MODULE -1

Environmental management standards

The International Organization for Standardization (ISO) defines an environmental management system as **"**part of the management system used to manage environmental aspects, fulfill compliance obligations, and address risks and opportunities."

Unique characteristics of Environmental Problems

1. **Genetic Modification Of Crops**

Environmental issues caused by man-made chemicals are becoming clearer. For example, there has been a 90% reduction in the Monarch butterfly population in the United States that can be linked to weed killers that contain glyphosate.

There is also some speculation that genetically-modified plants may leak chemical compounds into soil through their roots, possibly affecting communities of microorganisms.

2. **Waste Production**

The average person produces 4.3 pounds of waste per day, with the United States alone accounting for 220 million tons per year. Much of this waste ends up in landfills, which generate enormous amounts of methane.

Not only does this create explosion hazards, but methane also ranks as one of the worst of the greenhouse gases because of its high global warming potential.

3. **Population Growth**

Many of the issues listed here result from the massive population growth that Earth has experienced in the last century. The planet's population grows by 1.13% per year, which works out to 80 million people.

This results in a number of issues, such as a lack of fresh water, habitat loss for wild animals, overuse of natural resources and even species extinction. The latter is particularly damaging, as the planet is now losing 30,000 species per year.

4. **Water Pollution**

Fresh water is crucial to life on Earth, yet more sources are being polluted through human activities each year. On a global scale, 2 million tons of sewage, agricultural and industrial waste enters the world's water every day.

Water pollution can have harmful effects outside of contamination of the water we drink. It also disrupts marin

5. **Overfishing**

It is estimated that 63% of global fish stocks are now considered overfished. This has led to many fishing fleets heading to new waters, which will only serve to deplete fish stocks further.

Overfishing leads to a misbalance of ocean life, severely affecting natural ecosystems in the process. Furthermore, it also has negative effects on coastal communities that rely on fishing to support their economies.

e life, sometimes altering reproductive cycles and increasing mortality rates.

6. **Deforestation**

The demands of an increasing population has resulted in increasing levels of deforestation. Current estimates state that the planet is losing 80,000 acres of tropical forests per day. This results in loss of habitat for many species, placing many at risk and leading to large-scale extinction. Furthermore, deforestation is estimated to produce 15% of the world's greenhouse gas emissions.

7. **Urban Sprawl**

The continued expansion of urban areas into traditionally rural regions is not without its problems. Urban sprawl has been linked to environmental issues like air and water pollution increases, in addition to the creation of heat-islands.

Satellite images produced by NASA have also shown how urban sprawl contributes to forest fragmentation, which often leads to larger deforestation

8. **Acid Rain**

Acid rain comes as a result of air pollution, mostly through chemicals released into the environment when fuel is burned. Its effects are most clearly seen in aquatic ecosystems, where increasing acidity in the water can lead to animal deaths.

It also causes various issues for trees. Though it doesn't kill trees directly, acid rain does weaken them by damaging leaves, poisoning the trees and limiting their available nutrients.

9. **Ozone Layer Depletion**

Ozone depletion is caused by the release of chemicals, primarily chlorine and bromide, into the atmosphere. A single atom of either has the potential to destroy thousands of ozone molecules before leaving the stratosphere.

Ozone depletion results in more UVB radiation reaching the Earth's surface. UVB has been linked to skin cancer and eye disease, plus it affects plant life and has been linked to a reduction of plankton in marine environments.

10. **Ocean Acidification**

Ocean acidification is the term used to describe the continued lowering of the pH levels of the Earth's oceans as a result of carbon dioxide emissions. It is estimated that ocean acidity will increase by 150% by 2100 if efforts aren't made to halt it.

This increase in acidification can have dire effect on calcifying species, such as shellfish. This causes issues throughout the food chain and may lead to reductions in aquatic life that would otherwise not be affected by acidification.

11. **Air Pollution**

Air pollution is becoming an increasingly dangerous problem, particularly in heavily-populated cities. The World Health Organization (WHO) has found that 80% of people living in urban areas are exposed to air quality levels deemed unfit by the organization.

It is also directly linked to other environmental issues, such as acid rain and eutrophication. Animals and humans are also at risk of developing a number of health problems due to air pollution.

12. **Lowered Biodiversity**

Continued human activities and expansion has led to lowered biodiversity. A lack of biodiversity means that future generations will have to deal with increasing vulnerability of plants to pests and fewer sources of fresh water.

Some studies have found that lowered biodiversity has as pronounced an impact as climate change and pollution on ecosystems, particularly in areas with higher amounts of species extinction.

13. **The Nitrogen Cycle**

With most of the focus being placed on the carbon cycle, the effects of human use of nitrogen often slips under the radar. It is estimated that agriculture may be responsible for half of the nitrogen fixation on earth, primarily through the use and production of man-made fertilizers.

Excess levels of nitrogen in water can cause issues in marine ecosystems, primarily through overstimulation of plant and algae growth. This can result in blocked intakes and less light getting to deeper waters, damaging the rest of the marine population.

14. **Natural Resource Use**

Recent studies have shown that humanity uses so many natural resources that we would need almost 1.5 Earths to cover our needs. This is only set to increase as industrialization continues in nations like China and India.

Increased resource use is linked to a number of other environmental issues, such as air pollution and population growth. Over time, the depletion of these resources will lead to an energy crisis, plus the chemicals emitted by many natural resources are strong contributors to climate change.

15. **Transportation**

An ever-growing population needs transportation, much of which is fueled by the natural resources that emit greenhouse gases, such as petroleum. In 2014, transportation accounted for 26% of all greenhouse gas emissions.

Transportation also contributes to a range of other environmental issues, such as the destruction of natural habitats and increase in air pollution.

16. **Polar Ice Caps**

The issue of the melting of polar ice caps is a contentious one. While NASA studies have shown that the amount of ice in Antarctica is actually increasing, these rises only amount to a third of what is being lost in the Arctic.

There is strong evidence to suggest that sea levels are rising, with the Arctic ice caps melting being a major contributor. Over time, this could lead to extensive flooding, contamination of drinking water and major changes in ecosystems.

17. **Climate Change**

The majority of the issues previously listed contribute or are linked to climate change. Statistics created by NASA state that global temperatures have risen by 1.7 degrees Fahrenheit since 1880, which is directly linked to a reduction in Arctic ice of 13.3% per decade.The effects of climate change are widespread, as it will cause issues with deforestation, water supplies, oceans and ecosystems. Each of these have widespread implications of their own, marking climate change as the major environmental issue the planet faces today.

Systems Approach to corporate environmental Management

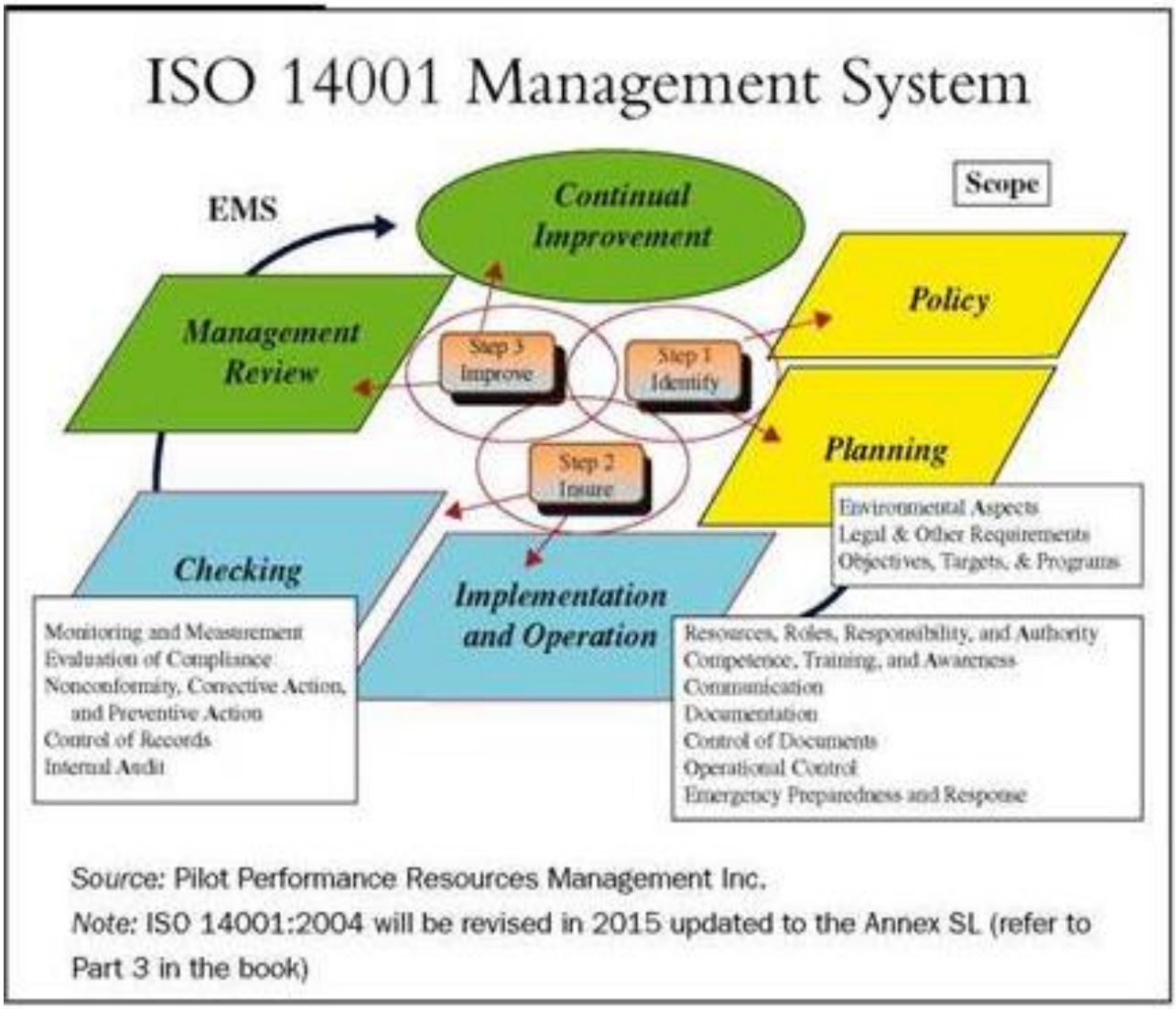
A system approach is identifying, understanding, and managing integrated and interdependent processes and their risks that contribute to the organization's environmental management system effectiveness.

Reviewing the inputs and outputs of each process as only a section of the company as a whole contributes to understanding the effects on other processes within the organization. This approach helps managers avoid analyzing problems in isolation.

The most common system model used for environmental management is the ISO 14001. There have been other models, such as the European Eco-Management and Audit Scheme (EMAS) and the Responsible Care model, developed by the American Chemical Council (ACC).

Many organizations, when implementing their environmental management system (EMS) to ISO 14001 requirements, have used the PDCA methodology, based on Deming's “Plan-Do-Check-Act,” implemented in post-WWII Japan.

The focus in the twenty-first century has been on the environmental revolution, and the ISO management system's emphasis has been on continual improvement. In 1995, I developed the Three-Step Process: Identify, Insure, Improve™ for management system implementation. These three steps can be applied not only to quality but also to implementation of an environmental management system (see Figure 7.1).



Environmental impact reduction efforts

Use energy more efficiently. Producing electricity and natural gas and delivering it to your door generates greenhouse gas emissions. Installing energy-efficient building systems and equipment can save energy and reduce your environmental footprint. See the Commercial or Industrial energy efficiency tools for recommendations that are tailored to your business segment.

Install renewables. Clean, renewable energy systems, such as solar and wind, can reduce your impact on the environment significantly while lowering your energy bill. A variety of federal, state and local incentives are available to make installing renewable energy more affordable. See the Database of State Incentives for Renewables and Efficiency (DSIRE) for information about incentives available in your area

Conserve water. Energy is used (and emissions generated) to heat the water used in your facility and process waste water. Reduce water heater temperatures and repair leaks. Install low-flow showerheads and aerated faucets to reduce the amount of water used; this can be especially effective in lodging and multi-family facilities. Facilities with high hot water demand, such as hospitals and restaurants, should consider heat recovery to capture the energy from waste fluids to heat or preheat water.

Reduce, reuse, recycle. Your environmental footprint goes beyond energy use and your business. All of the materials and equipment in your facility must be produced and shipped there, and then disposed of—all of which impacts the environment. Look for ways to use less; it could be something as simple as printing on both sides of paper or developing a better preventive maintenance program to make equipment last longer. Establish a companywide recycling program.

Travel less. Employees driving to and from work produce a substantial amount of air pollution. Encourage (or subsidize) employees to use public transportation or organize car pools, and allow employees to work from home whenever possible. Minimize business travel through web conferencing, email and other low-emission communications. If you maintain a fleet of vehicles, use them only when needed and look for fuel-efficient models.

Consider near sourcing. All businesses require resources to function, whether it is office supplies or raw materials for manufacturing. Transporting these resources to your door uses energy and creates emissions. Near sourcing—using vendors close to your business—is a growing trend that can reduce your environmental impact and may save you money as well.

Ship goods more efficiently. If your business delivers products, consider ways to reduce your shipping emissions. Ground shipments, by rail or truck, are generally more fuel-efficient than shipping by air. Fewer, full ground shipments will use less fuel than frequent light loads. If you do not have enough goods for full shipments, consider teaming up with other local businesses.

Business charter for sustainable production and consumption

Sustainable economic growth provides the foundation and resources for societies to develop and prosper, and for people to meet their needs and pursue their aspirations. It helps enable economic empowerment and poverty eradication, advance environmental stewardship; and contribute to dealing with the trans-boundary global challenges highlighted by the UN Sustainable Development Goals.

At the heart of economic growth are innovative, successful, and responsible businesses operating within strong, forward-looking governance and policy frameworks.

Now more than ever, sustainable development depends on the solutions, capabilities, contributions and engagement of business. ICC believes this entails:

- · Innovation in all dimensions of sustainable development so as to develop more integrated strategies, policy and decision-making.
- · Leadership and collaboration to leverage the mutually-reinforcing and cross-cutting elements of integrated policy-making.

- · Integrated governance structures fostering greater policy coherence between economic, environmental and development objectives.
- · Efforts by all actors to reconcile short-term pressures with longer-term strategies to deal with the multiplicity of economic, societal, and environmental challenges and opportunities in an integrated manner.
- · Bottom up and top down actions pursued simultaneously by governments and business in support of sustainable growth. A one-size-fits-all approach will not be effective, nor will policies that work in silos.
- · Multilateral and cross-cutting approaches across countries and sectors, which are indispensable in the global marketplace.

ICC and sustainable development ICC has played a long-standing role in promoting responsible business conduct and remains committed to providing through leadership to deliver sustainability solutions.

In 1991, only four years after the milestone Brundtland report ―Our Common Future‖, ICC launched its first Business Charter for Sustainable Development, voicing the first world business position on sustainable development. The Charter was subsequently updated in 2000 and 2015, with the latest version reflecting the new approach to sustainable development and its economic, societal, and environmental dimensions.

The 2015 Business Charter for Sustainable Development has been specifically designed to help companies contribute to the SDGs' implementation. Based around eight guidelines, it sets out a strategic framework to help companies place sustainability at the heart of their operations; it calls on the widest range of enterprises to enhance their sustainability performance; it also calls for enhanced co-operation to support sustainable growth. Sustainable development as a business priority

- To recognize the business contribution to sustainable development as a key priority and an enabler for long-term business success.
- To build the necessary awareness and understanding amongst its employees, shareholders, customers, and other stakeholders.
- To clarify and integrate sustainability into its strategies, leadership principles, operations, activities and investments according to each business' individually relevant context.
- To govern its business with integrity, develop best practices in any relevant area of work, and promote ethical conduct, including fighting corruption.

Tools for Sustainable Business Management

Specific tools for translation of general requirements of sustainable development into manageable demands are necessary. The sustainability balanced scorecard is the central tool for the development and implementation of sustainable business strategies. In order to identify the position of an enterprise related to sustainable development the concept of sustainability cube is discussed. With this instrument the social, economical and ecological dimension of sustainable

development within an enterprise can be measured. A tool for sustainable design of new products or services is the sustainable orientated quality function deployment. This concept combines the needs of the market and customers with the principles of sustainable development.

Sustainable cube In order to determine organisation's position in the light of sustainable development the "sustainable cube" can be applied 191. This tool contains the three perspectives of sustainable development - the economical, the ecological and the social one - and proposes a metric system for each of them. The position within the cube allows one to define strategies for further sustainable management. The cube can be used for the whole organisation, for parts of an organisation or for individual products or services. The economic perspective can be measured with common economic concepts like economic value added, option pricing theory, shareholder value, contribution accounting, target costing or product profitfloss accounting. Economic value added, shareholder value, options price theory and contribution accounting can be used to analyse the whole organisation. Target costing is a tool for product-specific questions. Meanwhile specific variations of shareholder value or contribution accounting were developed including ecological requirements (spec. ecological shareholder value [lO], environmental contribution accounting [l l]). The ecological perspective can be measured by life cycle assessment resp. environmental performance measurement and indicators. The chosen method should refer to principles of sustainable development, the methods suitably are assessing not-monetary and quantitative. The methods Sustainable Process Index (SPI) [12], Material Input per Service (MIPS) [13], Ecoindicator 99 [l41 and Eco-Points [l 51 are in discussion.

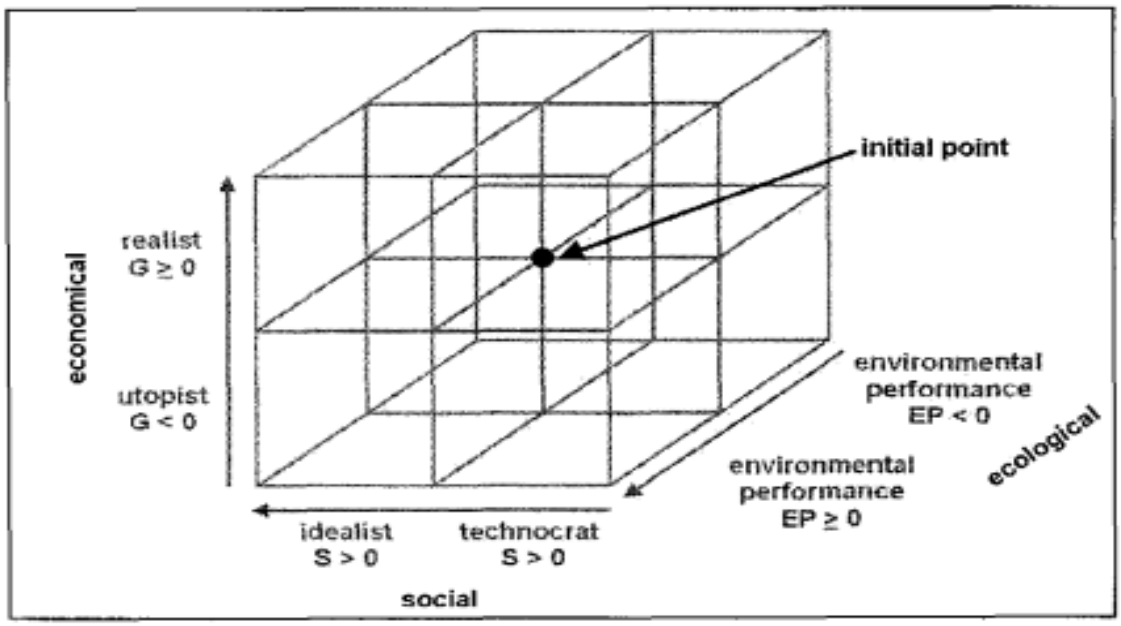


Figure 1: Sustainable cube.

These methods allow the measurement of ecological effects of products, processes or organisations. Application is usually complex, and the methods are debatably. If environmental effects can be evaluated by experts, also indicators combined with ABC-analysis can be used [16]. Social perspective can be measured by indicators. Questions of legal compliance of social

standards and laws, of human rights and of gender mainstrearning, to give a few examples, are here in focus. For practical use, the relevant indicators for each perspective have to be defined for a specific organisation. The next step is measuring and collecting the needed data, due to evaluate and calculate each indicator. The sustainable cube is an instrument used in organisational decision making processes - therefore evaluation is of a relative characteristic. The organisation starts in the centre of the cube and can derivate strategies for each sustainability perspective to improve the position. The cube can be used for benchmarking purposes, too, but in this case all partners of the benchmarking process have to use the same criteria, indicators and methods. The lettering of the axis is characterized by "W, "S" and "EP and is measured through specific criteria valid for the organisation. The ideal position of measurement point within the cube would be the top of each perspective, economic realistic, social ideal, with high environmental performance. An unalterable demand for the position of each organisation is section with $G > 0$, otherwise they lose money. In this case the organisation has no economic perspective, and there is no continuous success in the ecological and social perspective.

