

Effects of CO₂ Leaks Onshore

Whilst everything will be done to ensure leakage does not happen at any stage – capture, transport or storage, it is important to recognise that sometimes accidents can happen. Operators will be required to demonstrate that they are aware of the risks, and have a deep understanding of what the potential risks are, and how to deal with them to minimise and remediate any potential hazards.

Leak Sources

It is conceivable for CO₂ to leak from any stage of the process, capture, transport or storage, but all the risks can be managed to minimise and ensure swift detection and remedial action to remedy the problem.

Dangers and Environmental Impacts

CO₂ only presents a danger to humans when concentrations rise to over 3%. At this point it can lead to unconsciousness, and death if the casualty is not removed from the source of CO₂. However, the probability of exposure at high enough levels for long enough periods of time is unlikely as wind and air movements would dissipate any CO₂ very rapidly, and the length of exposure would likely be very short, with no lasting effects.

CO₂ is not to be confused with carbon monoxide (CO) as CO is very dangerous – many people will have CO detectors in their homes to detect leaks from their gas boiler. CO₂ is not in the same league, we breathe small amounts of CO₂ every day, in every breath, and it is the main constituent of what we breathe out.

Plants react in a similar manner, with one particular difference of note, and that is that at low concentrations, CO₂ can actively encourage growth and development in plants. Large numbers of commercial greenhouses (particularly in The Netherlands) use CO₂ captured from industrial processes to enhance the growth rate of their flowers which are then sold all over Europe. CO₂ does still pose a danger to plants, and at concentrations over 20%, plant death will occur.

Leakage Risks and Prevention Measures

Leakage from the capture or transport processes would occur on or near the surface, so any such leak would have an immediate and apparent effect, however the leak would also be easily detectable and manageable. Any changes in pressure within a pipeline system would instigate an immediate shut down and rapid repair. Any leaks at the capture process would be taking place in an industrial setting, with rigorous procedures in place for health and safety, and any leak here would also be shut down very quickly.

The larger risk would be leakage from the storage site. Any storage site will be around 1000m below the surface, or more, and therefore detection proves to be a more complex process. However, due to extensive site characterisation and monitoring before and during injection, any changes would be picked up quickly, and should a leak occur, injection would cease while the problem was dealt with. Over decades of oil and gas exploration and production, a vast suite of monitoring technologies has been developed, and site operators would have a large number of monitoring tools at their disposal. Seismic surveying works by sending sound waves into the earth, and monitoring the reflected signal – kind of like an echo. By interpreting the signal that returns, and measuring the time delay and other factors, operators can tell precisely where the CO₂ that has been injected is, and where it is moving. Any leaks from the storage reservoir would be detected by similar monitoring techniques and wells that were causing a leakage 'pathway' can be isolated, blocked and sealed to prevent such leaks reaching the surface.

Summary

While leakage is possible from the different elements of the whole process, operators would be required to minimise risks, operate within safe limits, and maintaining an extensive monitoring programme, with remediation plans in place should something go wrong. Leaks can be detected, isolated and repaired, whilst careful site and route selection will minimise or remove any potential risks to humans, animals or environmentally sensitive or protected plant species.

It is important not to ignore the risks associated with leaks, but it is also important to recognise that the risks are extremely small, and it is a simple matter to remediate them. The chances of extreme or dangerous accidents are low. Although some gases are flammable, CO₂ is not, so there is not a fire risk from any leakage – CO₂ is actually used in fire extinguishers.