

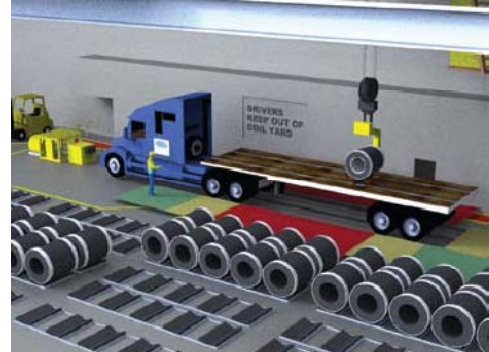
Visual Safety Training

Using Accurate, Engaging Visuals to Reduce Accidents

When staff see and interact with hazards via 3D visualisations they get closer to potential hazards than they can in reality, but without the risk. This leads to better knowledge retention, staff engagement, improved compliance and reduced accident-related costs.

This whitepaper contains three sections:

- Why Health & Safety Training is Critical
- Towards a New Visual Safety Training Model
- Case Study: New Zealand Steel's award-winning 3D Safety Training



Why Health & Safety Training is Critical

Every company has a legal duty to protect the health and safety of its employees. This extends to training employees in safe work practices and making them aware of safety hazards in the workplace. Aside from the legal and ethical reasons for making workplaces safe, fewer accidents mean reduced work stoppages, increased productivity and lower taxes and ACC levies.

The need for safety training is ongoing as new hazards are introduced, workplace models change and new workers bring relaxed attitudes to risks. New methods of training and education are now available which offer employers powerful tools to reach employees and achieve positive behavioural change. This paper introduces readers to 3D or visual-based training methods.

Work-related injury – the ‘work toll’

Each year, over 200,000 occupational injuries result in ACC claims – the equivalent of 12 injuries per 100 workers. In addition, over 100 people die from occupational injuries each year.

The manufacturing sector has the highest number of work-related injuries, followed by the mining, construction, agriculture, forestry and fishing sectors.

Sprains and strains are by far the most frequent injury (90,000 claims), followed by open wounds (37,000 claims).

An estimated 50% of injuries result in impairment, and 6% in permanent impairment.

The costs to businesses from staff accidents and downtime can be significant. Production disturbances make up 12% of the total economical and social cost of occupational disease and injuries, the largest component of costs after rehabilitation which make up 62% of the total cost¹. One Department of Labour study following 15 people

¹ L Pezzullo & A Crook (2006). *The economic and social costs of occupational disease and injury in New Zealand*. National Occupational Health and Safety Advisory Committee (NOHSAC).

with injuries found their cases alone had a total documented social and economic costs of \$1.167 million².

However, there are also potential business benefits from health and safety investments. A body of empirical evidence is emerging that establishes links between health and safety programmes and business productivity. These include both direct benefits (such as reduced sick pay and compensation claims) and indirect benefits (for example, reduced absenteeism, improved corporate reputation and reduced staff churn)³.

What does the law say?

Under the Health and Safety in Employment Act (1992), employers must ensure employees are either sufficiently experienced to do their work safely or are supervised by an experienced person (section 13 (a)).

Under section 13(b) employees must be adequately trained in the safe use of all plant, objects, substances, and protective clothing and equipment that they may be required to use or handle. The Act requires employers to take "all practicable steps" to ensure these requirements are met.

Providing information on hazards

Before an employee begins work of any kind their employer must inform them of:

- Emergency procedures (developed under section 6(e));
- Hazards the employee may be exposed to while at work;
- Hazards the employee may create while at work which could harm others;

² M Adams, J Burton, F Butcher, et al (2002). *Aftermath: The social and economic consequences of workplace injury and illness*. NZ Department of Labour.

³ C Massey, F Lamm & M Perry (2007). *Healthy people in safe & productive workplaces*. Department of Labour

- How to minimise the likelihood of these hazards becoming a source of harm to others; and
- The location of safety equipment.

The obligation to provide information relates to **all** existing or potential hazards, not only "significant hazards". The requirement is not qualified by the "all practicable steps" standard, which makes it particularly stringent. The information must be "given" by the employer and remain "readily accessible" to the employees.

Workplaces also have a responsibility to protect visitors, customers, volunteers, bystanders and local residents.

Ensuring employees understand safety training

Section 12 also stresses the need for employees to be able to understand the information they are given. It requires that the information must be presented in such a form and manner that the employee is reasonably likely to understand it. This may lead to technical information - such as a material safety data sheet, or operating manuals - being interpreted or abridged to meet the needs of employees in a particular place of work.

