

Index

Page numbers in *italic* denote figures. Page numbers in **bold** denote Tables.

- abandonment, salt caverns 119–127
- Abbeystead Pumping Station, natural gas seepage 195
- Above Ground Balance (AGB) testing 130
- above ground storage vessels, incidents 198, **197–198**, 205
- acoustic imaging, CO₂ leakage monitoring 263
- air, in gas supply pipes 3–4, 13, 18
- Albury gas storage project **23**, *40*, **68–69**
- Aldbrough gas storage facility **23**, *40*, **70**, 74
- Anderlues, coalmine storage facility, leakage *184*, 194, 204
- anhydrite
 - cementation 65
 - laboratory testing 102, *104*
 - Permian 62, 63
 - rehydration 65
 - Weyburn Reservoir caprock 241–244
- aquifers
 - as storage facility 21, 29
 - leakage *178*, *180*, 188–189, 203, *204*
 - strength 28
 - associated gas 19
- Astrakhan, salt caverns, abandonment 193
- atmosphere, CO₂ leakage monitoring 264
- Atwick gas storage facility *40*, 62, 74
 - soluble salts *183*, 193
 - see also* Hornsea gas storage facility
- Bacton-Balgzand, interconnector 4, 173
- Ballyboley Halite Member *44*, 62
- Battleford Formation 244
- Bayou Choctaw, incident *183*, 190, 205
- Bearpaw Formation 241
- Belmont School, leakage *157*, *187*, 185
- Bhopal incident 201
- Billingham Main Anhydrite 62
- Bletchingly gas storage project **23**, **69**
- Borehole Regulations 158
- boreholes
 - corrosion 156, 167, 245
 - integrity testing 129–137, 245, 270
 - see also* well integrity
- Boulby Halite Formation *41*, 62, 63
- Boulby Potash Mine, gases 66
- Branscombe Mudstone Formation *43*, 53
- breccia collapse 43, 45–46, 58, 60
- Breitbrunn/Eggstatt gas field, leakage *179*, 185
- Brenham, Texas
 - incidents 189, 191, 205
 - leakage *176*, *181*
- brine
 - disposal 31, 73, 220
 - extraction 66–67
 - precipitation infill 65–66
 - pumping 45, 49, 50, 53
- brine strings 29
 - failure 190, 203, 206
- Bryan Mound, depressurized salt cavity *183*, 193
- Buncefield oil depot incident 155, 199, 202
- Byley cavern storage facility 2, **23**, *40*, **70**, *71*, 72
- Byley Mudstone Member *43*, 46, 48
- California
 - leakage 167, *179*, 185, *186*, *187*, 187–188, 206
 - peak demand periods 164
 - regulatory agencies 169–170
- California Environmental Quality Act 142–143
- Wild Goose Gas Storage Field 143–144
- Canada
 - leakage *179*, *184*, 194
 - see also* Weyburn CO₂ Monitoring and Storage Project
- capacity *see* storage, capacity
- caprock
 - safety issues 6
 - Weyburn Reservoir evaporites 241–244
- carbon dioxide
 - injection and storage 227–254
 - enhanced oil recovery 227–229
 - microseismic monitoring 240
 - safety and risk assessment 252–253
 - soil gas monitoring 245–252
 - Weyburn CO₂ Project 228–254, 268–270
 - leakage
 - monitoring 245–252, 263–264, 268–270, 272–274
 - natural 272
 - storage
 - long-term 218, 257–274
 - leakage monitoring 263–264, 268–270, 272–274
 - migration monitoring 259–262, 264–268
 - site monitoring 270–273
 - Sleipner gas field 264–268
 - Weyburn CO₂ Project 268–270
 - principles 258–259
 - regulation 170
 - see also* underground gas storage
- carbon monoxide, Weyburn Oilfield 233
- Carlisle Basin
 - Triassic halite-bearing strata *42*, 56, 61
- Carlsbad gas pipeline incident *176*, 205
- Carnduff Halite Member *44*, 62
- casing collar locator (CCL) 131
- Castaic Hills, California, leakage 185, *179*, *204*
- casualties
 - UFS leakage incidents *178*, *179*, *180*, *181*, *184*, 194, 202–208
