Developing a safe and cost-effective CO_2 infrastructure - Utrecht University

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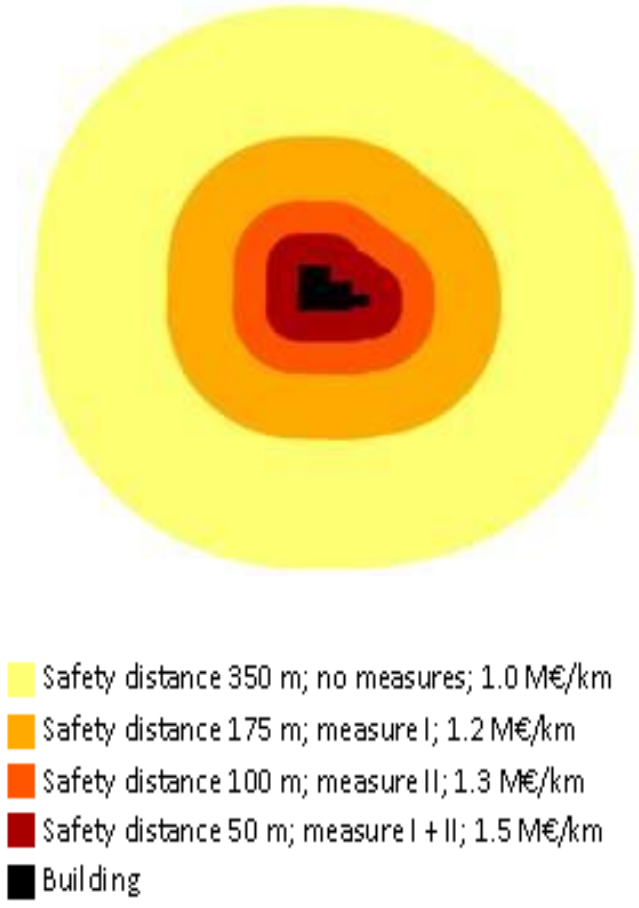
- *Project duration*: 2010-2014
- *Supervisor*: dr. A. Ramirez; prof. dr. A. Faaij
- *Main research question*: How can we build up a cost-effective and safe CO_2 transportation infrastructure?
- *Relevance*: CO_2 transport is unavoidable in linking CO_2 sources to suitable sinks. We want to do this as safe and cost-effective as possible.
- *First results*: CO_2 infrastructure can be built safe with limited additional costs even in densely populated areas. A good planning is crucial for developing a cost-effective CO_2 infrastructure.

