national research centre for
OHS regulation

RegNet

Working Paper 24

Regulatory Strategies for the Safe Design of Plant

Liz Bluff
Researcher, National Research Centre for Occupational Health and Safety Regulation, Regulatory Institutions Network, Research School of Social Sciences, Australian National University

April, 2004

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- facilitate and promote groups of collaborating researchers to conduct empirical and policy-focused research into OHS regulation in each of the States and Territories;
- facilitate the integration of research into OHS regulation with research findings in other areas of regulation;
- produce regular reports on national and international developments in OHS regulation;
- develop the research skills of young OHS researchers; and
- assist in the development of the skills and capacities of staff of the NOHSC Office.

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Address for correspondence:

National Research Centre for Occupational Health and Safety Regulation
Regulatory Institutions Network (RegNet)
1st Floor Garden Wing, University House
The Australian National University
Canberra ACT 0200
Ph (02) 6125 1514 Fax (02) 6125 1507
Email nrcohsr@anu.edu.au
Web http://ohs.anu.edu.au

1. The Rationale for Safe Design

Eliminating and controlling risks to health and safety 'at the source', as early as possible in the life cycle of work, workplaces and equipment used, is a well recognised strategy for preventing or minimising occupational fatalities, injuries and ill-health. For plant, including machinery, equipment, appliances, implements and tools, a 'safe design' approach involves addressing OHS in the upstream phases of procurement, design, manufacture, import, supply, installation, erection and commissioning.

The importance safe design is highlighted by epidemiological analysis of work-related incidents involving fixed plant and machinery. Between 1989 to 1992, of 225 work-related fatalities, a design problem was identified as a contributing factor in 117 (52%).[1] However, the proportion of fatalities where design is a factor could be as high as 95% according to a recent analysis of incidents for the years 2000/01 and 2001/02.[2]

If hazards can be eliminated or effectively controlled in the early life cycle phases then OHS problems may be overcome for those who use or work with the plant downstream, including when plant is erected or installed, commissioned or set up, transported or stored, maintained, cleaned, repaired or adjusted, and in response to failure, breakdown or blockages. To this end, eliminating hazards at the design stage is one of five priorities established in *The National OHS Strategy 2002–2012*, endorsed by the Australian Workplace Relations Ministers' Council in May 2002.[3] A national action plan identifies several strategies for pursuing this safe design priority, the first of which is to improve the regulatory framework.[4] This working paper takes up this goal, asking what form of OHS regulation might be effective in stimulating and underpinning the production of plant that is inherently safe.

While the principal focus of this paper is the preventive provisions of OHS statute law, it is important to recognise that legal action of a remedial nature could arise in several ways under the common law, where a person sustains injury or other loss.[5,6,7] First, as the relationships between the parties engaged in procuring, producing and supplying plant may involve contractual agreements, an action could be initiated for an alleged *breach of contract*, such as failure to address OHS matters in contravention of an expressed or implied term of a contract. Second, common law action could arise for the *tort of negligence* if a plaintiff can successfully prove that a duty of care was owed by the defendant, that the defendant breached the standard of care required to discharge the duty of care, that the risk of injury was foreseeable and not insignificant,[8] that reasonable and practicable precautions were not taken, and that the breach caused the injury or other damage sustained by the plaintiff. A third possibility is action for the *tort of breach of statutory duty*, where a person sustains injury or loss caused by an alleged breach of a statute or regulation, and action under the common law is permitted, or at least not explicitly prevented, under the relevant statute. (Such action is possible under at least four of the Australian OHS statutes).[9] The potential for such actions under the common law may provide some incentive for upstream parties to seriously consider their role in ensuring that plant is inherently safe.

Nonetheless, the principal focus of this paper is the preventive obligations of upstream duty holders under Australian OHS statute law. Attention to OHS in the early life cycle of plant is required under the ten Australian OHS statutes, as well as under OHS regulations which are mandatory and some evidentiary standards which have legal

status but allow the duty holder to follow the standard or take alternative action that achieves an equivalent or better level of protection. Table 1 presents a list of the relevant statutes, regulations and key evidentiary standards. The OHS statutes establish general duties on a range of upstream parties whose actions have the potential to impact upon OHS, including persons who design, manufacture, import, supply, install and erect plant. The general duties are broad statements of responsibility which have been in place for ten to twenty years, depending on the jurisdiction, while the current plant regulations and evidentiary standards are a more recent development, following the declaration in 1994 of the *National Standard for Plant*.[10] This model standard, intended to be the basis for a uniform regime of OHS regulation for plant,[11] has been variously adopted under mandatory Commonwealth, state and territory regulations as well as evidentiary standards.

Table 1 : Australian OHS Statutes, Regulations and Key Evidentiary Standards Relating to Plant and Upstream Obligations[12]

Jurisdiction	**OHS Statute**	**Abbreviation**
Australian Capital Territory	*Occupational Health and Safety Act 1989* *Approved Code of Practice: National Standard for Plant (NOHSC, 1994)*	OHSA(ACT) ACOP NSP (ACT)
Commonwealth government	*Occupational Health and Safety (Commonwealth Employment) Act 1991* *Occupational Health and Safety (Commonwealth Employment)(National Standards) Regulations 1994*	OHS(CE)A (Cwlth) OHS(CE)(NS)R
Maritime industry	*Occupational Health and Safety (Maritime Industry) Act 1993*	OHS(MI)A
New South Wales	*Occupational Health and Safety Act 2000* *Occupational Health and Safety Regulation 2001*	OHSA (NSW) OHSR (NSW)
Victoria	*Occupational Health and Safety Act 1985* *Occupational Health and Safety (Plant) Regulations 1995* *Code of Practice - Plant 1995*	OHSA (Vic) OHS(P)R (Vic) COP(P) (Vic)
South Australia	*Occupational Health, Safety and Welfare Act 1986* *Occupational Health, Safety and Welfare Regulations 1995*	OHSWA (SA) OHSWR (SA)
Western Australia	*Occupational Safety and Health Act 1984* *Occupational Safety and Health Regulations 1996*	OSHA (WA) OSHR (WA)
Northern Territory	*Work Health Act 1986* *Work Health (Occupational Health and Safety) Regulations 1992*	WHA (NT) WH(OHS)R (NT)
Queensland	*Workplace Health and Safety Act 1995* *Workplace Health and Safety Regulation 1997* *Plant Advisory Standard*	WHSA (Qld) WHSR (Qld) PAS (Qld)
Tasmania	*Workplace Health and Safety Act 1995* *Workplace Health and Safety Regulations 1998*	WHSA (Tas) WHSR (Tas)

This working paper also discusses some relevant requirements of trade practices (product safety) law. The Australian *Trade Practices Act* 1974 (the TPA) and

complementary state/territory legislation establish requirements in relation to product safety and product liability. While this legislation is principally concerned with the supply of goods to 'consumers' it may apply, in some circumstances to plant used at work, for example if plant is supplied for personal use, by a self-employed person.[13] The regulation of electrical equipment safety is also briefly discussed. This applies to all electrical equipment, whether supplied for occupational or non-occupational use.[14]

These Australian requirements are contrasted with the European approach to regulating machinery safety. The principal instrument for regulating machinery safety in Europe is the *Machinery Directive*, "Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of laws of the member states relating to machinery".[15] The Directive applies to the initial 'placing on the market' or 'putting into service' of machinery and safety components, in the European Economic Area (EEA). As such it principally applies to new machinery although it also applies to second hand machinery if it is placed on the market in the EEA for the first time. While there are additional directives for specific machinery including pressure equipment, lifts, and agricultural and forestry tractors, and directives[16] for specific hazards such as electromagnetic radiation and noise, it is the *Machinery Directive* which establishes the principal requirements relating to machinery safety. The Directive has now been transposed into national legislation by all EU member states and is administered by the European Commission in conjunction with member states' labour or OHS inspectorates. As the world's largest exporter of machinery, the EU's regulatory regime for machinery safety is an important influence on plant traded around the world.[17] In particular, Australian manufacturers are expected to comply with the *Machinery Directive* if they wish to place their plant on the market in Europe.

