

KNOWLEDGE

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BUILDING A BETTER REGULATOR

What does an effective regulator look like?


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AND PETER MURPHY


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CONTENTS

Introduction	5
Why regulate?	7
Where does the regulator sit within government?	11
What should regulators do? Strategy and its implementation	12
Regulatory tools and techniques	14
Regulatory capability	18
Conclusion	21
About the authors	22



INTRODUCTION

The cost of regulation to industry and its impact on industry's operations is being discussed across the world as countries seek to gain economic competitive advantage. Some argue that safety and environmental regulation is an unnecessary cost to industry and that the burdens imposed are not worthwhile. Based on Noetic Group's 15 years' experience in working with regulators around the world, this Noetic Knowledge paper aims to demonstrate that regulation is necessary and that an effective regulator provides benefit to both the community and industry. This paper provides the case for why regulation of even the best managed companies is needed, and what the role of the regulator is. Additionally, it details the activities a regulator should be undertaking, and the types of tools and approaches that result in good outcomes. These include the importance of using a carefully-developed regulatory strategy and the targeted use of regulatory actions. Finally, this paper concludes with analysis of the capabilities of an effective regulator, both organisationally and individually. The coal mining industry is used here as an illustrative example, but the findings are equally applicable to the regulation of high hazard and risk industries such as oil and gas, petro-chemical and hard rock mining.

Across the globe, there appear to be divergent views on the regulation of hazardous industries. In some countries, there is a perception that reduced regulation will enhance national competitiveness or maintain market share of particular industries. In others, the impact of disasters on lives, health, and the environment are driving governments to strengthen regulation to prevent recurrence of these events. While most would agree that there is a need to regulate to protect health, safety and the environment, the type of regulatory system and its method of operation is a matter for government and its legislative program. The effectiveness of the oversight of the legislated regulatory framework is complex, as the legislation rarely specifies how a regulator is to organise itself beyond describing its objectives.

The regulation of high hazard¹ industries is particularly challenging. There is a mix of occupational health risks, fatal accident risks, and rare potentially catastrophic major accidents such as explosions to contend with. Occupational health, where the exposure to a workplace contaminant can have a latency period measured in years (and therefore an adverse effect may not be immediately apparent) presents additional complexity. These industries are invariably large scale and often global. Their operations are compounded by complex technical challenges and difficult operating environments. Establishing a regulatory framework to effectively protects workers, the environment and communities is not a simple task. Administering this framework in an even-handed and beneficial way is even more demanding.

Noetic Group has over 15 years of experience working on regulation and its practical application. This Noetic Knowledge paper evaluates the value of regulation and how effective regulators organise and apply their capability. It seeks to answer the fundamental question of “Why regulate?”, as well as to outline the role of the regulator and its essential functions. In undertaking this role, the use of regulatory strategy and the tools to implement a strategy are reviewed, as is the important concept of regulatory discretion. The paper concludes with a description of regulatory capability, focussing on the importance of people, structure and process. A number of recommendations are made for governments and regulators throughout, and case studies drawn from Noetic Group’s experience.

1. This paper refers to a hazard as anything that may cause harm, while a risk is the chance of harm being caused and its severity.

WHY REGULATE?

Regulation of hazardous industries arose in the early nineteenth century from the need to prevent worker injury and limit overworking.² Much has been learnt since, which has not only improved health and safety outcomes, but also improved profitability for companies as workers become more productive and minimised losses through fewer incidents. Despite substantial improvement since the start of regulatory activity, the health and safety of workers and the environment continue to be impacted by the operation of hazardous (and other) industries. The following case study highlights that major incidents continue to occur in the mining industry.

Safety and occupational health disasters continue to occur

On 5 April 2010 in West Virginia, USA, the Upper Big Branch coal mine explosion killed 29 miners. It is believed to have occurred when a long wall miner ignited a pocket of methane, resulting in a chain of explosions across the underground mine. Methane explosions are a well-known risk and barriers were in place to prevent this occurring. However, these were not properly maintained and subsequently failed. A number of company officials were successfully prosecuted in relation to safety breaches at the mine³.