Background and research question

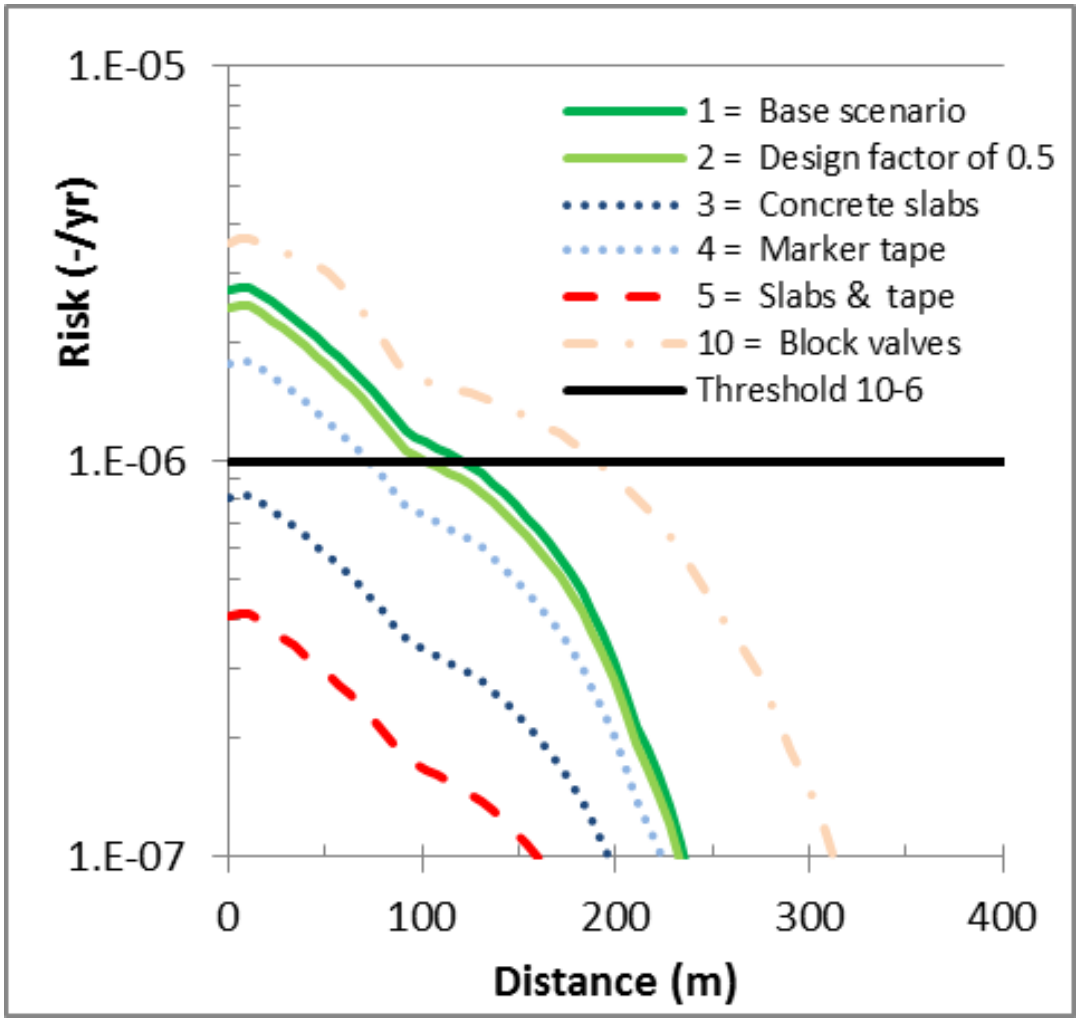
- If CCS take place, CO_2 pipelines will (also) go through densily populated areas.
- Balance between economics and safety.
- *How would risk and safety considerations affect the design, routing and costs of CO_2 pipeline transport?*

Methods

- Calculate failure frequency
- Calculate pipeline costs with and without additional safety measures for three case studies
- Calculate lethality distances and 10^{-6} locational risks.
- Least cost routing function in ArcGIS



