Workshop on prevention and control of air pollution

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Malé Declaration: Workshop on Health Impact
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Introduction and objectives of the workshop

On completion, you should be able to:

Understand the principles of air quality management.

Identify air quality policies and management plans integrating different economic sectors and government.

Understand the legal and institutional frameworks for air quality management.

Describe the advantages and disadvantages of different policy instruments.

Propose policy instruments that can improve air pollution conditions in your city.

Understand the importance of raising awareness.

Describe the techniques of environmental impact assessment.

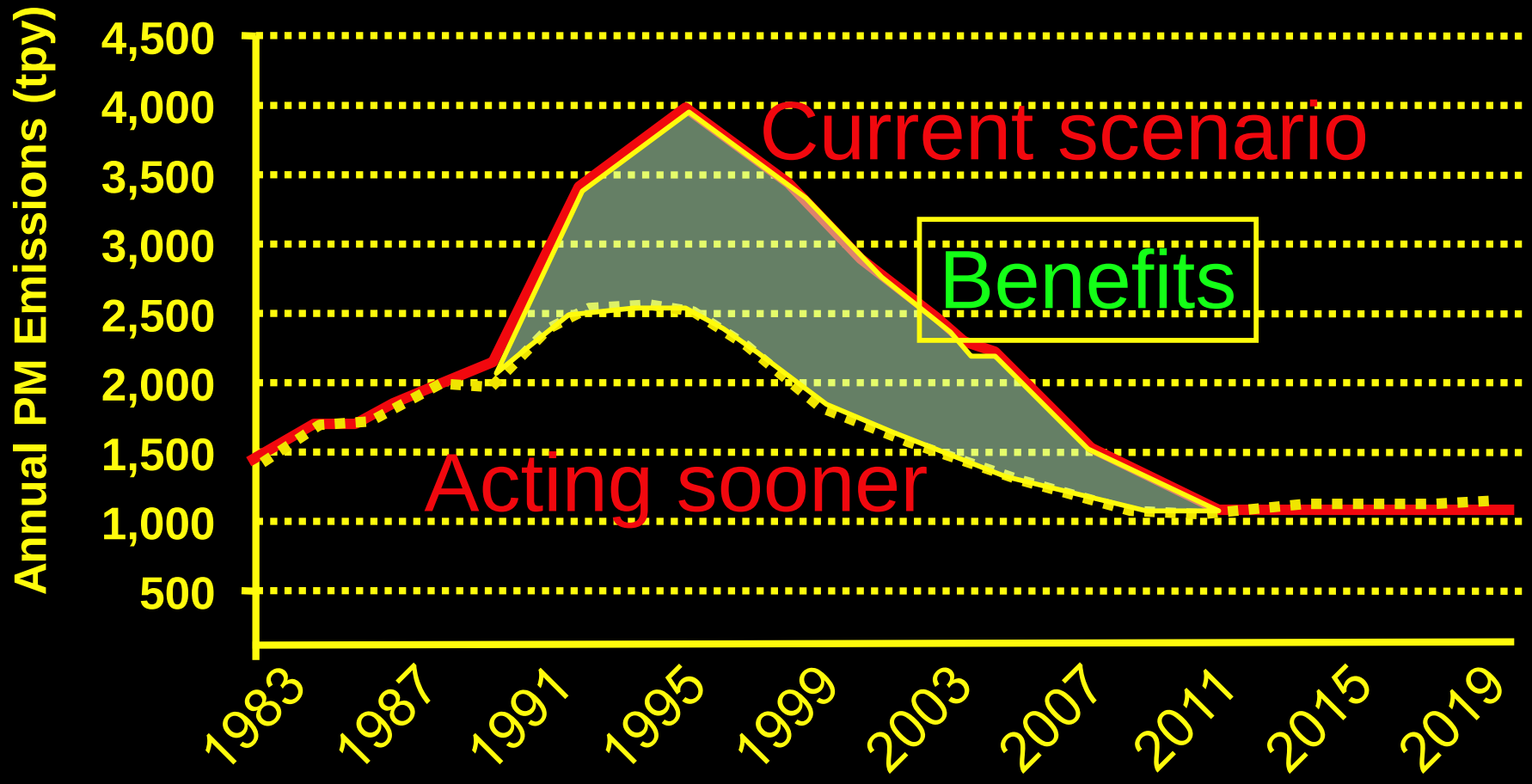
Content

- Principles
- Policies
  - Regulatory instruments
  - Economic instruments
  - Self-regulation and co-regulation
  - Education and information
  - Environmental impact assessment
- Lessons learned from developing countries
- Experience with air pollution in South Asia
- Sim Exercises

Why air quality matters

- Deteriorating urban air quality causes significant health problems and economic losses in South Asian countries, estimated between 0.5 to 2.5% of GDP.
- The children and the poor are particularly impacted.

Motorcycle Pollution: Benefits of Acting 5 Years Sooner in Bangkok



Drivers of environmental management - air quality

1. Command and control (eg licensing, works approval, Ministerial conditions)
2. Self-regulation instruments (eg industry codes of practice)
3. Co-regulation (pollution reduction targets)
4. Economic instruments (load based licensing)
5. Education and information (eg training, corporate environmental reporting, community right to know)

Principles for air quality management

Principles

The following are key principles of environmental protection.

1. ***Integration of Economic, Social and Environmental Considerations***

   Sound environmental practices and procedures should be adopted as a basis for sustainability for the benefit of all human beings and the environment.

   The measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.

2. Precautionary Principle

(1) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

(2) Decision making should be guided by:

- **a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and**
- **an assessment of the risk-weighted consequences of the options**

3. Intergenerational Equity

- **The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.**

4. Improved Valuation, Pricing and Incentive Mechanisms

(1) Environmental factors should be included in the valuation of assets and services

(2) Those who generate pollution and waste should bear the cost of containment, avoidance or abatement.

(3) Users of goods and services should pay prices based on full life cycle costs of providing goods and services, including costs relating to the use of natural resources and the disposal of wastes.

5. Shared Responsibility

Protection of the environment is a responsibility shared by all levels of Government and industry, business, communities and the people.