 - production/supply chain 195–201, **200**
- Cavern Operation Survey and Planning (COSP) 119
- Caythorpe gas field *40*, **68**
 - public inquiry 3, **23**, 174
- Chémery, leakage *180*, 189
- Cheshire Basin
 - brine pumping 45, 49
 - halite storage facilities 5, *40*, *42*, *43*, 67, **69–70**, 67–72
 - Triassic halite-bearing strata 46, 48, 49
 - wet rock head 45–46

- Clausthal University of Technology, rock mechanics testing 102, 103
- Cleveland Basin, Triassic halite-bearing strata 61
- coalmines
as storage 31, 179
leakage 178, 184, 193
- Coat Walls Mudstone Member 56, 57, 58, 60
- Colorado Group 241
- compressed air energy storage (CAES) 8, 177–178, 194
- compressors 33, 34, 36
- condensate removal 28
- constitutive models 108–110, 113
- construction
environmental issues 146
monitoring 118
- continuum damage mechanics 97, 102, 105, 114
- continuum mechanics 97, 102, 105, 114
- Control of Major Accident Hazards (COMAH) 3, 158–159
- Conway Underground East storage facility
leakage 181, 183, 191, 204
wet rock head 45, 193
- corrosion, borehole seals 156, 167, 245
- creep, laboratory testing 102, 103–104, 106, 105
- Cretaceous aquitard 237, 244
- Crossville, Illinois, propane leakage 184, 194, 204
- cushion gas 21, 28
hydrogen storage 218, 223
terminology 27
- Dakota Sandstone 244
- damage
rock salt 102, 104, 105, 115
modelling 108–109, 114
- deformation 102, 103, 115
- dehydration, gypsum 65–66
- deliverability 27, 33
- Demopolis propane storage facility, leakage 184, 194, 204
- Department for Business, Enterprise and Regulatory Reform (BERR) 1, 2, 3, 4
gas storage 13–15, 174
Welton Oilfield project 152–153
- Department of Communities and Local Government (DCLG) 2, 3, 4
- Department of Trade and Industry (DTI) *see* Department for Business, Enterprise and Regulatory Reform (BERR)
- design and safety, Germany 95, 99, 100, 112
- dilation 102, 104, 109
- dolomite
Midale Evaporite 242–243
Zechstein Group 62
- Dorset Halite Member 42, 43, 53, 54, 55
- Downs, Pennsylvania, leakage 179
- Droitwich Halite Member 43, 50–51
- dry gas 19
- dry rock head 43, 46
- duration 17, 27, 33
- East Whittier, California, leakage 177, 179
- El Segundo, California, leakage 179, 185
- electromagnetic methods, CO₂ migration monitoring 260, 261–262
- electricity generation, by gas 18
- Eminence salt cavern, Mississippi, volume loss 183, 193, 205
- Enbridge Gas Distribution Inc., leakage 195
- energy industry, incidents 195–196, 198–201, 205
- enhanced oil recovery 227–229
- environmental impact assessment 5, 7
UK 223
USA 170
Wild Goose Gas Storage Field 143–148
- Epps, Louisiana, leakage 185, 179, 204
- equations of state 221–222
- Eskdale Evaporite Member 61
- ethane
Stenlille 86, 87
Weyburn CO₂ Project 247, 251, 270
- ethylene, Weyburn CO₂ Project 246, 247
- facilities
distance from market 28
finance 22
performance 33–37
planning 32–33
safety monitoring 270–273
- Fairfax, gas leakage 187, 188
- fault zones, in salt cavities 97
- fibre optics, tightness testing 131–132
- Fjerritslev Formation 84, 86
- Flixborough incident 199
- Fordon Evaporites 41, 62, 63, 74
- Fort Morgan, Colorado, leakage 179, 181
- Fort Saskatchewan, leakage 176, 182
- fractures
non-halite interbeds 64–66
infill 65–66
salt cavities 102, 103, 104, 107
- France, gas consumption and capacity 2, 20, 21
- friction 34–35
- Frobisher Evaporite 228, 241