Current health & safety training practices

Since the introduction of the Act many industry best practices have been developed to manage companies' health and safety requirements. Health and Safety Officers accountable for an organisation's overall safety capability are now standard, and champion the use of Health & Safety Plans, Hazards Registers, Job Safety Analyses and the integration of safety procedures into all operations. These can range in sophistication from paper-based folders to computerised databases and reporting.

Traditional teaching tools such as manuals, classroom style teaching and guided induction tours are reinforced with workplace posters and staff newsletter reminders. Ideally, processes to update staff on new hazards are in place and tests are conducted to ensure the training information is understood.

Towards a New Visual Safety Training Model

3D visuals have emerged as an effective and practical training tool – and one that is particularly suited to the demands of complex manufacturing and processing sites.

For example, potentially dangerous equipment can be modelled in 3D and shared with workers using standard computers so they can view it from all angles and interact with it virtually. Workers can access areas that are otherwise out-of-bounds or inaccessible, or better understand hard-to-reach parts of a plant, and do so at their own pace. A 3D model can be an initial reference point and include links to other site and hazard information held in company databases or online.

The benefits of a ‘visual’ approach to safety training are many.

"I hear and I forget. I see and I remember. I do and I understand."

Lao Tsu, 6th Century B.C. Chinese Philosopher

Greater engagement

The greater engagement and interaction allowed with 3D models is more effective not only at communicating safety requirements but actually instigating behavioural change – especially for younger workers used to 3D in computer games and movies.

Research as long as 40 years ago highlighted the contribution that audiovisual materials can make in increasing the effectiveness of learning. It does this by reducing passive learning and increasing interaction with the subject matter.

The Cone of Learning⁴ summarises how greater involvement leads to better comprehension and retention.

Cone of Learning		
After 2 weeks we tend to remember		Nature of Involvement
90% of what we say and do	Doing the Real Thing	Active
	Simulating the Real Experience	
	Doing a Dramatic Presentation	
70% of what we say	Giving a Talk	Passive
	Participating in a Discussion	
50% of what we hear and see	Seeing it Done on Location	
	Watching a Demonstration	
	Looking at an Exhibit Watching a Demonstration	
	Watching a Movie	
30% of what we see	Looking at Pictures	
20% of what we hear	Hearing Words	
10% of what we read	Reading	

⁴ Robert Kiyosaki (2008), *Increase Your Financial IQ*, adapted from Edgar Dale (1969), *AudioVisual Methods in Teaching*.

Improved comprehension of complex equipment

Manufacturing and processing plants often include complex, moving and inter-linked equipment that can be difficult to understand at a glance from a 2D blueprint or plan.

Visuals are intuitively easy to understand and modern audiences can move around 3D images more quickly than cross-referencing 2D diagrams.

Interactive models can also be taken apart, components explored, processes animated, cross-sections viewed and step-by-step instructions included.

Users can rehearse procedures without the real thing, add information, update objects to reflect the latest designs or product lines. During this process, group discussion is often sparked, and faster than conceptual descriptions allow.

Include rich information

Important information about a hazard or site can also be annotated to a 3D model. Step-by-step instructions or links to the Health and Safety Register or Standard Operating Procedures Database can be included.

The use of visuals with annotated illustrations for training has been shown to be significantly more effective than text alone⁵.

The 3D models used do not have to be an approximation. The right modelling software can create training models based on actual production plans, engineering CAD data or scans. Large CAD data files can be compressed into usable training materials without losing their visual quality, and can be updated as the plant upgrades.

Easily accessible

A key requirement of the Act is that training materials remain accessible to staff. Advances in computing power mean that 3D training tools can be viewed on standard PCs. Computerisation makes training materials easier to search and find and access from any computer onsite at any time.

Traditional training seminars are dependent on experienced operators being available, and written manuals are often stored in one location and can only be accessible by one person at a time.

The training models can be shared by staff at home, new recruits and with visitors. Visual instructions can also help overcome language barriers.

Integration with health & safety programmes

Being digital, computer training visuals can be linked to other relevant data such as manuals, policies, instructions and product information. They can be linked with Standard Operating Procedures (SOP) databases and hazard registers to ensure they are updated regularly and reference the latest, most accurate information. 3D models can also quickly generate accurate visuals for use in traditional training seminars, manuals and posters.

⁵ Mayer, R.E., Bove, W., Bryman, A., Mars, R., & Tapangco, L. (1996). When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. *Journal of Educational Psychology*, 88, 64-73.

Case study: New Zealand Steel’s award-winning 3D safety training

New Zealand Steel’s Safety Programme

Already an acknowledged leader in health and safety practices, New Zealand Steel won the Best Technology Initiative at the 2009 NZ Workplace Health and Safety Awards for their 3D training programme which shows truck drivers how to safely secure loads of steel and navigate the Glenbrook steel mill.