6. Product Stewardship

Producers and users of goods share responsibility with Government to manage the environmental impacts throughout the life cycle of the goods and services, including the ultimate disposal of any wastes.

7. Waste Hierarchy

Wastes should be managed in accordance with the following order of preference:

1. **Avoidance;**
2. **Reuse;**
3. **Recycling;**
4. **Recovery of energy;**
5. **Treatment;**
6. **Containment;**
7. **Disposal.**

8. Integrated Environmental Management

If approaches to managing impacts on one segment of the environment have potential impacts on another segment, the best overall environment outcome should be sought.

9. Accountability and Transparency

The aspirations of the people for environmental quality should drive environmental improvement.

The public should therefore be given:

(a) access to reliable and relevant information to enable an understanding of environmental issues; and

(b) opportunities to participate in policy and program development.

Environmental decisions and recommendations should be transparent and published.

10. Enforcement

Enforcement of environmental requirements should be undertaken to:

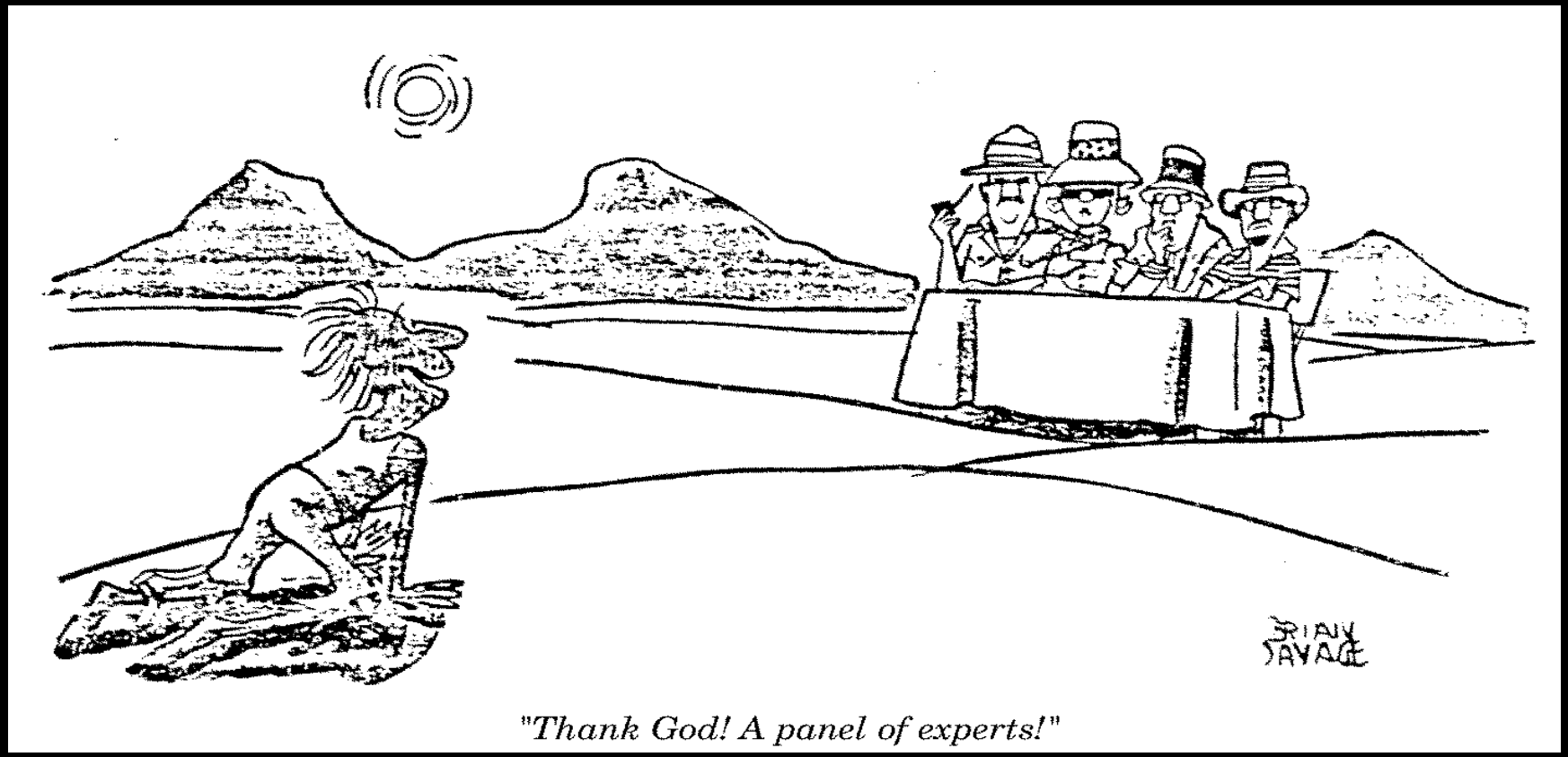
(a) better protect the environment and its economic and social uses;

(b) ensuring that no commercial advantage is obtained by those who do not comply with environmental requirements; and

(c) influence the attitude and behaviour of those whose actions may have adverse environmental impacts

Policies for air quality management

5. What are the key factors that affect air quality?



"Thank God! A panel of experts!"

Policy options

- Strategic planning
- Government regulations
- Economic incentives
- Education

Regulatory instruments

ENVIRONMENTAL REGULATION

DATE	PRESSURE	RESPONSE	IMPLICATIONS
Up to the 1970s	Increasing public concern about air, water and land pollution. Public demands for nature conservation areas	Responsible agencies developed individual pieces of legislation. Command and control approach to regulation	Inconsistent approaches, haphazard and fragmented implementation by a variety of agencies

ENVIRONMENTAL REGULATION

DATE	PRESSURE	RESPONSE	IMPLICATIONS
1970s and 1980s	Increasing public concern about pollution, impacts of new developments. Increasing demands for nature conservation areas.	Environmental Protection Acts and EPA's established. Command and control approach to regulation was tightened.	More consistent and uniform approaches to environmental protection. Tougher standards, more legislation, increased range of issues.