Australia's coal industry prided itself on the elimination of black lung disease (coal workers' pneumoconiosis). Yet in 2015 the re-detection of the illness sparked a widespread inquiry by the Queensland government into how regulatory and monitoring systems failed to protect worker health. At least 21 workers were diagnosed and more are likely to be in the future. The inquiry found "...catastrophic failure, at almost every level of the regulatory system..."⁴

There is a need to regulate because, despite the great advances made in risk and safety systems, incidents, both large and small, continue to occur. Before discussing the role of the regulator in more detail, and how they can prevent these incidents, it is worth considering

2. See UK Health and Safety Executive, The History of HSE, 2017, retrieved 26 June 2017, <http://www.hse.gov.uk/aboutus/timeline/index.htm>. This page describes the history of the UK Health and Safety Executive.

3. See D McCallister, Ex-Massey Energy CEO Completes 1-Year Federal Criminal Sentence, The Two-Way, 2017, retrieved 14 July 2017, <http://www.npr.org/sections/thetwo-way/2017/05/11/527886633/ex-massey-energy-ceo-completes-1-year-federal-criminal-sentence>.

4. Parliamentary Committees, Inquiry into the re-identification of Coal Workers' Pneumoconiosis in Queensland, Coal Workers' Pneumoconiosis Select Committee, Report No. 2, 55th Parliament, May 2017.

how incidents occur. A discussion on the “models” normally used to explain why unplanned events occur is outside the scope of this paper. However, for the purposes of this paper it is assumed most incidents occur as a result of a failure to have (for whatever reason) the appropriate defences (which are also known as controls or barriers) in place to prevent the unwanted results. This is sometimes referred to as the “Swiss Cheese” model of incident causation. This model, which is widely recognised, is often the basis for legislation (either implicitly or explicitly).

If there is a need to regulate to ensure that operators of hazardous operations have the necessary controls in place, what is the role of the regulator? A central role is to provide the framework and direction to industry to manage risks. Legislation provides the legal structure and articulates the goals to be achieved “...to protect workers and others from harm to their health and safety...”

Legislation defines what duty-holders⁵ such as mining companies are expected to do. The legislation may provide some general guidance about the purpose and scope of a regulator, often in an “Objects” section of the legislation. Yet the specifics of how a regulator goes about its business is rarely spelt out. We have distilled these into a set of objectives or activities as follows:

- + promoting and securing compliance by duty-holders through leadership, guidance and education
- + implementation of effective risk-based intervention strategies
- + providing effective and efficient approval and administrative processes
- + encouraging an industry culture which supports safe operations
- + maintaining information management and reliable data to support industry and regulatory decisions
- + maintaining regulatory capability
- + measuring, reporting and evaluating regulatory performance
- + maintaining appropriate governance standards in the delivery of the above goals.

5. Noetic Group defines “duty holder” as anybody who under legislation has legal obligations, including licence holders, contractors, suppliers, designers etc.

In turn, these activities are underpinned by a set of principles:


- + targeted and proportionate in its inspection activities and examination and assessment of documents which have to be approved or accepted by the regulator
- + consistent in approaching similar situations to achieve similar outcomes
- + transparent in its assessment of the duty holders documents
- + sufficiently expert to be able to assure itself duty holders are capable of discharging their responsibilities
- + independent yet challenging, yet willing to cooperate with and offer guidance to those it regulates and others in the pursuit of safety.

To deliver these activities against the principles requires a breadth of skills and services, including technical and interpersonal skills and knowledge, and administrative and policy expertise. These include data collection, analysis allied to the development of appropriate strategies, and tactics to guide front line activities. These are all critical to the overall success of the regulator. The following sections first explore strategy, and then discusses the tools for intervention.