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Table 2: Classical model for QFD [23].

Step	Matrix	What	How
1	House of Quality	Voice of the Customer	Technical Performance Measures
2	Subsystem Design Matrix	Technical Performance Measures	Piece-Part Characteristics
3	Piece Part Design Matrix	Piece-Part Characteristics	Process Parameters
4	Process Design Matrix	Process Parameters	Production Parameters

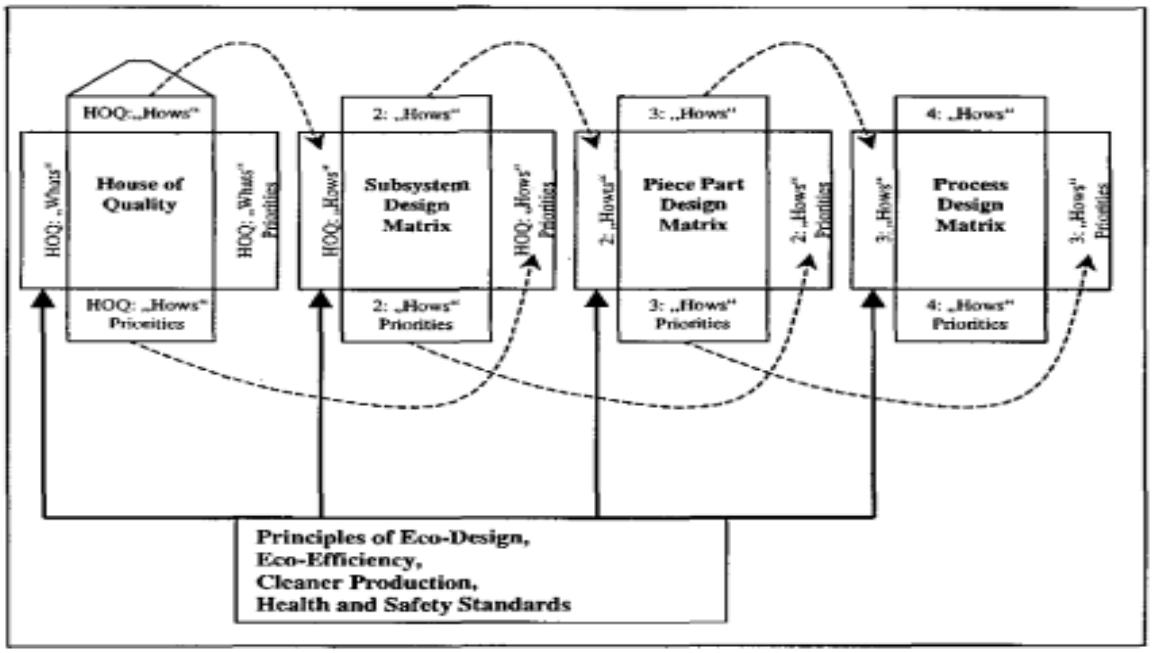


Figure 2: QFD – interrelated matrices and impact of sustainability criteria.

Sustainability requirements can be included on all steps of the Qm> process. For the House of Quality (HOQ), the subsystem design matrix and the piece part design matrix the relevant criteria can be derived from the principles of ecodesign as well as from criteria's concerning social resp. health and safety issues. Eco-Efficiency Criteria and principles of Cleaner Production can be integrated into the process design matrix, but it has to be noted, that these principles will also have an impact to matrix 1 - 3 (see Table 2). Eco-Efficiency means creating more value with less impact [24]. The goal of the concept of Cleaner Production are environmental sound processes, in order to avoid harmful emissions and waste which have to be cleaned up with so called end-of-pipe technologies. The objective of Eco-Design is to maximize the benefit and to minimize the environmental impact of a product or service. Additionally requirements of corporate strategy are important. Therefore tool employment has to be seen in the light of the general objectives which are management for example with a SBSC within a Generic Management System

What is Environmental Stewardship

- Human responsible consumption, protection of the natural environment or corrective activities that could be achieved through conservation efforts and sustainable practices.
- The responsible use and management of natural resources in a way that takes a full and balanced account of the interests of society, future generations, and other species while accepting significant answerability to society for these actions.
- Reduce the number of bags you use for shopping. Use reusable bags.

- Reduce water usage and waste by closing taps and lower the flow to the smallest needed to do the job in reasonable time.
- Reduce the amount of fuel you use by choosing smaller, lighter vehicles. Carpool. Live close to where you work. Use public transit if you can.

Environmental stewardship ties in with land stewardship and good agricultural practices which farmers would not truly practice if they care about obtaining optimal yields for an infinite period of time.

It includes things like:

- Planting trees around fields to act as wind break barriers which reduce soil erosion due to winds blowing across cultivated ground.
- Reduced tillage or no tillage methods of growing crops. This also helps reduce soil erosion by wind because less or nose bare soil is left open to the elements.
- Incorporation of plant waste, such as stems, back into the soil to add organic matter. This means healthier soil and corresponding increased yields. It also can mean soil which is more open allowing for better drainage.
- Not using equipment on soil when it is too wet resulting in compaction. This can mean reduced yields and reduced drainage. Also using suitable equipment to match the soil such as tracked equipment versus just plain wheels on muck type soil.
- Applying the correct amount of fertilizer or manure at the correct time to achieve optimal growing results without having run off issues. Allowing fertilizer or manure to leach into waterways is harmful to the environment as well as a waste of the resource. As part of this, incorporating the fertilizer or manure into the soil

Drivers of sustainability

The business case for sustainability has been at the forefront of much of the literature. Some of the most commonly mentioned drivers/benefits of sustainability include: competitive advantage, reduced costs, increased sales, improved image and reputation, and increased employee motivation (FSC, 2010; Jenkins, 2006; KPMG, 2008; Makower, 2010; Masurel, 2007; Morsing, 2006; Simpson, Taylor, & Barker, 2004; Werbach, 2009; Willard, 2005). In December 2010, the American Institute of Public Accountants (AICPA), Canadian Institute of Chartered Accountants (CICA) and the Chartered Institute of Management Accountants (CIMA) released a report on drivers to sustainability. This report looked at the evolution of CR practices in Canada, the US and the UK;

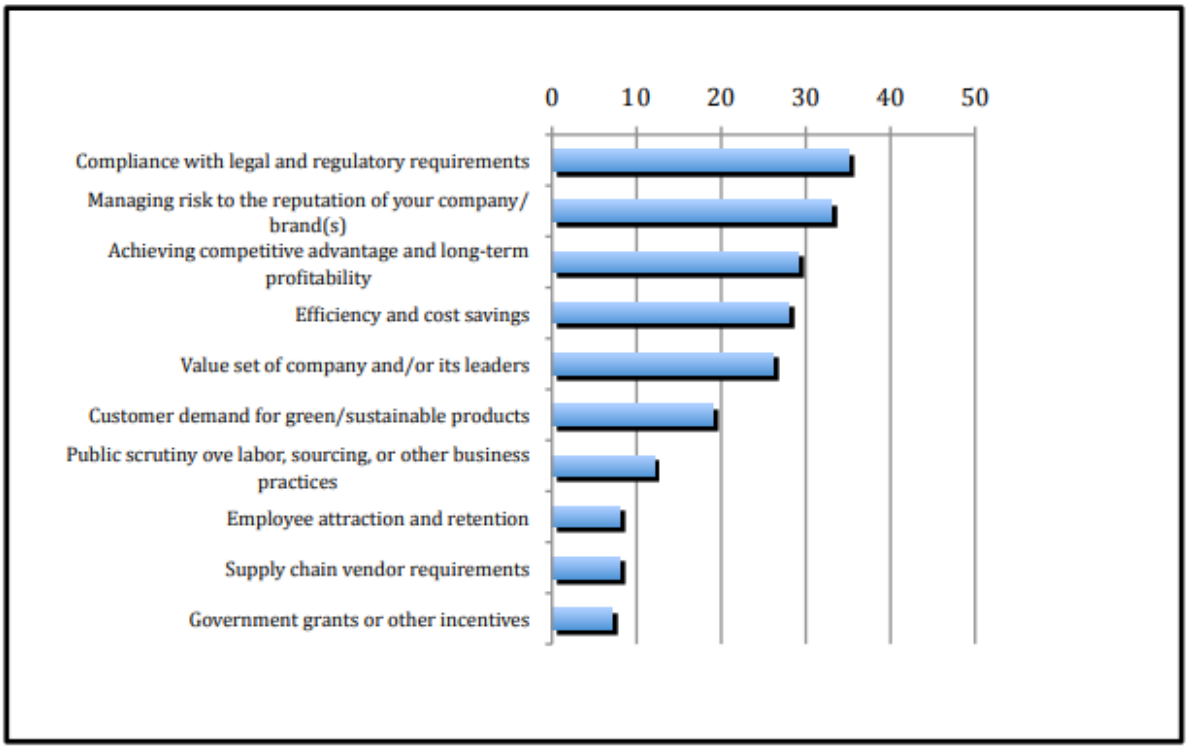
The top three drivers to sustainability for large organizations were:

(1) Compliance with legal and regulatory requirements,

(2) Managing risk to the reputation of your brand and

(3) Achieving competitive advantage and long-term profitability (see figure 6) (AICPA, CIMA, CICA, 2010, p.5).

The survey respondents were small (under 1000 employees) and large (over 1000 employees) organizational leaders who are members of these three associations. Based on the literature, the most important drivers for sustainability are external to 18 the company and focus on competitive advantage, compliance with regulatory bodies and managing risk and reputation. Jenkins (2006) concluded that external drivers are: improved image and reputation, better market position; and internal drivers are: increased employee motivation, cost savings and increased efficiency. Figure 6 – Sustainability drivers for large companies



Large organizations are also more inclined to have formal sustainability departments as well as formal reporting standards, and 79% of companies currently had a sustainability strategy

BARRIERS

Sustainable development has been widely promoted as a holistic concept which aims or targets to integrate social, economic and cultural policies to ensure high-quality growth. However, there are barriers combating the implementation of sustainable development. These barriers are, according to an UK essay and other materials, the following:

•**Economic and financial barriers**: Economists observed that the dominating development model tends to focus on economic growth as precedence rather than people's rights or welfare, and environmental processes and limits. This requires a shift in the worldview from treating the

environment as part of the economy to treating the economy as part of the environment; strategically this means the economy should be adapted to ensure environmental services are maintained.

Innovational Barriers: In the educational sector there is a lack of innovation-oriented research. This means that there has to be a closer connection between research institutes and the economy, which would also overcome problems concerning the knowledge transfer to applications in real life.

•**Social barriers:** Population growth, paired with unsustainable consumption and production patterns among the wealthy, are the biggest social challenges to achieving sustainable development in the world. Absent of a significant change in human behavior, sustainability will not be potential. There are other social barriers which are: The marginalization of the poor and entrenched inequities Limited awareness about sustainable development. Environmental issues among both politicians and the wider public fragmented civil society. Inadequate interaction between civil society and government. Insufficient incentives to for the private sector to pursue sustainable development.

•**Political barriers:** Inadequate economic, social and environmental methods for policies, plans and projects are the major barrier combating the implementation of sustainable development.

•**Poor monitoring and evaluation systems**: A basic problem is lack of specific targets (globally, nationally and at local level), measurement and data to track progress, resulting in a lack of information available to decision-makers. It is suggested for strengthening monitoring and evaluation of sustainable development strategies in order to establish a dynamic improvement process, with an objective of increasing their effectiveness. It is recommended that governments should turn up deeper and assess the socio-economic impacts of developmental projects, rather than the outcome alone.

•**Institutional barriers**: Institutional barriers as a result of lack of institutional experience to operate all the mechanism of democratic system has been combating and frustrating sustainable development in many developing countries.

•**Trade barriers**

Environmental Management Principles

Principles of environmental management are a set of rules and guidelines that help attain desirable environmental outcome. Principles of environmental management, refers to procedure, government, industries and people should follow. Environmental management *principles* have been drivers, in response to economic and social problems which may arise as a result of any economic undertaking. This includes agriculture, mining, industries and natural disasters likely to damage the environment.

7 Key Principles Of Environmental Management

Below are the main principles of environmental management important for environmental decision making and any undertaking, likely to damage the environment. **7 main principles of environmental management**, which play major role in economic, social and environmental decision making, including policy formulation.

1. **Polluter Pays Principle (PPP)**

Most economists around the world suggested for many years that the only to ensure clean safe environment was through this principles of environmental management. Experts suggested that firms producing hazard chemicals and pollutants affecting the environment must pay

After many countries embarked on measuring damage, through environmental impact assessment (EIA). It was noted that pollution must be linked to damage and pollution caused, therefore prices must be according to damages caused the industry.

Polluter pays principle, ensures absolute liability for any damage and harm caused by the industry and firms. It makes the process and procedure for compensation easy in an event where there victims affected. Another important aspect of this among **principles of environmental management** is that the cost gets shared and its easy to repair or reduce damages.

2. User Pays Principle (UPP)

This principle has been derived from the polluter pays principle which gives the responsibility to users for them to pay for any long run cost and marginal environmental damage or pollution.

It includes users bearing the costs for utilizing resources, services and treatment services whenever the resources are consumed and been used.

For instance consumption of water which comes from rivers, each household is required to pay certain fee towards the service. Farmers are required to pay land fees, which part of the money goes towards cleaning and budgetary funding for developing **EIA** systems to help predict, protect and prescribe measure s to protect the environment from economic activities

3. Precautionary Principle (PP)

This proposes protecting the environment through precautionary measures, especially for heavy activities that might cause more damage to the environment. Precautionary principle has major objectives which include measuring primary and secondary activities posing a threat to the environment.

4. Principle of Responsibility

Among **principles of environmental management**, this states each person and firm needs to be held accountable and take responsibility to maintain safe, clean and sustainable development. Ecological sustainability should be attained by ensuring the use of resources is properly managed and not wasted, people must go about knowing that one of there duties is to protect the environment, safe applies for firms and corporations extracting and committing gasses polluting the environment.

5. Principle Of Effectiveness and Efficiency

It the responsibility of government in every country, city or state to ensure, well structured policies and procedures are put in place for essential waste management. Failure to properly mage waste can lead to diseases, soil problems, chemical build ups, water born diseases. Hence its essential that through the principle of effectiveness and efficiency, major agencies and council do everything possible to reduce waste building up and control dump sites for garbage.

6. Principle of Proportionality

This refers to striking a balance between development and protecting the environment. Building of basic essential infrastructure through development has been considered major part for Human development, therefore, protecting the environment but so does development. Without the environment which provides for land, man would not have where to build homes.

7. Principle Of Participation

Every citizen, person, government and firms have a responsibility to participate in environmental decision making and protection policies. Through collective collaboration in the affairs of the environment its easy to foster a shift and wave reflecting need to protect the environment.

Every individual should take a major step and contribute to issues relating to solid waste management, garbage collection, construction, chemicals, gaseous omission and demolition materials which are likely to affect the environment and how to reduce the impact.

National Environment Policy (NEP)

The National Environment Policy (NEP) by the Ministry of Environment and Forests (MoEF) aims at mainstreaming environmental concerns into all developmental activities. It emphasises conservation of resources, and points that the best way to aid conservation is to ensure that people dependent on resources obtain better livelihoods from conservation, than from degradation of the resources. It argues that environmental degradation often leads to poverty and poor health outcomes among populations.

The document goes on to highlight the principles underlying the policy that emphasise the

- Important role of human beings in the sustainable development processes
- The non negotiability and incomparable value of environmental resources
- Right to development for all
- Equity in the use of environmental resources and

The need for the decentralised and multisectoral approach in dealing with environmental issues.

The objectives of the policy include:

Conservation of critical environmental resources

Intra-generational equity

Livelihood security for the poor

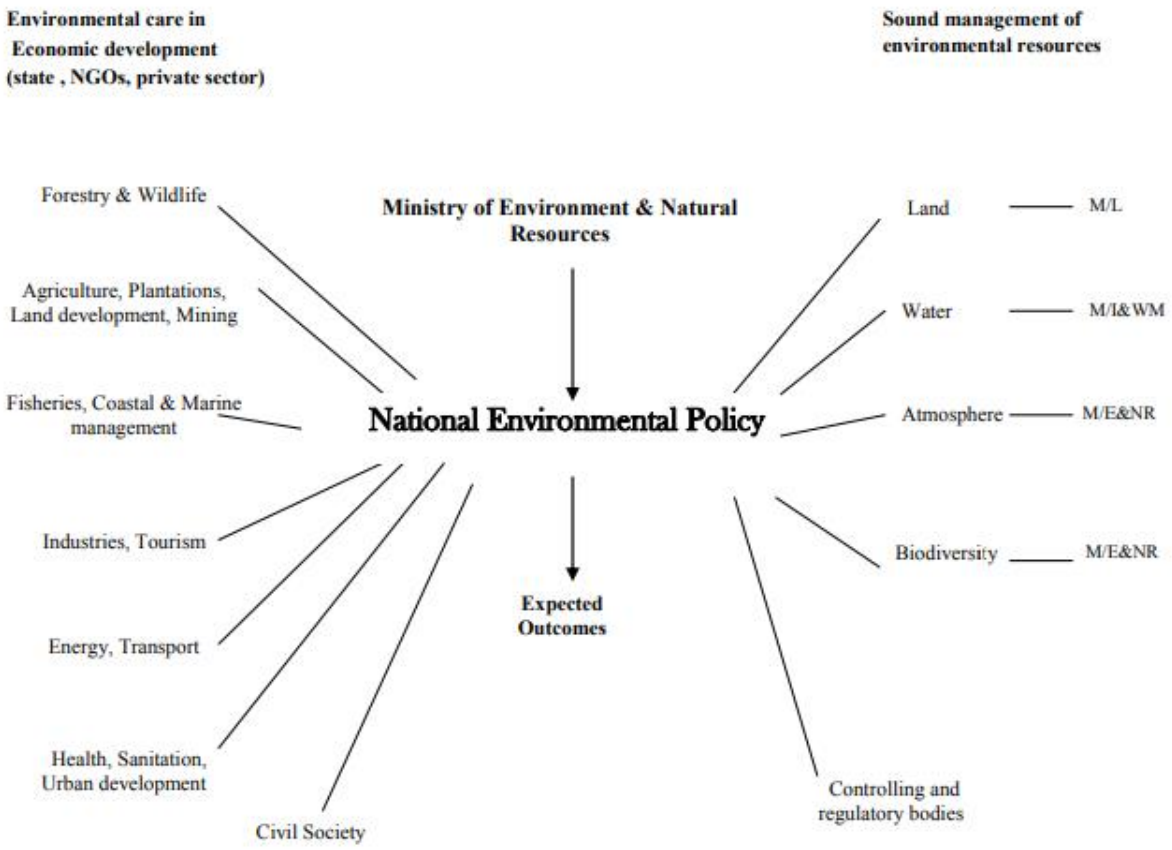
Inter-generational equity

Integration of environmental concerns in economic and social development

Efficiency in environmental resource use

Environmental governance

Enhancement of resources for environmental conservation



Abatement of pollution and conservation of resources

Pollution Abatement

Pollution abatement refers to any measure taken to reduce, control or eliminate pollution from a given environment. Abatement measures can be technological, like catalytic converters on vehicles to reduce air pollution, or they may be regulatory, like laws limiting the amount of

solid waste a sewage management facility can release into a waterway. Abatement measures may also be behavioral, like turning down a home thermostat a degree or two in winter to reduce electricity consumption and greenhouse gas emissions

Air

Smog, ground-level ozone pollution, acid rain and climate change influenced by greenhouse gas emissions are all products of fossil-fuel combustion, whether for industrial processes, electricity generation or gasoline-powered vehicles. Examples of contemporary abatement strategies include requiring smoke-stack scrubbers on coal-fired power plants to reduce emissions of sulfur and nitrogen dioxides and placing caps on carbon emissions to reduce greenhouse gases.

Soil

Land pollution can come from a variety of sources. Landfills, chemical and fuel refinery leaks or spills and industrial agricultural techniques that require heavy use of pesticides and chemical fertilizers all contribute to soil pollution. Abatement measures include eliminating lead from fuels to reduce lead pollution of the soil, requiring underground liners for landfills, voluntary recycling programs, regulating fuel and chemical production to minimize risks of spills or leaks and exploring alternative agricultural methods to reduce the need for pesticides and herbicides.

