

AIR QUALITY MONITORING & MANAGEMENT IN THE STATE OF KUWAIT



الهيئة العامة للبيئة
دولة الكويت
Environment Public Authority
State of Kuwait



Environmental Monitoring
Information System of Kuwait

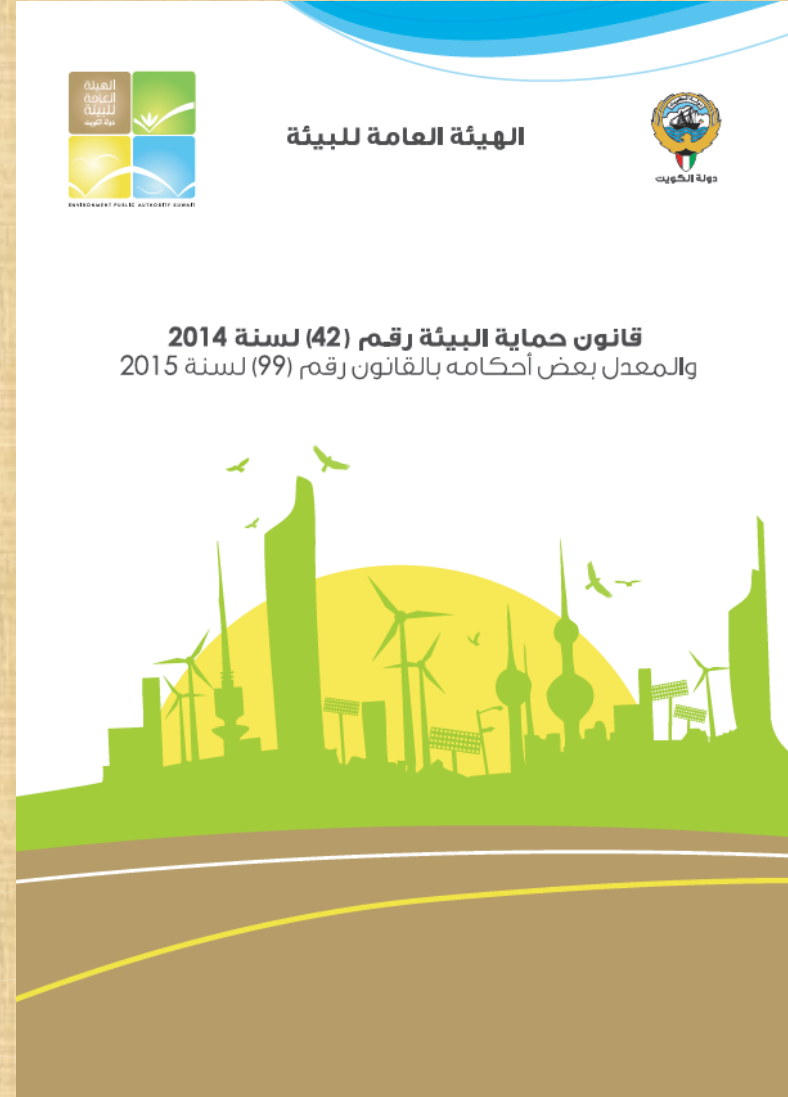
Dr. Marwan Al-Dimashki

Contents:

- 1) Environmental Protection Law in Kuwait .
- 2) Major Sources of Air Pollution in Kuwait.
- 3) Air Quality Monitoring Network in Kuwait.
- 4) The Environmental Monitoring Information System of Kuwait(www.emisk.org).
- 5) Environmental Data Sharing and Publishing - Kuwait Official Environmental Portal (www.Beatona.net).
- 6) Air Emissions monitoring & inventories.
- 7) GCC-Environmental Portal.



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-Terrestrial, and eMISK-Air*)