ENVIRONMENTAL REGULATION

DATE	PRESSURE	RESPONSE	IMPLICATIONS
1990s	Downsizing of governments, and economic rationalism. Personal liability of directors, insurance liabilities, increased importance of image and marketing	Restructuring of EPAs. Reform of regulations, and use of other forms of regulatory control, including co-regulation, self-regulation, education and economic instruments	Requirement for due diligence. Development of EMS, voluntary industry codes, best practice approaches, auditing

REGULATIONS

The traditional approach has been the ‘command and control’ approach:

- the regulations, standards and techniques were prescribed by government,
- compliance was checked by government inspectors.

The trend in most developed countries in recent years has been towards increased use of other forms of regulatory control.

REFORM OF REGULATIONS

This is driven by:

- **smaller government, reduced costs, increased efficiency and effectiveness**
- **new management systems in organisations**
- **New processes and technology unfamiliar to many government officers**

TYPES OF ENVIRONMENTAL REGULATION

Command and control

Command and control	**Issue of licenses, setting of standards, checks for compliance with standards, sanctions for non-compliance**	**Example: Air and water pollution control, waste disposal**

‘COMMAND AND CONTROL’ APPROACH TO ENVIRONMENTAL REGULATION

Under this system (eg. pollution control);

- **licenses are required to operate certain processes;**
- **standards are set in licenses;**
- **compliance is checked;**
- **enforcement action is taken in non-compliance.**

‘COMMAND AND CONTROL’

ADVANTAGES

- **Traditional, well established**
- **Has public confidence, and**
- **provides a degree of certainty to industry and the public,**

‘COMMAND AND CONTROL’

DISADVANTAGES

- **Time-consuming, expensive;**
- **Puts pressure on the technical capacity of the regulator**
- **Encourages doing the minimum necessary for compliance**
- **Does not encourage ‘beyond compliance’, more than the minimum necessary**
- **Legalistic**

‘COMMAND AND CONTROL’

As any penalties imposed by the courts may be light, the outcomes may be unsatisfactory for all involved.

The failings of Command and Control, including lack of resources provided by Governments means new approaches are needed to add to it.

The Basics of Air Quality Management by Regulation

CHECK AND REVIEW
Assess Status
Measure Progress
-AQ Monitoring
-Health Effects

PLAN
Set Standards
and Objectives
-Ambient AQ Standards
-Critical Ecosystem Loads

DO
Design and
Implement Control Strategies
-Identify key sources
-Control Emissions
-Anticipate Growth

Regulatory approaches

Ambient air quality management

Establish ambient air quality standards

1. **Primary standards: to provide an ‘adequate margin of safety’ including a ‘representative sample of the sensitive populations’.**
2. **Secondary standards: to protect public welfare (animals, crops, forests, materials, aesthetics, ecological processes)**

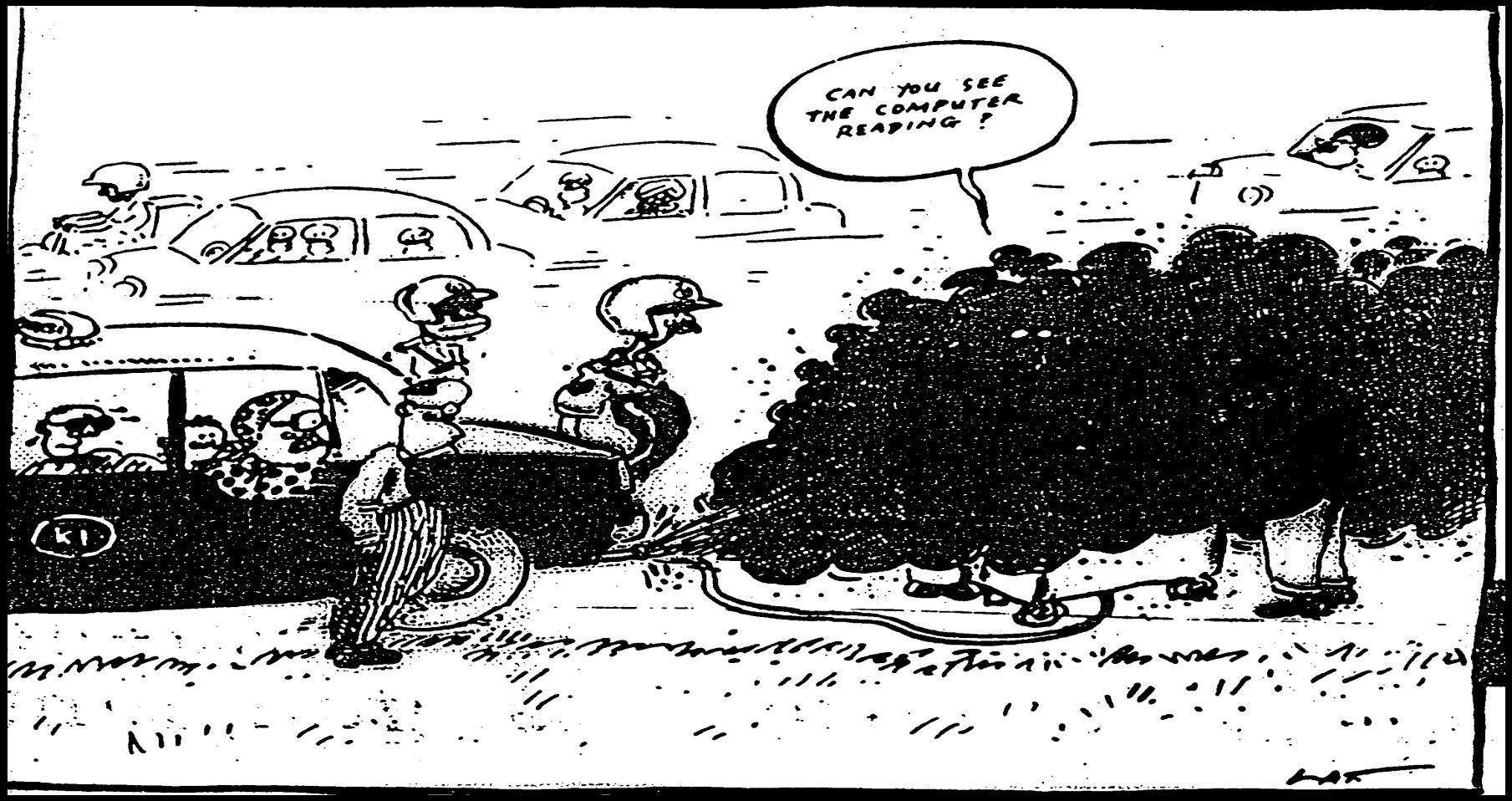
Pressures for compliance

- Regulator pressure for compliance
- Market pressure for at least compliance
- Stakeholder pressure (internal and external) leading to beyond compliance

Drivers for regulatory compliance

- **Financial penalties - increased costs, threat of closure**
- **Public shaming - local response, market share penalties**
- **Market perceptions - increased risk**

What were the effects of those efforts on air quality ?



