



## Safety in hard times – A qualitative analysis of safety concerns in two industrial plants under financial duress



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### ABSTRACT

A purposive critical case study of two heavy industrial plants was conducted to identify and discuss safety issues faced by companies under financial duress. Access to these companies presented a rare opportunity for study: one plant had announced definite closure while the other was under threat of closure. Both companies were facing significant redundancies. Interviews with senior staff members accountable for safety outcomes sought to answer three questions relating to lean management, redundancies, and hierarchy of control methodology in times of financial duress. An inductive analysis compared respondents' comments with peer-reviewed literature and identified commonalities, differences and concerns. Four recommendations are made for companies facing similar financial duress. These recommendations include (i) an emphasis on use of the hierarchy of controls for hazard mitigation, (ii) the influence of lean management, (iii) prioritisation of injury classification, and (iv) the importance of external audits.

### 1. Introduction

The evidence base for the efficacy of the *zero accident vision* (ZAV) is growing. Recently, in a critique considering all sides of the ZAV debate, Zwetsloot et al. (2017) called for “a more realistic understanding of the strengths and weaknesses of the ZAV” (p. 263). The Zwetsloot et al. (2017) paper cited Young's (2014) analysis of New Zealand Aluminium Smelter's (NZAS) exemplary safety performance as positive evidence for ZAV. Young's paper described the nature of the interventions used in a hazardous industry to achieve a remarkable safety result over the period 1972–2011. It found that (*inter alia*) hazards are more readily ameliorated by long-term persistence with hierarchy of control methodology for injury prevention. But what happens when an organisation with an apparently successful safety strategy faces extreme financial duress?

The global financial crisis of 2007–2008 appeared to have relatively little effect on smelter operation, but in recent years, oversupply in world aluminium markets has resulted in lower prices (Bureau of Resources and Energy Economics, 2014). In response to the consequential economic pressures and NZAS's \$49 million loss in 2012, the company reduced the size of its organisation by 100 roles, representing 14% of the workforce (New Zealand Aluminium Smelters Limited, 2014). In order to address the same fiscal drivers, in February 2014, Alcoa announced the closure of its aluminium smelter and rolling mills

at Point Henry, Geelong Australia (Alcoa Corporation, 2014). Both companies demonstrated excellent safety records in the years leading to this time, but what effect would prolonged financial duress have on safety in these extremely hazardous worksites? In particular, the following three questions were selected for investigation:

- Both plants practised ‘lean’ management methodology in order to maximise profits (or minimise losses). What were the effects on safety management when ‘lean’ management practices were subject to even further financial duress?
- The staff at both plants were likely to be affected by confirmed or looming redundancy. What were the key issues for safety managers surrounding actual or likely staff redundancy?
- NZAS's ZAV had been characterised by a long-term persistence with upper-level controls for injury prevention (Young, 2014). Did the benefits derived from hierarchy of control methodology continue in times of financial duress? [For a discussion on the efficacy of the upper levels of the hierarchy of controls, see Young (2014, sections 5 and 6)].

A purposive strategy using critical case sampling (Teddlie and Yu, 2007) was employed to provide insight into the effects and significance of financial duress on safety management at these two large industrial plants. When asked whether safety standards slip in tough economic

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times, 73% of a sample of United States chemical engineers replied that there is a decline (Sharp, 2010); but very few studies have been conducted to substantiate or challenge this claim. This paper sought to explore safety management issues relating to the imminent closure of the Alcoa plant, and the rationalisation of NZAS, with a view to providing a useful insight for other companies facing similar difficulties.

The NZAS aluminium smelter is recognised as a particularly hazardous work environment (Young, 2014), but despite the threat of closure, it continued its exemplary safety performance with only four lost-time injuries in 2014 (all musculo-skeletal injuries in an aging workforce). At the Point Henry Alcoa rolling mill, one staff member commented on the potential for catastrophe: "...the consequences in heavy industry is death in a lot of cases – or a very serious injury" [Alcoa 2]. Nevertheless, despite the pending closure, and the possibility that the associated workforce anxiety could produce a spike in injuries, "...this year's been the best year that... Alcoa Rolled Products has ever had in regards to safety" [Alcoa 1]. In posing the three questions above, this paper examined the apparent contradiction of highly stressed staff remaining free of serious injury during 'hard times'.

## 2. Methods

The research project undertook a purposive study of two large industrial plants, with different corporate owners and in two different countries, operating in similar industries. Both were experiencing significant down-sizing or closure. The exemplary safety record of one of the plants was researched previously by one of the authors in a mixed method study (see Young, 2014) and presented as evidence substantiating the *zero accident vision* (ZAV). The current research project sought to build on the previous study by investigating the same plant in the context of a particularly challenging time in its operation. Another similar plant facing the same financial challenges was also examined.