This working paper highlights key differences between the Australian and European regimes and identifies some options for improving the regulation of safe design under Australian OHS law. In particular, the discussion focuses on: (1) the types of plant to which safe design requirements should apply; (2) the parties with designated responsibilities; (3) the systematic process of risk management; (4) the use of technical standards to underpin safe design; (5) testing and examination, technical assessment and design verification of plant; (6) provision of information; (7) documentation of safe design; (8) use of safe design 'marks' or identifiers; (9) qualification of safe design obligations; and (10) consistency in regulation of safe design. Each of these elements are addressed in turn, proposing some goals for regulating safe design of plant and outlining some strategies for achieving these goals.

Defining plant and machinery – what should safe design obligations apply to?

How plant is defined determines the application of safe design regulation. Under the Australian OHS statutes 'plant' is defined broadly to include a range of machinery or equipment, and components or fittings of these.[18] This broad definition extends to manually powered as well as power-driven plant. Likewise the *National Standard for Plant*[19] defines plant broadly to include "any machinery, equipment (including scaffolding), appliance, implement or tool and any component or fitting thereof or accessory thereto." In contrast, while still covering a broad range of plant, the Australian OHS regulations and other evidentiary standards have, in some jurisdictions, adopted a narrower definition focusing on plant that is powered by a source other than manual power.[20] The Australian obligations typically apply to plant

for use ‘at work’ or plant for use ‘at a workplace’ but nonetheless extend to certain high risk plant such as boilers and pressure vessels, lifts and cranes, scaffolding and amusement devices, whether or not these are used at work or situated at a workplace.

In contrast the EU *Machinery Directive* extends to machinery in general, whether it is for occupational or for non-occupational use.[21] This includes machinery powered by manual effort if the manual effort is stored in springs, hydraulic or pneumatic accumulators which can produce dangerous action. Machinery also includes ‘safety components’ which have a safety function as a specific characteristic of the component, for example electro-sensitive devices to detect persons in the danger zone of machinery, roll over protective structures, power-operated guards, or emergency stopping devices. Some machinery is not covered including: machinery for medical use; amusement devices; steam boilers, tanks and pressure vessels; means of transporting passengers or goods by air, road, rail, water (except vehicles used in mineral extraction); mobile offshore units; agricultural and forestry tractors; lifts which permanently serve buildings and structures; and construction site hoists for lifting persons or goods.[22] However, some of these are regulated by specific Directives, for example those for pressure equipment, lifts, and agricultural and forestry tractors.[23]

In summary, an important consideration in safe design regulation is its application. If the *goal* of regulation is to *ensure that safe design effort is applied to plant where inherent safety is most needed*, several matters are important to address in defining ‘plant’. First, recognising that plant is most dangerous when it is energised in some form, it is crucial to encompass both power driven plant and plant that is powered by manual effort, if that effort is stored and can produce dangerous action. Second, there is merit in making it explicit that plant includes safety components as the safe design and performance of these are critical to ensuring that plant is inherently safe. While safety components are ‘components’ within the scope of plant as defined under Australian OHS law, they are not specifically identified. Third, it would be possible to extend safe design regulation to encompass non-occupational plant as well plant supplied for use at work. However, such plant is currently addressed under the product safety requirements of trade practices law[24] and as such it is unnecessary to extend OHS requirements to non-occupational plant, other than the high risk items currently included, unless a more ambitious integration of OHS and trade practices (product safety) obligations is contemplated.

Responsibility for safe design functions

A key question for safe design regulation is where responsibility should lie for addressing OHS in the upstream phases of the life cycle of plant. Under the Australian OHS statutes the upstream duties extend to design, manufacture, import and supply, installation and erection of plant.[25] Persons who *manufacture*, *install* or *supply* plant (including wholesale or retail, new and second hand sale, and hire of plant), have a duty of care under all of the OHS statutes, as do persons who *import* plant, except in NSW. However, the NSW *Occupational Health and Safety Regulation 2001* does give importers responsibilities in relation to plant.[26] *Designers* have a duty of care under the OHS statute in most jurisdictions but not in the Commonwealth, ACT or maritime industry. Persons who *erect* plant have an explicit duty of care under all the OHS statutes except in Tasmania.[27]

The scope of the upstream duties is broadly similar. For persons responsible for *design*, *manufacture*, *import* or *supply* the duties involve ensuring that plant is designed and constructed to be safe and without risks to health (or ensuring that plant is in a safe condition, or ensuring that persons using plant are not exposed to hazards or risks). The duties also typically require provision of information, and testing and examination of plant. However, the precise duties are somewhat different in each jurisdiction. For example, not all OHS statutes require all duty holders to ensure testing and examination, and the Queensland statute assigns different responsibilities to each duty holder. The duties of persons who *install* or *erect* plant are more limited than other upstream parties. Their duties are to ensure that plant is installed and erected so as to be safe. The duties do not include either testing or provision of information (except in NSW, where the term 'manufacturer' is taken to include a person who installs or erects plant).

More detailed responsibilities are found under the OHS regulations and evidentiary standards for plant.[28] In contrast to the OHS statutes, these tend to differentiate the responsibilities of upstream parties, establishing a somewhat different role for *suppliers* as compared with those who *design* and *manufacture* plant, and those who *install* or *erect* it. The specific obligations of risk management, testing and examination, information provision and design verification are discussed further below.

Australian trade practices law takes a different approach, designating the *supplier of goods* as the responsible party. Product safety requirements apply generally to the supplier who could be a retailer, wholesaler, importer or manufacturer. Electrical equipment safety requirements, which concern the testing of prescribed equipment, also apply to *suppliers* in general.

The EU *Machinery Directive* also places responsibility on a particular party, the *person who places* the machinery *on the market*, or *into service*, in the EEA.[29] This is usually the manufacturer or his/her 'authorised representative'. A distributor who sells machinery under his/her brand name is the 'apparent manufacturer' and takes on the manufacturer's obligations. In general, responsibilities relate to new plant and the EU regime only extends to second hand plant if it is placed on the market in the EEA for the first time.

In the interests of producing inherently safer plant it could be argued that all of those who have real control and influence over plant safety from initial concept through to commissioning should take steps to ensure that OHS is effectively addressed. It is also pertinent to keep in mind that even if statute law narrows the range of responsibility, the common law does not. A person who is negligent in designing, manufacturing, constructing, installing, erecting or supplying plant could face the prospect of common law action initiated by a person injured through that negligence.

For OHS law, this could mean designating responsibility to all upstream parties. One approach would be to differentiate responsibilities, as in the earliest phases of design and manufacture it is possible to design out hazards and/or incorporate risk control measures that are compatible with the original design concept and functional requirements of the plant. In contrast, a supplier, whether as a retailer, wholesaler or otherwise, may be less able to make the design and manufacture of the plant inherently safe. However, even here there may be possibilities to retrofit controls,

make modifications to minimise OHS risks and, at the very least, not interfere with safety features incorporated by the manufacturer. The same is true for those who install and erect plant. Moreover, if imported plant is to meet the same standards as locally produced plant then importers must take on full responsibility for ensuring that this is so. A further consideration is the degree of overlap between duty holders in that, for example, an end product manufacturer may also be responsible for design and supply of plant. Thus differentiation of obligations may involve unnecessary 'splitting' of responsibilities and complexity of obligations.