Options Assessment

Feasibility of practical implementation

- **Technical**
- **Economic**
- **Social**
- **Environmental**

Control of industry

- Route of preference is environmental impact assessment process - get it right from the start using best practice
- Zoning and incentives to locate in special zones
- Regulation to reduce emissions

Example: Control of Fuel Quality

- It is a serious problem:
  - Reduces tax revenues
  - Damages vehicles
  - Increases air pollution
  - Causes environmental and safety risks.
- Mainly related to price differences:
  - kerosene subsidies
  - between industrial solvents and petrol
- It requires concerted efforts:
  - To develop more serious monitoring and control procedures
  - To inform consumers

US CLEAN AIR ACT 1990 – Reviewed for 2000

- SO_2 emissions halved by 2000 to 10 million tonnes per year
- NO_x reduced by 33% by 2000 to 4 million tonnes per year (cost US$ 3 billion per year)
- Cars emit 60% less NO_x and 40% less hydrocarbons by 2003, starting 1994 (cost fuel industry US$ 30 billion per year, probably about 6-10% more for fuel and US$ 600 more per car)
- 90% reduction in toxic emissions (cost US$ 25 billion per year)

US CLEAN AIR ACT 1990

- Limits on Industrial emissions in “pristine”areas (PSD)
- Restrictions on emissions in non-attainment areas
- Limits on stationary source emissions (factories, etc.)
- Limits on vehicle emissions
- Limits on toxic emissions

FEATURES OF COMMAND AND CONTROL STRATEGY

Direct Regulator - Individual factory relationship

- Arbitrary decisions (eg individually tailored emissions licenses)
- Usually ignores equity (eg require expensive pollution control of new sources, while old sources pollute)

COMMAND AND CONTROL

- Usually ignores costs
- (eg require expensive pollution control of new source, while old source could be controlled much cheaper for the same total emissions)
- Arbitrary enforcement
- Provides little incentive to go beyond compliance on pollution, encourages a compliance-only culture

Reform of regulation

- The traditional system of regulation of heavy industry was command-and-control.
- Increasingly impractical in the current circumstances - major industrial incidents resulted from over-reliance on command and control measures.
- The legal measures required are opposed by powerful sectors, and the costs of monitoring and enforcement are high for the regulators.

Economic instruments

TYPES OF ENVIRONMENTAL REGULATION:
Economic Instruments

Economic instruments	Use of pricing, subsidies, taxes, and charges to alter production and consumption patterns of organisations and the public	Tradeable emission permits. Load-based pollution charges. Differential taxes. True cost pricing of resources

MARKET APPROACHES

Government determines the objectives and strategies (what should be achieved)

Market mechanisms determine the tactics (least cost options) (how to achieve them)

ECONOMIC INSTRUMENTS

These are increasingly important. They include:

- **load-based pollution charges:**
  - **increase operating costs for industry if pollution discharge increases, and**
  - **decrease operating costs for pollution prevention measures which decrease emissions and discharges**
- **Taxes (eg. Carbon tax)**
- **Cap-and-Tradeable emissions permits**
- **etc**

ECONOMIC INSTRUMENTS

The use of economic instruments in environmental management is commonly opposed by economists who argue that they distort the marketplace.

Others argue they provide a means of adding the costs of externalities into the costs of production and price of goods and services.

Example of trading - cap & trade

Establish market size of specific pollution (eg CO_2 or SO_2) emissions, and geographical distribution, based on policy objectives (eg protection of human health, protection of sensitive ecosystems).

Establish future market size.

Issue tradeable pollution rights to existing sources

Create a free and open market, while achieving policy objectives

ECONOMIC INSTRUMENTS - Examples

- Higher taxes on leaded petrol than unleaded petrol
- Carbon tax on fossil fuel emissions to decrease CO_2 emissions, and fund renewable energy development
- Taxation incentives for best available technology

MECHANISMS

An example.

Power station A and near-neighbour Smelter B

EPA modelling estimates that a reduction of emissions of 1,000 tonnes of SO_2 per year is necessary to meet air quality objectives

Under ‘Command and Control’ EPA could ask for emissions controls on A, B, or both. On what basis should the decision be made?

Suppose the cost of removing 1,000 tonnes of SO_2 per year is $20 million for the smelter, and $10 million for the power station.

It would be cheaper for the smelter to pay the power station to remove the 1,000 tonnes of SO_2 emissions per year. A market mechanism would allow this to occur.

Economic Incentives: Vehicle Emissions

- Along with regulations, economic incentives can accelerate the introduction of technology
- Europe and the catalytic converter
  - Purchase and tax incentives for cleaner cars
  - Catalysts introduced well ahead of deadline
- U.S. and hybrid electrics
  - Tax credits for hybrid electric purchase
  - Incentive for early purchases at technology start-up

A Case Study: Mobile Sources

- Addressing mobile emissions requires a mix of regulatory controls, financial incentives, ***and*** prevention
- Key components:
  - Fuels
  - Vehicle emissions
  - Anticipating growth in travel

Control of vehicle emissions by urban and transport planning

Good urban and transport planning policies can prevent urban sprawl leading to air pollution

Social and economic approaches

- Urban planning and transport policies
- Discourage vehicles in city centres, encourage public transport
- Taxes, fuel levies, parking fees, park and ride, pedestrian zones
- Social equity in costs and benefits

