

Environmental Management Systems (ISO 14000) and associated topics

Outline of lecture

- Sustainability
- Environmental Management Systems (ISO 14000)
- Environmental Protection Act (EPA)
- Polluter Pays Principle (PPP)
- Precautionary Principle
- Life Cycle Assessment

Sustainability

"Meeting the needs of the present without compromising the ability of future generations to meet their own needs."

World Commission on
Environment and Development
(Brundtland Commission Report 1987)

Sustainability

- A balance of:
 - Economic
 - Environmental
 - Equity (social factors)
 - Governance
 - the latter factor rarely features in analyses
 - thus often referred to as “triple E”

Equity

- Maslow's hierarchy of needs
Motivation and Personality (1954)
 - physiological needs
 - safety or security needs
 - belongingness and love needs
 - esteem needs
 - self-actualisation

Twelve Guiding Principles of Engineering for Sustainable Development

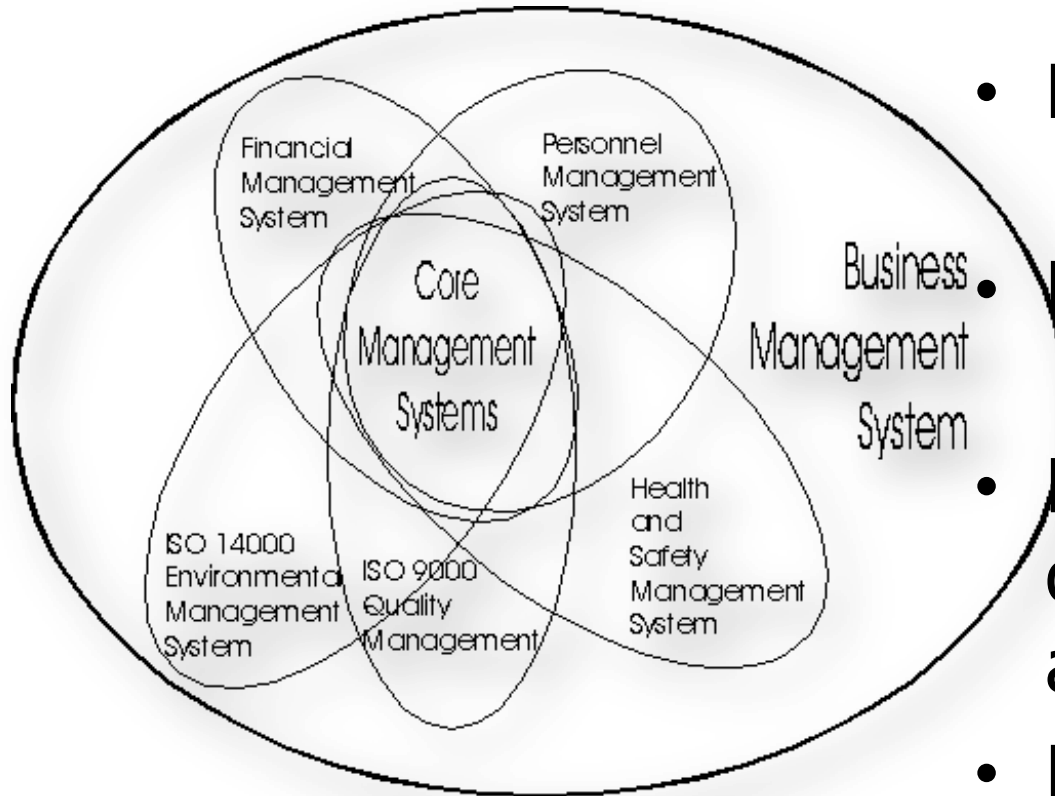
- Look beyond your own locality and immediate future
- Innovate and be creative
- Seek a balanced solution
- Seek engagement from all stakeholders
- Make sure you know the needs and wants
- Plan and manage effectively
- Give sustainability the benefit of the doubt
- If polluters must pollute ... then they must pay as well
- Adopt an holistic '**cradle-to-grave**' approach
- Do things right, having decided on the right things to do
- Beware cost reductions that masquerade as value engineering
- Practice what you preach

Sustainable Development Education Working Group
of the Royal Academy of Engineering

Cradle-to-grave ?

