during an open, transparent and inclusive engagement process with interested stakeholders and have been subject to further public consultation in accordance with the DTI 'Guidance Notes for Decommissioning of Offshore Installations and Pipelines under the Petroleum Act 1998' (DTI Guidance Notes). No objections to the proposals were made during formal consultation.
The environmental impacts of the recommended decommissioning program have been considered and assessed as acceptable.

4. Organisation

A full multi-discipline project team had been assembled within the operator's (Shell's) project execution organization for the implementation of the Decommissioning Programme. The team's responsibility was to execute the decommissioning of the wells, platforms, pipelines and hose bundles within Shell's "Project Engineering A12 Process Management System" guidelines.
The project organization was set-up to maximize the Shell's in-house resources and existing contracts for the preparatory work and subsea decommissioning, and to award (lump sum) contracts to pre-qualified prime contractors for the main decommissioning activities such as platform removal and disposal.

The main contractors and subcontractors involved in Inde Decommissioning Project were:

- **ODE UK.** Conceptual engineering studies.
- **AJS UK.** Engineering for topsides cleaning & making safe and engineering for removal.
- **AJS UK.** Offshore topsides cleaning and making safe.
- **Workfox NL.** Providing accommodation vessels Seafox 1 & 4.
- **HAK NL.** Pipeline cleaning.
- **BW Carmen Norway.** Providing FPSO for collecting and transportation of pipeline cleaning liquids.
- **AF Decom Norway.** Engineering and offshore lift preparations and piece small removal.
- **Seaway Heavy Lifting NL.** Detailed engineering and offshore removal.
- **SubSea7 UK.** Sub-sea work on pipelines like cutting risers, spool removal, remediation of pipeline ends and exposure sections.
- **SubSea7 UK.** Offshore removal of hose bundles.
- **Veolia UK.** Onshore load-in, dismantling and disposal..
- **NFFO UK.** Seabed debris clearance.

5. HSEQ

5.1. HSE Planning

There was very little precedent to apply to Inde decommissioning. Many existing Shell and industry HSE processes and procedures fail to include much detail covering the decommissioning phase of an installation's lifecycle. An example is that the Shell Discipline Controls and Assurance Framework (DCAF) was introduced while decommissioning Inde but the content for the decommissioning phase was absent and, had we applied DCAF) (there was no need as we were close to end the project), then we would have had the extract suitable topics from the previous DCAF phases.

Given the dynamic nature of decommissioning, i.e. a rapidly changing design and status of the installation during reverse engineering and piece small demolition, conventional management processes and procedures, e.g. management of change and safety case maintenance activities, were harder to apply since most had been designed for much smaller and slower incremental change that allowed decision-making over a longer period of time. For example, material changes to the safety case required a 3-month submission period to the HSE for their acceptance before change could take place. If this had been applied to Inde decommissioning then the project duration would have extended considerably. However, a more practical solution was applied, and agreed with the HSE, to allow changes to be managed by internal revisions to the safety case. This was not outside any legal remit but simply a reasonable interpretation of UK legislation.
It was decided at an early stage to fully engage the HSE and Shell Verifier to maintain an open dialogue to avoid adverse surprises and given lack of experience in decommissioning to develop strategies that ensured we had a common understanding of hazard management activities, in particular, those relating to major accident hazards, safety critical elements and associated performance standards. This worked extremely well and facilitated a smooth transition through the decommissioning phases.

The lack of planning precedent meant that we had to pay close attention to detail so that each stage of each activity was closely scrutinized to make certain we applied our hazard management processes adequately, such as HAZID, to each operation, often repeating them when changes were subsequently made. Again close engagement with all the key players, e.g. authorities, main contractors and their subcontractors and Shell technical disciplines, etc. minimized the risk of controversy, error or failure.

5.2. Hazard Evaluation and Management Process (HEMP)

Current standards within the project engineering did not generally extend to cover decommissioning in any comprehensive detail. For example DCAF did not make direct provision for decommissioning. Consequently, this left some flexibility in the approach taken. The primary tools used were HAZID and this technique was used extensively through the decommissioning. QRA was not used given that the data is extremely limited and where available may not reflect specific methodologies.

Standards

There were few offshore standards for decommissioning but there were onshore standards for demolition. Consequently these were used to extract relevant checklists for HAZIDS and specifications for demolition equipment such as excavators.

5.2.1. Safety Cases

The strategy for safety case management worked well and was accepted by the HSE. The operational safety case for each of the Inde installations was first revised to cover decommissioning under regulation 14(1). The safety case was then revised to cover dismantlement under regulation 11. This required a 3 month review period by the HSE. Very few queries were flagged by the HSE. The strategy was to make both the decommissioning and dismantlement revisions fairly high level to provide maximum flexibility in work execution.

5.2.2. Inductions

The project committed to a number of inductions to explain project work scope, key safety objectives, life saving and golden rules and to allow feedback of any concerns etc. This worked well and enabled open relationships to be formed so personnel felt they could contribute to safety performance.

5.2.3. Organization

Given the inexperience of some of the offshore construction contractors and the relative novelty of offshore decommissioning and rig less abandonment, the offshore organization might be considered to be ‘top’ heavy with management/supervisory ratios to workforce fairly high. However, this worked well and enabled a more intensive and extensive management of multiple worksites.

5.2.4. Incidents

A comprehensive strategy of leading and lagging key performance indicators was established at the beginning of the project. The leading indicators to prevent incidents, e.g. management visits, audits and inspections, etc. and lagging indicators to identify what was going wrong and to allow remedial measures to be introduced to prevent recurrence. An invaluable part of this was the use of STOP type reporting that often crossed the divide between leading and lagging KPI’s, but provided valuable informal information about safety performance.

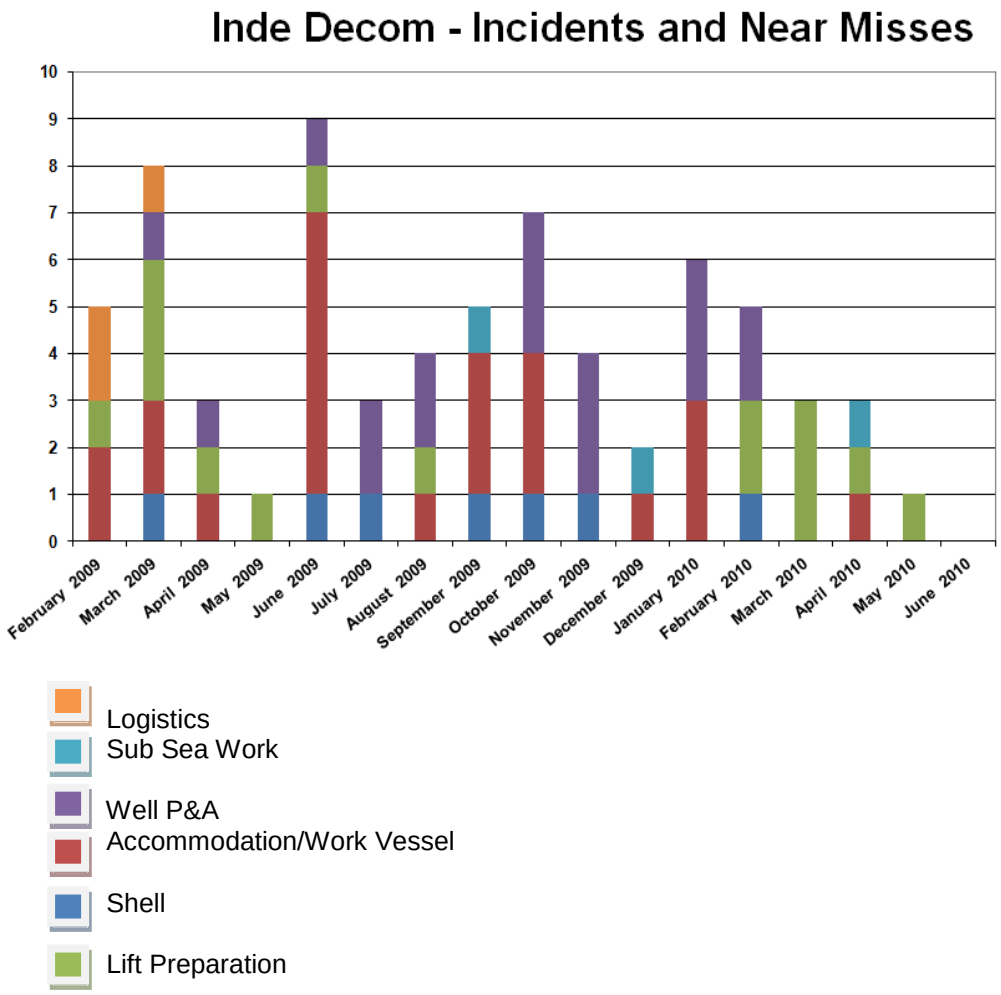
A spreadsheet database was developed that provided analysis and focus on the top potential incident characteristics that enabled preventative measures to be introduced before more serious outcomes ensued, e.g. safety barriers.

5.3. HSE Execution

The project team, its main contractors and subcontractors maintained good cooperation and communication. It was sometimes difficult to get some contractors to accept Shell’s HSE goals mainly due to [HSE] cultural differences. Also the HSE Performance information submitted to Shell by contractors as part of their HSE qualifications process were sometimes different to reality. However, the project took a stand to pursue Shell’s HSE expectations relentlessly and the Project Manager and his team supported this approach without exception.

5.4. HSE Statistics (Performance)

Incidents and near misses over time are as per below diagram. The total number of exposure hours is 1.090.000.



The total number of incidents plus near misses was 70. Broken down as follows: 53 near misses, 11 fist aid cases and 6 incidents.
There were no Lost Time Injuries (LTI's).

6. Facility Decommissioning and Pipeline Cleaning

6.1. History and Condition of Facilities

History

The Juliet, Kilo and Lima platforms in the Inde field were installed over a period from 1970 to 1977. They were originally manned platforms that were converted in the 1980's to "normally unmanned installations" (NUI's) with limited accommodation facilities. Glycol dehydration facilities and condensate tank on the Juliet and Kilo platforms were decommissioned but were not removed. The last time the platform wells were visited by drilling rigs were in 1992, 1988 and 1992 for Juliet, Kilo and Lima respectively.
Mike and November were designed as NUI's and installed in 1985 and 1987 respectively. The platform wells were drilled by jack-up rigs in 1985/86 and 1987/88 respectively.

Condition

In general, the primary structures, wells and process facilities of all the indefatigable platforms were considered to be in good condition for their age. The condition was monitored and maintained to allow safe operation and decommissioning. However, some redundant parts of the platforms, including all walkways at the top of the jackets, had not been maintained and were cordoned off. These areas could not be relied upon for safe access.

6.2. Execution Strategy

The strategy for this project was to maximize Shell's in-house resources and existing contracts for the preparatory work and to award a lump sum contract to pre-qualified prime contractors for the main decommissioning activities such as platform removal and disposal. The preparatory work includes well decommissioning, topside and pipeline flushing and cleaning, equipment isolation and making safe for handover to decommissioning contractors.
Early in the project it was decided to change the execution strategy and not to utilize fully all in-house contracts as it appeared that utilizing company's drilling rigs and accommodation vessel on an opportunity basis, i.e. use the facility when a gap in the sequence occured, made it impossible to run Inde as a time managed project. Time management was mandatory as the pre-lifting activities had to be ready in time to suit the requirements of the lump-sum facilities removal contract.
The strategy was also to utilize the available beds on the drilling rigs and accommodation vessels to the maximum extent.

The offshore make safe activities were, prior to the availability of accommodation vessels, executed by a small dedicated team in a so-called shuttling mode.
The INDE project team contracted the Seafox1 accommodation vessel. However the well P&A campaign and the facility's work started on November with the Seafox 4, because the Seafox 1 was not available at that time.

6.3. Engineering

6.3.1. Conceptual Engineering

The concept engineering was managed from the front end engineering group in Aberdeen. The concept engineering was executed by engineering contractor ODE. The main delivery of ODE was the draft Decommissioning Programme.
The project was handed over to the project group of OneGas. The Decommissioning Programme was updated by the Inde project team at various stages, 2 consultation meetings had been held (in 2005 and 2006) and was finally submitted to DECC in June 2007.

6.3.2. Topsides Cleaning, Making Safe and Initial Lift Preparation

The engineering for topsides cleaning, removal of flowlines, making safe and lift preparation was executed by AJS, Shell's integrated service contractor. The making safe engineering was related to activities to minimize the hydrocarbon risks on the platforms, to maintain and modify power provisions, platform cranes, helicopter support systems, etc.
The engineering for lift preparation concerned all engineering required for the definition of the EPCM tender. The basis for the engineering was removal as per the reversed installation method.

6.3.3. Pipeline Cleaning

Engineering and offshore execution of pipeline cleaning was performed by HAK. The BWO Carmen FPSO was contracted to collect the contaminated liquids removed from the 20" and 24" export pipelines as part of the last pipeline cleaning operation.

6.3.4. Pipeline Remediation and Umbilical Removal

Engineering for pipeline remediation and umbilical removal was executed by Shell's integrated sub-sea service contractor, Subsea Seven.

6.3.5. Final Lift Preparation

Final lift preparation engineering was executed by the lift preparation contractor AFDO. The design of the lift pad-eyes and trunnions, prepared by AJS, was finalized by the heavy lift contractor Seaway Heavy Lifting.

6.3.6. Dismantling

Load-in and dismantling engineering was executed by the dismantling and disposal contractor Veolia. Major engineering activities were the load-in engineering, including managing the interfaces with Seaway Heavy Lifting. Dismantling engineering concerned all engineering required to safely dismantle the topsides and jackets. In this respect, jacket toppling calculations have been prepared.

6.4. Clean and Make Safe

6.4.1. General

The majority of the clean and make safe work was executed by AJS from Q1 2006 through Q2 2007 prior to the pre-lifting activities. This work on Mike and Lima was predominantly executed concurrent with the well P&A work. On the other platforms the work was executed during a so-called heli-shuttling campaign.

6.4.2. Mike

The clean and make safe activities had been executed during the first well P&A campaign. The well P&A campaign was executed in 2 phases, as the gap in the drilling sequence was too short to plug and abandon all 4 wells. For the first phase the drilling rig, Britannia was utilized and for the second phase the drilling rig Noble George.

During the first campaign (spring 2006) the following make safe activities had been executed:

- Remove flow lines.
- Repair crane boom.
- Overhaul crane.
- Replace engine of diesel generator set.
- Perform overdue maintenance.
- Perform Non Destructive Testing on critical joints.

The Uninterrupted Power System was replaced later during a shuttling campaign.

6.4.3. Lima

The flow lines had been removed in a so-called shuttling campaign, prior to the well P&A activities. The following activities had been executed during the P&A campaign (March 2007 through July 2007) with the Monarch drilling rig:

1. Perform overdue maintenance; mainly related to helicopter landing systems and live saving systems.
2. Perform Non Destructive Testing on critical joints.
3. Install 2 lifting trunnions.
4. Install launcher and execute cleaning of the 16" pipeline from Lima to Juliet.

The diesel generator set was replaced later during a shuttling campaign.

6.4.4. November

The following activities had been executed during a shuttling campaign:

5. Remove flow lines.
6. Perform overdue maintenance; mainly related to helicopter landing systems and live saving systems.
7. Install a new Uninterrupted Power System.

6.4.5. Kilo

Major structural modifications were executed to restore the structural integrity of walkways, platforms and stairs during a shuttling mode concurrently with a similar campaign on Juliet assisted by the accommodation vessel Seafox 4 in Q2 2005.

The following activities had been executed later during a shuttling campaign:

8. Remove flow lines.
9. Perform overdue maintenance; mainly related to helicopter landing systems and live saving systems.
10. Fabric maintenance of secondary steel.

6.4.6. Juliet

Major structural modifications were executed during a Seafox 4 campaign in Q2 2005 to restore the structural integrity: securing potential dropped objects and repairing walkways, platforms and stairs.

The following activities had been executed in a so-called shuttling campaign:

11. Remove flow lines.
12. Perform overdue maintenance; mainly related to helicopter landing systems and live saving systems.
13. Further fabric maintenance on secondary steel.
14. Install new diesel generator set.

6.5. Facility Pre-Lifting Activities

6.5.1. General

The pre-lifting concerned all activities to prepare the facilities for lifting, such as:

- Flush clean or ensure adequate containment of any hazardous fluids of materials.
- Disconnect caissons, risers and J-tubes from topsides.
- Perform Non Destructive Testing on critical structural members and joints.
- Make access to and install lifting pad-eyes.
- Install structural reinforcements (predominantly on Lima).
- Install scaffolding starters on transition pieces of Kilo, Mike and Lima (the preparation work for this activity was too late for November and Juliet).
- Install temporary pig launchers and receivers for the pipeline cleaning campaign.
- Remove sections of risers and umbilicals connected to the transition legs between the jackets and the topsides.

- Remove all loose items and items, which could not be properly sea-fastened; removal did include batteries, fire extinguishers, hazardous liquids (which could not be properly contained in the topsides).
- Lower caissons into the jacket and secure for lifting.
- Perform cutline work to the maximum extent possible. So perform basically all cuts in the structure, which did not affect the structural integrity.
- Perform piece small topsides removal of Inde Juliet and Kilo (for details see section 7.6).

The pre-lifting activities have been executed by AFDecommissiong Offshore with AKD as subcontractor for installing lifting pad-eyes and structural reinforcements.

6.5.2. November

The status of the platform changed as a result of the pre-lifting work from a platform fully certified to receive helicopters to a platform without power and no longer suited to receive helicopters. The main elements, which contributed to this approach was the wish to decommission the power provision, crane and heli-deck during the pre-lifting phase in order to save on lifting days. The authorities accepted our proposal to leave the platform, surrounded by cardinal buoys, in this partly decommissioned condition till the final removal date.
The pre-lifting activities have been executed concurrently during the Seafox 4 well P&A campaign from 20 February till 26 April 2009. The pipeline and umbilical to Juliet have been cleaned early in this campaign. Loose items, batteries and liquids, which could not be contained properly, have been removed during this phase.
The activities as listed in 6.5.1 have been executed.

