Walking the Line uncovered more and more temporary repairs

The Shell internal investigation into the conduct of then Managing Director Malcolm Brinded and the Oil Director Chris Finlayson in 1999 found when it reported in July 2005 to the Shell CEO of the new combined Shell Company Royal Dutch Shell (RDS) no evidence that the immediate actions raised in 1999 to reduce the unacceptable levels of risks associated with these repairs were undertaken. This can not come as a surprise to the reader given the data provided to HSE in November 2003, refer to Bundle B1 and B2. In these few pages the reader can travel through evidence from 1999 to observe beyond reasonable doubt that the failure of Directors to prevent unauthorised temporary repairs was a root cause of the deaths in 2003. This is accepted by the Crown, the then Lord Advocate Elish Angolini, wrote to the MSP Christine May, to say that a factor in the deaths was the haphazard management of such repairs over a prolonged period.

After the fatalities in 2003, operators were overwhelmed by a tsunami of repairs that had been carried out on pipes, so many they were instructed to walk every line by their Production Director Greg Hill, the more they looked, the more they found.

By the time Shell reported this situation to HSE early in November only days after the fatalities they had uncovered 472 temporary repairs, 214 of which were not approved, 73 of which were in hydrocarbon service.

Taken on average, over the period of circa 208 weeks Sept 1999 – 2003, a repair was taking place somewhere in the Shell offshore operations in their Northern and Central fields every 3 days with an unapproved repair circa every 7 days and with an unapproved and potentially defective repair being carried out on hydrocarbon pipe every three weeks.

So 73 losses of containment (dangerous occurrences) happened when hydrocarbon pipes leaked from holes in the walls of paper thin pipes, one dangerous occurrence every three weeks or so over the prolonged period 1999 – 2003. Many, if not all, were not reported to the HSE in breach of the Regulations pertaining to the reporting of such events.

The paragraphs below refer to the attached documented evidence in Bundle C

> **In 1999 the Oil Director Chris Finlayson and his MD Malcolm Brinded were clearly warned that action needed to be taken to reduce risk**
>
> **In Doc (1A and 1B) Directors are made aware in October 1999 that hydrocarbon pipes are failing and are being repaired on a temporary basis to allow production to continue. Many such repairs are not approved by a technical**

authority; no register of repairs is being maintained, all in breach of Shell Codes of Practice and the respective Safety Cases. The Note is sent from the Internal Audit Manager UEFA to the Oil Director Chris Finlayson UED.

In Doc (2) and (3) (AS stands for Audit Services, the then Shell Expro Internal Audit Department) it is pointed out in these confidential internal audit documents in 1999 Directors that quote no person appears to have an overview of the collective loss of containment risks associated with leaks from hydrocarbon pipes unquote – what we are witnessing is a band-aid approach, when a pipe fails, fit a temporary clamp, and then another clamp, and then another, repeating this process over and over again. Breaking all the rules in the book Asset Managers were doing what they liked to keep production going

Doc (3) highlights that the Asset Manager was carrying out many changes to plant and equipment without prior approval, pipe repairs were just one such example, to change the design without prior approval had become the norm. This was in violation of Shell Codes of Practice and a serious breach of the offshore installation Safety Cases

Over the month from the fatalities in Sept 2003 until November, the operators were requested by the then Production Director Greg Hill to walk every line. During this period the effected installations continued to operate with materially defective repairs similar to the one involved in the deaths on Brent Bravo.

In Doc (4) we see the results after the fatalities of the band-aid approach, hundreds of repairs half of which are not approved and Doc (5) indicates that at least 8 of the temporary repairs were found in a similar condition to that which caused the fatalities on Brent Bravo

Unapproved temp repairs was a pan Shell Expro problem, there was a shortage of technically competent staff to assess these repairs. In Doc (6) we see that temporary repairs are not just a problem in the Brent field but a problem all over the oilfield. The data shows the position on 18 offshore installations. On some of these installations like Gannet none of the repairs had been approved.

What the public Inquiry found on Brent Bravo

In Doc (7) the Sheriff reports on the background to the materially defective unapproved repair that was involved in the fatalities. A month before the fatalities this pipe repair is leaking badly so we have by definition a dangerous occurrence, a leak into the atmosphere from a line containing hydrocarbons. The urgency to do something is accepted but nothing is done. As an example of production taking precedence over safety no consideration is given to ceasing operations to stop the leakage into an enclosed space. On Brent Bravo there were 16 other unapproved temporary repairs.

