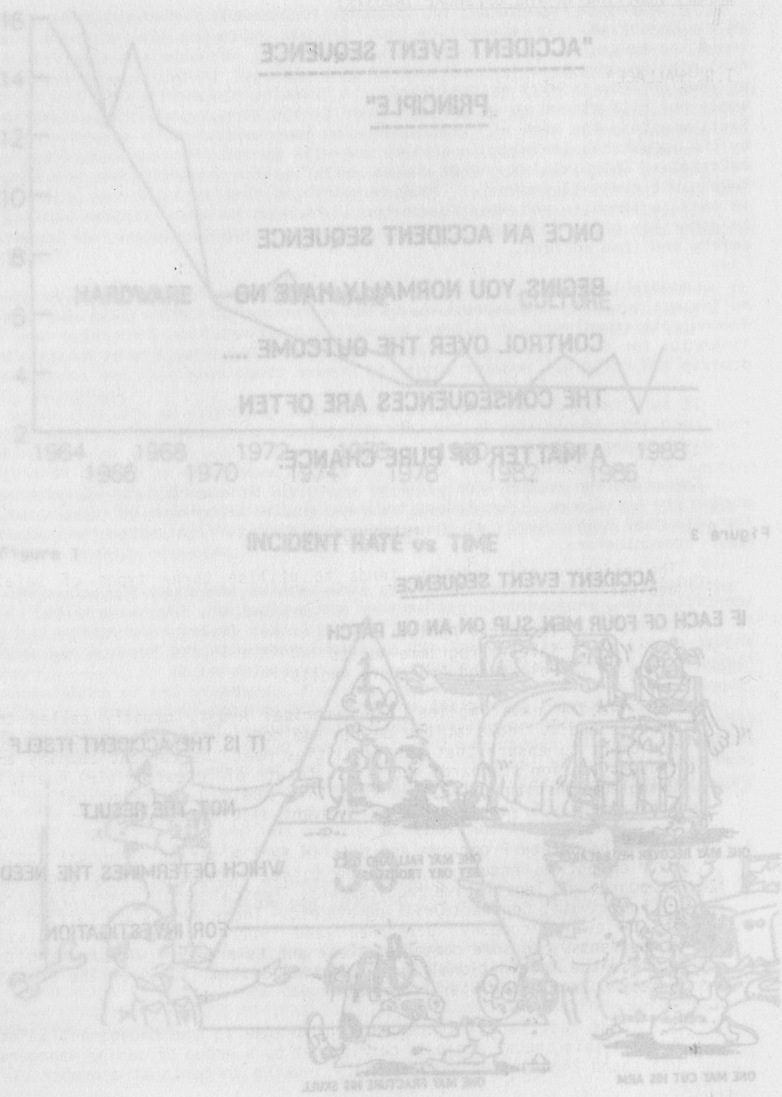

SAFETY AUDITING IN THE OFFSHORE INDUSTRY

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1.0. INTRODUCTION

The offshore oil industry tends to utilise three types of safety audits:

Technical Audits
Safety Programme Audits
Policy and Procedure Audits

As the name implies, the Technical Audit, usually called the Process Audit, looks at the design and construction standards of the equipment to ensure that the facilities meet the current company and industry design standards such as Institute of Petroleum (IP) American Petroleum Institute (API), etc. This Audit is carried out on an approximately 5 yearly cycle by relevant discipline engineers.

The Safety Programme Audit is in fact a series of annual audits carried out to ensure we continue to meet company safety programme standards and legislative requirements. Typical audits cover Training, Radioactivity, Contract Drilling etc etc. These audits are carried out by relevant company personnel and where appropriate outside consultants. In some companies these audits are very wide ranging and utilise the International Safety Routing System (ISRS) or the British Safety Council Five Star Programme.

The last facet of the audit programme is the Management Safety Audit. This annual audit is carried out by a group of senior managers, who spend 24 hours on each facility looking in depth at a number of

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safety procedures and programmes to establish whether the policy/programme is relevant, implemented properly, being effective and to identify problem areas or changes needed for the future. The audit allows the facilities to be given credit for the good things that they are doing and senior management gains an appreciation of the problems being encountered in achieving a safe operation and confidence that the facilities are in fact well managed.

