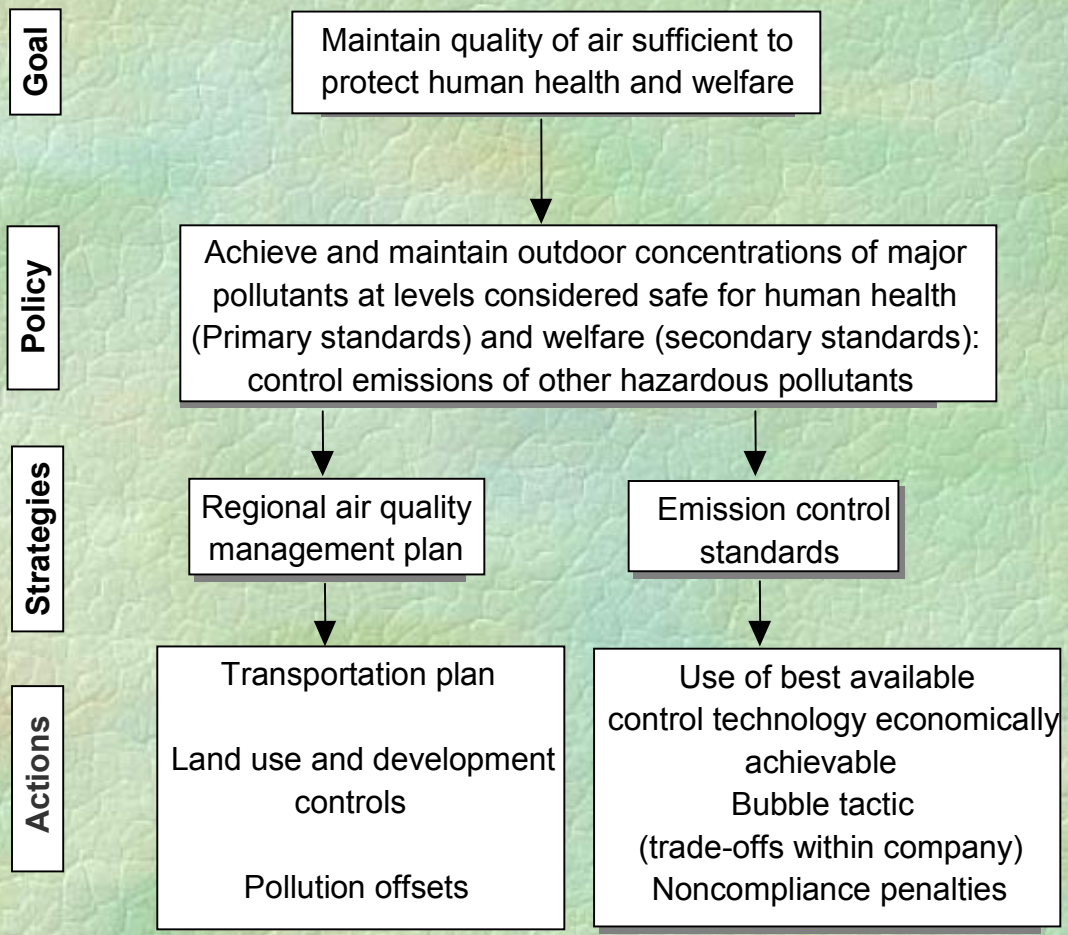
Planning for Air Quality Monitoring: A Case Study