6.5.3. Mike

The status of the platform changed as a result of the pre-lifting work from a platform fully certified to receive helicopters to a platform without power and no longer suited to be visited. The main elements, which contributed to this approach was the wish to decommission the power provision, crane and heli-deck during the pre-lifting phase in order to save on lifting days. The authorities accepted our proposal to leave the platform, surrounded by cardinal buoys, in this partly decommissioned condition till the final removal date.
The pre-lifting activities have been executed during a Seafox 1 campaign from 21 May till 10 June 2009. The pipeline and umbilical to Kilo have been cleaned early in this campaign.
The activities as listed in 6.5.1 have been executed.

6.5.4. Kilo

The pre-lifting activities have been executed concurrently during the Seafox 1 well P&A campaign from 28 June till 16 September 2009. The activities as listed in 6.5.1 have been executed.
The status of the platform changed as a result of the pre-lifting work from a platform fully certified to receive helicopters to a platform without power and no longer suited to be visited. The main elements, which contributed to this approach was the wish to decommission the power provision and heli-deck during the pre-lifting phase in order to stop maintenance activities and to shorten the piece small campaign. The authorities accepted our proposal to leave the platform, surrounded by cardinal buoys, in this partly decommissioned condition till the next (piece small) phase.

6.5.5. Juliet

The pre-lifting activities have been executed concurrently during the Seafox 1 well P&A campaign from 1 March 2010 till 14 May 2010. The activities as listed in 6.5.1 have been executed.
Unfinished pre-lifting work was executed during the piece small period. The main item to be finalized was the 38m high vent stack. The selected method was to remove the 18m high top section, which was outside the reach of the platform crane, by abseilers (angle iron by angle iron) and the lower section in a few big sections by the platform crane. Removing the top section by hand (steel member by steel member) by removing the bolts and nuts proved to be very inefficient. The removal of the total vent stack was estimated at 1044 man-hours and 19 days. The actual was 2526 man-hours (excl. WOW) and 58 days (incl. waiting on weather).

6.5.6. Lima

Visits to Lima were stopped in 2009. The power was switched off and similar to the Mike and November platforms, cardinal buoys were placed to mark the 500m zone.
The Seafox 1 accommodation vessel was used in support of the pre-lifting campaign from 10 July till 31 July 2010.
Some of the activities as per section 6.5.1 had already been started during the P&A campaign.

The following work was executed /finalized during the pre-lifting campaign:

- Finish Non Destructive Testing on critical structural members and joints.
- Make access to and install remaining 2 lifting trunnions.
- Install structural reinforcements in main deck.
- Install scaffolding starters.
- Remove sections of risers and umbilicals connected to the transition legs between the jackets and the topsides.
- Remove all loose items and items, which could not be properly sea-fastened; removal did include batteries, fire extinguishers, hazardous liquids (which could not be properly contained in the topsides).
- Lower caissons into the jacket and secure for lifting.
- Perform cutline work to the maximum extent possible. So perform basically all cuts in the structure, which did not affect the structural integrity.

6.6. Facility Piece Small Removal

6.6.1. General

The piece small activities have, similar to the pre-lifting activities been executed, by AF Decom Offshore with AKD as subcontractor for rigging, welding/flame cutting and support activities like scaffolding.
Juliet and Kilo had been selected for piece small because of the great number of small modules to be lifted by an (expensive) heavy lift vessel. Both platforms were perfectly suited for piece small execution, as their main decks had been designed to locate and carry a tender drilling rig. However the wood covered main deck has been specially prepared to carry the load of the excavator over the full main deck area and to create a deck surface suited for flame cutting and piece small processing activities. The main deck was covered by so-called drive elements; a steel sandwich construction composed of 300 mm high steel beams, welded together. The drive elements varied in size from 200x1500x300 mm and 11300x1500x300 mm. The modules/structures have been cut into pieces of some 10 tons and lifted on the main deck for further processing. The steel was cut by an excavator equipped with hydraulic scissors. The scrap was loaded in specially fabricated containers, which were loaded to a maximum weight of 20 tons. Full containers were stored on the accommodation vessel Seafox 1. The full containers were picked up by a supply boat during night and shipped to Enviroco, AFDO's scrap/waste processing subcontractor in Great Yarmouth.

The piece small processing proved to be a safe and efficient method for offshore dismantling. The man-hours/ton for all the pre-lifting activities on Mike, November and Lima appeared to

be very similar to the man-hours/ton for piece small removal of the modules on top of the modular support frames.

6.6.2. Juliet-D and Juliet-P

The piece small activities have been executed during a Seafox 1 campaign from 30 September 2009 till 1 March 2010. The 12 modules on top of the modular support frames on the 6-legs jacket and the 4-legs jacket of Juliet D, and the 4 modules on top of the modular support frame of Juliet P have been piece small removed.

The piece small campaign did run more or less as per plan without incidents and significant technical issues. However the contractual target man-hours have been overrun. The planned man-hours at the start of the campaign, which were already more than the target hours, have been exceeded by 50%.

	Man-hours
Planned man hours at start campaign	18510
Actual man hours excluding variations	27863
Approved variations	1954

Piece Small in progress on Juliet D

6.6.3. Kilo

The piece small activities have been executed during a Seafox 1 campaign from 21 May 2010 till 3 July 2010. The 11 modules on top of the modular support frames on the 6-legs jacket and the 4-legs jacket have been piece small removed.

The piece small campaign did run more or less as per plan without incidents and significant technical issues. However the contractual target man-hours have been overrun. The planned man-hours at the start of the campaign, which were already more than the target hours, have been exceeded by12%.

	Man-hours
Planned man hours at start campaign	16210

Actual man hours excluding variations	18135
Approved variations	1411

6.7. Facility Removal

6.7.1. General

The facility removal has been executed by Seaway Heavy Lifting (SHL) with their heavy lift vessel Stanislav Yudin. The offshore lifting campaign started 15 March 2011. The Stanislav Yudin left on 11 April 2011 to execute a job for another client and returned to Inde on 3 May 2011. The lifting of all facilities was completed on 11 July 2011.

The following main activities have been executed by the crew of the HLV for each of the platforms:

- Remove all objects, which are considered as a hazard (falling object).
- Install scaffolding around the legs of the topsides at the cutline positions.
- Weld guide plates at the cutline positions of the legs of the topsides.
- Remove conductors of November, Juliet D and Kilo (the conductors on Mike and Lima had been removed by the drilling rig).
- Install rigging, lift topsides and fix topsides (by welding) on grillages beams on barge.
- Remove transition pieces and check by lowering a chaser into the jacket piles whether there were any obstacles in the pile. Where required remove the obstacles by lifting and dropping the chaser on top of the obstacle.
- Remove the soil in the legs till a level of 5 m below the seabed by means of an airlift tool.
- Cut the holes for the shackle pins at the upper end of the jacket legs by means of abrasive high pressure water cutting.
- Install rigging, lift jacket, cut all pile stubs at the same level and fix topsides (by welding) on grillages beams on barge.
- Sail barge to Newcastle and handover barge to dismantling contractor.

6.7.2. November

The Stanislav Yudin arrived on the November location on 15 March 2011 and finished work on 29 March 2011. The activities, as listed under section 6.7.1, have been executed without facing any particular problem. An observation was that the jacket was in a remarkable good condition. This is also applicable for the steel mud mats. This in itself caused a minor problem, as mud mats carried a substantial load of rock dump material, which is a dropped object hazard. So part of the rock dump materials were removed to create a safe working place on the barge.

6.7.3. Juliet-P

The Stanislav Yudin started on Juliet-P after a 4 days waiting on weather period on 2 April 2012.
The activities, as listed under section 6.7.1, have been executed without facing any particular problem. The work was finished on 10 April 2011. The intension was to start working on Juliet-D, but the weather was not favorable and the HLV left the Inde field to execute a lifting job for another client.

6.7.4. Juliet-D

The Stanislav Yudin returned to the Inde field and started working on the Juliet D removal on 3 May 2011. The activities, as listed under section 6.7.1, have been executed. A problem occurred by accessing the piles with a chaser. Obstructions were found in 6 of the 10 piles. Access was obtained by a chasing process, which is rather similar to a piling job. A relatively small and heavy chaser was dropped on the obstruction till it gave way. Then the diameter of the chaser was slightly increased. This process was repeated till the diameter was adequate to safely pass the internal cutting tool. The delay caused by chasing was 17 hours. The remaining work went as per plan and the structure left the Inde site on 2 June 2011.

6.7.5. Mike

The Stanislav Yudin started on the removal of the Mike platform Mike on 3 June 2011. The activities, as listed under section 6.7.1, have been executed without facing any particular problem. The work was finished on 16 June 2011.

6.7.6. Lima

The Stanislav Yudin started on Lima on 17 June 2011 and finished work on 25 June 2011. The platform crane was removed in addition to the activities, as listed under section 6.7.1. About the complete spider deck was removed, as an unplanned activity, because it had become a potential dropped object.

6.7.7. Kilo

The Stanislav Yudin started on Kilo on 26 June 2011 and finished the work on 11 July 2011. The planned scope of work did consist of the activities as per section 6.7.1 plus the external cutting of 4 piles. During installation 4 piles had been filled with grouting, which made it impossible to cut the legs internally. However it was also investigated whether the grout could be removed by means of a drilling tool. This option was not pursued as it required some more maturation. Prior to cutting the legs excavation work as per section 7.4.2 was executed. The 4 piles have been cut by a ROV-operated diamond wire cutting device.
One of the conductors caused a problem since it did not move. The conclusion was that it had probably not been cut completely (3 m below seabed), during the rigless well P&A campaign.

The conductor was cut one meter above seabed by a ROV-operated external cutting device (diamond wire). This work was done under a variation. This became an expense variation, as the work took 90 vessel hours due to a substantial period of waiting on weather. The conductor stub has been removed one year later during a subsea operation. The conductor appeared to have been cut by some 98%, which was just not adequate, in combination with the high friction over the guides, to have it safely pulled out by the crane of the HLV. 2 Jacket piles on Kilo had obstructions, which required 14 hours additional vessel time to remove them. The remaining work went well and the last structure left the Inde field on 11 July 2011.

6.8. Facility Dismantling

6.8.1. General

The load-in, dismantling and disposal activities have been executed by Veolia. Veolia has for the purpose of the Inde project established a dismantling yard on the former Swan Hunter yard in Newcastle. Veolia has for the load-in contracted PSBS for the overall load-in and ALE for the load-in calculations of the SPMT's (Self Propelled Modular Transporters) and supply of the SPMT's. PSBS had the overall responsibility for the load-in including barge management.

6.8.2. Load-in

The structures had been offloaded after the bumpers and guides, sea-fastening and loose Inde components had been removed and the weather conditions and tide on the river Tyne were favourable. The structures were transported by means of the SPMT's to the area where the structure would be dismantled. The structures were offloaded on concrete blocks. The contractually established barge turn-around period was maximum 7 days. The following periods have been achieved:

Barge	Structure	Barge Receipt Date	Barge Return Date
1	November Topsides & Jacket	30-3-2011	08-4-2011
2	Juliet P Topsides & Jacket	11-4-2011	18-4-2011
3	Juliet D Topsides (Modular Support Frames)	11-5-2011	18-5-2011
4	Juliet D Jackets	22-5-2011	30-5-2011
5	Mike Topsides & Jackets	04-6-2011	11-6-2011
6	Lima Topsides & Jackets	17-6-2011	24-6-2011
7	Kilo Topsides (Modular Support Frames)	26-6-2011	02-7-2011
8	Kilo Jackets	12-7-2011	17-7-2011

6.8.3. Dismantling and Disposal

Dismantling started by removing all the hazardous waste from the topsides. The topside structures were dismantled by cutting the structures into pieces. Preferably by means of an excavator with a hydraulic shear. All steel exceeding the capacity of the hydraulic shear were manually cut by flame cutting.

The marine growth on the jacket, which was about 65% less than predicted, was removed by means of high pressure cleaning. The jacket structure has been weakened by taken out bracings followed by toppling of the jacket structure on a sand bed. Jacket was weakened by pre-cuts and pulled by the onside excavators, Smaller diameter parts have been cut into pieces by means of an excavator and the bigger parts have been cut by flame cutting.

The environmental conditions on the dismantling yard have been monitored during the dismantling process. No complaints were received from the neighbors.

The following dismantling fractions have been retrieved (including piece small) from the Inde structures:

	Description	Weight tons	Comments
A	Structural material including cables	11,348.35	Includes all grades of metal
B	Sale / reuse of materials	111.72	Engines, etc.
C	Hazardous materials recovered	221.61	Includes waste recycled like oils and CCA wood
D	Hazardous Materials Disposed	172.80	Some hazardous materials such as asbestos and oil contaminated sand could only be land filled or incinerated.
E	Non-Hazardous Materials Recycled	408.68	Cement (concrete) and wood were largest fractions
F	Non-Hazardous Materials to Landfill	77.65	Residues which could not be cost effectively recycled.70.29 Tons out of a total of 277.8 tons marine growth went to landfill
K	**Sum**	**12,340.81**	Predicted 12548 tons as presented in the Decommissioning Program
	Reuse / Recycling Rate (A+B+C+E)/ K	**97.97%**	
	Sent to landfill or destruction (D+F) / K	**2.03%**	

Total non-metal waste recycled or disposed is 880.74 tons. The project forecast waste tonnage was 1592.93 tons. Substantial deviations in marine growth (planned/actual 800/277.8 tons) and cement in the conductors (planned/actual 321.7/100 tons). The re-use/recycling objectives established at the start of the Decommissioning Programme were met.

6.9. Pipeline Cleaning

6.9.1. Summary

Engineering and offshore execution of pipeline cleaning was performed by HAK. The pipeline cleaning program was initiated during 2007 with the pigging and cleaning of the 16” Lima to Juliet pipeline. This was carried out successfully. Nitrogen was the driving medium for the solids removing run with a foam pig and a bidi gauging pig for the second run. As both pigs encountered a high friction in the Juliet riser, seawater was used as the driving medium for the last (multiple pig) cleaning run. More driving force could be achieved with water and as it was the last run, the seawater driving the pigs would not contribute to a larger volume of contaminated water. The contents of this pipeline and the liquids contained between the various pigs of the cleaning run were flushed though into the 20” Juliet to Perenco 23A pipeline.

The 10” November to Kilo pipeline was cleaned during April 2009, seawater was used as the medium to drive the cleaning batches. In parallel to the pipeline cleaning, the umbilical cores were flushed using a mix of Surfatron and water. The 12” Mike to Juliet pipeline was cleaned during May 2009. Nitrogen was used as the medium to drive the cleaning batches. In parallel to pipeline cleaning, the umbilical cores were flushed using a mix of Surfatron and water.

The final cleaning program involved the flushing and driving of pigging cleaning batches though the 24” Kilo to Perenco 23A and from Perenco 23A platform though the 20” pipeline to Juliet. Preparations for this work included the separation of the live process pipe work from the 20” and 24” Inde risers on the Perenco 23A and the installation of an 8” bypass between the 2 risers. Seawater was used as the driving medium for the cleaning batch runs. Liquids were received at the Offloading Tanker via a manifold system and flexible transfer hose at Juliet. Submersible pumps located at Kilo provided flow to drive the pigging cleaning batches from Kilo to Perenco 23A and Perenco 23A to Juliet. Re-injection of some of the

contaminated liquids from the Offloading Tanker into an abandoned well on Juliet was carried out successfully during nightshift, consistent with regulatory permit. After the completion of the pipeline cleaning activities, the Offloading Tanker transited to Teesport in the UK for discharge of liquids for processing and disposal onshore.
Oil in water analysis of final liquids samples taken and analyzed for all five pipelines were found to be within the DECC regulatory limit of 30 mg/l.
Further description of the cleaning programs for each pipelines are detailed below.

6.9.2. Execution Strategy

The DECC standards for the decommissioning of pipelines to be left in-situ require that hydrocarbon freeing be carried out to a cleanliness standard of <30mg/l in the final cleaning water batch. Therefore programs for the cleaning of all pipelines were developed on the basis of inputs from various potential pipeline cleaning contractors. The final program was developed together with the selected pipeline cleaning contractor A-Hak BV. Basically 3 pig runs per pipeline were planned: the 1st run with a cleaning foam pig run to remove the majority of the solids from the pipeline. The 2nd gauge pig run established that there were no obstructions in the pipeline. The 3rd cleaning batch run, consisting of several pigs, creating batches between the pigs containing a cleaning agent.
Part of the strategy was also not to treat the polluted liquids at the unmanned receiving platforms to a level required for discharging the water to sea, but to store the polluted water in the next downstream Inde pipeline. So during the cleaning of the 16" Lima to Juliet and 12" Mike to Juliet pipelines, the inventory was flushed into the 20" Juliet to Perenco 23A pipeline. During the cleaning of the 10" November to Kilo pipeline the inventory was flushed into the 24" Kilo to Perenco 23A pipeline.
All production liquids and cleaning liquids collected in the 20" Juliet export line and the 24" Kilo export pipeline would be removed as part of the combined cleaning campaign as described in section 7.9.1.

6.9.3. General

The pipelines scope includes the cleaning for decommissioning of five intra-field pipelines and two umbilicals. The pipeline risers were cut and removed, and pipeline ends buried. The umbilicals were removed. All platforms were removed and debris clearance carried out within 500 m zones of removed facilities and 100m at either side of pipeline routes.
The DECC standards for the decommissioning of pipelines to be left in-situ require that hydrocarbon freeing be carried out to a cleanliness standard of <30 mg/l in the final cleaning water batch. Therefore programs for the cleaning of all pipelines were developed in order to achieve this standard.