The Sheriff determines in Doc (8) that the fatalities might reasonably have been prevented if this repair had been approved and thus not materially defective. The Sheriff was not made aware of this evidence because Shell and HSE colluded to withhold it from the public inquiry.

Duty to conform with safety case

In June 1974 a massive explosion at a chemical plant in Flixborough killed 28 operators. The root cause of the explosion was loss of containment from a temporary bypass pipe. This accident was the precursor for the use of Safety Cases per se and the mandatory requirement in hazardous process and plant to have rigorous procedures to control changes to plant and equipment. Shell has such a change control policy. It states in its Safety Management Section of its Safety Cases that any change to plant and equipment MUST be approved in advance of the change by a competent person, in Shell parlance a technical authority.

So the legal position is not disputed. The Duty Holder covers the use of this key procedure in the Safety Management System of the Brent Bravo, and all other Safety Cases for that matter. Shell had a duty to conform to its Safety Case and Regulation 16 of this suite of legislation states that they should ensure that the procedures and arrangements described in the current safety case which may affect heath or safety are to be followed. But in 73 instances it carried out temporary repairs to hydrocarbon carrying pipes with no prior approval, so 73 times it was in breach of Regulation 16, on 9 occasions these repairs were found to be materially defective, including the repair which initiated the fatalities on Brent Bravo.

What were the risks associated with this failure

This has to be assessed from historic data. So the facts are that loss of containment caused 167 deaths on Piper Alpha and 2 deaths on Brent Bravo. If the 6000 + cubic metres of gas had ignited in the enclosed leg of Brent Bravo on 11 Sept 2003 the potential for many more deaths and associated damage to the installation was present. As stated an average over the period 1999 – 2003 some 73 unapproved repairs were carried out on hydrocarbon carrying pipes. You cannot have a dangerous occurrence by HSE definition every three weeks on average and dispute that the lives of those persons employed on up to 20 installations were not at unacceptable levels. As it was 9 materially defective repairs were found including the one on Brent Bravo.

Although HSE officials were aware that violations of this key change control procedure was common both in 1999 and 4 years later in 2003, not just on Brent Bravo but throughout the Shell offshore operations no enforcement actions were taken in 2003 and no prosecutions followed other than on Brent Bravo.

Shell Expro
Platform Safety Management Review (PSMR)
A Briefing Note (20/10/99)

To: UED/UEG
From: UEFA

Purpose of this Briefing Note

To highlight immediate concerns arising from the PSMR in advance of the final Level 1 Review Report. The subsequent Level 1 report will provide more detail and also highlight observed areas of best practice.

Interim Opinion / rationale

There are significant weaknesses in essential controls, which require senior management attention.

Resources and Standards
Following the transition to Enhanced Expro (post technical function) there is a strong reliance on the corporate 'glue' being provided by Process Owners Forums (POFs), supported by service providers in UESC and UESE to set and review standards. However POFs have varying effectiveness - in some cases they actively review and set standards whereas in others the role is largely passive. POFs will offer advice when requested however the Asset Manager can reject such advice if they so wish. Most notably, in the context of this review, there was evidence of the Maintenance POF having raised serious concerns within the organisation but these concerns remain. In addition, the effectiveness of the POFs in proactive skill-pool management remains an area of weakness.

Safety Case Management and Risk Assessment
Under the Safety Case legislation Duty Holders are expected to demonstrate in their day to day operations that the risks on their offshore installations are ALARP. On Brent Bravo for example, with a POB of 156 there were high activity levels, combined with equipment operating outside its design envelope, a significant number of overrides and other weaknesses in direct controls including inappropriately authorised changes to safety critical equipment. However the Asset Management team could not clearly demonstrate a holistic approach to the management of risk on the installation. Our concern is that other platforms may be operating at risk levels above ALARP, and the possibility is that these risks could be exceeding threshold values.

There were also concerns on the rigour of the decision making process around approval of design changes. In some instances persons approving such changes (including operating outside the design and operations envelope) may not be sufficiently experienced or adequately informed to take such decisions.