The role of the procurer is also important. The client or customer may influence OHS outcomes through design features, timeframes, financial aspects and other requirements they specify or impose. This can be a positive influence, encouraging those responsible for design and construction to address OHS matters. Conversely, procurer specifications, budgetary and other constraints may make it difficult or impossible to address OHS effectively. Procurers may also play a crucial role in requiring end user involvement in the design and manufacture phases. This is essential to designers and manufacturers understanding operators, their intentions and the operating environment and, in turn, for operators to understand how the plant is designed and constructed, and the boundaries of safe operation.[30,31] Australian OHS law does not currently establish obligations of persons procuring plant, although plant regulations may require an employer to take certain steps to address OHS before or during the introduction of plant to the workplace.[32]

In summary, if the *goal* of safe design regulation is to *enhance consideration of OHS matters as early as possible in the life cycle of plant, in the design, and in the choice, manufacture and assembly of materials and components*, this requires the engagement of all parties with real control or influence in the early life cycle phases of plant in addressing OHS problems. These parties include the client or customer procuring plant and persons responsible for design, manufacture, import, supply, installing, erecting and commissioning of plant – that is, all of those involved in the chain of supply of plant. As a stimulus for safe design, consideration could be given to establishing obligations that apply to all of the upstream parties, requiring them to address OHS matters as far as (reasonably) practicable. (See also section below, *Qualification of safe design obligations*).

A systematic process of risk management

Risk management is the process of systematically identifying potential sources of harm (hazards), assessing risks and determining control measures commensurate with those risks. The process provides a means to pursue improved OHS outcomes when specific preventive measures cannot be specified because, for example, of technological diversity.[33] Only one Australian jurisdiction, Queensland, provides for this process under the principal OHS statute, as part of the general arrangements for 'ensuring workplace health and safety'.[34] In the other jurisdictions (and also in Queensland), risk management provisions can be found in the OHS regulations and/or evidentiary standards.

The risk management processes for plant are broadly based on the *National Standard for Plant*. In general, the *designer* is initially responsible for hazard identification, risk assessment and eliminating or minimising risk (sometimes expressed only as minimising or reducing risk). The *manufacturer* assumes the designer's duties if the

latter is outside the jurisdiction, is responsible for eliminating or minimising (or reducing) risks arising in manufacture of the plant, and for addressing faults identified after supply of the plant. An *importer* takes on the duties of the designer and manufacturer if the latter are outside the jurisdiction. The *supplier* has duties to eliminate or minimise (or reduce) risks of plant under his/her control and to identify faults to the purchaser/owner after supply (except in Queensland where the supplier's obligations are limited to provision of information).[35] In some jurisdictions a person who *installs or erects* plant must also ensure that hazards are identified, risks are assessed and eliminated or minimised (or reduced),[36] or must ensure that plant is not damaged so as to cause an OHS risk.[37]

In regard to what is required in the risk management process, there are important variations between the jurisdictions. Under the South Australian and Commonwealth regulations, and the ACT code, the approach is the same as the *National Standard for Plant.* There is a list of hazards to be considered including entanglement, crushing, trapping, cutting, stabbing, puncturing, shearing, abrasion, tearing and stretching, as well as failure of the plant resulting in loss of contents, loss of load, unintended ejection of work-pieces, explosion, fragmentation or collapse of parts, and the capability of the plant to lift and move people, equipment and materials.[38] Risks must be controlled for the life cycle phases of manufacture, installation, erection, use, maintenance, adjustment, repair and cleaning. A hierarchy of control measures is invoked which involves considering in turn, and applying, the measures of substitution, modification of design, isolation, engineering controls, administrative measures and personal protective equipment. Certain specific risks must be addressed including ergonomic design, rollover and falling objects, discharge of unwanted substances, access and egress, emergency lighting and alarms, guarding, procedures for clearing jams, operational controls, emergency stops and warning devices. Required operator competencies are to be identified and specified items of plant must be designed to comply with particular technical standards (discussed further below).

The other jurisdictions take a somewhat different approach. The Western Australia OHS regulations adopt essentially the same approach to risk control as the *National Standard for Plant* but, in addition, the Australian Standard AS 4024.1 *Safeguarding Machinery* is an approved code of practice, providing guidance about ergonomic, mechanical and other plant hazards.[39] Queensland's *Plant Advisory Standard* outlines a range of factors to be addressed advises duty holders to consider applying relevant technical standards, including AS 4024.1.[40] A variant of the hierarchy of control measures is advised, which includes design, substitution, redesign, separation (isolation), administrative controls and personal protection.[41] The Victorian *Code of Practice – Plant* outlines a list of hazards to be addressed,[42] some of which are the same as the *National Standard for Plant.* Victoria's plant regulations cover some of the specific risk controls addressed in the *National Standard for Plant* and the plant code lists a number of technical standards, including AS 4024.1, that "designers may choose to consider".[43] In New South Wales the approved *Code of Practice for Technical Guidance*[44] incorporates a number of Australian Standards relevant to specific types of plant and the OHS regulation covers some aspects of the risk control approach in the *National Standard for Plant*. Regulations in Tasmania take a more cursory approach identifying a limited set of risk control measures to be applied[45] while the Northern Territory regulations require risks to be minimised and duty holders to comply with a schedule of Australian Standards.[46]

The approach taken by the EU Machinery Directive is different in some important ways. The Directive also applies risk management principles, requiring integration of safety at the design stage, taking into account use and operation, as well as adjustment, maintenance, assembly and dismantling of machinery. The Directive also identifies 'essential health and safety requirements' which must be complied with.[47] There are general requirements that address materials and substances, lighting, control systems and devices, emergency and normal stopping, power supply and starting, stability, falling or ejected objects, surfaces and edges, tools, type of guarding and access for installation, maintenance and clearing blockages, electrical hazards and static electricity, hydraulic, pneumatic and other energy sources, extreme temperatures, fire and explosion, vibration, radiation, lasers, emissions, trapping and enclosure, slipping, tripping and falling, access to operating position, isolation and dissipation of energy sources, cleaning and unblocking, maintenance and operator intervention, warning devices, warning of residual risks (using pictograms). There are also specific requirements that apply to agri-foodstuffs machinery, portable hand-held and/or hand-guided machinery, woodworking and analogous machinery, machinery hazardous due to mobility or lifting, machinery for underground work, and machinery for lifting or moving people.

The *manufacturer (or authorised representative)* must assess each of the essential requirements to identify those which apply to the machine, and then design and construct the machine taking account of this assessment. Thus essential health and safety requirements may help overcome a potential weakness of the generic risk management process, failure to recognise hazards, by highlighting specific problems to be addressed. As well as serving to alert upstream parties to important hazards to be considered, some of the essential health and safety requirements are expressed as performance outcome standards. The value of this approach is that it defines the OHS outcomes to be achieved but leaves open the choice of measures used to achieve this outcome.[48] Table 2 presents some examples of the essential health and safety requirements that are performance outcome standards.

