

ISO/TR 27925:2023-07 (E)

Carbon dioxide capture, transportation and geological storage - Cross cutting issues - Flow assurance

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Abbreviated terms	2
5	Overview of the necessity of flow assurance in CCS projects	3
5.1	General	3
5.2	Reasons to maintain flow assurance	3
5.3	Potential factors affecting flow of CO ₂ streams at individual components of CCS projects	4
5.3.1	General	4
5.3.2	CO ₂ sources	5
5.3.3	Capture facilities	5
5.3.4	Transportation	5
5.3.5	Field distribution	5
5.3.6	Injection wells	6
5.3.7	Storage reservoirs	6
5.3.8	Optional components	7
5.4	Providing flow assurance	7
5.4.1	General	7
5.4.2	Technical design	7
5.4.3	Operational procedures and work-flows	7
5.4.4	Overarching project management	8
6	Fluid composition and physical properties	8
6.1	General	8
6.2	CO ₂ phase behaviour and thermophysical properties -- Key features	9
6.3	Modelling properties of pure CO ₂	12
6.4	Properties of impure CO ₂ -- Phenomena and their modelling	13
6.5	Individual impurities	16
6.5.1	General	16
6.5.2	Water	16
6.5.3	Nitrogen and argon	16
6.5.4	Hydrogen	16
6.5.5	Oxygen	17
6.5.6	Carbon monoxide	17
6.5.7	Methane and ethane	17
6.5.8	Propane and other aliphatic hydrocarbons	17
6.5.9	Nitrogen and sulfur oxides	17
6.5.10	Hydrogen sulfide	18
6.5.11	Carbonyl sulfide	18
6.5.12	Ammonia	18
6.5.13	Amines	18
6.5.14	Benzene, toluene, ethylxylene and xylene	18

6.5.15	Methanol	18
6.5.16	Ash, dust, metals and other particulate matter	19
6.5.17	Naphthalene	19
6.5.18	Volatile organic compounds	19
6.5.19	Chlorine	19
6.5.20	Hydrogen chloride, hydrogen fluoride and hydrogen cyanide	19
6.5.21	Glycols	19
6.6	Effects of reactive impurities -- Phenomena and their modelling	20
6.6.1	General	20
6.6.2	Formation of corrosive aqueous phases	20
6.6.3	CO2 specifications	22
6.6.4	Modelling of formation of corrosive aqueous phases	22
6.6.5	Depressurisation and impact of reactive impurities	23
6.6.6	Corrosion issues in CO2 injection wells	23
6.6.7	Monitoring reactive impurities in the CO2 stream	23
6.6.8	Particle, wear and clogging	24
6.7	Modelling of CO2 stream properties in commercial flow assurance tools	24
6.7.1	General	24
6.7.2	Joule-Thomson effect	25
6.7.3	Viscosity	26
6.7.4	Flow assurance simulation for CO2 transportation in pipes	28
7	CO2 pipeline transport and well injection	29
7.1	Operation under single-phase flow conditions	30
7.1.1	General	30
7.1.2	Fluid hammer	31
7.1.3	Shut-down of pipeline and well	31
7.1.4	Start-up and restart of pipeline transport and well injection	32
7.2	Normal operation under two-phase flow conditions	33
7.2.1	General	33
7.2.2	Identification of two-phase flow in the pipeline and well	33
7.2.3	State of the art of modelling two-phase CO2 flow in pipelines and wells	34
7.2.4	Shut-down and restart	34
7.2.5	Cavitation	35
7.3	Special operation with two-phase flow	35
7.3.1	Depressurization	35
7.3.2	Planned and un-planned pipeline pressure release	36
7.3.3	Well blowout	37
7.3.4	Leakage detection	37
7.4	Other issues	37
7.4.1	Dry ice formation	37
7.4.2	Hydrates	37
7.5	Ready for operation	39
8	Fluid flow in storage reservoirs	40
8.1	General	40
8.2	Depleted gas reservoirs	42
8.3	Saline aquifers	44
8.4	EOR operations	45
	Bibliography	48