

# Urban Environmental Management in Singapore



Jothieswaran P  
Chief Engineer  
Pollution Control Department  
National Environment Agency



# Introduction

**City state comprising a main island and some islets**

**Land area - 700 sq km**

**Population - 4.5 million**



# Introduction

- **Many large-scale industries such as:**
  - oil refineries,**
  - petrochemical complexes,**
  - pharmaceutical plants,**
  - wafer fabrication plants,**
  - electronic industries.**
- **750,000 motor vehicles**



# Introduction

**High population density and a highly industrialised economy**

**Immense challenges to maintain a clean and healthy environment**

# State of the Environment

**Environment quality  
compares well with best  
cities in the world**

**Major air pollutants within  
international standards**

**Inland and coastal waters  
support aquatic life**



**Financial  
District**



**Marina  
Bay**



# Environmental Management Strategy

- **Prevention**
- **Enforcement**
- **Monitoring**
- **Education**



# Prevention

- **Environmental Planning Controls**
  - Land use planning
  - Judicious siting of industries
- **Environmental Infrastructure**
  - Comprehensive sewerage system
  - Efficient solid waste system
- **Regulatory Controls and Policies**
  - Controls and policies on air and water pollution and hazardous chemicals and hazardous industrial wastes

# Environmental Controls In Land Use Planning

- Land zoned for specific uses such as residential, commercial, industrial, etc.
- Safeguarding land for drainage, and sewerage and solid waste collection, treatment and disposal facilities
- Protection of water catchments