By

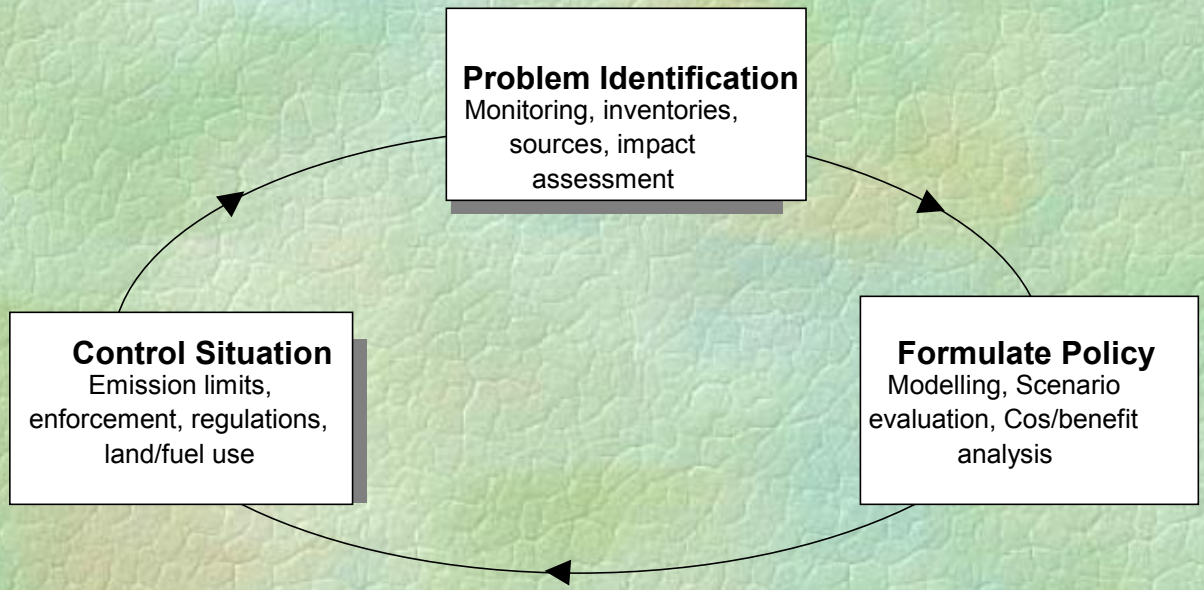
Dr Subrato Sinha

UNEP RRC.AP, Bangkok

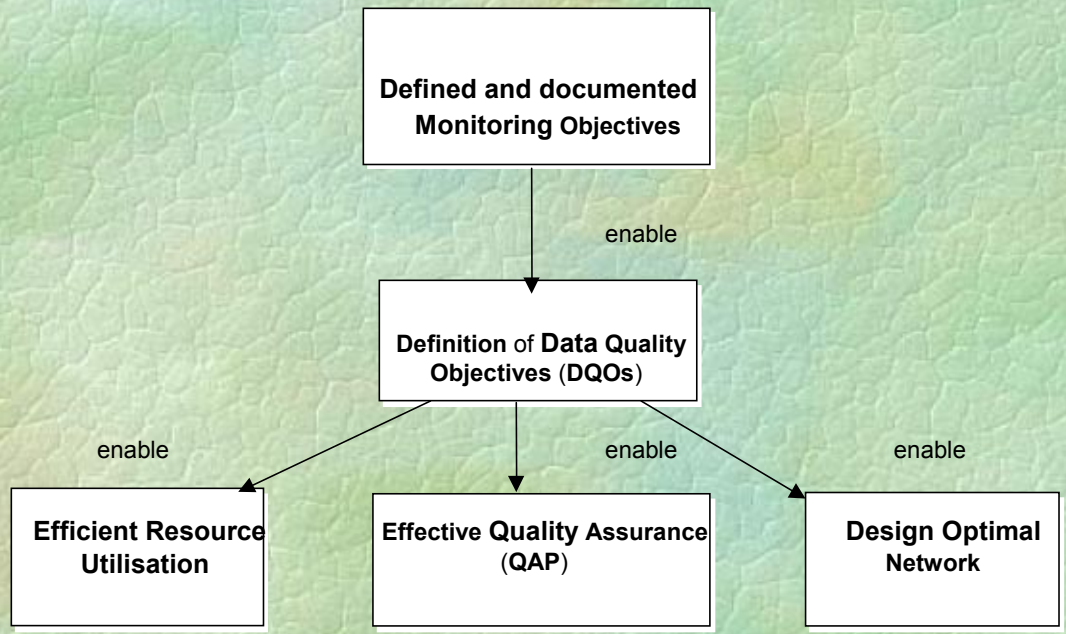
(subrato@ait.ac.th)