- Gainsborough gas storage project 23
- gamma-gamma tools 130–131
- Gas Act 1965 2
- Gas Balancing Alert 2006 3
- gas cap, oil reservoir 29
- gas fields, depleted
as storage 27–28, 68–69
hydrogen 219
incidents 178, 179, 181, 185
- gas price 19
- gas production
associated 19
dry 19
incidents 199, 200, 205
- gas storage *see* storage; underground gas storage
- gas supply
indigenous 18, 19
infrastructure 4, 19–20, 173
development 13, 14, 173
pressure balance, safety issues 3–4, 13, 18
shortage 14, 25
supply and demand balancing 13–14, 17, 25, 26
seasonal variation 13, 19

- Gassum Sandstone Formation 83–85, 86
 geochemistry
 Weyburn Oilfield 233–235
 experiments and modelling 235–240
 Midale Evaporite Unit 242–244
 geomechanics
 salt storage caverns 94–128, 96
 abandonment 119–127
 laboratory testing 101–107
 simulation 110, 111, 113, 114
 Germany
 gas consumption and capacity 2, 20, 21
 leakage 180, 189
 salt storage caverns 93–128, 94
 gravimetry, CO₂ migration monitoring 260, 261, 262, 268, 269
 Greenlick Field, Pennsylvania, leakage 179
 groundwater
 hydrocarbon content 84–88, 90–91
 Weyburn Oilfield 230–233
 gypsum
 dehydration 65–66
 veining 65
 halite
 fluid inclusions 65
 gases 66, 190
 physical properties 39
 see also rock salt; salt; salt storage caverns
- Hambleton Mudstone 43, 53, 58, 59
 Harding, Pennsylvania, leakage 184, 194
 haselgebirge facies 46, 53, 60, 67
 Hatfield Moors gas field, storage facility 5, 22, 40, 66, 156
 healing, rock salt 102, 105
 Health and Safety Executive, Welton Oilfield project 151, 154, 157–159
 helium, Weyburn Oilfield 233, 246, 251, 269
 Hole House, gas storage cavern 22, 40, 48, 67, 69, 72
 Holford, gas storage cavern 22, 40, 48, 67, 69–70, 72
 Holford Brinefield 48, 49, 72, 73
 Honor Rancho, California, leakage 179, 185
 Hornsea gas storage facility 22, 40, 62, 69, 74
 see also Atwick gas storage facility
 Humbly Grove oilfield, storage facility 1, 5, 22, 68
 Hungary, leakage 180, 189
 Huntorf salt dome 8
 Huntsman, Nebraska, leakage 179
 Hutchinson, Kansas
 leakage 6, 165, 167, 170, 176, 181, 189, 191, 192, 207
 see also Yaggy
 hydrocarbon reservoirs *see* oilfields, depleted, as storage facilities
 hydrocarbons
 light, Weyburn CO₂ Project 246, 247, 251, 270
 storage 4–5, 177–181 179–182
 above ground incidents 195, 197–198
 hydrogen
 underground storage 8
 economics 223–224
 estimating demand 218
 halite caverns 219–220
 leakage 219
 legal aspects 222–223
 losses 217–218
 modelling 221–222
 pore storage 219
 purification 221
 social aspects 223
 transport 221
 United Kingdom 217–224, 220
 Weyburn Oilfield 233
 hydrogen sulphide
 blowout, Gao Quiao 152
 corrosion 156, 167
 in EOR 229
 Welton Oilfield storage facility 151, 153, 155–156, 160
 Weyburn Oilfield 233
- ideal gas law 221–222
 Illinois, leakage 180
 impulse neutron-gamma tools 130
In-Situ Balance (ISB) testing 7
 improved 129–130
In-Situ Compensation (ISC) testing 130
 INFIL 123
 infill
 brine 65–66
 non-brine 66
 infiltration 120–127
 infrastructure *see* gas supply, infrastructure
 injectability 27, 33
 injectivity 28
 interconnector, infrastructure 4, 173
 Isle of Man, Triassic halite-bearing strata 61
 Isle of Portland gas storage facility 70, 73–74
 Italy, gas consumption and capacity 2, 20, 21
- Jouli Fou aquitard 237, 244
- Kalle, leakage 180, 189
 Kanopolis compressed air storage, leakage 194
 Kansas
 leakage 181, 183
 regulatory agencies 170