WHERE DOES THE REGULATOR SIT WITHIN GOVERNMENT?

Independence is a key consideration for the organisational positioning of the regulator. Typically, the regulator is co-located with the agency responsible for policy development and managing the resource. In some respects this makes sense, as it enables expertise to be shared and for information to be readily exchanged by the different functions. However, Noetic Group's experience through reviewing regulators is that this can lead to a perception of a conflict of interest. Therefore, the regulator should ideally be separate from the policy agency or department.

A photograph of two men in industrial settings, wearing yellow hard hats and high-visibility vests. They are looking upwards and to the left with expressions of focus or concern. The background is blurred, showing industrial equipment.

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WHAT SHOULD REGULATORS DO? STRATEGY AND ITS IMPLEMENTATION

As noted previously, regulators are seldom directed in detail as to how they should act, and they usually have substantial discretion. In most cases they are also unlikely to have all of the resources needed to meet the objectives of their legislation. Consequently, they need to think carefully about their strategy and tools. Without a strategy, regulators may simply focus on the areas in which they get the most feedback in terms of incidents and other information. For example, Noetic Group is aware of regulators who respond to most of the incidents reported to them, but this has left them with limited time for more proactive tasks.

Regulators working in the mining sector have a difficult mix of hazards to address. These range from relatively-frequent but lower-consequence (not less important) incidents, often referred to as slips, trips, sprains and strains, to fatal accident risks. They must also account for those rare, but potentially catastrophic events which present special problems, such as underground fires and explosions and occupational health hazards such as respiratory disease or occupational cancers. Poor control over occupational ill-health risks can be difficult to detect. It is not always intuitive and easy to see these, compared with the absence of guarding of a machine or fall arrest precautions. Catastrophic hazards are rare and can lull people into a false sense of security.

A strategy must address all of these types of incidents. Not only are there a range of risks to account for but there are usually a variety of duty holders with different characteristics. They range from large multinational mining corporations, to small local quarrying or opal miners. Similarly some contractors will be large companies working internationally to small, highly specialised contractors. Original Equipment Manufacturers (OEMs) who design, build and supply equipment have an important part to play in health and safety. Each will come with its own history, management team and culture. The combination of all of these factors, types of incidents, and duty holder characteristics, provides a rich array of possibilities for developing a regulatory strategy. Unfortunately, there is no simple algorithm to make sense of this situation or to allocate resources.

Making sense of the factors is not straightforward and clear evidence on which to base a decision will not necessarily be available. For example, evidence of occupationally-caused illness is difficult to obtain, and catastrophic events are so rare as to be beyond statistical analysis. Likewise, data on a duty holders' risk and safety culture or the effectiveness of its management may be elusive. As a result, it can be difficult to always follow evidence-based policy-making principles.

However, expert-based input on the foresee-ability of ill-health from diesel particulates, or of an underground methane explosion from poor implementation of controls, can support the development of the regulatory strategy.

Regulators dealing with low-probability, but high-consequence events, generally have to look beyond their own jurisdiction to develop a strategy. This is due to the rarity of some foreseeable events. Taking a purely jurisdictional view might lead to the conclusion, for example, that because an underground dust explosion has not occurred for many years they can be discounted. In these cases, a broader view encompassing relevant international experience is needed. For example, offshore petroleum well blowouts are uncommon but potentially catastrophic. As such, international experience and learnings are an essential input into developing an offshore petroleum regulatory strategy.

Consequently any regulatory strategy must take into account:

- + relevant international experience
- + experience in other jurisdictions within the country
- + the particular circumstances of the jurisdiction.

The strategy can be made more detailed by considering if there are different priorities for different types of activity. For example, a more detailed strategy for a mining regulator could be developed for different sectors such as:

- + coal underground/open cut
- + metalliferous underground/open cut
- + quarries
- + small mines e.g. precious gems.