Results

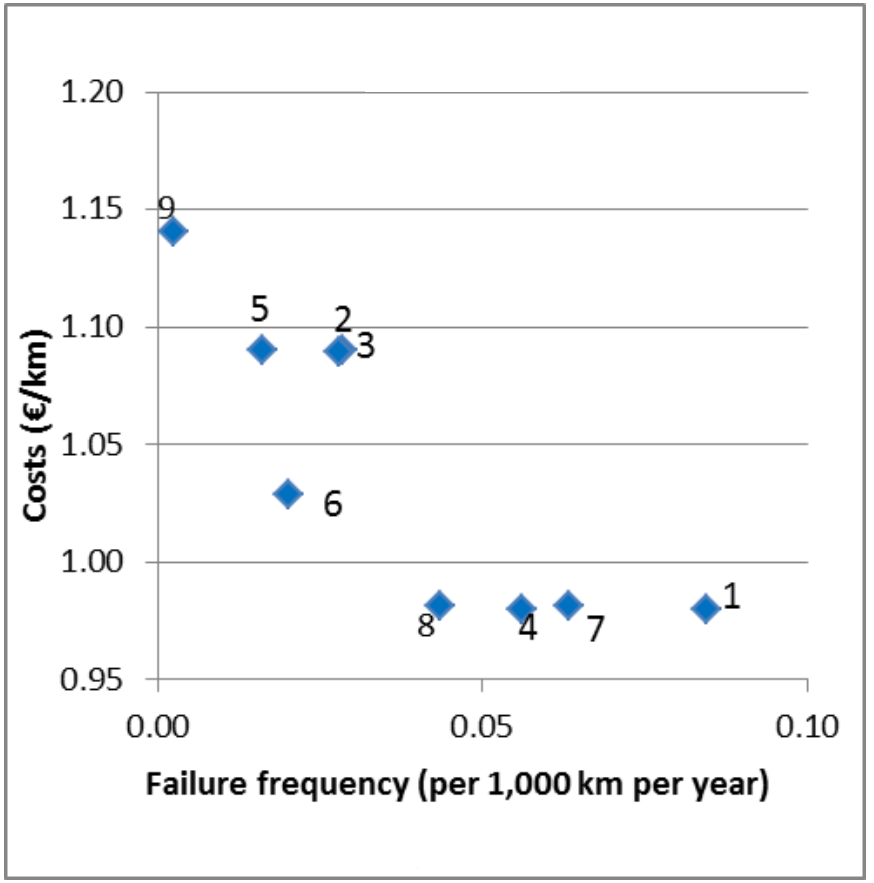


- Transporting 33 kg/s (about 1.1 Mt/y) over 70 km distance.
- 10^{-6} locational risks are 0 m for liquid CO_2 transport
- For gaseous CO_2 transport 10^{-6} locational risks are given in the figure.
  - 125 m in the base case
  - 0 m if concrete slabs are installed
- Higher locational risk for block valves due to methodological issues.

Discussion and conclusion

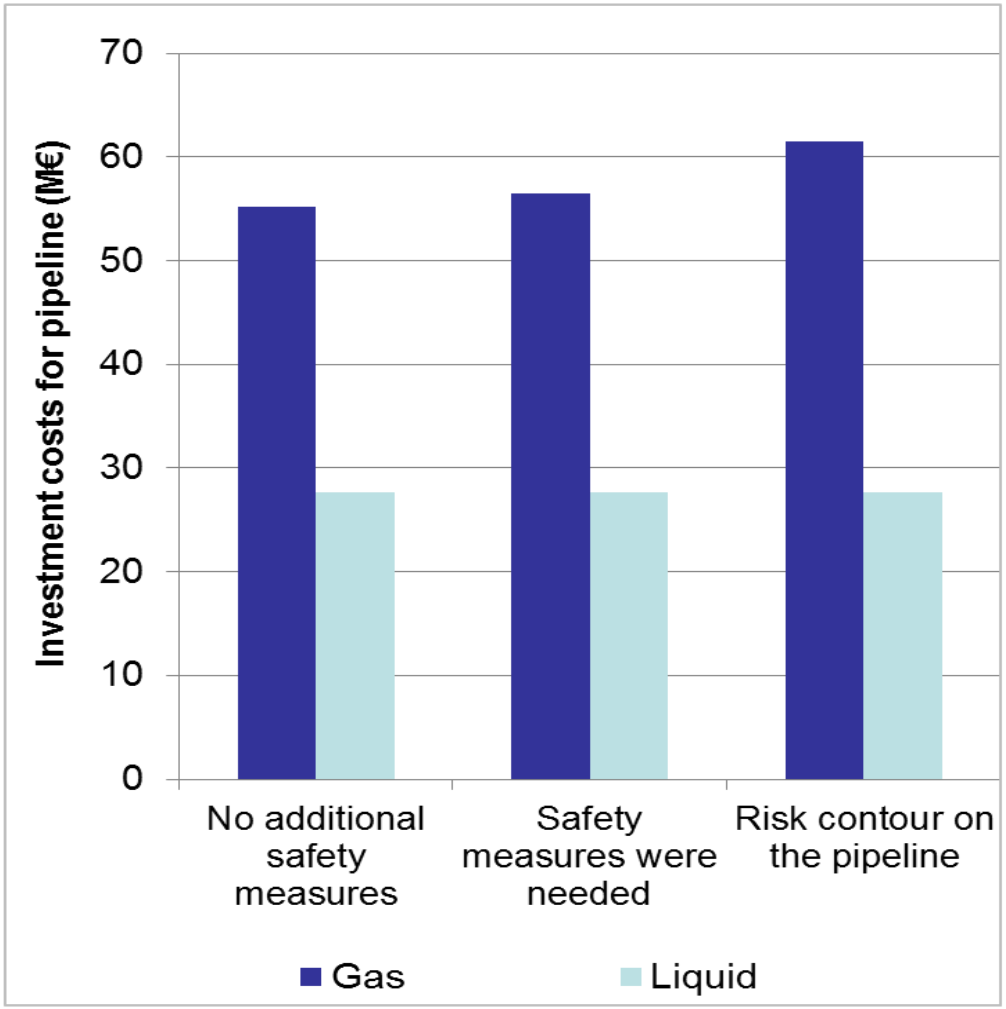
- Pipelines transporting liquid CO_2 can be routed without major problems.
- Gaseous CO_2 transport leads to larger locational risks than liquid CO_2 pipeline transport and more mitigation measures are needed.
- Marker tape and increased surveillance are very cheap options to reduce the risk of a pipeline failure.