The project was implemented by 3D specialists Revisia Ltd, who were tasked with developing NZ Steel’s visually engaging training media and a flexible content delivery system. Revisia applied the latest Right Hemisphere visualisation technology, supplied by strategic partner Nextspace Ltd.

Using 3D to restrain heavy loads

Loading NZ Steel’s vast range of steel products “safely” on the back of a truck is one thing, but ensuring each and every truck driver knows how to secure an 18 tonne steel coil for safe transport is another.

Applying load restraint requirements can be challenging at times, especially considering that trucks are rarely loaded the same way twice!

To address these challenges, the Load Restraint Committee at NZ Steel engaged Revisia to develop an eLearning training series. Revisia used their understanding of the plant processes and 3D expertise to transform traditional paper-based guidelines into animated 3D learning modules.



The clear, concise and portable training gave all the transport companies coming onto the steel mill site the flexibility to train their drivers in circumstances that suited them and with very little cost outlay. Unlike a paper-based system, the strong visual element gave exact and succinct information that is easily absorbed by those participating in the training.

The highly visual nature of the training content provides a more clear and intuitive approach for truck drivers to grasp the “ins and outs” of the guidelines. Hard to grasp work practices with complex job steps have been ‘demystified’, making safety hazards easier to identify.

This technology is also easily updated, and the eLearning modules will be linked into the Standard Operating Procedure database in future.

Revisia worked closely with NZ Steel to ensure the training materials were accurate, including adapting paper-based guidelines, using existing 3D CAD models of the plant and undertaking plant tours and interviews.

“Revisia’s work on this project will enable us to teach a huge number of people with little resource. Compared to standard methods of training, this approach dramatically increases understanding of the guidelines and leads to improved knowledge retention.”

Gary Bright, Distribution Controller, NZ Steel



Results

As well as being a winner at the 2009 NZ Workplace Health and Safety Awards, the project has contributed to NZ Steel's overall safety performance. In the same year, the company reduced the number of medical treatment injuries (MTIs) by 40% and celebrated one year lost-time injury-free (LTI free).

"People are far more inclined to learn hands-on tasks by doing what they see, not doing what they read."

Mark Foster, Revisia

Benefits of NZ Steel's safety training

- Reduction in incidents
- Training time nearly halved
- Complex procedures and spaces are easy to understand
- Standardised training procedures improve compliance
- Contractors and drivers from different trucking firms can be trained offsite
- Can be viewed on a standard PC and online
- Able to be tailored and updated

New Zealand Steel found the visualisations have streamlined its training delivery, reduced the amount of one-on-one time spent with instructors and ensured essential safety messages are communicated consistently. It is estimated that the number of training hours was nearly halved. The vastly improved training materials have also contributed to a positive health and safety culture which leads to improved OSH compliance and fewer accidents.

Revisia's 3D solutions have been adopted at New Zealand Steel beyond health and safety. Plant maintenance personnel use 3D models to plan and develop optimal work practices, and have saved thousands of dollars by rehearsing maintenance shutdowns virtually.

About Revisia

Revisia is New Zealand's foremost expert in 3D modelling and animation to improve industrial maintenance and risk management.

Our visual, team-based solutions take cost and risk out of operations to reduce maintenance downtime, mitigate errors and promote safe work practices. The result is significant savings and measurable productivity improvements that help asset-intensive companies in metallurgy, mining, energy, power generation, pulp and paper beat their current year maintenance budgets.

Revisia's internationally-experienced team of business analysts, engineers and CAD operators embed themselves on-site in clients' operations and culture. This deep engagement and Revisia's industry expertise allow consultants to handle complex assignments quickly and ensure that scenario plans, simulations and training meet front-line staff's needs.

About Nextspace

Nextspace is a 3D industry catalyst and consultancy that was established with government backing to leverage Right Hemisphere's success and unique IP to enhance New Zealand's international competitiveness.

Nextspace acts as a conduit for firms, education and research organisations to access and take advantage of Right Hemisphere technology. The Nextspace team includes experienced 3D developers, content experts and sector-specific business consultants putting it in a unique position to add value to New Zealand.

A cluster of organisations have partnered with Nextspace to apply Right Hemisphere tools to new sectors such as heavy industry, construction, training, eLearning, marine, medical imaging and entertainment. Nextspace has also integrated Right Hemisphere's 3D platform into ERP, document management and customer websites.

Taking the Next Step

To evaluate how Visual Health & Safety Training could help your business, and the solutions available contact:

Nextspace

Level 3, Building C, Millennium Centre

602 Great South Road, Ellerslie

PO Box 99-873, Newmarket

Auckland 1051, New Zealand

Phone: +64 9 571 4115

www.nextspace.co.nz