Strategic Planning

- Transport and planning decisions can either worsen or improve air quality
  - Road development, rapid transit, pedestrians
- US Experience (NAS Report):
  - Transport decisions independent of environment for many years
  - Since 1990 – transportation plans must *conform* to air quality
  - Beginning to bring transport and environment agencies together
- ***Challenge:***
  - To use increasing wealth to invest in pollution prevention
  - To plan for integrated transportation, land use and environment plans (e.g. Bogota)

The Basics of Air Quality Management

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Self-regulation and co-regulation

TYPES OF ENVIRONMENTAL REGULATION

Self-Regulation

Self-regulation	Self-imposition of guidelines and environmental audits by industry groups. Voluntary adoption of environmental management measures	Voluntary codes of practice Adoption of best practice Self-audit Pollution reduction targets

TYPES OF ENVIRONMENTAL REGULATION:

Co-Regulation

Co-regulation	Formulation and adoption and rules, regulations and guidelines in consultation with stakeholders, negotiated within prescribed boundaries	National registers, eg the National Pollutant Inventory

CO-REGULATION

Companies and their industry organisations have successfully lobbied governments to be included in discussions of options for reform of regulation, and the process of review of these options.

This pro-active approach by industry organisations has led to a degrees of co-regulation in some areas.

CO-REGULATION

It has resulted in:

1. the adoption of regulations and guidelines that are practical and realistic by those affected, and have simplified and reduced costs of compliance.

2. the voluntary adoption of environmental management measures in a collaborative manner.

Co-regulation

Co-regulation should consist of implementation of negotiated agreements between individual organisations and regulators including:

- environmental performance targets and strategies;
- documented product stewardship responsibilities;
- independent third party verification; and
- underpinned by the requirement for the regulator to take action when circumstances require it.

SELF-REGULATION

Some industries, eg chemical industry and petroleum industry groups, are very familiar with current best practice within their own industry.

Self regulation involves:

- **setting industry codes of practice;**
- **setting industry standards; and,**
- **setting performance targets.**

SELF-REGULATION

- Individual companies are required to conduct self monitoring of compliance;
- Self monitoring is subject to independent audit.
- Examples include industry codes such as the environmental management code of the Minerals Council, and ‘Responsible Care’

DUE DILIGENCE

To help to protect themselves against legal liability for environmental matters, company directors, executives, employees and consultants have most commonly tried to show ‘due diligence’.

‘Due diligence’ implies that they have taken all reasonable and practical measures to avoid an offence. This can exonerate them under most legislation.

TO DEMONSTRATE DUE DILIGENCE

Courts have held that an environmental manager must be able to SHOW:

- **an awareness of environmental hazards and risks;**
- **that a system to ensure environmental compliance was operating;**

TO DEMONSTRATE DUE DILIGENCE

- proper supervision of staff involved in environmental compliance; and,
- an immediate and proper response when a system failure was detected, or a problem arose.

EMS in large organisations, when correctly implemented, and with proper delegation for environmental compliance by a board, can usually satisfy due diligence provisions.

Anita Roddick, Founder of the Body Shop

‘The marketplace is saying that there is a change on, a new kind of social thinking. The new word in the marketplace is values - and what consumers want are companies making socially responsible products or providing socially responsible services’

CORPORATE ENVIRONMENTAL POLICIES

Corporate environmental policies may commit the organisation to some or all of the following (adapted from ISO, 1996):

- Compliance with environmental regulations in all areas of the organisation's activities;
- Minimising environmental impact of operations;
- Development of environmental performance indicators, and assessment of performance against these indicators;

CORPORATE ENVIRONMENTAL POLICIES

- **Continuous improvement of environmental performance;**

- **Minimising environmental impacts of production, use and disposal of products through lifecycle thinking (cradle-to-grave assessment);**

