

BG Group

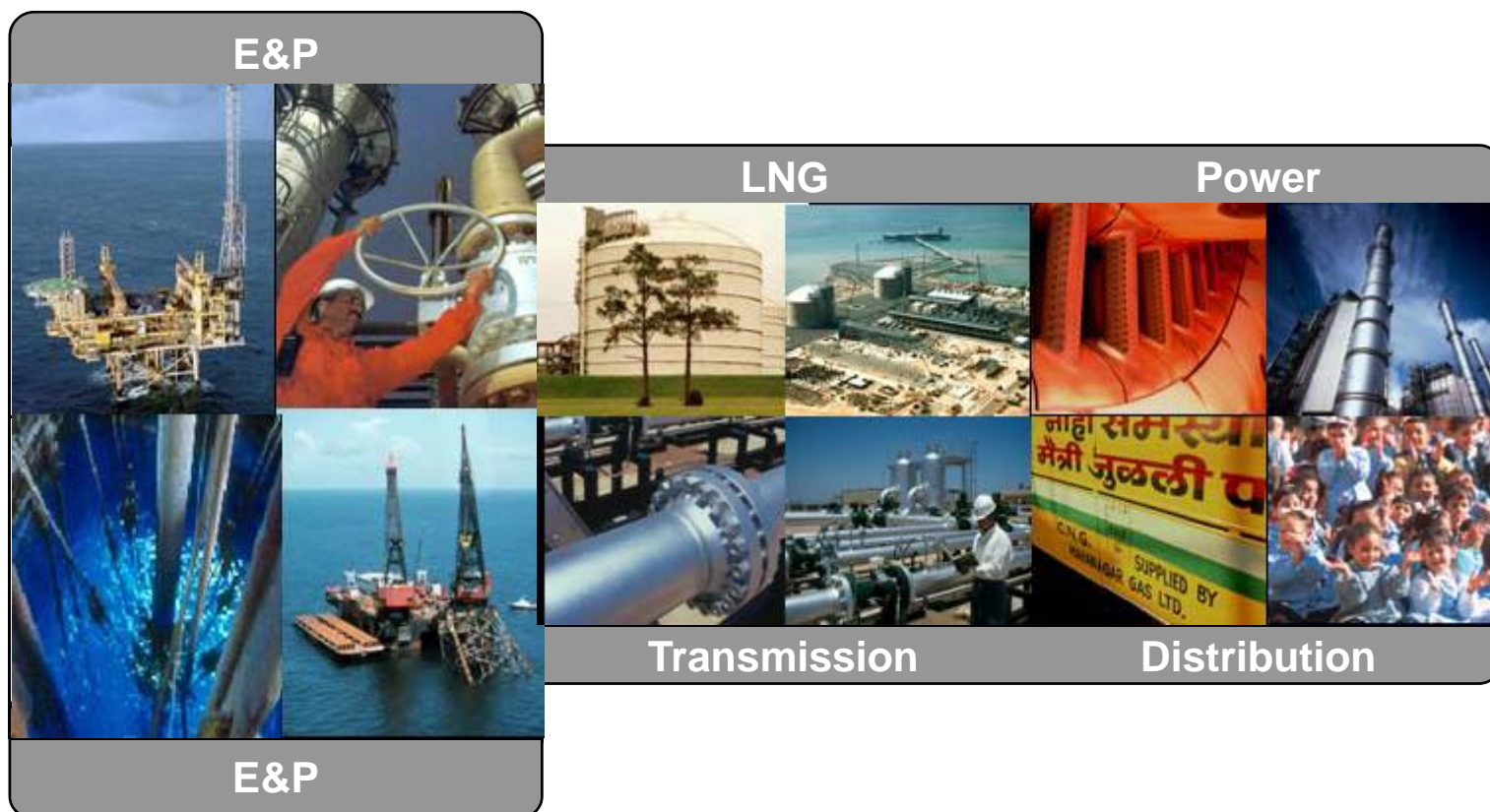


OGP Material Standard's Workshop

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Who we are & what we do



A Global Natural Gas Business



Active in 25 countries

Corporate Standards History

- **Early 1990s**
 - Approx. 300 corporate standards (based on licence from BP)
- **Mid 1990s**
 - Management consultants - zero corporate standards – use only industry standards and contractor specifications - CRINE
- **2006-2007**
 - Industry standards plus small number of technical standards & guidelines
 - Include lessons learnt & best practice to:
 - Eliminate hazards - 'inherent safety' in design
 - Reduce risks - ALARP - asset integrity
 - Contain/mitigate possible incidents - safe egress of people
 - Ensure high availability & operating consistency
 - Ensure consistency of approach across assets
 - Enable 'Informed buyer' status

Material standards

- **Seven technical standards to cover “Materials Engineering’ issues” across all our business segments & to supplement internationally accepted codes & standards:**
 - MATL-TS-0001 Material Selection & Corrosion Control
 - MATL-TS-0003 Materials & Fabrication Requirements for Sour Service*
 - MATL-TS-0004 Insulation*
 - MATL-TS-0005 Protective Coatings
 - MATL-TS-0006 Cathodic Protection
 - MATL-TS-0007 Fabrication of Equipment & Piping
 - MECH-TS-0012 Flange Management, Commissioning & Pressure Testing
- **Technical standards set high level ‘strategy’ & minimum key requirements – engineering contractor responsible for detailed implementation, developing project specifications**
- **Guideline documents* to support technical standards – more detail, help interpretation**
- **Technical standards are mandatory – guidelines advisory**