In addition to taking the innate characteristics of the hazards into account, there are local factors which should also be considered. For example is the geology in one region more difficult, or is a particular mining technique riskier? Are there particular characteristics about a specific company or mine site that warrant specific consideration, such as a higher frequency of incidents or a history of non-compliance?



REGULATORY TOOLS AND TECHNIQUES

Regulators have a range of tools available to promote and secure compliance. These range from prosecutions and notices to inspections,⁶ and investigations, to influencing. Regulators have wide discretion in how they apply these tools. Each has a place in the regulator's tool kit and this section explores the use of each and its application.

Prosecution and notices

Legislation provides regulators with powers and sanctions that may be used for enforcement. This includes the ability to issue notices to prohibit work or make improvements, and the power to prosecute. These tools are generally well understood and explored in detail in other papers. This paper will focus on the more subtle, but arguably more valuable, tools described below.

Inspections

Visiting workplaces to carry out inspections and incident investigations provides reassurance that protection of workplace health, safety and environment is taken seriously. Visiting workplaces to see it firsthand is essential to achieve and maintain confidence on the part of those at risk, the community and other interest groups. However, the visibility that comes from going into workplaces, while essential, is not sufficient on its own. In addition to being seen in the workplace, what inspectors check and investigate, and how they do it, determines a regulator's credibility.

An effective inspection involves checking to see that the company is complying with the law. This is straightforward if the law is prescriptive. However, much modern legislation is not prescriptive, requiring regulators to instead exercise judgement. In general, the less prescriptive the legislation, the more judgement is needed. The greater the degree of judgement needed on the part of individual inspector, the greater the opportunity for inconsistent decision making. This has important implications for a regulator's internal processes, particularly in relation to achieving consistency⁷.

6. Inspections in this context are taken to mean proactive interventions to make a judgement about the state of compliance with the relevant legislation. These may vary in the terms of the time taken, the depth of the inspection, whether it is on a wide range of topics or a particular theme. They can also be called "audits" in some regulatory environments.

7. The issue of consistency is discussed in the paper's final section.

An effective inspection requires a structured approach and has the following key steps:

- + Determine how the duty-holder intends to comply with the legislation
- + Make a judgement of the adequacy of the duty holder's intention as expressed in their management plans, procedures etc.
- + Compare what is found with the company's stated intended method of complying with the law
- + Assess the gap (if any) and decide on its significance by comparing with industry norms, guidance and standards
- + Decide what action (if any) is needed
- + Advise and explain to the duty-holder what action (if any) is proposed
- + Take action
- + Report for data collection and future analysis.

These steps are much the same as for an incident investigation – except in this case they are conducted once something has happened.

Inspection in practice

An inspection activity requires a regulator to go to where the actual implementation of the company's intention can be assessed. If it is about avoiding light vehicle/heavy vehicle interactions, then it will involve looking at company plans, procedures and standards (most likely at the office of either the regulator or the company). It must then involve finding out in practice how these risk controls are applied. Office-based reviews of documents have merit for regulators in preparing for the site work, but cannot be a substitute for it. The documents outline what companies say they are going to do. However, the real test is how is it implemented in practice, which requires regulators to see what is happening on the ground. Furthermore, regulators must be seen to be doing their job. Going on-site is an indispensable and important part of the job, but not only for the above reasons. It also facilitates building relationships with personnel at all levels on site. This in turn enables information exchange, including obtaining intelligence about past and planned activities.

Incident Investigation

Incident investigations are an important activity for regulators. There is a community expectation that regulators will investigate accidents, especially if somebody is injured or is liable to attract public attention. As noted previously, the process of conducting an investigation is much the same as an inspection but conducted after the fact. As a result, investigations are sometimes regarded as reactive work compared with proactive inspections, which are conducted to identify potential compliance weaknesses which could lead to an accident or illness. Incident investigation techniques are well known and are not discussed further here.