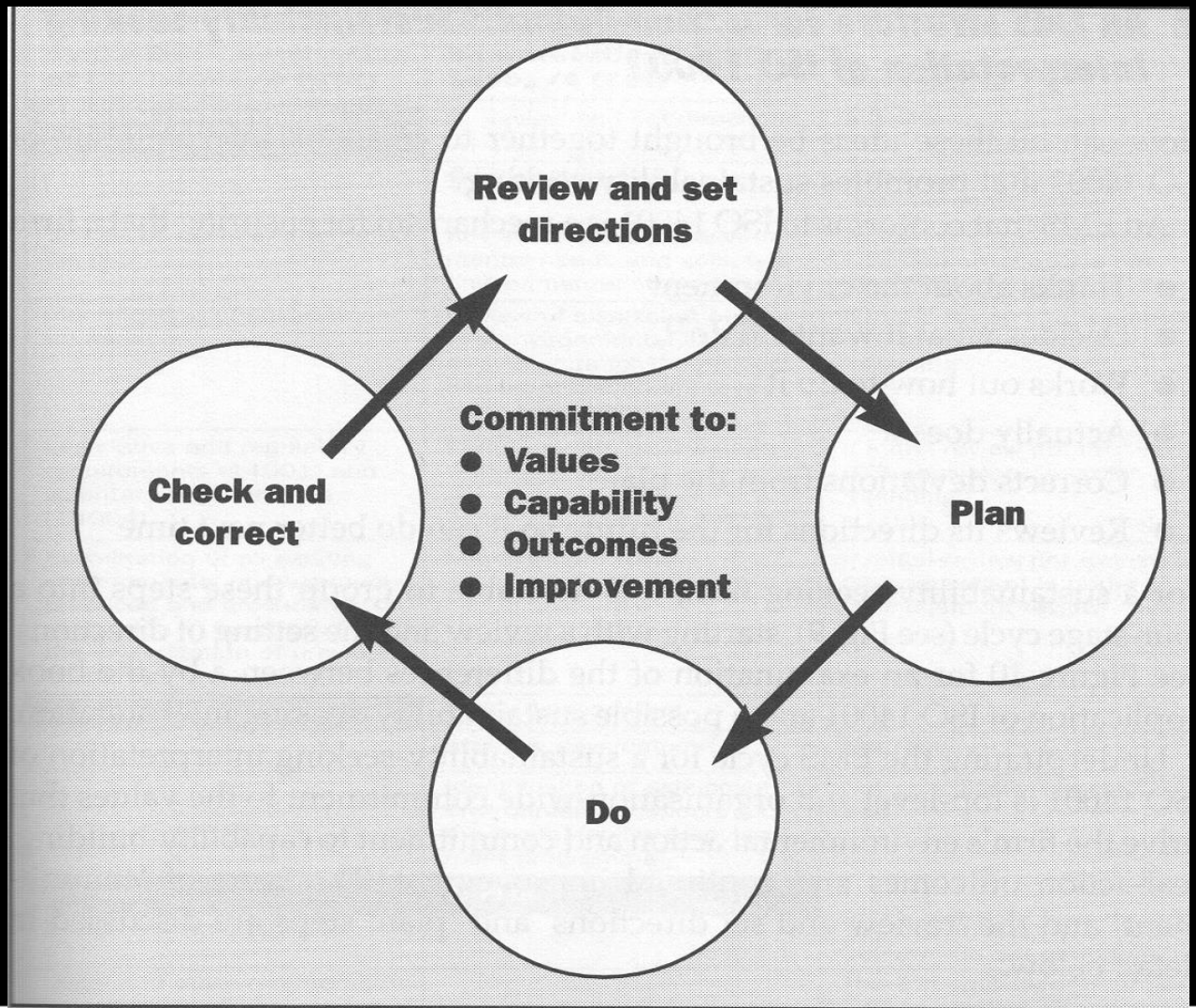
CORPORATE ENVIRONMENTAL POLICIES

- Reduce resource (water, energy, biodiversity, materials) consumption, and waste generation, and commit to recovery and recycling wherever realistic;
- Pollution prevention, or at least pollution minimisation;
- To increase environmental awareness of the workforce by education and training;
- Achieve industry best practice through benchmarking and technology transfer;

ENVIRONMENTAL MANAGEMENT SYSTEMS

EMS offer a SYSTEMATIC way to conduct environmental management

Environmental Management Systems – Plan-Do-Check-Review



A HISTORICAL PERSPECTIVE - FIREMAN

1. “Fireman” approach to environmental management (to 1980s)

- Environmental issues were peripheral to the main game which was production and profit
- Environmental management was a cost to be minimised
- Respond to problems if and when they arise
- But is it smarter to plan to avoid problems?

A HISTORICAL PERSPECTIVE - PLANNING

2. "Planning" approach to environmental management (1980's to mid 1990's)

- **Environmental issues were increasing in importance, but not central, and considered an essential "cost"**
- **Studied problems, and assessed them using technical factors, cost-effectiveness, scale of impacts etc**
- **Produces a priority ranking and fixes problems by priority**

2. A HISTORICAL PERSPECTIVE - PLANNING

PLANNING is the development of an organised method by which the policies can be implemented.

The plan usually involves the formulation of suitable objectives, targets, and implementation programs to achieve them.

Objectives are broad goals to be achieved to fulfill the policy. An example of a objective is a commitment to minimise the amount of solid waste produced.

3. A HISTORICAL PERSPECTIVE - Systems approach

3. “Systems” approach to environmental management (from mid 1990’s)

- Environmental issues became mainstream corporate issues (legal and corporate image issues), eg Shell, BHP - OK Tedi etc)
- Environmental issues had to be got right
- Demonstrate due diligence
- International trade issues
- Requires corporate structure, responsibility, planning, activities practices, procedures and resources to achieve the corporate policy

ENVIRONMENTAL MANAGEMENT SYSTEMS

British Standard 7750 introduced in 1992

European Union Eco-Management and Audit Scheme (EMAS) introduced in 1993

Multinationals observed with horror a growing number of schemes. Will they become compulsory?

ISO 14 000 Series

- **International standards based on the ISO 9000 QA series**

ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM

It is a process standard not a performance standard (how you go about doing it, not what you achieve)

- Performance includes emissions, discharges, energy use, recycling etc.
- Remember it is GLOBAL!
- In a performance based system, some could relax, others would find it almost impossible
- Require different levels, constant updating with technology

ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM

Demonstrate continuous improvement

Integrate with production management systems (QA - ISO 9000) and occupational health and safety systems (ISO 19000)

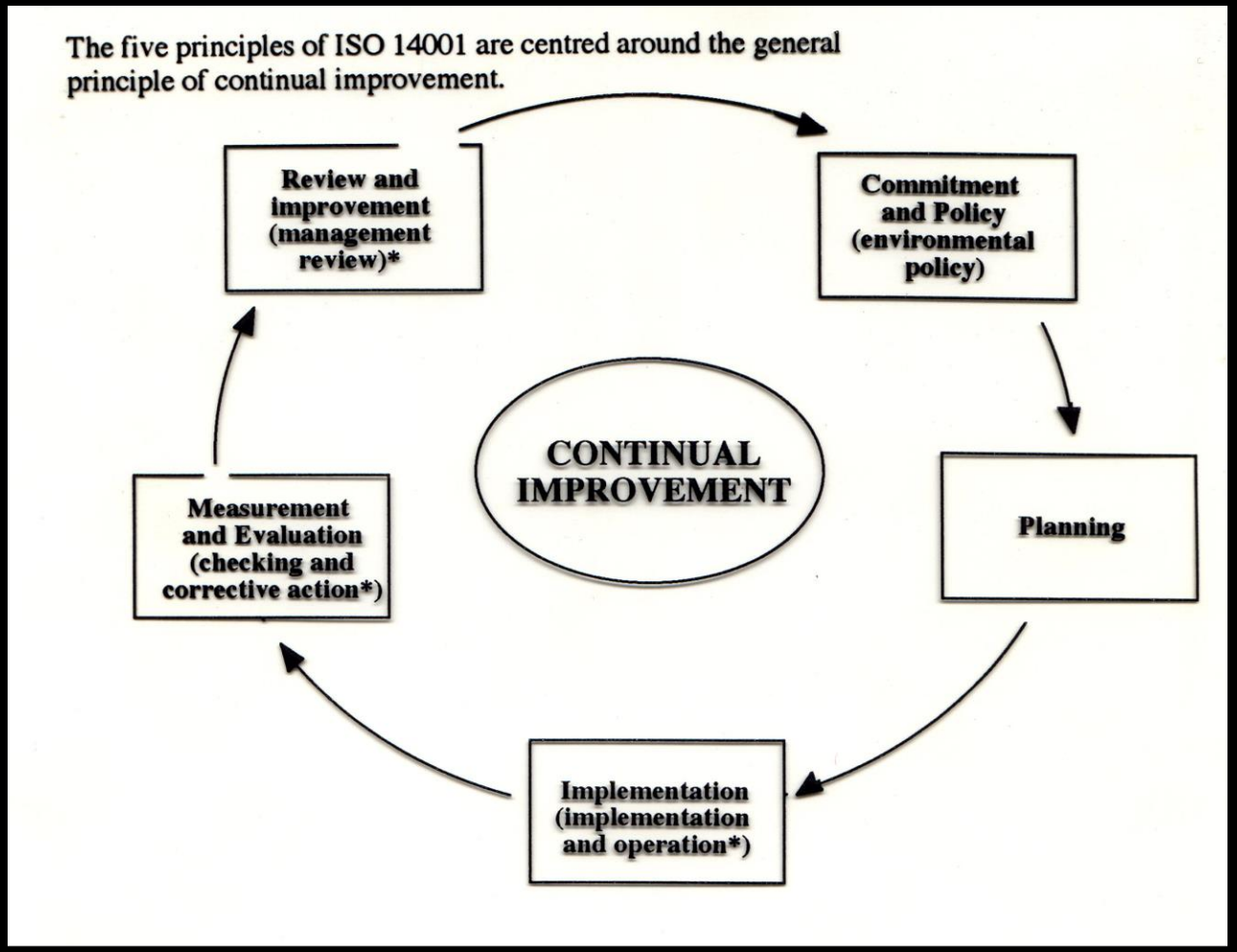
EMS is increasingly integrated with health and safety management systems (EHS, HSE)

