Human Factors in Environmental Issues

Relevance to the Gases Industry

Summary

EIGA's Working Group 5 - Environment has compiled this technical bulletin to provide information on environmental issues relevant to the Industrial Gases Industry. These guidelines are intended to assist people understand how human factors can influence positive and negative environmental outcomes.

Introduction

Human factors play a significant role in environmental incidents and in maintaining legal compliance. As with safety incidents, eliminating or minimising human factor causes can be achieved by design and by using behavioural techniques.

This publication provides information on techniques for improving human factors in environmental issues, methods for assessing human factors-related risks and examples and guidance for the gas industry on the use of human factors tools and their application to environmental issues. It provides some examples of where these tools can be applied in addressing conditions with human factors causes, for example during deliveries of materials, loading unloading, filling.

Tools and techniques include:

- critical systems audits;

- awareness materials including tool box talks;

- site exercises including aspects of mitigation (spill containment and clean up) and emergency actions;

- workplace design.

Environmental incidents, with human factors causes, can arise from site conditions driven by the actions of people that are not aware of the correct behaviour. In many circumstances it may be possible to design out the conditions that present a risk.

Dynamic environmental conditions, which can change at any time can be managed using behavioural tools and techniques, but constant vigilance is required to spot conditions that could lead to incidents.

Human Factors

Human factors refer to environmental, human and individual characteristics, organizational and job factors that influence behaviours at work in a way which can affect health, safety and environmental performance.

More detail on Human Factors is given in EIGA Safety Info HF-01 Human Factors – an Overview[1] and other related Human Factor publications referenced in Info HF-01.

In summary, human factors identify what people are being asked to do (the task and characteristics), who is doing it (the individual and their competencies), and where they are working (the organisation and its attributes). A good management system includes human factor assessments in a similar way to any other risk management programs, categorizing human failure with the different causes and influencing factors, as well as prevention strategies to reduce the failures.

Managing poor human behaviour and promoting good behaviour is essential to preventing incidents both minor and major, preventing environmental damage and maintaining the reputation of the organisation.

Improving human factors in environmental issues

Recommended strategies for improving human-environment interactions and reducing negative impacts are:

What	How
Risk assessment	Assess the risk associated with human factors in order to identify and mitigate the risks associated with human error and human behaviour. *For more details see chapter: Assessing Human Factors-Related Risks.*
Operational and maintainance procedures	Implement and maintain operational and maintainance procedures to ensure effective and safe operations and minimise human error. Procedures need to be technically accurate, well-written, usable and up to date. Poorly written procedures can be a reason for people to develop alternative practices. Effectively written procedures are vital in maintaining consistency and in ensuring that everyone has the same information. *More details given in* EIGA Info HF 04 *Task Factor - Design and Effectiveness of Procedures*[2] and EIGA Info HF 05 - *Task Maintenance Error.* [3]
Environmental training and education	Train employees on environmental issues and best practices to ensure competence. Schedule regular trainings and assessments to maintain high standards and minimize errors. *More details given in* EIGA Info HF 02 *Individual- Training and Competence*[4]
Environmental-Critical Communication	Ensure clear and concise communication in environmentally critical situations. Implement effective communication strategies including, for example, shift handovers, permit-to-work processes and emergency protocols. *More details given in* EIGA Info HF 06 *Organisation – Site emergency response*[5]
Monitoring and continuous improvement	Track feedback, case studies, examples and incident analysis to enable continuous improvement based on lessons learned from past incidents and best practices.
Behavioral incentives	Encourage good behaviours and good practices among employees by recognizing employee achievements in environmental safety and good environmental practices (reducing emissions, saving energy, reducing waste, etc.) Publish environmental performance data to encourage better behaviour and employee trust.
Improved environmental culture	Promote environmental responsibility through workplace policies, safety checks, and accountability.

Assessing Human Factors-Related Risks

Integrating human factors into environmental risk assessments optimises human performance and minimises human error, which can have a significant impact on environmental safety. The key aspects to be addressed are:

Aspect	What to do
Identify Environmentaly Critical Tasks	Identify tasks that are critical to environmental safety. If performed incorrectly, these tasks could lead to significant incidents.
Involve the Workforce	• Involve employees in the risk assessment process to gain insight into how tasks are performed and where potential human errors might occur. Involving employees in the risk assessment process helps identify appropriate controls and ensures that the assessment is based on practical, real-world conditions. • Conduct walkthroughs and observations of tasks to understand the real conditions and challenges faced by workers.
Identify Human Failures	Identify the potential human errors that could lead to accidents and the factors that influence these errors.
Implement Control Measures	Design appropriate control measures to prevent or mitigate the human failures you have identified. This includes putting in place systems and tasks that reduce the likelihood of errors and allow recovery when errors do occur.
Continuous Improvement	• Check that your control measures are working. • Set up feedback loops to learn from incidents and near misses and update risk assessments accordingly to reflect new knowledge and improvements. This ensures that the risk management process adapts to changing conditions and remains effective.

Case studies relevant to the Industrial Gases Industry

The following examples illustrate the concept of assessing impact of human factors on conditions of compliance when reviewing safe environmental storage of chemicals on site.

Human Factors particularly impact dynamic conditions - conditions that can be changed at any time - such as whether drums or containers are within spill containment devices. Drums and containers can be moved out at any time and it requires operational discipline to make sure they are put back within the spill containment after they have been used. Improved workplace design can be used to make sure the storage is close to where the product is used to encourage good behaviour.

Other examples include whether activities such as washing, deliveries are taking place in the right place and whether storage of machinery, vehicles and substances is away from drains.