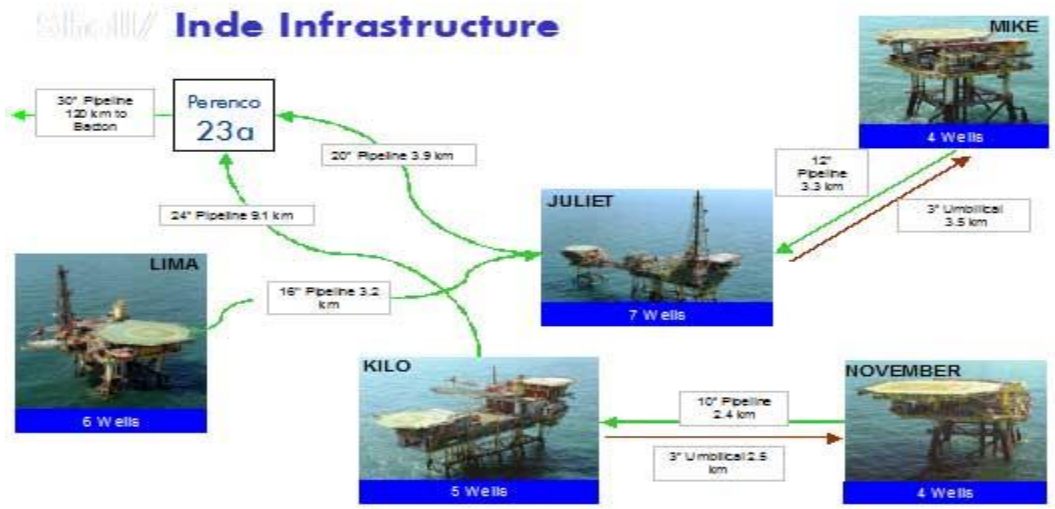


Fig1: Pipeline and Umbilical Infrastructure

6.9.4. 16" Lima to Juliet Pipeline (PL 82)

The cleaning of the 16" Lima to Juliet pipeline was carried out during April 2007. Nitrogen was used as the driving medium for the 1st cleaning foam pig run and 2nd gauge pig run. Seawater was used as the driving medium for the 3rd cleaning batch run. The pipeline cleaning and nitrogen spread was mobilized to the Inde Lima platform via the Santa Fe Monarch drilling rig. Pipeline cleaning was commenced on the 14th April with the receipt of the 1st foam cleaning pig. The total volume of nitrogen used was 1150 m^3. Approximately 400 liters of production liquids with sand and other debris was received at the Juliet Platform.

The 2nd Bi-Di gauge pig was launched and driven with nitrogen, this pig became lodged at the top of the Juliet riser. The driving medium of seawater was used to free the pig, this was successful.

The 3rd, 4th, 5th, 6th and 7th Bi-Di cleaning batch runs were launched using seawater as the driving medium. A 2% Ryzolin and water mix of 723 m^3 was used for the cleaning batches. Approximately 362 m^3 of liquids was flushed into the 20" Juliet to Perenco 23A pipeline. Clear seawater was received at Juliet and samples were taken. The cleaning program was completed on the 17th April 2007.

Note: Ryzolin Economic was used as the cleaning agent. This is a surfactant similar in property to Surfatron, which was used for the later cleaning programs.

Results
Final liquid's samples were taken at the receiver on Juliet after the completion of pipeline cleaning. Analysis of oil in water was carried out by SGS Great Yarmouth UK and results of are shown below. See Appendix G for Sampling Laboratory Report.

Pipeline DECC Identification	Description	Sample Location	Result (mg/l)
PL82	Final Sample	Juliet	<1

Table 1 – Liquids Sample Results for 16" Lima to Juliet Pipeline

Note: Approximately 2kg of solid debris and the foam pig were sent for analysis by Tracerco. See Appendix L for laboratory test results.

6.9.5. 10" November to Kilo Pipeline (PL402)

The cleaning of the 10" November to Kilo pipeline was carried out during April of 2009. It was estimated that 80 m^3 of liquids would be present in this line, therefore it was decided that cleaning with seawater as the propulsion medium would be appropriate. The pipeline cleaning spread was mobilized to the Inde November platform via the Seafox 4.

Pipeline cleaning was commenced on the 15th of April with the 1st foam pig cleaning run, this was received on the Kilo thereby proving access through the line. Approximately 80 m^3 of liquids was flushed into the 24" Kilo to Perenco 23A pipeline. See Appendix A for Pig Tracker. The 2nd, 3rd and 4th Bi-Di and foam pig cleaning runs were sent with a 5% Surfatron and seawater mix; total 8.1 m^3 in volume. The pipeline was flooded with the initial cleaning run. Clear seawater was received at Kilo and samples were taken. The cleaning program was completed on the 17th of April.

Results
Final liquid samples were taken at the receiver on Kilo after the completion of pipeline cleaning. Analysis of oil in water was carried out by SGS Great Yarmouth UK and results of are shown below. See Appendix H for Sampling Laboratory Report.

Pipeline DECC Identification	Description	Sample Location	Result (mg/l)
PL402	Final Sample	Kilo	<1

Table 2 – Liquids Sample Results for 10" November to Kilo Pipeline

Note: An insufficient volume of solids was recovered for a sample to be taken.

6.9.6. 12" Mike to Juliet Pipeline (PL302)

Pipeline Cleaning
The cleaning of the 12" Mike to Juliet pipeline was carried out at the end of May 2009. Nitrogen was used as the driving medium for the cleaning batch runs. The pipeline cleaning and nitrogen spread was mobilized to the Inde Mike platform via the Seafox 1.
Pipeline cleaning was commenced on the 29th May with the 1st foam pig run, this was received on Juliet thereby proving access through the line. A liquids volume of approximately 102 m^3 was flushed into the 20" Juliet to Perenco 23A pipeline. See Appendix B for Pig Tracker.

Shortly after the launch of the 2nd bi-di batch run, the first pig in the train became lodged at the first bend after the launcher. The line was depressurized and the pig was successfully removed. No damage was noted, however measurements at the entrance to the bend confirmed a reduced internal diameter (ID). Therefore due to the ID restriction it was decided to use soft bodied cleaning foam pigs for the remaining batch runs.

The 2nd, 3rd and 4th cleaning runs were sent with a 5% Surfatron and water mix of 4 to 6 m^3 in volume. The batches were driven with approximately 2000 m^3 of nitrogen and were launched from Mike and received on Juliet. The pipeline was then flood with the final cleaning run. Clear seawater was received at Juliet and samples were taken. The cleaning program was completed on the 31st May.

Results
Initial liquid's samples were taken prior to pipeline cleaning and final liquid's samples were taken at the receiver on Juliet after the completion of pipeline cleaning. Analysis of oil in water was carried out by SGS Great Yarmouth UK and results of are shown below. See Appendix I for Sampling Laboratory Report.

Pipeline DECC Identification	Description	Sample Location	Result (mg/l)
PL302	Initial Sample	Juliet	1060
PL302	Final Sample	Juliet	9.4

Table 3 – Liquids Sample Results for 12" Mike to Juliet Pipeline

Note: An Insufficient volume of solids was recovered for a sample to be taken.

6.9.7. 24" Kilo to Perenco 23A and 20" Juliet to Perenco 23A Pipelines (PL81 & PL80)

Introduction

The cleaning of the 24" Kilo to Perenco 23A and 20" Juliet to Perenco 23A pipelines was carried out during September 2009.

Prior to the planned pigging and cleaning program, Perenco carried out the installation of an 8" bypass, removal of pipe work and the fitment of separation blinds from the live process pipe work on the 23A platform during their annual shutdown in August 2009. Consideration was given to cleaning the pipelines using nitrogen, however due to the large volumes required to complete the necessary cleaning runs, it was concluded that seawater would be used as the driving medium. The main issue to be addressed for the cleaning of these final pipelines was the removal and safe disposal of the large volume of pipeline contents of contaminated liquids, this was estimated to be in the region of 1700 m^3 of oily water and condensate mix.

Additionally the proven method and good results from the earlier conducted cleaning programs gave additional confidence.

The cleaning of these final two pipelines was critical in terms of the project schedule and the agreed timing with Perenco, therefore it was decided to employ two methods for the disposal of the contaminated liquids:

1. A liquids offloading vessel would be employed for the receiving of liquids directly from the cleaning runs.
2. The use of an available well on the Inde Juliet platform would be utilised for the disposal of part of the liquids in order to reduce the operational risks of multiple tanker runs.

After consideration of several vessel types, it was concluded that an A Tank Class DP 2 vessel with a storage capacity in excess of 7500 m^3 would be optimum for this activity. The BW Carmen was contracted to carry out this operation.

Analysis of permeability conditions, well restrictions and volume capacity of the J1030 Well on Juliet was conducted, this well was concluded to be suitable for the injection of contaminated liquids. However due to possible restrictions in the well and lack of historic information concerning the permeability of the reservoir, it was decided that a high pressure Frac/Pump would be required at Juliet.

Pipeline Cleaning

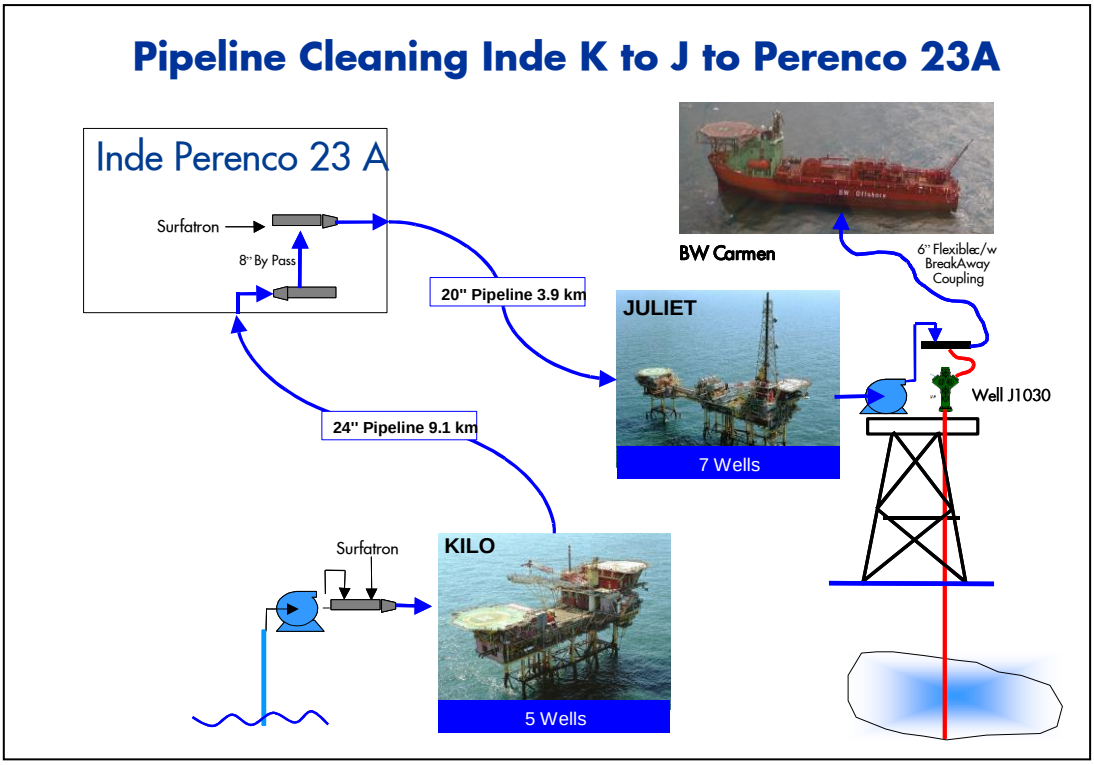
A-Hak B.V. were contracted to carry out the pipeline cleaning program. The Kilo, Perenco23A and Juliet platforms were manned with the pipeline cleaning team which consisted of 7 persons in total including 1 person to cover night operations on Juliet.

Two submersible drive pumps were located on Kilo, each with sufficient capacity to provide up to 500 m^3/hr flow at 10 Barg through the Kilo 24" and 20" Juliet pipelines.

At Perenco 23A, the existing 30" and 24" reducers were utilised as receiver and launcher for the pigs. Perenco provided operational support to the pipeline cleaning team.

On Juliet, the receiver was connected via 2 off 4" lines to the Offloading and Re-injection manifold.

See Appendix C for complete 'Pipeline Cleaning Layout' schematic.



System Description

The pipeline cleaning runs were commenced on 12 September with the launch from Kilo and receipt on 23A of the 1st hi-sealing foam pig. The 1st hi-sealing foam pig was launched from 23A and received on Juliet on 14 September. This signified the flushing of all the pipeline contents into the tanks of BW Carmen. The total volume of liquids received of the initial pipeline contents from both the 24" Kilo to 23A and 20" Juliet to Perenco 23a was 2013 m^3.

The 2nd, 3rd and 4th pipeline cleaning batches were launched simultaneously from Kilo and Perenco 23A. A 5% surfatron in water mix of 17 to 26 m^3 for each cleaning batch was used. All batches were driven with seawater. At the completion of cleaning, a total of 6215 m^3 of slightly contaminated liquids was received by the Carmen. This included the 2013 m^3 of initial contents of both pipelines. Clear seawater was received at both Perenco 23A and Juliet and samples were taken. The cleaning program was completed on 16 September. See Appendices D and E for Pig Trackers.

Liquids Offloading and Re-injection

The offshore liquids offloading vessel "BW Carmen" was contracted to handle the pipeline cleaning liquids for storage during the cleaning operations and offloading for re-injection into the Inde Juliet Well J1030 or for disposal onshore. A 400 metre in length by 6 inch nominal diameter flexible hose was used to transfer liquids to the BW Carmen tanks from the receiver via a 30 m^3 break tank.

BW Carmen at Inde Juliet

Prior to the arrival of the Carmen, the liquids handling manifold and hose over-boarding chute were installed on the main deck on the Juliet platform. The design and management of the construction of these items was carried out by Fluor B.V. The fabrication was arranged by A-Hak BV.

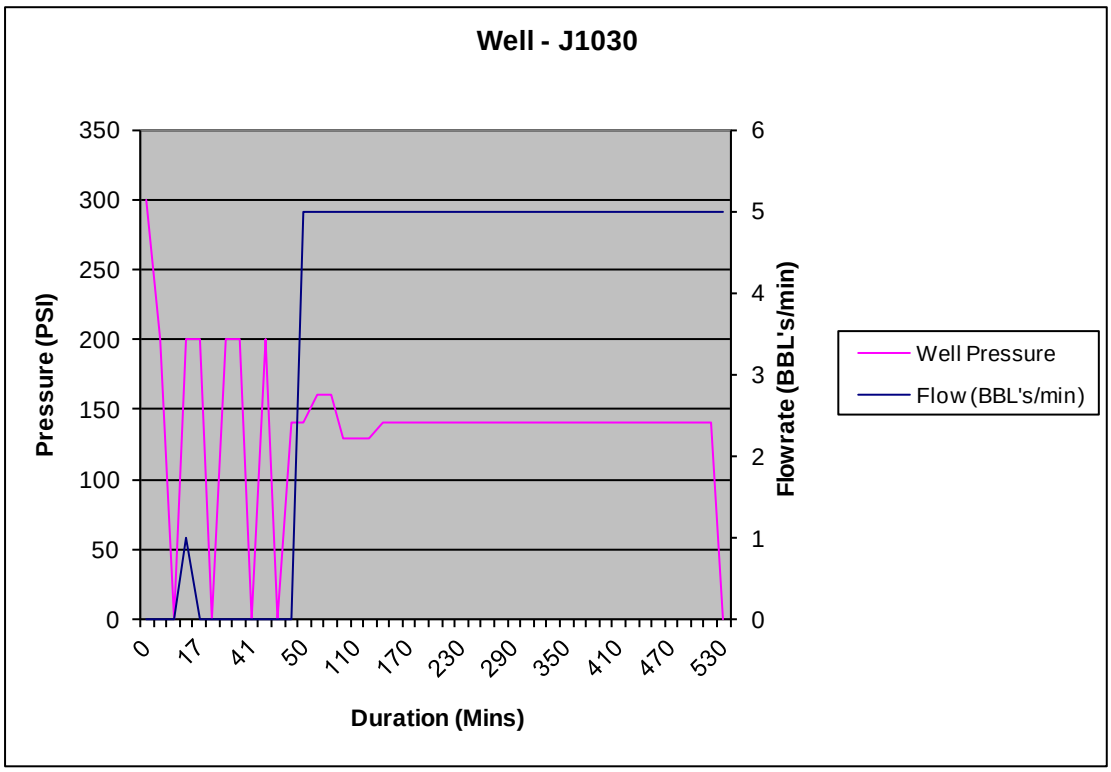
Manifold and Hose Overboarding Chute at Juliet

The BW Carmen departed from Norway at 01.00 hrs on the 9th September and arrived at the Juliet at 15.00 hrs on the 10th September.

The vessel was hooked to the south side of the Juliet platform via the liquids transfer hose complete with Break Away Coupling from 11 September until the completion of liquids transfer at 18:15 hrs on 17 September. Weather and tidal criteria were set by the Shell Marine Department and strictly adhered to for the both the hook and unhook operations.

After the vessel hook up, the BW Carmen moved off to a location approximately 300 m southerly from the Juliet platform. A hose swivel connection was employed to allow the BW Carmen to weather vane while at location.

Halliburton UK were chosen to provide a hi-pressure pump capability, to carry out the re-injection down Well J1030 on the Inde Juliet platform. Three persons were mobilised to Juliet on 11 September to carry out well injection from the BW Carmen during nightshifts. The maximum potential flow rate provided by the frac pump was limited by the Carmen's offloading capacity, the resultant total volume of liquids re-injected down the well was 412 m^3. This was carried out during one nightshift period on 16 September. See result graph below and Appendix F for Well Injection Layout.



Inde Juliet Well Injection

After initial back pressure spikes and low flow for a period of approximately one hour, a steady flow into the well of 0.8 m^3/min (5 BBL/min) was achieved for the remaining flowing period totalling nine hours. In addition to the limited pump capacity from Carmen, it was calculated that the down hole bore size of 2.7" would ultimately limit the maximum flow achievable to approximately 1.5 m^3/min.

Results

One high sealing pigging run was completed through both the 24" Kilo and 20" Juliet pipelines before. This enabled the flushing of all of the pipeline contents though the break tank on Juliet to the offloading tanker. See Appendix J and K for Sampling Laboratory Reports.

Pipeline DECC Identification	Description	Sample Location	Result (mg/l)
PL80	Initial Sample	Juliet	660
PL80	Final Sample	Juliet	20
PL81	Initial Sample	Perenco 23A	1670
PL81	Final Sample	Juliet	<1

Table 4 – Liquids Sample Results for 20" Juliet to Perenco23A and 24" Kilo to Perenco 23A Pipelines

Note: An insufficient volume of solids was recovered for a sample to be taken.