Structure of the ambient air quality management



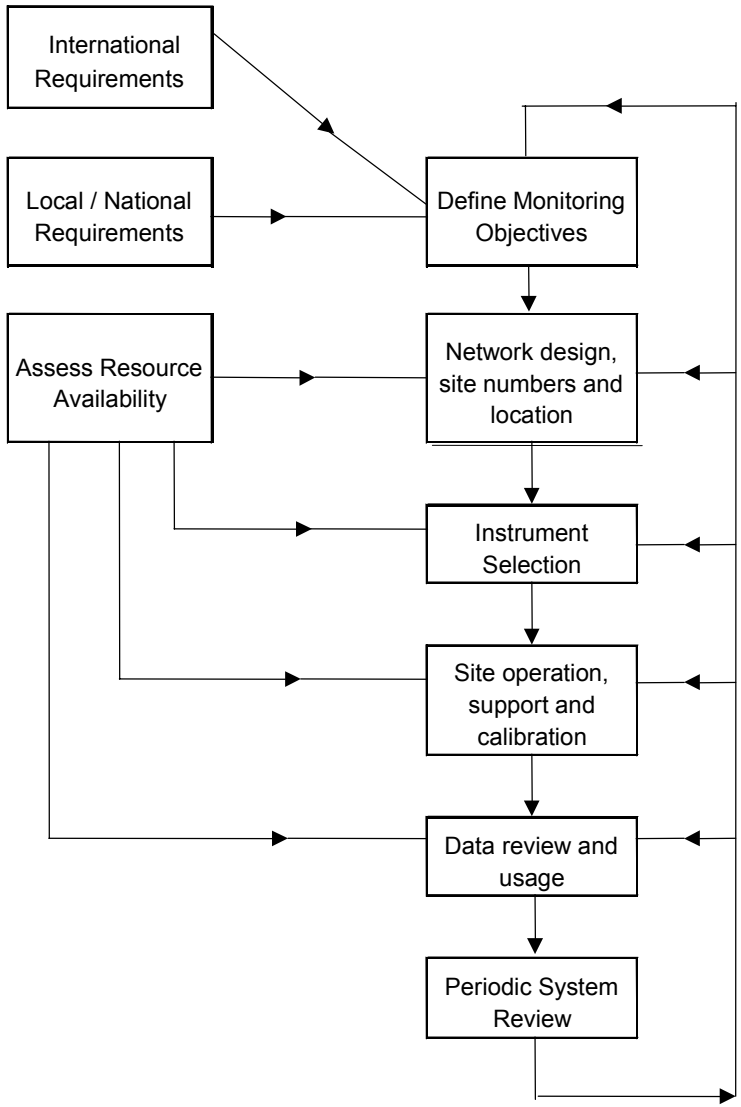
The Role of Monitoring in Air Quality Management