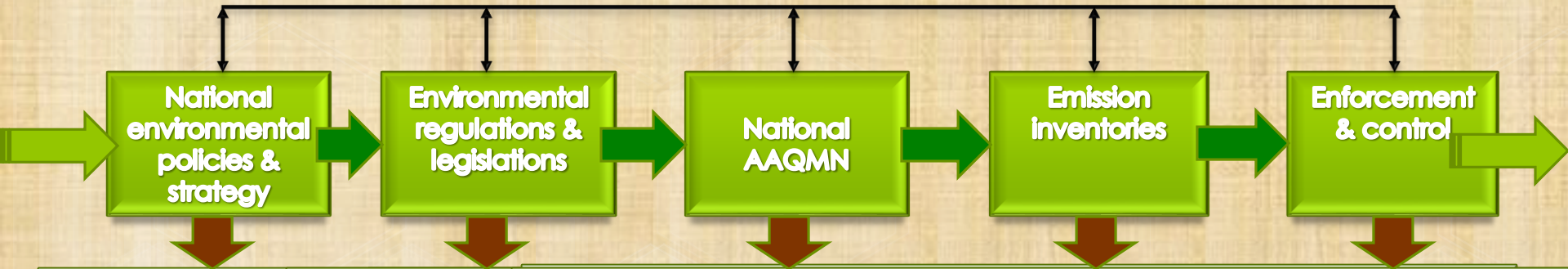
Article (50):

- 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



1. Phasing
2. Phasing
3. No flaring
4. Mobile
5. Environ
6. Nationa

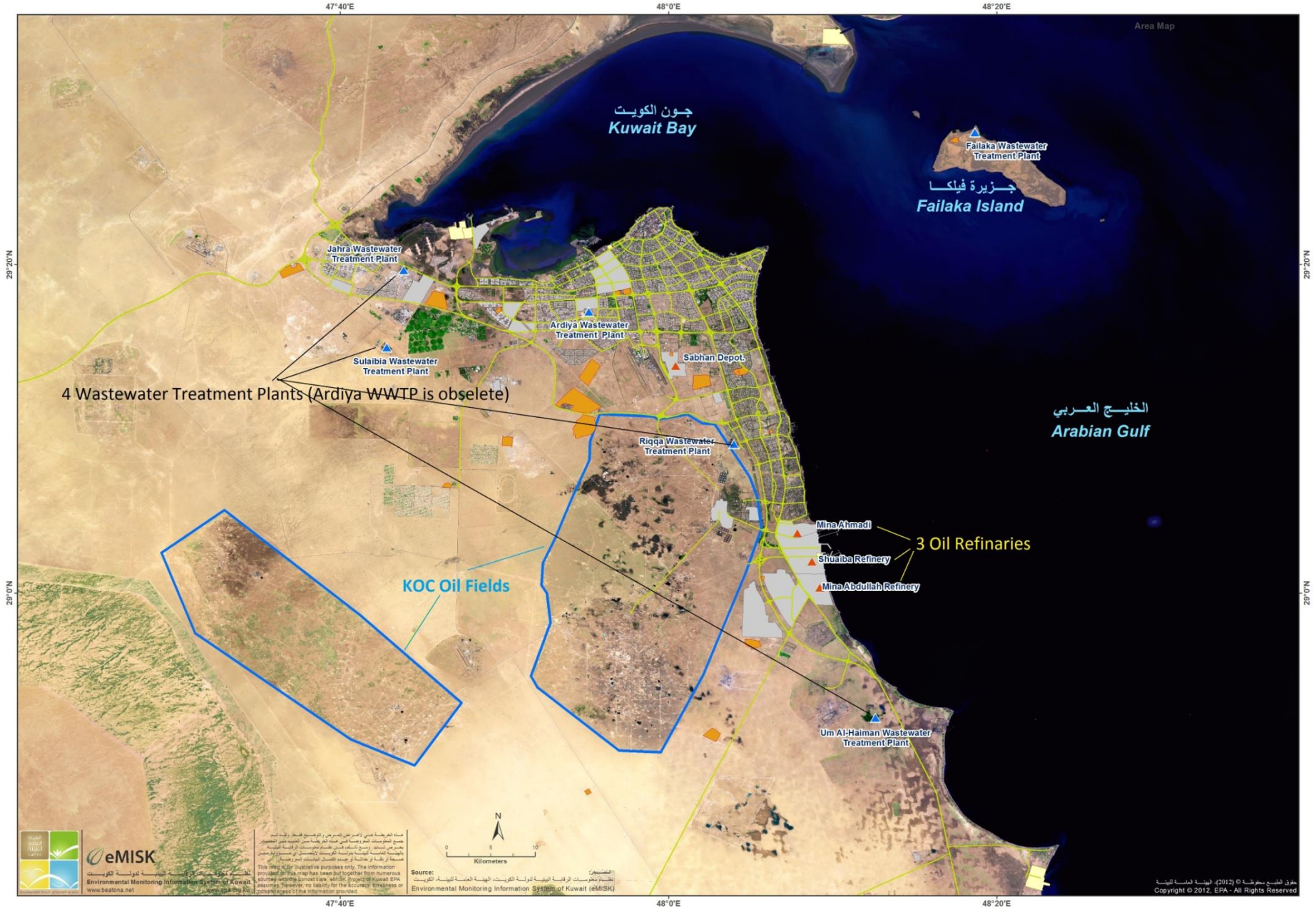
1. KEPA/V (2014)
2. KISR/KE (2012-2014)
3. UNDP/
4. UNEP/K
5. Mobile & stationary source emission inventory (2017-2020)