Water

Water pollution usually comes in one of two major forms, point source pollution and nonpoint source pollution. Point sources include specific release of pollutants into waterways, like industrial effluents or untreated sewage. Nonpoint sources are not locally specific and include pollution from storm water runoff in urban areas and pollutant leaching from contaminated soils. Abatement measures include requiring treatment of sewage waste water solids, installation of storm runoff retention systems (also called wet ponds) in areas with a high density of impervious surfaces and educating the public about the dangers of storm water pollutants to streams, rivers and aquifers.

Energy Conservation

Another basic but important pollution abatement strategy includes what many call reducing your carbon footprint. More people using fewer resources and less energy reduces pollution impacts on a larger scale. Examples of conservation include: using cleaner-burning fuels and renewable sources of energy like solar or wind power, using public transportation or carpooling, recycling and reusing paper, plastics and metals, insulating your home to make it more energy-efficient, installing energy-efficient appliances, and buying locally produced goods to reduce the need for shipping of products over long distances.

The focus in the twenty-first century has been on the environmental revolution, and the ISO management system's emphasis has been on continual improvement. In 1995, I developed the Three-Step Process: Identify, Insure, Improve™ for management system implementation. These three steps can be applied not only to quality but also to implementation of an environmental management system

CHARTER ON CORPORATE RESPONSIBILITY FOR ENVIRONMENTAL PROTECTION (CREP)

Ministry of Environment & Forest (MoEF) launched the Charter on "Corporate Responsibility for Environmental Protection (CREP)" in March 2003 with the purpose to go beyond the compliance of regulatory norms for prevention & control of pollution through various measures including waste minimization, in-plant process control & adoption of clean technologies. The Charter set targets concerning conservation of water, energy, recovery of chemicals, reduction in pollution, elimination of toxic pollutants, process & management of residues that are required to be disposed off in an environmentally sound manner. The Charter enlists the action points for pollution control for various categories of highly polluting industries. The Task Forces were constituted for monitoring the progress of implementation of CREP recommendations/ action points.

Action Points under CREP for Tannery Sector

1. Chrome Recovery

i) All the chrome-tanning units in the country will have the Chrome Recovery Plant either on individual basis or on collective basis in the form of Common Chrome Recovery Plant and use the recovered chrome in the tanning process. By December 2004

ii) Common Chrome Recovery Plant is to be installed and commissioned at Kanpur, for which the Feasibility Report has already been prepared. All the chrome tanning units will make their financial contribution to the extent of 10% By June 2003

ii) Recovered Chromium is to be utilized in tanning process By December 2005

2. Waste Minimization Measures

i) Waste minimization circles will be formed in all the clusters of tanneries in the country to implement waste minimization measures and for adoption of clean technologies March 2004

ii) Waste minimization measures as identified by the Task Force to be implemented in all the tanneries By December 2005

3. Reduction of Water Consumption in Tannery Units

i) All the tanneries will install water meters and flow meters to measure actual consumption and waste water discharge. By December 2003

ii) Water consumption rates will be brought down to 28 m 3 /tonne of hides by taking water conservation measures. By December 2003

4. Compliance of standards All CETPs and ETPs will take the following measures:

i) Deployment of qualified and well trained staff for O & M of the ETPs/CETPs. By December 2003

ii) Installation of automatic monitoring instruments by CETPs/large tanneries. By December 2003

iii) Separate Energy meters for ETPs/CETPs By December 2003

iv) Replacement of open anaerobic lagoons with cleaner technology options will be implemented By December 2005

v) Implementation of guidelines developed by CPCB for Health & Safety of worker employed in the industry / ETP/ CETP.

vi) All large tannery units (processing more than 5 tonne/day of hides/skins) will undertake Environmental Auditing on annual basis. By June 2004

vii) Modification/up-gradation of the CETPs/ETPs wherever necessary will be taken up by tannery units and CETP management By December 2005

5. Management of Total Dissolved Solids (TDS) For TDS management the following methods will be adopted:

i) Manual/mechanical desalting By December 2003

ii) Use of cleaner technology for less use of salt By December 2005

iii) High Rate Transpiration System for effluent treatment will be adopted wherever feasible By December 2004

iv) Treated wastewater will be mixed with the sewage wherever feasible and further treated and the treated combined effluent will be used on land for irrigation. By December 2005

6. Solid Waste Management For solid waste management the following methods will be adopted:

: i) Utilization of process sludge for by-product recovery. By December 2004

ii) Resource recovery from process sludge and ETP sludge in the form of Biogas By December 2004 iii) Safe disposal of hazardous sludge and non-hazardous solid wastes By December 2005

7. Salts from Solar Evaporation The following methods will be adopted depending on the site specific conditions:

i) Reuse of recovered salt. By December 2005

ii) Safe land disposal or Sea disposal

8. Use of Boron bearing compounds will be dispensed with. By December 2003

9. Ground water quality monitoring to be strengthened wherever the treated effluents are applied on land for irrigation. By December 2004

10. Implementation of recommendations of the Task Force constituted by the MOEF, Govt.of India will be commenced by June 2003. By June 2003

Note: Non-complying units not meeting notified standards under Environment (Protection), 1986 will submit action plan with PERT chart along with Bank Guarantee to SPCB By June 30, 2003

MODULE 2

THE ENVIRONMENTAL QUALITY OBJECTIVES

1. **REDUCED CLIMATE IMPACT** In accordance with the UN Framework Convention on Climate Change, concentrations of greenhouse gases in the atmosphere must be stabilised at a level that will prevent dangerous anthropogenic interference with the climate system. This goal must be achieved in such a way and at such a pace that biological diversity is preserved, food production is assured and other goals of sustainable development are not jeopardised. Sweden, together with other countries, must assume responsibility for achieving this global objective.
2. **CLEAN AIR** The air must be clean enough not to represent a risk to human health or toanimals, plants or cultural assets.
3 **NATURAL ACIDIFICATION ONLY** The acidifying effects of deposition and land use must not exceed the limits that can be tolerated by soil and water. In addition, deposition of acidifying substances must not increase the rate of corrosion of technical materials located in the ground, or water main systems, archaeological objects and rock carvings.
4. **A NON TOXIC ENVIRONMENT** The occurence of man-made or extracted compounds in the environment must not represent a threat to human health or biological diversity. Concentrations of non-naturally occuring substances will be close to zero and their impacts on human health and on ecosystems will be negligible. Concentrations of naturally occuring substances will be close to background levels.
5. **A PROTECTIVE OZONE LAYER** The ozone layer must be replenished so as to provide long-term protection against harmful UV radiation.
6. **A SAFE RADIATION ENVIRONMENT** Human health and biological diversity must be protected against the harmful effects of radiation.
7. **ZERO EUTROPHICATION** Nutrient levels in soil and water must not be such that they adversely affect human health, the conditions for biological diversity or the possibility of varied use of land and water.
8. **FLOURISHING LAKES AND STREAMS** Lakes and watercourses must be ecologically sustainable and their variety of habitats must be preserved. Natural productive capacity,

biological diversity, cultural heritage assets and the ecological and water-conserving function of the landscape must be preserved, at the same time as recreational assets are safeguarded.

9. **GOOD QUALITY GROUNDWATER** Groundwater must provide a safe and sustainable supply of drinking water and contribute to viable habitats for flora and fauna in lakes and watercourses.
10. **A BALANCED MARINE ENVIRONMENT, FLOURISHING COASTAL AREAS AND ARCHIPELAGOS** The North Sea and the Baltic Sea must have a sustainable productive capacity, and biological diversity must be preserved. Coasts and archipelagos must be characterized by a high degree of biological diversity and a wealth of recreational, natural and cultural assets. Industry, recreation and other utilization of the seas, coasts and archipelagos must be compatible with the promotion of sustainable development. Particularly valuable areas must be protected against encroachment and other disturbance.
11. **THRIVING WETLANDS** The ecological and waterconserving function of wetlands in the landscape must be maintained and aluable wetlands preserved for the future.
12. **SUSTAINABLE FORESTS** The value of forests and forest land for biological production must be protected, at the same time as biological diversity and cultural heritage and recreational assets are safeguarded.
13. **A VARIED AGRICULTURAL LANDSCAPE** The value of the farmed landscape and agricultural land for biological production and food production must be protected, at the same time as biological diversity and cultural heritage assets are preserved and strengthened.
14. **A MAGNIFICENT MOUNTAIN LANDSCAPE** The pristine character of the mountain environment must be largely preserved, in terms of biological diversity, recreational value, and natural and cultural assets. Activities in mountain areas must respect these values and assets, with a view to promoting sustainable development. Particularly valuable areas must be protected from encroachment and other disturbance.
15. **A GOOD BUILT ENVIRONMENT** Cities, towns and other built-up areas must provide a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural assets must be protected and developed. Buildings and amenities must be located and designed in accordance with sound environmental principles and in such a way as to promote sustainable management of land, water and other resources.
16. **A RICH DIVERSITY OF PLANT AND ANIMAL LIFE** Biological diversity must be preserved and used sustainably for the benefit of present and future generations. Species habitats and ecosystems and their functions and processes must be safeguarded. Species must be able to survive in long-term viable populations with sufficient genetic variation. Finally, people must have access to a good natural and cultural environment rich in biological diversity, as a basis for health, quality of life and well-being.

Closing the loops

Businesses use all kinds of terms to prove they're environmentally friendly. "Recyclable," "plant-based," and "energy efficient" all get tossed around a lot — and while most people generally know

what those words mean, there's one frequently used phrase that's harder to decipher: closed-loop system.

When a company says it uses a closed-loop system, it's referring to its supply chain. Under a closed-loop system, businesses reuse the same materials over and over again to create new products for purchase. It's a way to conserve natural resources and divert waste from the landfill, and increasingly, more companies are adopting it.

The phrase "closed-loop system" is often paired with "circular economy," which is "an industrial system that is restorative and regenerative by intention or design," to use the World Economic Forum's definition. It's helpful to think of literal loops or circles to understand the core concept. Instead of raw materials moving in a straight line from collection, through manufacturing, to purchase (and, once it's broken or used up, the trash can), imagine a loop. The materials are always moving through this loop, never reaching an endpoint

When a product has served its purpose, it restarts at collection. Someone pares the item back down to scraps, providing "new" raw materials. Then it's manufactured into a finished product yet again, one the consumer can then purchase.

Think of aluminum cans. When you finish drinking a beverage out of a can, you put it in a recycling bin. Factories salvage the aluminum and make another can that is shipped to a store, where anyone can buy it. The process can be repeated thousands of times.

Closed-loop systems can be applied to all kinds of industries. Take the beer business. Sierra Nevada **has closed the loop** in the company's Chico, California facilities, where the beermakers compost waste generated from the brewery into soil used to grow new barley and hops.

But that's far from the only example. Companies like **For Days** are fighting the concept of fast fashion with closed loop clothing. When customers sign up for a For Days subscription, they receive a bundle of shirts, ranging from basic tank tops to sweatshirts. Once the clothes are worn down, stained, or torn, subscribers send them back for a new set — derived directly from those used threads.

Module 2:ENVIRONMENTAL MANAGEMENT OBJECTIVES

THE 16 ENVIRONMENTAL QUALITY OBJECTIVES

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The rationale of environmental standards

The purpose of environmental quality standards is **to protect quality of life and health by controlling the quantity and quality** (mainly in terms of toxicity) of anthropogenic pollutants, emanating mainly from industrial activities, released to the environment.

It includes

Concentration and mass standards

Effluent and stream standards

Emission and ambient standards

Mass and concentration.

- Mass concentration (mass per unit volume e.g. ppb or μg L^{-1}) is the traditional metric to report the environmental concentration (exposure) and toxicity thresholds (dose) of conventional contaminants.
- Mass concentration is also the metric used when investigating the release and fate and transport of conventional contaminants in the environment. It is likely the best suitable metric to represent sedimentation of manufactured NMs after aggregation.
- In addition, there are well-validated methods for NM mass concentration determination, making the production of accurate data easier. Therefore, mass concentration is the current practical choice for a rapid overall assessment of environmental processes related to the larger NM fractions (e.g. sedimentation).
- For example, the mass concentration of fullerene C_{60} was considered critical to predict the fate of aqueous nanoscale fullerene (C_{60}) suspensions
- Although mass concentration metrics have been widely adopted in the hazard and risk characterization of NMs, they are known to have limitations.
- Few studies have investigated the impact of dose metric (mass, number and surface area) on the dose–response relationship for NMs, but there is no consensus on the best dose metric to express NM toxicity.
- It is likely that the dose metric will be NM-dependent.This is particularly true for polydisperse NM samples where mass concentration primarily reflects larger NM fractions.
- A potential challenge is to quantify mass concentration of specific NMs in complex biological matrices. The NMs can be altered via dynamic interaction with surrounding media. Finally, manufactured NMs are typically present at low concentrations (parts-per-trillion to ppb).
- Highly sensitive and specific analytical techniques are required to measure these toxicologically relevant mass concentrations. This metric is also not appropriate for specific toxicological processes, e.g. assessing inflammation under high aerosol concentration.[16] In these cases, the surface properties of NMs are found to play a dominant role.

Effluent Standards:-

- They are generally established for the effluent from industry and municipality waste water treatment plant to be discharge into stream, land, sewer, ocean etc.
- Effluent standard system is carried out to control the following stream standard system.
- No detail stream analysis is required to determine exact amount of waste treatment, effluent standard can serve as a guide to establish the stream classification or during organization of any pollution abutment program.
- Unless the effluent standards are upgraded, this system does not provide any effective protection for an over loaded stream.
- Main disadvantage of this type of standards is that there is no control over total volume of polluting substances added to stream each day

Stream Standards:-

- The system is based on establishing classification or standard quality for a stream & regulating any discharge to the extent, necessary to maintain the established stream classification or quality
- The primary objective of stream standards is to protect and preserve each stream for its best usage on a equitable basis for both upstream & downstream uses.
- The stream standard system is the prevention of excessive pollution regardless of type of industry or other factors such as location of industry or municipality.
- Pollution abutment should be considered in the decisions concerning location of a plant just as carefully as the laboures, transportation, market & other conditions.
- It also allows the public to establish goals for maintaining quality of water for present as well for future needs.

Emission standards

- Emissionstandards are requirements that set specific limits to the amount of pollutants th at can be released into the environment.
- Many emissions standards focus on regulating pollutants released by automobiles (mo tor cars) and other powered vehicles but they can also regulate emissions from industry , power plants, small equipment such as lawn mowers and diesel generators.

An emission performance standard is a limit that sets thresholds above which a different type of emission control technology might be needed. ..

Emission Norms:-

- It was in 1991 that first time emission norms were introduced in India for petrol cars, diesel cars followed in 1992.
- Emission norms means some rules (which has specified quantity) decided by the govt for control of air pollution.
- Implementation of mandatory catalytic converters in 1995 for the 4 Metro cities, thus reducing pollution further.

- From 2000,India introduced strict Emission standards modeled on the European ones. This means the birth of Bharat Norms, with the first set of norms known as Bharat stage II, followed by BS III, and BS IV (BS I was the earlier, Indian standard)

Ambient Air Quality Standards (AAQS) are setup for protecting public health from adverse effects of air pollution and eliminating or reducing to a minimum, those contaminants that are known to be or likely to be hazardous to human health.
Several approaches have been considered for setting air quality standards. Some of these are:
i) using another community's air as the standard,
ii) using as standard the quality of air that existed at an earlier time for which it was believed that adverse effects were either nonexistent or tolerable by the community,
iii) using as standard the quality of air that exists in the community on certain days of good ventilation and
iv) considering health protection - control cost relationship.
National Ambient Air Quality Standards A National Ambient Air Quality Standard (NAAQS) is a uniform, national standard establishing the maximum permissible concentration of an air pollutant in the ambient air - the "portion of the atmosphere, external to buildings, to which the general public has access..
" The USEPA has setup two types of standards, viz. "Primary Standards" to protect health with a margin of safety and for "Secondary Standards" to protect welfare
Primary Standards Primary NAAQS define the acceptable concentration of an air pollutant in the ambient air - necessarily to protect health with adequate margin of safety.
Secondary Standards Secondary NAAQS define the concentration of an air pollutant in the ambient air necessary to protect the "public welfare.
" Effects on welfare includes, but is not limited to, effects on soils, water, crops, vegetation, man-made materials, animals, wildlife, weather, visibility and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well- being, whether caused by transformation, conversion, or combination with other air pollutants
national environmental standards

Minimum National Environmental Standards for industrial wastewater (often referred to as NESs)

National Environmental Standards provide the opportunity for central government to promote the adoption of consistent standards at the regional and district levels.

National environmental standards are regulations which prescribe technical standards, methods or requirement for land use and subdivision, use of the coastal marine area and beds of lakes and rivers, water take and use, discharges, or noise. They can also prescribe technical standards, methods or requirements for monitoring.

Wastewater discharge standards are set (at least) at a national level for centralized treatment systems for salient receiving environments

. The key feature of a water body from a discharge perspective is its assimilative capacity i.e., maximum amount of pollution that can be diluted or degraded without affecting preliminary defined designated best uses.

Effluent discharge standards can be concentration-based or load-based. Concentration-based standards are the most common and specify a permissible mass of pollutant per liter.

A limitation of concentration-based standards can be that it does not promote wastewater treatment, since dilution can be used to meet the discharge standard.

The original standards developed in Britain were concentration-based—although those standards assumed a minimum 8-fold dilution in the receiving water body. Most countries in the Global South have adopted discharge standards from the Global North and they have not been developed for their local context

A national environmental standard may set a minimum standard, allowing councils to impose stricter standards in their own plans, it may set a 'starting point' standard, allowing councils to impose more lenient standards, or it may be absolute, so that local rules cannot be more lenient or stricter than the standard.

National environmental standards may contain qualitative or quantitative standards, discharge standards, methods for classifying a resource, methods, processes or technologies to implement standards, non-technical methods and standards and exemptions from standards.

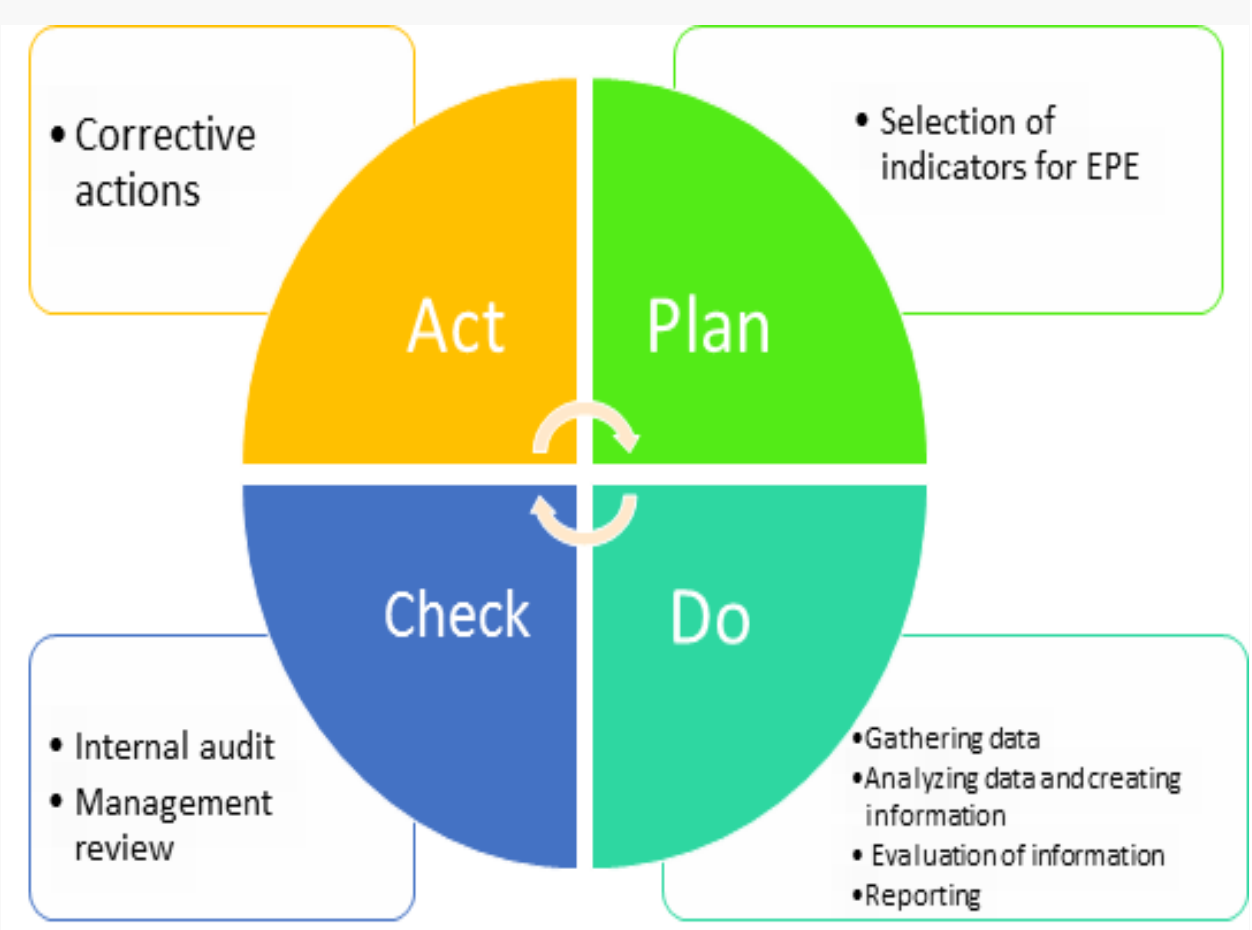
A national environmental standard may:

- Prohibit an activity
- Require resource consent for an activity
- State that a resource consent is not required for an activity
- Allow a resource consent to be granted for an activity only if it complies with conditions specified in the standard and/or in the rules of a regional or district plan
- Restrict the making of a rule or granting of a resource consent
- Require a person to obtain a certificate from a specified person stating the activity complies with a specific term of condition in the national environmental standard
- Specify the relationship between existing rules and the rules in the national environmental standard
- Require the review of a water, coastal or discharge permit
- Determine whether an activity is controlled, restricted discretionary, discretionary or non-complying
- State the matters over which discretion is restricted or control is reserved

- Specify that a resource consent application must be publicly notified or must not be publicly notified or notified on a limited basis.