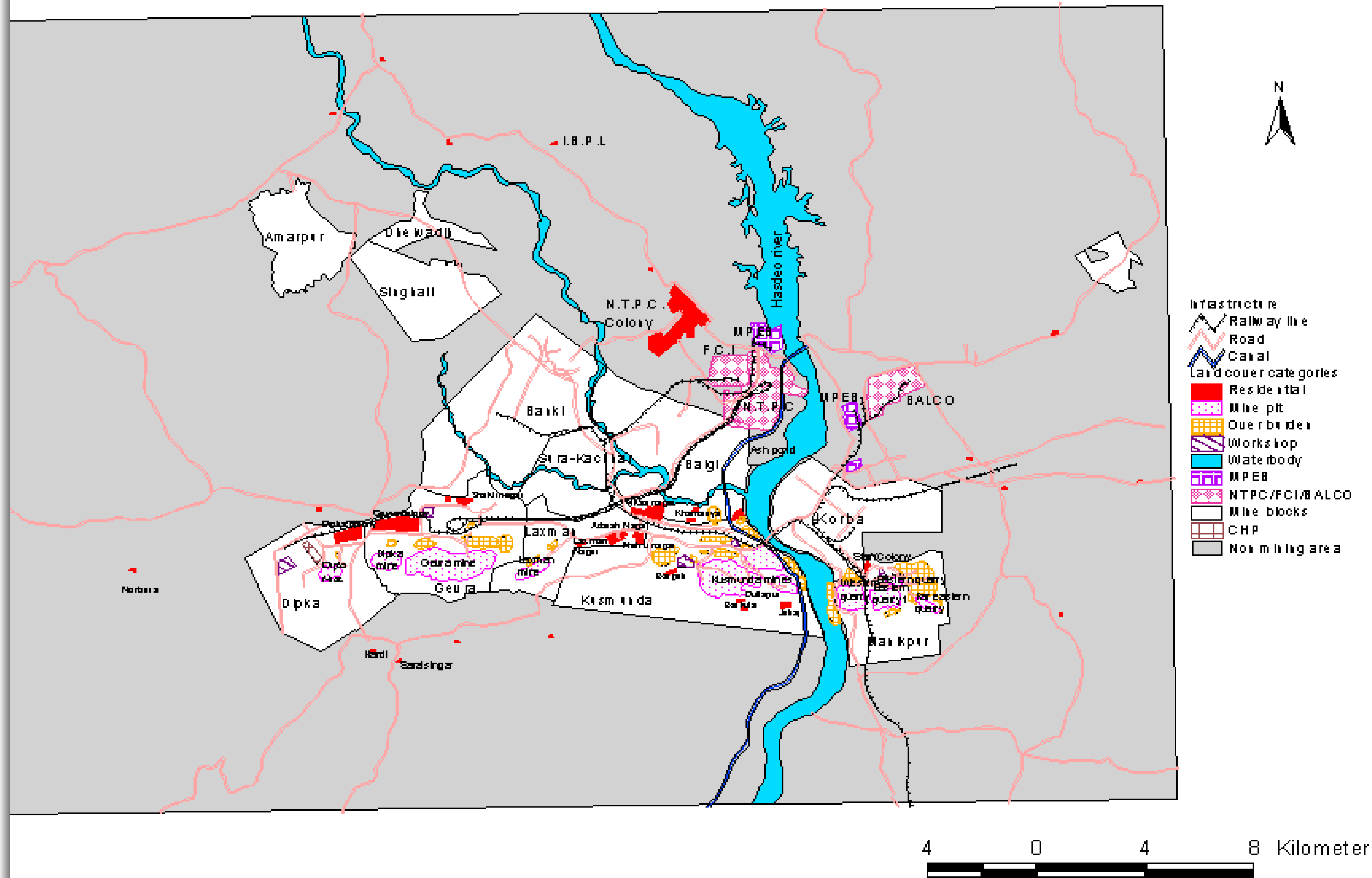
The Importance of Objective Setting

Monitoring objectives

- Population exposure and health impact assessment
- National or international standards
- Air Quality Management, traffic and land-use planning
- Source apportionment and identification
- Informing dissemination
- Identifying threats to natural ecosystems
- Policy development and prioritization of management actions
- Development / validation of management tools
- Trend qualification
- Transboundary air pollution



Air quality monitoring: a step-by-step approach



Study Area

Air quality monitoring

Ambient air quality in 6 stations:

- Background
- Mine dust source
- Residential colonies
- Rehabilitation village, and
- Korba town

Criteria for air quality monitoring

- Zone of maximum pollutant concentration
- Areas of population exposure
- wind direction
- Dispersion of pollutants, and
- Non-mining area

Indoor air quality monitoring & exposure assessment

- Microenvironments:
  - Occupational
  - Indoor
  - Background, and
  - Cooking
- Population groups:
  - Miners
  - Non mining staff
  - Officers
  - Housewives, and
  - Children