Interviews were conducted with safety management staff in the two organisations. A purposive critical case sample ( $n = 8$ ) of in-depth interviews was chosen to provide rich data on topics of interest across the two sites. The interviewees were "...deliberately selected for the important information they can provide that cannot be gotten as well from other choices" (Maxwell, 1997, p.87).

Purposive sampling leads to greater depth of information from a smaller number of carefully selected cases (Teddlie and Yu, 2007). The researcher's unique access to New Zealand Aluminium Smelters Limited (NZAS) (Young, 2014), and access to Alcoa's Point Henry smelting operation, offered an excellent opportunity to provide considerable insight into these workplaces under financial duress. Unlike the original NZAS study (Young, 2014), this study did not seek to validate the empirical data concerning safety performance. With both NZAS and Alcoa, the authors accepted the injury data as presented by the respondents in the current study, and focussed on accessing qualitative understanding "...that had previously been inaccessible to scientific investigation" (Yin, 1994, p.42).

The selected roles for the two companies are listed in Table 1.

The critical case (Maxwell, 1997) interviews were conducted in November and December 2014, during a period of significant economic restraint, and sought responses to purposive questions (Teddlie and Yu, 2007) relating to the implications for safety management in harsh economic circumstances. The interviews were recorded with the respondent and interviewer only present, in closed offices, over 20–30 min. Interviews were subsequently transcribed verbatim with transcripts coded according to themes of interest and new topics emerging from the participants' responses. Quotes identified as being rich in detail and contextual meaning were highlighted (Patton, 2002). An inductive analysis was developed to interpret the participants' understanding of any effect on plant safety as a result of the difficult economic reality facing both workforces. Finally, both themes of interest and new emerging topics were compared to existing literature in a logic model approach where recorded statements were compared to

**Table 1**  
Company roles selected for interview.

Role	Company
Maintenance Safety Supervisor	Alcoa Rolling Mill, Australia
Safety and Environment Change Agent	Alcoa Rolling Mill, Australia
Health and Safety Advisor	Alcoa Rolling Mill, Australia
General Manager	New Zealand Aluminium Smelters Ltd
Senior Manager – Loss Reduction	New Zealand Aluminium Smelters Ltd
Manager – Health and Safety	New Zealand Aluminium Smelters Ltd
Communications Manager	New Zealand Aluminium Smelters Ltd
Health and Safety Advisor	New Zealand Aluminium Smelters Ltd

Note. The labels following each quote in the text below e.g. [NZAS 2] refer to a randomly allocated number for NZAS participants (similarly for Alcoa). These labels do not necessarily relate to the order of participants listed in this table.

theoretically predicted events (Yin, 1994).

## 3. Results

The coding of the interview transcripts highlighted the three purposive themes addressing the respondents' reflections on safety during times of financial duress:

1. Concerns about the effects of lean management on safety practices;
2. Key issues for safety personnel surrounding staff redundancies;
3. The continuing influence of hierarchy of control implementation.

These themes appear here as questions, sub-questions and relevant comments representing a coherent account and analysis of the respondents' understanding of their difficult financial situation and its effect on their safety management duties.

### 3.1. What are the effects on safety management when 'lean' management practices are subject to even further financial duress?

"...all the 'nice-to-haves' are gone..." [NZAS 5].

#### 3.1.1. What does 'lean' mean for staff safety?

NZAS staff noted a gradual deterioration in their safety processes due to the often indistinguishable effects of the progressive application of lean principles. In particular, their decades-old checks and balances that had kept them safe (Young, 2014), were gradually being eroded despite their best intentions: "...no-one said 'stop using your systems'; in fact, everyone thought that they were being used..." [NZAS 3]. With fewer operatives, more digital systems were introduced to assure compliance with long-established procedures: "What lean said was 'OK we'll have a visual system that says have the checks been done and did you find anything?'; and that system kept on coming up: 'check's been done – didn't find a thing' – so they took it away..." [NZAS 3].

Observations about the role of safety management considered the apparent contradiction between saving money and keeping their people safe: "...it's imperative that you have to have these governance systems in place... they're robust and they're audited, because they're the things that are stopping you from killing people... and if it falls over, unfortunately it's probably only a matter of time" [NZAS 3]. Senior management noted that despite operational staff being focussed on production economy, "the leaner your organisation gets, the stronger your governance has to be, in some ways, because you can afford to do 'light-touch and fit-for-purpose' but you've got to be really sure that things aren't slipping" [NZAS 1]. A balance between an urgency of saving money at a divisional shop floor level and a consideration of the possibly negative effects on safety of cost saving, appeared to have preoccupied management thinking at NZAS: "...if you're not operating for the long term, then you're probably not going to be there for the long term..." [NZAS 3]. Governance decisions made offsite were also

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