Machine Safety Directions in Australia

The area of machine safety in Australia is generally not one of the best addressed aspects of Australian Occupational Health and Safety. While many organisations do cover this area extremely well, others have a lower level of machine safety compliance, or in some instances, none at all.

Whether this is due to a lack of understanding, or knowledge of the requirements, or deliberate avoidance, is not clear but the facts show that machine safety does not generally achieve the required levels of compliance within Australian industry. Whatever the reason, this is an area that requires more attention and better understanding to ensure that Australian workers are kept as safe as possible when working with machinery.

This paper will consider why machinery is often not compliant with current Australian Standards for machine safety and how this should be addressed. Further, recent changes to the international machine safety standards will also have an impact on the Australian machine safety market. These standards and the associated changes will also be discussed.

Personal experience in the machine safety sector since 1998, including spending the last 4 years working as a machine safety consultant, has provided ample examples of the lack of proper machine safety in some Australian industry.

To get a proper perspective of the importance of machine safety in Australian industry, it is useful to have an understanding of where machine safety stands within the Workers' Compensation statistics. The most up to date data available from Safe Work Australia is the preliminary data for FY2007/08. This data has been used to provide supporting information for the purpose of this paper.

Although relevant in many industry sectors to varying degrees, machinery is most commonly used in the manufacturing sector. For ease of interpretation of the statistics, it shall be assumed that manufacturing is the predominant industry sector where machinery is used. It is recognised that machinery is used in other industry sectors but this assumption is considered to be appropriate for the purpose of assessing machine safety compliance.

Analysis of the most recent data available from Safe Work Australia, shows that the manufacturing sector accounts for the majority of claims of any industry sector in this period, with over 24,300 claims recorded, equating to approximately 18.5% of all claims for this period. Analysis of the claims associated with "Machinery and (mainly) fixed plant" combined with those for "Powered equipment, tools and appliances" shows that these two categories account for over 4,300 claims, or almost 20% of the total claims made in this period in the manufacturing industry sector. Similar comparison with the other industry sectors shows the next highest sector for these categories to be the construction industry, with only 1,700 claims for the same period.

A further breakdown of the claims associated specifically with “Machinery and (mainly) fixed plant” shows a total of over 2,900 claims in the manufacturing sector. This is significant when compared to the total claims for all industry sectors of 7,600, showing that manufacturing accounts for 38% of all claims for this agency of injury. Of these manufacturing claims, over 2,600 (almost 90%) fall under the agencies that would typically be associated with machinery.

Looking at the overall picture, machinery accounted for over 10% of the injuries occurring in the manufacturing industry in the period FY2007/08. It is difficult to explain why the compliance levels are not as good as they ought to be for machinery. Personal experience in the industry indicates that there are many factors which are commonly seen. These include a lack of knowledge, or understanding, of the requirements for machine safety in Australia, often coupled with assumptions based upon common industry myths such as “recently installed machinery already complies and doesn’t need to be checked” or “old machinery which hasn’t been moved, or modified, doesn’t need to be considered”. These assumptions may indeed be correct, if a proper risk assessment has previously been carried out to ensure that the machinery safety is compliant, but all too often the risk assessment is not carried out, so there is no validation process to verify that machinery has been made safe according to the appropriate standards.

On the other hand, there are organisations which do try to implement some form of machine safety but rely upon the electrician, or maintenance fitter, who has not had any training in this field, to install the safety measures.

These safety systems typically show a level of good intention but often fail to comply with current Australian Standards’ requirements, simply because there was insufficient knowledge of the requirements to be met.

Sometimes there is simply a fear of the consequences of “getting it wrong”, so instead nothing is done.

Another common reason given for non-compliant machine safety is the cost of implementing an appropriate machine safety solution. While cost is a relevant consideration, the cost of installing an appropriate machine safety system should be weighed against the cost of not installing an appropriate system. Clearly, the initial cost of not installing a safety system is zero – until something goes wrong and a person is injured, or worse. In this situation, the costs begin to mount significantly and swiftly. There are the immediate costs of lost productivity plus all of the costs associated with any work injury – medical, legal, ongoing productivity, etc., not to mention the impact that a serious injury can have on a person, their family and work colleagues. This is significantly worse in the event of a fatality. In situations where cost is claimed as a factor to be considered, a reasonable staged approach, addressing the worst hazards first, should be implemented. While this may not be a perfect approach, at least it is a practical solution to address the safety issues but should not be considered as the first option if a more complete solution can be reasonably implemented instead.