Table 2: Some Examples of EU Essential Health and Safety Requirements

Control devices must be designed or protected so that the desired effect, where a risk is involved, cannot occur without an intentional operation. [clause 1.2.2, para 1, point 6]
From the main control position the operator must be able to ensure that there are no exposed persons in the *danger zones*. (clause 1.2.2, para 5]
Precautions must be taken to prevent risks from *falling or ejected objects* (for example work pieces, tools, cuttings, fragments, waste etc). [clause 1.3.3]
Machinery must be so designed and constructed as to prevent or limit the build-up of potentially dangerous *electrostatic charges* and/or be fitted with a discharging system. [clause 1.5.2]
Machinery must be so designed, constructed and/or equipped that risks due to *gases, liquids, dust, vapours* and other waste materials, which it produces, can be avoided. [clause 1.5.13]
Machinery must be designed, constructed or fitted with a means of preventing an exposed person from being *enclosed within* it or, if that is impossible, with a means of summoning help. [clause 1.5.14]
Handholds and steps must be designed, constructed and arranged in such a way that the operators use them instinctively and do not use the controls for that purpose. [clause 3.4.5]

In selecting the most appropriate methods to control risks, the manufacturer must apply a hierarchy of controls requiring: (1) elimination or reduction of risks as far as possible so the machinery is designed and constructed to be inherently safe; (2) taking the necessary protection measures in relation to risks that cannot be eliminated; (3) informing users of the residual risks due to any shortcomings of the protection measures adopted; and (4) indicating whether any particular training is required and specifying any need to provide personal protection equipment.

While there is some concern that the essential health and safety requirements should be more developed in the area of ergonomics,[49] they nonetheless provide a more directed and more comprehensive approach to risk management than the broad processes required under the Australian OHS regime. Failure to comply with essential health and safety requirements may justify prohibition, withdrawal or other restriction to machinery or safety components being placed on the market or put into service on the grounds that they may endanger safety.

Technical standards to support safe design

An alternative or complementary approach to providing direction to underpin safe design is the use of technical standards. Indeed technical standards are a valued source of guidance for designers and manufacturers.[50,51,52] A cornerstone of the *National Standard for Plant* was to identify consistent design standards for designated 'high risk' plant including various types of cranes, pressure equipment, gas cylinders, lifts, building maintenance units, work boxes, elevating work platforms, prefabricated scaffolding, hoists, mast climbing work platforms and amusement structures. As new technical standards have become available since the declaration of the national standard in 1994, it is timely to reconsider the design standards referenced in OHS legislation.

Use is also made of technical standards under the product safety requirements of the Australian trade practices law.[53] It is an offence to supply consumer goods that do not comply with a prescribed 'consumer product safety standard' or 'consumer product information standard'.[54] Some examples of mandatory standards are AS/NZS 1841 and AS/NZS 4353 for portable, non-aerosol and aerosol type fire extinguishers respectively; and AS/NZS 2693 and AS/NZS 2615 for vehicle and trolley jacks.

More extensive use is made of technical standards under the EU Machinery Directive. There are more than 400 'harmonised standards' which are technical standards drawn up by the European standards bodies[55] and taken over unchanged in the member states' national collections. These standards deal with basic concepts for design of machinery, ergonomic principles, preventing access to danger zones, safety components or devices, and specific types of machinery. While manufacturers must comply with the essential health and safety requirements, they may do this by complying with relevant harmonised standards. If machinery complies with harmonised standards there is a 'presumption of conformity' with the essential health and safety requirements that correspond to the standards complied with. However, manufacturers are not required to apply harmonised standards and if they choose not to do so they must demonstrate how the essential health and safety requirements have been met by other means.

In summary, if a *goal* of safe design regulation is to *ensure that foreseeable risks are comprehensively identified and eliminated or minimised, in order to improve OHS outcomes for a range of persons who use, operate, maintain or otherwise work with or may be exposed to risks arising from that plant throughout its life cycle*, then the approach of Australian OHS legislation is not optimal. It leaves duty holders uncertain about what is expected because the current, multi-faceted, regime presents confusing differences in the process of risk management, the range of hazards to be considered, the life cycle phases to be addressed and the risk control measures to be applied. In additional to inconsistencies in approach, the risk management process itself is a generic obligation which can be ambiguous to duty holders who are not fully attuned to the ways in which their decisions impact on OHS. There is a real danger that key risks will be overlooked.

The EU approach of prescribing essential health and safety requirements is one strategy for providing greater focus and direction about OHS problems to address and OHS outcomes to be achieved. A complementary approach is to make greater use of technical standards, as is also done in the EU. Such standards provide guidance, in particular, for decisions about OHS in the design and construction of plant which are often specific and technical in nature. They "fill in the detail so that machinery designers and suppliers have clear guidance on how to achieve conformity … and to integrate safety at the design stage."[56] If given evidentiary status, technical standards provide one means of complying but allow duty holders the option to apply engineering principles or other strategies to develop alternative risk control measures. In addition to these strategies for underpinning the risk management process, a consistent approach to application of the hierarchy of control measures is also important to facilitate understanding and application of this concept.

Testing and examination, technical assessment and design verification

Testing and examination are the means by which residual hazards are identified and the adequacy of control measures is determined. The Australian OHS statutes require at least some of the upstream duty holders to ensure the testing and examination of plant, in all jurisdictions except New South Wales and Tasmania. Those most commonly assigned duties of this type are *manufacturers* and *importers*. Nonetheless, *designers* have such duties in five jurisdictions, and *suppliers* have such duties in six jurisdictions. It is not expected that the responsible persons undertake the testing themselves, they simply need to ensure that it has been done. Testing and examination must be sufficient to ensure that the duty to design and construct safe plant[57] or discover, eliminate or minimise risks,[58] is complied with. Where testing is required of duty holders, it is expressed in the same manner for all such duty holders within the jurisdiction.

Duties to test and examine are also established under OHS regulations for plant and some jurisdictions have evidentiary standards which describe duties to test. The duties under sub-ordinate legislation are more limited in scope and application than under the OHS statutes. Of the jurisdictions that cover testing and examination, only Queensland's *Plant Advisory Standard* identifies a role for *designers*.[59] The other six jurisdictions focus primarily on the role of *manufacturers* and *importers* and link testing with compliance with the scheduled technical standards for design verification and registration of plant (discussed further below). The Queensland standard is also the most expansive in regard to the role of *manufacturers*, referring to a range of tests

to be considered[60] and *importers* are advised to check the designer and manufacturer's documentation. Compared with their duties under the OHS statutes, *suppliers* have a minor role in testing under OHS regulations. Only a few jurisdictions require particular suppliers, those who hire or lease plant, to carry out testing.[61]

As the appropriate form of testing or examination depends on the type of plant, it is difficult for legislation to be more precise about the form of testing required. Thus provisions relating to testing and examination of plant are brief under the OHS statutes and regulations, although there are various technical standards which have legal status and some of these identify testing and examination requirements.

There are two particular forms of testing and examination under the Australian regulatory regimes which require special consideration. These are design verification and technical assessment, both of which may involve a competent and independent third party. One example is the uniform approvals scheme, administered by state/territory regulatory authorities for electrical safety, which is aimed at preventing the sale of unsafe electrical equipment. Prescribed electrical equipment, whether manufactured locally or imported must be approved after testing by an accredited testing facility (or licensed person), and must carry an approval number to indicate compliance with safety standards. The approval is recognised in all other states or territories. For equipment that is not prescribed, manufacturers and importers of may voluntarily submit any item to an approval authority for examination. This regime for electrical equipment is an example of a system that requires pre-sale compliance, reinforced by compliance checks by enforcement officers at sale outlets. The requirement for an approval number on designated items provides enforcement officers and purchasers with a means to check compliance. A national register is maintained of recalled electrical equipment, providing another means by which purchasers may check their acquisitions.

