EXPLOSION AND FIRE - WATSON OIL FIELD SOUTH-WEST QUEENSLAND 17 DECEMBER 1997

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SUMMARY

An explosion and fire occurred at Santos Watson oil processing facility south-west Queensland resulting in two deaths and one serious injury. The paper covers the investigation of the accident and the preparation of a report used as primary evidence in the Coronial Inquest that followed. The Coroner made a number of findings and recommendations that are likely to impact the petroleum industry and have been made at a time when the existing Petroleum Act and Gas Act are under review and amalgamation. The amalgamated Acts and subsequent Regulations are likely to follow mining legislation in that the focus of legislative requirements will rest on the development of safety management systems as opposed to current prescriptive requirements. The paper concludes with a short review of the recently issued report into the Longford gas explosion, identifies parallels and explores the impacts and lessons for the mining industry.

INITIAL RESPONSE

At approximately 9.00am on 17 December 1997 an emergency call was received at Petroleum and Gas Operations Branch, Queensland Department of Mines and Energy. It was reported that an explosion had occurred at SANTOS Watson facility. At the time of the report it was known that a man was unaccounted for and that others had been burned. The report nominated that the explosion had occurred in what is called a "wash" tank. "Wash tanks" separate oil and water mixtures by gravity allowing the separated fluids to be pumped away.

The earliest flight to Jackson, approximately 100 km from Watson, was due to depart Brisbane airport at 1.00 PM. SANTOS offered the Department a seat on the flight to Jackson, the offer was accepted.

On arrival at Jackson at 4.00 PM it was reported that the fire was still burning. Many remote petroleum sites have a "burn-down policy" and evacuate rather than attempt to fight large fires.

An assessment of the situation occurred at this point and by now the body of a worker had been seen in the flames. In consultation with Police and SANTOS personnel, the following was agreed:

- The first priority had been achieved, that is, the removal of the seriously injured for treatment.
- The second priority was to control the fire, make the site secure and retrieve the body of the deceased.
- The third priority was to make the site safe to enter.
- The fourth priority was to begin an investigation and allow SANTOS access to plan a site clear up.

At 7.00 PM the fire was brought under control and the body of the deceased Alan Proctor was retrieved. The Police cordoned the site and posted personnel to ensure the site was secure until morning.

Neville Blenkins died overnight from his injuries having suffered 80% burns. Neville Gillespie suffered 60% burns and is alive today.

All the affected workers were employed by Kadco Pty Ltd a construction contractor effecting expansion work at the Watson site. At the time of the explosion a common pipe was being fabricated to connect two tanks to the one that exploded.

After nearly 12 hours the fire was extinguished by a specialist team with equipment flown in from other sites. Once the correct people and equipment were assembled, the final engagement of the fire took 18 minutes.

On arrival the Police declared an emergency under relevant powers. The emergency remained in place until the site was declared safe to enter following a Departmental inspection the following morning (18 December).

During the inspection SANTOS staff were instructed to effect containment measures on necessary vessels and to remove oil from tanks when a tanker was available. The site was released to the company to form a plan of clear up.

The affected vessel was inspected, together with artefacts in the immediate area.

The investigation revealed welding equipment on top of the vessel that exploded together with evidence that "tack welding" had been carried out. The end of the vessel that exploded had separated from the tank and was found 83 metres away. A 4 inch pipe approximately 5 metres long was found another 100 metres past the tank end. Before the explosion this pipe had been connected to the tank end. Mr Proctor was found lying at the base of the tank he had been working on. Both Messrs Bienkins and Gillespie had been working just to the side of the tank end that blew off and were engulfed in fire as the liquid contents of the tank released in their work area.

INVESTIGATION

The Chief Inspector Petroleum and Gas John Fleming arrived on the morning of 18 December 1998 and a plan of investigation was agreed.

It was agreed that we would work with Police to provide as clear a report as possible to the Coroner.

The initial investigation included the gathering of physical and photographic evidence that would later prove to be the key to presenting the report to the Coroner.

The Police gathered and preserved the artefacts as evidence.

The Kadco personnel who remained at Jackson were informed that formal interviews would be held in the coming weeks when they had a chance to settle down. Several of the men were clearly in shock.

In the meantime contractual documents were obtained from both client and contractor to determine what was supposed to have been occurring at the Watson site.

A dossier was prepared to present to witnesses containing photographs, copies of contract documents, drawings and permits to work that had been issued as work progressed.

Witnesses were interviewed including supervisors, workers, engineers, permit issuing authorities and others associated with the project.

The Police acted as main interviewers and the Department acted in leading the technical and procedural questioning of witnesses.

The interviews took place over a period of six months. The tracking of remote area workers proving to be a logistical problem that would have been difficult if Police resources were not available.

The evidence dossier was collated and numbered so that reference could be made during the reading of witness transcripts.

The numbering system was used and referred to during interviews so that the items pointed out by witnesses could be tracked and compared with the words of the transcript when preparing the report.