6.9.8. Umbilical Cleaning

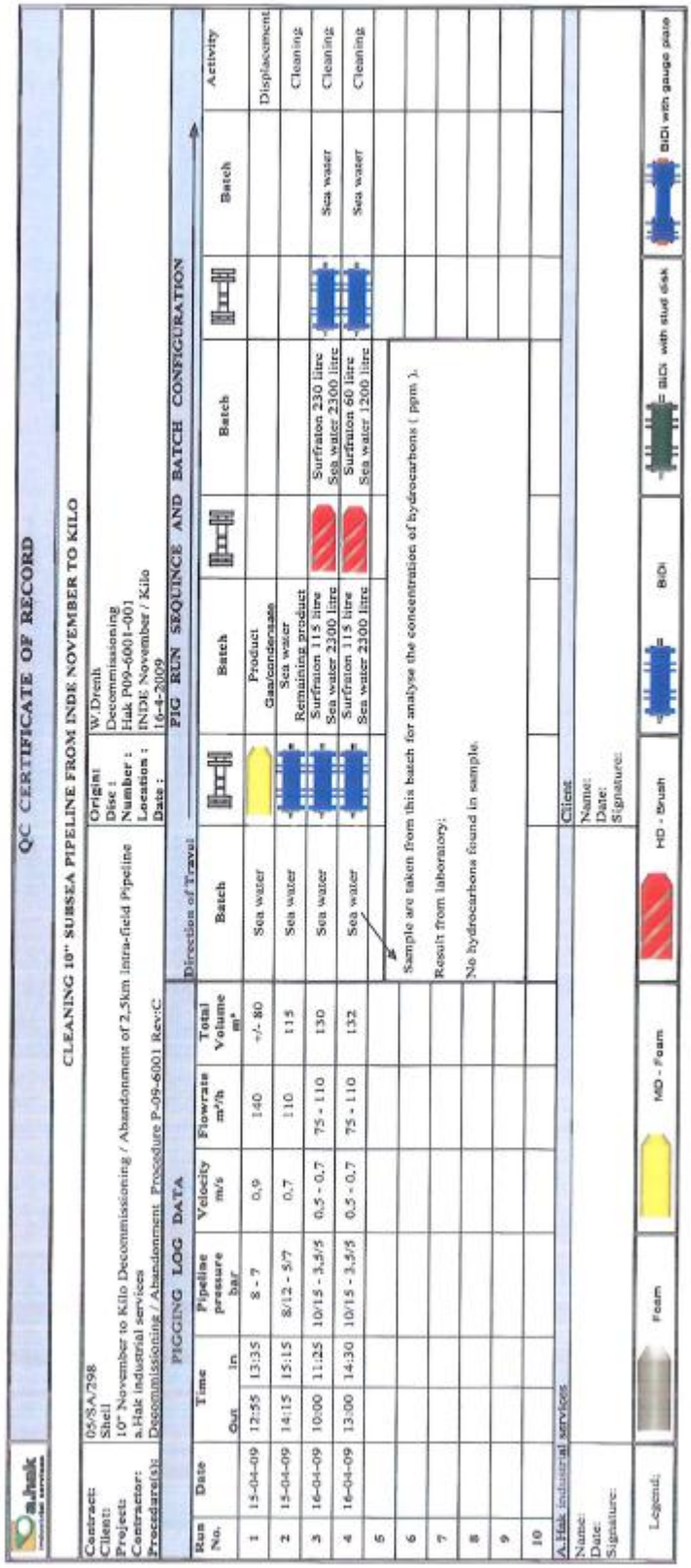
The flushing and cleaning of the Inde Kilo to Inde November and Inde Juliet to Inde Mike umbilical cores was carried out between April and May 2009 parallel to the pipeline cleaning operations. All umbilical cores were flushed with a minimum of two volumes of a 5% Surfatron and seawater mix into the 20" Inde Juliet to Perenco23A and 24" Inde Kilo to Perenco23A pipelines.

All cores were deemed to be sufficiently clean for the purposes of decommissioning.

6.9.9 Appendices Pipeline Cleaning

Appendices A to L have been added to the next pages.

Appendix A – Pig Tracker for 10" Inde November to Inde Kilo



QC CERTIFICATE OF RECORD

CLEANING 10" SUBSEA PIPELINE FROM INDE NOVEMBER TO KILO

Contract: 05/SA/298
Client: Shell
Project: 10" November to Kilo Decommissioning / Abandonment of 2,5km Intra-field Pipeline
Contractor: a.Hak Industrial services
Procedure(s): Decommissioning / Abandonment Procedure P-09-6001 Rev:C

Origin: W.Dyesh
Disc : Decommissioning
Number : Hak P09-6001-001
Location : INDE November / Kilo
Date : 16-4-2009

PIGGING LOG DATA

PIG RUN SEQUENCE AND BATCH CONFIGURATION

Direction of Travel

Run No.	Date	Time Out	Time In	Pipeline pressure bar	Velocity m/s	Flowrate m³/h	Total Volume m³	Batch	Batch	Batch	Batch	Activity
1	15-04-09	12:55	13:35	8 - 7	0,9	140	+/- 80	Sea water	Product Gas/condensate			Displacement
2	15-04-09	14:15	15:15	8/12 - 8/7	0,7	110	115	Sea water	Sea water Remaining product			Cleaning
3	16-04-09	10:00	11:25	10/15 - 3,5/5	0,5 - 0,7	75 - 110	130	Sea water	Surfraton 115 litre Sea water 2300 litre	Surfraton 230 litre Sea water 2300 litre	Sea water	Cleaning
4	16-04-09	13:00	14:30	10/15 - 3,5/5	0,5 - 0,7	75 - 110	132	Sea water	Surfraton 115 litre Sea water 2300 litre	Surfraton 60 litre Sea water 1200 litre	Sea water	Cleaning
5												
6												
7												
8												
9												
10												

Sample are taken from this batch for analyse the concentration of hydrocarbons (ppm).

Result from laboratory:

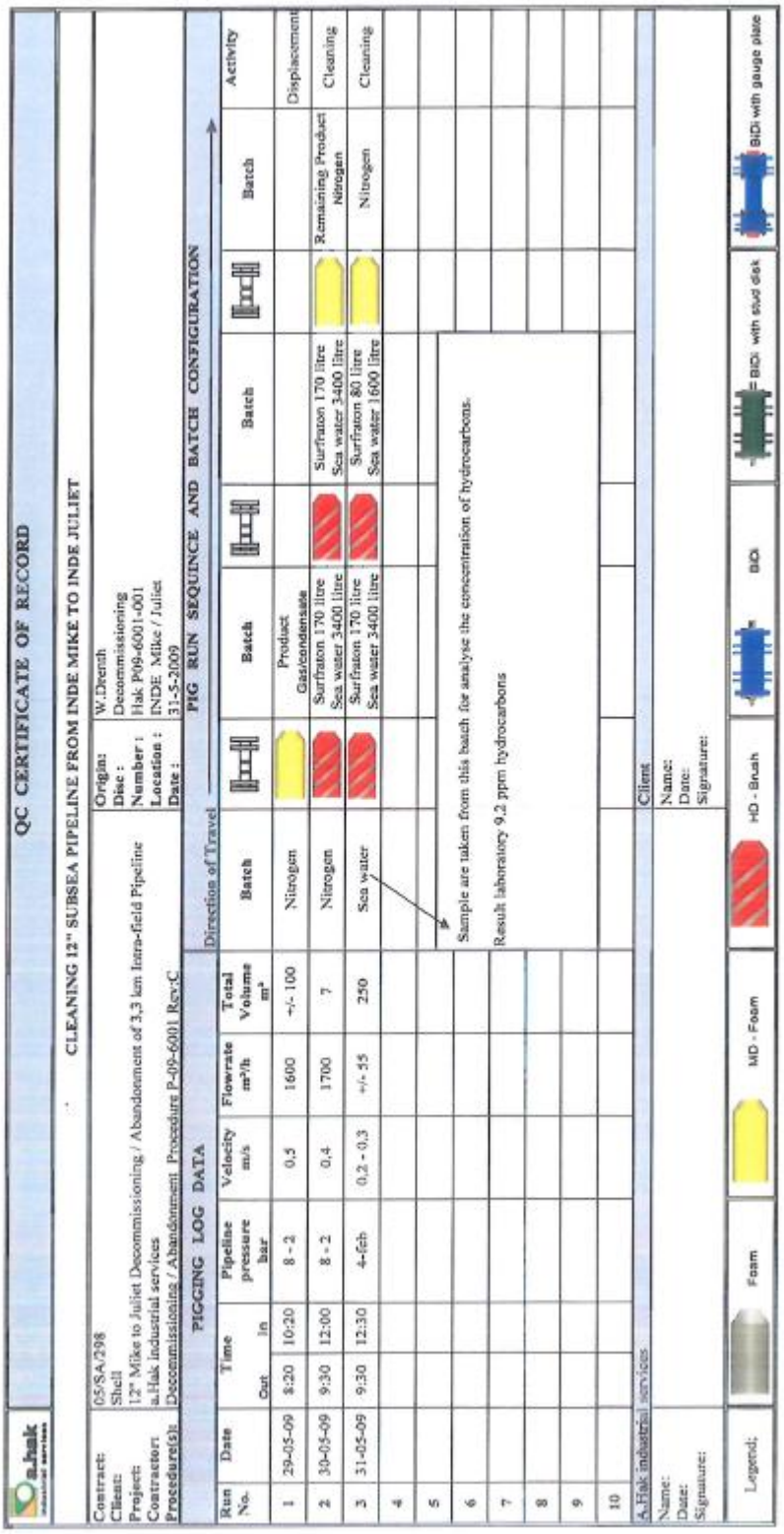
No hydrocarbons found in sample.

a.Hak Industrial services
Name:
Date:
Signature:

Client
Name:
Date:
Signature:

Legend: Foam | MD - Foam | HD - Brush | BiDi | BiDi with stud disk | BiDi with gauge plate

Appendix B – Pig Tracker for 12' Inde Mike to Inde Juliet



QC CERTIFICATE OF RECORD

CLEANING 12" SUBSEA PIPELINE FROM INDE MIKE TO INDE JULIET

Contract: 05/SA/298
Client: Shell
Project: 12" Mike to Juliet Decommissioning / Abandonement of 3.3 km Intra-field Pipeline
Contractor: a.Hak industrial services
Procedure(s): Decommissioning / Abandonment Procedure P-09-6001 Rev.C

Origin: W.Drenth
Disc : Decommissioning
Number : Hak P09-6001-001
Location : INDE Mike / Juliet
Date : 31-5-2009

PIGGING LOG DATA

PIG RUN SEQUENCE AND BATCH CONFIGURATION

Direction of Travel

Run No.	Date	Time Out	Time In	Pipeline pressure bar	Velocity m/s	Flowrate m³/h	Total Volume m³	Batch	Batch	Batch	Batch	Activity
1	29-05-09	8:20	10:20	8 - 2	0.5	1600	+/- 100	Nitrogen	Product Gas/condensate			Displacement
2	30-05-09	9:30	12:00	8 - 2	0.4	1700	7	Nitrogen	Surfraton 170 litre Sea water 3400 litre	Surfraton 170 litre Sea water 3400 litre	Remaining Product Nitrogen	Cleaning
3	31-05-09	9:30	12:30	4-fch	0.2 - 0.3	+/- 55	250	Sea water	Surfraton 170 litre Sea water 3400 litre	Surfraton 80 litre Sea water 1600 litre	Nitrogen	Cleaning
4												
5												
6												
7												
8												
9												
10												

Sample are taken from this batch for analyse the concentration of hydrocarbons.

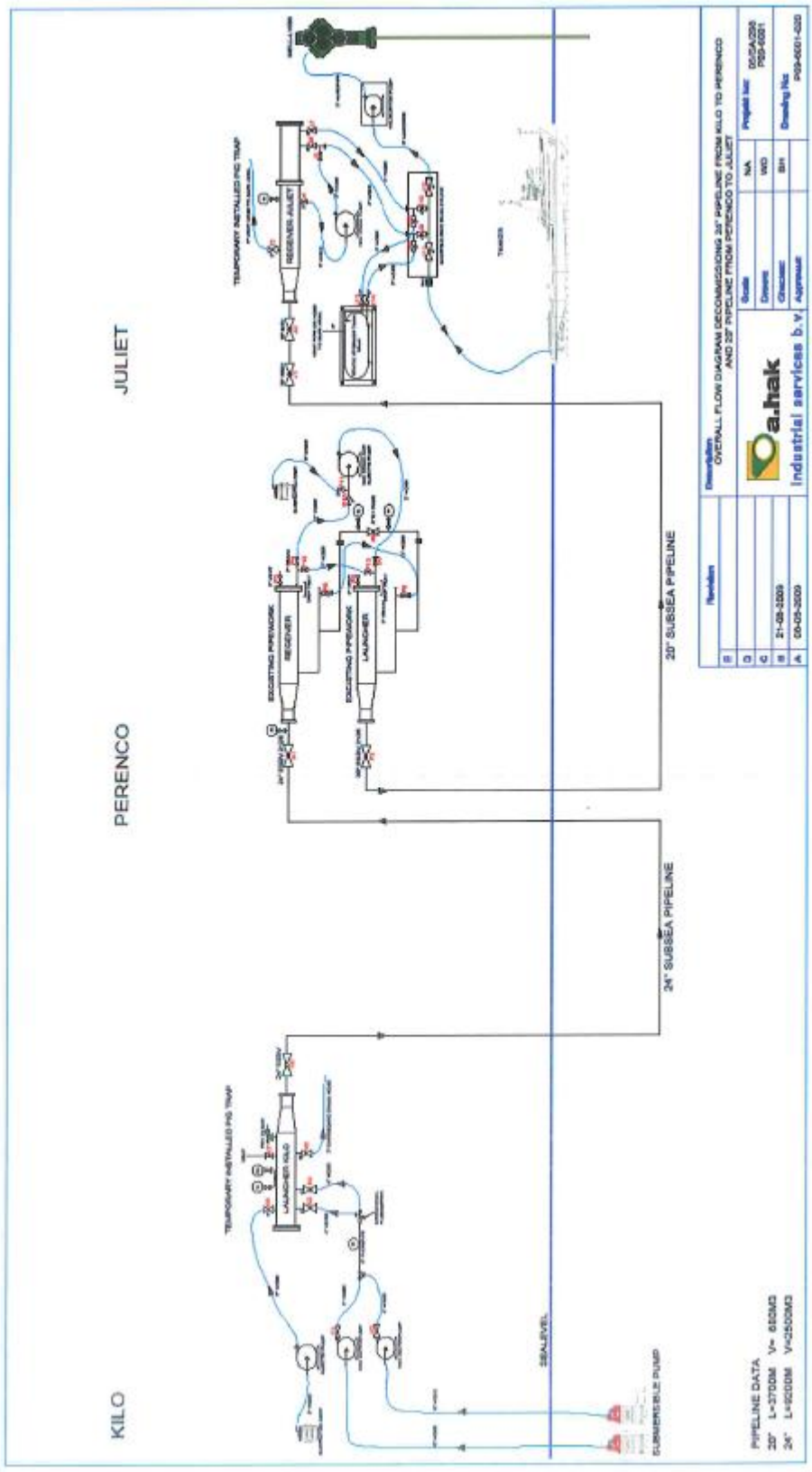
Result laboratory 9.2 ppm hydrocarbons

A.Hak industrial services
Name:
Date:
Signature:

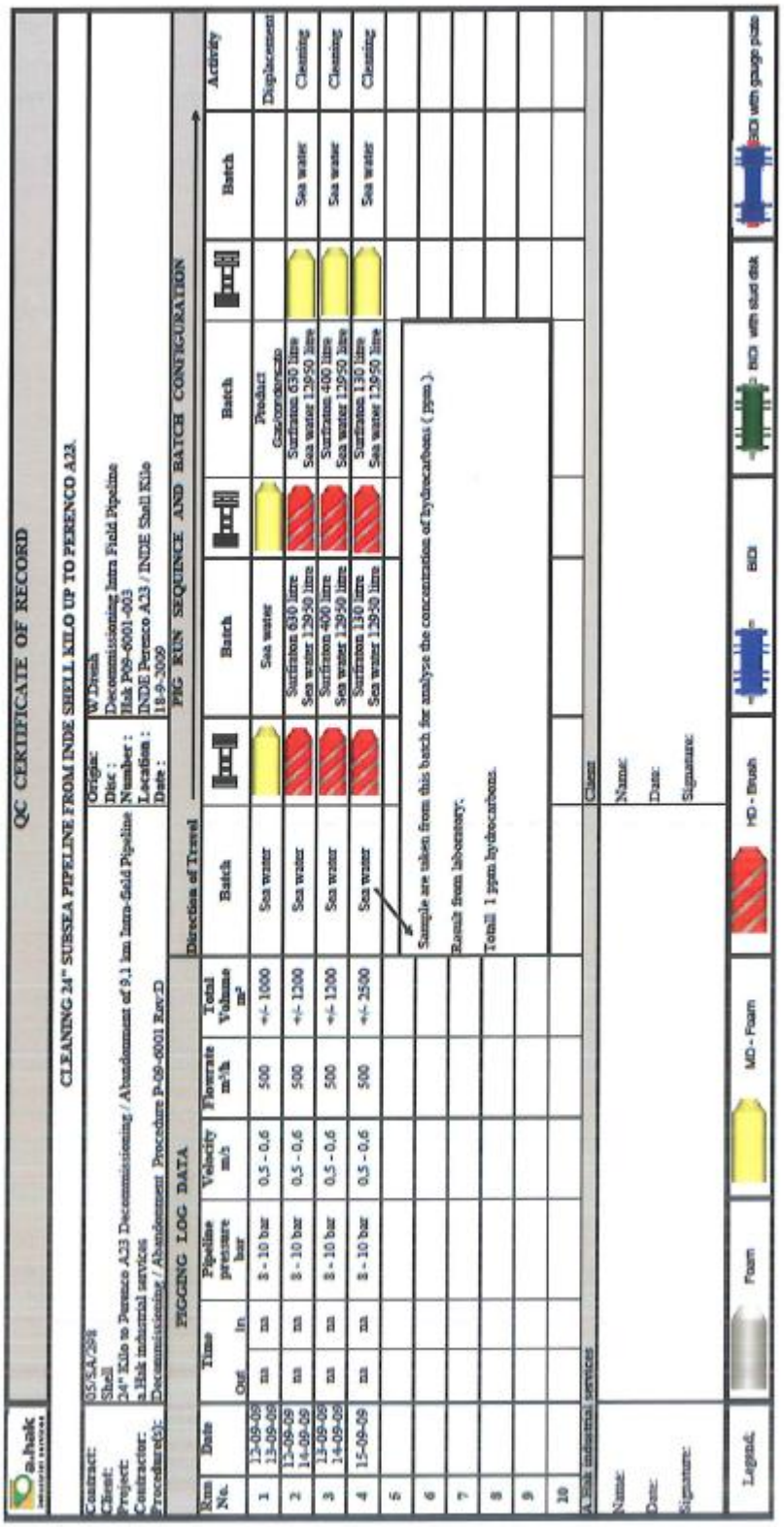
Client
Name:
Date:
Signature:

Legend: Foam | MD - Foam | HD - Brush | BDi | BDi with stud disk | BDi with gauge plate

Appendix C: – Pipeline Cleaning Layout Drawing



Appendix D – Pigging Tracker for 24" Kilo to Perenco 23A Pipeline



QC CERTIFICATE OF RECORD

CLEANING 24" SUBSEA PIPELINE FROM INDE SHELL KILO UP TO PERENCO A23.