 Ketzin, leakage 180, 189, 204
 Kiel salt cavern, volume loss 183, 193, 204
 Killingholme, LPG storage 5, 40, 69, 177
 King Street gas storage facility 40, 70, 73
 Kinsale *see* SW Kinsale
 Kirkham Mudstones Formation 41, 56, 58
- Langed South pipeline 4, 173
 Larne Basin
 Halite-bearing strata 40, 44
 Permian halite-bearing strata 63–64
 Larne Halite Member 44, 62
 Larne Lough gas storage facility 70, 75
 LaSalle, Colorado, leakage 168
 leaching *see* solution mining
 leakage
 abandoned mines 193, 204
 aquifer storage facilities 189–190, 203, 204
 CO₂
 long-term storage 245–252, 263–264, 268–270
 natural 250, 270
 depleted fields 203, 204

- leakage (*Continued*)
 financial impact 166–167
 hydrogen storage 219
 natural 195, 272
 CO₂ 250, 270
 salt storage caverns 190, 193, 203, 204, 205
 Stenlille storage facility 88–92
 UFS facilities 174–195, 203–207
 United States of America, UGS facilities 165–171
 unlined rock caverns 195–197, 204
 wells 6, 7, 155, 156, 160, 206
 minimum detectable rate 135, 136–137
- Leidy, Pennsylvania, leakage 179, 181
- Leyden UGS facility, leakage 165–166, 167, 169, 184, 194, 204
- Lincolnshire County Council, Welton Oilfield planning application 149, 151, 157, 159
- liquified natural gas (LNG)
 peak shaver facilities 17
 storage 5, 175, 193
 duration 17
 salt caverns 27
 seasonal 17
- liquified petroleum gas (LPG)
 incidents 191, 193, **197–198**, 198
 storage 5, 175, 177
- Ll. Torup, gas storage cavern 81, 82, 83
- load cases, simulation 111, 114
- load duration curve 33
- Loop storage facility, roof collapse 191
- Los Angeles Basin, well leakage 167, 168, 185, 186, 187, 188–189
- Los Angeles City Oilfield 185, 186, 187
- loss, hydrogen
 modelling 222
 once-only 218
 operating 218
- Louisiana, storage facility incidents 190
- Lunlunta, Argentina, leakage 179, 204
- McDonald Island, California, leakage 179, 181
- macro-fractures 102, 103
- Madison Group 228
- Magnesian Limestone Formation,
 Northern Ireland 63–64
- Magnolia storage facility, leakage 165, 167, 181
- Mannville aquifer 234–235, 237, 244
- marlstone, laboratory testing 102, 104
- mechanical integrity test (MIT) 7, 129–137
- membrane separation 221
- mercaptans 229
- Mercia Mudstone Group 43, 46–60
- methane
 in groundwater, Stenlille 86, 87–88
 Weyburn Oilfield 233, 246, 247, 251, 269, 270
- Mexico City, BLEVE incident 198
- micro-fractures 102, 103, 105, 107
- microseismic monitoring, Weyburn Oilfield 240
- Midale Beds 228, 230, 233–240
- Midale Evaporite Unit 241, 242–244
- mines
 as storage facility 5, 31, 174–177
 incidents 164, 178, 184, 194, 204
- mining *see* room and pillar mining; solution mining
- Mississippian Aquifer System 228, 230–232, 234–235, 237
- monitoring
 CO₂
 leakage 263–264, 268–270
 long-term storage 245–252, 257–274
 subsurface migration 259–262, 264–268
 surface 271–272
 site performance 270–273
 Stenlille storage facility 84–86
- Mont Belvieu, Texas, leakage 6, 167, 181, 182, 190–191
- Montebello Field UGS facility, leakage 166, 167, 169, 179, 181, 188, 204
- Moss Bluff UGS facility, leakage 166, 167, 169, 176, 181
- mudstone, Cheshire Basin 46, 48
- Muhlenberg, Kentucky, leakage 179
- multiple casing collar locator (MCCL) 131
- Mythop Halite 42, 53, 56, 58, 59
- National Environmental Policy Act 142
- Needwood Basin
 Triassic halite-bearing strata 42, 43, 49, 50
- Netherlands
 gas consumption **21**