In looking at the application of the various tools at hand, regulators often make a distinction between planned preventive work and reactive work. Inspections fall into the first category (as do educational activities such as conference presentations, and other guidance), investigations into the second. However, the distinction is not black and white – is a published report on an incident reactive or proactive? We have assumed that both are necessary and the key question to be answered is “what is the right balance?” There is no easy answer. However, most experienced regulators believe that it is better to undertake more preventive, than reactive, work.

Regulators typically become aware of circumstances which may warrant investigation, either formally (reporting) or informally (intelligence). However, not all investigations are of equal importance. Is legally mandated reporting to a regulator sufficient to cause an investigation? As noted earlier, regulators have to exercise discretion and this includes deciding where to use resources.

If an incident occurs which has serious consequences, then normally it will need investigation. Failure to do so will likely result in a loss of confidence on the part of stakeholders, especially workforce representatives. However, what should be done about circumstances in which serious consequences could have arisen but did not, because of defences in depth or chance? An example in a mining context might be the partial failure of a high wall (with no injuries, publicity, or demonstrable public concern) in an open cut due in part to an inadequate design. This would warrant some form of investigation, but may not have the same urgency as a fatality, even though the consequences could have been the same in different circumstances.

Noetic Group believes that prevention is preferable to investigating incidents, but both are needed. However, there is often an expectation that incidents will be investigated by a regulator. In practice, this would mean that there would be little opportunity to undertake preventative work. Consequently, Noetic Group's view is that regulators should have a public document which explains the rationale for how they use their discretion to decide on the priority given to all regulatory activities.

Influencing

The final tool available to regulators is that of promoting compliance. This can be undertaken through a number of mechanisms such as guidance and education. The primary target of this work is the management team. The vast majority of senior executives in duty holders are committed to complying with the law. They usually recognise the business imperative to do so. In addition to the personal tragedy, there are significant costs, reputational damage, and a threat to their social licence to operate if they have incidents. Although this is the intention, history shows that companies do not always achieve these goals. Consequently, there is a role for the regulator in helping to encourage the stated intent of duty holders.

When using these tools, a regulator should ask two questions:

1. What are the goals of leadership, guidance and education actions?
2. Where is the guidance and activity targeted?

It might seem intuitive to aim this activity at site level through the provision of technical guidance and the like. But is this what is most needed? Does it cover topics particularly relevant to senior managers who are assumed to have the most power and influence? It is likely that both are needed. But as resources are limited, it must be linked to the overall regulatory strategy. Experience shows that this strategy should encompass the provision of guidance to senior managers on broader topics, as well as narrower technical guidance to workers.

REGULATORY CAPABILITY

If we accept that the regulators job is to judge if a company has the leadership, staff, systems and procedures to safely operate a hazardous facility and take action where there are deficiencies, what capabilities are needed within the regulatory organisation? The key elements of capability for consideration are structure, people and process. Some aspects of process were covered earlier in this paper, this section will focus on structure, people, and decision support.

Structure

There is no single correct organisational structure. However, there are some organisational design principles which regulators have found useful. The following discussion assumes the majority of relevant skills are available in house and focuses on front line inspectorial roles.

There are two main design principles. First, to provide a single point of contact; and second, to have inspectors with specialist capability provide support to a range of companies. It is desirable to provide duty holders with a single point of contact between the regulator and the site or company. This has a number of benefits. Most importantly, company management and the workforce can get to know the inspector, facilitating communication both ways. However, any one inspector cannot be expected to have all the requisite skills and knowledge required of an effective regulator. The second principle is that inspectors providing a specialist capability do so to a broader range of companies by providing the single point of contact. The specialist inspector can acquire a broader picture of the prevailing standards across the industry. This facilitates decision-taking as to what is reasonably practicable.

Typically, the inspector who provides the single point of contact would accompany other specialists to the site to carry out inspections and investigate incidents. This helps to ensure that the specialist understands the context of the company as a whole, and that the company is not faced with different messages from inspectors.