Monitoring site conditions

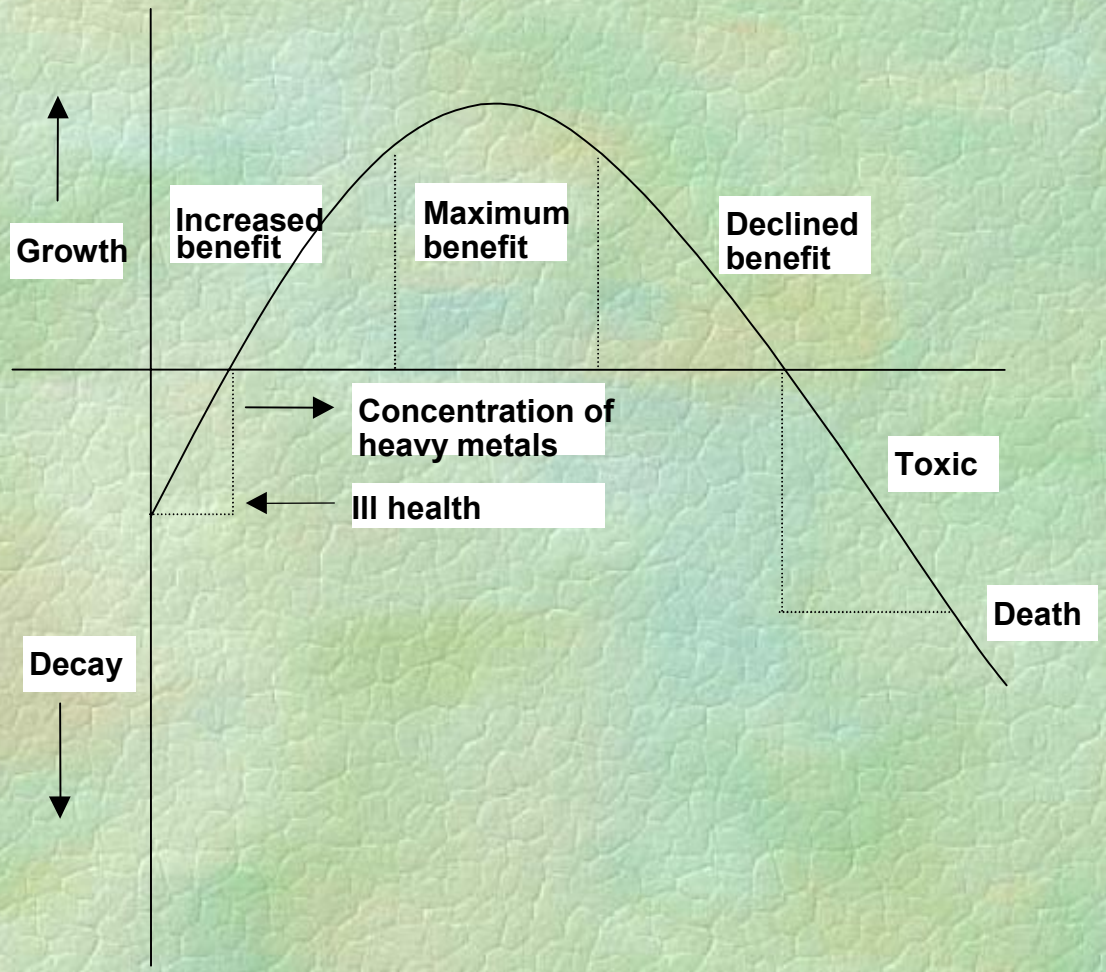
- 3-5 m above ground level
- Stable foundation/structure
- Away from vehicular traffic
- Accessible/secure
- Less travel time
- No obstruction for wind flow
- Away from water body

Instruments used

- High Volume Sampler
- Respirable Dust Sampler
- Personal Dust Sampler
- Wind Monitor
- Cascade Impactor
- Atomic Absorption Spectrophotometer

Sampling frequency and procedure

Parameters	Instrument	Sampling duration	Media
SPM	HVS	24 hourly sampling, 3 days in a week, 4 weeks in a month, 1 month for a season	EPM-2000 filter paper
RMP-10	RDS	24 hourly sampling, 3 days in a week, 4 weeks in a month, 1 month for a season	GF/EPM-2000 filter paper
Particle size distribution	5 stage Cascade impactor	8 hourly sampling, 1 in a week	Special GF filter paper
PM 5	PDS	8 hourly for occupational and 4 hourly for indoor air quality	Teflon filters
Wind data (wind speed, wind direction, temperature, humidity)	Wind monitor	Hourly data generation the monitoring period.	Data logger
Heavy metals	AAS	For all EPM filter papers	Through acid digestion of EPM-2000 filter paper