EMS FRAMEWORK

Five key principles:

- **Commitment and policy**
- **Planning**
- **Implementation**
- **Measurement and evaluation**
- **Review and Improvement**

ISO 14000 ENVIRONMENTAL MANAGEMENT SYSTEM



TARGETS

Targets are specific, measurable performance indicators. They must be realistic and achievable under the circumstances of the organisation. They usually include a time frame.

An example of a target is a commitment to reduce the amount of solid waste produced by an organisation, by 20% by 2005, using 2000 as the base year.

TARGETS - examples

- % waste recycled
- Waste produced per unit product
- $ invested in environmental protection
- Number of environmental accidents
- Number of staff attending environmental awareness courses

Aim to relate to most areas of the organisation's environmental policy

Usually measurable indicators of the status of implementation of the policy

3. IMPLEMENTATION

- Resources (human, physical, financial)
- Compatibility of management systems (EMS with financial,human resources, production)
- Responsibility
- Environmental awareness and motivation
- Knowledge skills and training
- Support (communications, documentation, operations etc)

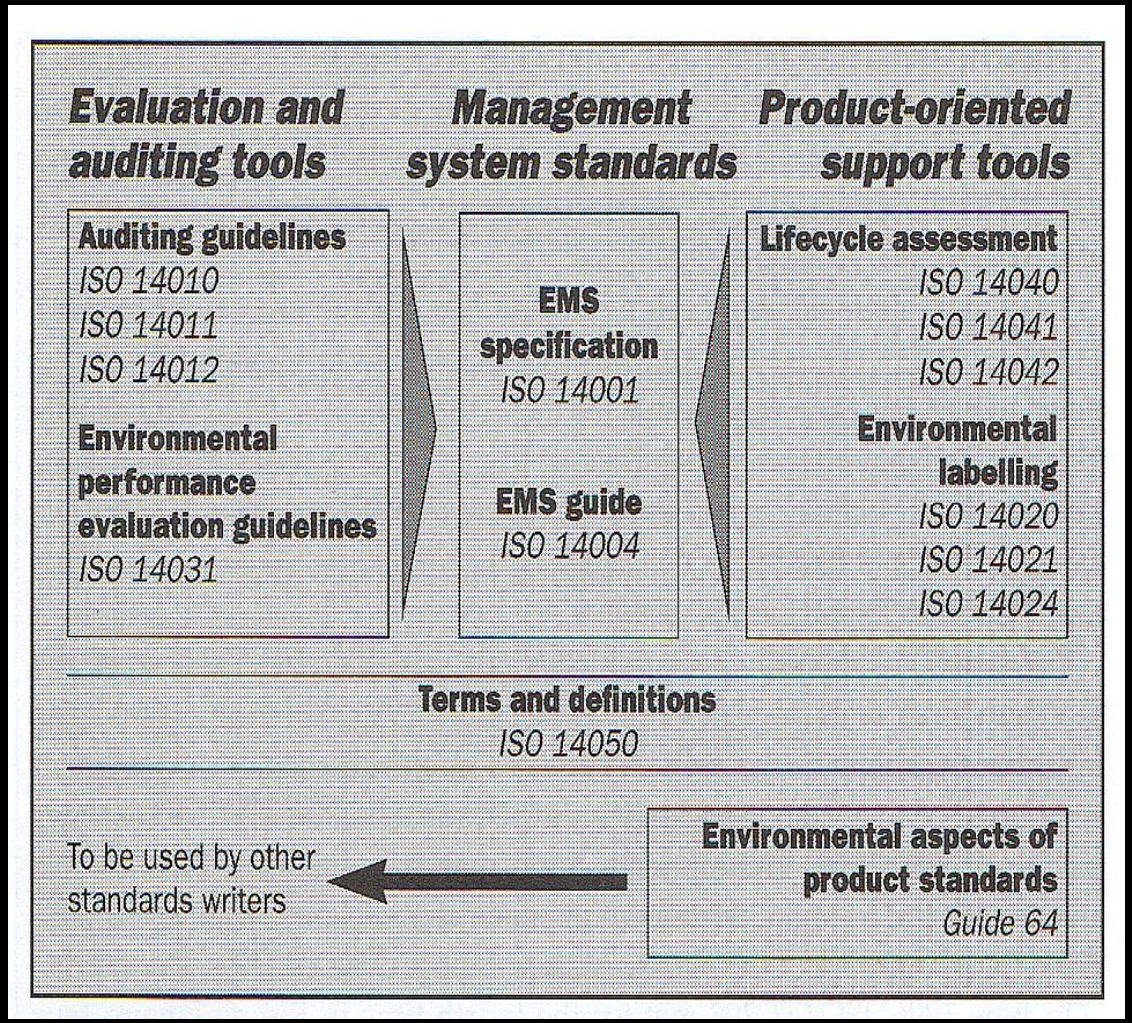
4. MEASUREMENT AND EVALUATION

- Key performance indicators
- Corrective and preventative action
- EMS records and information management
- Audits of the EMS