Contract: 05/SAA/268
Client: Shell
Project: 24" Kilo to Perenco A23 Decommissioning / Abandonment of 9.1 km Intra-field Pipeline
Contractor: a.hak industrial services
Procedure(s): Decommissioning / Abandonment Procedure P-09-6001 Rev.D

Origin: W Divers
Dist.: Decommissioning Intra Field Pipeline
Number: Hak P09-6001-003
Location: INDE Perenco A23 / INDE Shell Kilo
Date: 18-9-2009

PIGGING LOG DATA

PIG RUN SEQUENCE AND BATCH CONFIGURATION

Direction of Travel →

Run No.	Date	Time Out	Time In	Pipeline pressure bar	Velocity m/s	Flowrate m³/h	Total Volume m³	Batch	Batch	Batch	Batch	Activity
1	13-09-09 13-09-09	m	m	8 - 10 bar	0,5 - 0,6	500	+/- 1000	Sea water	Sea water	Product Gasconderado		Displacement
2	13-09-09 14-09-09	m	m	8 - 10 bar	0,5 - 0,6	500	+/- 1200	Sea water	Surfratan 630 litre Sea water 12950 litre	Surfratan 630 litre Sea water 12950 litre	Sea water	Cleaning
3	13-09-09 14-09-09	m	m	8 - 10 bar	0,5 - 0,6	500	+/- 1300	Sea water	Surfratan 400 litre Sea water 12950 litre	Surfratan 400 litre Sea water 12950 litre	Sea water	Cleaning
4	15-09-09	m	m	8 - 10 bar	0,5 - 0,6	500	+/- 2500	Sea water	Surfratan 130 litre Sea water 12950 litre	Surfratan 130 litre Sea water 12950 litre	Sea water	Cleaning
5												
6												
7												
8												
9												
10												

Sample are taken from this batch for analyse the concentration of hydrocarbons (ppm).
Result from laboratory;
Tottall 1 ppm hydrocarbons.

a.hak industrial services

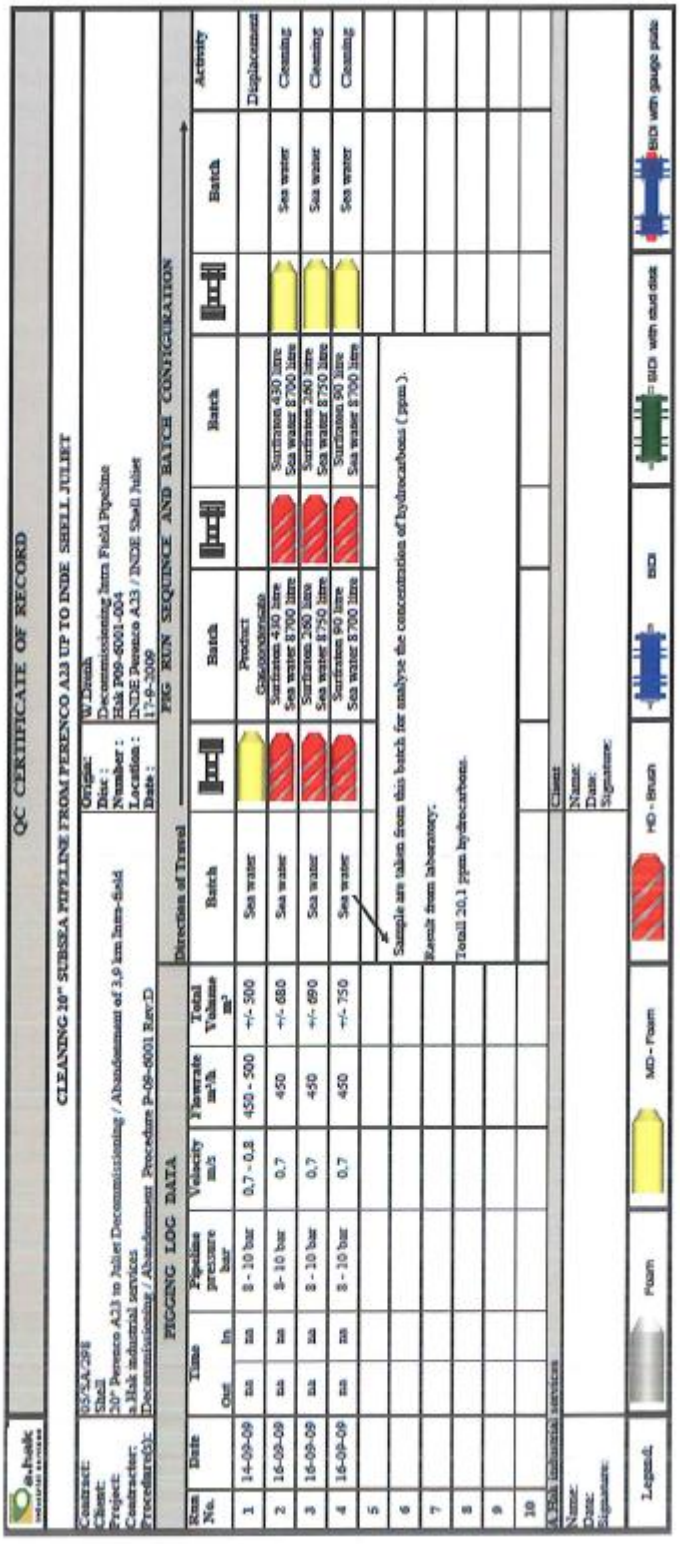
Name:
Date:
Signature:

Client

Name:
Date:
Signature:

Legend: Foam | MD - Foam | MD - Brush | BDI | BDI with stud disk | BDI with gauge plate

Appendix E: - Pigging Tracker for 20" Perenco 23a to Juliet Pipeline



QC CERTIFICATE OF RECORD

CLEANING 20" SUBSEA PIPELINE FROM PERENCO A33 UP TO INDE SHELL JULIET

Contract: 05/SAA/298
Client: Shell
Project: 20" Perenco A23 to Juliet Decommissioning / Abandonment of 3.9 km Inter-field a.Hak industrial services
Contractor:
Procedure(s): Decommissioning / Abandonment Procedure P-06-6001 Rev:D

Origin: (if Distrib.
Distr.: Decommissioning Inter Field Pipeline
Number: Hak P09-6001-004
Location: INDE Perenco A33 / INDE Shell Juliet
Date: 17-9-2009

PIGGING LOG DATA

PIG RUN SEQUENCE AND BATCH CONFIGURATION

Direction of Travel →

Run No.	Date	Time Out	Time In	Pipeline pressure bar	Velocity m/s	Flowrate m³/h	Total Volume m³	Batch		Batch		Batch		Activity
1	14-09-09	na	na	8 - 10 bar	0,7 - 0,8	450 - 500	+/- 500	Sea water		Product Gelcondensate				Displacement
2	16-09-09	na	na	8 - 10 bar	0,7	450	+/- 680	Sea water		Surfonas 430 litre Sea water 8700 litre			Sea water	Cleaning
3	16-09-09	na	na	8 - 10 bar	0,7	450	+/- 690	Sea water		Surfonas 260 litre Sea water 8730 litre			Sea water	Cleaning
4	16-09-09	na	na	8 - 10 bar	0,7	450	+/- 750	Sea water		Surfonas 90 litre Sea water 8700 litre			Sea water	Cleaning
5														
6														
7														
8														
9														
10														

Sample are taken from this batch for analyse the concentration of hydrocarbons (ppm).
Result from laboratory:
Total: 20,1 ppm hydrocarbons.

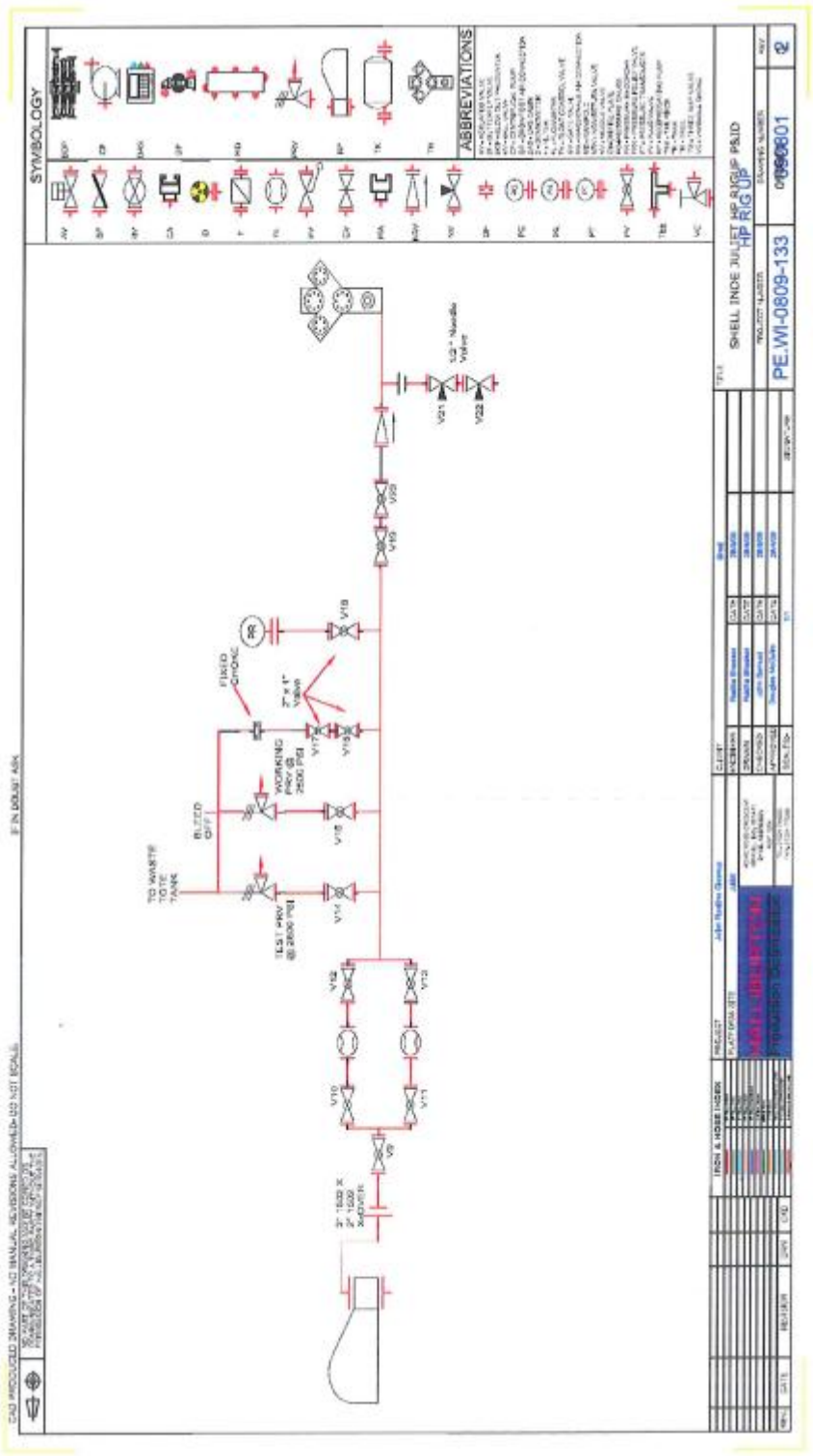
a.Hak industrial services — Client

Name:
Date:
Signature:

Name:
Date:
Signature:

Legend: Foam | MD - Foam | HD - Brush | BDI | = BDI with mid disc | = BDI with gauge plate

Appendix F - Well Injection Layout - 20" Perenco 23a to Juliet Pipeline



Appendix G – Sampling Results for 16" Inde Lima to Inde Kilo

SGS

Tel 01493 [illegible]

SGS United Kingdom Ltd

FINAL REPORT

AYL 12349

Produced Water Samples from Juliet

Samples Received 18[th] April 2007

Tests

Determination of hydrocarbon oil in water, soils or sludge's by infra-red absorption (MCWAM)
And Gas GC method ISO 9377-2 as modified by OSPAR

[illegible]

Distribution: [illegible]

Prepared By — Approved for Issue

Gary Cole, Laboratory Technician — Tony Ballen, Laboratory Supervisor

Date:- 24[th] April 2007

Page 1 of 2

SGS

Sample Number	Date	Time	Source	Aliphatic Hydrocarbon (mg/kg)	Method
AYL12349-1	16/04/2007	1245	Water Monarch	40	Gas GC
AYL12349-2	17/04/2007	1135	Between Pigs 4 & 5	7.8	Gas GC
AYL12349-3	17/04/2007	1218	After Pig 5	2.4	Gas GC
AYL12349-4	17/04/2007	1460	After further flushing post Pig 5	1	Infra-red

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Appendix H – Sampling Results for 10" Inde November to Inde Kilo

SGS

SGS Oil Gas & Chemicals

Unit G4,
Boundary Road,
Harfrey's Industrial Estate,
Great Yarmouth,
Norfolk
NR31 0LY
Tel: 01493 442 369
e-mail: tony.bullen@sgs.com

SHELL UK EXPLORATION &
PRODUCTION
1 ALTENS FARM ROAD
ABERDEEN
AB12 3FY

Date: 29/04/2009

ANALYTICAL REPORT No: GY09-00300

PRODUCT DESCRIPTION: Line Flush
SAMPLE SOURCE: Discharge
VESSEL: N/A
LOCATION: Inde

SAMPLE RECEIVED: 17/04/2009
SAMPLE ANALYSED: 29/04/2009
SAMPLE TYPE: Line
SAMPLE BY: Client

METHOD: ISO 9377-2 (Modified by OSPAR) DESCRIPTION: Dispersed Mineral Oil Content

SAMPLE ID	SOURCE	RESULT	UNITS	SAMPLED	ANALYSED	CLIENT ID
GY09-00300.001	Discharge@ 1443	<1	mg/l	15/04/2009	29/04/2009	Nov-Kilo

REPORT COMMENT:
The sample was run on the day of receipt and reported verbally as requested.
This is the official report issued subsequently.

Precision parameters apply in the determination of results.
Also refer to ASTM D3244, IP 367 and IP standards (Test Methods) for utilisation of test data to determine conformance with specification.
Sampling not ISO/IEC 17025 Accredited.
This document is issued by the Company subject to its General Conditions of Service available on request and accessible at: www.sgs.com
* Analysis not ISO/IEC 17025 Accredited

Authorised Signatory

Page 1 of 1

Tony Bullen - Laboratory Manager

SGS United Kingdom Ltd

Unit G4, Boundary Road, Harfrey's Industrial Estate, Norfolk NR31 0LY Tel: 01493 442 369 Fax: 01493 440 822
Registered in England No. 1193985 Rossmore Business Park, Ellesmere Port, Cheshire CH65 3EN www.sgs.com

Member of the SGS Group (SGS SA)

Appendix I – Sampling Results for 12" Inde Mike to Inde Juliet

SGS

SGS Oil Gas & Chemicals

Unit G4,
Boundary Road,
Harfrey's Industrial Estate,
Great Yarmouth,
Norfolk
NR31 0LY
Tel: 01493 442 369
e-mail: tony.bullen@sgs.com

For information on Laboratory Services please visit:
www.uk.sgs.com/laboratoryservices

SHELL UK EXPLORATION &
PRODUCTION
ACCOUNTS PAYABLE
1 ALTENS FARM ROAD
ABERDEEN
AB12 3FY

Date: 27/07/2009

ANALYTICAL REPORT No: GY09-00409

PRODUCT DESCRIPTION: Produced Water
SAMPLE SOURCE: Offshore Platform
VESSEL: N/A
LOCATION: Juliet

SAMPLE RECEIVED: [illegible]/07/2009
SAMPLE ANALYSED: 27/07/2009
SAMPLE TYPE: Line
SAMPLE BY: Client

METHOD: ISO 9377-2 (Modified by OSPAR) DESCRIPTION: Dispersed Mineral Oil Content

SAMPLE ID	SOURCE	RESULT		UNITS	SAMPLED	ANALYSED	CLIENT ID
GY09-00409.001	Offshore Platform@ 0950	[illegible]	#	mg/l	29/05/2009	27/07/2009	First
GY09-00409.002	Offshore Platform@ 1415	16		mg/l	30/05/2009	27/07/2009	Last

REPORT COMMENT:
The report gives the results in mg/l in accordance with the method.
The initial sample contained [illegible] this is equivalent to 0.008%

Precision parameters apply in the determination of results.
Also refer to ASTM D3244, IP 367 and IP standards (Test Methods) for utilisation of test data to determine conformance with specification.
Sampling not ISO/IEC 17025 Accredited.
This document is issued by the Company subject to its General Conditions of Service available on request and accessible at: www.sgs.com
* Analysis not ISO/IEC 17025 Accredited
# - Result is outside of test method limits and/or analytical range used in method precision study