People within the organisation are taking decisions in isolation which may not appear unreasonable, but after the event could have severe implications e.g. changing ESDV leak-off test criteria from 1 scm/m to 4 scm/m to 20 scm/m. Also, where equipment fails to meet its performance criteria, simply relaxing the standard seems to have become a normal response. No evidence was found of cases where hardware modifications are made to enable equipment to subsequently meet its original standard.

Procedures
Under interview, recognition and acknowledgement of violation of procedures by people is variable. However review of hand-over notes indicates that violation is common. Many such violations are apparent to the general workforce. This would be a serious reputation issue after a major event. People are coping, and to cope sometimes means to violate. Violations observed varied in severity from procedural non-compliance (Permit System) to operating plant outwith its design and operating limit. In one specific case

involving operation of an oil separator, the violation was known about and accepted up to the level of a Senior Manager. There was evidence of false and misleading information in maintenance records for safety critical equipment, for example the Brent Bravo ESDV which failed its leak-off test in April 1998 was recorded as 'NO FAULT FOUND'.

Implementation and Performance Monitoring

PFEER Examination and DCR Verification Schemes

The general level of understanding of these schemes throughout the organisation is poor and even encompasses the limited knowledge of some people who work the process on a day to day basis. A significant concern is the effectiveness of the PFEER process. This is a statutory scheme ensuring that PFEER safety critical elements on an offshore installation are examined and tested in accordance with the Duty Holders' published performance standards. A number of offshore systems can not currently meet their published performance standards. These standards in turn are being relaxed with no demonstration of a robust assessment of the risks involved. There is also divergence in standards being applied pan Expro e.g. leak-off testing for riser ESDV's. Where cited in the Duty Holder's written scheme, the 2nd Party Verifier (UESE/6) should validate and approve any changes to these performance standards but this does not always happen. Concerns expressed to the review team by an independent PFEER examiner included pressure being exerted to sign off non-compliance's. Evidence was obtained of a report being signed off prior to remedial actions being undertaken.

Maintenance Non-compliance

Sampling revealed many examples of non-compliance with safety critical and other routine maintenance. Much of this non-compliance appears driven by the requirement to prevent production deferment. As an example, the process for authorising deferments in NBU had significant weaknesses (now being revised). Changes in reporting parameters resulting from the introduction of SAP-PM have served to highlight the non-compliance issue (in the sense that 'true compliance' is now monitored and reported). However the general prevalence of non-compliance is not directly attributable to SAP.