A system in which a mechanical engineer examines mechanical issues at a mine and an electrical engineer examines electrical issues, is not necessarily the best use of resources, because this can result in inspectors missing the bigger picture. After all, most incident causation models recognise that the majority of incidents have multiple causes rather than one root cause, and that they typically involve a number of aspects including people, systems, processes and procedures, as well as technical or engineering aspects.

Enabling the system discussed above typically involves a matrix structure. A possible way to structure the regulatory body is to have two main roles. The first role is the single point of contact between

the company or site and the regulator. They are allocated a number of companies. Individuals in the teams are responsible for specific companies or sites under the management of a team leader. Their role is to manage the overall relationship between the company or site and the regulatory body. They will assess documents requiring approval, and organise and report on inspections, as well as providing an initial response for investigations.

The second role involves those inspectors who are expected to provide specialist advice. They too are under the management of a team leader and are responsible for developing and maintaining the deeper technical skills and knowledge needed. Single point of contact inspectors could have specialist skills or knowledge (e.g. mining engineering). However, what distinguishes the two groups is the role and the breadth of knowledge required. The first point of contact inspector would become knowledgeable about the company or site, and the specialist about the topic and the standards that exist across the industry in that speciality. Some rotation between the roles is desirable. A visual diagram of the operational structure is in Figure 1.

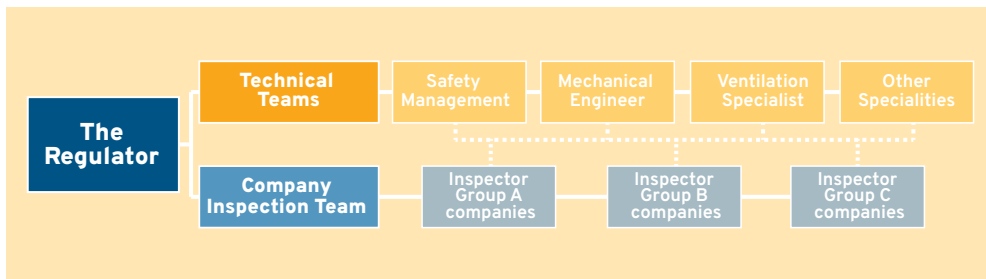


Figure 1: Overview of an operational structure of a regulator

People

Skilled people are the key to effective regulatory capability.

There are two broad categories of skills – interpersonal and technical. Good interpersonal skills are needed to engage with front line workers and their representatives and senior managers. The following are considered the core interpersonal attributes for an inspector:

- + Influencing and communicating
- + Results-orientated and outcome-focussed
- + Client focussed
- + Adaptable and responsive
- + Self-managing and a team player
- + Constructive
- + Continuously learning

With regard to technical skills, knowledge and experience, the following factors should be considered:

- + Industry knowledge without which the regulator will not be credible in the eyes of those who work in the industry
- + Knowledge of hazards from slips, trips, sprains, and strains, fatal accidents, catastrophic hazards peculiar to the industry regulated, and occupational health risks
- + Safety regulatory knowledge including accident causation theory, safety management systems, human factors, knowledge of relevant laws, as well as inspection, auditing and incident investigation skills
- + Public administration and policy-making experience
- + Data collection and interpretation

Given this range of skills, knowledge and experience, it becomes apparent that there is no single perfect background. Other industries and regulators have found value in diverse views and complementary skills. A good example of how this works effectively is mining engineers working in offshore oil and gas production.

Decision support

A lack of consistency⁸ in decision-making is often a criticism levelled at regulators. Dealing with such criticism usually requires initial clear guidance as to what is expected and legally enforceable, to both duty holders and regulatory personnel, backed up by training and briefing. Regulators have often found these approaches essential, but not sufficient.

