

## HSE Human Factors Briefing Note No. 5

### Emergency Response

Briefing Note 1 – ‘Introducing Human Factors’ explains the background to these Briefing Notes.

Plant managers and employees do everything they can to stop emergency situations such as fires or leaks from happening, but emergencies are still possible on any plant. The plant should have the necessary resources in place: designated workspaces, equipment and people organised to manage the emergency so as to reduce damage to facilities and harm to employees and public.

#### Case study

In June 1988 at a UK plant, the crankcase of a pump used to pressurise ammonia was punctured by fragments of the failed crankshaft. This released 10 tonnes of ammonia in 3 minutes and a further 28 tonnes in the next 40 minutes.

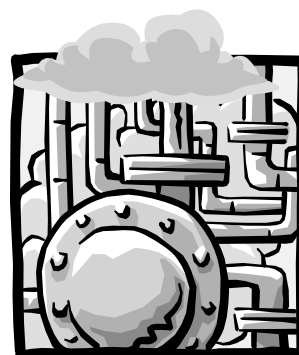
Operators could stop the ammonia supply only by switching off a pump locally. They needed gas-tight suits to do so. Only two were available and were immediately used for search and rescue purposes.

Ammonia entered the plant control room and the operators sounded the alarm and started plant shutdown. They left wearing 10 minute BA sets.

Two operators died immediately, 5 fire crew were injured; 3 000 people on site and 50 000 off site were exposed to ammonia. The on-site emergency plan was activated within minutes of the alarm being sounded. It was found that only 2 men were missing and it was decided to use the 2 gas-tight suits for search and rescue rather than isolate the ammonia ring main supply.

The off-site emergency plan was activated within 5 minutes of the start of the release. Local radio warnings were given but they were too late for some local schools and some mothers and children were affected while making their way home.

The accident illustrates that the site needed additional protective clothing, better communications or alarms (a siren perhaps) to alert local residents and an alternative/gas tight location for activating alarms and plant shutdown.



As a result of the accident, the plant installed automatic remotely operated shut-off valves in the ammonia supply systems to allow the plant to be isolated quickly and without the need for PPE.

Source: Ref. 1

There are three key areas where HSE has taken action on this issue:

- Lack of adequate training and competency arrangements
- Poorly thought out and designed procedures
- Lack of an understanding of the role of people in emergency response, leading to unrealistic expectations of their abilities.

## Human factors checklist

The main features of a good emergency response system are set out below as a checklist. See how many you can tick.

**For emergencies, our company has:**

- |  |                          |
|--|--------------------------|
| ➤ Assessed which emergencies are most likely (or are not very likely but could do a lot of damage)                     | <input type="checkbox"/> |
| ➤ Set up good warning systems (alarms, PA, flashing lights) to let everyone know that there's a problem                | <input type="checkbox"/> |
| ➤ Installed remote shutdown facilities so that no-one has to go into a danger area to isolate equipment                | <input type="checkbox"/> |
| ➤ Provided back-ups in case equipment is damaged   | <input type="checkbox"/> |
| ➤ Placed alarms and made them loud, bright and clear enough so we will notice them in any conditions                   | <input type="checkbox"/> |
| ➤ Provided specific equipment (protective clothes, fire-fighting, radios etc) for the types of emergency we could have | <input type="checkbox"/> |
| ➤ Made clear plans for each type of emergency  | <input type="checkbox"/> |
| ➤ Put together well-written procedures   | <input type="checkbox"/> |
| ➤ Tested the procedures and our performance in exercises and drills  | <input type="checkbox"/> |
| ➤ Changed equipment or how we do things based on lessons learned from exercises  | <input type="checkbox"/> |
| ➤ Given clear instructions about roles and how to organise for an emergency  | <input type="checkbox"/> |
| ➤ Set out contingency plans in case someone in the emergency team is missing   | <input type="checkbox"/> |

You can think of emergency response arrangements as what you do:

- Before the emergency (planning)
- During the emergency (doing)
- After the emergency (learning/improving).

The next page sets this out in more detail.

## Learning more about emergency response

**We have set out below an ideal emergency response system. You must decide which parts of it apply to your site, the work you do and the type of personnel you have. The information below is from a wide range of sources: guidance documents, HSE audits, inspections and case studies.**

## Stages in Emergency Response: What To Do

### Preparing for Emergencies

You should assess your site risks to find out what are the most likely/most damaging emergencies that could arise. You will then know how most emergencies would start and progress and how to detect them. You should then match your response plans to the scale and probability of those emergencies. Decide what information everyone will need to handle the emergency; how to get that information and pass it on. You should set out what resources you will need. This will include:

- Detectors and alarms
- An emergency control centre
- Access and escape routes
- Fire-fighting and first aid equipment
- Power supplies
- Communication equipment (phones and radios)
- Remote controls to shutdown or isolate plant; clear procedures and checklists.
- Protective clothing and special equipment (e.g. breathing apparatus, cutting or lifting gear)
- A competent, well-organised emergency team with clear responsibilities assigned to all
- Help from off site (e.g. fire brigade)

You should make sure that your plan works under all foreseeable conditions (e.g. day or night, in all weathers, with personnel off sick or on leave, with contractors or visitors on site, if emergency team members are missing or busy).

You must exercise and evaluate emergency plans under realistic conditions as often as needed to maintain competence. Keep records of what happened in exercises; use the information to improve your emergency response. Use different forms of exercise from 'table top' exercises to full muster drills.

### Actions During an Emergency

#### Start of Emergency

A sensor, or someone on the site, detects a problem (e.g. a leaking tank). Manual or automatic alarms alert everyone on site. The emergency team assembles; all on site go to their muster station. A roll call establishes who is present and who is missing. The team gathers information to decide:

- What triggered the alarm (a fire, leak, bomb threat)
- Where the problem is
- Possible hazards (smoke, flames, chemicals, unsafe structures)
- What to do next to deal with the problem (stop the leak, put out the fire) and to deal with its effects (rescue and treat casualties; clean up; save property)

#### Emergency Continues

The emergency team continues to:

- Gather information, which may not be complete
- Keep everyone informed about the situation
- Liaise with outside help
- Take decisions (bring in outside help; evacuate the site)
- Manage the effects of stress (mainly to avoid errors)

#### Emergency Ends

The team is satisfied that the emergency is over and stands down

Management find out if it is possible to restore operations at the site or sets out to repair damage.

### After an Emergency

Site management learns from the emergency about plant safety and emergency response. That is: which decisions and actions were successful and which were not and what changes need to be made to: the overall approach to emergencies, facilities and equipment, procedures, emergency team structure, competence and whether the safety culture supported the execution of the plan.

Management pass on information to other companies and learn from *their* experiences.

## References

1. Mars Major Accident Reporting System (MARS) entry 344  
<http://mahbsrv2.irc.it/MARS/servlet/ShortReports>
2. HSE (2001), 'Inspecting and auditing the management of emergency response'. Offshore Technology Report, 2001/091
3. OECD (2003) 'Guiding Principles for Chemical Accident Prevention, Preparedness and Response'. OECD 75 775 Paris CEDEX 16, France
4. HSE (1997) 'Recent Major Accidents: Lessons on Emergency Planning'. Chemicals Sheet No.1
5. HSE (1997) 'Prepared for Emergency'. INDG246. HSE Books. Free leaflet. ISBN 0 7176 1330 5