Environmental performance evaluation

The environmental performance evaluation (EPE) is an internal process and mechanism that should enable continual management of reliable and verifiable information in order to determine whether the environmental management system meets criteria defined by the management of the organization. The EPE uses indicators for gathering the information, and compares current and previous performance with criteria for environmental performance established by the organization itself.



Environmental performance indicators (EPI)

The standard identifies two categories of EPI — operational performance indicators (OPIs) and management performance indicators (MPIs). A third category — environmental condition indicators (ECI) — measures how an organisation's activities, products and services interact with the natural environment at a local, regional, national or global level. ISO 14031 provides guidance on the selection of indicators, the measurement and monitoring processes and the subsequent use of the validated data.

Typical EPIs in the first two categories may include:

- MPIs relate the management system and address:
  - policy issues and development, eg effectiveness of environmental commitments
  - resource allocation and purchasing
  - human resource issues, eg staff training
  - planning and practices, eg which objectives are being pursued and achieved
  - conformance with regulations and audit programmes.
- OPIs relate to performance of operations, including:
  - inputs, eg energy, materials, utilities and contractor services
  - through-puts, eg design, installation, operation and maintenance of buildings, materials used, process equipment and other facilities
  - outputs, eg process emissions, trade effluent, emissions to air, solid and liquid wastes, noise, vibration, light, dust, litter, odour and radiation.

Examples of performance indicator data might include:

- raw materials consumed (including hazardous substances and materials)
- quantities of emissions and discharges that can have a significant impact
- environmental protection measures
- number of polluting incidents or breaches of compliances which attracted fines, damages or increased costs of regulatory inspections
- performance indicators such as waste generated per unit of production or energy consumption. indicators

(ECI) Environmental condition indicators

ECIs are principally about the state of the natural environment that may be affected by an organisation's activities, products and services. This will include local air and water quality and the condition of land or whether the soil is contaminated. Overall responsibility for the state of the environmental rests with those governmental and regulatory agencies responsible for protecting and improving it, hence the need for regulatory controls and statutory monitoring regimes.

ECIs refer to those activities and operations that might interact or have an impact on the quality of the natural environment. A key factor is ensuring that emissions to air, discharges to water and waste, meet regulatory compliance, but an organisation may also carry out operations or activities that interact in other ways and should be included in performance evaluation.

ECIs might include:

- air quality, eg polluting or non-polluting odours that can cause nuisance to local residential areas
- water condition, eg activities that release water causing turbidity in local streams. Equally, are local water resources suitable for operational use? Is there enough water resource for future business needs?

- land, eg are activities likely to degrade soil condition? Equally, are there opportunities for enhancing local biodiversity by planting trees, for example?

By monitoring and measuring EPEs in all three categories described above, organisations can identify those activities over which it has control or influence and set improvement priorities accordingly.

Environmental benchmarking is a business tool that helps companies evaluate their environmental performance and identify operating practices that contribute to superior performance.

Many companies have begun conducting benchmarking studies for the purpose of identifying work processes and practices that influence the environmental performance of their organizations.

Organizations are aware that their operations may have detrimental, mitigating, or even positive impacts on the environment depending upon how the practices are implemented.

The impacts of processes can be quantified and thus used as a statistic to evaluate the organization's

Performance and competitive standing in the industry. For example,there is an increased awareness and interest in the contributions organizations make to climate change and the risks of a variable climate.

The Financial Times FTSE4Good Index, the Dow Jones Sustainability Index, and the Carbon Disclosure Project demonstrate the increased emphasis of investors on organizations' practices related to carbon and its association with climate change.

Although a benchmarking study should be customized with respect to the organization's needs,

The general approach to an environmental benchmarking study is as follows:

- Define criteria for establishing practices as best-in-class;
- Define performance metrics/criteria that address the areas of specific interest and allow for comparison across firms;
- Research industry practices and trends, including collecting and analyzing quantitative and qualitative data on the policies, actions, successes, and failures of industry peers;
- Select individual organizations for study based upon specific criteria that position the organization as leaders in the industry (e.g., environmental indices, sustainability report measures, industry awards);
- Evaluate the overall performance of individual organizations included in the analysis relative to the metrics and develop rankings to identify best-in-class;
- Perform a gap analysis to highlight an organization's strengths and weaknesses relative to the field; and
- Provide targeted recommendations for cutting-edge projects, policies, and initiatives that allow an organization to maximize operational efficiencies, improve environmental quality,

Pollution prevention and pollution control

The Central Pollution Control Board (CPCB) of India is a statutory organization under the Ministry of Environment, Forest and Climate Change (Mo.E.F.C.C.).

It was established in 1974 under the Water (Prevention and Control of pollution) Act, 1974. The CPCB is also entrusted with the powers and functions under the Air (Prevention and Control of Pollution) Act, 1981.

It serves as a field formation and also provides technical services to the Ministry of Environment and Forests under the provisions of the Environment (Protection) Act, 1986.

It Co-ordinates the activities of the State Pollution Control Boards by providing technical assistance and guidance and also resolves disputes among them. It is the apex organization in country in the field of pollution control,as a technical wing of MoEFCC.

The board is led by its Chairperson appointed by the Appointments Committee of the Cabinet of the Government of India The current acting chairman is Shri Tanmay Kumar (August 2021) and the Member Secretary is Dr. Prashant Gargava.and reduce operating costs.polution .

CPCB has its head office in New Delhi, with seven zonal offices and 5 laboratories. The board conducts environmental assessments and research. It is responsible for maintaining national standards under a variety of environmental laws, in consultation with zonal offices, tribal, and local governments.

It has responsibilities to conduct monitoring of water and air quality,[8] and maintains monitoring data. The agency also works with industries and all levels of government in a wide variety of voluntary pollution prevention programs and energy conservation efforts.

It advises the central government to prevent and control water and air pollution. It also advises the Governments of Union Territories on industrial and other sources of water and air pollution. CPCB along with its counterparts the State Pollution Control Boards (SPCBs) are responsible for implementation of legislation relating to prevention and control of environmental pollution.

The board has approximately 500 full-time employees[11] including engineers, scientists, and environmental protection specialists.

Functions of CPCB

Functions of CPCB comes under both national level and as State Boards for the Union Territories. CPCB, under the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981, aims to promote cleanliness of streams and wells in different areas of the States by prevention, control and abatement of water pollution, and to improve the quality of air and to prevent, control or abate air pollution in the country.

- **Air quality/ pollution** : CPCB runs nationwide programs of ambient air quality monitoring known as National Air Quality Monitoring Programme (NAMP). The network consists of 621 operating stations covering 262 cities/towns in 29 states and 5 Union Territories of the country.

Under N.A.M.P., four air pollutants viz., Sulphur Dioxide (SO_2), Oxides of Nitrogen as NO_2, Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM/ PM10) have been identified for regular monitoring at all the locations. The monitoring of meteorological parameters such as wind speed and wind direction, relative humidity (RH) and temperature were also integrated with the monitoring of air quality. This information on Air Quality at ITO is updated every week.

- **Water quality/ pollution :** Fresh water is a finite resource essential for use in agriculture, industry, propagation of wildlife & fisheries and for human existence. India is a riverine country. It has 14 major rivers, 44 medium rivers and 55 minor rivers besides numerous lakes, ponds and wells which are used as primary source of drinking water even without treatment. Most of the rivers being fed by monsoon rains, which is limited to only three months of the year, run dry throughout the rest of the year often carrying wastewater discharges from industries or cities or towns endangering the quality of our scarce water resources. The inland water quality monitoring network is operating under a three-tier program i.e. Global Environment Monitoring System (GEMS), Monitoring of Indian National Aquatic Resources System (MINARS) and Yamuna Action Plan (YAP).
- **Urban area programs** (EcoCity Program) : CPCB programs for urban areas, also known as EcoCity Program comes under X Plan to improve environment through implementation of identified environmental improvement projects in the selected towns and cities. Pilot studies conducted for urban areas by the Centre for Spatial Environmental Planning created at the CPCB under the World Bank funded Environmental Management Capacity Building Project and supported by the GTZ-CPCB Project under the Indo-German Bilateral Program.According to these studies CPCB develop a comprehensive urban improvement system employing practical, innovative and non-conventional solutions. Under the X Plan, a budget provision of Rs. 15 crore has been made for the period 2002–03 to 2006-07 for the Ecocity projects.
- **Municipal Solid Waste rules** : Every municipal authority comes under the Municipal Solid Wastes (Management & Handling) Rules, 2000 (MSW rules, 2000) and responsible for collection, segregation, storage, transportation, processing and disposal of municipal solid. CPCB collects necessary information form municipal authorities and provide them technical assistance.
- **Noise Pollution/ Rules** : According to S.O. 123(E) by MoEFC, various sources like industrial activity, construction activity, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health. CPCB has the responsibility to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards.[26]
- **Environmental Data Statistics** : CPCB manages environmental data statistic in which air quality data and water quality data comes through. In the case of air quality data, it measures the level of SO_2, NO_2, RSPM and SPM.[27][28] CPCB measure and maintains water quality data

as well. Quality level of river and ponds are the major fields which comes under the water quality data criteria

Cleaner production

Cleaner production can reduce operating costs, improve profitability and worker safety, and reduce the environmental impact of the business. Companies are frequently surprised at the cost reductions achievable through the adoption of cleaner production techniques. Frequently, minimal or no capital expenditure is required to achieve worthwhile gains, with fast payback periods. Waste handling and charges, raw material usage and insurance premiums can often be cut, along with potential risks. It is obvious that cleaner production techniques are good business for industry because it will:

- Reduce waste disposal cost.
- Reduce raw material cost.
- Reduce Health Safety Environment (HSE) damage cost.
- Improve public relations/image.
- Improve companies performance.
- Improve the local and international market competitiveness.
- Help comply with environmental protection regulations.
- On a broader scale, cleaner production can help alleviate the serious and increasing problems of air and water pollution, ozone depletion, global warming, landscape degradation, solid and liquid wastes, resource depletion, acidification of the natural and built environment, visual pollution, and reduced bio-diversity.

Clean technology,

In short cleantech, is any process, product, or service that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources, or environmental protection activities. Clean technology includes a broad range of technology related to recycling, renewable energy, information technology, green transportation, electric motors, green chemistry, lighting, grey water, and more. Environmental finance is a method by which new clean technology projects that have proven that they are "additional" or "beyond business as usual" can obtain financing through the generation of carbon credits. A project that is developed with concern for climate change mitigation is also known as a carbon project.

Clean Edge, a clean technology research firm, describes clean technology "a diverse range of products, services, and processes that harness renewable materials and energy sources, dramatically reduce the use of natural resources, and cut or eliminate emissions and wastes." Clean Edge notes that, "Clean technologies are competitive with, if not superior to, their conventional counterparts. Many also offer significant additional benefits, notably their ability to improve the lives of those in both developed and developing countries

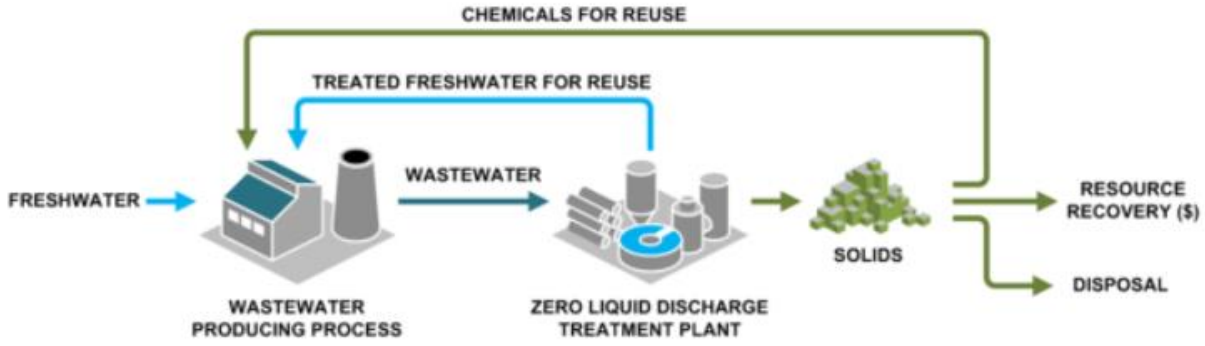
Closed Loop System?

- Businesses use all kinds of terms to prove they're environmentally friendly. "Recyclable," "plant-based," and "energy efficient" all get tossed around a lot — and while most people generally know what those words mean, there's one frequently used phrase that's harder to decipher: closed-loop system.

- When a company says it uses a closed-loop system, it's referring to its supply chain. Under a closed-loop system, businesses reuse the same materials over and over again to create new products for purchase. It's a way to conserve natural resources and divert waste from the landfill, and increasingly, more companies are adopting it.
- The phrase "closed-loop system" is often paired with "circular economy," which is "an industrial system that is restorative and regenerative by intention or design," to use the World Economic Forum's definition. It's helpful to think of literal loops or circles to understand the core concept. Instead of raw materials moving in a straight line from collection, through manufacturing, to purchase (and, once it's broken or used up, the trash can), imagine a loop. The materials are always moving through this loop, never reaching an endpoint
- When a product has served its purpose, it restarts at collection. Someone pares the item back down to scraps, providing "new" raw materials. Then it's manufactured into a finished product yet again, one the consumer can then purchase.
- Think of aluminum cans. When you finish drinking a beverage out of a can, you put it in a recycling bin. Factories salvage the aluminum and make another can that is shipped to a store, where anyone can buy it. The process can be repeated thousands of times.
- Closed-loop systems can be applied to all kinds of industries. Take the beer business. Sierra Nevada has closed the loop in the company's Chico, California facilities, where the beermakers compost waste generated from the brewery into soil used to grow new barley and hops.
- But that's far from the only example. Companies like For Days are fighting the concept of fast fashion with closed loop clothing. When customers sign up for a For Days subscription, they receive a bundle of shirts, ranging from basic tank tops to sweatshirts. Once the clothes are worn down, stained, or torn, subscribers send them back for a new set — derived directly from those used threads.

Zero-liquid Technologies

Zero-liquid discharge (ZLD) is a water treatment process in which all wastewater is purified and recycled; therefore, leaving zero discharge at the end of the treatment cycle. Zero liquid discharge is an advanced wastewater treatment method that includes ultrafiltration, reverse osmosis, evaporation/crystallization, and fractional electrodeionization



Clarifier and or a reactor: Essential step to precipitate out hardness, silica salts and metals

Biological process: Decomposition of organic waste using microbes; according to the COD/BOD ratio, biological processes like activated sludge, Soil biotechnology treatment, Membrane Aerated Biofilm Reactor, Anaerobic Digestion, can be employed

Chemical feed: Precipitation, Flocculation, Disinfection and Coagulation need chemicals as precursors for the removal of metals and other suspended solids.

Filter: Concentration of secondary solid waste can be done after pretreatment alongside with an evaporator

Filtration: It is essential for the removal of suspended solids according to the size of the particles and helps prevent fouling, scaling and unnecessary eroding or corrosion down the line of treatment. Filtration includes Microfiltration, Ultrafiltration, Nano-filtration.

Reverse osmosis: Removes dissolved stubborn solids from the stream from the primary and secondary stages of concentration

Brine concentration: Further concentration of the stream occurs, helps in reduction of the waste volume

Evaporator: Final stage of concentrating the liquid counterpart of the stream before crystallization.

Crystallizer: Presents the dry solid waste cake which can be readily disposed off, it is devoid of any liquid

Ultra-filtration : . It is used for the separation of suspended solids, colloidal particles, and large size microorganisms from the liquid effluent.

MODULE 3

An Environmental Management System (EMS) is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency.

Basic Elements of an EMS include the following:

Reviewing the organization's environmental goals;

Analyzing its environmental impacts and compliance obligations (or legal and other requirements);

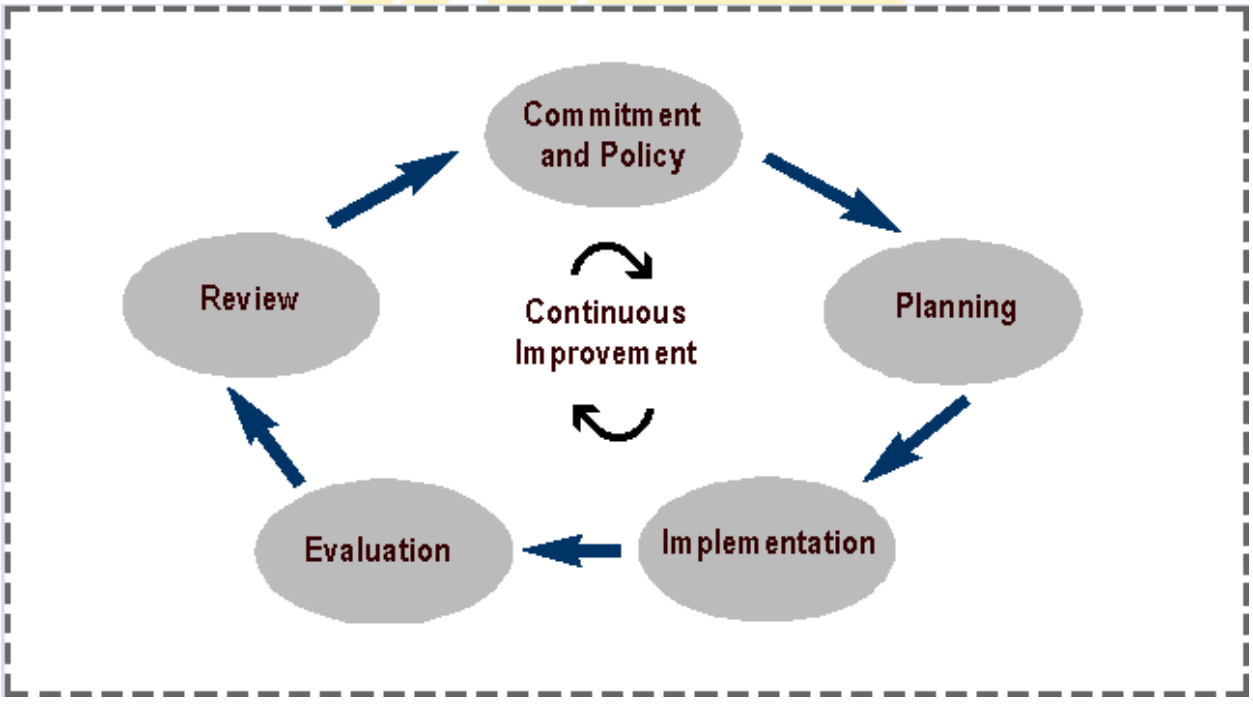
Setting environmental objectives and targets to reduce environmental impacts and conform with compliance obligations;

Establishing programs to meet these objectives and targets;

Monitoring and measuring progress in achieving the objectives;

Ensuring employees' environmental awareness and competence; and,

Reviewing progress of the EMS and achieving improvements



The five main stages of an EMS, as defined by the ISO 14001 standard

1. Commitment and Policy - Top management commits to environmental improvement and establishes the organization's environmental policy. The policy is the foundation of the EMS.