As such, it is important to have a process or procedure aimed specifically at delivering consistency. These include tools sometimes known as an enforcement management model (EMM).⁹ This is based on the premise that inspectors should be able to articulate the gap between what is required in law and what the duty holder has delivered. This gap, plus a number of other aggravating or mitigating factors, help to define what action is appropriate in any one situation. Other processes include post facto reviews by first line managers of a sample of decision-taking by their teams to identify learning and peer review techniques. Deciding which, if any, of these approaches is appropriate depends on a number of factors. For example, a small regulator with most of its personnel located in one office would likely not have as great a need for processes promoting consistency.

8. Consistency in this context means achieving similar outcomes from similar situations.

9. Health and Safety Executive (UK HSE), Enforcement Management Model (EMM), 2013, retrieved 22 February 2016, <http://www.hse.gov.uk/enforce/emm.pdf>

CONCLUSION

Regulation of hazardous industries is an essential role of government. Protection of worker health and safety, and the environment, is expected by the community and stakeholders. While the vast majority of duty holders seek to effectively manage the hazards and risks they create, compliance still needs to be checked, and, when necessary, enforced. Regulators have a range of tools at their disposal to achieve the objectives of their legislation. These tools allow them to both promote and enforce compliance. The way regulators apply their discretion in using these tools should be determined by a comprehensive and carefully-considered regulatory strategy. As with any endeavour, the quality of the implementation of this strategy will be determined by the capability of the people undertaking the task. To ensure that worker health and safety, and the environment are protected it requires a well-structured regulator with staff who possess both the requisite interpersonal attributes and technical skills.

ABOUT THE AUTHORS

Peter Wilkinson

Peter is an experienced regulatory professional who worked as a frontline regulator and in HQ roles in the UK's Health and Safety Executive (HSE) regulating heavy manufacturing industry, petrochemicals, railways and oil and gas, on and offshore. In Australia, (on loan from the UK HSE), Peter was the principal architect of NOPSA the forerunner to NOPSEMA, the joint Commonwealth/States/NT, offshore oil and gas safety and environment regulator.

Whilst working on loan to the then Commonwealth Department of Industry, Tourism and Resources, in 2005 he also carried out project work for the WA Mines Minister, Clive Brown on the feasibility of introducing a safety case regime to WA. In 2004 and 2005 Peter was appointed as an assessor to the Wran Review of the New South Wales (NSW) mine safety regime. Following the Pike River disaster in New Zealand, Peter provided both policy advice and technical training to the then High Hazards Unit of the Department of Labour (now part of WorkSafe NZ). In 2014 the NSW Resources Minister commissioned Peter to review 5 deaths which occurred in the mining industry. His Report "The Wilkinson Fatality Review" was accepted by all parties including the Minerals Council and CFMEU representatives.

More recently Peter was the principal author for the London based International Council on Mining and Metals Implementation Guidance on Critical Control Management published in December 2015. Also in 2015 Noetic provided support to the statutory Triennial Review of NOPSEMA. Peter was one of three expert assessors who interviewed a substantial number of stakeholders.



Peter Murphy

Peter is a Director and Co-founder of Noetic Group. He has worked with governments to establish regulatory authorities for offshore oil and gas in Australia and Timor-Leste. In the aftermath of the Montara blowout (Australia's worst oil spill) he led a team that oversaw the implementation of the findings of the Commission of Inquiry. He subsequently led a group of specialists on behalf of the Federal and Northern Territory governments that provided two years of oversight of the Ranger Uranium Mine after a significant spill. Peter has delivered training for regulators of major hazard facilities, mines, maritime safety, and offshore oil and gas. In addition, to this practical work he has assisted Federal agencies on policy development for the resources sector, maritime safety, and therapeutic goods (medicines). He worked with the Asia Pacific Partnership on Clean Development and Climate, APEC and the International Council for Mining and Minerals on energy and coal mine safety. In addition to regulatory work, he has assisted on safety strategy and its implementation for mining, and oil and gas companies in Australia, China and North America.





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