In regard to workplace plant more generally, the system envisaged by the *National Standard for Plant* required independent verification of the design for certain 'high risk' types of plant, against prescribed technical standards, and registration of the design with the relevant OHS authority. The registered design would then be recognised in all other jurisdictions. 'Independent' means that the design verifier must not have any involvement in the design of the relevant plant, and the designer and the design verifier must not be employed or engaged by the same person unless a quality system, certified by an accredited body is used to design the plant.[62]

Six jurisdictions introduced regulations or an approved code of practice giving effect to the arrangements set out in the *National Standard for Plant*.[63] Three others introduced variations on the national standard requiring design verification by a person who is competent but not specifying criteria for independence of the design verifier.[64] There are also some differences in the types of plant for which verification is required, and whether technical standards are prescribed as a benchmark for design verification and, if so, which ones. A consistent approach would require that all jurisdictions agree to functional independence for design verification, and develop and adopt a list of design standards that are acceptable in all jurisdictions.[65]

These matters have been addressed in the EU's *Machinery Directive* which requires technical assessment for a set list of machinery and safety components. This assessment may involve an independent third party and applies to a range of plant

which is quite different from plant requiring design verification in Australia. It includes some types of saws, spindle moulding machines, presses, injection moulding machines, machinery for underground work, vehicles servicing lifts, devices for lifting people and machines for manufacture of pyrotechnics, electro-sensitive devices, logic functions for bimanual controls, automatic screens to protect presses, roll over and falling object protective structures.[66]

Items listed which conform completely to harmonised standards covering all the relevant essential health and safety requirements, may be declared by the manufacturer to conform to the *Machinery Directive*. The manufacturer must send a 'notified body' a copy of the technical construction file (see below) and the notified body may acknowledge receipt of the technical file, verify the technical file and certify, after examining the file, that the harmonised standards have been complied with, or carry out an EC type-examination for the machinery listed. In principle, notified bodies are designated by member states and must meet specified criteria of independence and competence for performing inspection and assessment. For assessment of particular machinery, the notified body must not be the designer, manufacturer, importer, supplier, installer or authorised representative for the machinery. They must also have a thorough technical understanding of that machinery and the relevant essential requirements and harmonised standards.[67] However, refinements are proposed to the EU system to ensure independence and expertise of notified bodies in practice, as well as consistency in the standard of their technical assessments.[68]

Items listed which do not conform to harmonised standards (or where there are no relevant standards) must be submitted for 'EC type-examination' by a notified body. The notified body examines the machinery and the technical construction file and, if satisfied, issues an EC type-examination certificate. If not satisfied the notified body may refuse to issue a certificate. *Other types of machinery and safety components (not listed in Annex IV)* are subject to a 'self-certification procedure' where the manufacturer self-assesses the machinery or safety component and records the means used to conform to essential requirements in the technical file.

In summary, if a *goal* of safe design regulation is to *assure that plant is designed and constructed to be inherently safe*, testing and examination and, when warranted, more specialised technical assessment and verification by a competent and independent third party are essential elements of the regulatory regime. Testing and examination enable residual risks to be identified before plant is placed on the market or put into service. Greater guidance in this area is warranted, including advice about user trials and testing to input end user experience. Technical assessment and/or design verification are mechanisms to ensure that specified items of plant receive particular attention before they are supplied. It is appropriate that such mechanisms are applied to plant that presents particular risks.

However, there is a case to review the plant prescribed as high risk, taking account of machinery in use that is intrinsically higher risk. There is also a need to ensure consistency in prescribed plant between jurisdictions, as well as criteria of independence and competence for undertaking assessment and verification, and consistency in the use of technical standards. In addition to dealing more consistently and effectively with designated high risk plant, there is merit in establishing an infrastructure for independent, technical assessment by accredited bodies, in order to

provide a resource and technical expertise for voluntary, independent assessment of other plant, at the discretion of the designer or manufacturer. Such a demand has been experienced in the EU where manufacturers, uncertain about how to translate the *Machinery Directive* to address specific design issues with their plant have sought expertise from notified bodies, even when plant is not listed as requiring third party technical assessment and certification.[69]

Information provision

Information provision is the process by which those to whom plant is supplied are advised about risk control measures and any residual risks that it was not reasonably practicable to control before supply of plant. The specific form of information provision varies, and may include product manuals, signs or audio-visual methods. An obligation to ensure that information is provided is part of the duties of *designers*, *manufacturers*, *importers* and *suppliers* under the Australian OHS statutes. Typically the duty is to provide information in connection with supply of the plant,[70] although some jurisdictions require that information is 'available',[71] 'available in connection with use'[72] or 'when requested'.[73] Within a jurisdiction the duty to provide information is generally the same for all duty holders, although in two jurisdictions[74] information to be provided *manufacturers* and *importers* are different from *suppliers*.

There is considerable variation between the OHS statutes regarding the nature of information to be provided. Items include the *use* for which the plant has been designed and tested;[75] details of *design and construction* ;[76] *dangers* of the plant;[77] the *condition* of plant at the time of supply, risks arising and steps to eliminate them;[78] *safe use*;[79] proper *maintenance*;[80] data on *testing* undertaken.[81]

There are also requirements to provide information under the Australian OHS regulations relating to plant, and/or in evidentiary standards. Although these are generally derived from the *National Standard for Plant* there are variations between the jurisdictions. An important feature of information provision under these subordinate instruments is the differentiation between the roles of the different duty holders. Thus *designers* provide certain information to *manufacturers*, who in turn provide this information to *suppliers*, together with any additional items the manufacturer is responsible for (for example, results of testing of the plant). *Importers* take on the role of the designer/manufacturer if the latter are outside the jurisdiction. *Suppliers* provide the designer/manufacturer's information to purchasers and owners of the plant.

Information provision reflecting the *National Standard for Plant* is required under OHS regulations or codes in five jurisdictions.[82] The approach under Victoria's plant regulations is similar although the *designer* has primary responsibility for generating information while the *manufacturer* and *importer* obtain this information 'so far as is practicable'.[83] The Commonwealth's OHS regulations assign the primary role to the *manufacturer/importer* to make information available to the employer. Queensland's *Plant Advisory Standard* treats *designers*, *manufacturers*, *importers* and *suppliers* equally in identifying the same range of information to be provided.

Compared with the OHS statutes there is greater consistency in the scope of information to be provided under OHS regulations, again reflecting the adoption of elements of the *National Standard for Plant*. Thus core information items are:

purpose for which the plant is designed;[84] *testing* and inspections to be carried out on the plant;[85] *information* about installation, commissioning, operation, maintenance, cleaning, transport, storage and dismantling;[86] systems of work for *safe use* of the plant;[87] knowledge, training or skill necessary for those inspecting and testing the plant;[88] *emergency procedures*;[89] ways the plant should *not be used* and specific prohibitions; *results of tests* on the plant; residual risks and methods of control, special tools for maintenance; instructions to the manufacturer about materials, manufacturing process, fitting of parts and specific hazards in manufacture.[90]

In contrast to the role of different duty holders under Australian OHS law, the EU regime requires the manufacturer to ensure that instructions accompany each machine. These instructions must advise on foreseen use, safe installation, putting into service, use, handling, assembly, dismantling, adjustment, maintenance, noise emission level, requirements to reduce noise and vibration, training, and ways the machinery should not be used. Information must be provided in one of the EU languages as well as the language of the country where the machinery will be used.

In summary, an important *goal* of safe design regulation is to *ensure that key information is transferred to the client or customer in a form that is accessible and informative to facilitate development of safe practices for those involved in use, maintenance, repair and other work with the plant*. There is a need both for consistency in the type of information to be provided and improved guidance about the content, form and style of such information in order to improve the quality and practice of information provision. The current lack of guidance in this area is in striking contrast to the guidance provided to Australian manufacturers and importers of hazardous substances, through a national mode code of practice adopted in all jurisdictions.[91] There is merit in developing a national code of practice to provide guidance about plant information, combining the items variously identified under Australian OHS statutes, regulations and evidentiary standards, and under EU law, as a useful starting point.

