

# **TRANSPORT OF CO<sub>2</sub> BY PIPELINE - CONSEQUENCE ASSESSMENT**

It explains the effects of LOC scenarios from the HP pipeline, both aboveground, underground and at a waterway crossing. For each LOC scenario the maximum concentration profile has been calculated as well as the lethality footprint.

The maximum concentration profile shows a side view of the maximum concentration distances. For all scenarios three concentrations are displayed: the alarm value, the 1% lethality and the 100% lethality concentration (see also Paragraph 2.1.2). It is important to note that the lethality concentrations are derived from a 30 minutes exposure time and that the maximum concentration distances are not sustained for such a long time.

Therefore, the lethality footprint is displayed containing the 1%, 10% and 100% lethality contours. Safeti-NL calculates the lethality of a certain LOC scenario by calculating the dose at a location and using the CO<sub>2</sub> probit function. The dose is a combination of concentration and exposure time. The lethality contours are always smaller than the maximum lethal concentration.

The consequence assessment will only look at the *effects* of the different LOC scenarios (so assuming it will happen) and does not take into account the *probability* of a LOC (is it likely to happen).

Table 10-3 summarizes the results of Appendix 2. It shows the effect distances for the different HP scenarios.

**Table 10-3:** Effect distances HP pipeline scenarios

Location	Scenario	Distance 50,000 ppm (m)		Distance 1% lethality (m)	
		F1.5	D5	F1.5	D5
Aboveground	Rupture	300	285	156	145
	Leak	44	40	37	35
Underground	Rupture	10	10	8	8
	Leak	<0.5	<0.5	<0.5	<0.5
Waterway crossing	Rupture	1980	355	740	210
	Leak	50	28	<1	<1

### 10.4.1 Conclusion consequence results

In this section the consequences, concentration and lethality, have been calculated for the LOC scenarios for a HP pipeline.

- Dangerous CO<sub>2</sub> concentrations (50,000 ppm) at ground level due to a LOC of an aboveground pipeline can reach up to 300 meters and the 1% lethality contour reaches 156 meters.

- Dangerous CO<sub>2</sub> concentrations (50,000 ppm) at ground level due to a LOC of an underground pipeline do not reach far because the CO<sub>2</sub> jet is directed vertically and the CO<sub>2</sub> concentration is quickly diluted before reaching the ground again. At the release location some solid formation occurs which causes dangerous CO<sub>2</sub> concentrations at the release location.
- Although the release of a LOC of a pipeline crossing a waterway is directed vertically, as for the underground pipeline, dangerous CO<sub>2</sub> concentrations (50,000 ppm) at ground level can reach up to 1980 meters and 1% lethality contour reaches 740 meters. This is caused by the loss of momentum of the jet which lowers the air entrainment and thereby lowers the dilution of CO<sub>2</sub>.

Source: <http://hub.globalccsinstitute.com/publications/co2-liquid-logistics-shipping-concept-llsc-safety-health-and-environment-she-report/104>