1. Issuing permits.
2. Installation of air pollution control systems.
3. Regular inspection visits.
4. Issuing warrants.
5. Penalties.
6. Closure of violating industries.

(2)

**Major Sources of Air
Pollution in Kuwait**

Major Sources of Anthropogenic Air Pollution in Kuwait



4 Wastewater Treatment Plants (Ardiya WWTP is obsolete)

3 Oil Refineries

KOC Oil Fields



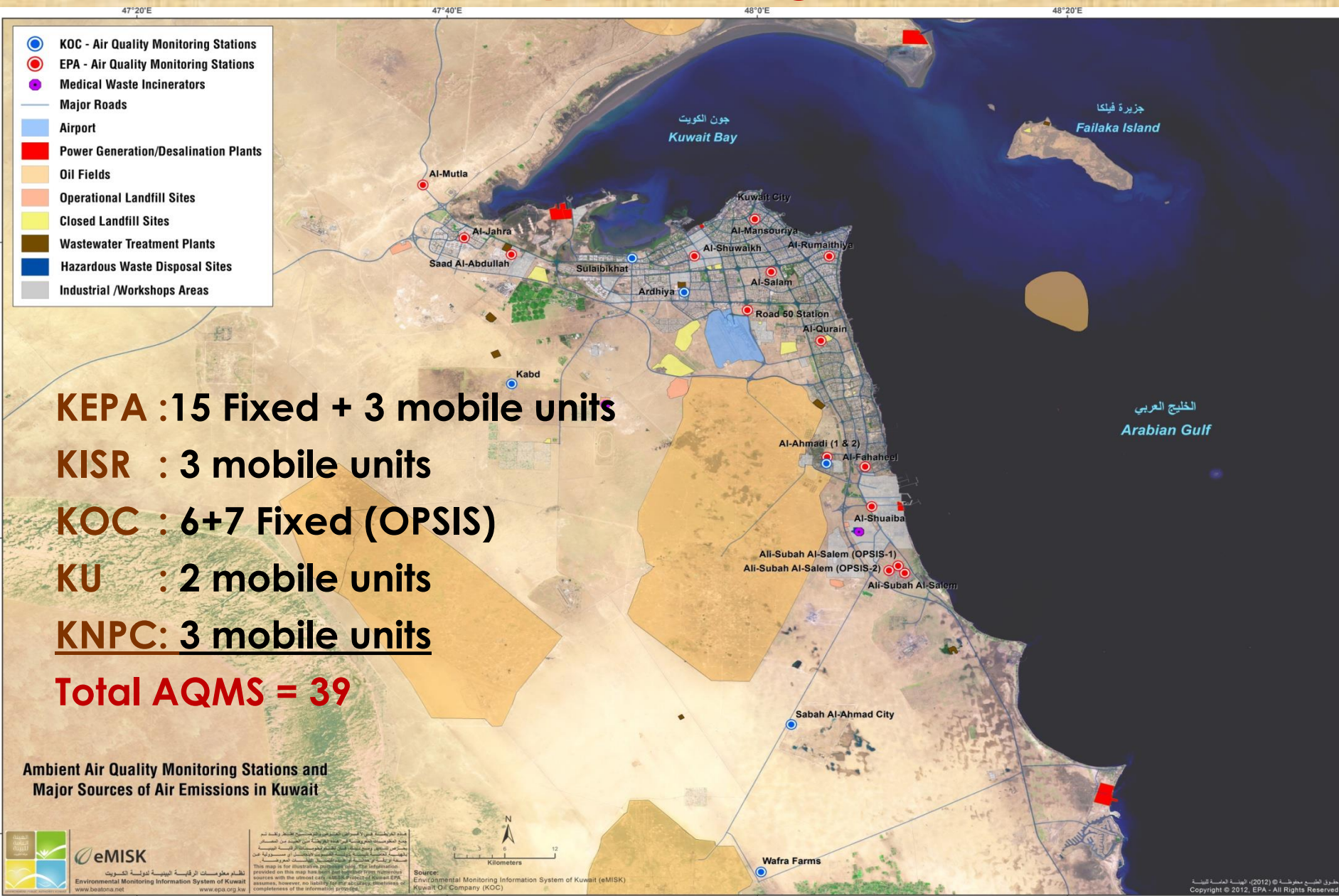
هذا النظام من أجل من الغرض من التقييم فقط ولا يهدف إلى تحديد المسؤولية عن التلوث. المعلومات الواردة في هذا النظام هي لأغراض إعلامية فقط ولا ينبغي استخدامها كأساس لاتخاذ قرارات أو إجراءات أخرى. لا يضمن النظام دقة أو اكتمال المعلومات الواردة فيه. لا يتحمل النظام مسؤولية أي أضرار أو خسائر قد تنتج عن استخدام المعلومات الواردة فيه. المعلومات الواردة في هذا النظام هي لأغراض إعلامية فقط ولا ينبغي استخدامها كأساس لاتخاذ قرارات أو إجراءات أخرى. لا يضمن النظام دقة أو اكتمال المعلومات الواردة فيه. لا يتحمل النظام مسؤولية أي أضرار أو خسائر قد تنتج عن استخدام المعلومات الواردة فيه.

