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Lessons in Process Safety

Shift Handover

Learning from cases relating to shift handover – what can you do?

Accidents of many different types can result from poorly conducted shift-to-shift handovers. We have reviewed three different accidents that were caused by shortcomings in handover, covering serious (even fatal) personal injuries and environmental consequences.

In each case, learning points are discussed.

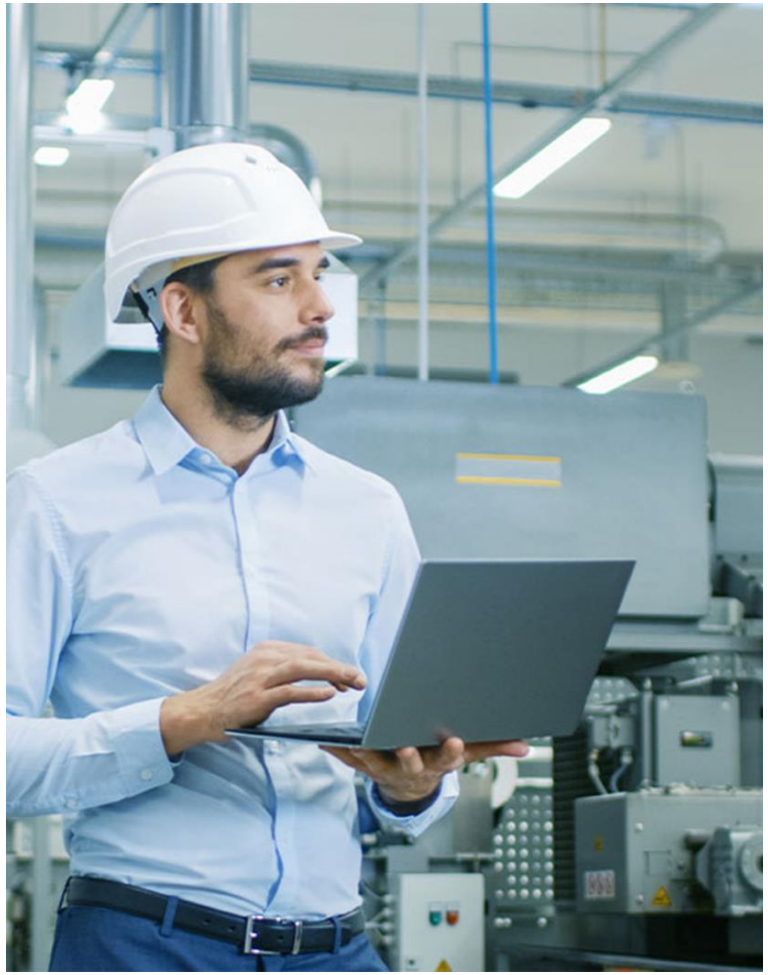
We have listed the actions to avoid inadequate shift handovers that can be applied to virtually any situation, thus aiming to address the fact that shift handovers, whether very good, very poor or somewhere in between, can occur in just about any plant or other workplace and are not specific to any industry, plant or other workplace.

Case 1 — An incident involving unauthorized entry into a confined space

Case 2 — An incident with major environmental consequences

Case 3 — Contamination of breathing air by a toxic gas – a potentially fatal accident

Note: This is a four-week learning program to emphasize **shift handovers**.



Case 1 — An incident involving unauthorized entry into a confined space

- A fitter was involved in a fatal incident at a site in the northwest of England as he was preparing to handover at the end of his shift to an operator (who incidentally was his brother-in-law) to do his shift.
- The fitter had been tasked to carry out some repair work inside a 10,000-liter capacity reactor. After following all the necessary protocols and correct safety procedures, requiring total electrical isolation of the reactor, he entered the reactor. He successfully completed the necessary task and reinstated the electrical power to the agitator.

Case 1 — An incident involving unauthorized entry into a confined space

- He told his brother-in-law, the oncoming operator, what he had done and handed the use of the reactor over to him.
- After giving the OK he suddenly remembered that he had left a hammer that he was using inside the reactor. For what he thought was only a brief entry, to retrieve the hammer, he re-entered the reactor without following the necessary electrical isolation of the reactor.
- Unknown to the operator that his brother-in-law, the fitter, had re-entered the reactor he started the agitator to start his batch.
- This regrettably led to the tragic death of the fitter.

Case 1 — An incident involving unauthorized entry into a confined space

Key Learnings

- The HSE investigation concluded that in a **rush to do the job**, before the shift handover, the fitter had inadvertently left his hammer inside the reactor.
- For what may well have seemed to be a quick and brief re-entry he bypassed all the necessary electrical isolation procedures that he needed to have followed.
- The entire workforce was traumatized by the incident, not least his brother-in-law.
- Shift handovers often require multiple exchanges of information and completion of tasks and as such people do things in a **rush** to get away from the site.
- It is thus critical for companies to ensure that the necessary **human factors risk assessments** are stringently followed. The **Permit to Work** (if any) was disregarded.
- **A safety culture** that would automatically have made the fitter stop and think (of what the worst consequences might be), backed up by **training**, could provide significant benefits.