- ***William McDonough***
Cradle to cradle:
remaking the way we make things
North Point Press, 2002
- reconsider design such that
end-of-life waste is effective raw materials
for the next generation

Management Systems



- BS5750/ISO9000 quality
- BS7750/ISO14000 environment
- BS8800/OHSAS18000 occupational health and safety
- BS8888 technical product documentation

ISO 14000 series

- BS 7750 Environmental Management Systems (1992, updated in 1994).
- ISO 14000 series is modelled on BS7750 and influenced by the Uruguay GATT negotiations and Rio Environment Summit in 1992.

ISO 14000 series

- The standard is a model for an environmental management system consisting of several guideline standards
- **one compliance standard:
ISO 14001 Environmental Management Systems.**

ISO14000 series

- An organization may elect to comply with ISO 14001 as a:
 - model for an Environmental Management System
 - format against which to audit the EMS
 - method of demonstrating the EMS compliance
 - process for third party and/or customer recognition
 - public declaration of their EMS

ISO 14000 series

- Registration to ISO 14001 should be considered when it:
 - is a customer or industry requirement
 - complements market strategy
 - is perceived as a valuable motivational factor.

ISO 14000 series

- benefits of implementation may include:
 - enhanced compliance to legislation
 - facilitated financial and real estate transactions, where environmental performance is a factor
 - reduced costs associated with consumer audits
 - ability to bid for contracts
(protection or increase of market share)
 - market forces
(a real or perceived 'greening' of the marketplace)
 - economic return from better efficiency of resource use
 - increased ability to adapt to changing circumstances.

ISO 14001: the compliance standard

- Five elements:
 - **Environmental policy**
 - **Planning**
 - **Implementation and operation**
 - **Checking and corrective action**
 - **Management review**

ISO 14001: the compliance standard

- **Environmental policy**
- **Planning**
 - Environmental aspects
 - Legal and other requirements
 - Objectives and targets
 - Environmental management program(s)

ISO 14001: the compliance standard

- **Implementation and operation**
 - Structure and responsibility
 - Training, awareness and competence
 - Communication
 - Environmental management system documentation
 - Document control
 - Operational control
 - Emergency preparedness and response

ISO 14001: the compliance standard

- **Checking and corrective action**
 - Monitoring and measurement
 - Non-conformance and corrective and preventive action
 - Records
 - Environmental management system audit
- **Management review**

ISO 14000 - summary

ISO 14001 Environmental Management System Elements:

1 Environmental policy

2 Planning

2.1 Environmental aspects

2.2 Legal and other requirements

2.3 Objectives and targets

2.4 Environmental management program(s)

3 Implementation and operation

3.1 Structure and responsibility

3.2 Training, awareness and competence

3.3 Communication

3.4 Environmental management system documentation

3.5 Document control

3.6 Operational control

3.7 Emergency preparedness and response

4 Checking and corrective action

4.1 Monitoring and measurement

4.2 Non-conformance and corrective and preventive action

4.3 Records

4.4 Environmental management system audit

5 Management review

ISO 14000 guidelines

▶ Standard Title / Description

- ▶ 14000 Guide to Environmental Management Principles,
 - systems and Supporting Techniques
- 14001 Environmental Management Systems
 - specification with Guidance for Use
- 14004 Environmental Management Systems
 - ▶ - general guidelines on principles, systems and supporting techniques
- ▶ 14006 Environmental Management Systems
 - guidelines for incorporating ecodesign
- 14010 Guidelines for Environmental Auditing
 - General Principles of Environmental Auditing
- 14011 Guidelines for Environmental Auditing
 - Audit Procedures 1: Environmental Management Systems
- 14012 Guidelines for Environmental Auditing
 - Qualification Criteria for Environmental Auditors
- 14013 Guidelines for Environmental Auditing
 - Audit Programmes, Reviews & Assessments

ISO 14000 implementation

Standard Title / Description

14015	Environmental Management - environmental assessment of sites and organisations
14020/23 14024	Environmental Labeling Environmental Labeling - Practitioner Programs - Guiding Principles, Practices and Certification Procedures of Multiple Criteria Programs
14031/32	Guidelines on Environmental Performance Evaluation
14040/43	Life Cycle Assessment General Principles and Practices
14050	Glossary
14060	Guide for the Inclusion of Environmental Aspects in Product Standards