Documentation - records and files

A further *goal* of safe design regulation is to *ensure that key information is transferred between the parties producing plant, and between producers and the regulator*. Documentation is a means by which duty holders record action taken to address OHS and make this available, on request to the regulator. Such a mechanism is not established under Australian OHS law in the manner that it operates in Europe.

The EU Machinery Directive adopts a different approach requiring the manufacturer to maintain a 'technical construction file'[92] which must include: (1) detailed drawings and calculations, tests and other measures to check conformity with the essential health and safety requirements; (2) a list of the essential requirements addressed and how they have been addressed; (3) the details of any harmonised standards used in design; (4) the methods used to eliminate hazards; (5) any technical reports from competent bodies; (6) the health and safety instructions; and (7) the measures used to ensure conformity for machinery manufactured in series (that is, multiple items). The file must be presented in response to a request from the regulator in the member state but can remain on the premises of the manufacturer, even if the latter is overseas.

The value of a technical construction file is that it can be both a tool for exchanging important safe design information between different parties to a project (procurers, designers, manufacturers, suppliers, installers and so on), as well as providing a basis for evaluating the safety of the plant through technical assessment by an independent expert (see above), or by the regulator assessing compliance. Importantly it should document how OHS has been addressed, a prevention focus, rather than being 'paper driven'.

Safe design mark

A safe design mark is a mechanism for signalling action taken to address OHS matters in the design and manufacture of plant. It can be a useful tool to remind those procuring plant of safe design requirements. It is also a regulatory tool. Under the EU's *Machinery Directive* the safe design mark, the 'CE' mark, together with the technical construction file, is the basis for declaring conformity with machinery safety requirements. The manufacturer (or authorised representative) is responsible for making the EC 'declaration of conformity' with the essential health and safety requirements, and for affixing the CE mark to the machinery. Presence of the mark on machinery is a pre-condition for the supply of the product. Its absence signals non-compliance with safe design requirements and is a form of alert for those procuring that type of product. While the CE mark is not a guarantee of compliance or a guarantee of safety, as in many cases manufacturers will undertake assessment themselves,[93] it provides a means of evaluating plant safety, in conjunction with a technical construction file (as discussed above). *A safe design mark could have particular value in procurement of plant, providing a signal and reminder of the need to address OHS before plant is supplied to the workplace.*

Qualification of safe design obligations

Under Australian OHS legislation, obligations are typically qualified by the expression 'so far as reasonably practicable' ('practicable' or 'reasonable precautions' and 'proper diligence' according to the jurisdiction). Recently the High Court considered the meaning of 'reasonably practicable' in *Slivak v Lurgi (Australia) Pty Ltd* [2001] 205 CLR 304 concluding that whether a measure is or is not reasonably practicable involves a value judgment on the basis of what was known at the relevant time, and balancing the likelihood of the risk occurring against the cost, time and trouble necessary to avert that risk.[94]

A somewhat different approach is taken under the Queensland *Workplace Health and Safety Act* 1995 which requires the responsible person to comply with the provisions of regulations, ministerial notices, advisory standards or industry codes of practice, or if there are none of these, to take 'reasonable precautions' and to 'exercise proper diligence'. It is accepted that the expression 'reasonable precautions' means that hazards are identified, risks are assessed, control measures are determined and implemented to prevent or minimise the risk, and 'proper diligence' means that the effectiveness of control measures is monitored and reviewed.[95]

In addition to the qualification of '(reasonably) practicable', in all jurisdictions upstream obligations are further qualified by the phrase of 'when properly used'. The South Australian OHS statute takes a somewhat different approach to the other statutes, requiring duty holders to take account of reasonably foreseeable forms of misuse.[96] However, in other jurisdictions incorporation in the duty of the expression

'when properly used' could mean that it is possible, in at least some instances, to design, make and supply plant that has inherent risks, such as accessible moving parts, and to rely on instructions and warnings about the risks, as the sole precaution. This is most clearly the case under the Victorian OHS statute which provides that plant is not to be regarded as properly used where it is used without regard to relevant/appropriate information or advice about its use.[97,98,99]

A different interpretation of 'safe and without risks to health when properly used' was made in *WorkCover Authority of New South Wales (Inspector Mulder) v Arbor Products International (Australia) Pty Ltd* [2001] 105 IR 81. The supplier of a mobile wood-chipping machine was prosecuted following an incident in which a worker sustained serious traumatic injuries to both arms after becoming caught in the machine. The company argued in its defence that the machine was not properly used and that safety information supplied in a manual had not been followed. The Industrial Relations Commission in full session concluded (on appeal) that too much weight was given to the provision of information in a manual and training to the Council employees and that the qualification 'when properly used' "is intended to limit liability of a supplier where the plant which is supplied is safe (in the sense that the safety is ensured but such plant becomes unsafe because of misuse (for example, the wilful misuse of a machine by removal of a guard".[100] Other, subsequent, cases in New South Wales and Western Australia have made a similar interpretation.[101]

The EU's *Machinery Directive* likewise places the emphasis on ensuring that machinery is inherently safe, requiring consideration of 'foreseeable abnormal uses' as well as 'intended use'.[102] When designing and constructing machinery, and when drafting instructions, the manufacturer must envisage uses which could reasonably be expected and the machinery must be designed to prevent abnormal use if this would engender a risk. Abnormal use might include the likelihood that an operator will disable safety devices installed in a manner that hinders the operator or reduces production substantially. The manufacturer must specify the intended uses of the machinery clearly in the information instructions, including assembly and dismantling. They should also indicate ways in which the machinery should not be used. It is not sufficient to warn the end user of risks if measures exist which could reasonably be integrated into the machine and which would automatically limit or eliminate the risks in question.[103]

In summary, while a *goal* of safe design regulation is to *ensure that obligations are reasonable*, and this may involve some form of qualification of the obligations of upstream parties, current use of the expression 'when properly used' may give the impression that safety depends on the end user or that it is sufficient to warn of risks in plant that is unsafe, rather than ensuring that it is designed and constructed to be inherently safe. The expression is potentially misleading in view of the direction that legal action is taking, in at least some jurisdictions, following the Arbor products prosecution. It is also out of step with the principles of negligence applied in common law actions where foreseeability of risk of harm, as judged from what a reasonable person in that position could be expected to know, is key to answering the question of what precautions are reasonable and practicable. A further point of confusion is the fact that the expression 'when properly used' has largely been abandoned under OHS regulations which adopt, as discussed above, a risk management approach. Thus, there are strong arguments for removing the expression 'when properly used' from the

relevant provisions of the OHS statutes, regulations and evidentiary standards in which this expression remains. The necessary qualification is already provided by the device of 'reasonably practicable' ('practicable', taking 'reasonable precautions' or exercising 'proper due diligence', as expressed under the particular OHS statute).

Consistency in regulation of safe design

The issue of national consistency takes on new importance in relation to safe design as plant is traded between jurisdictions within Australia, as well as into and out of this country. It is not possible to have an effective regulatory regime based on different requirements in each jurisdiction. However, this is the reality under the ten Australian OHS statutes, associated regulations and evidentiary standards which establish a regulatory framework for safe design of plant that varies across the ten jurisdictions. For upstream parties who operate across jurisdictional borders, this range of instruments is a significant challenge. Taking a broad brush, these instruments incorporate some common processes of risk management, testing and examination of plant, provision of information, use of technical standards as a benchmark for safe design, and requirements for verification of design for some types of plant designated as high risk.