 gas storage capacity **20**, **21**
- nitrogen, Weyburn CO₂ Project 233, 246, 250, 270
- non-halite interbeds, fractures 64–66
- Northern Ireland
 Permian halite-bearing strata 63–64
 Triassic halite-bearing strata 61–62
- Northwich Halite Member 42, 43, 46, 48, 49, 67, 71, 72, 73
- oil production/supply chain, incidents 195–199, **200**, 205
- oilfields, depleted
 as storage facility 5, 14, 17, 21, 28–29, **68–69**, 156
 hydrogen storage 219
 safety incidents 157, 178–179, 181, 185, 186–187, 185–189, 203, 204
- Old Salt Lake oilfield, leakage 185
- operation, monitoring 118, 146
- opposition, community 2, 3, 7
- Ormen Lange field 4
- Ormskirk Formation 43, 58
- oxygen, Weyburn CO₂ Project 246, 250, 251, 270
- peak shaver facilities 17, 25, 27
- permeability, rock salt 39, 102, 107
- Permian, halite-bearing strata 62, 64
- Petal, Mississippi, incident 181, 191, 205
- petrochemical industry, accidents 195, 201
- pipeline incidents 199, **200**
- planning
 facilities 31, 33
 underground hydrogen storage 222–223
- planning applications, Welton Oilfield gas storage facility 148, 150–155, 157–160
- planning consent 2, 3, 14, 72, 174
- planning policy 4
- Playa del Rey oilfield 154, 186, 187
 safety incidents 157, 177, 179, 181, 186, 188, 204
- Poland, leakage 180, 189
- pore storage 5, 8

- hydrogen 219
- safety 163, 164, 169
- porosity, rock salt 102, 104, 107
- Portland gas storage project **23**
- Porvoo storage facility, incident *184*, 194
- potash mining 66
- Preesall
 - brine pumping 53
 - halite cavern storage facility 2, **23**, *40*, *42*, *46*, **70**, 71
 - public inquiry 2, 3, 73, 174
 - Triassic halite-bearing strata *53*, *56*, *56*, *57*, *58*
- Preesall Halite Member *42*, *43*, *56*, *56*, *57*, *60*–*61*, 73
- pressure loss 33–36
- pressure swing absorption 221
- production storage 25
- production/supply chain, incidents 195–201
- productivity, wells 28
- propane
 - leakage 87, 190, 191, 194
 - Weyburn CO₂ Project 247
- Public Inquiry
 - Byley storage facility 72
 - Caythorpe storage facility 3, 174
 - Preesall storage facility 2, 3, 73, 174
- radioactive wireline methods 130–131
- radon, monitoring, Weyburn CO₂ Project 246–247, 250–251, 269, 270
- Ravensworth propane storage facility, leakage *184*, 194
- Regina, Saskatchewan, leakage 195
- regulation
 - gas supply infrastructure 4
 - well integrity, USA 169–170
- rehydration, anhydrite 65
- remote sensing, CO₂ leakage monitoring 264
- risk
 - public health and safety 3, 5–7, 163, 168–169
 - UFS 173–208
 - Welton Oilfield project 153–154, 157–160
 - Weyburn CO₂ Project 252–253
- rock caverns
 - as storage 31, 174–177
 - incidents **69**, *178*, *184*, 194, *204*
- rock mass models 107–111, *110*
- rock mechanics *see* geomechanics
- rock salt
 - laboratory testing 101–107
 - mining 49, 62, 66, 117, 118
 - rock mass models 107–111, *110*
 - see also* halite
- room and pillar mining 49, 62
- Ross Department Store, leakage 157, 168, 188
- Rossall Halite *42*, *53*, *58*, *59*
- Rough storage field 12, 21, **22**, **68**
 - incident 3, 19, 177, *179*
- Russia
 - gas supply dispute, winter 2005/2006 3, 25
 - incidents *183*, 191, 203
- safety
 - gas tightness *see* tightness, testing
 - public perception of 2, 3, 7, 174, 202, 205
 - Welton Oilfield 151, 153–160
 - salt caverns
 - Germany 97, 99, 97–101, 114
 - USA 164, 169
 - well integrity, USA 163–171
 - Weyburn CO₂ Project 252–253