Several reports were commissioned to cover aspects of the investigation that would require unquestionable expertise when presented in court. The function of the Departmental investigator involves the coordination of several experts ranging from QUT metallurgical consultants to SIMTARS and ETRS experts in gas properties, explosion behaviour and heat transfer through pipe walls. Reports were also commissioned into the identification of thread forms found on pipes and fittings found to have been "seal welded" and on welding residues and welding rods found at the scene.

The portable welder found on top of the tank next to the one that exploded was tested by the Office of Electrical Safety to determine the energy available at the point of welding.

SIMTARS expert Colin Hester gave expert evidence on the ignition energy requirements for gas and air mixtures.

DEPARTMENTAL REPORT

The Departmental report focussed on several areas of the project and circumstances that led to the tragedy, namely:

- Source and mechanism of ignition
- Adherence to contracted work
- Incompatible thread forms
- Hot work permit
- Supervision by the contractor
- Supervision by the facility owner
- Location of fabrication activities and equipment
- Calibration and operation of safety devices
- Fire fighting capability of the site

The Departmental report included conclusions and a set of recommendations aimed at preventing a recurrence of this tragedy.

CORONIAL INQUEST

The inquest into the deaths of Neville Blenkins and Alan Proctor was held in the Brisbane Coroners Court over a period of thirteen hearing days. A number of issues emerged that were not covered in detail in the Departmental report.

- Communication breakdown between site operator and site construction supervisor regarding a piping change found necessary on placing two new tanks next to the tank that exploded.

- Lack of communication of the above piping change by the contractor's supervisor to the site construction supervisor.

- The failure of the contractor's supervisor to document the piping changes.

- A lack of understanding between senior personnel of the owner and contractor regarding the appointment and qualification of fire-watcher's. The persons nominated include SANTOS' Engineer, site construction supervisor, the two designated site operator/permit authorities and the contractor's supervisor.

- The permit issuer's authority was not current.

- Non-qualified personnel were performing fire-watching duty.

- Inconsistencies were found in the methodology of hot work permit completion.

- Ambiguity in the meaning of terms associated with the completion of hot work permits.

- An inadequate induction process.

The Coroner could find no evidence upon which any person could be committed for trial as a result of the incident.

CORONER'S RECOMMENDATIONS

The Coroner recommended that the Department act as a facilitator to initiate a meeting of relevant industry representatives to compare the recommendations made in the Departmental report against relevant industry standards. A meeting of oil and gas industry senior personnel has been held and concluded that the current safety and technical review committee of the Petroleum and Gas Acts are charged with this responsibility.

OTHER ISSUES

At the time of the incident the Departmental inspection team for petroleum consisted of two part-time officers in an acting capacity.

Since the completion of the report, funds have been allocated to restructure the Branch to include the coverage of both the petroleum and gas industries. Professionally qualified Regional Inspectors have been appointed in Brisbane, Rockhampton and Mt Isa to boost the total number of inspectors in the combined Branch from 8 to 11.

A planned safety audit schedule is currently underway and is exceeding target levels. The areas under consideration include petroleum production sites, pipelines, gas reticulation systems, LP Gas terminals and large LP Gas storage on customer sites.

In the future areas such as seismic survey, drilling and randomly selected construction projects will be included in the program.

LONGFORD ROYAL COMMISSION

On 25 September 1998 an explosion occurred in the gas plant that processes Bass Strait Natural Gas at Longford, Victoria. The

subsequent Royal Commission made a number of findings:

The "Real causes" referred to in Chapter 15 (15.6) of the report nominate:

- Operators did not have knowledge of the dangers associated with the condition that led to the failure of the vessel.

- Supervisors did not have the knowledge to deal with the situation that arose and the actions taken by them were inadequate.

The collective lack of knowledge was directly attributable to deficiencies in their initial or subsequent training.

Not only was their training inadequate, but there were no current operating procedures to guide them in dealing with the problem encountered on the day of the explosion.

A planned Hazard and Operability Study (HAZOP) of the area that failed had not been conducted.

The implications of these factors are can be condensed as follows:

- Management are responsible to adequately train staff to the level of knowledge required to operate such plants.

- Management are responsible to adequately supervise operators and to use the information flowing from appropriate supervision of staff and monitoring of operations to develop training plans and adequate procedures to operate the plant safely.

- Hazard identification is a responsibility of management.

- Management are responsible for devising methods of controlling the hazards that have been identified by a combination of procedural methods and the provision of adequate training to provide the knowledge needed to cope with hazardous situations effectively.

PARALLELS BETWEEN LONGFORD AND WATSON

Despite the communication failures and contractual issues alluded to in the Watson Incident, common threads emerge between this incident and the Longford explosion.

It is known that the best teaching opportunity for Contractors is at the time when they are inducted to the worksite, that is; the site where the work will be performed. In the case of Watson, the induction was found by the Coroner to be lacking in several areas of hazard identification and training in the working of the permit system. To clarify, the contractors were inducted away from the worksite in Jackson by a person unfamiliar with their job. The contractors were told that no work was to be done without a permit. The contractors induction to the worksite at Watson did not include a tour of the hazardous areas in the site and at no time was a drawing showing the hazardous areas available for use by either contractors, supervisors or permit authorities. The contractors did not receive instruction on the intimacies of the permit system and the contractors supervisor accepted a single permit for a full days work covering the entire site. It should be noted at this stage that the permit authority issued the permit with the conditions previously stated. The permit included instructions to the contractor that the permit authority was not allowed to delegate and did not have sufficient authority to perform himself without authorisation from senior management.