However, looked at more closely there are many sources of variation within these core elements. In particular, there is variation in the range of hazards to be identified, the life cycle phases of plant for which risks are to be addressed, methods of risk control, the particular technical standards applied (and whether they have mandatory or evidentiary status), whether and, if so how, plant is tested or examined, the types of plant requiring design verification, the criteria for selecting a design verifier, and the type of information to be provided, by whom and to whom. While Australia's mutual recognition legislation establishes that goods (including plant) that can be legally produced or imported into one Australian jurisdiction can be lawfully supplied in all others,[104] this is no excuse for variation. It simply means that it is legally possible to produce or import plant in one jurisdiction, which then presents problems to the unwary purchaser who will still need to ensure that the plant complies with OHS requirements in the jurisdiction in which the plant will be used at work. Thus, there is a challenge to achieve national consistency in safe design regulation in a way that has not been achieved under Australian OHS law to date.

As well as differences in the OHS law of the ten Commonwealth, state and territory jurisdictions, upstream parties must also take account of other statutory regimes regulating product safety, in particular trade practices and electrical safety, as well as the potential for liability under the common law. Those importing plant or exporting overseas must also take account of overseas requirements relating to plant safety. A further problem is the difference in scope of obligations under the OHS statutes, as compared to regulations and/or evidentiary standards. (A number of such differences were identified above). Duty holders cannot simply choose one or other as Acts and regulations both have legal standing and even if regulations are more specific, the requirements of OHS statutes apply to the extent that regulations do not address some matters that are addressed by the OHS statute.[105,106,107]

For all of these reasons, it can be a very time consuming, laborious and confusing process for anyone trying to make sense of the differences, within and between different areas of the law. Thus, for both clarity and impact, a crucial *goal* of a

regulatory regime for safe design is *national uniformity*. Mechanisms exist for achieving a nationally uniform regime. The one with arguably the most potential is template legislation which requires governments to resolve differences of approach and drafting before the law is adopted in entirety in all jurisdictions.[108,109] This in itself is a significant challenge. However, in developing a uniform regime, it is also important to emphasise that the goal is not uniformity per se but uniformity of the 'right' provisions, that is, those that will be effective in stimulating and underpinning safe design. This means making hard decisions on a range of matters from the regulatory instruments used (statutes, regulations, evidentiary standards), to every aspect of the form and content of obligations. This working paper has canvassed some ways forward.

Conclusion

The role of upstream parties in ensuring the safe design of plant has been regulated under the Australian OHS statutes for a number of years but the existing arrangements are not optimal. The current regimes are not only inconsistent but there is cause for concern that the obligations rely on responsible parties having the knowledge, capacity and motivation to apply broad principles and processes to address the specific, often technical problems involved in producing inherently safer plant. Stronger underpinnings for safe design can be achieved by designing regulation that specifically addresses regulatory goals and seeks out the most effective forms of regulation to achieve these goals, and takes account of overseas' experience. This paper suggested some goals for regulation of safe design and some strategies for achieving these goals. A crucial element not canvassed in this paper is enforcement policy and practice for safe design. Review and development of new approaches for regulators to engage with upstream parties are required to ensure awareness and compliance with safe design regulation. These matters are explored in a second Centre working paper *Enforcing Safe Design*.

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1. NOHSC. *Work-related fatalities associated with design issues of fixed plant and equipment in Australia, 1989-1992*. Sydney: Epidemiology Unit, National Occupational Health and Safety Commission, 2000.

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5. Brooks, A. *Occupational health and safety law in Australia*, fourth edition. Sydney: CCH Australia, 1993.

6. Davies, M and Malkin, I. *Torts*, fourth edition. Sydney: LexisNexis Butterworths, 2003.

7. Luntz, H and Hambly, D. *Torts. Cases and commentary*, fifth edition. Sydney: LexisNexis Butterworths, 2002.

8. NSW *Civil Liability Act 2002*, s 5B, Queensland *Civil Liability Act 2003*, s 9 and equivalent legislation in other jurisdictions.

9. Action for breach of statutory duty is permitted under OHSWA (SA) s 6(2). WHSA (Qld), OSHA (WA) and WHSA (Tas) are silent on the matter and hence do not preclude it. Such action is precluded under OHSA (NSW) s 32, OHSA (Vic) s 28, OHS (CE)(Cwth) s 79, OHS (MI) s 118, WHA (NT) s 34 and OHSA (ACT) s 95.

10. NOHSC. *National Standard for Plant*, [NOHSC:1010]. Sydney: Worksafe Australia, 1994.

11. Emmett, E. Occupational health and safety in national development - the case of Australia. *Scandinavian Journal of Work Environment and Health* 1997, 23(5): 325-333.

12. Note that some jurisdictions have other regulations made under the OHS statute. The regulations listed in Table 2 contain the key provisions in relation to safe design. Note also that Table 2 does not include all technical standards such as Australian Standards which may be called up in regulations or given evidentiary status as approved codes of practice or advisory standards (Qld). The codes listed are ones that contain material otherwise included in the OHS regulations in other jurisdictions.

13. TPA ss 4 & 4B.

14. See Queensland Electrical Supply Office. *Approval of electrical equipment (appliances)*. Accessed online March 2004, at http://www.eso.qld.gov.au/applianc/approval.htm. Check

15. European Commission. Council directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of laws of the member states relating to machinery. *Official Journal* L 207, 23/07/1998: 1-46.

16. European Commission. Council directive 73/23/EEC on the harmonization of the laws of member states relating to electrical equipment designed for use within certain voltage limits. *Official Journal* L 077, 26/03/1973: 29–33.

    European Commission. Council directive 74/150/EEC of the European Parliament and of the Council of 4 March 1974 on the approximation of the laws of the member states relating to the type-approval of wheeled agricultural or forestry tractors. *Official Journal* L 84, 28/3/1974: 10 (and last amendment by decision 95/1/EC, Euratom, ECSC, *Official Journal* L 1/1/1995: 1.

    European Commission. Council directive 79/113/EEC of the European Parliament and of the Council of 19 December 1978 on the approximation of the laws of the member states relating to the determination of the noise emission of construction plant and equipment. *Official Journal* L 033, 08/02/1979: 15-30.

    European Commission. Council directive 86/662/EEC of the European Parliament and of the Council of 22 December 1986 on the limitation of noise emitted by hydraulic excavators, rope-operated excavators, dozers, loaders and excavator- loaders. *Official Journal* L 384 , 31/12/1986:1-11.

    European Commission. Council directive 87/404/EEC of the European Parliament and of the Council of 25 June 1987 on the harmonization of the laws of the member states relating to simple pressure vessels. *Official Journal* L 220, 08/08/1987: 48-59.

European Commission. Council directive 89/336/EEC of the European Parliament and of the Council of 3 May 1989 on the approximation of the laws of the member states relating to electromagnetic compatibility. *Official Journal* L 139 , 23/05/1989: 19–26.

European Commission. Council directive 95/16/EC of the European Parliament and of the Council of 29 June 1995 on the approximation of the laws of the member states relating to lifts. *Official Journal* L 213, 07/09/1995:1-31.

European Commission. Council directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the member states concerning pressure equipment. *Official Journal* L 181, 09/07/1997:1-55.

17. European Commission. *Proposal for a directive of the European Parliament and of the Council on machinery and amending Directive 95/16/EC.* Brussels: Commission of the European Communities, 2001.

18. WHSA(Qld) Sch 3, OHSA(NSW) s4, OHSA(Vic) s4, OHSWA(SA) s4(1), OSHA(WA) s 3(1), WHSA (Tas) s 3(1), WHA (NT) s 3(1), OHSA (ACT) s 5(1), OHS(CE)A(Cwlth) s 5(1), OHS(MI)A s 4.