Authorised Signatory

Page 1 of 1

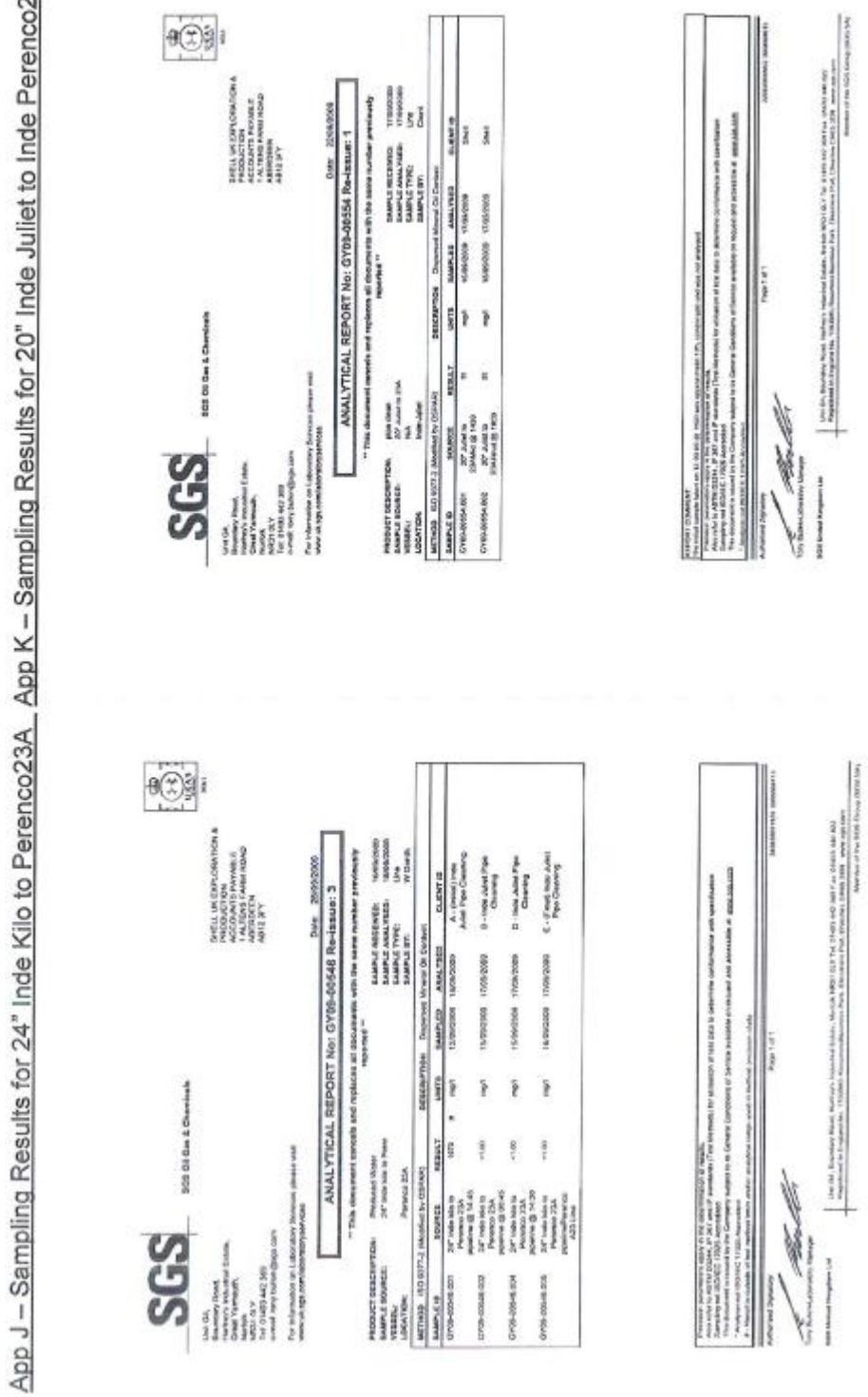
Tony Bullen - Laboratory Manager

SGS United Kingdom Ltd

Unit G4, Boundary Road, Harfrey's Industrial Estate, Norfolk NR31 0LY Tel: 01493 442 369 Fax: 01493 440 822
Registered in England No. 1193985 Rossmore Business Park, Ellesmere Port, Cheshire CH65 3EN www.sgs.com

Member of the SGS Group (SGS SA)

App J – Sampling Results for 24" Inde Kilo to Perenco23A App K – Sampling Results for 20" Inde Juliet to Inde Perenco23A



Appendix L – Mercury Analysis in Solid Recovered from 16" Inde Lima to Inde Juliet

Tracerco

Page 1 of 1

Mr M Bailey
Shell Exploration & Production
Bacton Gas Terminal
Paston Road
Bacton
Norwich
NR12 0JB

Report Reference: CP 17111
Direct Line: 01642 375465
E-mail: chris.pollin@tracerco.com
7 June 2007

Tracerco Analytical Services

Dear Mark

RADIOCHEMICAL ANALYSIS – SHELL BACTON

Tracerco ref	54211	54212	54213
Your ref	Sludge Juliet Foam Pig (Med Density) 14.04.07 14:00	Sludge Sample 07032 Backup Separator ZP-V-3570 16.04.07	Sludge Sample 0703x Sediment Cond Tank ZP-T-3810 30.04.07
Mercury	840	400	220

All results are quoted as Parts Per Million (PPM)

Date Samples Received : 03.05.07
Date Samples Analysed : 03.05.07 – 01.06.07
Methods of Analysis Used : Analysis supplied by SembCorp Utilities (UK).

Yours sincerely

C POLLIN
Radiochemistry Supervisor

K WATERMAN
Laboratory Operations Manager

7. Sub-sea Execution

7.1. Summary

The Subsea scope at Inde was conducted in a number of phases during the field abandonment program. These consisted of:

- Pre-lift debris clearance.
- Riser cuts and spool removals.
- Umbilical recovery.
- Pipeline burial.
- Pipeline end and seabed remedial works.
- Debris clearance and verification by trawling techniques.
- Final decommissioning survey and environmental sampling.

7.2. Introduction

The Shell Underwater Group carried out the majority of the subsea scope at Inde. The Underwater Services Contractor (USC), Subsea 7 conducted this scope using Shell dedicated vessels, the DSV “Seven Atlantic” and the ROVSV “Normand Subsea”.

DSV Seven Atlantic **ROVSV Normand Subsea**

7.3. Pre Works

7.3.1. Surveys

In 2006 pre-decommissioning environmental seabed survey was carried out at the Juliet platform to provide an assessment of physical, chemical and faunal status prior to decommissioning. In 2008 a desk top study of the Indefatigable field acoustic data was conducted to assess the potential presence of protected and other sensitive habitats, and in particular biogenic reefs formed by *Sabillaria Spinulosa*. In 2009 further habitat assessment, including visual ground-truthing, was carried out at all Indefatigable locations. No benthic species or habitats were identified in 2008 and 2009 that could be sensitive to proposed decommissioning activities.

Pipeline exposures and spans were identified and measured. Bathymetry of the seabed areas around the platforms were mapped in preparation for decommissioning operations. Further surveys were conducted at Inde during 2008 and 2009.

7.3.2. Debris Clearance

The GB Diving conducted debris clearance during September 2005 at Inde Juliet in preparation for the arrival of the Seafox 4. This survey and debris recovery scope confirmed the presence of significant quantities of debris in the vicinity of the platform.

The DSV Bibby Topaz conducted debris clearance during September/October 2008 at Inde Kilo and Inde Lima in preparation for the arrival of the Seafox 4. Several tons of assorted debris was recovered. Large debris was identified at Lima for later recovery.

Debris Recovered at Kilo by the DSV Bibby Topaz -2008

The DSV Toisa Polaris conducted debris clearance during August 2009 at Inde Juliet in preparation for the arrival of the Seafox 4. Debris clearance along the hose route for the BW Carmen was carried out. 11 tons of debris was recovered during this intervention.
The DSV Toisa Polaris conducted debris clearance during September 2009 and a second intervention conducted during April 2010 by the DSV Seven Atlantic. A total of approximately 28 tons of debris was recovered during these two interventions. Further debris clearance was carried out during subsequent ROVSV and DSV interventions to provide access and safety for divers.

Debris recovered from all of the Inde Field locations was very similar in type. It consisted mainly of scaffolding poles, ladder sections, deck grating and handrails etc. A total of 91.4 tons of debris was cleared by the DSV and ROVSV during the Inde Decommissioning Project.

Typical debris recovered from Inde Platform Locations – DSV Seven Atlantic

7.4. Execution of Subsea Scope

7.4.1. Juliet

Preparations for Platform Lift

The first DSV decommissioning intervention to Juliet was conducted during May/June 2009. A diamond wire cutting device was employed to cut the 20 inch (PL80), 16 inch (PL82) and 12 inch (PL302) risers at the base of the jacket. Further cuts were made after the riser turns and spools were removed. This ensured separation between the platform and the pipelines.

The umbilical to Mike was cut at the J tube base and pulled back clear of any obstructions around the platform. Debris clearance was conducted around the horizontal braces at seabed level. A total weight of approximately 18 tons of debris was cleared from the seabed during this intervention.

Pipeline End Burial

20 Inch Pipeline

During May 2012 the DSV laid a mattress over the 20 inch (PL80) pipeline end, the mean seabed level was assessed as greater than 0.6 meter above the top of the mattress.

16 Inch Pipeline

During March 2012 the ROVSV used a mass flow evacuation tool to bury the 16 inch (PL82) pipeline end. During May 2012 the DSV laid a mattress over the pipeline end, the mean seabed level was assessed as greater than 0.6 meter above the top of the mattress.

12 Inch Pipeline

During March 2012 the ROVSV used a mass flow evacuation tool to bury the 12 inch (PL302) pipeline end. However two grout gabion containers were located below the pipeline, therefore restricting sufficient burial. During May 2012 the DSV used a diamond cutting device to remove a section of the pipeline and recover the 2 gabion containers. Measurements taken of the adjacent seabed level reported depth from top of pipe was in excess of 0.6 meter.

Recovered grout gabion from 12 inch (PL302) at Juliet

Variance to Planned Scope

During March 2011, ROV and diver inspections of the seven conductors revealed four clamps with no gap between the shell of the clamp and the conductor. These clamps were subsequently opened to allow the unhindered removal of the conductor by the HLV.

During the lift of the platform a 45 meter section of umbilical became detached from the J-tube as the jacket was held at the water/air interface. This section of umbilical was later recovered by DSV.

During the final preparations for the pipeline burial, two open top grout gabion containers were found adjacent to the 12” Mike pipeline. Further pipeline sections and the two grout gabions were removed.

7.4.2. Kilo

Preparations for Platform Lift
DSV interventions were conducted at Kilo during December 2009 and April 2010 to carry out the riser and umbilical cuts. A diamond wire cutting device was employed to cut the 24 inch (PL81) and 10 inch (PL402) risers at the base of the jacket. Further cuts were made after the riser turns and spools were removed. This ensured separation between the platform and the pipelines.

The umbilical (PL479-487) was cut at the J tube base and pulled back clear of any obstructions around the platform.

In order to reduce the likelihood of dropped objects during the heavy lift of the platform, debris clearance was conducted by DSV around the horizontal braces at seabed level.

Pipeline End Burial

24 Inch Pipeline

The 24 inch (PL81) pipeline end was found to be buried in hardened rock dump. The DSV spent 5 days removing sufficient rock material to enable the final cut at the pipeline end to be completed. After the last cut was made, divers moved existing rock dump to provide cover over the pipeline end greater than 0.6 meter.

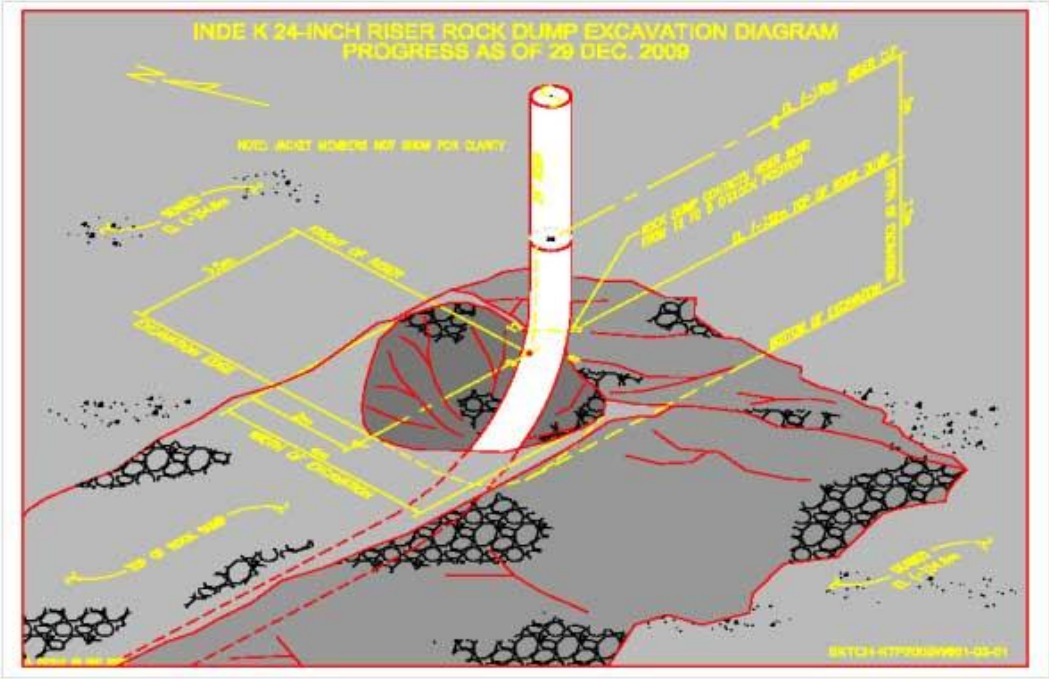
10 Inch Pipeline

During March 2012 the ROVSV used a mass flow evacuation tool to bury the 10 inch (PL402) pipeline end. However, hard seabed material was encountered under the pipeline. A DSV intervention during May 2012 used diamond wire cutting to remove further 20 meters of pipeline. A mattress was laid over the pipeline end. Assessment of the depth from top of the mattress within the trench to the adjacent seabed level was in excess of 0.6 meter.

Variance to Planned Scope
Four of the platform leg piles (D2, D3, E2 and E3) were internally grouted to above the minus 3 meter level below seabed. Therefore leg piles had to be cut externally for which excavation work by a subcontractor of Seaway Heavy Lifting (SHL) was scheduled. Excavation was not performed by SHL since a conflict about indemnities could not be resolved. The excavation work was added to the scope of SS7.
Prior to the Heavy Lift program, a subsea excavation tool was employed to remove rock and seabed material from around these legs to an excavation depth of approximately 3 meters. This was a time consuming operation, however ultimately successful. This rock excavation was later re-profiled by the use of a Scangrab tool to provide overtrawlability and depth of cover in excess of 1 meter at the 4 leg pile locations.

During the retrieval of the conductors by the HLV contractor, the K10 conductor could not be successfully pulled. This conductor was cut about 1m above seabed level by SHL by means of a remotely operated diamond wire cutting tool. The K10 stub was subsequently removed by DSV during January 2012.

As detailed above, additional DSV time was used to attempt to remove hardened rock and steel slag material at the 24 inch (PL81) riser base, prior to riser cutting.



Hardened rock with steel slag conglomerate found on 24 inch at Kilo

7.4.3. Lima

Preparations for Platform Lift

A DSV intervention to Lima was conducted during March/April 2010. A diamond wire cutting device was employed to cut the 16 inch (PL82) riser at the base of the jacket. Further cuts were made after the riser turns and spools were removed. This ensured separation between the platform and the pipelines. A 32 inch conductor section was removed from inside the jacket base. A boat fender lodged between the jacket vertical legs was removed.

Lima

Pipeline End Burial

16 Inch Pipeline

The 16 inch (PL82) pipeline end was found to be buried in hardened rock dump. During April 2010 the ROVSV moved existing rock dump material with the Scanmudring subsea digger to provide cover over the pipeline end greater than 0.6 meter.

Variances to Planned Scope
There were no variances to the planned scope

7.4.4. Mike

Preparations for Platform Lift

The first DSV decommissioning intervention to Mike was conducted during September 2009. A diamond wire cutting device was employed to cut the 12 inch (PL302) riser at the base of the jacket. Further cuts were made after the riser turns and spools were removed. This ensured separation between the platform and the pipelines.

The umbilical was cut at the J tube base and pulled back clear of any obstructions around the platform.

Debris clearance was completed around the jacket base and out to approximately 40 meter radius. A total of 6.1 tons was removed from the seabed.

Pipeline End Burial

12 Inch Pipeline

During March 2012 the ROVSV carried out a depth of burial survey at the pipeline end, this was shown to be buried to a depth of greater than 0.6 meter from top of pipe. Therefore the mass flow evacuation tool was not used at this location.

Variance to Planned Scope
During the cut and pull back of the umbilical at Inde Mike, the umbilical was found to be lodged in steel slag hardened rock dump material for a length of approximately 20 meters. After several attempts by divers and use of the vessel crane to dislodge this section, the umbilical was then cut at both sides of the rock dump pile. A comparative assessment was later submitted to DECC and approval was received to leave this section of umbilical in situ.

A seawater pump including discharge pipe appeared to be present in the caisson. The pump assembly dropped out of the caisson on the seabed during the jacket lift. These items were later recovered by the DSV.

Pump pipe sections recovered from Mike

7.4.5. November

Preparations for Platform Lift
An early intervention to survey and carryout debris clearance in preparation for the arrival of the Seafox 1 was carried out by the Bibby Topaz during October 2008.

Debris clearance was completed around the jacket base and out to approximately 40 meter radius. A total of 5.5 tons was removed from the seabed during September 2009.

A DSV decommissioning intervention to November was conducted during April 2010. A diamond wire cutting device was employed to cut the 10 inch (PL402) riser at the base of the jacket. Further cuts were made after the riser turns and spools were removed. This ensured separation between the platform and the pipelines.

The umbilical was cut at the J tube base and pulled back clear of any obstructions near the platform.

Pipeline End Burial

<u>10 Inch Pipeline</u>

During March 2012 the ROVSV used a mass flow evacuation tool to bury the 10 inch (PL402) pipeline end. The ROVSV placed a mattress over the pipeline end. Assessment of the trench depth confirmed that the depth from top of the mattress to the adjacent seabed was greater than 0.6 meters.
It should be noted that approximately 18 mattress were located under the pipeline end, with DECC approving these remain under the pipeline.

Variance to Planned Scope
No variance to planned scope. However an obstruction at November had been identified later during the verification trawls for which a remediation work was initiated. For details see section 7.5.2.

7.4.6. 20” Juliet to Inde AT (PL80) – General Pipeline Burial

A depth of burial survey was carried out on the 20 inch Juliet to Inde AT (or Perenco 23a) pipeline during March 2012 by the ROVSV. This showed the burial condition of this pipeline to be stable and adequate for decommissioning. The majority of the pipeline length was reported to have a burial depth from top of pipe greater than 0.6 meters.
Therefore no further burial activities were conducted. For further details see Section 7.5.4.

Pipeline End at Inde AT (Perenco 23A)

The pipeline end at Inde AT (Perenco 23A) and out to the platform’s 500 meter zone has not been surveyed for burial of depth or any remedial pipeline burial scope carried out.