Technical Integrity Reporting and Overview

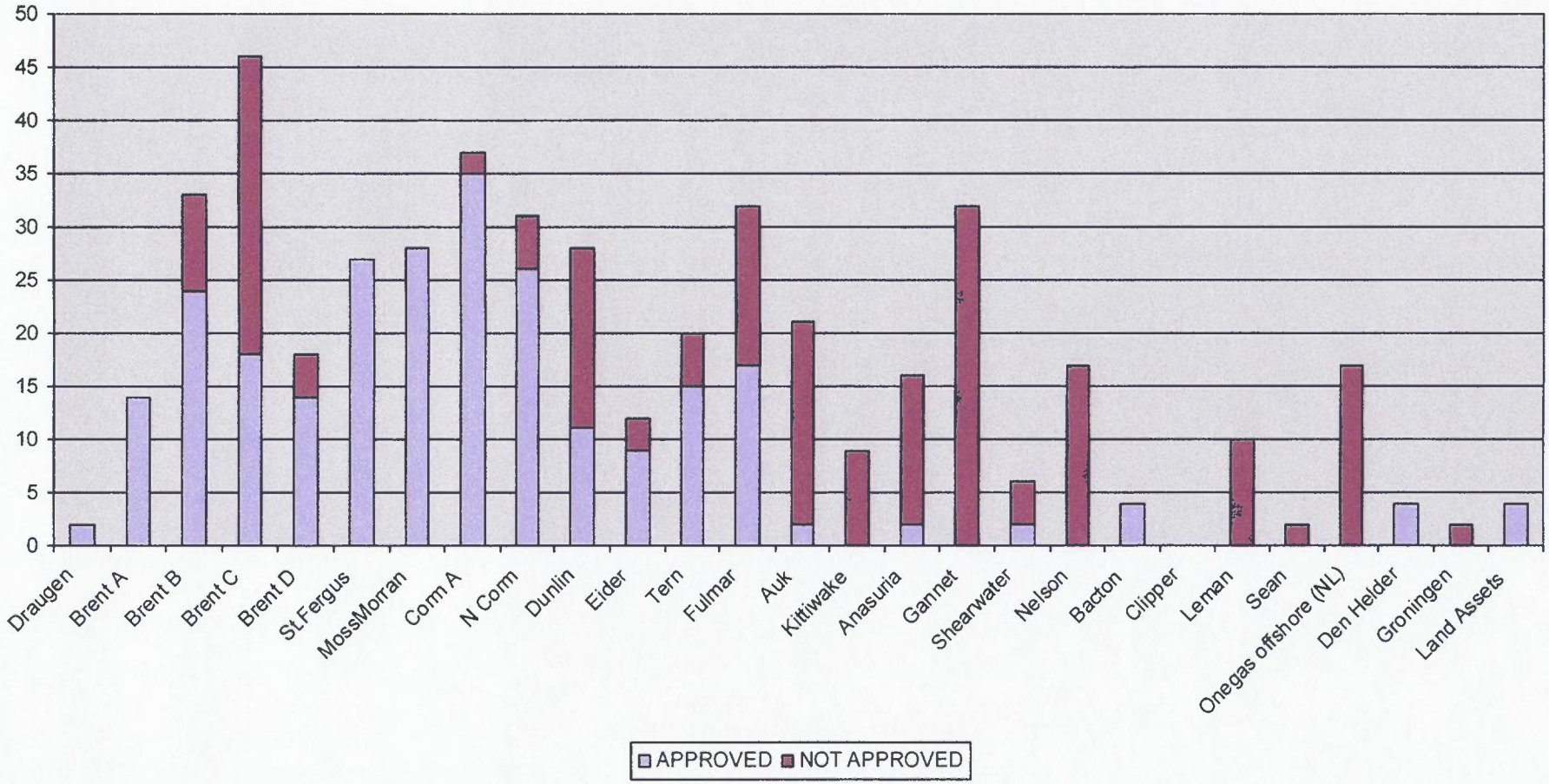
Based on fieldwork in the Northern Business Unit, Technical Integrity information given to Managers is fundamentally flawed. There is no data validation at source by the people compiling the NBU report. Key performance indicators lack clear definition (e.g. gas release) and acceptable control limits have not been established (e.g. number of overrides on a specific installation). **No person at any level in the organisation appears to have a concise overview of the technical integrity status of a specific offshore installation, (e.g. collective picture of loss of containment risks due to clamps, thin wall pipework, etc at any moment in time.)**

Note – circulation of the Briefing Note

UED and UEG are the Oil and Gas Director, Chris Finlayson and Tom Botts respectively

UEFA is the Internal Audi Manager

OVERVIEW OF TEMPORARY REPAIRS



What Directors were told about temporary repair and patches on 22nd October 1999, by their Audit team

- Another warning that went unheeded -

Extract from a viewgraph used at the management presentation of the Audit findings to the Shell Expro Leadership Team including the Oil and Gas Director at Tullos on 22nd October 1999

In our ageing assets there is increasing use of temporary clamps, due to pipe-work reaching minimum allowable wall thickness

Our corrosion management data is out of date, so who has overall responsibility for this within our business?

INCLUDES NUMBER OF UNAUTHORISED TEMP REPAIR

Sampling revealed many examples of non-compliance with safety critical and other routine maintenance. Much of this non-compliance appears driven by the requirement to prevent production deferment. As an example, the process for authorising deferments in NBU had significant weaknesses (now being revised). Changes in reporting parameters resulting from the introduction of SAP-PM have served to highlight the non-compliance issue (in the sense that 'true compliance' is now monitored and reported). However the general prevalence of non-compliance is not directly attributable to SAP.