Consequently, there are numerous machines being used in Australian industry today which fail to provide an appropriate level of safety, or to comply with the requirements of current Australian Standards. The current Australian Standard series for machine safety is AS 4024.1—

2006. A series of related standards, this provides an excellent guide through the process of ensuring that all machinery is safe to use.

The foundation block for all machine safety, as with all other areas of occupational health and safety, has to be the risk assessment. Under current OHS legislation, risk assessment is a mandatory requirement in all states.

Many organisations, however, appear to be unaware of the specific requirements for machine safety and how these relate back to the risk assessment. Many techniques have been developed for risk assessment, all of which are equally valid and useful, but typically the various methods of risk assessment are particularly suited to particular industries, or processes.

Machine safety is no different in this respect as the outcome required of the risk assessment process is specific to machine safety. Where many risk assessment methods provide a risk score, or risk rating, machine safety requires the risk assessment to provide an outcome detailing a category for the safety system of each machine. Sometimes the category may vary across individual zones of a large machine, or process, but in a large number of situations a single category will be determined for the complete machine. This category is always determined according to the worst hazard identified. When a risk assessment method does not provide an outcome of a risk category, some means of correlating the risk assessment outcome to the safety categories must be employed to determine the relevant category, or categories.

AS 4024.1501—2006 provides a range of categories that will be identified through the risk assessment process.

This standard includes a diagram showing how these categories are determined but this is not a range of categories which may be selected according to preference, but rather a range of categories which the risk assessment process will work through to determine the category required for each specific situation.

The risk assessment process incorporates the usual criteria of severity, exposure and probability. Working through the diagram in AS 4024.1501—2006, it can be seen how the required category level increases as these criteria levels increase. Thus, Category 4 is the highest level, providing the most robust safety system.

A brief overview of these categories starts with Category B, which in very brief terms means that the components used in the safety system are fit for purpose, according to the requirements of the particular machine, or process, or environment. It should be noted that the risk assessment diagram given in AS 4024.1501—2006 does not offer Category B as an ideal solution at any hazard level.

The first category which can be deemed to be an appropriate industrial solution is Category 1, however, the diagram indicates that this category is only applicable for low severity injuries, typically considered to be those which only require minor first aid rather than medical intervention. This is the only category which does not consider the exposure or probability factors, due to the low severity constraint. The definition of Category 1behaviour in AS 4024.1501—2006 states that a single fault may lead to the loss of the safety system.

The requirements for the performance and behaviour of the safety system increases as the category level increases. For Category 4, the standard requires that a single fault must not lead to the loss of the safety function plus a single fault must be detected at, or before, the next demand on the safety function. Typically, this is achieved by means of redundant, or dual channel, safety systems with continuous monitoring, however, there is technology available on the market which can meet these requirements using only a single channel system. Whilst it is reasonable to judge that Category 4 provides the most robust safety system, it does not follow that a Category 4 safety system will always provide the best safety system. The category for a safety system should always be determined through the risk assessment process, to ensure that all hazards have been identified and considered. The risk assessment process should also take into consideration the operational requirements of the process, the machine operators and others who are likely to interact with the machinery, such as maintenance or cleaning personnel. The safety system should always be designed with these additional factors being included to ensure that the safety system works with the process, rather than against it.

There is a common misconception that installing a safety system will result in reduced productivity and reduced profitability. If the factors described above are appropriately considered in the design of a safety system, there is every likelihood that the safety system will not have any negative impact upon productivity. In many instances, a correctly designed safety system will result in reduced production cycle times and increased productivity, leading to increased profitability as a consequence of improved safety.

Having discussed the significance of these categories for machine safety, it is also important to be aware of the changes which are happening within the European and international standards for machine safety. Effective from the end of this year, EN 954-1 will be replaced by EN ISO 13849-1. EN 954-1 is the European Standard which provides the definitions and requirements for the safety categories, as adopted in AS 4024.1501—2006.