2. Planning - An organization first identifies environmental aspects of its operations. Environmental aspects are those items, such as air pollutants or hazardous waste, that can have negative impacts on people and/or the environment.

3. Implementation - A organization follows through with the action plan using the necessary resources (human, financial, etc.). An important component is employee training and awareness for all employees (including interns, contractors, etc.

4. Evaluation - A company monitors its operations to evaluate whether objectives and targets are being met. If not, the company takes corrective action.

5. Review - Top management reviews the results of the evaluation to see if the EMS is working. Management determines whether the original environmental policy is consistent with the organization's values.

Top 10 Components in a Successful Environmental Management System

For maximum environmental and economic benefits from an environmental management system and to help comply with the EMS requirement under the Toxics Use & Hazardous Waste Reduction law, a business should include the following 10 components in its system. These components can apply to many different EMS models, including ISO 14001. Use this checklist to be sure your system includes all 10 and keep it on site.

1. **Environmental Policy**
   - Reflects how the organization feels about the environment
   - Identifies environmental impacts of processes and products
   - Ensures compliance with environmental requirements
   - Commits organization to prevent pollution, reduce environmental risks and share information with external stakeholders
2. **Environmental Requirements and Voluntary Initiatives**
   - Employees understand their roles in meeting environmental requirements
   - Identify management and manufacturing practices that affect the organization's ability to meet requirements
   - Identify and work with programs that encourage preventing pollution
3. **Objectives/Targets**
   - Set the following environmental objectives: comply with environmental requirements; continuous improvement in regulated and non-regulated areas; prevent pollution
   - Make objectives specific to the organization Set timeframes to meet objectives
   - Update objectives as environmental requirements evolve
4. **Structure, Responsibility and Resources**
   - Ensure the organization has the personnel and resources needed to meet objectives
   - Make managers responsible for the environmental performance of their unit
   - Develop procedures for attaining objectives
5. **Operational Control**
   - Establish a procedure to ensure the proper waste management hierarchy is followed
   - Develop simple procedures to measure and report environmental impacts of processes and products
6. **Corrective and Preventive Action and Emergency Procedures**
   - Document procedures for identifying, correcting and preventing mistakes
   - Develop emergency procedures to minimize or eliminate adverse environmental impacts associated with accidents or emergencies
   - Correct causes of potential hazards to prevent pollution
7. **Training, Awareness and Competence**
   - Train staff whose roles affect meeting objectives, and make certain staff are capable of carrying out required duties
   - Mandatory trainings include detailed pollution prevention methods
8. **Organizational Decision-making and Planning**
   - Use life-cycle analysis to identify the impact products make on the environment
   - Empower all employees to make pollution prevention improvements that do not require significant resources

9. Document Control

- For future evaluation, document steps taken to meet objectives Use electronic documentation to improve record management
- Document all pollution prevention suggestions

10. Continuous Evaluation and Improvement

- Conduct and document periodic objective-based audits of the organization's performance
- Use audits to assess pollution prevention efforts

WHAT IS EMAS?

The EU Eco-Management and Audit Scheme (EMAS) is a premium management instrument developed by the European Commission for companies and other organisations to evaluate, report, and improve their environmental performance. EMAS is open to every type of organisation eager to improve its environmental performance. It spans all economic and service sectors and is applicable worldwide.

ISO 14000 is a family of standards related to environmental management that exists to help organizations

(a) minimize how their operations (processes, etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land);

(b) comply with applicable laws, regulations, and other environmentally oriented requirements;

(c) continually improve in the above

ISO 14001 standard provides a systematic framework for integrating environmental management practices by supporting environmental protection, pollution prevention, waste minimisation, as well as energy and materials consumption reduction.

Contents of International Standard 14001

This International Standard conforms to ISO's requirements for management system standards. These requirements include a high level structure, identical core text, and common terms with core definitions, designed to benefit users implementing multiple ISO management system standards.

This International Standard does not include requirements specific to other management systems, such as those for quality, occupational health and safety, energy or financial management. However, this International Standard enables an organization to use a common approach and risk-based thinking to integrate its environmental management system with the requirements of other management systems.

This International Standard contains the requirements used to assess conformity. An organization that wishes to demonstrate conformity with this International Standard can do so by:

- making a self-determination and self-declaration, or
- seeking confirmation of its conformance by parties having an interest in the organization, such as customers, or
- seeking confirmation of its self-declaration by a party external to the organization, or
- seeking certification/registration of its environmental management system by an external organization.

WHAT ARE THE BENEFITS OF AN ISO 14001 CERTIFICATION?

Organisations certified to ISO 14001 demonstrate their commitment to continuous improvement and reduced environmental impact

The certificate can significantly improve your bargaining position when taking part in public and private green procurement tenders. As consumers are becoming increasingly aware of environmental and ecological issues, ISO 14001 certification helps your brand stand out as a responsible provider

Companies that implement the ISO 14001 EMS aim to minimize wastage, from materials to energy consumption, throughout the supply chain and can thereby reduce cost

Potential Benefits

Improved environmental performance

Enhanced compliance

Pollution prevention

Resource conservation

New customers/markets

Increased efficiency/reduced costs

Enhanced employee morale

Enhanced image with public, regulators, lenders, investors

Employee awareness of environmental issues and responsibilities

Barriers associated with EMS's In 1999, the Department of Enterprise, Trade and Employment stated that the majority of companies accredited to ISO 14001 in Ireland at that time were large indigenous organisations or the subsidiaries of large multi-national corporations. Many of these certified companies are now examining the environmental performance of their downstream suppliers, many of them Small Medium Enterprises (SME's), and ultimately may require them to

become certified to ISO 14001. In many cases the SMEs themselves are anxious to demonstrate environmental probity by adopting and implementing environmental management system standards, but are reluctant to do so for the following reasons

• Fear o f the unknown

• Lack o f resources

• Lack o f technical expertise

• More pressing business imperatives

• Lack of direction

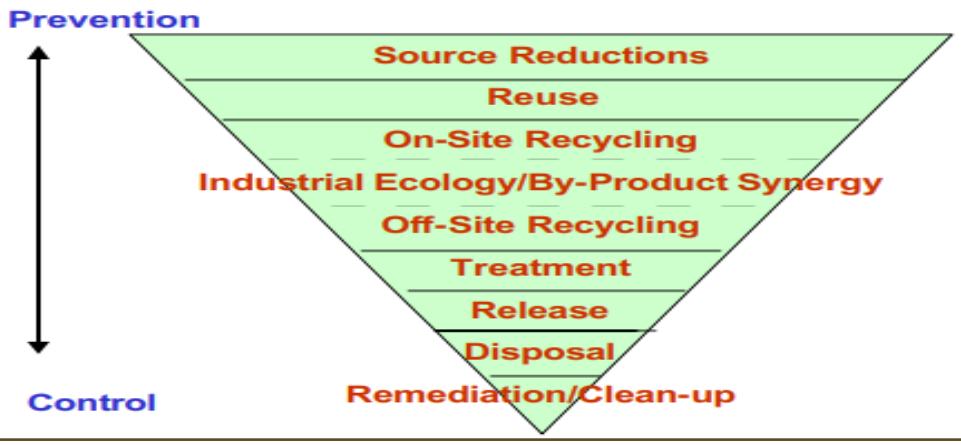
• Fear o f failure.

What is Pollution Prevention and Continuous Improvement? Definitions Pollution prevention is generally defined as "the use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants or wastes at the source."

1 The strategic planning framework identifies an opportunity to "continuously improve air quality by minimizing the use of polluting processes, practices, materials and products,

"2 which is the broad definition used by the project team in its work.

Figure 1. Pollution Prevention Environmental Management Hierarchy



Pollution prevention techniques and practices focus on:

- Substances of concern
- Materials and feedstock substitution

- Operating efficiencies
- On-site reuse and recycling
- Training
- Purchasing practices
- Product design
- Equipment modifications
- Product reformulation
- Process changes
- Clean production
- Avoidance of cross-media transfer of pollutants or waste
- Life-cycle assessment

Examples of Pollution Prevention Techniques and Practices Materials and feedstock substitution is a method of source elimination. Polluting materials in a production process or embedded in a product are replaced with less polluting or nonpolluting substances. Opportunities for materials and feedstock substitution include:

- Painting applications
- Parts cleaning
- Metal finishing
- Printing operations
- Building and grounds maintenance
- Operating efficiencies and training are examples of how normal parts of good operation can provide effective ways to prevent pollution. Examples include:
- Changing production schedules to minimize equipment and feedstock changeovers
- Improving maintenance schedules
- Segregating by-products at the source
- Training staff to improve material handling and recognize P2 opportunities

Product design and reformulation includes methods for preventing pollution associated with the entire life cycle. Addressing environmental concerns at an early stage can avoid environmental impacts throughout the product life cycle in a cost-effective manner. Results of redesigning or reformulating a product include:

- Reducing toxicity of a product
- Reducing waste material
- Extending the life of a product
- Extending the life of the materials used
- Reducing energy and material intensity needed to produce, use and dispose of the product

Equipment modifications and process changes involve new technologies or approaches to existing operating systems processes and practices to improve production efficiencies and reduce pollution and waste. An example is mechanical stripping instead of using solvents to remove paint and varnish

The Value of Waste Waste can also be viewed as a loss of valuable process materials that could have economic and environmental benefits if reused or recycled. The following approaches reflect this perspective on the value of waste

On-site reuse and recycling is considered pollution prevention because it occurs at the same place as the original activity.4 Reuse means using materials again in their original form or in new applications. Recycling extends the effective life of resources. Environmentally sound recycling is usually preferable to end-of-pipe solutions. Raw materials, chemicals and treated and untreated wastewater are examples of materials that could be reused or recycled. Some examples of reuse and recycling are:

• Recovering metals by ion exchange or reverse osmosis

• Recycling cooling water

• Reusing trim and cuttings from plastic moulding in on-site production rather than taking them for off-site disposal

Environmental policy is the commitment of an organization or government to the laws, regulations, and other policy mechanisms concerning environmental issues.

These issues generally include air and water pollution, waste management, ecosystem management, maintenance of biodiversity,the management of .natural resources, wildlife and endangered species[1]

For example, concerning environmental policy, the implementation of an eco-energy-oriented policy at a global level to address the issues of global warming and climate changes could be addressed.[2]

Policies concerning energy or regulationof toxic substances including pesticides and many types of industrial waste are part of the topic of environmental policy. This policy can be deliberately taken to influence human activities and thereby prevent undesirable effects on the biophysical environment and natural resources, as well as to make sure that changes in the environment do not have unacceptable effects on humans.[3]

the first step in creating an EMS is to perform an Initial Environmental Review. This tells you where you are and creates a road map for your organization. There are four main areas:

- Review previous environmental issues.
- Consider any regulations which have operational impact.
- Identify and evaluate possible environmental issues in your organization.
- Outline current operations and how are they managed; also consider indirect impacts.

What is an initial environmental review?

The IER is the first step in the implementation of an EMS - where a business considers all the factors affecting its 'relationship' with the environment. It should form the baseline and foundation for the other parts of your EMS.

Your IER should enable you to:

- Identify how existing site operations have an environmental impact - eg the impact of normal operating conditions, abnormal conditions and emergency situations
- Establish which of these impacts are significant and need improvement by setting objectives and targets
- Identify breaches or potential breaches of environmental legislation
- Identify relevant EMS documentation which needs to be put in place
- Quantify emissions, discharges, and material and utility use
- Identify opportunities for improving performance and minimising waste
- Evaluate previous emergency situations and accidents
- Develop your environmental policy

Environmental Aspects According to of ISO 14001:2004, an environmental aspect is any "element of an organization's activity, products or services that can interact with the environment." Goetsch & Davis (2001) state: In simple terms an environmental aspect is anything resulting from the organization's activities, products or services that has the potential to cause an environmental

impact, even if it is presently controlled, or prevent such impact. The fact that the potential exists (if something goes wrong, for instance) makes it an environmental aspect (p. 18). An environmental aspect can be either negative or positive. Negative aspects include emissions to the air or water, discharge of oil to the land or water, generation of hazardous waste, generation of solid waste, community impact, and the generation of dust and noise. Positive aspects include recycling of used materials such as steel, aluminum, copper, glass bottles and paper, removal of pollutants from the air or water, and restoring land by removing decontaminated soil.

Environmental Impact

In cause and effect, if one considers an environmental aspect to be the cause, then the environmental impact is the effect. An environmental impact is any change to the environment, whether adverse or beneficial, wholly or partially resulting from the organization's activities, products or services. Essentially, the environmental impact is the result of the environmental aspect. For example, suppose a company is discharging wastewater to a nearby stream. A potential environmental impact of that activity is pollution to the water

What are Legal Requirements?

Relevant national, regional, and local laws and regulations

Government operating permits, licences, and approvals

Relevant international standards and conventions

Contracts and other documents that include legal obligations

Examples of "Other Requirements"

Industry codes of practice

Non-regulatory standards (e.g., ISO 14001)

Agreements with public authorities

Company policies and procedures

Voluntary compliance agreements (e.g., possible future commitment by MRC members to ISO adoption)

What is an Objective? What is a Target?

Environmental objectives are goals that you would like to meet in the future.

Targets are the means for providing verifiable evidence that you have actually met the objective. For example, your environmental objective may be to reduce the generation of hazardous wastes. Your may then set your target at 20 percent reduction within 12 months. In the parlance of iso 14001,

Objectives are "documents" whereas targets are "records." Documents can be modified while records cannot. For example, you can modify your objectives, but you cannot change having missed your targets.

In setting your targets, make sure you are not overly ambitious—especially during the first year of implementation. Set a target that is realistic and reasonably easy to achieve in the first year.

You don't want your organization to fail the first time it tries to meet an environmental target. Failure can be very demoralizing to your team members.

It is much better to set an achievable target and meet it the first year and then set progressively more aggressive targets in following years.

Remember that the fundamental basis of an effective environmental management program consists of top-down support and bottom-up involvement.

Always get senior management to buy in on the objectives and targets, and make sure you communicate the objectives clearly to the employees. After all, the employees are the ones who are going to make it happen.

Programs:

Environmental management programs support the NIEHS Environmental Policy and the overall goal of reducing negative environmental impacts. These programs were established to assure compliance with federal, state, and local environmental regulations. Each program includes specific requirements that are documented in the NIEHS EMS Manual as well as a corresponding written plan, procedure, or instruction

1. **Air Emissions**

   This program includes performance standards for the boilers, emergency generators and incinerators located on the NIEHS Campus. This program also encourages and supports alternative transportation including bus, carpool, and telework options.

2.Energy Management

This program seeks to reduce electricity consumption associated with NIEHS laboratory, utility, office, and outdoor operations and support HHS/NIH agency wide efforts to reduce campus building energy intensity and increase usage of renewable energy.

3.Green Purchasing

This program encourages the purchase of recycled content materials, energy-efficient equipment, alternative fueled vehicles, bio-based products, environmentally preferable products, and non-ozone depleting substances.

4.Hazardous Materials Management

The program provides criteria for the safe and environmentally sound storage, handling, transportation and disposition of hazardous materials used in laboratory research, support and maintenance operations, and construction activities.

5.Pesticides

This program follows integrated pest management (IPM) principles when controlling pests in the animal facilities, inside campus buildings, and on campus grounds through limited pesticide application in a manner that is effective yet safe for the environment, personnel, and research activities.

6.Solid Waste Management

This program insures that solid wastes are identified, classified, collected, transported, stored, recycled, treated and/or disposed safely and in a manner protective of human health and the environment. Maximization of the quantity of material diverted from the landfill, either by recycling, reuse, or reduction in quantities used, is a primary objective.

7.Storm water Management

This program focuses on reducing the potential for outdoor petroleum and chemical spills, and minimizing the impact of construction projects on the stormwater conveyance system.

8.Wastewater

This program reduces the potential for pollutants to enter the sanitary sewer system through effective pretreatment, source reduction, proper chemical disposal, and other wastewater management programs.

9.Water Consumption

This program seeks to reduce water consumption associated with NIEHS laboratory, utility, facility, and domestic operations.

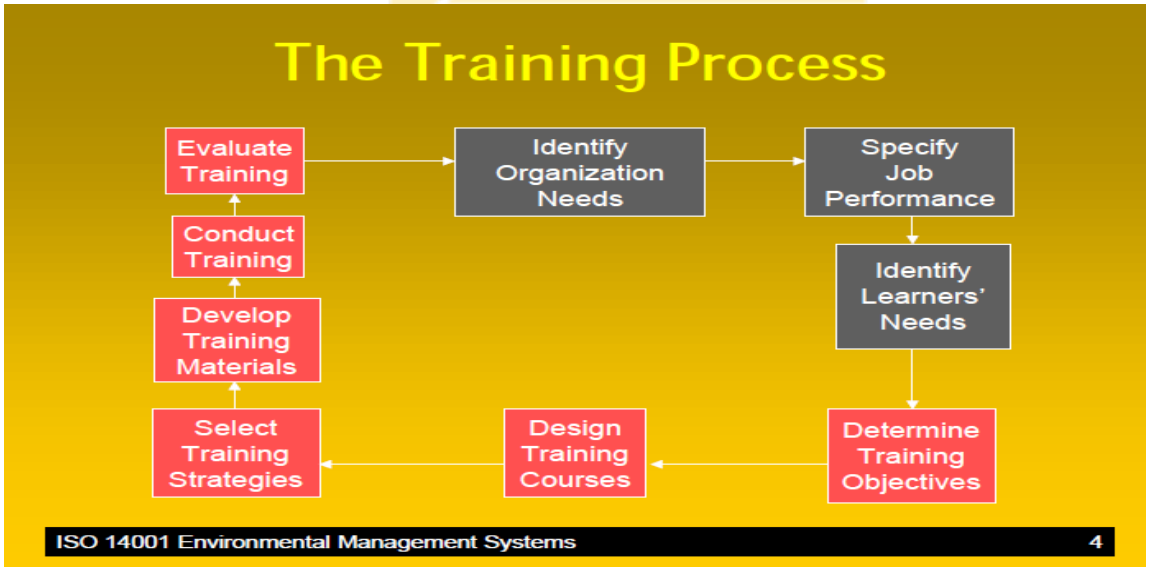
STRUCTURE AND RESPONSIBILITY

Organizational structure outlines the hierarchy and reporting relationships between various functions and levels in an organization. Duties at each level of responsibility and functional area may be summarized in a more detailed organization chart

Management's Responsibilities Top management has the responsibility to:

- Define the environmental policy for the organization
- Lead by example in their commitments to continual improvement, prevention of pollution, and compliance with relevant environmental legislation and regulations
- Authorize adequate resources to implement and maintain the EMS
- Reward good performance in the EMS
- Conduct regular management reviews of the EMS
- Integrate environmental management principles and practices into the organizational culture.

Awareness and Competence



Awareness

- People accept responsibility more readily if they understand why their actions are important
- People become self-motivated, so less reinforcement by management is required
- Emphasizes that environmental protection is everyone's responsibility
- Helps to generate commitment by employees

Competence

- The application of knowledge, understanding, judgments, and skill to consistently carry out an activity effectively and efficiently to a pre-set standard
- The objective of training should be to develop competence, or the means to attain competence

ISO 14001 REQUIREMENTS FOR INTERNAL AND EXTERNAL COMMUNICATION Effective

- communication is an essential foundation of an EMS. Communicating relevant information about the EMS means sharing the power for implementing, maintaining, and improving the EMS.
- Informed and knowledgeable employees can be active participants in the EMS. Conversely, when communications are inadequate and information is missing, an EMS is weakened

Internal Communication ISO 14001 mandates that there be clearly-defined procedures for communicating about the EMS within and between the various levels of responsibility, and within and between different functions (i.e., departments, areas of operation) in the organization. There are many basic reasons for such communications; for example:

Some specific and practical requirements for internal communications in ISO 14001 are:

- Environmental policy ·
- Legal and other requirements
- Significant environmental aspects and impacts
- Environmental objectives and targets
- Changes to activities, products, or services that affect environmental management programs
- Roles and responsibilities in the EMS
- Training, awareness, and competence requirements
- Operating and document control procedures that may affect the environment

- Emergency preparedness and response actions
- Requirements for, and results of, monitoring and measurement
- Environmental incidents
- Non-compliance with laws and regulations
- Non-conformance with the requirements of the EMS
- Corrective and preventive actions and follow-up to ensure effectiveness
- Results of environmental audits
- Information on the EMS to top management
- Results of management reviews of the EMS
- Effectiveness of the EMS.