ISO 14000 set of standards

Standard Title / Description

14000	Guide to Environmental Management Principles, Systems and Supporting Techniques
14001	Environmental Management Systems - Specification with Guidance for Use
14010	Guidelines for Environmental Auditing - General Principles of Environmental Auditing
14011	Guidelines for Environmental Auditing - Audit Procedures 1: Environmental Management Systems
14012	Guidelines for Environmental Auditing - Qualification Criteria for Environmental Auditors
14013/15	Guidelines for Environmental Auditing - Audit Programmes, Reviews & Assessments
14020/23	Environmental Labeling
14024	Environmental Labeling - Practitioner Programs - Guiding Principles, Practices and Certification Procedures of Multiple Criteria Programs
14031/32	Guidelines on Environmental Performance Evaluation
1404x	Life Cycle Assessment (see later)
14050	Glossary
14060	Guide for the Inclusion of Environmental Aspects in Product Standards

ISO 14000

- Registration generally requires twelve to eighteen months of effort depending on the complexity of the organization and the existing systems.
- It will take at least the same time to develop and implement an Environmental Management System which complies with ISO 14001 requirements.

PD ISO/TR 14062:2002

- for use by all involved in the design and development of products.
- suggests the potential benefits of this methodology ...

PD ISO/TR 14062:2002 benefits

- lower costs by optimising the use of materials and energy, more efficient processes, and reduced waste disposal
- stimulation of innovation and creativity
- identification of new products, e.g. from discarded materials
- meeting or surpassing customer expectations
- enhancement of organisation image and/or brand
- improved customer loyalty
- attraction of financing and investment, particularly from environmentally conscious investors
- enhancement of employee motivation
- increased knowledge about the product
- reduction in liability through reduced environmental impacts
- reduction of risks
- improved relations with regulators
- improved internal and external communications

EMS / Sheldon and Yoxon

- a score should be calculated for each different area of business:
- **Score = Environmental hazard x Likelihood of the problem arising x Size of the Problem**
- Each parameter rated 1 (low) - 3 (high)
 - minimum score is one
 - maximum score is 27.
- Pareto chart can then indicate which issues should be given highest priority.

The Green Blue

- new environmental awareness initiative
 - British Marine Federation
 - Royal Yachting Association
- aims to promote the sustainable use of coastal and inland waters by boating and watersports participants, and the sustainable operation and development of the recreational boating industry

Green Blue case studies

- good practice identified at
 - SP Systems:
 - achievement of ISO 14001 compliance
 - Hamble Marine:
 - boat wash-down trials to reduce the impact of anti-fouling biocides
 - Norfolk Broads:
 - green fuel (electric and biodiesel boats)
 - UKSA Isle of Wight:
 - waste and resource minimisation

Environmental Protection Act 1990

- I. Integrated Pollution Control
and Air Pollution Control by Local Authorities
- II. Waste on Land
- III. Statutory Nuisances and Clean Air
- IV. Litter, etc.
- V. Radioactive Substances
- VI. Genetically Modified Organisms
- VII. Nature Conservation and Countryside Matters
- VIII. Miscellaneous
- IX. General

DPSIR: general framework

– Drivers

- anthropogenic forces imposing pressures

– Pressures

- physical expressions of the drivers

– State

- the condition of the ecosystem

– Impact

- effects due to changes in state

– Response

- preventative or adaptive actions

EEA Report No 9/2005

Polluter-Pays Principle (PPP)

- "the principle that a company that causes pollution should pay for the cost of removing it, or provide compensation to those who have been affected by it"

Polluter-Pays principle (PPP)

- **core of the principle** is that:
 - the polluter should pay for any environmental damage created
 - the burden of proof in demonstrating that a particular technology, practice or product is safe should lie with the developer, not the general public.
 - when and how much the polluter should pay is often unclear

PPP assurance bonds I

- money is put up by the "polluter"
to insure against a worst case impact
- the bond is recovered only if,
after sufficient time,
it is demonstrated that the technology, process or
product in question had been deemed to be as
safe as was
reasonably acceptable.

PPP assurance bonds II

- alternatively, if damage occurred, the bond is used for environmental restoration, and to pay damages to those harmed.
- the bond accrues interest:
incentive to ensure that
 - best environmental practice is followed
 - to demonstrate that the technology, process or product is as safe as is practicably possible, without involving excessive cost.