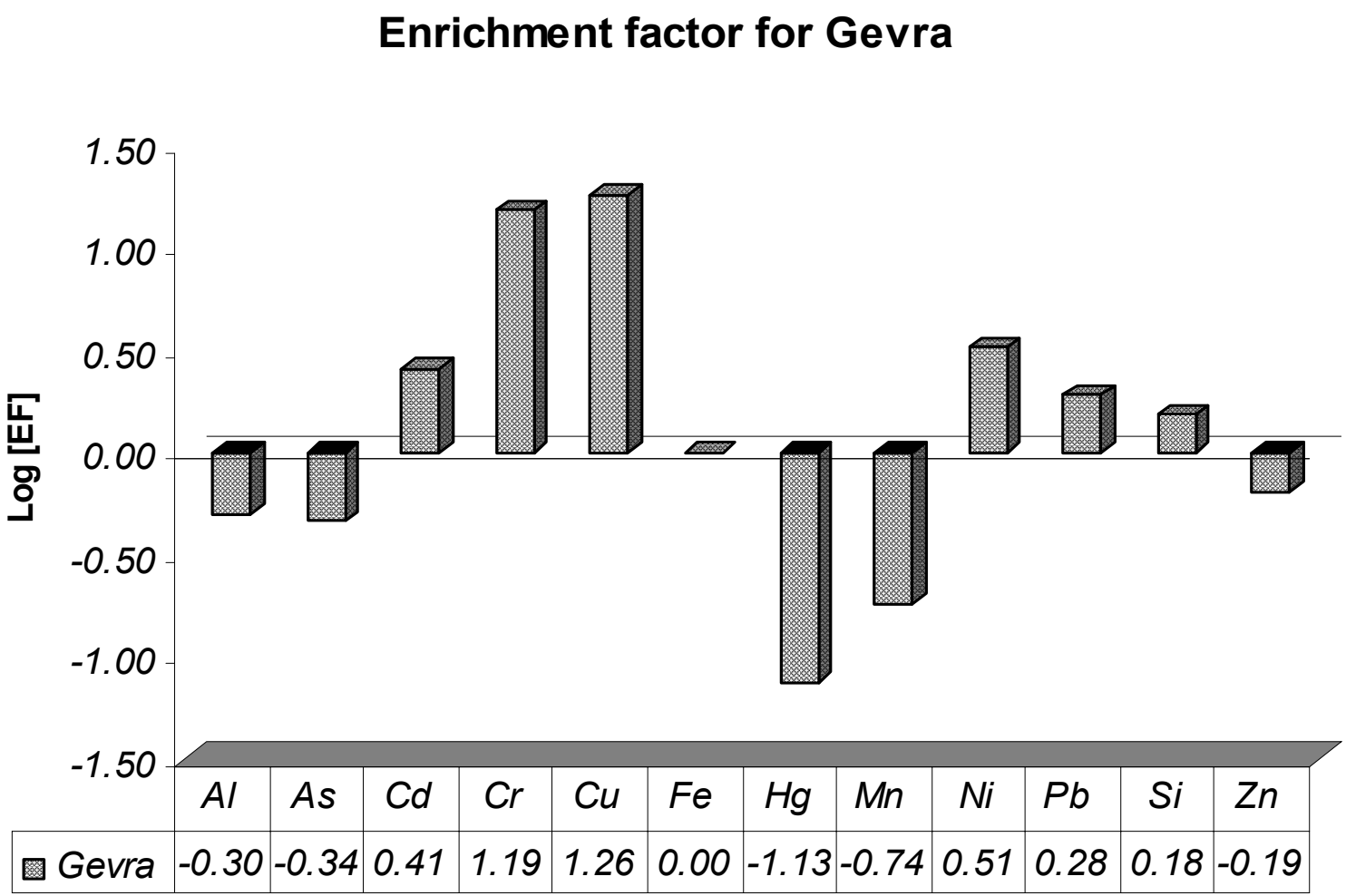


Heavy metals in life

Source identification for heavy metals

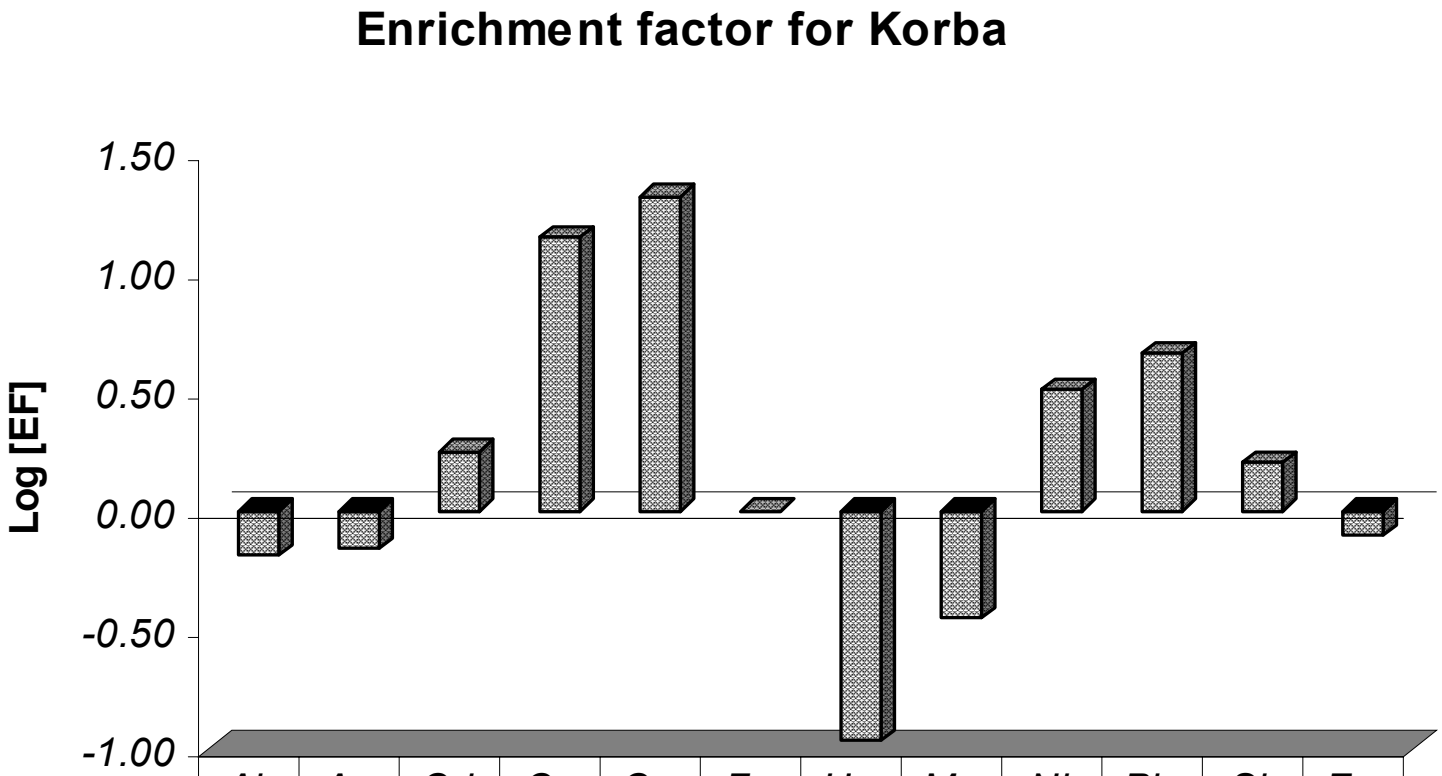
- Methodologies used
  - Enrichment factor
  - Principal Component Analysis
- Sources identified
  - Corrosion of metallic parts and tyre wear
  - Combustion of coal and oil
  - Domestic activities
  - Crustal origin

Enrichment factor



	Al	As	Cd	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Si	Zn
Gevra	-0.30	-0.34	0.41	1.19	1.26	0.00	-1.13	-0.74	0.51	0.28	0.18	-0.19

Enrichment factor



Exposure study

- Exposure: Drill operators highest followed by coal handling plant operators, payload operators, and feeder breaker operators (exceeding DGMS standard - 3 mg/m^3)
- Exposure level:
  - lesser in winter than in summer
  - Cooking with coal higher than cooking with LPG
- Indoor to outdoor ratio of particulate
  - Gevra area: 0.36
  - Kusmunda area: 0.80
- Daily exposure higher in Gevra compared to Kusmunda

Recommendation for good air quality management

- Environmental planning and reporting
  - Set a goal and policy, develop strategies and detail steps for air quality management
  - Environment cell for each mine and generate memory data for ambient indoor and occupational air environment
  - Produce environment status report once in two years
- Dust control in mines
  - Water and chemical spraying at dust generating sources, preference for paved haul roads, stabilization and biological reclamation for overburden dumps, closed belt conveyors and its transfer points

Contd...

- Dust control in residential areas
  - No coal burning in households, use of LPG, develop green belts surrounding mines, colonies, and roadsides
- Dust control during coal transportation
  - Check over-loading and over-speeding of trucks, road cleaning and development of green belts along roadsides
- Control of worker's exposure to finer dust
  - Cabins provided with machines should be protected and properly maintained
  - Dust masks to be provided to workers