* Under development

MATL-TS-0001 Material Selection & Corrosion Control



- **Defines requirements for selecting optimum materials & appropriate corrosion management strategies**
- **Includes:**
 - Responsibilities
 - Appropriate inputs
 - Corrosive environments, material degradation mechanisms
 - Mitigation
 - Monitoring
 - Material requirements
 - Corrosion risk assessment
 - Documentation
- **Also includes “*commentary*” - aids understanding of why we specify something**

MATL-TS-0001 Material Selection & Corrosion Control



- Some commonality with Norsok M-001:
 - Corrosivity evaluation, material degradation
 - Monitoring
 - Mitigation
 - Material requirements
- Some differences:
 - Scope –excludes well equipment & structures
 - More global application?
 - No ‘recommended’ materials for systems – responsibility of engineering contractor based on corrosion evaluation – intention to develop supporting guideline with this information

MATL-TS-0001 Material Selection & Corrosion Control



- **Industry codes**
 - ISO 15156 - sour service
 - BS PD 6484 – bimetallic corrosion
 - NACE RP0198 – CUI
 - NACE RP0403 – caustic service
 - NACE RP0391 – sulphuric acid materials
 - API RP945 – amine units
 - API 12GCDU – glycol units
 - EEMUA 194 – sub-sea materials
 - DNV RP 0501 – erosion
 - EFC WP15 – CUI
 - MTD 99/100 – vibration induced fatigue
 - Norsok M-WA-01 – HSC of sub-sea duplex



- Under development
- Will define additional material, fabrication, welding, NDE, inspection & QA/QC requirements for static and rotating equipment, piping, instruments, fasteners
- Based on poor experience in Kazakhstan and Tunisia & need to capture lessons learnt
- Industry codes
 - ISO 15156 – sour service
 - NACE TM0284 – HIC/SWC
 - NACE TM0177 – SCC

MATL-TS-0004 – Insulation

- Under development
- Will define additional design, material, application, inspection & QA/QC for hot, cold, dual service, acoustic, personnel protection insulation
- Good design and installation - CUI mitigation
- Performance criteria – no thickness tables
- Industry codes
 - CINI – insulation
 - NACE RP0198 – CUI
 - EFC WP15 – CUI
 - ASTM – various documents covering insulation materials and test methods

MATL-TS-0005 – Protective Coatings

- **Defines additional requirements for selection, application, inspection & QA/QC of protective coatings for steel & concrete structures, pipe lines, static & rotating equipment and piping**
- **Performance criteria – no generic systems defined**
- **Inspection & Maintenance manual – define what systems we have, when & how to inspect and how to repair**
- **Industry codes**
 - ISO 12944 – coatings (general)
 - ISO 20340 – coatings (severe)
 - ISO 1461 – galvanised coatings
 - ISO 2063 – thermal spraying
 - BS 6374 – polymeric linings
 - NACE RP0176 – corrosion protection offshore structures
 - NACE RP0892 – concrete coatings
 - NACE TM0204/0404 – offshore coatings
 - NACE RP0178 – fabrication details for linings
 - EEMUA 190 – buried LPG bullets

MATL-TS-0006 – Cathodic Protection

- **Defines additional requirements for cathodic protection systems for steel structures, pipe lines, piping, internal surfaces of vessels, tanks & piping, steel piles, concrete reinforcement**
- **Strategy & performance requirements, no details of coating breakdown factors, anode chemistry, consumption rates, calculations**
- **Industry codes**
 - ISO 15589 – CP of pipelines
 - NACE RP0169 – CP buried piping
 - NACE RP0176 – corrosion protection offshore structures
 - NACE RP0193 – CP of storage tank base plates
 - API RP651 – CP of tanks
 - EN 12474 – CP submarine pipelines
 - EN 12495 – CP fixed offshore structure
 - EN12954 – CP buried or immersed structures
 - EEMUA 194 – sub-sea materials
 - DNV RP-B401/RP-F103 – CP

MATL-TS-0007 – Fabrication of Equipment & Piping

- **Defines additional requirements for fabrication, welding/joining, heat treatment, inspection, testing & QA/QC of metallic and non-metallic equipment and piping**
- **Slightly more prescriptive than other standards**
- **Optimum materials but poor fabrication – problems!**
- **Industry codes**
 - ASME VIII – pressure vessels
 - ASME B31.3 – process piping
 - ISO 13703 - offshore piping (API RP14E)
 - ISO 14692/13121 – GRP equipment & piping
 - BS 4994/7159 – GRP
 - API RP582 – welding recommendations
 - API RP6HT – heat treatment critical components
 - EN 1011 – welding recommendations
 - Welding Research Council Bulletin 452 – Local PWHT



- Defines additional requirements for flange management, flushing, pre-commission cleaning and pressure testing of equipment & piping
- Pre-commission cleaning and pressure testing – can affect material selection
- Industry codes
 - UKOOA/IP – bolted joint integrity
 - HSE GS4 – pressure test safety

Future for BG Standards

- Review all standards regularly
 - Include lessons learnt
 - Include changes in technology
 - Address latest version of industry standards – include new, relevant ISO standards as applicable
- Develop Guidelines
 - Support the interpretation & implementation of each technical standard –
 - More detail & reason why
 - Not mandatory but have to have good reason to ignore!
- Develop new technical standards if necessary (hopefully not required!)

Conclusions

- Optimum material selection & corrosion management practice as important as correct design practice to ensure safety & asset integrity
- Material selection standard missing link in chain – coatings, cathodic protection covered
- Norsok M-001 very good document but regional – USA, Middle east, Far East?
- Where ISO standard exists, BG will use as base document
- Always foresee need for BG standard to capture lessons learnt – quick and simple reactive solution