



































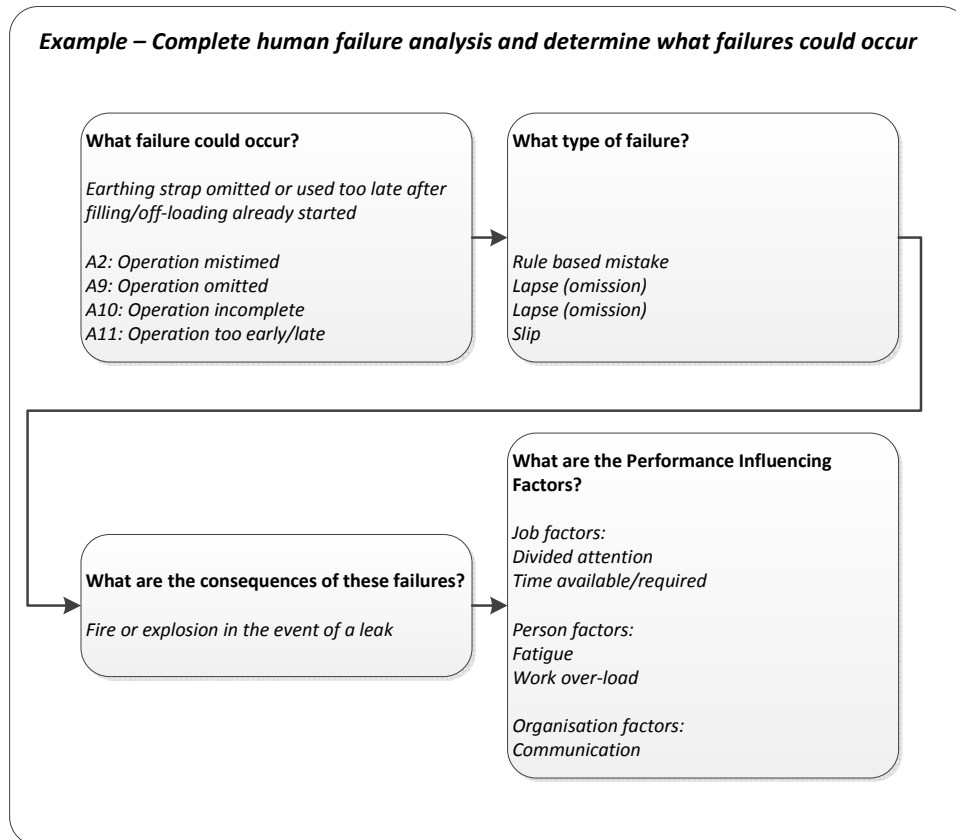




- Human Error Analysis and Reduction Technique (HEART)
- Technique for Human Error Rate Prediction (THERP)

Use of these techniques can provide Human Error Probabilities (HEPs) which can be used to inform quantitative risk assessment, Layers of Protection Analysis (LOPA), Safety Integrity Level (SIL) determinations and As Low as Reasonably Practicable (ALARP) demonstrations. These tools can be helpful in evaluating the benefit of taking additional measures to reduce human error, but should only be applied by a suitably competent person.

<sup>3</sup> Further information on QHRA can be found in the Energy Institute publication 'Guidance on quantified human reliability analysis (QHRA)', <http://www.energyinst.org/technical/human-and-organisational-factors/qhra>



#### 4.5 Review existing safe-guards that could prevent the human failure

In sections 4.4 and 4.5 the failures, type of failure, and the factors which influence that failure (PIF) have been identified. The next step is to determine what existing controls and safe-guards are already in place which may address each of the PIFs.

Following this analysis, those PIFs that do not have existing controls, weak controls that could be improved or safeguards will be identified.

**Example – Review existing safeguards that could prevent the human failure**

**Measures to prevent the failure from occurring:**

- Detailed procedures with Safety Critical task highlighted
- MAH scenario signage at earth point
- Earthing strap permanently fixed to plant
- Multiple and well positioned earth straps in place to avoid violation apathy

**Measures to address PIFs:**

*Divided attention; Time available/required; Work overload; May be distracted by other deliveries/ activities. Planning system includes dispatch cover for offloading/loading activities. Shift pattern allows for holiday/sickness cover.*

*Communication:  
Planning system alerts technicians to activities for the week ahead with additional daily despatches to account for changes/additional deliveries. Offloading check sheet and handover log completed to communicate to oncoming shift.*

## 4.6 Determine opportunities for recovery

Not all human failures will lead to an undesirable consequence. There may be opportunities for recovery before reaching the consequence. It is important to take recovery from errors into account in the assessment. A recovery process generally follows three stages:

1. Detection of the error
2. Diagnosis of what went wrong and how
3. Correction of the problem.

**Example – Determine opportunities for recovery**

**Potential to recover (from the failure before the consequence occurs):**

- Tank has interlock system ensuring earthing continuity
- Off-loading checklist including earth confirmation
- Operation completed with ADR qualified driver present

## **4.7 Recommend additional safeguards for preventing failure or improving recovery**

Section 4.5 and 4.6 identified those PIF's for failure types that already have appropriate controls and safe-guards in place or have opportunities for recovery. For the remaining PIF's, consider what additional safeguards or recovery steps can reasonably<sup>1</sup> be implemented to mitigate the effect of the PIF, this may include:

### **Technical**

- Removing human interaction by automating the process, e.g. introduce automatic loading shutdown in the event of a meter overrun to remove driver monitoring and manual intervention.
- Consider use of new signage or improving existing signs/ labels, e.g. improving valve labelling to ensure operator doesn't open incorrect valve by mistake.

### **Procedural**

- Ensure safety critical steps are clearly identified and highlighted to those who carry out the tasks.
- For those tasks identified as safety critical, consider the use of job aids with detailed information of risks, minimum controls and potential human failures. E.g. breaking containment job aid, critical safety system maintenance.

### **Behavioural**

- Introduce robust processes to maintain competency and compliance to procedures, e.g. competency checks for safety critical tasks.
- Introduce independents check at critical tasks, e.g. second permit to work authority verifies permit before issuing.

If the risk of the PIF for the task step cannot be mitigated, reference should be made to the risk assessment for the MAH to see where additional risk reduction measures can be introduced<sup>1</sup>.

<sup>1</sup> Any further risk reduction measures should be subject to the ALARP principle.

**Example – Recommended additional safeguards**

**Measures to reduce the consequence/failure:**

*Consider expansion of earthing continuity protection system to all offloading points*

*Change laboratory offloading procedure to include independent check/confirmation of earthing in place*

*Task currently completed by self-managing team. Frequency of supervision checks/ presence in area to be increased including checks of safety critical tasks*





