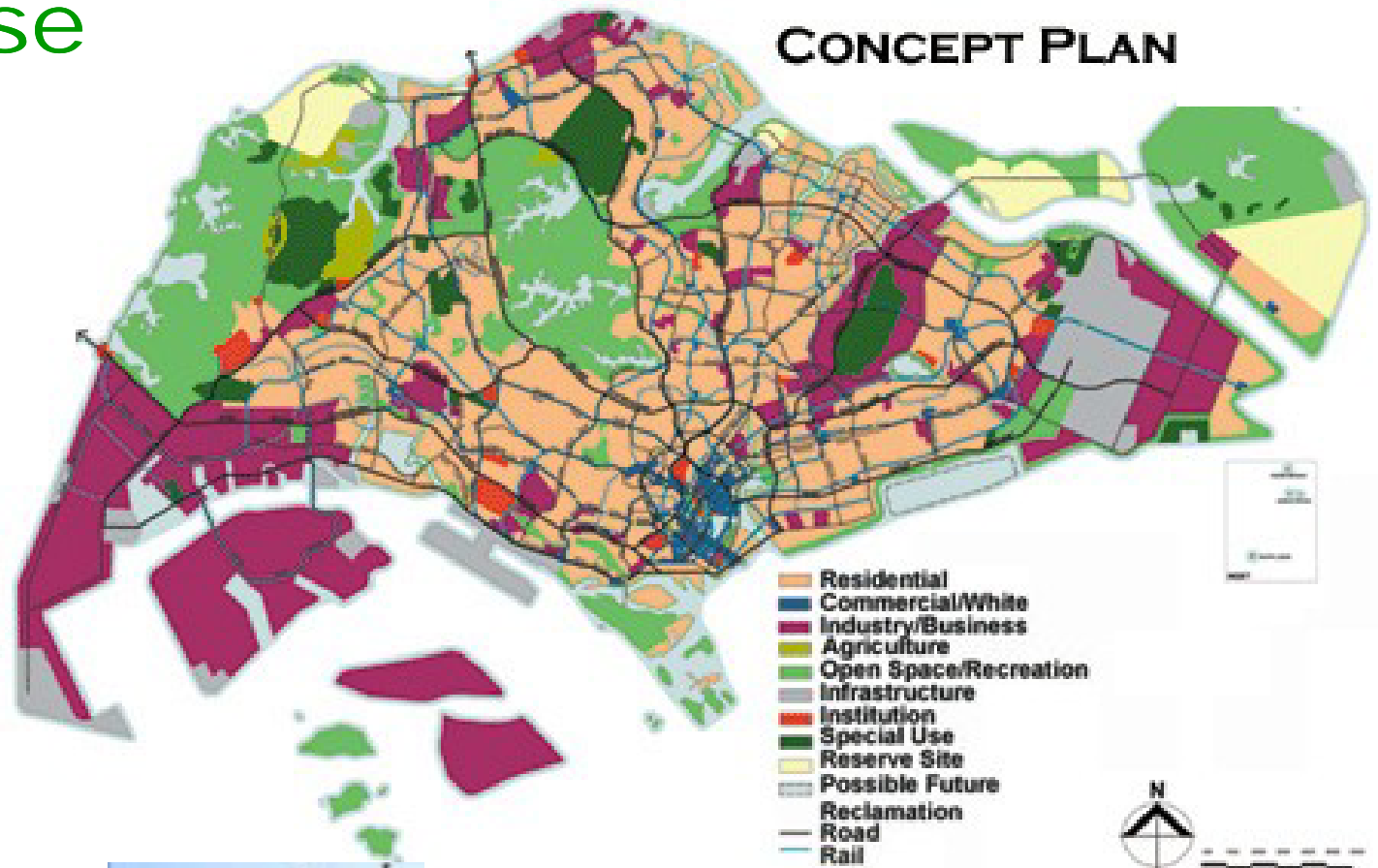
# Siting of Industries

**To optimise land use and minimise impacts from pollution,**

- site industrial estates for clean and light industries close to residential areas
- site general and special industries farther away from residential areas in Industrial estates, and out of water catchments



# Land Use Zoning



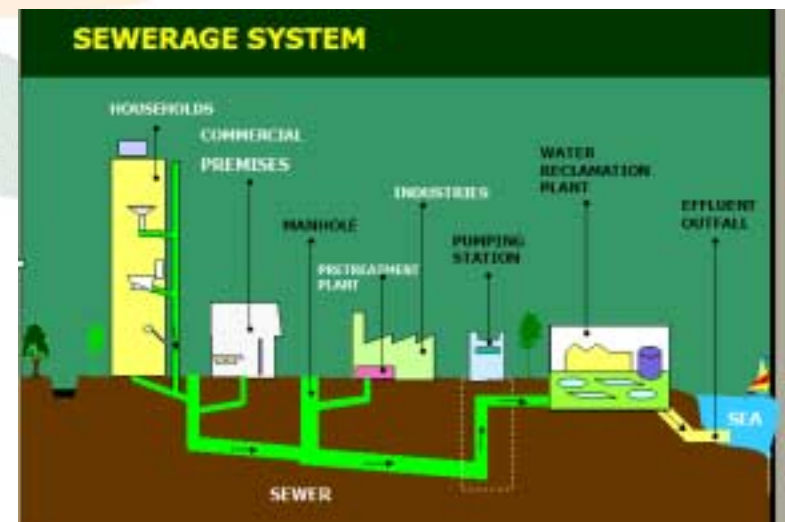
# Prevention

- **Environmental Planning Controls**
  - Land use planning
  - Judicious siting of industries
  - Development and building plans control
- **Environmental Infrastructure**
  - Comprehensive sewerage system
  - Efficient solid waste system
- **Regulatory Controls**
  - Controls on air and water pollution and hazardous chemicals and hazardous industrial wastes



# Sewerage Infrastructure

- 6 water reclamation plants
- >3000 km sewers
- >100 pumping stations
- served all industrial estates and almost all residential premises except for isolated pockets of residential premises with on-site sewage treatment plants



# Solid Waste Management

- Daily refuse collection service
- 90% of wastes incinerated at 4 incineration plants
- 10% of wastes disposed of at the off-shore Semakau sanitary landfill

## Refuse Disposal Facilities



ent

# Waste Management Hierarchy – 3Rs

- **Reduce** - to avoid unnecessary waste generation.
- **Reuse** - to use again Re-use and recycle recyclable in industrial and in the community
- **Recycle** - to convert unwanted things into useful and marketable recycled products.

**Aim:**

***To prolong lifespan of incineration  
plants and landfill***

# National Recycling Programme

- ❖ A recycling programme for households
- ❖ Residents given recycling bags/ recycling bins/ crates
- ❖ Door-to-door collection every fortnight





# National Recycling Programme

## ➤ Recyclables

- ❖ Paper
- ❖ Drink cans/ metal containers
- ❖ Glass bottles/jars
- ❖ Plastic bottles
- ❖ Carton boxes
- ❖ Clothing



Semb Visy MRF



# Recycling Bins at Public Places

- ❖ Outside subway stations
- ❖ Shopping streets and malls
- ❖ Residential estates