Source: Environmental Monitoring Information System of Kuwait (eMISK)

(3)

Air Quality Monitoring in Kuwait

Air Quality Monitoring in Kuwait



- KOC - Air Quality Monitoring Stations
- EPA - Air Quality Monitoring Stations
- Medical Waste Incinerators
- Major Roads
- Airport
- Power Generation/Desalination Plants
- Oil Fields
- Operational Landfill Sites
- Closed Landfill Sites
- Wastewater Treatment Plants
- Hazardous Waste Disposal Sites
- Industrial /Workshops Areas

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 and Major Sources of Air Emissions in Kuwait

Ambient Air Quality Monitoring Stations (fixed and mobile)



Road side



Conventional



OPSIS



OPSIS

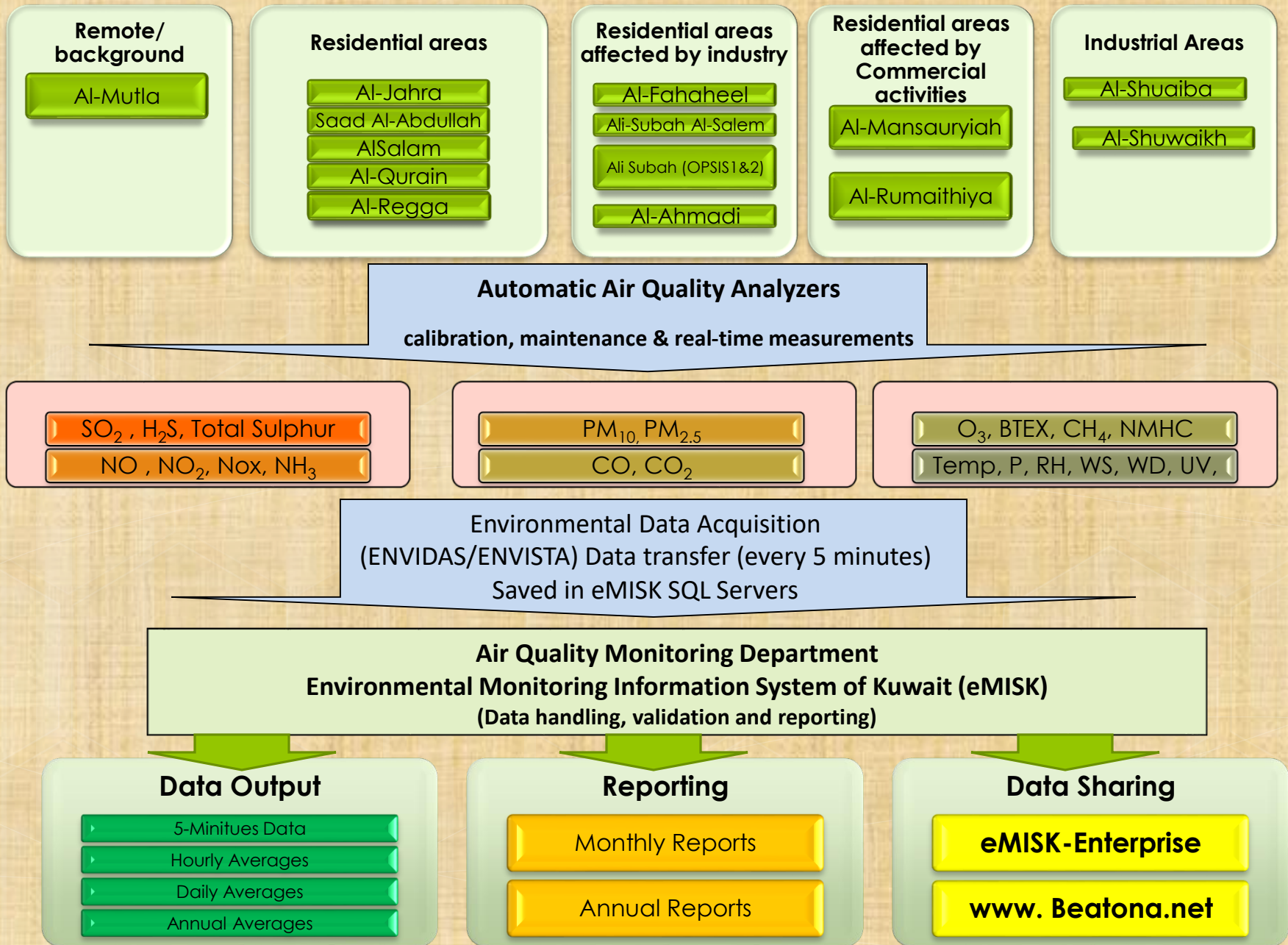


Conventional

Challenges in Environmental Data Management:

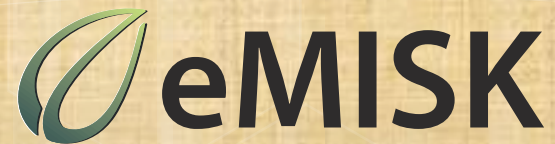
- 1) Huge environmental data sets (1983)
- 2) Scattered at various departments and authorities
(Gov., NGO's, Private sector, Oil sector, Research ins., etc..)
- 3) Present in different formats
(printed tables, reports, maps, Excel, Word, ASCII, Access, SPSS)
- 4) Require validation

Air Quality Data Flow



(4)

The Environmental Monitoring Information System of Kuwait (eMISK)



eMISK System:

Mobile users



GSM Network

KEPA Technical Departments



Intranet



eMISK Geodatabase

Public users



Internet

eMISK-Enterprise System
Intranet GIS Application

Direct Connection

www.beatona.net
Kuwait Official Environmental Portal



6 Consultants

eMISK Team
Data handling & Processing

23 eMISK Staff

(5)

Kuwait Official Environmental Portal