19. NSP (NOHSC) s 4.

20. OHS(P)R (Vic) r 106(1) and (3), OHSW R(SA) r 3.1.3, OSH R(WA) r 4.22.

21. *Machinery Directive* Article 1(2).

22. *Machinery Directive* Article 1(3).

23. European Commission 1974, 1987, 1995, 1997 op cit.

24. *Trade Practices Act* 1974 and associated state/territory legislation.

25. OHSA (CE) (Cwth) ss 18-20; OHSA (MI) ss 15-23; OHSA (NSW) s 11; OHSA (Vic) s 24; WHSA (Qld) ss 32-33; OHSWA (SA) s 24; OSHA (WA) s 23; WHSA (Tas) s 14; WHA (NT) s 30B; OHSA (ACT) ss 32-34.

26. OHSR (NSW) r 85.

27. OHS (CE) A (Cwth) Part 2, OHS (MI) A Part 2, OHSA (NSW) Part 2, OHSA (Vic) Part 3, WHSA (Qld) Part 3, OHSWA (SA) Part 3, OSHA (WA) Part 3, WHSA (Tas) Part 3, WHA (NT) Part 4, OHSA (ACT) Part 3.

28. (OHS(CE)(NS)R; OHSR (NSW); OHSWR (SA); OSHR (WA); WH(OHS)R (NT); WHSR (Qld) and PAS (Qld); WHSR (Tas); ACOP NSP (ACT); OHSR (P) (Vic) and COP(P) (Vic).

29. *Machinery Directive*, Article 2.

30. Busby, J. *Mutual misconceptions between designers and operators of hazardous installations*. Bath: HSE Research Report 054, Department of Mechanical Engineering, University of Bath, 2003.

31. Tozzi, G. The Machinery Directive. Gains and challenges to the new approach. *TUTB Newsletter*, June 2003, no. 21: 4.

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33. Gunningham, N, Johnstone, R and Burritt, P. *Review of occupational health and safety legal requirements for designers, manufacturers, suppliers, importers and other relevant obligation bearers*. Sydney: National Occupational Health and Safety Commission, 2000, p. 60.

34. WHSA (Qld) s 22.

35. PAS (Qld) s 4.

36. OHSWR(SA): rs 3.2.13 and 3.2.14; OSHR (WA): r 4.27; and ACOP (ACT) cl 22 & 23.

37. WH(OHS)R (NT) r 12.

38. NSP (NOHSC) 65, OHSWR(SA) Div 3.3, OHS(CE)(NS)R (Cwlth) Div 7, ACOP (NSP) (ACT) cl 65.

39. Standards Australia. AS 4024.1: *Safeguarding Machinery*. Sydney: Standards Australia, 1996.

40. PAS (Qld) Appendix 2.

41. PAS (Qld) s 12.4.

42. COP(P) (Vic) Appendix 3.

43. COP(P)(Vic) cl 13.3.

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45. WHSR (Tas) Part 4, Div 3.1.

46. WHR (OHS) (NT) r 9.

47. *Machinery Directive*, Annex 1.

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54. TPA s 65C.

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57. WHSA (Qld) ss 32-33, OHSA (Vic) s 24, OHSWA (SA) s 24, OSHA (WA) s 23 and WHA (NT) s 30B.

58. OHSA (ACT) ss 32-34, OHS (CE) (Cwth) ss 18-20.

59. PAS (Qld) s 1.11.

60. PAS (Qld) s 2.3.

61. OHSR (NSW) r 128, OHSWR (SA) r 3.2.11, OSHR (WA) r 4.35, ACOP (NSP) (ACT) cl 19(3).

62. NSP cls 69 and 70.

63. OHSR (NSW) r 107, OHSWR (SA) r 3.4.1, ACOP (ACT) cl 68, OSHR (WA) r 4.4, WHR (NT) r 2(1), OHS (CE) (NSR) (Cwth) r 4.51.

64. WHSR (Qld) r 15, OHS(P)R (Vic) r 1003 and WHSR (Tas) Sch 1.

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71. WHSA(Qld) s 32.

72. OHSA (Vic) s 24, OHSA (ACT) s 32, OHS (CE) A (Cwth) s 18.

73. OSHA (WA) s 23.

74. OHSA (ACT) ss 32-33, OHS (CE) A (Cwth) ss 18-19.

75. WHSA (Qld) s 32, OHSA (Vic) s 24, OHSA (ACT) ss 22-23 and OHS (CE) A (Cwth) ss 18-19.

76. OHS (CE) A (Cwth) ss 18-19.

77. OHSA (WA) s 23, WHA (NT) s 30B, WHSA (Tas) s 14.

78. OHSA (ACT) ss 32-33, OHS (CE) A (Cwth) ss 18-19.

79. WHSA (Qld) s 32, OHSA (NSW) s 11, OHSA (Vic) s 24, OHSWA (SA) s 24, OSHA (WA) s 23, WHSA (Tas) s14, WHA (NT) s 30B, OHSA (ACT) ss 32-33, OHS (CE) A (Cwth) ss 18-19.

80. OSHA (WA) s 23, OHSA (ACT) ss 32-33.

81. OSHA (WA) s 23, WHA (NT) s 30B.

82. OHSR (NSW) r 96, 105 and 132, OHSWR (SA) r 3.2.3, 3.2.7, 3.2.8, 3.2.12, OSHR (WA) r 4.30-4.33, WHR (OHS) (NT) r 84-86, ACOP NSP (ACT) cls 11, 15, 16, 18, 20.

83. OHS(P)R(Vic) r 308, 405 & 503.

84. PAS (Qld), OHSR (NSW), OHS (P) R (Vic), OHSWR (SA), OSHR (WA), WH (OHS) R (NT), ACOP (NSP) (ACT). (Sections as above).

85. PAS (Qld), OHSR (NSW), OHS (P) R (Vic), OHSWR (SA), OSHR (WA), WH (OHS) R (NT), ACOP (NSP) (ACT). (Sections as above).

86. PAS (Qld), OHSR (NSW), OHS (P) R (Vic), OHSWR (SA), OSHR (WA), WH (OHS) R (NT), ACOP (NSP) (ACT). (Sections as above).

87. OHSR (NSW), OHS (P) R (Vic), OHSWR (SA), OSHR (WA), WH (OHS) R (NT), ACOP (NSP) (ACT) OHS (CE) (NS) R (Cwth). (Sections as above).

88. OHSR (NSW), OHS (P) R (Vic), OHSWR (SA), OSHR (WA), WH (OHS) R (NT), ACOP (NSP) (ACT) OHS (CE) (NS) R (Cwth). (Sections as above).

89. OHSR (NSW), OHS (P) R (Vic), OHSWR (SA), OSHR (WA), WH (OHS) R (NT), ACOP (NSP) (ACT) OHS (CE) (NS) R (Cwth). (Sections as above).

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96. OHSWA (SA) s 24(1)(a)).

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100. *WorkCover Authority of New South Wales (Inspector Mulder) v Arbor Products International (Australia) Pty Ltd* [2001] 105 IR 81 at 99.

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103. European Commission (1998) *Community legislation on machinery. Comments on Council Directive* 98/37/EC, Office for Official Publications of the European Communities, Brussels, p. 90.

104. *Mutual Recognition Act 1992*, s 9.

105. See generally *Automatic Wood Turning Ltd v Stringer* [1957] AC 544, especially 551-552; *Miller v Boothman and Son Ltd* [1944] KB 337; and *John Summers Ltd v Frost* [1957] AC 740.

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