2.0. SAFETY AUDITS

As already explained in the introduction, the Industry operates 3 types of safety audits:

1. Technical Audit (or Process Audit)
2. Safety Programme Audits
3. Policy and Procedure Audits (or Management Safety Audits)

The first two are fairly standard and will be familiar to many other companies so that I do not propose to go into too much detail about them. However, the Management Safety Audit is only used by one or two other North Sea Operators, as far as I am aware, and so it may be of much wider interest and I have therefore devoted the bulk of my paper to this technique.

3.0. TECHNICAL AUDIT (PROCESS AUDIT)

The Process Audit programme results from an awareness that the production process is continually changing with changes in the reservoir characteristics. In addition technology steadily improves so that what was considered safe and satisfactory a few years ago may now not be considered prudent. In addition new techiques for assessing safety are developed as time passes. That is not to say that modern techniques are not utilised on these older facilities however the new techniques tend to be applied progressively to solve specific problems or in response to specific incidents. It is therefore appropriate at intervals to stop and take stock of the overall situation and see how we would design the overall facilities at that point in time. Where we identify differences between the existing facilities and the current theoretical design we assess the effect that the differences have on safety and implement them in the short term, incorporated them in the long term plan or justify why it is not necessary to implement them.

The latest audit that I have been involved in covered the following areas:

1. API RP 14C compliance
2. Platform Logic, Cause and Effect Chart and Emergency Shutdown Valve Review.

3. Area Classification
4. Pressure Safety Valve/Flare Header Capacity checks
5. Operating procedures and operating limits
6. Vessel capacities
7. Piping capacities
8. Electrical/Uninterruptable Power Supply (UPS) capacity
9. Ergonomics

Platform drains and atmospheric vent systems were not included, having been extensively reviewed as separate items in the past. Utility systems were also not included in the study.

Specific areas are allocated to appropriate discipline engineers. Where necessary additional specific expertise is brought in from Contract Engineers. A Senior Engineer runs the audit co-ordinating the activities and ensuring that adequate resources are available. Periodic reviews are carried out with Production & Safety to report on progress and the results to date. At the end of the audit an overall report is prepared describing the areas looked at, the problems identified and the projects raised to correct the deficiencies. Of course this report is backed up by detailed reports covering each specific topic.

3.1. API RP 14C Compliance

The object here was to determine whether the individual items of equipment complied with the recommendations of API Recommended Practice No 14C. This outlines the minimum levels of protection for process equipment and its basic tenet is that there should be two independent levels of protection against any particular unwanted event.

3.2. Logic, Cause and Effect + ESD Review

The unit control logic (UCL) which operates the platform safety shutdown systems is defined, as far as the initiating deviations and control actions, through the Cause and Effect Charts.

These charts are presented as a matrix and describe the outcome of a deviation in terms of the isolation valve actions. It is imperative to have an up to date record of the status of the logic and, to this end, a survey of the UCL was carried out, changes to the original design were highlighted and subjected to review. Following the update of the Cause and Effect charts the actual Emergency Shutdown System (ESD) was reviewed and confirmed as satisfactory.

3.3. Area Classification

An examination was carried out to determine what changes had taken place on each platform which might influence the zoning of areas with respect to hazard classification. The basis for the classification was the British code of practice BS5345 and the Institute of Petroleum code.

3.4. PSV/Flare Header Checks

Of prime importance in safe handling of hydrocarbons is the ability of the pressure safety valves (PSV) on all items of equipment to handle the worst case flowrate under relieving conditions. It was therefore important to check where relief valves were required and also to determine by detailed sizing whether the valves were sufficiently large to accommodate both present and future flowrates. Accurate calculation of the effect of back pressure from the flare system on the relief valve performance was carried out where appropriate.

3.5. Operating Procedures and Operating Limits

It is recognised that each system should have an adequate set of operating instructions for start-up, shutdown and normal operation and to this end it was anticipated that the Process Audit should address this area. The Operating Limits were reviewed in the light of the reservoir conditions, PSV, Vessel and Piping capacities to ensure that the limits were suitable for the current conditions.

3.6. Vessel Capacities

This is similar to the pressure safety valve analysis and was an examination of the adequacy of the vessels for current and future requirements.

3.7. Piping Capacities

Erosional considerations of piping velocities warrant consideration and to this end a check was made on production headers and critical pipework.

3.8. Electrical Capacities

The adequacy of the electrical, normal and emergency and uninterruptable power supply systems was examined to confirm that they were adequate and meet current standards.