The HAZOP of the design for the site upgrade was probed and it was found that the "HAZ" part of the exercise had not been done, only the "OP".

At the end of the day the Permit Authority was probed and found not to have been a current authority at the time of the incident, a plant operator and without any construction or engineering qualifications or experience. It was stated by many people that the Operator was very competent at his job (operating) and the original permit issuing training he completed was a competency based, self learning package.

The supervisor of the contract work was a welder by trade and had many sites to visit during the day. It was reported on a number of occasions that he would usually spend one

hour per day at the site. For the eleven hours of the day when the supervisor was not around the senior person at the worksite was the permit authority.

The contractors supervisor had for the past 10 or so years been a fabrication workshop foreman and relied on the expertise of the permit authority and accepted the permit and all associated conditions without question.

It was found that a critical change in specified work had occurred with the knowledge of the operator (permit authority) and contractors supervisor but without the knowledge of the contract supervisor. The misplacement of two tanks needed a pipe modification to allow the tanks to be connected to the existing tank. On this modification a tack weld was placed that was found by analysis to have caused the explosion.

We therefore have a number of items to consider when looking at Watson:

- Knowledge versus competency
- Knowledge inventory of staff
- Assessment of risk
- Management of risk
- Adequate procedures
- Supervision
- Audit of activities and correction of undesirable matters

When we look at Longford similar factors emerge:

- Operators did not have the knowledge of the dangers associated with the condition
- Supervisors did not have the knowledge to deal with the situation
- The collective lack of knowledge was attributable to training
- A HAZOP of the plant that failed had not been conducted and so the condition had not been identified and procedures created to deal with the condition
- Procedures were not available for operations and supervision staff to deal with (a) the condition and (b) the situation.

In much the same way as in the Watson Incident these factors emerge:

- Knowledge versus competency
- Knowledge inventory of staff
- Assessment of risk
- Management of risk
- Adequate procedures
- Supervision
- Audit of activities and correction of undesirable matters.

In the case of both incidents the responsibility for the key factors rest with the most senior management in the respective companies. It is unacceptable to attempt to place these responsibilities with middle or lower management. Contractors cannot be expected to enter unfamiliar sites containing hazards and have the inherent expertise of the designer of the site systems or processes within the site. Contractors require adequate and appropriate supervision by the site owner. In much the same way that you would be liable for somebody who trips over the lawnmower in your backyard, you will be liable for contractors injured on your site if you do not look after them.

CONCLUSION

Whilst it is recognised that the incidents occurred at Petroleum installations, the parallels that can be drawn with mining operations are many. Hazardous locations, permit to work systems, site inductions, the recording of variations, engineering and safety appraisal of variations to contracted work and plain old supervision, management and communication matters emerge as in most accident investigations.

A model for disaster

The complacency that familiarity can breed is generally the root cause of most accidents of this type, together with decision making by uninformed people somewhere along the line. The erosion of all your safety provisions at once, makes the accident inevitable.

If management decisions are made without the input of suitably knowledgeable persons, then an erosion of the core knowledge base occurs as staff are moved from areas where their knowledge prevents failures from occurring. When the core knowledge base is removed and new staff are brought in, trained to competently perform tasks without knowing why, generally by the persons promoted from previous operations posts; the process has

started. The previous operators are promoted to supervision posts without the knowledge of the previous incumbent, the beginning of Watson and Longford outcomes begin to look likely. If similar erosion occurs within the company in areas such as audit, maintenance, training and so on, things are looking very shaky.

It should be said at this point that management is not an easy job. Some managers believe that it is unnecessary for managers to concern themselves with technical knowledge. I am told by some that managers can manage anything, the skills are all the same in any business. The key skill in managing for safety in hazardous industry is **really knowing your business**, that is the people in your business, what they know and what they don't know; you also need to be fully aware of the hazards in your industry and have the hazards managed, together with systems to test your systems and mechanisms to improve your systems with the lessons learned. With that knowledge you can select the right person for the task, with an adequate training and succession program you can not only select and train the right person for when the incumbent leaves the area for good, but even for when the incumbent goes on two weeks holiday or gets a toothache. Knowing the hazards in your business allows you to select the right people to reduce the hazards to a level of inconsequence or manageability and to form procedures to allow training of operations staff to be effected.

To maintain and preferably exceed the standards in your industry you need to know not only what the standards are, but to understand the principles hiding behind the requirements contained in the standards. Those who keep informed and up to date and have the knowledge to adapt to changing environments with a loop to ensure that lessons learned get fed back to improve their systems will be the smart operations that maintain profitability and attract a **skilled, knowledgeable and competent staff.**

Operations with such staff will have minimal accidents. Operations that do not will suffer the very real consequences.