Communication with External Interested Parties

- According to ISO 14001, an organization must be open to receiving communications about their EMS, or environmental issues in general, from individuals, groups, agencies, and other organizations outside itself.
- All such communications should be documented (i.e., written down), recorded (i.e., filed for future reference), and responded to promptly and appropriately.
- External interested parties with whom communication is possible include:
- Individuals
- Ethnic tribes
- National, regional/provincial, and local government and community officials
- Local fishers, farmers, loggers, foresters·
- Customers of the organization ·
- Suppliers of equipment, materials, and services to the organization ·
- Public interest groups
- Tourism representatives, tourists, recreation interests, property and land owners
- Business associations ·
- Environmental and other non government organizations (NGO)
- University, college, and school students and teachers
- Community associations
- Representatives of the news media – television, newspapers, radio

Definitions of document

- Under ISO 14001, documentation refers to all written material concerning the EMS
- Documents include policies, procedures, manuals, plans, diagrams, flowcharts, correspondence, memoranda related to the EMS
- Records are documents, but under ISO 14001 are distinguished from documentation: » Documentation concerns what should happen
- Records contain information on what has happened

Documents

- ISO 14001 Standard specifications do not require extensive documentation ! A management system needs consistent procedures
- Documentation (i.e., written information) aids consistent application of procedures
- To ensure systematic use of documented procedures, they must be controlled Here is how ISO 14001 deals with the issue

  ISO 14001 Document Control says: The organization shall establish and maintain procedures for controlling all documents required by this International Standard to ensure that:

  (a) they can be located

  (b) they are periodically reviewed, revised as necessary, and approved for adequacy by authorized personnel ISO 14001 Environmental Management Systems

  (c) the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the EMS are performed

  (d) obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use

  (e) any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified ISO 14001 D
- Documentation shall be legible, dated (i.e., with dates of revision), and readily identifiable, maintained in an orderly manner and retained for a specified period. Procedures and responsibilities shall be established and maintained concerning the creation and modification of the various types of document.

How to Control Documents

Use a standard format for procedures Include:

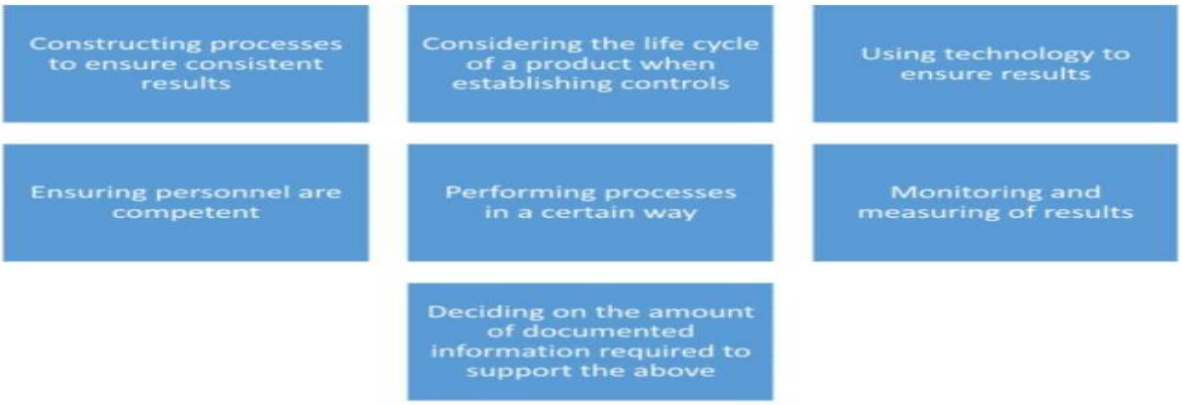
- Title, author/originator
- Organization, department, function
- Purpose, scope, definitions
- Procedure, persons responsible
- Records, forms, related documents, references » authorized approval signature
- Initial date, and dates of revisions
- Identify all printed copies as ‘uncontrolled’
- Store controlled versions of documents electronically (e.g., networked computer files)
- On-line ‘read only’ access by employees
- Changes to documents made only by authorized personnel - restricted access
- Schedule regular review and revision of procedures
- Notify all relevant personnel when a procedure is changed
- Keep a register of paper copies of key documents held by individuals
- Educate personnel about document controls

Definition and implementation of operational controls

The standard states that the methods defined to ensure **operational control** will be dependent on the organization's activities, legal obligations, and significant operational controls.

Therefore, an organization must decide how to construct and combine processes to ensure that total operational control of its environmental aspects is achieved. These methods of defining and implementing controls may include

- Constructing processes to ensure consistent results
- Considering the life cycle of a product when establishing controls
- Using technology to ensure results
- Ensuring personnel are competent
- Performing processes in a certain way
- Monitoring and measuring of results
- Deciding on the amount of documented information required to support the above



Methods of defining and implementing ISO 14001 operational controls

Monitoring and Measurement

- The organization must monitor, measure, analyze and evaluate its environmental performance.
- It must determine what needs to be monitored and measured and as applicable the methods for monitoring, measurement, analysis, and evaluation to ensure valid results.
- It must determine the criteria against which environmental' performance and its appropriate indicators will be evaluated.
- It must also determine when the monitoring and measuring shall be performed and when the results from monitoring and measurement will be analyzed and evaluated.

- The organization must ensure that calibrated or verified monitoring and measurement equipment is used and maintained, as appropriate.

The organization must also evaluate its environmental performance and the effectiveness of the environmental management system

When determining what should be monitored and measured, In addition to progress on environmental objectives, the organization should take into account its significant environmental aspects, compliance obligations, and operational controls.

The methods used by the organization to monitor and measure, analyze and evaluate should be defined in the environmental management system, in order to ensure that:

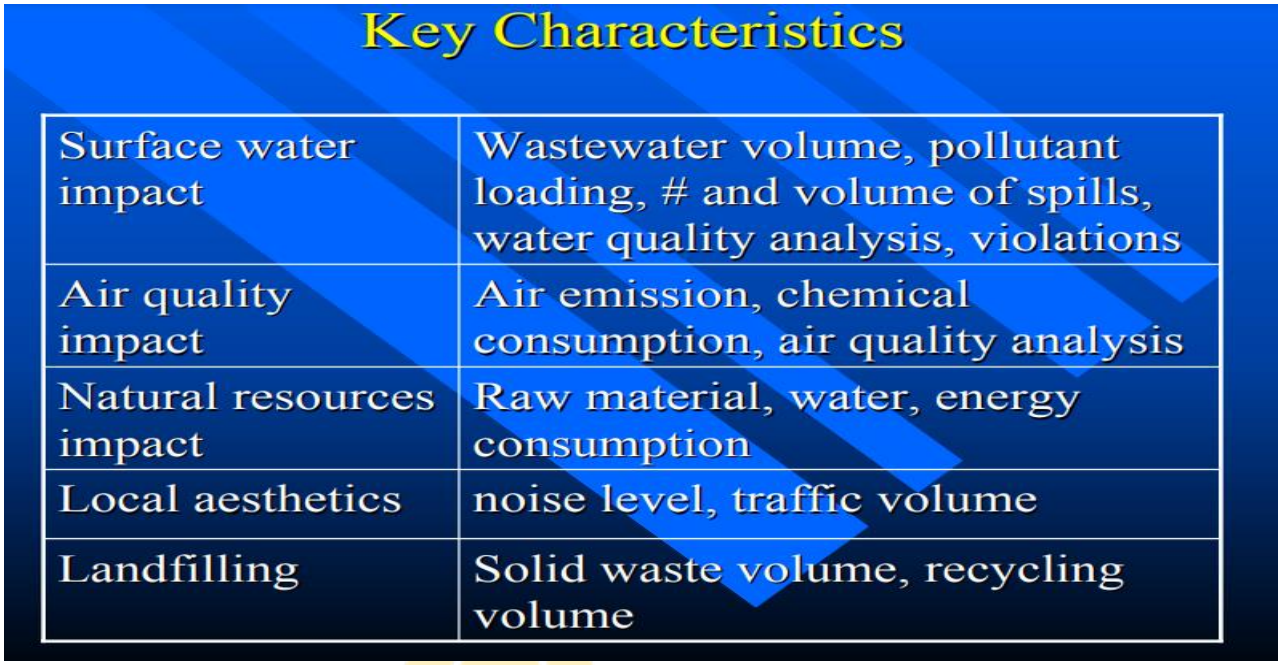
- The timing of monitoring and measurement is coordinated with the need for analysis and evaluation results;
- The results of monitoring and measurement are reliable, reproducible and traceable;
- The analysis and evaluation are reliable and reproducible and enable the organization to report trends.

Monitoring and measurement help you:

- Evaluate environmental performance;
- Analyze the root causes of problems;
- Assess compliance with legal requirements;
- Identify areas requiring corrective action, and,

Improve performance and increase efficiency. In short, monitoring and measurement help you manage your organization better. The results of pollution prevention and other efforts are easier to demonstrate when current and reliable data are available. These data can help you demonstrate the value of the EMS to top management. Your organization should develop means to:

- Monitor key characteristics of operations and activities that can have significant environmental impacts and/or compliance consequences;
- Track performance (including your progress in achieving objectives and targets);
- Calibrate and maintain monitoring equipment; and,
- Through internal audits, periodically evaluate your compliance with applicable laws and regulations.



Review and improve your environmental management system (EMS)

Carry out an EMS management review

Guide

A management review is the final element of the environmental management system (EMS) process. It involves a formal evaluation of the adequacy of your business' EMS - taking into account any new environmental issues, legislation, changing circumstances and continual improvement.

Management review meetings should be attended by individuals with either executive or specialist responsibility, for example:

- the site director
- the management representative
- line managers with specific environmental responsibilities

In these meetings, the management representative should give the results of any recent audits to senior management and present a written report detailing audit findings.

The management review should cover:

- Environmental performance and progress in achieving objectives and targets
- Compliance with legislation

- Results of internal audits and reports
- Actions required as a result of non-conformances
- New processes and any changes to known environmental issues

Any changes in circumstances - for example changes in legislation or new technology

- The effectiveness of training
- The need for any revisions to your environmental policy, objectives and targets
- Follow-up actions from previous management reviews

Important questions and tutorial questions

1.Define environmental policy,write the benefits of developing environmental policy.

2.what is initial environmental review? Give its benefits

3. Explain Emission and ambient Standards

4.. Explain environmental management programs

5.Explain EMS and EMAS

6.Explain or Mention the contents of ISO 14001

7.Explain Effluent and stream standards

8. with a neat sketch,explain the components of EMS.

9. Explain objectives and targets.

10. Explain Environmental aspects and impct analysis

11. With a neat sketch of pollution prevention hierarchy ,explain pollution prevention techniques.

12.Explain structure and responsibility

MODULE 4

ENVIRONMENT AUDIT

- ISO 19011 is defined as the standard that sets forth guidelines for auditing management systems. The standard contains guidance on managing an audit program, the principles of auditing, and the evaluation of individuals responsible for managing the audit programs. An audit program consists of the arrangements made to complete all of the individual audits needed to achieve a specific purpose

- ISO 19011:2018 provides valuable information on how to improve an audit program systematically, just as other departments in an organization are expected to improve. One aspect of such improvement is continuously ensuring the audit program objectives are in line with the management system policies and objectives. Organizations, in pushing for auditing improvements, should consider the needs of customers and other interested partie

ISO 19011 offers guidance on every step of auditing a management system or audit program, including:

- **Defining program objectives**

Ensuring you understand the specific objectives you hope to achieve

Making audit arrangements

Assigning roles and responsibilities

Defining number, scope, location, and duration of audits

Determining criteria and specific checklists

Establishing review procedures

- **Completing the audits needed**

Planning and reviewing internal documents

Collecting and verifying audit evidence

Generating findings and preparing reports

Communicating findings

- **Reviewing the results and process**

Assessing results and trends

Conforming with audit program procedures

Evolving needs and expectations of interested parties

Analyzing audit program records

Examining effectiveness of the measures to address risks

Ensuring confidentiality and information security

What are the Requirements to become an Environmental Auditor?

An environmental auditor needs several years of experience in environmental compliance or a bachelor's degree in one of the following:

Environmental Science

Environmental Management

Natural Resource Management

Environmental Engineering

Environmental Assessment

- Professional certification as a Certified Environmental Auditor[SM] is available from the National Registry of Environmental Professions.

- Applicable certifications include:

Environmental Professional – Compliance Environmental Auditor (EPCEA)

Environmental Professional – Environmental Management Systems Auditor (EPEMSA)

Certified Environmental Auditor(CEA)

- Additional Education for Environmental Auditors

While you can begin a career as an environmental auditor with a bachelor's degree or experience in a related field, some employers may require a master's degree and/or certification to be considered for the position. Certification or a master's degree can also be beneficial to advancing into senior level or management positions in the field.

Typical Job Duties of Environmental Auditors

- As an environmental auditor, you will be responsible for the regular auditing of all environmental policies and procedures. This involves working with an audit team and with staff to get a good picture of how environmental compliance is being handled. You will be responsible for:
- Selecting and managing the audit team
- Reviewing the operations of the business being audited and determining how environmental issues are being handled
- Gathering data on the business operations through on-site inspections, document reviews, staff interviews, and other methods
- Check business records for governmental permits and requirements, safety standards, maintenance, and inventory control measures
- Review emergency preparedness and response procedures
- Review management systems, environmental monitoring programs and waste management efforts
- Review employee training procedures and programs and the work environment for compliance with government and corporate standards
- Write and compile final audit reports including results of the audit and recommendations for changes and improvement
- Present the audit findings to the business managers and directors
- Assist in the development of an environmental management plan
- Follow up at a future time to ensure improvements and recommendations have been successfully implemented

Different types of ISO audit

ISO 19011 is a standard designed to help companies perform audits.

When it comes to ISO standards, there are two main different types of audit:

- Internal audits (first-party)
- External audits (second-party and third-party)

First-party This is simply an **internal audit.**

- Internal audits are conducted by (or on behalf of) the organization itself. These audits are typically in the context of assessing conformity, evaluating effectiveness, identifying areas that could be improved, or as requirements for certain ISO standards specifying that internal audits need to be carried out.
- First-party audits may also be done as a preparation for a 3rd party audit; however, first party audits can never result in an ISO certification.

Second-party

- External audits encompass both second and third-party audits.
- Second-party audits are conducted by, or at the request of relevant interested parties outside of the organization, like customers or contracted organizations on behalf of a customer.

- For example, a client and vendor have a contract, and goods or services are being exchanged. Typically, second-party audits will be more formal than first-party, because they will influence the relations with customers or other relevant interested parties.

Third-party

- Third party audits are done by independent organizations that have no vested or conflict of interest in the organization being audited, like those that provide certification, or government agencies.
- Independence of the audit organization is one of the defining factors of a third-party audit.
- Customers can also request third-party audits, and this will usually be in order to verify you conform to some specific requirements.
- Only third-party audits can be used to get ISO certified. Third-party audits may also result in other types of registration, recognition, or licensing.

Equally, failing a third-party audit might also result in a fine or citation

Principles of international standard organization

1.Integrity: The foundation of professionalism

- Auditors and audit programme managers should perform their work ethically, in an honest and responsible manner, and using their best judgement should:
- Undertake audit activities only if competent to do so
- Perform work in a fair and unbiased manner
- Remain sensitive to influences exerted upon their judgement while carrying out audits

2.Fair presentation: the obligation to report truthfully and accurately

- All audit findings, including documented evidence, conclusions and written reports should reflect truthfully and accurately the activities of the audit.
- This includes any obstacles, disagreements with other auditors, or difficulties faced during the audit. Everything must be adequately documented.
- It goes without saying that all communication, not just documented and reported information, should be truthful, timely, rational, clear, and complete.

3.Due professional care: Diligence and judgement in auditing

- Auditors should exercise due professional care in all tasks performed during the audit, in accordance with the confidence placed in them by the auditee and in recognition of the importance of the task they are performing.
- One of the most important requirements of this principle is that auditors have the ability to make reasoned judgements in all situations during the audit.

4.Confidentiality: Security of information

- Auditors should respect the confidentiality of all information they're dealing with throughout the audit.
- This means exercising due diligence in making sure all information acquired during the course of their duties as auditors is respected and adequately protected.
- Making sure information is secure includes taking special precautions where necessary, such as handling sensitive or confidential information.

5.Independence: Audit impartiality and objectivity

- Audits, by nature, should be independent of the activity being audited, to the furthest extent possible. They should not interfere with the activity, nor should they hold any bias or conflict of interest.
- If possible, internal audits should preferably be independent from the function being audited.

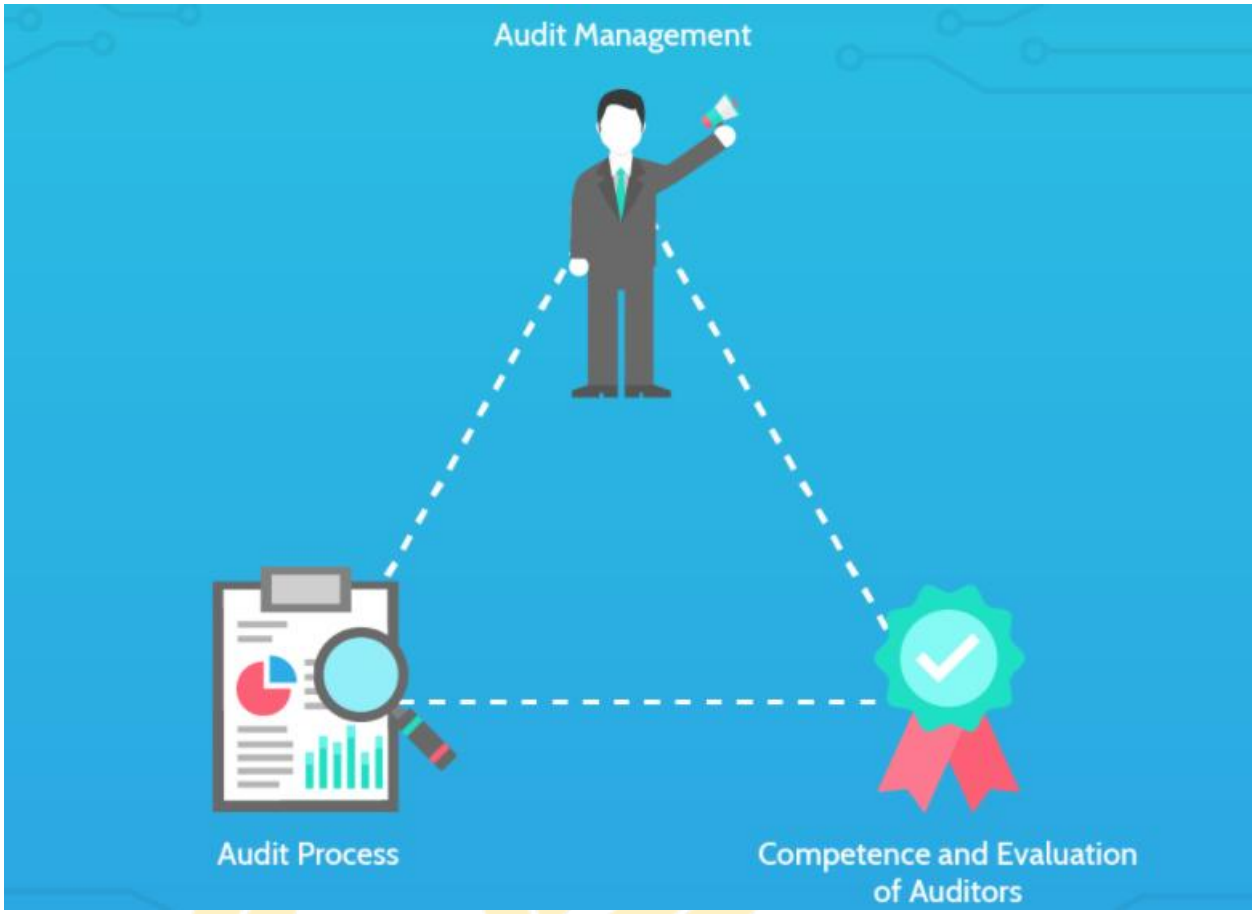
- Key to all audits is the pursuit of objectivity via rational process, to make sure all findings and results from the audit are based only on audit evidence.
- Smaller organizations may find it difficult to enlist truly independent auditors; as such every effort should be made to eliminate bias and encourage the pursuit of rational objectivity.