3.9. Ergonomics

This relates primarily to instrumentation and the ease of operation and control by Operators. Shortcomings in men-machine interfaces were investigated for future improvement.

4.0. SAFETY PROGRAMME AUDITS

Most companies develop and introduce programmes and activities to identify and correct safety deficiencies and weaknesses and raise the level of safety. It is important if these programme are to be effective that they are audited on a regular basis to monitor compliance and identify weaknesses in the programmes and standards.

Typical of these are the following;

4.1. Environmental Quality Assurance Audit

This involves a thorough annual audit of all discharges from the offshore platforms and is carried out by the Company Environmental Scientist.

The Audit consists of examining relevant documentation on the platforms eg:

i. Oil spill contingency plans
ii. Continental Shelf notices.
iii. Oil in water reporting procedures
iv. Oil in cuttings reporting procedure
v. Chemical usage recording and reporting
vi. Oil spills monitoring and reporting
vii. Remote sensing/aerial surveillance reporting

This is followed by a general facility inspection and the witnessing of the calibration of offshore I/R oil in water analyser.

Samples are taken for onshore oil in water cross checks with offshore laboratory results.

4.2. Radiation Protection Audit

This involves a thorough annual audit with respect to ionising radiations at all locations and is carried out by the Contract RPA along with the onshore and offshore Radiation Protection Supervisors. Included are checks in documentation covering:

i. Registrations
ii. Authorisations
iii. Disposal records
vi. Source records
v. Controlled and supervised area records
vi. Source leakage test records
vii. Instrument calibration records
viii. Dose records
ix. Transportation records

A full examination of all "Local Rules" is carried out along with a general facility inspection.

4.3. Chemicals Hazardous Materials Audit

The platform audit is to make an inventory of all hazardous substances. It is carried out periodically by the onshore safety advisor specialising in chemical safety and the industrial hygienist. They list all substances on the platform and confirm that an up to date material safety data sheet is available for each of them.

Most companies are expanding this audit to cover COSHH requirements.

4.4. Training Audits

This is a rolling audit of all personnel, company and contractor, safety training aiming to cover everyone approximately annually. It is carried out by the training section of the Employee Relations department. The audit compares actual training received by personnel against the standards laid out in the Division Training Policy. The policy defines survival and safety training required for all personnel. The relevant parts are included in contracts.

4.5. ISRS and Five Star Programme

These audit programmes are very detailed and require fully trained safety auditors. Although I have taken the ISRS training I have never used the programme but it has influenced me and the programmes that I have developed.

Having discussed their experiences with a number of users of the ISRS system it certainly benefits the company in many ways in addition to safety, however, it is a very major long term commitment and frequently it is necessary to adapt the programme to the company.

5.0. MANAGEMENT SAFETY AUDIT

5.1. Philosophy

In late 1986 the company that I worked for decided to institute an annual management safety audit of the Aberdeen facilities as part of the programme of activities designed to raise the level of awareness of and commitment to safety in all employees. The objective was to inspect all facilities, assess the standard of safety performances, communicate management's commitment to achieving the highest safety standards and their reaction to the standards actually being achieved, follow-up on the results of the inspection and the conclusions drawn and, finally, to assist in raising the safety standards in line with the policy of "Achieving Excellence".

The 1986 audit of the offshore facilities took place in December 1986 and consisted of a group of managers carrying out a detailed inspection of the facilities in the company of the Offshore Installations Manager and the Senior Maintenance Supervisor. Probably inevitably, the inspection degenerated into a housekeeping inspection and the results were very negative. With the size of the group and the lack of time, very few topics could be discussed in depth and only a very superficial impression of most aspects of the platform operations could be gleaned. Management ended up with knowledge of some of the failures of the facility personnel and virtually no knowledge of their successes and the good things that were being achieved. The facility supervisors equally felt that the audit was unfair as they received no recognition, merely blame.

The Safety Department therefore recommended that the style of audit be changed. It was recommended that the primary objective of the audit should be to develop a valid assessment of the safety conditions that exist at the time of the audit for the

benefit of both onshore and offshore management. The audit should identify the strengths of the current safety programme just as clearly as the deficiencies. It should not only determine what is not being done, but should recognise and give credit to the programmes which are good and effective.