# Plastic Waste Recycling



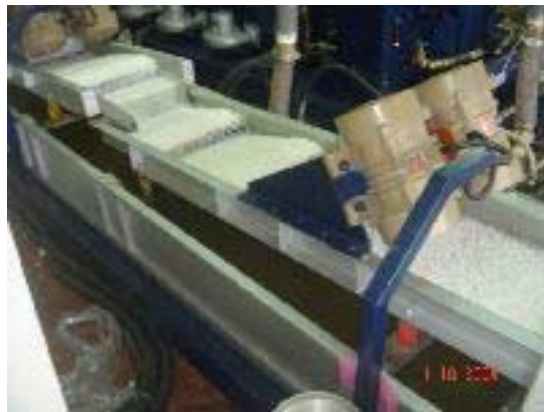
**Plastic scraps**



**Heating and Extrusion**



**KK Asia  
Plastic Recycling Plant**



**Plastic Pellets**

# Prevention

- **Environmental Planning Controls**
  - Land use planning
  - Judicious siting of industries
  - Development and building plans control
- **Environmental Infrastructure**
  - Comprehensive sewerage system
  - Efficient solid waste system
- **Regulatory Controls and Policies**
  - Controls on air and water pollution and hazardous chemicals and hazardous industrial wastes

# Air Pollution Control

- Licences required for pollutive industries
- Industries designed or provided with pollution control equipment to comply with allowable emission standards for air pollutants
- Fuel burning equipment to use fuel of specified quality
- Use of cleaner fuel





# Vehicular Emission Control

- Stringent emission standards for registration of vehicles
- Use of Unleaded Petrol and Ultra Low Sulphur Diesel
- Mandatory periodic inspection of in-use vehicles
- Stringent enforcement action against smoky vehicles
- Promote education on proper vehicle maintenance to prevent smoke emission



# Water Pollution Control

- Trade effluent pre-treated to allowable discharge limits for discharge into a public sewer or watercourse
- Licence required for discharge to trade effluent into watercourses
- Containment facilities provided for storage tanks of oil and chemicals





# Environmental Management Strategy

- Prevention
- **Enforcement**
- Monitoring
- Education

# Enforcement

- **Conduct regular inspections and checks on industries**
- **Air pollutants to comply with emission standards**
- **Trade effluent to comply with standards for discharge into sewers/watercourses**
- **Checks and audits on management and disposal of hazardous substances and hazardous industrial wastes**

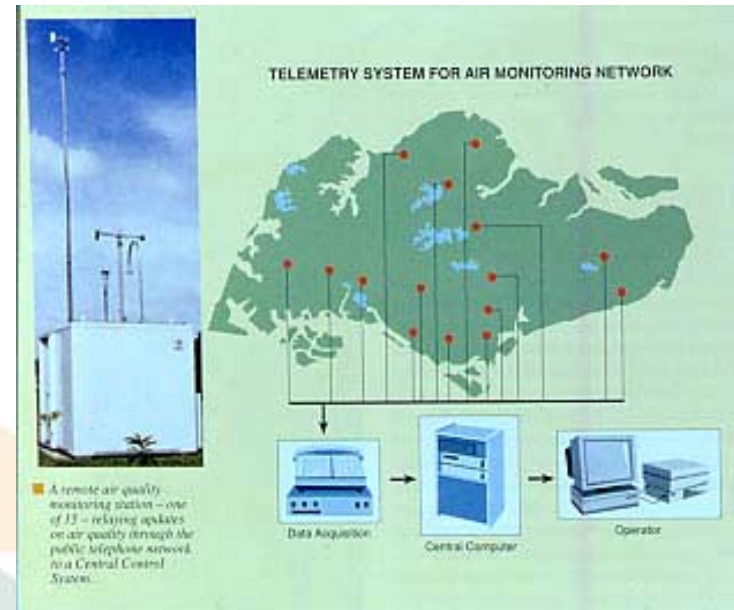


# Environmental Management Strategy

- Prevention
- Enforcement
- **Monitoring**
- Education

# Monitoring

- **Regular monitoring of ambient air quality, and inland and coastal waters via**
  - Continuous telemetric air monitoring system
  - Sampling of water qualities of rivers, reservoirs, beaches, etc
- **Monitoring data provides feedback on adequacy and effectiveness of control programmes**



# Education & Partnership

- NEA cannot succeed alone
- Work with industries as partners to move towards self-monitoring and co-regulation
- Regular dialogues with industries, professional institutions, etc
- Training courses for professionals, industries, etc
- Seminars, workshops, etc, for industries, businesses, etc



Thank you