6.Evidence-based approach: Rational, reliable, reproducible results

- Evidence is one of the pillars of a successful audit, and the foundation of rational, reliable, reproducible results.
- Audit evidence should be based on samples of available information, in acknowledgement of the fact that audits are conducted within limited periods of time, with limited resources.
- Collection of audit evidence is based on a formalized process known as audit sampling.
- Setting clear sampling objectives
- Determining how much of, and what will be sampled
- Selecting a sampling method
- Deciding on a sample size
- Carrying out the sampling
- Documenting and reporting all results

7.Risk-based approach: Considering risks and opportunities

- Risk management is a substantial factor when planning for, conducting, and documenting an audit.
- The goal of a risk-based approach is simply to orient the audits more clearly towards matters that are important for audit clients and the achievement of audit objectives.



- Generally speaking, an **ISO audit will consist of the following key elements, or stages:**
- Audit management
- Audit preparation
- Audit process
- Gathering evidence
- Evaluation of audit evidence against audit criteria
- Closing the audit
- Following up
- Competence and evaluation of auditors

Audit management

- Audit management starts with the establishment of an audit programme. The purpose of the audit programme is to oversee the whole audit process, including planning and scope, which includes determining which management system (or systems) will be audited, and the specific requirements.

- The full scope of the audit system will also depend on the size of the auditee (company being audited), as well as the nature and complexity of the management system being audited.
- During this stage, audit planning and preparations are made, including review of all available documented information for the management system being audited, and establishment of clear audit objectives and criteria.
- Work done under the banner of "audit management" goes on to inform and direct the actions of the auditors during the main audit process.
- An important part of audit management is making sure the entire audit party has adequately reviewed all documented information for the management system being audited.

Audit process

- "Audit process" might be a bit vague, but it basically means everything that goes into actually conducting the audit, starting from making contact with the auditee to prepare or request any documented information, and ending with conducting closing meetings and distributing the completed audit report.
- One of the first things to be done is to determine audit feasibility.
- Working from the audit objectives established during the planning stage of audit management, this basically asks "can we (the auditor) achieve the audit objectives, based on time, resources, information, and cooperation with the auditee?".
- The audit process also involves preparing a complete audit plan, preparing additional documented information for the audit (like reference standards and documents to bring with you during on-site evidence collection), preparing for and conducting opening meetings, collecting audit evidence, evaluating evidence against audit criteria, and preparing the final audit report.
- There's a lot that goes into the main audit process; the above points are just a brief summary of key steps. The complete process, start-to-finish, is outlined in the free ISO 19011:2018 template that appears later on in the article.

Competence and evaluation of auditors

- The final component of the ISO 19011 standard is aimed at providing general guidelines for making sure the auditors are competent to do their job.
- Ideally, competence should be evaluated on a regular basis using a process that takes into account the behaviour and knowledge of each auditor.
- Such a process should also consider the specific needs, objectives, and considerations of the audit program in question.

- As with all ISO standards, requirements and guidelines alike, the whole process of evaluating auditor competence should be adequately documented, in order to maintain consistency, and ensure fair and reliable results.
- The process for evaluating auditor competence has four main steps:
- Determine the level of competence required for the job
- Establish some criteria for evaluating competence
- Choose a method for evaluating competence
- Conduct the evaluation
- Following the evaluation, the results will contribute to the ongoing performance evaluation of the auditors, and can be used to inform the following decisions:
- Selecting the audit team
- Determining whether there is a need for improved competence (e.g. more training)
- Competence and evaluation of auditors also feeds back into and supports the principle of continuous improvement, allowing an audit team to maintain and improve competence via recurring participation in audits.

ENVIRONMENTAL STATEMENT FORM-V (See rule 14)

Environmental Statement for the financial year ending with 31st March

PART-A

i. Name and address of the owner/ occupier of the industry operation or process.

ii. Industry category Primary-Secondary-

iii. Production category - Units.

iv. Year of establishment v. Date of the last environmental statement submitted.

PART -B

Water and Raw Material Consumption:

i. Water consumption in m3/d

Process :

Cooling :

Domestic :

Name of Products	Process water consumption per unit of products	
	During the previous financial year	During the current financial year
1. 2. 3. 4. 5. 6.		

ii. Raw material consumption

Name of raw materials*	Name of Products	Consumption of raw material per unit of output	
		During the previous financial year	During the current financial year

Industry may use codes if disclosing details of raw material would violate contractual obligations, otherwise all industries have to name the raw materials used.

PART-C
Pollution discharged to environment/unit of output
(Parameter as specified in the consent issued)

Pollutants	Quantity of Pollutants discharged (mass/day)	Concentration of Pollutants discharged (mass/volume)	Percentage of variation from prescribed standards with reasons.
(a) Water			
(b) Air			

PART-D HAZARDOUS WASTES (as specified under Hazardous Wastes (Management & Handling Rules, 1989).

Hazardous Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
1. From Process 2. From Pollution Control Facilities		

PART – E

SOLID WASTES:

Solid Wastes	Total Quantity (Kg)	
	During the previous financial year	During the current financial year
a. From process		
b. From Pollution Control Facility		
c. Quantity recycled or re-utilised within the unit.		

PART – F

Please specify the characteristics (in terms of concentration and quantum) of hazardous as well as solid wastes and indicate disposal practice adopted for both these categories of wastes.

PART-G

Impact of the pollution control measures taken on conservation of natural resources and consequently on the cost of production.

PART – H

Additional measures/investment proposal for environmental protection including abatement of pollution.

PART –I

MISCELLANEOUS: Any other particulars inrespect of environmental protection and abatement of pollution.

- What is non conformance
- Non conformance (NC) is an ISO 9000 audit designation indicating the quality management system or a portion of it does not meet the requirements established by ISO 9000.
- Non-conformance is a sign that something went wrong in a service, process, product or in the system itself by not meeting a certain set of specifications. The existence of a non conformance implies that some aspects of a company's standard operating procedures are not being followed or they need to be modified or even updated.
- These deviations can be identified through internal and external audits, customer complaints, material inspection or routine testing. A non-conformance report is then prepared. The purpose of the report is to document the details of a deviation from expectations.

- The report helps define the problem in a clear, logical and concise way so that management can take steps to implement changes. ISO 9001:2015 no longer requires a documented procedure, but one must still keep records of the nonconformity and what was done to correct it.

Here are ways to prevent or minimize non-conformance:

1. Management Review

- Management review is akin to getting your car serviced every year even when there are no overt signs of problems.
- Management reviews are generally conducted once a year and present an opportunity to review the company's existing quality policy as well as set new objectives for the rest of the year. New objectives can be invaluable for minimizing non conformance.
- Product changes, new requirements, new processes, change management etc. are all reviewed. The management review process can identify and correct any current deficiencies before they might be revealed by an audit or incident.

Routinely reviewing the organization's process helps continuous improvement. A system should be in place for implementing any resulting plans for improvement or corrective action and verifying their effectiveness

2.Internal Audit

- An audit is simply another form of testing i.e. comparing things as they are to how they ought to be. Internal Audits need to be scheduled at regular intervals to check whether the quality system conforms to requirements and to ensure the system's efficacy.
- Unlike an external audit, all the processes need not be audited at the same. Internal audits can be conducted as a series of smaller audits, with different processes audited at different times.
- The frequency of audit can also be set depending on the process in question. With changing internal and external dynamics, the criteria for the audit can be decided prior to the audit rather than the planning stage.
- Any previous findings, past audit conclusions, and pre-defined questions all become valuable data. Observations raised during internal audits could be classed as preventive actions as they can suggest improvements within the system to prevent non-conformances from occurring in the future.

3.Feedback

- While all customer complaints are recorded and must be actioned, customer feedback also plays a role in minimizing non-conformance.

- Feedback from customers helps to understand potential non-conformance issues and is an opportunity for improvement. Customer suggestions may prevent any issues from being raised in the future.

- Negative as well as positive feedback is valuable data. Spending time to analyze could help spot trends and patterns.

- Feedbacks help to dig into the root cause of the issue which may not always be obvious (else it would have been picked up in audit testing). Understanding the root cause can help differentiate a temporary lapse from a process flaw

DUE DILIGENCE.

Due diligence is the investigation or exercise of care that a reasonable business or person is normally expected to take before entering into an agreement or contract with another party or an act with a certain standard of care.

- It can be a legal obligation, but the term will more commonly apply to voluntary investigations. A common example of due diligence in various industries is the process through which a potential acquirer evaluates a target company .

- The theory behind due diligence holds that performing this type of investigation contributes significantly to informed decision making by enhancing the amount and quality of information available to decision makers and by ensuring that this information is systematically used to deliberate on the decision at hand and all its costs, benefits, and risks.

Example for due diligence Business transactions and corporate finance[edit]

- Due diligence takes different forms depending on its purpose:

- The examination of a potential target for merger, acquisition, privatization, or similar corporate finance transaction normally by a buyer. (This can include self due diligence or "reverse due diligence", i.e. an assessment of a company, usually by a third party on behalf of the company, prior to taking the company to market.)

- A reasonable investigation focusing on material future matters.

- An examination being achieved by asking certain key questions, including, how do we buy, how do we structure an acquisition, and how much do we pay?

- An investigation of current practices of process and policies.

- An examination aiming to make an acquisition decision via the principles of valuation and shareholder value analysis

COMPLIANCE AUDIT

- A compliance audit is a comprehensive review of an organization's adherence to regulatory guidelines. Audit reports evaluate the strength and thoroughness of compliance preparations, security policies, user access controls and risk management procedures over the course of a compliance audit.

Internal vs. compliance audit

- Internal audits are carried out by employees of a company to gauge overall risks to compliance and security and to determine whether the company is following internal guidelines.
- Internal audits occur throughout the fiscal year and reports can be used by management teams to identify areas that require improvement. Internal audits measure company objectives against output and strategic risks.
- External audits are formal compliance audits that are carried out by independent third parties and follow a specific format that is determined based on the compliance regulation being assessed. External audit reports measure if an organization is complying with state, federal or corporate regulations, rules and standards.

What is a Waste Audit?

A waste audit is a physical analysis of waste composition to provide a detailed understanding of problems, identify potential opportunities, and give you a detailed analysis of your waste composition. A waste audit will help you clearly identify your waste generation to:

- Establish baseline or benchmark data.
- Characterise and quantify waste streams.
- Verify waste pathways.
- Identify waste diversion opportunities.
- Identify source reduction opportunities.
- Assess effectiveness and determine ways to improve efficiency of your current waste management systems.
- Gain specific information for local government
- Obtain detailed data on waste generation.

PHASES OF WASTE MINIMIZATION PLANNING

Phase 1: Extensive uncontrolled dumping

- In many countries waste is dumped on uncontrolled tips; there is no properly managed waste collection. At best, recyclable materials such as metals and plastics are collected by the informal sector and re-enter the resource cycle through a number of stages.
- People live on the rubbish heaps in appalling conditions. Basic principles of urban hygiene and environmental conservation are ignored. Rubbish is often used for heating and cooking with all the negative consequences for human health.

Phase 2: Reliable collection and better landfill sites

- Introducing systematic, regulated and reliable collection and establishing properly managed landfills comprises the first step in developing the waste management sector. Conveniently located transfer stations facilitate cost-efficient transportation of waste.

- It is crucial that collection is carried out efficiently since this is the most expensive element of waste management. However, along with the sorting processes, it also offers the greatest employment potential. It is important to identify the 'right' collection system for each town or community and its particular circumstances.

Phase 3: Separate collection and sorting

- Separating and collecting in several containers forms the basis of high-quality sorting and high-grade recycling processes. Efficient purpose- built vehicles with compactors are introduced for collecting the waste.

- The first optical separators make it possible to produce high-quality monofractions. A downstream, secondary industry develops as the supply of inputs becomes reliable. Increasingly, the industry adapts its processes to these materials. A significant number of jobs are created and waste management becomes part of industrial policy.

- The sorting facilities contain mechanical separation stages, screens and separators and prepare material for more efficient hand-picking. The first elements of a trading system emerge for recyclable materials that meet industry demand and bring in revenue (such as metal, PET and paper).

- Composting separately collected organic waste and extracting fractions with high-calorific value to generate refuse-derived fuel (RDF) leads to the emergence of new products for which there is increasingly a market.

Phase 4: Expanding the recycling industry

- Modern sorting facilities produce high-quality monofractions from separated waste; these are prioritised for recycling. Processes to separate plastics and sort by colour are used.

- Compost and/or biogas are produced from organic waste in composting and fermentation plants. Residual waste undergoes energy recovery in incinerators or is treated in mechanical-biological treatment facilities (MBT).

MBT extracts recyclable materials, delivers high-calorific fractions for energy generation and controls the decomposition of organic substances, which are mainly responsible for emissions from landfill sites – in particular landfill gas and leachate. Waste-to-energy facilities and waste biomass **CHP Combined Heat and Power Plants** replace primary fuels. This leads to a significant reduction in greenhouse gas emissions

Phase 5: The circular economy – waste as a resource

- In this phase waste is predominantly recycled or undergoes energy recovery; untreated household waste no longer goes into landfill.

- The high recycling rates achieved result in a functioning circular economy. Only small amounts of residual waste are landfilled and do not harm the environment. Preventing waste and taking a life-cycle perspective are underlying principles in all production processes and many consumer choices.

Module 4 continuation

Explain phases of Environmental Audit in industry or organization

There are three main Environmental Audit Stages or Phases:

- Pre-Audit
- Audit
- Post-Audit

Phase 1: The Pre-Audit

- Create the Audit Team, including a mixture of skills, talents and perspectives
- Create an Audit Plan
- Request and review documents, including:
  - Permits or permit applications
  - Production Records
  - Reports
  - Previous Audits including corrective actions and status of prior audit items
- Prepare a list of questions that regulators would ask, follow-up questions on prior audits, and requests for additional materials needed
- Begin to fill-in the Disclosure of Violation Table as issues are identified

Phase 2: The Audit

- Set the ground rules
- Determine what happens which issues are identified
- Conduct daily meetings to keep every informed
- Perform a document review:
  - Policies
  - Compliance
  - Training
  - Air/Water/Waste/Noise controls, monitoring and records
  - Emergency Response Procedures
  - Response to Complaints
  - Check documents for completeness, consistency, legal compliance, and whether it's up to date
- Conduct a Site Inspection
- Evaluate Operations for Compliance
- Take samples if needed
- Interview EHS personnel, operations, management, maintenance, to see if policies are understood and consistently handled.
- Discover issues of concern
- Conduct a Closing Meeting listing and discussing of all issues, develop corrective actions for each issue

Phase 3: Post-Audit

- Preparing the Environmental Audit Report and Disclosure of Violations form
- List confirmed issues and Areas of Concern
- List Action Items and required follow-up

MODULE 5

Application of ems and waste audit

- Environmental Management Systems can help to minimize environmental effects of an organization or company.
- They can help to amplify the productive use of assets that the company has.
- They are shown to help to reduce the amount of waste that a company produces.
- EMS's can help to give the public a good picture of the organization that you have and that you want to be.
- They can play a very large role in constructing the consciousness of environmental concern among people within your organization and that utilize what your organization has to offer them.
- Gain a superior understanding of the environmental effects of business exercises.
- Expansion benefits and enhancement of environmental plan execution, through more productive operations.
- Waste audits can determine the effectiveness of your operations
- Waste audit reduce the cost
- Waste audit measures the success
- Waste audit will verify and have access to more accurate data
- Waste audit meet certificate standards
- Waste audit are required for certain regulatory compliance and reporting purposes

POLLUTION PREVENTION AND CONTROL IN TEXTILE INDUSTRY

- **Textile industry** is concerned with design and production of yarn and cloth and their distribution.
- Textile industry comprises large quantity of water and also need various chemicals and dyeing agents for the process.
- Here arise large quantity of waste in terms of water, energy and other chemical substances which will directly or indirectly affects the environment.
- The pollution may be in the form of air, water or noise .

WATER POLLUTION¢

- The consumption of water includes various processes such as sizing, dyeing, and other end product processes.
- The major problem arises chemicals are directly discharged into water bodies.
- This water pollution not only affects human beings and house hold animals but also aquatic animals.

EFFECTS OF WATER POLLUTION

- Depletion of dissolved Oxygen
- Hinders with self purification process of water.
- Clogs the pores of the soil resulting in loss of soil productivity.

- Corrodes and incrustates the sewerage pipes.
- Effects the quality of drinking water in hand pumps making it unfit for human consumption.
- Leads to leakage in drains increasing their maintenance cost.
- Impurities in water affect the textile process in many ways. MEASURES TO CONTROL **WATER POLLUTION**
- Effluent treatment methods can be classified into :
- physical, chemical and biological methods;
- Exclusive treatment by one of these three methods has proved to be insufficient in removing colour and other effluent from textile industry wastewater.
- Combination of various effluent treatment methods can remove more than 85% of unwanted matter.
- Adoption of best practices:- § Reducing and Recycling Water
- Awarness to go green
- Practice “Air Dyeing Technology” Air Dyeing Technology is a dyeing process that uses air instead of water to dye garments, allowing companies to create garments with vivid designs and colors, without polluting the water and environment .
- Bleaching : Chlorine bleach is extremely toxic. An alternative method which is oxygen-based can be used.
- Functional Finishes :Rather than using harsh chemicals to soften and finish the fabric a finish made of bees wax, Aloe Vera and Vitamin A are a good alternative.
- Sizing :Instead of the use of polyvinyl alcohol (PVA) for sizing use of potato starch or carboxymethylcellulose

AIR POLLUTION

- The major air pollution problem in the textile industry occurs during the finishing stages, where various processes are employed for coating the fabrics.
- Air emissions include dust, oil mists, acid vapours, odours and boiler exhausts.
- Speculation concerning the amounts and types of air pollutants emitted from textile operations have been widespread but, generally, air emission data for textile manufacturing operations are not readily available.

MEASURES TO PREVENT AIR POLLUTION:

- In order to prevent the hazards emission from the industry the workers can be advised to use Material Safety Data Sheets.
- Staff members who regularly handle the chemicals can be given adequate training regarding the over usage of particular chemical and their ill effects on health and environment.
- Height of chimneys should not be less than 30m so that all deadly gases are released out of the living organisms.
- Settling chamber should be used
- Filtration method can also be used for filtering the hazardous pollutants in which bed filter, fiber filters and fabric filters are widely used.

ENVIRONMENTAL MANAGEMENT IN PULP AND PAPER INDUSTRY

India is a vast country with an average of 700 pulp and paper mills. It is one of the highest polluting industries in India and is highly water intensive. Relatively large wastewater discharges and accompanied release of high pollution load into the environment is the sequel of high water consumption and pollution generation in the process of pulp and paper manufacture. Steps are been taken to preserve the resources, especially water which is an integral part of the pulp and paper industrial functioning. The need of cleaner production programs has been felt in recent times by the paper industry by way of a resource and waste minimization concept. In India efforts have been going on for years to improve house keeping, optimize process parameters, increase recycles and adopt improved technology. This paper aims at highlighting the process used during manufacture, sources and types of waste generated and treatment options available for improving the quality of waste to be discharged.

Sources of Waste Generation

In pulp and paper industry, considerable quantity of water is used in paper making processes. The quantity of water consumption varies according to the quality and kind of paper to be manufactured. In addition considerable amount of solid waste and gaseous emission occurs.

(i) Waste Water Generation

- Washing wooden chips in large-scale pulp and paper mills using wool as raw material.
- Washing of bagasse for separation of pith.
- Washing of rice/ wheat before pulping.

2. Pulping and bleaching

- Washing of chemically cooked pulp.
- Washing of pulp during bleaching.
- Pulp cleaning equipments.

3. Stock preparation and paper machine

- Cleaning of pulp in cleaning equipment.
- Filtration for wire section of paper machine.
- Paper machine presses.

4. Chemical recovery

- Foul condensate from evaporator and steam surface condenser.
- Boiler blowdown.

Beside above major sources of wastewater generation there are frequent leakages of black liquor from pump glands and its improper handling, which contribute significant color and pollution to the stream.