Note: Pipeline end remediation will be executed in the future when the Perenco 23A facility will be abandoned.

7.4.7. 24” Kilo to Inde AT (PL81) – General Pipeline Burial

During March 2012 the ROVSV used a mass flow evacuation tool to bury all sections of shallow, exposed or spanning pipeline. The post depth of burial survey showed that the majority of the line was located within the trench with depth from the top of pipe greater than 0.6 meters. Some minor sections with depth of burial less than 0.6 meters still exist. For further details see Section 7.5.4.

Pipeline End at Inde AT (Perenco 23A)

The pipeline end at Inde AT (Perenco 23A) and out to the platform’s 500 meter zone has not been surveyed for burial of depth or any remedial pipeline burial scope carried out.

Note: Pipeline end remediation will be executed in the future when the Perenco 23A facility will be abandoned.

7.4.8. 16” Lima to Juliet (PL82) – General Pipeline Burial

During March 2012 the ROVSV used a mass flow evacuation tool to bury all sections of shallow, exposed or spanning pipeline. The post depth of burial survey showed that the majority of the line was located within the trench with depth from the top of pipe greater than 0.6 meter. Some minor sections with depth of burial less that 0.6 meter still exist. For further details see Section 7.5.4.

7.4.9. 12” Mike to Juliet (PL302) – General Pipeline Burial

A depth of burial survey was carried out on the 12 inch Mike to Juliet pipeline during March 2012 by the ROVSV. This showed the burial condition of this pipeline to be stable and adequate for decommissioning. The majority of the pipeline length was reported to have a burial depth from top of pipe greater than 0.6 meters. For further details see Section 7.5.4.
Therefore no further burial activities were conducted.

7.4.10 10” November to Kilo (PL402) – General Pipeline Burial

A depth of burial survey was carried out on the 10 inch November to Kilo pipeline during March 2012 by the ROVSV. This showed the burial condition of this pipeline to be stable and adequate for decommissioning. The majority of the pipeline length was reported to have a burial depth from top of pipe greater than 0.6 meter above mean seabed level. For further details see Section 7.5.4.

Therefore no further burial activities were conducted.

7.4.11 3" Juliet-D to Mike Umbilical (PL303)

The DSV carried out the recovery of the 3 inch Juliet-D to Mike umbilical during January 2012. A temporary spool and tensioning system was fitted to the aft deck area on the DSV. Diver assisted the recovery to deck of the umbilical end at Juliet-D. The recovery operation went smoothly with no snags experienced along route. The recovery time was 12 hours and 40 minutes with a maximum tension recorded of 7.5 Tons. The 3.5 km umbilical was then transported onshore in the UK for disposal and recycling.

7.4.12 3" Kilo to November Umbilical (PL479 – 487)

The DSV carried out the recovery of the 3 inch Kilo to November umbilical during January 2012. A temporary spool and tensioning system was fitted to the aft deck area on the DSV. Diver assisted the recovery to deck of the umbilical end at JD. The recovery operation went smoothly with no snags experienced along route. The recovery time was 6 hours and 5 minutes with a maximum tension recorded of 5.5 Tons. The 2.4 km umbilical was then transported onshore in the UK for disposal and recycling.

Inde Kilo to November – Umbilical recovery on to DSV

7.5. Post Works

7.5.1. Debris Recovery and Verification Trawls

DECC recommended third party verification by the National Federation of Fishermen's Organizations (NFFO). Due the possibility of issues from decommissioning oil/gas fields affecting the UK fishing industry, a vessel was sourced through the NFFO Services Ltd., the commercial arm of the NFFO.
The FV Farnella (H135) was provided through the NFFO on a daily rate basis.

Being of a standard stern trawler design, the vessel was seen as the safest type of vessel to conduct a debris recovery program based on a variety of factors which included:

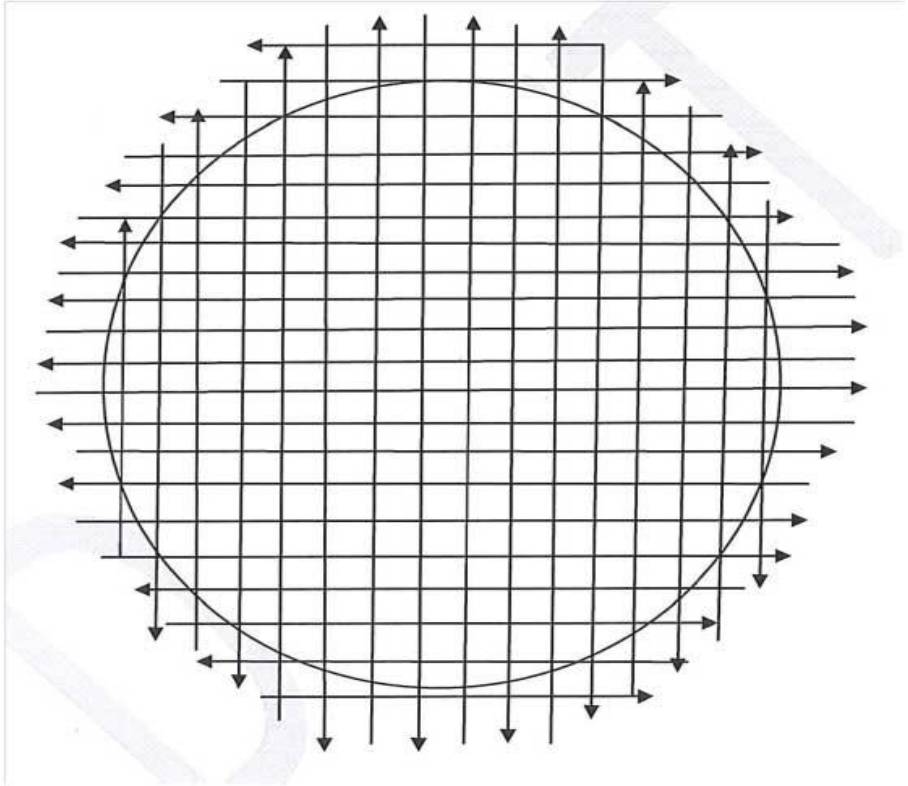
1. Vessel design.
2. Stern ramp and gear recovery process significantly reduced any stability issues arising from operations.
3. Maximum open deck area.
4. Documented vessel safety management system in place.
5. Compliance with marine standards at the highest level in the fishing industry.
6. Suitable engine power.
7. Suitable gear handling system.
8. Experienced crew.

The fact that the net and any debris were hauled up the stern ramp significantly reduced risk to vessel and personnel during the debris recovery process.
The nets used for clearance and for verification had been designed to catch debris and not to catch fish, with low ground clearance to pick up debris.

The FV Farnella (H135) carried out debris clearance and verification trawls inside the 500 meters zones at Inde J, K, L, M and N.

FARNELLA

The debris recovery program commenced on 8 June 2012 by trawling through the decommissioned 500 m safety zone. Each pass through the zone concluded with the recovery of the trawl and any debris removed from the net before proceeding with the next line. The objective of this practice was to limit the amount of debris which would be gathered at any one time and thereby making gear handling a safer process for the deck crew. The debris clearance sweeps were followed by the verification trawls.



A typical sweep pattern

All areas were declared clean on 27 July 2012, except for the November location where an obstruction was observed. It appeared that the pipeline end, which was trenched in order to lower it into the seabed, was still exposed. The exposed pipeline section was removed in October 2012 (for details see Section 7.5.2). A secondary series of bi-directional sweeps over the Inde November 500metre zone was executed in June 2013 and no obstructions had been encountered.
The Clean Seabed Certificate for the 5 decommissioned Inde 500 meter safety zones was received on 8 August 2013.

Clean Seabed Certificate:

National Federation of Fishermen's Organisations.

30 Monkgate
York
YO31 7PF

Tel: 01904 635 432
Fax: 01904 635 431
e-mail: apiggott@nffo.org.uk
Web: www.nffoservices.com

8th Aug 2013

To whom it may concern

Inde Field

CLEAN SEABED CERTIFICATE

The Hull based Stern Trawler **Farnella H135** operating under NFFO membership conducted the following activities at the Decommissioned **Inde Field** Well locations at – **November, Lima, Juliet, Kilo& Mike**

1. A series of intense bi-directional sweeps over known **November, Lima, Juliet, Kilo& Mike** 5oo metre Zones have been conducted with the objective of safe future over trawlerbility within the said zones.

A significant number of passes has been made across each area. (individual plotter data has been supplied)
Standard Southern North Sea trawl equipment with a series of chains suspended across the mouth of the trawl was used to conduct the sweeps.
Chains were attached to the trawl to ensure continuous contact with the seabed to determine whether there were any major obstructions which might present a major snagging hazard for future fishing activities. The trawl net was also seen as a means of gathering any items of debris located in the area.
No further debris or obstructions were encountered.

Following completion of the sweep programme the skipper of **Farnella H135** has reported to NFFO the following:

a) No major snag was experienced during any of the sweeps.
b) On no occasion did the winch pressure showed any increase.
c) The skipper of the Farnella is happy that as a result of the sweeps and the absence of any debris or snagging points on any of the above named decommissioned sites suggest that the areas will not pose any significant problem for future fishing operations.

Based upon feedback provided by the skipper, the Federation accepts that the decommissioned **Inde November, Lima, Juliet, Kilo& Mike** sites the abandoned well and the associated 500m safety zones were found to be clear of debris or major obstruction and posed no significant problem for future fishing operations.

The Federation would like to thank Shell for their efforts in ensuring that all significant items of equipment and debris have been recovered.

Signed

Alan Piggott

A Piggott
General Manager

7.5.2. Post Pipeline Remediation Work at the 10" Pipeline End at November

As mentioned in the foregoing section the pipeline end appeared to be exposed because the rate of natural backfill of the trench, created to lower the pipeline end and the16 mattresses, was inadequate. These mattresses used to support the last end of the 10" pipeline approaching the November platform.

A section of 34 m exposed pipeline was removed and a mattress was placed over the pipe end during a campaign with the DSV in October 2012. The final verification trawls, executed in July 2013, confirmed that the pipe end was well covered and the seabed safe for fishing activities.
The remedial works were covered by a license under the MCAA issued by DECC.

7.5.3. Post-Decommissioning Seabed Surveys

Post-Decommissioning Surveys – Geophysical:

- 2006 Environmental Seabed Survey (Juliet); Gardline Report No.: 7034
- 2012 Post Pipeline Burial Surveys; SS7 Overview Chart with DOB Listings
- 2012 Post Decommissioning Survey; Fugro, Shell Report No.: ED-2012-057
- 2013 Post Decommissioning Survey; SS7 Report ET0846-PET-FR-ST-003
- 2013 Inde Clearance Surveys; Osiris, Shell Report No.: ED-2013-030

Post-Decommissioning Surveys – Environmental:

- 2012 Post-Decommissioning Environmental Survey. Indefatigable Field, Fugro EMU/Report No.: J/2/25/0172.4V1.2. Volumes 1-3. Key findings and conclusions from this report are summarized in Section 7.5.5.

7.5.4 Post-Decommissioning Geophysical Surveys

The post depth of burial survey 2013 (report SS7 Report ET0846-PET-FR-ST-003) showed that the majority of each pipeline was located within the trench with depth from the top of pipe greater than 0.6 meter. Some minor sections with depth of burial less that 0.6 meter still exist, as summarized below:

20" Juliet to Inde AT (PL80)
Depth of lowering below MSB for the pipeline remained almost entirely in excess of the 0.6m minimum level throughout the 3.287km survey section, with only one instance of shallow burial, a 7m section at KP 0.370.

24" Kilo to Inde AT (PL81)
Depth of lowering below MSB for the pipeline remained almost entirely in excess of the 0.6m minimum level throughout the survey (> 99% of the 8.613km survey section). Depth of lowering below MSB dipped below the 0.6m minimum level on 63 separate occasions. Sand wave action was an attributing factor for the shallow coverage. The most significant finding was a short section where the crown of the pipe had become exposed due to scouring action. The length of the exposure was 30m, between KP 3.391 and KP 3.421.

16" Lima to Juliet (PL82)
Depth of lowering below MSB for the pipeline remained almost entirely in excess of the 0.6m minimum level throughout the survey (> 99% of the 3.248km survey section). Depth of lowering below MSB dipped below the 0.6m minimum level at two locations. Shallow coverage of a 13m section at KP 3.391. The most significant finding was a short section where the crown of the pipe had become exposed due to scouring action. The length of the exposure was 12m, between KP 0.050 and KP 0.062.

12" Mike to Juliet (PL302)
Depth of lowering below MSB for the pipeline remained almost entirely in excess of the 0.6m minimum level throughout the survey (> 99% of the 3.515km survey section). Depth of lowering below MSB dipped below the 0.6m minimum level at two locations. Shallow coverage of a 15.3m section between KP 0.050 and KP 0.203. The most significant finding was a short section where the crown of the pipe had become exposed due to scouring action. The length of the exposure was 28m, between KP 0.048 and KP 0.076.

10" November to Kilo (PL402)
Depth of lowering below MSB for the pipeline remained consistently in excess of the 0.6m minimum level throughout the survey.

Future Geophysical Surveys

The following geophysical surveys have been scheduled in accordance with the approved Decommissioning Programme to ensure stability and safety for other users of the sea:

- Pipelines PL 81 and PL 82 in 2015 and 2017
- Pipelines PL 80, PL 302 and PL 402 once in 2016 or 2017

The scope and frequency of further surveys will be subject to a risk assessment and to be agreed in consultation with DECC.

7.5.5 Post-Decommissioning Environmental Survey

A post decommissioning environmental survey of the Indefatigable field was undertaken September-November 2012 to assess the status of benthic ecology at the Indefatigable field after completion of the decommissioning activities.
In total sampling was carried out at 72 stations (Figure 1), most of which were arranged in cruciform pattern centred on each of the five former installations (Juliet, Kilo, Lima, Mike and November) with an attempt to revisit historic sampling locations as far as practicable sampled at Inde Juliet in 2006 (Gardline Report No. 7034) and at Inde Lima in 1984-1986. Sampling at each station included four grab samples collected using 0.1m^2 dual van Veen grab, as well as still/video photography. Samples were analysed for a suite of physical, chemical and biological parameters. In some instances two types of analytical methodologies were employed to account for differences in historical analytical methods.

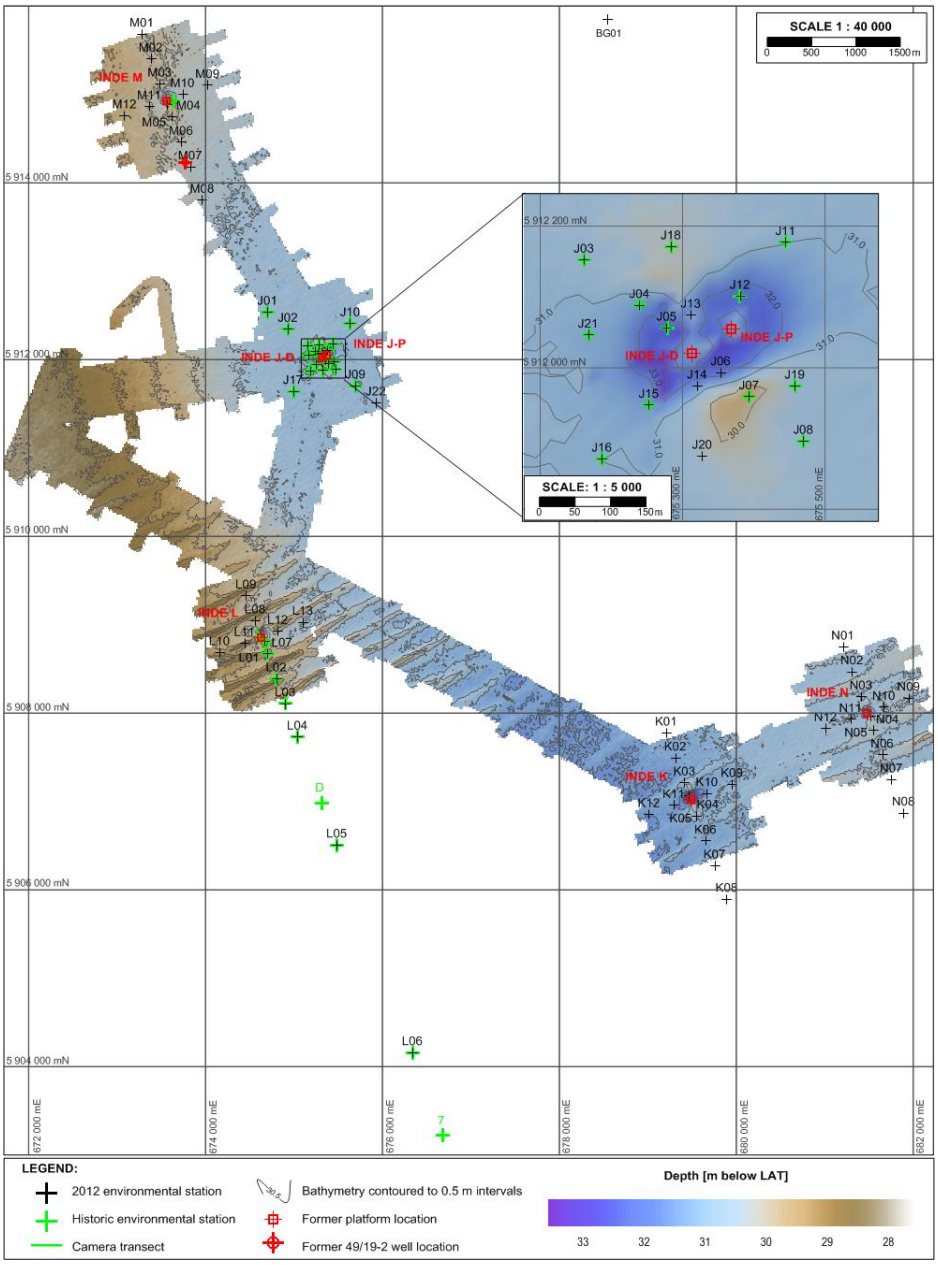


Figure1. 2012 and Historic Sampling Locations, Indefatigable Field

Full details can be found in the Fugro EMU Post Decommissioning Environmental Survey reports. UKCS Block 49/18, 49/19, 49/23 and 49/24 Indefatigable Field, Volumes 1-3.