Spotting evidence of good behaviours and good practices and recognising them is key to motivating people and to ensure that they will continue to carry out the task correctly.

Figure 1 - Drums in containment with additional drip tray and absorbent material to hand

Figure 2 - Drums stored outside of containment

Figure 3 - Overloaded container in incorrect area

Figure 4 - Incorrectly mixed waste

**Figure 5 - Hazardous mixing of waste materials in incorrect area**

Figure 6 - Properly labelled and segregated waste container

Useful tools and techniques

The following examples illustrate the use of tools and techniques in work place design such as:

- easy to use-colour codes for waste, drains.;

- use of visual indication of the risks. If its easy…people will do it!

Use pictures like these below and above to communicate good and bad practices.
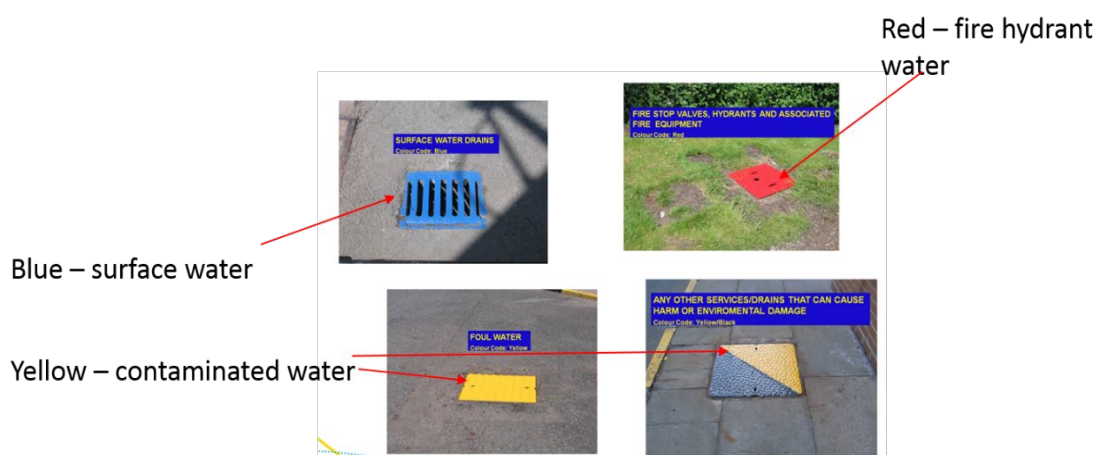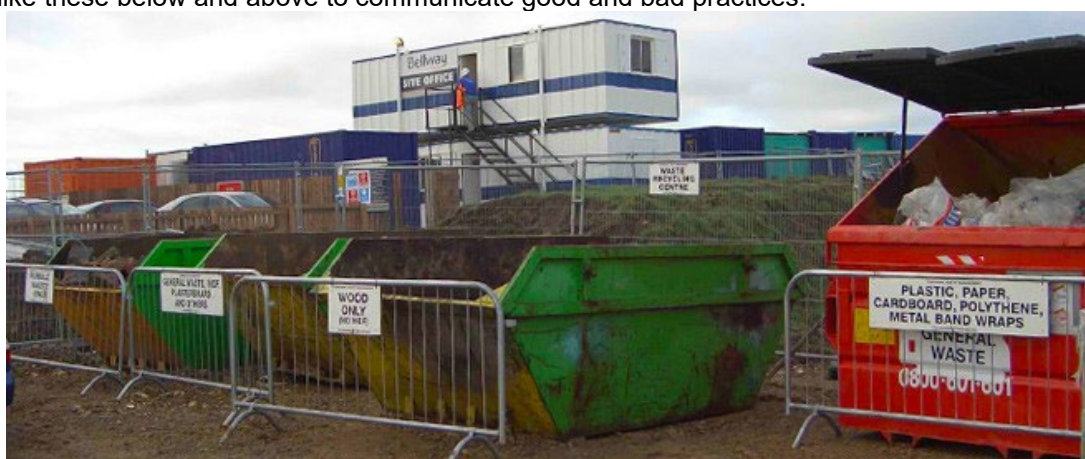
Red – fire hydrant water

Blue – surface water

Yellow – contaminated water

A good practice is to conduct 'What if' exercises. The template below shows how this can be accomplished to look for the risk of spills of different liquids and to make sure everyone on site knows what to do in the event of an incident.

What can we do if …?	Environmental impact	Solution
… oil or another hazardous substance has been spilled during handling and there is a risk that this reaches the rainwater collection pits or the sewage system?	Cleaning the spillage of hazardous substances with water increases the risk of land pollution and generates a greater amount of wastewater	Use appropriate spill kits
… we do not know whether the spilled substance is hazardous?	This may damage the environment and harm ourselves if the right measures are not taken	Deal with the material as if it was hazardous.
… we detect a water leak during the process that contains potentially hazardous substances?	This may pollute the land and water if it reaches the drainage system	Isolate the area, remove contamination.

References

[1]   EIGA SI-HF 01 *Human Factors – An Overview* www.eiga.eu

[2]   EIGA SI-HF 04 *Task Factor-Design and Effectiveness of Procedures* www.eiga.eu

[3]   EIGA SI-HF 05 *Task Maintenance Error* www.eiga.eu

[4]   EIGA SI-HF 02 *Individual – Training and Competence* www.eiga.eu

[5]   EIGA SI-HF 06 *Organisation Site Emergency Response* www.eiga.eu

Useful Reference Information

1.   EIGA Doc 40 *Work Permit Systems* www.eiga.eu

2.   *Human Factors in Risk Assessment* https://www.hse.gov.uk

3.   *Integration of Human Factors into Safety and Environmental Management systems* https://onepetro.org