Technical Integrity Reporting and Overview

Based on fieldwork in the Northern Business Unit, Technical Integrity information given to Managers is fundamentally flawed. There is no data validation at source by the people compiling the NBU report. Key performance indicators lack clear definition (eg gas release) and acceptable control limits have not been established (eg. number of overrides on a specific installation). No person at any level in the organisation appears to have a concise overview of the technical integrity status of a specific offshore installation, (eg. collective picture of loss of containment risks due to clamps, thin wall pipework, etc at any moment in time.)

Incident Investigation

The PSMR was triggered amongst other things by the M3E incident on Cormorant Alpha. The Review sponsors harboured concerns with regard to the initial investigation possibly having failed to identify all the root causes. Following the PSMR Level 2 Audit on Cormorant Alpha, the audit team considered it necessary to explore in more detail the earlier investigation process and the follow on actions. Our key finding is that the real root cause might not have been established prior to disciplinary action being taken, and thus the overall process was unsound. Three months after the incident the Audit Team observed that elements that contributed to the M3E incident were still very much in evidence, e.g. poor planning, overload and limited effectiveness of supervision. The decision to invoke the disciplinary process following the Brent Bravo LSA scale incident (where individual workload and pre-planning were contributing factors mitigating against the errors made) is additional evidence of deficiencies in the incident investigation process. In general, underlying causes of incidents are not always being established, and in some cases not being sought out.

Audit and Management Review

Audit Process

The PSMR has reaffirmed concerns previously expressed about an increase in control weaknesses pan Expro (1998 Audit Services Review et al) and also the effectiveness of the Audit process in counteracting these increasing trends. The behaviour appears to be that Auditees expend greater effort on debating significance and wording of the findings rather than focus on addressing the identified control weaknesses. This is further reflected

Hazard Management Process

Safety Case Management and Risk Assessment

Under the Safety Case legislation Duty Holders are expected to demonstrate in their day to day operations that the risks on their offshore installations are ALARP. On Brent Bravo for example, with a POB of 156 there were high activity levels, combined with equipment operating outside its design envelope, a significant number of overrides and other weaknesses in direct controls including inappropriately authorised changes to safety critical equipment. However the Asset Management team could not clearly demonstrate a holistic approach to the management of risk on the installation. Our concern is that other platforms may be operating at risk levels above ALARP, and the possibility is that these risks could be approaching threshold values. The Level 1 Review could not clearly establish either the process or the people with single point accountability for assessing on an ongoing basis the risks of operating offshore installations. Although risk consequences associated with individual changes may be assessed, in the absence of an appropriate overview, the cumulative effect may not be fully evaluated. There were also concerns on the rigour of the decision making process around approval of design changes. In some instances persons approving such changes (including operating outside the design and operations envelope) may not be sufficiently experienced or adequately informed to take such decisions.

There is much evidence of up-front effort expended on assessment of business risks - a notable example is the transition risk register that was developed in advance of changeover to the enlarged NBU. However issues highlighted by this PSMR indicate that a number of these risks were not successfully mitigated. In addition, a significant risk category that is not evident on radar screens is the associated threat to reputation arising from hazard management issues and decisions. People within the organisation are taking decisions in isolation which may not appear unreasonable, but after the event could have severe implications e.g. changing ESDV leak-off test criteria from 1 scm/m to 4 scm/m to 20 scm/m. Also, where equipment fails to meet its performance criteria, simply relaxing the standard seems to have become a normal response. No evidence was found of cases where hardware modifications are made to enable equipment to subsequently meet its original standard.

Planning and Procedures

Planning

Planning effectiveness varies in quality. On platforms with high levels of activity there were differing resources. Some have offshore-based planners, others have not. There was evidence of too much planning still being done offshore by those primarily responsible for implementation. The situation is often compounded by late deliverables, itself a likely consequence of reduction in onshore resources. Some platforms are clearly driven from onshore. This approach does not always enable the incremental HSE risks

Sept. 2003: **What was reported to the Production Director by his post fatality Review team that so 'horrified'* him?**

The exercise identified a total of **472** temporary repairs of which

- 205 were Hydrocarbon service
- only 258 were 'approved'
- 214 were 'not approved' of which 73 or 30% were in hydrocarbon service
- * On 31st of August 2006 at a meeting with the Head of the OSD (HSE) in Aberdeen, and the OILC, the author was informed that the Shell Production Director had presented the results of his post fatality review to them in October 2003. They quoted him as saying at the time that he was 'shocked and horrified' when first presented with these findings by his post fatality Technical Integrity Review team in Aberdeen

After the Fatalities the Shell Production Director so 'shocked and horrified' by his Review Findings asks for operators to check, and check again, by walking every line

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Shell Aberdeen Production Director Note of 18/9/2003 in relation to the findings of his internal review into the status of temporary repairs (extract)

Quote from Production Directors e-mail.....