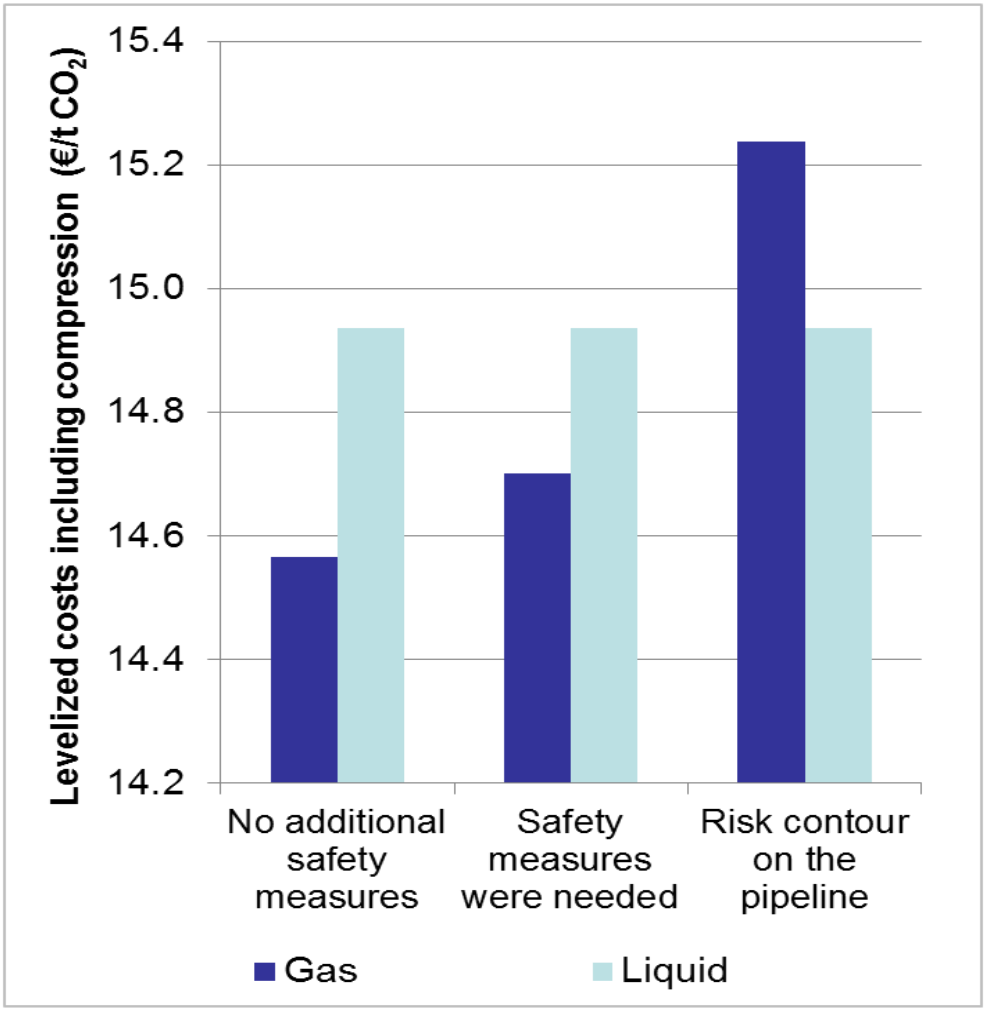
Failure frequency and costs



1 = Base scenario
2 = Design factor of 0.5
3 = Concrete slabs
4 = Marker tape
5 = Slabs & marker tape
6 = Burying the pipe on 2.0 m
7 = Weekly surveillance
8 = Marker tape & surveillance
9 = Multiple measures

Total and levelized costs





Higher risk for block valve scenario?