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Case 2 — An incident with major environmental consequences

- Radioactive waste liquor was accidentally discharged to sea from a collection tank due to a failure of communication systems and procedures **human factors** culture between shifts.
- The tank's contents were not described accurately, and errors were made in the written logbook.
- A tank which was assumed to contain liquid suitable for discharge to sea, in reality contained significantly radioactive material.

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Case 2 — An incident with major environmental consequences

- This resulted in a misunderstanding between shifts and a decision to discharge the liquor. The beach became contaminated at low tide and had to be closed to the public for several months.
- A massive physical clean-up, involving identification and retrieval of radioactively contaminated debris, was necessary before it could be re-opened.
- The company was prosecuted and convicted of breaches of safety regulations.

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Case 2 — An incident with major environmental consequences

Key Learnings

- The event occurred **during plant shutdown** for routine annual maintenance.
- As a result, a written description was handed over from one shift log to the next, across numerous sequential shifts. The description of the tank contents was changed from “ejections” to “washout” and that change resulted in significantly radioactive material being interpreted as low-level effluent suitable for discharge to sea.
- The investigation revealed that the company **lacked sound procedures** for handover between shifts at all managerial and supervisory levels.

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Case 2 — An incident with major environmental consequences

Key Learnings

- The handover did not seem to be adequately reliable and additional robust procedures needed to be in place for critical activities.
- Normally, discharge would be carried out either on the same shift as the tank became full, or soon after.
- The consequences of this kind of accident can include heavy financial penalties, lowering of public confidence and loss of business as well as accident and/or illness to employees and the public, though it is emphasized that, in the case of this incident, no harm was done to either.

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Case 3 — Contamination of breathing air by a toxic gas – a potentially fatal accident

- Maintenance was in progress on a storage tank used for the interim storage of hydrofluoric acid solution (HF).
- The tank had been emptied for maintenance but still contained residual HF which, at the concentration concerned, gave off HF fume.
- Physical isolation of the tank was necessary so that welding repairs to some of the tank pipework could be carried out.

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Case 3 — Contamination of breathing air by a toxic gas – a potentially fatal accident

- This had to be carried out by an operator dressed in full body PVC protective clothing consisting of full-length trousers and a combination jacket and hood with an integral breathing air-line connected to the centralized breathing air system.
- The departing operator reported the current position to his foreman.
- Then, in the changeroom, he told the oncoming operator that he had left a flexible air hose next to the tank with the other end connected to the central breathing air supply, so that all the oncoming operator had to do to proceed with the job was to connect it to his integral breathing air-line.

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Case 3 — Contamination of breathing air by a toxic gas – a potentially fatal accident

Key Learnings

- This, itself, was a flawed step by an inexperienced operator.
- He should have advised the oncoming man to make his own checks first before proceeding. To compound this error, the flexible hose was not, in fact, a breathing air-line.
- It was a process air-line, the other end of which was connected to the central process air main. The operator duly connected his integral line to the hose and started work in preparation for isolation.

Case 3 — Contamination of breathing air by a toxic gas – a potentially fatal accident

Key Learnings

- He was almost immediately aware of burning sensations in his nose and throat and watering of his eyes. He quickly removed his combination jacket and hood and jumped onto the nearest automatically operated shower. This, fortunately, gave him immediate relief, after which, he reported to the foreman who had him escorted to the works surgery.
- He was given treatment for what was quite clearly exposure to HF fume. Investigation showed that a separate process air hose had been in use previously to purge the tank atmosphere. This had been left connected to the tank, with the air pressure off, and HF fume had seeped into it from the tank. This had caused local contamination of a section of the process air main including the part that the operator had connected his integral line to. He, thanks to his own, and the surgery team's prompt actions, suffered no lasting effects.

Case 3 — Contamination of breathing air by a toxic gas – a potentially fatal accident

- Always formally check the validity of handover information before proceeding — don’t accept off-plant information however well-intentioned.
- Make process air and mask air connections physically distinguishable from each other. The works concerned introduced color coding of the air connecting points i.e. different colors for each type of air.
- Inhalation of HF fume at this concentration will result in death if sufficient is inhaled.
- The process, and breathing mask, air connections installed in the plant, were not sufficiently different from each other.

What can you do?

Our source, IChemE Safety Centre (ISC) believe that leadership across six key functional elements is vital to achieve good process safety outcomes.

These elements are:

- Systems and procedures
- Engineering and design
- Assurance
- Knowledge and competence
- Human factors
- Culture