Particle Size Analysis and TOM

Sediments in the Indefatigable field were dominated by sand at all stations (83.1-99.9% of sand). Subtle spatial differences in the proportions of the fine and medium sand fractions were observed between sites located to the shallower north and west of the field, and sites located in the deeper south areas. A subtle change in sediment type was observed in 2012 from the 2006 survey, as evidenced by decreases in mean phi and fines content, and increases in the proportions of sand-sized sediments . This change could be caused by the physical disturbance of the seabed sediments during decommissioning operations, particularly during the most recent clearance work, which caused re-suspension and subsequent winnowing of surficial fine sediments. Total organic matter was within 0.8 -3.9% range with 1.4% mean value.

Hydrocarbons

2012 total hydrocarbon concentrations (THC) were generally low to moderate throughout the Inde field, and ranged 0.9 – 8.3 µg.g^{-1} at all stations located 100 m and more away from the platform centres. The exception were 3 samples obtained within 50 m of the former platform centres of Inde Juliet, Lima and Mike, which recorded the most elevated THC of 16.6, 40.3 and 26.9 µg.g^{-1} respectively; (Figure 2). However these are still below the 50 µg.g^{-1} threshold above which significant environmental impact (SEI) is likely (UKOOA Phase 2 and 3 JIP). Above-background concentrations, defined as above SEA2 95th percentile, were limited to some stations within a 200 m range, GC traces at some of these stations showed evidence of substantially weathered historic OBM/LTOBM inputs. Comparison of 2012 results to historic data indicates a noticeable reduction in THC since 1986 (post-drilling) Inde Lima (Figure 3) and also slight decrease from 2006 pre-decommissioning THC concentrations at Inde Juliet.

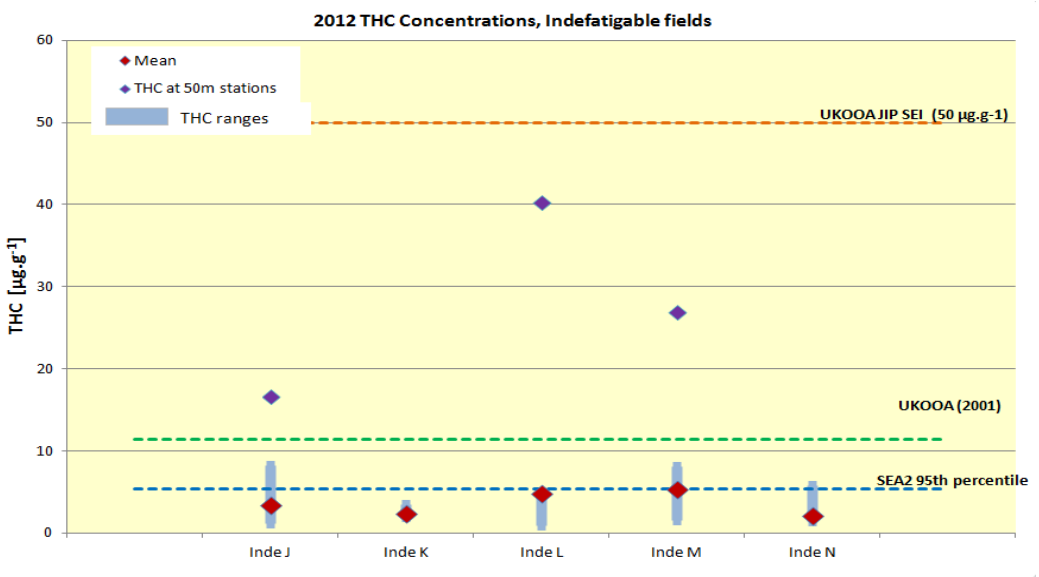


Figure 2. 2012 THC Concentrations, Indefatigable Fields

A slight increase in 2-6 ring PAHs was noted in 2012 at some Inde Juliet stations compared to 2006 pre-decommissioning survey which is attributed to exposure of less well weathered sediments by decommissioning operations. However, all 2012 2-6 PAHs were within the 28-353 ng.g^{-1} range which is below UKOOA 95th percentile (741 ng.g^{-1}).

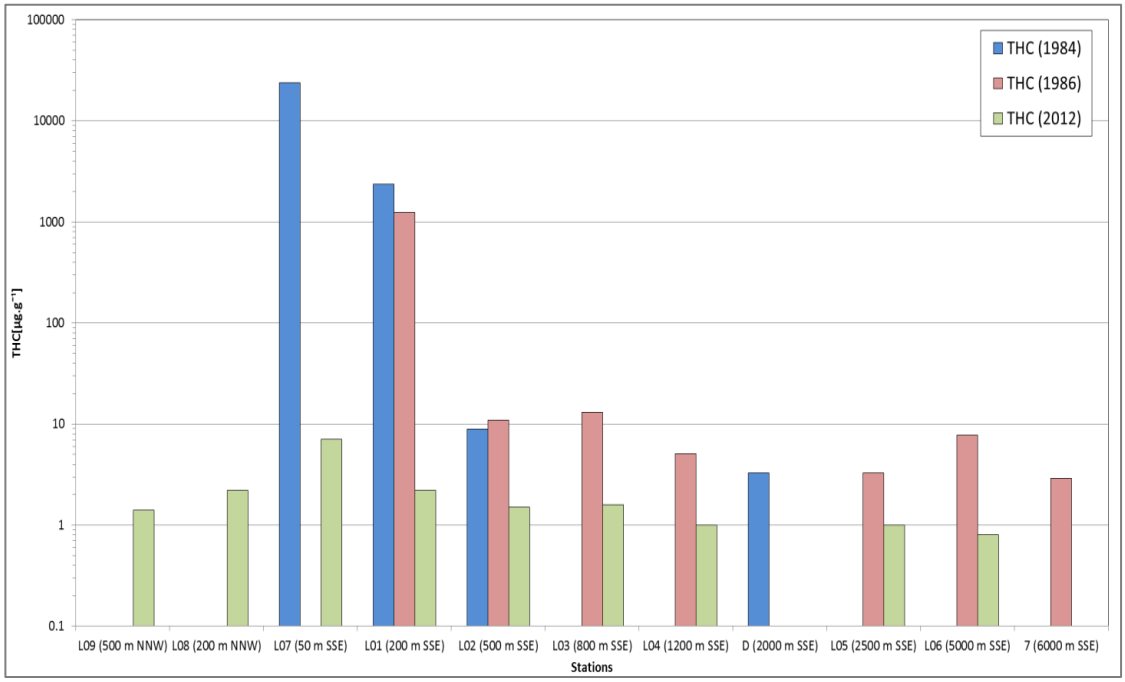


Figure 3. Comparison of THC Distribution between 1984, 1986 and 2012 Surveys, Indefatigable L

Heavy and trace metals

Concentrations of heavy and trace metals (Ba, Cr, Cu, Pb, Hg, Ni and Zn) were largely drilling related with elevated concentrations restricted to stations within 200 m range from the platform centres and with stations further away recording near-background levels. Heavy and trace metals associated with oil and gas activity persist in sediments longer than hydrocarbon contaminants, therefore levels within the vicinity of the former platform locations would be expected to be higher than background concentrations, however these are expected to be further dispersed or buried over time.

Fauna

A single distinct macrobenthic community was found in the Indefatigable field with slight variations in community structure across individual sites attributed to minor granulometric changes and low-level contamination at the individual sites, as evidenced by localised increases in the abundance of the pollution-tolerant opportunistic species.

Conclusions

The post-decommissioning environmental survey provided a consistent overview of the current status of the Indefatigable Field.
Comparison of 2012 data with 1986 post drilling survey at Inde Lima, recognizing sampling and analytical limitations, suggests that the sediments around the former Lima platform have largely recovered from historic inputs of OBM/LTOBM. Similar THC ranges and mean values were recorded at other Inde locations in 2012, providing evidence of sediments returning to the background condition. Review of pre- and post-decommissioning survey data for the Inde Juliet site (2006, 2012) showed only minor changes in sediment physical, chemical and biological characteristics, that could be attributed to re-distribution of the sediment during the decommissioning activities. However, the observed data and trends show evidence that the decommissioning operations did not have a significant effect on the sediment chemistry for a combination of drilling related hydrocarbons and metals, nor the benthic community structure. The results of the 2012 study are consistent with the expected recovery of sediments around older hydrocarbon fields in the Southern North Sea region. The survey recorded low level

contamination within 200 m from the former platform location, which was not detrimental to seabed fauna.
It is the opinion of Shell UK Limited that further environmental sediment surveys should not be required, as based on the recorded sediment status in 2012 and the evidence from the previous environmental surveys at the Indefatigable and other oil and gas fields in the Southern North Sea, it is expected that the observed trend of sediment recovery to the background levels will continue with time.

Shell UK Limited has submitted the 2012 post-decommissioning environmental survey results for DECC ODU review and consideration. Requirements for any further environmental monitoring work, and its scope and timing, if such survey is deemed necessary, will be agreed with DECC.

References:
FUGROEMU 2013. Post Decommissioning Environmental Survey UKCS Block 49/18, 49/19, 49/23 And 49/24 Indefatigable Field, Survey Period: 5 September to 11 November 2012, Fugro EMU/Report No.: J/2/25/0172.4V1.2, Volume 1 of 3 - Synthesis of Data.

FUGROEMU 2013. Post Decommissioning Environmental Survey UKCS Block 49/18, 49/19, 49/23 And 49/24 Indefatigable Field, Survey Period: 5 September to 11 November 2012, Fugro EMU/Report No.: J/2/25/0172.4V1.2, Volume 2 of 3 - Site Reports.

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UKOOA 2001. An analysis of UK offshore oil and gas environmental surveys 1975-95.

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UKOOA Report No. 2004/197, “UKOOA phase III - characterisation of Beryl, Brent A, Brent S,

Clyde and Miller cuttings piles through field work, laboratory studies and chemical analysis”

7.5.6 Notifications

The following bodies have been informed about the decommissioned status of the Indefatigable field:

- The UK Hydrographic Office (UKHO) have been notified of the changes at Indefatigable and have acknowledged these and have revised the charts after the safety zones had been revoked.
- Kingfisher Information Services (KLTC) have been notified that the seabed is clear.
- The Marine Coastguard Agency (MCA) have been notified

8. Cost

The cost figures are presented in a similar manner as presented in the Decommissioning Programme, which was approved by DECC on 6th August 2007. The costs for decommissioning the wells are not included in below listed table.

8.1. Cost Summary for Removal and Disposal

		Estimate as presented in Decommissioning Programme £ Million	Actual Cost £ Million
Programme One	**Topside and Jacket Removal (Juliet, Kilo, Lima, Mike and November**	**£ 51.1**	**£ 137.6**
Programme Two	**Interfield Pipelines (PL82, PL302, PL402 & PL303. Hose Bundles PL479-487)**	**£ 5.8**	**£ 13.5**
Programme Three	**Export Lines to Perenco23AT Platform (PL80, PL81)**	**£ 4.4**	**£ 3.7**
Total		**£ 61.3**	**£ 154.8**

The explanation to account for this difference is the fact that the cost figures, as shown in the Decommissioning Programme, were taken from an old estimate (~2003) and had not been corrected for inflation and actual cost data applicable for the decommissioning market.

9. Schedule

9.1. Execution Strategy

The execution strategy was to balance the following drivers:

- Avoid prolonged delay, which would extend safety exposure and incur operational costs.
- Allow maximum flexibility in timing for contractors in order to optimize costs.

It was an obvious choice to start off with the well abandonment program. Drilling rigs had been scheduled for the first two well P&A campaigns. These drilling rigs were contracted by the OneGas asset. The Inde project was used to fill the gaps in the drilling sequence. The wells of remaining 3 platforms were in the plan to be plugged and abandoned as per the rig-less concept. A prerequisite for this concept was the availability of an accommodation vessel. Part of the strategy was to utilize spare beds on the drilling rigs and accommodation vessel for pipeline cleaning, facility make safe work and pre-lifting work.

The intention was to give schedule flexibility to the facility removal contractor to allow operations to be carried out between 2008 and 2012 to assist resource availability.

Final timing was dependent on availability of equipment for decommissioning of the wells and marine vessel spread for removal of the platforms. The proposed schedule of activity is shown below. The indicative program provided relatively wide windows for offshore activities, which were not necessarily continuous, but indicated timely removal. The timings and durations were also indicative.

9.2. Initial Overall Schedule

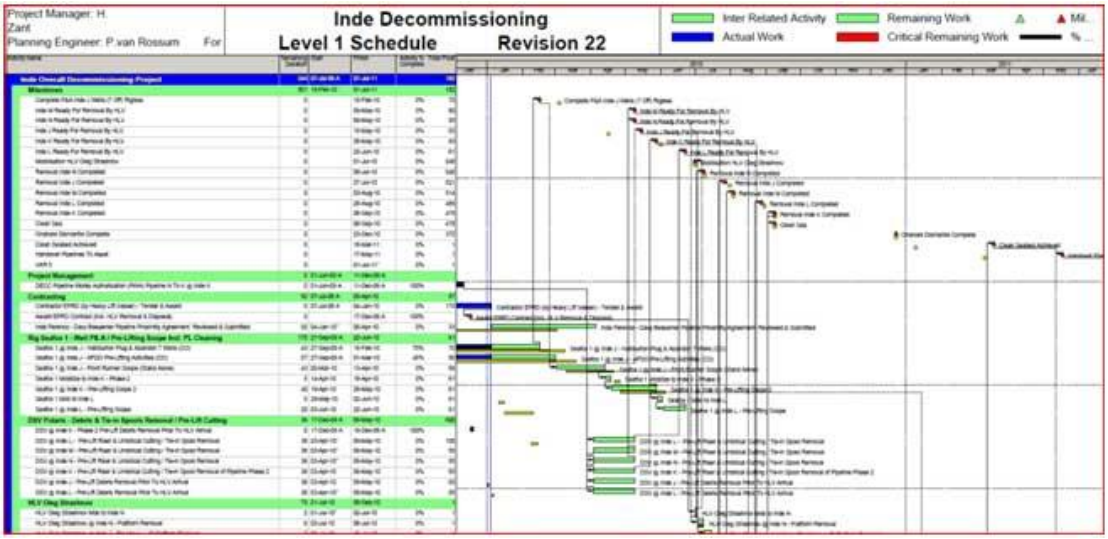
Well decommissioning on Inde Mike commenced in April 2006 and all wells were scheduled to be completed during 2009. The earliest start of module segregation and pre-lifting work was scheduled for summer 2008, allowing the first modules to be removed in summer 2008.
Part of the plan was to provide maximal schedule flexibility to the heavy lift contractor. The schedule, shown below, is the schedule which was also part of the Decommissioning Program. The indicative program provided relatively wide windows for offshore activities, which were not necessarily continuous, but indicated timely removal.

9.3. Make Safe Schedule

The making safe campaign window was from 2006 through 2008.

9.4. Pre-Lifting Schedule

The basis for the pre-lifting schedules, which were prepared by AF- Decom, was the following overall schedule prepared by Shell. This schedule has been updated on a regular basis.



The fundamentals of above planning were that all platforms have been prepared for lifting before the heavy lift vessel Oleg Strashnov arrives as per contract as from the first of July 2010.

Scheduled dates from above plan:

- All risers and umbilicals cut during the DSV campaign planned from 3 April through 9 May 2010.
- Inde November ready for lift on 9 May 2010.
- Inde Mike ready for lift on 9 May 2010.
- Inde Jukiet ready for lift on 15 May 2010.
- Inde Kilo ready for lift on 22 May 2010.
- Inde Lima ready for lift on 22 June 2010.

The last platform Lima was ready on 31 July 2010, which was still in time to match the lifting schedule.

9.5. Lifting Schedule

The contractual lifting window was set from July 2010 till October 2011. The following removal completion dates were scheduled on the basis of a start of 1st July 2010:

- Removal of Inde November completed on 8 July 2010.
- Removal of Inde Juliet completed on 27 July 2010.
- Removal of Inde Mike completed on 3 August 2010.
- Removal of Inde Lima completed on 26 August 2010.
- Removal of Inde Kilo completed on 5 September 2010.

The removal activities have been postponed till 2011 due to the late availability of the new built heavy lift vessel the Oleg Strahsnov. The work was finally executed with the Stanislav Yudin. The removal work started in the Inde field on 15 March 2011 and finished on 11 July 2011.

The actual durations were as follows:

	Offshore Days Work	Offshore Days WOW	Offshore Days Total
November	12	3	15
Juliet P	6	7	13
Juliet D	16	12	28
Mike	7	5	12
Lima	12	2	14
Kilo	17	8	25
Total	70	37	107

9.6. Onshore Dismantling Schedule

The first operational activity of dismantling was receiving the barge, followed by the offloading of the structures with SPMT's. This was a critical activity because the four barges had to be used twice. The contractual established offloading period was set at 7 days in order to match an ambitious turn-around-time of the barge of 28 days. This turn-around time includes: sailing to Wallsend (Newcastle), waiting for favorable weather and tide for offloading, offload the structures, install barge furniture, sail to contractor to modify grillages and sea fastening for the next structures and sail back to Inde.
All 8 barges have been offloaded in the period between 30 March 2011 and 17 July 2011.
The dismantling and disposal was completed by 15 December 2011.

9.7. Sub Sea Schedule

The main drivers for the subsea schedule were timely completion of following activities:

- Debris clearance prior to arrival of jack-up vessel on any of the Inde locations. The planning was to have cleared the leg location area 2-4 weeks prior to arrival of the vessel.
- Riser and umbilical cutting at least 1 month prior to arrival of the heavy lift vessel.
- Digging holes around the legs of Inde Kilo in support of the external cutting of the legs, 2 till 3 months prior to arrival of the heavy lift vessel on Kilo.
- Finish all pipeline remediation work and umbilical removal prior to start of the final seabed clearance.

9.8. Debris Clearance Schedule

The debris clearance and verification sweeps with the fishing vessel Farnella started on 8 June 2012 and finished on 27 July 2012. All areas were declared clean, except for the November location where an obstruction was observed. It appeared that the new pipeline end, which was trenched in order to lower it into the seabed, was still exposed. The exposed pipeline was removed in October 2012. A secondary series of bi-directional sweeps over the Inde November 500 meter zone was executed in June 2013 and no obstructions had been encountered.

A Clean Seabed Certificate for the 5 decommissioned Inde 500 meter safety zones was received from the National Federation of Fisherman's Organizations on 8 August 2013.