5.2. 1987 Audit

The recommended method of achieving an effective audit was by looking at the safety programmes in depth. Is there a formal or informal policy and programme? What does it cover and specify? Does it meet Company standards? Is being applied in practice? Is it effective? Are the standards satisfactory for our specific operations? Are they too high or too low? Are the results recorded? Are the deficiencies found corrected in an acceptable time scale? Finally, what recommendations, if any, should be considered to improve the current situation?

Thus, the investigator needs an in depth review of written policies and procedures, discussion on their application and effectiveness with supervisors and the personnel applying them and, finally, monitoring of the actual application and standard being achieved.

Obviously in the time available it would not be possible to cover every safety policy and programme. It was therefore recommended that a number be selected and allocated to specific team members. In addition, all team members were asked to record any unsafe acts or conditions observed during their inspections, note and comment on the housekeeping standards, training programmes, standards and records and, finally, the overall safety management of the platform.

Prior to the audit taking place, an audit procedure was developed and approved by the Operations Manager, Production Manager and Drilling Manager. In addition, specific safety programmes were allocated to specific team members (See Table 1).

An opening conference was held on each platform at which the Safety Manager described the technique and a discussion was held on the detailed organisation with all the platform personnel involved. Each group then set to work and audited the programmes allocated in conjunction with the relevant platform personnel. The groups toured selected parts of the platforms appropriate to the programmes being audited. At the end of the audit one member of each group reported on a programme at a closing conference. They described the appropriate programme, its effectiveness and any recommendations for improvement. Each group then produced a written report which was forwarded to the Safety Department who produced an overall summary for each platform.

The new audit procedure was felt by both offshore and onshore to be a major improvement on the previous technique. Onshore management were able to carry out an in depth examination of a number of safety systems and programmes and to gain an impression of the overall status of the safety climate. Offshore management were satisfied that their attributes were recognised as well as any deficiencies and believe that the audit was useful and equitable. It was judged by all concerned to be a success.

5.3. 1988 Audit

The technique developed for the 1987 Safety Audit was utilised and as before the audit team was divided into groups of two and allocated specific topics as shown in Table 2. Guidelines were generated for each topic and distributed along with a general introduction to the audit technique.

During the opening conference on each platform the OIM reviewed the 1987 audit recommendations and discussed the implementation of the major items. In addition he introduced the platform staff who would be assisting the audit team and arrangements were made for the various teams to discuss the appropriate programmes and tour relevant parts of the platform.

In 1988 in addition to the Division Senior Management, representatives from Headquarters, Exploration and Production and Corporate Occupational Safety and Health took part in the audit. Just prior to the audit the idea of inter-company audits was discussed at a very senior level in a number of companies. This was agreed and representation from two majors joined the team as observers.

Another innovation this year was the use of a physical conditions inspection record sheet. This was based on the International Loss Control Institute checklist. The concept is to mark each specific observation of a wide range of physical conditions, each time the standard is shown as satisfactory or substandard. A comparison of the number of substandard to total observations gives a quantitative assessment of the standard of compliance.

As in 1987 the audit was felt by everyone concerned to be of great value. The platform personnel received credit for the positive efforts that they are making to achieve a safe operation along with guidance from Senior Management on possible improvements. Onshore Management were able to make an in depth assessment of the effectiveness of the programmes in place in a positive way rather than using the accident figures which are negative and merely measure the failures. The addition of the representatives proved very beneficial. The operations were

looked at by totally fresh minds and assessed based on corporate standards and programmes. In the opposite direction the corporate representatives were able to gain experience of a different technique of auditing and knowledge about large North Sea installations.

The physical conditions inspection work sheet proved to have far too many items to be able to be used effectively by the team members. The concept of inter-company audits was shown to have potential.

5.4. 1990 Audit

In 1989 a major re-organisation of the company production operations was implemented and it was not possible to organise an audit in 1989 due to other priorities, however, an audit was organised in March 1990. This followed the format used in 1988 except that each group was allocated two aspects of housekeeping to look at during their physical inspections rather than the whole range of conditions. In addition the concept of inter company audit was continued and a Dept of Energy inspector also joined the team. The topic allocations are listed in Table 3.

6. POSSIBLE DEVELOPMENTS

I fully expect to see the Technical Audit introduced in some form as part of the Formal Safety Assessment legislation likely to be recommended by Lord Cullen in his report on the Piper disaster. This will lead to development of the topics covered and formalisation of the procedure.