Precautionary Principle

- **"when there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation"**
- Ministerial Declaration on Sustainable Development, United Nations Economic Commission for Europe, Bergen - Norway, 1990.

Harremoës et al book, 2002

fisheries	radiation	asbestos
Great Lakes chemicals	PCBs	halocarbons
lead in petrol	sulphur dioxide	benzene
diethylstilboestrol	growth promoters 2	mad cow disease

Harremoës et al book, 2002

- and of especial relevance to the marine industry

Tri Butyl Tin (TBT) Anti Fouling Toxin (AFT)
coatings

Precautionary principle for AFT I

- C4 BC: Aristotle notes small fish (barnacles) slow down ships
 - 1975: New Scientist: hull drag due to fouling estimated to consume 25% of US Navy fuel
- 1824: Sir Humphrey Davy: anti-fouling action of copper sheathing on wooden ships related to rate of copper solution
- 1863: Tarr & Wonson, US patent 40 515: cuprous oxide (Cu_2O) as AFT

Precautionary principle for AFT II

- 1943: Tisdale, British patent 578 312: organotin compounds as AFT.
- 1960s: introduction of commercial TBT AFT
- 1970s: rapid take-up of TBT by shipping and small boats

Precautionary principle for AFT III

- 1970: Blaber (Plymouth Sound): appearance of penis in female dogwhelks
- 1971: Smith (US East Coast): "imposex" in mudsnails .. development of male sexual structures in females
- mid 1970s to 1981: oyster production falls by 80% (from 15K to 3K tonnes) due to reproductive failure and shell deformation

Precautionary principle for AFT IV

- early 1980s: **TBT** responsible for imposex in oyster drill (*Ocenebra erinacea*) in Arcachon Bay (French Atlantic)
- 1982: France legislates to prohibit TBT AFT on vessels <25m
- 1985: UK controls on sale of TBT AFT for use on small vessels
- January 1987: reduction of UK TBT levels

Precautionary principle for AFT V

- May 1987: total UK ban on retail sales of TBT AFT for vessels <25m
- 1988: prohibition in US
- 1989: prohibition in Canada - Australia - New Zealand
- 1991: harmonisation of EU TBT controls

Precautionary principle for AFT VI

- 1994: Marine Environment Protection Committee (**MEPC**) decided "no further controls were necessary"
- 1995: 4th Conf Protection of the North Sea agreed concerted action for worldwide phase-out of TBT on all ships
- 1998: **MEPC** draft mandatory regulations

Precautionary principle for AFT VII

- 2003: phase out of **application** of TBT
- 2008: phase-out of the **presence** of TBT on **ALL** ship hulls

Life Cycle Assessment (Brady, 2005)

- **Brady (2005) identifies four stages:**
 - **Goal and scope definition**
 - **Inventory analysis**
 - **Impact assessment**
 - **Interpretation**

Life Cycle Assessment (Brady, 2005)

- **Goal and scope definition:**
 - goal and scope of the study are defined in the context of the intended application.
- **Inventory analysis**
 - collection of data, calculation procedures, resulting in a table that quantifies the relevant inputs and outputs of the analysed system.
- **Impact assessment**
 - translates the results of the inventory analysis into environmental impacts to evaluate significance
- **Interpretation:**
 - conclusions and recommendations for decision makers are drawn from the inventory analysis and impact assessment.

ISO 14040 series standards

ISO 14040:2006 Environmental Management -
Life Cycle Assessment - principles and
frameworks

- "provides an overview of the practice, applications and limitations of Life Cycle Assessment to a broad range of potential users and stakeholders, including those with a limited knowledge of life cycle assessment"

ISO 14040 series standards

ISO 14044:2006 Environmental Management -
Life Cycle Assessment - requirements and
guidelines

- replaces 1998/2000 standards:
 - ISO14041 goal and scope definition and inventory analysis
 - ISO14042 life cycle impact assessment
 - ISO14043 life cycle interpretation

environmental impact classification factors

- Non-Renewable/Abiotic Resource Depletion
- Global Warming Potential
- Ozone Depletion Potential
- Acidification Potential
- Eutrophication Potential
- Photochemical Oxidants Creation Potential
- Human Toxicity Potential
- Aquatic Toxicity Potential