AIR QUALITY MONITORING & MANAGEMENT IN THE STATE OF KUWAIT

Dr. Marwan Al-Dimashki
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الهيئة العامة للبيئة بدولة الكويت
Kuwait Environment Public Authority (KEPA)
Legislations and Regulations

Article (7): 17 items defining KEPA’s duties and tasks

- Develop environmental policies, strategies and action plans.
- Develop national environmental standards, regulations and legislations.
- Establish environmental monitoring programs and networks to monitor the environment.
- Conduct comprehensive inventories for the various environmental domains (eMISK-Marine, eMISK-Waste, eMISK-Terresterial, and eMISK-Air)

Article (50):

- KEPA publishes air quality index on the web and informs the public of air quality levels.

Article (51):

- KEPA establishes and develops the National Ambient Air Quality Monitoring Network. Governmental and private organizations must also establish their own air quality monitoring systems and link them with KEPA.
KEPA in collaboration with relevant national & international authorities & organizations

<table>
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<th>National environmental policies &amp; strategy</th>
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(2) Major Sources of Air Pollution in Kuwait
Major Sources of Anthropogenic Air Pollution in Kuwait

1. Kuwait Bay
2. Failaka Island
3. Arabian Gulf
4. 4 Wastewater Treatment Plants (Ardiya WWTP is obsolete)
5. KOC Oil Fields
6. 3 Oil Refineries
(3)
Air Quality Monitoring in Kuwait
Air Quality Monitoring in Kuwait

KEPA: 15 Fixed + 3 mobile units
KISR: 3 mobile units
KOC: 6 + 7 Fixed (OPSIS)
KU: 2 mobile units
KNPC: 3 mobile units
Total AQMS = 39
Ambient Air Quality Monitoring Stations (fixed and mobile)
Challenges in Environmental Data Management:

1) Huge environmental data sets (1983)
2) Scattered at various departments and authorities (Gov., NGO’s, Private sector, Oil sector, Research ins., etc..)
3) Present in different formats (printed tables, reports, maps, Excel, Word, ASCII, Access, SPSS)
4) Require validation
Air Quality Data Flow

Remote/background
- Al-Mutla

Residential areas
- Al-Jahra
- Saad Al-Abdullah
- AlSalam
- Al-Qurain
- Al-Regga

Residential areas affected by industry
- Al-Fahaheel
- Al-Subah Al-Salem
- Ali Subah (OPSI1&2)
- Al-Ahmadi

Residential areas affected by Commercial activities
- Al-Mansauryiah
- Al-Rumaithiya

Industrial Areas
- Al-Shuaiba
- Al-Shuwaikh

Automatic Air Quality Analyzers
- Calibration, maintenance & real-time measurements

- SO₂, H₂S, Total Sulphur
- NO, NO₂, Nox, NH₃
- PM₁₀, PM₂.₅
- CO, CO₂
- O₃, BTEX, CH₄, NMHC
- Temp, P, RH, WS, WD, UV,

Environmental Data Acquisition (ENVIDAS/ENVISTA)
- Data transfer (every 5 minutes)
- Saved in eMISK SQL Servers

Air Quality Monitoring Department
- Environmental Monitoring Information System of Kuwait (eMISK)
- (Data handling, validation and reporting)

Data Output
- 5-Minutes Data
- Hourly Averages
- Daily Averages
- Annual Averages

Reporting
- Monthly Reports
- Annual Reports

Data Sharing
- eMISK-Enterprise
- www.Beatona.net
(4) The Environmental Monitoring Information System of Kuwait (eMISK)
eMISK Geo-Database (11 Domains)

- Base Map
- Terrestrial Environment
- Marine Environment
- Atmospheric Environment
- Hydrology & Water Resources
- Biodiversity
- Waste
- Energy
- Industry
- Oil & Gas

Legend:
- Polygon
- Polyline
- Point
- Raster
- Table
- Feature Dataset
eMISK System:

KEPA Technical Departments

Mobile users

GSM Network

Intranet

eMISK Geodatabase

Internet

Public users

eMISK-Enterprise System
Intranet GIS Application

www.beatona.net
Kuwait Official Environmental Portal

Direct Connection

6 Consultants

23 eMISK Staff

eMISK Team
Data handling & Processing
(5) Kuwait Official Environmental Portal
(www.Beatona.net)
The Module “Our Environment Status” displays the continuous air quality monitoring data as “Air Quality Index” as well as charts of the historical air quality data in Kuwait.
Our Environment Status
Display Air Quality Index for Monitoring Stations