- St Clair County, leakage *179*, 205
- salt
 - bedded 30, 96, 219
 - gassy 66, 191
 - plasticity 30, 39, 65, 66, 101–102
 - see also* halite; rock salt
- salt domes 30, 99, 191, 219
- salt mining
 - UK 21, 22, 30, 66–67
 - see also* room and pillar mining; solution mining
- salt storage caverns 2, 5, 14, 21, 22, 29–31, **69**–**70**, 175
 - abandonment 119–127
 - construction and operation monitoring 111, 114–117
 - convergence 30, 204
 - design and safety criteria 95, 99, 100–101, 112
 - duration 17
 - geomechanical behaviour simulation *110*, 111, 112, *113*
 - geomechanical characteristics 94, 96, 97
 - laboratory testing 101–107
 - Germany 93–128, *94*
 - hydrogen storage 39, 219–220
 - incidents 164, 169, *178*, 181, *182*–*183*, 189–191, 192–196, 205, 206
 - LNG 27
 - onshore UK 39–73, *40*, 193
 - natural gas storage potential 67, **68**
 - safety 6–7
 - salt wall falls 190
 - solution mining 29, 30, 95, 96, 219–220
- Saltfleetby gas storage project **23**, *40*, **68**
- Saltholme gas storage facility *40*, 61, 63, **69**, 75
- sandstone reservoir, Stenlille 81–92
- Sarnia, Ontario *see* Enbridge Gas Distribution Inc.
- seabed logging 261
- seals, borehole, Weyburn CO₂ Project 245
- seepage 121, 123–126
 - natural 195
- seismic data, CO₂ migration monitoring 259–261, 264–265, 271
- Sidmouth Mudstone Formation 46
- Singleton Mudstone *43*, *53*, *58*, *59*
- Sleipner gas field, monitoring long-term CO₂ storage 259, *261*, *264*–*268*, *269*, 271
- soil gas monitoring
 - Montebello Field 166
 - Weyburn CO₂ Project 245–252, 263
- solution mining 29, 30, 95, 96, 219–220
 - monitoring 117, 118
- Somerset Basin
 - Triassic halite-bearing strata *40*, *42*, 49–52
- Somerset Halite Member *42*, *43*, 51
- SoMIT 7, 133, *133*, *134*, 135–137
- sonar bathymetry 260, 263
- sonar MITs 133–135
- sonar surveys 118
- sour gas *see* hydrogen sulphide
- Southport, Triassic halite-bearing strata 60–61
- Spandau, leakage *180*, 189

- stability, static 99, 100, 114–117
- Stafford Basin
Triassic halite-bearing strata 42, 43, 49, 50
- Stafford Halite Member 42, 43, 49, 50
- Stanwix Halite 42, 43
- Stanwix Shales 61
- Star Energy 17
Welton Oilfield 2
planning application 149, 151, 152–160
- steam methane reformer 221
- Stenlille storage facility 81–92
gas leakage 88–92, 180, 189
methane in groundwater 86, 87–88
monitoring 5, 82, 84–86
- storage
capacity, UK 1, 2, 3, 20, 21–23, 21, 22, 27
daily variation 25
duration 17, 27
environmental issues 145–147
long-range 17, 18, 18
market
characteristics 32–33
development 14
medium-range 17, 18
production 25
purpose 25–27
seasonal variation 17, 25, 26
short-range 17, 18
strategic 25
types 4–5, 21, 27–31
- stress distribution 115
- strontium isotope ratios, Weyburn Oilfield 233, 234–235, 237
- Stublach gas storage facility 3, 23, 48, 70, 72–74
- subsidence, salt caverns 101
- Sudbrooke Parish Council, Welton Oilfield 151–152
- Sulphur, Louisiana, incident 193
- supply and demand 13–14, 17, 19, 25, 26
- SW Kinsale gasfield, leakage 179, 185, 204
- technical reviews, USA 170–171
- Teesside, Permian halite-bearing strata 62–63
- Tersanne natural gas facility 6
volume loss 183, 193, 205
- Texas
storage facility incidents 182, 190
- Third Party Access 22, 36
- Thornton Mudstone Member 56, 57, 59
- tightness 6, 7, 99, 100
testing 129–137
fibre optics 131–133
minimum detectable rate 133, 135–136
radioactive methods 130–131