One of the most significant changes in this new standard is a move away from the safety categories with the introduction of Performance Levels (PL) for safety systems. As with the safety categories, the Performance Levels are determined through the risk assessment process. One of the main differences found is that, unlike the category system where an S1 hazard did not require the exposure, or probability, factors to be included, the Performance Levels employ all three risk assessment criteria at all levels. This gives a range of five Performance Levels, rated from “PL_a” to “PL_e”.

These Performance Levels may appear to be similar to the categories, in that both systems have five levels, however, the significant difference lies in the means of achieving the appropriate Performance Level identified through a risk assessment. The categories are defined by a range of system behaviours and requirements, providing a fairly rigid system of classification, according to the structure of the safety system, i.e. single channel, dual channel, etc.. The Performance Levels, by contrast, are defined by five ranges of Probability of Dangerous Failures per Hour (PFHD). In other words, the Performance Level determines the overall reliability required of the safety system. The categories still play a part in the calculation of the Performance Levels, as these are used to factor the safety system structure into the PFHD calculation.

In real terms, this will now provide a greater scope of flexibility for safety system designers, as they will no longer be confined to the rigid category definitions. In effect, this means that safety systems will have the potential to integrate even more closely with the machine control systems. This change now moves machine safety into the sphere of functional safety which was previously used mainly for the process industry and large machine safety applications, employing standards such as AS 61508 and IEC EN 62061.

This transition into functional safety provides a common path for safety systems of all sizes and complexities, and facilitates the comparison of different systems to determine which would provide a better level of reliability. The original functional safety standards mentioned above provide a different system of classification, employing Safety Integrity Levels (SIL) to determine the different levels required of safety systems. As with the Performance Levels, the Safety Integrity Levels also require a calculation to determine a Probability of Dangerous Failures per Hour, which will fall within one of three Safety Integrity Levels (SIL1 – SIL3). There are four Safety Integrity Levels specified within AS 61508 but the highest of these levels, SIL4, is not considered to be applicable in machine safety, rather being applied in situations where extremely high levels of safety reliability are required.

While these changes may not immediately appear to be of major significance to machine safety in Australia, there are some complications which may arise as a result of this change overseas. AS 4024.1501, as mentioned previously, takes the definitions for the categories and the category selection process directly from EN 954-1. It is understood, at this stage, that Standards Australia has no plans in place to formally adopt EN ISO 13849-1 as an Australian Standard. Technically, these categories in AS 4024.1—2006 will continue to be the machine safety classification system used for machine safety systems in Australia, while these same categories will no longer be the means of safety system classification in Europe and many other countries around the world. This could have the potential to cause the Australian machine safety industry to fall behind international developments in this field.

Fortunately, this need not be the case as the Australian Standards do permit the use of alternative standards, when these can be shown to be at least of equal standing. This should enable organisations to freely adopt the use of the new Performance Levels in the risk assessment process and the design of machine safety systems, since the new standard and classifications have been introduced in Europe, and globally, as a replacement for the older category classification system of EN 954-1.

These changes to the machine safety standards open up exciting new potential for designers to have more flexibility in the way that they design machine safety systems, while continuing to ensure that the appropriate safety levels are met to keep Australian workers safe when working with machinery. This increased flexibility will also assist to keep Australian industry competitive, without having to sacrifice worker safety. Lastly, this new direction will ensure that the Australian machine safety industry continues to evolve as one of the leaders in the world safety market.

References

- Safe Work Australia Statistics online database,

  (http://safeworkaustralia.gov.au/AboutSafeWorkAustralia/WhatWeDo/Statistics/Pages/Statistics.aspx)

- AS 4024.1—2006 Safety of Machinery.
- AS 61508 Functional safety of electrical/electronic/programmable electronic safety-related systems.
- EN ISO 13849-1:2006 Safety of Machinery – Safety-related parts of control systems – Part 1: General principles for design.
- EN IEC 62061:2005 Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems.
- EN 954-1 Safety of machinery – Safety-related parts of control systems.

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