5. REVIEW AND IMPROVEMENT

- Review objectives targets and performance
- Review findings of audits of the EMS
- Evaluate EMS effectiveness
- Evaluate the need for change (caused by new regulation, new company activities, changes in production or pollution control technology)
- Evaluate the lessons learned from environmental incidents

The ISO 14000 Series



Education and information

TYPES OF ENVIRONMENTAL REGULATION

Education and Information

Education and information	Raises awareness in the community; provision of information to provide for informed comment and debate	Examples: Community Right to Know legislation; toxic release inventories, community-based air quality groups

Environmental impact assessment

ENVIRONMENTAL IMPACT ASSESSMENT

EIA is a political response by governments to community concern about developments, with a purpose to:

- **Provide environmental protection through decision-making process and conditions**
- **Provide for conservation & development**
- **Be educative (improve)**
- **Be iterative (research)**
- **Meet statutory and government policy requirements**

ENVIRONMENTAL IMPACT ASSESSMENT

EIA provides an opportunity for a regulator to get pollution prevention or emissions control right from the start, through planning

- **Optimal siting**
- **Optimise the production process (pollution prevention)**
- **Optimise emissions control**
- **Minimise emissions**
- **Require monitoring**
- **Ensure it meets statutory and government policy requirements**

Background

- By the late 1960s there was widespread and growing public concern about the need to regulate new developments, especially industrial developments. Concept of Careless Technology eg DDT, mercury, etc
- Led to the US National Environmental Policy Act (1969)
- Most developed and developing countries enacted EIA legislation

Issues

The situation in 1960s was characterised by

- Fragmentation of responsibilities, water, land, air, health, planning, wildlife, mines, local government, Commonwealth government
- Need for environmental assessment
- Need for responsibilities to be clear
- “Progress seems to be like a rapidly accelerating train, destroying everything in its path, and no-one seems to have any control over it”

The Early Role of EIA in Environmental Management

- At the time of inception of EIA, the idea was to ensure that the environment was properly considered when decisions were taken about new developments
- Consideration focussed on
  - What are expected to be the impacts
  - How can they be managed?
  - They were not simply Yes/No

Objectives of EIA

- Ensure proponents take primary responsibility for environmental protection
- Ensure best practicable measures are taken to minimise effects on the environment, and that standards are met,
- Provide opportunities for public participation during assessment
- Encourage continuous improvement by proponents
- Ensure reliable advice is available to government before decisions are made
- Educate the proponents, consultants and the community

EIA as a technical process

EIA requires that the following be explained in technical terms:

- The details of the proposed development
- The characteristics of the surrounding environment (biodiversity, physical etc)
- The potential impacts on the environment
- The management of these potential impacts
- The expected impacts on the environment
- The acceptability of these impacts

EIA as a political process

- Governments usually see EIA as a way to ensure developers consider environmental aspects and integrate them into their developments
- Governments do not want EIA to hinder development
- Government is supposed to consider social, economic and political aspects.

Types of projects subject to EIA

- Resource development
- Industrial processing
- Infrastructure
- Land use
- Planning schemes

Considerations

- Likely type and extent of impacts on the environment, both biophysical and social
- The environmental values of the areas affected
- The confidence in predictions of impacts
- The extent to which the proposal implements the principles of sustainability
- The capacity to put conditions on any approval to ensure environmental outcomes are achieved
- The amount of public interest, and the extent and quality of consultation

Lessons learned from implementation in developing countries

Lessons from Bangladesh (conversion of 3 wheelers to CNG)

- Socially difficult environmental decisions can be executed if there is strong public support.
- Public support can be created by working with the stakeholders and the press on genuine issues.
- Decisions are the result of political will but this has to be earned through effective management of technical issues.
- Careful planning is needed for the mitigation of adverse impacts on both the public and the stakeholders.

Lessons from India

- Very high levels of urban air pollution, especially particulate pollution, in Indian cities in the 1990s.
- Independent analyses estimated that it could be responsible for significant health damage.
- A series of policy interventions followed, in which civil society and judiciary have played a major role (Delhi has set an example)
- A number of other highly polluted cities prepared “action plans” for addressing urban air pollution.

Health benefits of changes in particulates

Cities	Population (mil.)	No. of lives saved/yr	Economic value (mil. $/yr)
Delhi	12.8	3629	432
Kolkata	13.2	3293	392
Mumbai	11.9	5308	409
Hyderabad	5.5	125	10
Chennai	6.4	484	37
TOTAL	**49.8**	**12,838**	**1279**

Summary of key actions across Indian cities

Intervention	Industry	Urban	Transport
Clean fuels	Switching to cleaner fuels (reduction in sulphur, gaseous alternatives)	Increasing share of domestic and commercial users of cleaner fuels (gas and kerosene for cooking, electricity for heating)	Use of cleaner fuels (unlead fuel, sulfur reduction, use of gaseous fuels) Better lubricant quality and only pre-mixed 2T oil for two- and three-wheelers
Improved technology	More efficient and cleaner combustion technology	Better road infrastructure (road widening, traffic management, flyovers)	Scrapped old commercial vehicles and replaced with a new fleet
Stronger and better enforced regulation	Tightened and better enforced emissions leading to installation of pollution control devices	Enforcement of land-use zoning regulations (closure and relocation of industry from non-conforming areas, development of green belts/areas)	Introduction and enforcement of new and more stringent emission norms for new and in-use vehicles

Discussion session:

The experience with air pollution control in South Asia