Select a date from the calendar to display the air quality index for monitoring stations
View station details and the air quality index (AQI) for 5 criteria air pollutants (Ozone, Nitrogen Dioxide, Sulphur Dioxide, Carbon Monoxide and Particulate matter of 10 microns)
Our Environment Status
Display Air Quality Data for Primary Air Pollutants

SO₂ annual mean at Al-Mansourya station showing a decreasing trend over the years
Our Environment Status
Display Air Quality Data for Primary Air Pollutants

Ozone monthly averages at Al-Mansouriya showing higher ozone levels during summer period (2015)
AQI during Dusty Days

Our Environment Status

Air Station
Saad Al-Abdullah
Last Updated: 31-10-2015

Address:
Saad Al-Abdullaa, Al-Duhaa Kindergarten

Location:
Lat: 29.31951
Lon: 47.73575

Site Description:
This air quality monitoring station is located on the roof of Al-Duhaa Kindergarten in Saad Al-Abdullaa residential area. The site represents the expansion of new residential areas in Kuwait. This

Air Quality Index on 12-2-2015
Very Bad

Click on pollutant for more details.

- $O_3$: 40
- $NO_2$: 42
- $SO_2$: 7
- $PM_{10}$: 40
- $CO$: 9

The AIR QUALITY was Very Bad because Particulate Matter levels were above the national air quality standards.
AQI during Dusty Days

The image shows a map of a region with a pop-up window displaying environmental data. The pop-up window includes a bar chart indicating daily average air quality levels for various pollutants such as O₃, NO₂, SO₂, PM₂.₅, and CO. The chart shows the air quality index (AQI) for different days in February 2015, with a national standard of 350 set as a reference. The AQI values are categorized into very good, good, moderate, bad, very bad, and no value.
Daily averages of PM10 concentration in Kuwait during 2015 showing high levels (2800 µg/m³) during dust storms and dusty days.
(6)

Air Emissions Inventories
1st Attempt to establish the National Emission Inventory (PM$_{10}$, PM$_{2.5}$, SO$_2$, NOx, CO)

Outer grid (5km x 5km resolution) covering an area of 200km x 200km

Inner grid (1km x 1km resolution) covering an area of 70km x 70km
Kuwait City emission maps (2010-Base Year)
Dispersion Modeling Architecture

Wind velocities, temperature, pressure, relative humidity, precipitation, cloud cover, wind directions, and other meteorological data are processed from the RAMS model to generate inputs for the CAMx model.

The CAMx model, a Eulerian Chemical Transport Model, processes emissions from various sources, including:

- Road transport
- Power Generation
- Industrial sector
- Natural Emissions
- Anthropogenic Area Emissions

The model outputs dispersion patterns and concentrations of pollutants in the atmosphere, useful for air quality studies and regulatory planning.
1) **Air Emission inventory (EI):** Entry of air emission sources. Displaying the results in tabular formats and bar charts.

2) **Air Dispersion Modelling (ADM):** perform air dispersion modeling for selected sources and displaying the concentration contours on map.

3) **Risk Assessment**

4) **Permitting**

5) **Compliance**

6) **Reporting**
Collaboration with Comon-Invent in Delft and the Environment Agency in Rotterdam (eNOSES Project)
eNose fingerprints

Fingerprint of eNose for various gases @ 10 ppm (best fit method)

Crude oil
Kerosene
Gasoline

eNose 21901 Sensor values (Auto)

S1  S2  S3  S4
Pinpointing a leaking tank
Establishment of eNOSES network in Kuwait

Installation of 150 eNOSES in Kuwait covering urban areas, oil production fields and industrial zones.
(7)
GCC-Environmental Portal
GCC-Environmental Portal

http://gcceportal.com
GCC-Environmental Portal

The main screen
Air Quality Index

✓ Simple way to show air quality in GCC
✓ Explore air quality monitoring stations in GCC
✓ Show stations readings for air pollutants in GCC on daily bases
✓ Five criteria air pollutants ($O_3$, $CO$, $NO_2$, $SO_2$, $PM_{10}$)
For more information, please visit our websites:

www.emisk.org

http://www.epa.org.kw

www.beatona.net