(ii) Solid Waste Generation

In pulp and paper industry solid wastes are generated from following operation;

- Raw material handling.
- Rejects from screening and centri-cleaners.
- Primary and secondary sludges from wastewater treatment system.
- Coal or boiler ash from steam and power genera- tion.
- Lime sludges from causticizing section of chemi- cal recovery plant.

(iii) Air Pollution

In pulp and paper industry air pollution is caused due to odour emitting reduced sulphur compounds such as hydrogen sulphide, methylmercaptan, dimethly sulphide, and particulate matter SO2 and NOx present in the gases emitted by different process units. Gaseous emission from pulp and paper mills can be broadly classified into the following categories:

- Gases from digesters.
- Gases from multiple effect evaporators.
- Gases from recovery.

Effluent Treatment Practices in Pulp and Paper Industry

Several control and treatment technologies have been developed to reduce wastewater discharge from the pulp and paper industry. The two major technology approaches are:

1. At source treatment controls measurements aimed at reducing wastewater volume and pollutant load discharged from the mill.

2. Wastewater treatment technologies or end-ofpipe treatment system aimed at reducing discharge of pollutants in the wastewater.

Various approaches for the management of effluent discharged include (Tarar et al. 2000)

Segregation : Highly concentrated and offensive effluents are segregated from relatively voluminous effluents.

Chemical Recovery: Efficient recovery of chemicals from the spent liquor is an integral part of modern sulphate (kraft) and soda processes.

Good Housing Keeping: Proper installation and operation of equipment, keeping them well cleaned before emptying into drain. Avoiding unnecessary biodegradable material to be dumped into waste stream, reuse of water when possible, reduces considerably the pollution load.

Reclamation and Recycling: About 80-90% reduction in pollution load and 70 % reduction in effluent volume in chipper house can be achieved through effluent reuse. Similarly recirculation in multi-stage bleaching operation reduces pollution loads by 30- 80%. Effective fiber recovery from paper machine can reduce the pollution load by 20- 60% and volume by 60-80% (Birdie and Birdie, 2008).

Primary Treatment : It includes coagulation & flocculation, floatation and sedimentation. A well designed clarifier is considered most suitable and is expected to settle 90-95 % of the settleable solids and removes 25-30% of BOD. Clarifier should be designed for an overflow rate of 30 cubic meters per square meter per day and a detention time of three hours. Settled sludge is

regularly pumped out at about 3% solid consistency. The sludge can be dewatered to spedable consistency by drying on usual drying beds, vacuum bed filters, and solid bowl centrifuges.
Biological Treatment : Depending upon the conditions at site and degree of treatment required for final disposal of effluents, biological treatment methods that can be adopted include; oxidation pond, aeration lagoon, trickling filter with secondary clarifier and activated sludge process.

Pollution prevention and control in Tanning industry

The leather industry is one of the main examples of industries which play an important role in the Indian economy in terms of exports and employment opportunities, while being blamed for environmental pollution

Effects of waste discharged from tannery on environment

- Pollution of environment by tannery waste is one of the most horrible ecological crisis to which we are subjected today. Due to lack of proper management facilities the tannery waste creates environmental pollution day by day.

[23]

- About 95% of the tannery industries have been built in unplanned way . These unplanned tanneries caused environmental pollution very much.
- These wastes affect the main elements of environment such as air, water and soil and the animal or plants living depending on these elements are harmed drastically.
- It was showed that the most harmful environmental effect was bad smell to the surrounding areas which caused environmental pollution

Cleaner technology in Leather Processing

Cleaner technology in leather processing can significantly reduce the costs of environmental compliance by reducing effluent loadings and chemical costs in leather manufacture.The pressure to adopt cleaner technologies normally emanates from environmental imperatives such as the need to meet specific discharge norms, reduce treatment costs or comply with occupational safety and health standards.

The typical primary targets are:

- lower water consumption,
- improved uptake of chemicals,
- better quality/re-usability of solid waste, and
- reduced content of specific pollutants such as heavy metalsand electrolytes.

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Waste Minimisation Measures

Systematic implementation of the waste minimisation measures **in tannery** sector can provide a viable solution to the environmental problems faced by the tanners as well as assist the tanners in improving their profitability. The following measures should be taken:

a) All the tanneries shall install water meters and flow meters to measure actual consumption and waste water discharged. Water consumption rates shall be brought down to less than the prescribed limits per tonne of hides by taking water conservation measures.

b) Process-wise, some of the waste minimisation measures to be adopted by the tannery units include the following:

i) Soaking: The waste minimisation measures for reducing water consumption inter-alia include:

- Use of counter current system of washing to concentrate the salt and other soluble materials such as dirt and blood.

- Reuse of the 2nd main soak for dirt soak: Soaking consists of dirt soak and main soak. The main soak is retained and used for dirt soak for the following batch.

- Reuse of dirt soak: The dirt soak liquor may be collected and added polyelectrolyte to flocculate and settle the suspended solids. Soak liquor thus treated and filtered can be reused partially in liming, deliming washes and pickling.

- Drum soaking instead of pit soaking: This will not only reduce water consumption but will also bring down the soaking time from 12 hrs to 3 hrs. This will enable the tanners to construct solar evaporation pond in less area thereby using the open land for more productive use.

- Addition of soaking enzymes: Soaking enzymes are added to achieve uniform and thorough soaking. Further, to improve the treatability of waste water, regular wetting agent should be substituted with biodegradable wetting agents.

- Stop "open washing systems" in drum washing. Use batch systems only. Batch washing involves washing of hides and skins during processing by introducing the required quantity of clean water into the processing vessel and using the action of the vessel to achieve the required agitation as opposed to running water washes which use the inflow and outflow of large quantities of water.

ii) Liming: The following measures shall be adopted to optimise chemical consumption in this process step. These include:

- Substitution of paste lime by 85% pure calcium hydroxide [Ca(OH)!]: This will bring down the quantity of consumption of powdered lime to one third ofits original quantity. lt will also reduce the frequency of cleaning the primary settling tanks which consisted mainly of the lime sludge.

- Use of liming enzymes: Use of liming enzymes will reduce Sodium sulphide (NaS) consumption by 40%. • Provision of a slight slope in the pasting area: By providing a slight slope in the pasting area the excess liming paste can be effectively collected and used which is otherwise washed away in the drain by lime yard workers.

- Reuse of relime liquor: 50% of relime liquor can be retained and reused for liming of subsequent batches. This will also reduce water consumption in liming. In addition to optimisation of the chemical consumption in liming section, fleshings can be used to produce biogas, gelatine, glue and also high-grade protein. This will solve the problem of solid waste disposal from the liming section.

iii) Deliming: Efforts should be made to reduce the water consumption in this section process by implementing the following measures:

- Use of deliming agents such as ammonium chloride/ ammonium sulphide.
- Use of 2nd delime wash for liming.
- Reduce the use of ammonium by the injection of carbon dioxide gas (mainly applicable for large tanneries and /or the use of other substitutes deliming agents 10

iv) Pickling: In this process, the following measures should be adopted to reduce salt consumption: a. Use of drained float for next batch or go directly to tanning. b. Controlling pickle liquor to 6° - 7° to optimise use of sodium chloride (NaCl).

v) Chrome tanning: The following measures should be adopted to recover chrome from chrome tanning process, if it is applicable for the tannery. It may be restricted by the need to produce leather properties which meat the customer requirement in particular related to dyeing (reduced fastnesss and less brightness of colours) and fogging. a. Collection of spent chrome liquor after basification and recovery of chrome from the same. The recovered chrome can be used along with regular Basic Chrome Sulphate (BCS) for chrome tanning.

vi) Dyeing: The waste minimization measures under this process include the following: a. Use of soft water for dyeing process to reduce the dye consumption as well as syntans consumption, in case, the fresh water quantity is not good enough (hardness). b. Use of automated water dosing systems.

Pollution prevention and control in Sugar industry

1.	Installation of sealed flow metre in
	a borewells to ascertain usage of fresh water
	b at major areas of cold and hot water consumption
	c for measuring the effluent from prominent areas
2.	Maintenance of log book for recording the daily water consumption and effluent generation
3.	Recirculation of water employed in SO_2 gas coolers, massecuite cooling, and elsewhere with proper cooling
4.	Dry cleaning of factory floors using bagasse
5.	Construction of tank to collect hazardous wash water generated
6.	Installation of condensate polishing unit (CPU) where high pressure boiler is used

7.	Use of membrane-based technology to attain brine recovery
8.	Use of surplus cooled condensate as make-up water
9.	Maintenance of retention time in various units of effluent treatment plant (ETP)
10.	Colour coding of pipelines carrying recycled process water and fresh process water
11.	Development of proper infrastructure for operation and maintenance of ETP
12.	Development of analytical facility for analysis of various streams of water
13’	Commissioning of mechanical sludge handling system of adequate capacity
14.	Ensuring the analysis of effluent discharge parameters notified under Environment (Protection) Rules, 198 daily basis.

Pollution Control

- There is scope of recycling and reuse of water in sugar mills thereby minimising water consumption and ultimately effluent quantity.
- The recycling and reuse of hot condensate water can reduce the water consumption to as low as. 100-200 litres, as against 1,500-2,000 litres per tonne of cane crushed.
- Proper housekeeping, periodic checking and maintenance of pipe joints, valves and glands further reduces the water consumption and effluent quantity
- .The effluents from the sugar industry can be treated added. The preparation of milk of the lime by conventional biological treatment systems. general, anaerobic biological processes (oxidation ponds and biomethanation) several advantages over aerobic processes (aerated lagoons, activated sludge process).
- Anaerobic processes are easier to control and operate, produce a lower quantity of sludge and their costs are lower. Anaerobic processes decompose the organic compounds in an atmosphere free of oxygen and consequently require significantly less energy as compared to aerobic processes.
- Among the air pollution control of treated equipments; wet collectors and multi-cyclones, can reduce particulate matter in boiler emissions by 90% or more.
- These equipments can reduce ..the concentration of particulate matter to 450 mg/ Normal cubic metre. Double Sulphitation Process, already adopted by most of the sugar industries, reduces the quantity of lime sludge and press mud to a I great extent.
- The lime sludge is usually dumped in low lying areas, whereas press mud is sold to farmers as it can be used as manure.
- Bagasse is either used as fuel or sold to pulp and paper industry which use them as raw materials.. Molasses produced in sugar industry is raw materials for fermentation industries.

ELECTROPLATING INDUSTRY

Pollution Prevention and Control Plating involves different combinations of a wide variety of processes, and there are many opportunities to improve on traditional practices in the industry. The improvements listed below should be implemented where possible.

1. **Changes in Process**

- Replace cadmium with high-quality, corrosion-resistant zinc plating. Use cyanide-free systems for zinc plating where appropriate. Where cadmium plating is necessary, use bright chloride, high-alkaline baths, or other alternatives. Note, however, that use of some alternatives to cyanides may lead to the release of heavy metals and cause problems in wastewater treatment
- Use trivalent chrome instead of hexavalent chrome; acceptance of the change in finish needs to be promoted.
- Give preference to water-based surface-cleaning agents, where feasible, instead of organic cleaning agents, some of which are considered toxic.
- Regenerate acids and other process ingredients whenever feasible.

2.Reduction in Dragout and Wastage

- Minimize dragout through effective draining of bath solutions from the plated part, by, for example, making drain holes in bucket-type pieces, if necessary.
- Allow dripping time of at least 10 to 20 seconds before rinsing
- Use fog spraying of parts while dripping.
- Maintain the density, viscosity, and temperature of the baths to minimize dragout.
- Place recovery tanks before the rinse tanks (also yielding makeup for the process tanks). The recovery tank provides for static rinsing with high dragout recovery

3.Minimizing Water Consumption in Rinsing Systems

Testing is required to determine the optimum method for any specific process, but proven approaches include:

- Agitation of rinse water or work pieces to increase rinsing efficiency
- Multiple countercurrent rinses
- Spray rinses (especially for barrel loads)

4.Management of Process Solutions

- Recycle process baths after concentration and filtration. Spent bath solutions should be sent for recovery and regeneration of plating chemicals, not discharged into wastewater treatment units.
- Recycle rinse waters (after filtration).
- Regularly analyze and regenerate process solutions to maximize useful life. • Clean racks between baths to minimize contamination.
- Cover degreasing baths containing chlorinated solvents when not in operation to reduce losses. Spent solvents should be sent to solvent recyclers and the residue from solvent

recovery properly managed (e.g., blended with fuel and burned in a combustion unit with proper controls for toxic metals).

ELCROPLATING INDUSTRY

The key production and control practices that will lead to compliance with emissions guidelines can be summarized as follows:

- Use cyanide-free systems.
- Avoid cadmium plating.
- Use trivalent chrome instead of hexavalent chrome.
- Prefer water-based surface cleaning agents where feasible, instead of organic cleaning agents, some of which are considered toxic.
- Minimize dragout.
- Use countercurrent rinsing systems; recycle rinse waters to the process after treatment.
- Regenerate and recycle process baths and rinse waters after treatment.
- Recycle solvent collected from air pollution control systems.
- Send spent solvents for recovery.
- Do not use ozone-depleting substances.
- Manage sludges as hazardous waste. Reuse sludges to the extent feasible but without releasing toxics to the environment.

Hazardous-waste management,

- the collection, treatment, and disposal of waste material that, when improperly handled, can cause substantial harm to human health and safety or to the environment.

- Hazardous wastes can take the form of solids, liquids, sludges, or contained gases, and they are generated primarily by chemical production, manufacturing, and other industrial activities. They may cause damage during inadequate storage, transportation, treatment, or disposal operations.

- Improper hazardous-waste storage or disposal frequently contaminates surface water and groundwater supplies as harmful water pollution and can also be a source of dangerous land pollution.

- People living in homes built near old and abandoned waste disposal sites may be in a particularly vulnerable position. In an effort to remedy existing problems and to prevent future harm from hazardous wastes, governments closely regulate the practice of hazardous-waste management

Hazardous-waste characteristics

- Hazardous wastes are classified on the basis of their biological, chemical, and physical properties. These properties generate materials that are either toxic, reactive, ignitable, corrosive, infectious, or radioactive.

- Toxic wastes are poisons, even in very small or trace amounts. They may have acute effects, causing death or violent illness, or they may have chronic effects, slowly causing irreparable harm. Some are carcinogenic, causing cancer after many years of exposure. Others are mutagenic, causing major biological changes in the offspring of exposed humans and wildlife.

- Reactive wastes are chemically unstable and react violently with air or water. They cause explosions or form toxic vapours. Ignitable wastes burn at relatively low temperatures and may cause an immediate fire hazard. Corrosive wastes include strong acidic or alkaline substances. They destroy solid material and living tissue upon contact, by chemical reaction.

- Infectious wastes include used bandages, hypodermic needles, and other materials from hospitals or biological research facilities.

- Radioactive wastes emit ionizing energy that can harm living organisms. Because some radioactive materials can persist in the environment for many thousands of years before fully decaying, there is much concern over the control of these wastes.

- However, the handling and disposal of radioactive material is not a responsibility of local municipal government. Because of the scope and complexity of the problem, the management of radioactive waste—particularly nuclear fission waste—is usually considered an engineering task separate from other forms of hazardous-waste management

Treatment

- Hazardous waste can be treated by chemical, thermal, biological, and physical methods.

- Chemical methods include ion exchange, precipitation, oxidation and reduction, and neutralization.

- Among thermal methods is high-temperature incineration, which not only can detoxify certain organic wastes but also can destroy them.

- Special types of thermal equipment are used for burning waste in either solid, liquid, or sludge form. These include the fluidized-bed incinerator, multiple-hearth furnace, rotary kiln, and liquid-injection incinerator. One problem posed by hazardous-waste incineration is the potential for air pollution.

- Biological treatment of certain organic wastes, such as those from the petroleum industry, is also an option. One method used to treat hazardous waste biologically is called landfarming. In this technique the waste is carefully mixed with surface soil on a suitable tract of land.

- Microbes that can metabolize the waste may be added, along with nutrients. In some cases a genetically engineered species of bacteria is used. Food crops are not grown on the same site. Microbes can also be used for stabilizing hazardous wastes on previously contaminated sites; in that case the process is called bioremediation.

- The chemical, thermal, and biological treatment methods outlined above change the molecular form of the waste material.
- Physical treatment, on the other hand, concentrates, solidifies, or reduces the volume of the waste. Physical processes include evaporation, sedimentation, flotation, and filtration. Yet another process is solidification, which is achieved by encapsulating the waste in concrete, asphalt, or plastic.
- Encapsulation produces a solid mass of material that is resistant to leaching. Waste can also be mixed with lime, fly ash, and water to form a solid, cementlike product

Disposal methods

1: Underground disposal

- The only way this method is compliant is when the hazardous waste is brought to mines that are either inactive or partially active (along with meeting additional geological and technical specifications).
- Many companies need to dispose of radioactive waste, whether from medical treatments, laboratory experiments, nuclear fuel production, or radioactive ore mining. For those cases, this method is considered a strong, cost-effective option.
- These hazardous waste facilities will vary in their sustainability, per the EPA. The agency is responsible for protecting people and the natural world by verifying that these units' design, operation, and maintenance adhere to its standards.

2: Landfill disposal

- Dumpsites and landfills are the most commonly used and oldest method of waste disposal. Hazardous waste landfills are specially built and are NOT intended for liquid wastes. They are engineered and excavated so that they are within the ground rather than piling upward.
- These landfills are lined with clay, HDPE, or other non-porous materials to prevent the waste from leaching into the ground. Wind dispersal controls, leak protection systems, and a double liner are additional protections so that humans and the environment come into contact with as little of the waste as possible.
- Human health is generally not impacted by hazardous waste landfills. However, it is possible for people near the landfill to be harmed if there is a leak.

#3: Ocean dumping

- For the avoidance of groundwater contamination, deep-sea depositing is sometimes used. It is necessary to treat hazardous waste before ocean dumping to minimize the impact on marine life. This treatment is important to human health, too, since the waste can make its way to humans when they consume seafood. Some environmental agencies ban this. practice, but it is allowed by the EPA if you have a permit and strictly follow its guidelines

- Regarding sustainability, treatment is critically important. Radioactive waste, industrial waste, and sludge all cause considerable ocean pollution. Mercury and cadmium, toxic heavy metals, are within about 10 percent of dredged material.

Hazardous Waste Disposal Alternative: Recycling

- A federal analysis revealed that 1.5 tons of hazardous waste were managed through recycling in 2017. Recycling is preferable to disposing of hazardous wastes for numerous reasons. It results in economic benefits, decreases our raw material reliance nationally, conserves natural resources, prevents pollution, and cuts energy use.
- Any of the following are ways that recycling can be achieved:
- **Reclaiming** – Regeneration or processing to recover a useful product
- **Reuse/use** – Substituting it for another product or using it as an industrial ingredient
- **Burning to recover energy** – Burning for fuel

Disposal through use – Placement of waste on the land

Transboundary movement

- **Any movement of hazardous wastes or other wastes from an area under the national jurisdiction of one State** to or through an area under the national jurisdiction of another State or to or through an area not under the national jurisdiction of any State, provided at least two States are involved in the movement
- Controlling transboundary movements of hazardous and other wastes is a corner stone of the Basel Convention.
- Parties to the Basel Convention have the overall obligation to ensure that transboundary movements of hazardous and other wastes are minimized and that any such movement is conducted in a manner which will protect human health and the environment.
- In addition to these general obligations, the Convention provides that transboundary movements can only take place if certain conditions are met and if they are in accordance with certain procedures.
- Parties are under an obligation to take the appropriate measures to ensure that transboundary movements of hazardous wastes and other wastes are only allowed if one of the three following **conditions** is met:
- the State of export does not have the technical capacity and the necessary facilities, capacity or suitable disposal sites in order to dispose of the wastes in question in an "environmentally sound manner"; or
- the wastes in question are required as raw material for recycling or recovery industries in the State of import; or
- the transboundary movement in question is in accordance with other criteria decided by the Parties (such criteria will normally be found in the decisions adopted by the Conference of the Parties)
- In all cases, the Convention requires that the standard of environmentally sound management of hazardous wastes or other wastes is met. **Environmentally sound management** means taking all practicable steps to ensure that hazardous wastes or other

wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes.

- In addition to these conditions, the Basel Convention specifies instances in which Parties may restrict transboundary movements and instances in which Parties must restrict transboundary movements.
- Finally, the Basel Convention requires that only persons authorized or allowed to transport or dispose of wastes undertake such operations and that wastes subject to a transboundary movement be packaged, labelled and transported in conformity with generally accepted and recognized international rules and standards.