- In light of these findings, I am requesting you to complete the following actions. It is my expectation that these have been done in the ordinary course of business. However we need to ensure that all procedures have been properly carried out, and hence this request:

  - Re-check all temporary pipe-work repairs. This means that you must satisfy yourself that all "lines have been walked" to identify all temporary repairs on pipe-work. For each of those repairs I expect you to record the location, type of service, and the integrity of the patch;

  - For each repair, also indicate approval status by the appropriate internal authority, the expiry date of the approval, compliance with the inspection program, and your plans to effect a permanent repair;

Witness an a further exponential rise in temporary repairs and patches

Sept. 2003: **More and more repairs!**

- The initial exercise triggered another bow wave of deviation requests in the former Expro Assets to secure technical approval

205 such requests processed from 12-30 Sept of which

- 162 were 'new' approved
- 35 were extensions to existing approvals where expiry was imminent
- 8 were rejected by the Technical Authorities as being not acceptable

Temporary repairs in relation to the Fatalities - what did the Sheriff say!

You need to question how can the Shell CEO claim a vigorous and effective response to the 1999 Audit when the cause of the deaths was due to a generic deficiency highlighted to Directors 4 years earlier?

- The leaking temporary patch which caused the accident was first observed to leak on 17th August 2003. The leak caused a gas sensor to go into alarm at low level, so the operators were aware at that time that the leak from the De-Gasser rundown line was volatile

- On 21st August, 2003 the operation supervisor's written hand-over noted that the temporary patch in question has failed and is leaking badly and he was trying to locate a replacement spool

- A highest ranking of 1 was given to the matter - it had to replaced urgently by a replacement spool within one month but this was not accomplished

- As a direct result of this two men died on 11th Sept 2003, when they attempted to effect a repair on this patch releasing significant hydrocarbon vapour into the shaft

15. DETERMINATION

In terms of Section 6(1) of the Fatal Accidents and Sudden Deaths Inquiry (Scotland) Act 1976 I find as follows:-

(a)..... Sean Scott McCue, born 2 August, 1981, who resided at Springbank Cottage, Hallfields Court, Kennoway, and Keith Scot Moncrieff, born 20 December, 1957, who resided at 108 Main Street, Invergowrie, Tayside, both died sometime between 15.30 hours and 19.55 hours on 11 September, 2003 on the Brent Bravo offshore platform situated in Quadrant 211, Block 29 at Latitude 61 degrees 03 minutes 21.031 seconds North, Longitude 01 degrees 42 minutes 47.155 seconds East in the United Kingdom sector of the North Sea Continental Shelf.

(b)(i)... The cause of death of both Sean Scott McCue and Keith Scot Moncrieff was inhalation of hydrocarbon vapours;

(ii)... The cause of the accident which resulted in the deaths of both men was the release, and vaporation, of liquid hydrocarbons through a hole, caused by corrosion, in the closed drain degasser rundown line within the utility shaft of the Brent Bravo offshore platform.

UNAPPROVED TEMPORARY CLAMPS & PATCHES

(c)..... The accident which resulted in the deaths of Sean Scott McCue and Keith Scot Moncrieff might reasonably have been prevented if:-

(i)..... an appropriate temporary repair had been applied to the hole on the closed drain degasser rundown line such as a fully engineered repair and not a repair using a neoprene patch and jubilee clips;

(ii)..... the temporary repair had been appropriately managed in order that a replacement spool could have been fitted within a reasonable time on a section of a safety critical line which was known to be corroding;

(iii)..... the permit to work system had been followed which would have involved a risk assessment resulting in an isolation and drain down of that section of the closed drain degasser rundown line prior to any attempt to remove the neoprene patch.

(d)..... Defects in the system of working which contributed to the accident which resulted in the deaths were:-

VIOLATION OF PERMIT TO WORK SYSTEM