JNRC - Learning Opportunity Notification (LON) - 005

Incident Details	
Incident	Longford Gas Plant
Date of Incident	25-Sep-98
Location/Country	Longford, Victoria, Australia
Type of Incident	Fire
Offshore/Onshore	Onshore
Asset Type	Onshore Processing
Asset Status	Operational
Immediate Cause	Loss of Containment
Similar Root Cause Incidents	LON - 001, LON - 002
Date Updated	19-Aug-22

Incident Impact	
People	2 dead / 8 injured
Environment	Minimal
Asset (adjusted claim at the time of loss)	USD 633 million (PD, BI & Liability)
Reputation	Significant reputational damage to Operator

Incident Description

The Longford Gas Plant, situated in a rural near coastal location in the State of Victoria, Australia, at the time of the loss processed gas from 3 offshore fields in the Bass Straits. The gas plant had experienced expansion over its operational lifetime and consisted of a three gas plants and a crude stabilisation unit. The Gas Plant 1 (GPS 1), a refrigerated lean oil absorption plant, was the original gas plant, starting up in 1969.

At the time of the loss, the gas plant was restarting after an extended period of process upset due to high liquid flow into the slug-catchers. GPS 1 was in a highly transient state, and experienced rapid changes in temperature. A heat exchanger, GP905, known as the De-methaniser Reboiler, failed catastrophically when warm oil was reintroduced after a period of cooling.

The failure released more than 10 tonnes of hydrocarbon vapour, with the cloud drifting for an extended distance (~170m), before igniting off a set of fired heaters. The resulting fierce jet fire caused three further fires due to impingement on an elevated piperack junction and burned for over 2 days due to the absence of remote operated isolation valves (ROIVs) between interconnected units.

Two employees were killed, and a further 8 injured. Supplies of gas to domestic and industrial users in the State of Victoria were halted for over two weeks, causing economic loss and widespread inconvenience.

A Royal Commission conducted a public investigation into the incident, with extensive recommendations.

The Operator was found guilty of charges brought under the Occupational Health and Safety Act, although no individuals were charged. In separate class action, the Operator was found not to be responsible for third party financial losses as a result of the temporary cession of gas supply.

Incident Analysis and Findings (including Causal Factors)

The basic cause of the loss of containment that resulted in the widespread fires was a brittle fracture of the De-methaniser Reboiler as result of experiencing a low temperature of minus 42 deg.C, followed by relatively rapid return to a normal temperature of 100 deg.C.

Significant contributors to the loss and subsequent extent of loss have been identified by formal investigation and other third-party analysis to include:

- extended period of process upset, including loss of warm lean oil flow for an extended period;
- absence of remote operated isolation valve (ROIVs) from which resulted widespread damage and significantly impacted the outage period before some gas processing could recommence;
- the absence of senior engineering staff on the site, having been relocated to a central head office in Melbourne several years previously – this was identified as depriving plant operators from having easy access to engineering expertise and knowledge, and likewise led to Engineering having a reduced understanding of plant operations and problems that were being experienced but not addressed.

The root causes of the incident were all largely found to be of a human performance nature, and included:

- poor hazard identification – the GPS 1 plant had never been subject to formal HazOp, although was planned;
- poor operating procedures – in part due to poor hazard identification, although the loss of a key flow such as lean oil should have been anticipated, but not documented in operating procedures;
- inadequate operator training – those on site did not understand the significance of cold temperature, and had not experienced specific training into abnormal operations and plant upset;
- inadequate alarm management – one of the earlier examples of alarm overloading, resulting in distracting operators from responding effectively to an upset situation, and evidence of operators in the absence of site-based engineers developing an alarm tolerant culture;
- organisational management of change – the decision to relocate engineering staff back to a remote central office location, whilst in many respects justifiable, was not subject to management of change;
- supervision – there had been reductions in supervision, and on the day of the loss there was inadequate supervision due to vacancies and illness. The safety management systems were not implemented and personal safety was prioritised over process safety.

Root Causes

Equipment Failure				Human Performance				Other	
Repeat Failure		Unexpected Failure		Human Engineering		Training	X	Sabotage	
Preventive/Predictive Maintenance				Procedures	X	Management System	X	Natural Peril	
Design				Communications		Quality Control		Other	
Equipment/Parts Defective				Immediate Supervision	X				

Lessons Learned

The following lessons are considered appropriate to this loss:

• cold metal embrittlement of carbon and low alloy steels is a threat (low probability - high consequences) that is often overlooked. Ideally this should be dealt with by selection of a suitable material of construction - but when this is not considered appropriate, yet the threat remains, wide plant design, procedure and training should all reflect the present threat;

• process plant should be subject to rigorous and appropriate process hazards analysis, which in turn feeds a risk assessment, from which suitable means of prevention and mitigation can be established;

• ROIVs should be installed in line with a suitable standard to allow for rapid isolation of large process inventories, and mitigation of event escalation;

• large consequence events of this nature should be seen by the regulator as an learning opportunity, and should be investigated in the public domain with expert and well resourced investigation teams, with publication in the public domain of the investigation report, and should also be seen as challenge to the adequacy of existing regulatory oversight of the sector – it is noted that in direct response to this loss, the State of Victoria introduced legislation to mandate a Safety Case Regime for major hazard facilities in 2000;

• the Operator at the time was judged by many in the industry to have a world class Operational Management System, yet still seemingly had weakness in its implementation that led to this incident. The Royal Commission and subsequent other third-party review were critical of both: the auditing process employed, which whilst active in quantity, were lacking in quality and failed to identify the many latent management system shortcomings that were evident to the investigation process; and also the key performance indicators used which focussed on monitoring personal safety to the exclusion of process safety indicators. In this regard the organisation lacked a 'chronic unease' which ignored issues such as absent PHA, poor alarm management culture, incomplete recording and investigation of incidents, lacking supervision and the unchallenged poor plant performance issues that had been allowed to develop with a change to centralised engineering support;

• there is often a stark difference between the perceived value of training provided by a company, and the actual competence of an operator to trouble-shoot a plant in an upset situation. The full value of the training is incomplete if the resulting level of achieved competence is not measured and demonstrated.

References

1. Report of the Royal Commission into the Accident at Esso Longford, June 1999.

2. Lessons from Longford, Andrew Hopkins, CCH Australia Ltd. 2000, ISBN 1-86468-422-4.

3. The Willis Loss database.