I believe the individual programme audit is a very useful technique to ensure that standards are being maintained. It helps to identify problem areas whilst spreading the workload and involving personnel in the safety effort and enhancing their commitment. I personally would like to see a significant expansion of this programme, however, it does take a lot of effort to develop the necessary checklists and train personnel.

The Management Safety Audit technique should be further refined. I would like to see a wider team membership probably to include Safety Representatives. Inter company audits will almost certainly increase and I see significant benefits in joint audits with the Dept of Energy.

Finally, I suggest that companies consider the advantages of creating a new job, the "Compliance Coordinator". Part of this persons job will be to monitor compliance with legislative, Industry and Company requirements and standards. Obviously this will involve ensuring that audits are effective, identifying areas where new audits would be useful, carrying out audits himself where appropriate and reporting his findings to senior management.

Table 1

1987 Management Safety Audit

TEAM MEMBERSHIP TABLE

CATEGORIES	OPERATIONS MANAGER	PRODUCTION MANAGER	ENGINEERING MANAGER	DRILLING MANAGER	ENGINEERING SUPT	DRILLING SUPT	PRODUCTION SUPT	PRODUCTION SUPT	GENERAL MANAGER	SAFETY MANAGER
General										
Management										
Training										
Housekeeping										
Systems Safety Programmes										
Chemical Management Programme										
Contractor Safety Programme										
Emergency Shutdown System										
Fire Protection Programme										
Hand Tool Inspection Programme										
Lifting Equipment Safety Programme										
Personnel Injury Prevention Programme										
Pollution Control Programme										
Self Audit Programme										

Table 2

1988 Management Safety Audit

	UK SAFETY	CORPORATE SAFETY	SAFETY MANAGER	PRODUCTION SUPERINTENDENT	PRODUCTION SUPERINTENDENT	PRODUCTION MANAGER	DRILLING SUPERINTENDENT	DRILLING MANAGER	SUPERVISOR PROJECTS	ENGINEERING MANAGER	OPERATIONS MANAGER	GENERAL MANAGER
Housekeeping												
Protective Equipment Compliance												
Unsafe Acts/Conditions												
Safety Attitude and Awareness												
Scaffolding												
Portable Lifting Gear & Slings												
Eye Protection												
Stairs and Ladders												
Operating Procedures												
Drill Floor Operations												
Cranes												
Gas Cylinders												
Work Permits												
Modification Safety Reviews												
Emergency Procedures												
Alarm Systems												

Observers : BP
Shell

TABLE 3

1990 MANAGEMENT SAFETY AUDIT

TEAM LEADER	FULL TIME MEMBER	MEMBER SOUTH	MAIN TOPICS		HOUSEKEEPING TOPICS DURING TOUR	
GENERAL MGR	DRILL SUPT	OFFSHORE INST. MANAGER	SAFETY REPS	CHICKSANS	AISLES	NOISE
OPS MGR		MAT & LOG MGR	CONTRACTOR TRAINING	WORK PERMITS	DRUMS & CONTAINERS	GUARDS
PROD MGR	SAFETY MGR	PLANT SUPER	FIRE PUMPS	SLINGING	FIRE DOORS	COLOUR CODING
JOINT OPS MGR	MAINT SUPT		CONTRACTOR EQUIPMENT	ENVIRONMENTAL COMPLIANCE	COMP GAS CYLINDERS	BA SETS
CORPORATE SAFETY	MNG DIRECTOR	OFFSHORE INST. MGR	PERSONNEL PROTECTION	MODIFICATIONS	FIRE EXTINGUISHERS	LADDERS (FIXED)
GEN MGR EXPLORATION		PROD SUPT - GAS	BULK DELIVERY	PROCEDURES	FIRE HYDRANTS & HOUSING	FLARES
ENG MGR		FIELD SUPT	SERVICE HOSES	TEMPORARY FACILITIES	STAIRS	SIGNS
STAFF SAFETY ADVISOR		DRILL SUPT	EMERGENCY ESCAPE	SAFETY TRAINING	HAND TOOLS	LADDERS (PORT)
CORPORATE SAFETY		PLANT SUPT	CRANES	LIFEBOATS	POWER TOOLS	SHOWERS/ EYEBATHS

OBSERVER - DEPARTMENT OF ENERGY INSPECTOR
- CHEVRON