sonar tool 133, 133, 137
- till, Late Pleistocene, Weyburn 244–245
- Triassic, halite-bearing strata 42, 46–62
- Ukraine, gas supply dispute, winter 2005/2006 3, 25
- unbundling 26
- underground fuel storage (UFS)
leakage 177–194, 195, 202–208
safety 7
UK 174
- underground gas storage (UGS)
California, incidents 206
Germany 93–128, 94
history 31
safety 7, 144, 206–207
terminology 27
United Kingdom 13–15, 173–174, 175
USA 163–164, 177
worldwide 32, 175–177, 177
- United Kingdom
gas consumption 1–2, 2, 20, 21
gas market, overview 18–20
natural seepage 195
oil and gas exploration 6
onshore halite storage caverns 39–75
salt mining 66
UFS 174
UGS 13–15, 173–174, 175
capacity 1, 2, 3, 20, 21–23, 21, 22
market development 14
outlook 22–23
supply and demand 13–14, 17, 174
underground hydrogen storage 217–224
- USA
environmental impact assessment 170
gas consumption 2, 21
gas storage capacity 2, 20, 21
technical reviews 170–171
UGS facilities 163–164, 177
leakage 165–171, 179, 180, 206
USF facilities 176, 178–184, 203
well leakage, regulatory agencies 169–170
- Utah, leakage 180
- Utsira Sand 228, 264, 265, 266, 268
- Viking aquifer 237, 244
- volatile organic compounds 163
- Walney Island
channel, solution subsidence feature 46
Triassic halite-bearing strata 40, 42, 46, 56, 58, 59, 60
- Warmingham Brinefield 48, 49, 69, 71
- water, removal from gas stream 28
- water curtain 218
- Watrous Formation 241, 242, 244
- wave velocity, ultrasonic 105, 106, 107
- Weeks Island storage facility
incident 184
wet rock head 194
- Weld County, Colorado, leakage 168–169
- well integrity 155, 156, 160, 166–171
regulatory agencies, USA 169–170
- wells
leakage 6, 155, 156, 160, 167–169, 205, 206
tightness testing 129–137
- Welton Oilfield gas storage facility 2, 7, 23, 68, 149–160, 149
incidents 156–157
planning applications 148, 150–155, 157–160
public reaction 151, 153–160
- Wessex Basin
halite storage caverns 40, 42, 43
Triassic halite-bearing strata 47, 53, 54, 55

- West Hackberry, Louisiana
 - incidents 181, 182, 189, 190
- West Lindsey District Council, Welton Oilfield
 - gas storage facility 146, 157, 159
- West Virginia, leakage 179
- wet rock head 43, 45–46, 58, 60, 191
- Weyburn CO₂ Monitoring and Storage Project 228–254
 - borehole seals 245
 - fluid-rock interactions 233–235
 - groundwater and migration pathways 230–233
 - leakage monitoring 245–252, 268–270
 - overburden characterization 241–245
 - reservoir characterization 229–240
 - safety and risk assessment 252–253
 - soil gas monitoring 245–252, 268–270
- Weyburn Oilfield 241
 - CO₂-EOR 228–229, 231–232
 - geochemistry 233–235, 242–244
 - batch experiments 236–238
 - fluid flow experiments 238–239
 - modelling 239–240
 - microseismic monitoring 240
- White Brae Mudstone Formation 63
- Whitehill gas storage facility 23, 70, 74–75
- Wild Goose Gas Storage Field
 - expansion project 139–148
 - Environmental Impact Report 143–148
- Wilkesley Halite Member 42, 43, 46, 48, 49
- Williston Basin 228, 229, 237, 244
- Wilton gas storage facility 40, 63, 70, 75
- Worcester Basin
 - brine pumping 50
 - Triassic halite-bearing strata 40, 42, 43, 49–51
 - wet rock head 46
- working gas volume, terminology 27

- Yaggy UGS facility, leakage 165, 167, 170, 176, 181, 191, 192, 207
 - see also* Hutchinson
- Yorkshire, Permian halite-bearing strata 62, 63

- Zechstein Group 62
- Zeebrugge, interconnector 4, 173