www.Beatona.net

Kuwait Official Environmental Portal

www.beatona.net

Environmental Explorer Knowledge Base

Beatona Our Environment

Kuwait Official Environmental Portal

Street Satellite Hybrid Terrain None

Abdali العبدلي

Arvand Kenar ارويدكنار

5 Major Modules

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.

Jahra الجهراء

Kuwait Bay حوب الكويت

Al-Zawr الزور

Kuwait City مدينة الكويت

Fahaheel الفحيجيل

Mina Alzour ميناء الزور

Al-Khiran الخيران

Al-Wafrah الوفراء

Al-Nuwiseeb النويصيب

50 km

40 mi

Powered by eMISK

Google Lat: 29.20168 Lon: 48.56506

Fix Our Environment

Explore Our Environment

Our Environment Status

Environmental Alerts

Our Environment Maps

Relevant Organizations Partners

Environment Public Authority (EPA)

View All Organizations

EXPLORE Beatona & Create your own environment GIS Map

HOT ISSUE

حوت نافع بطول 15 متراً في رأس عجوزة

© 2013 Environment Public Authority Kuwait All rights reserved.

Important Information | Guestbook | Contact Us |

Our Environment Status

Display Air Quality Index for Monitoring Stations

Environmental Explorer Knowledge Base | Tuesday 03 Nov 2015 | العربية | English

Beatona Kuwait Official Environmental Portal

Street Satellite Hybrid Terrain None

Our Environment Status

Air Water

Select date to view the available stations, Click station on the map for more information.

Air Quality Index on 25-10-2015

Today Yesterday Last Week This date last year

October 2015

Su	M	Tu	W	Th	F	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

[What is Air Quality Index?] <<Back

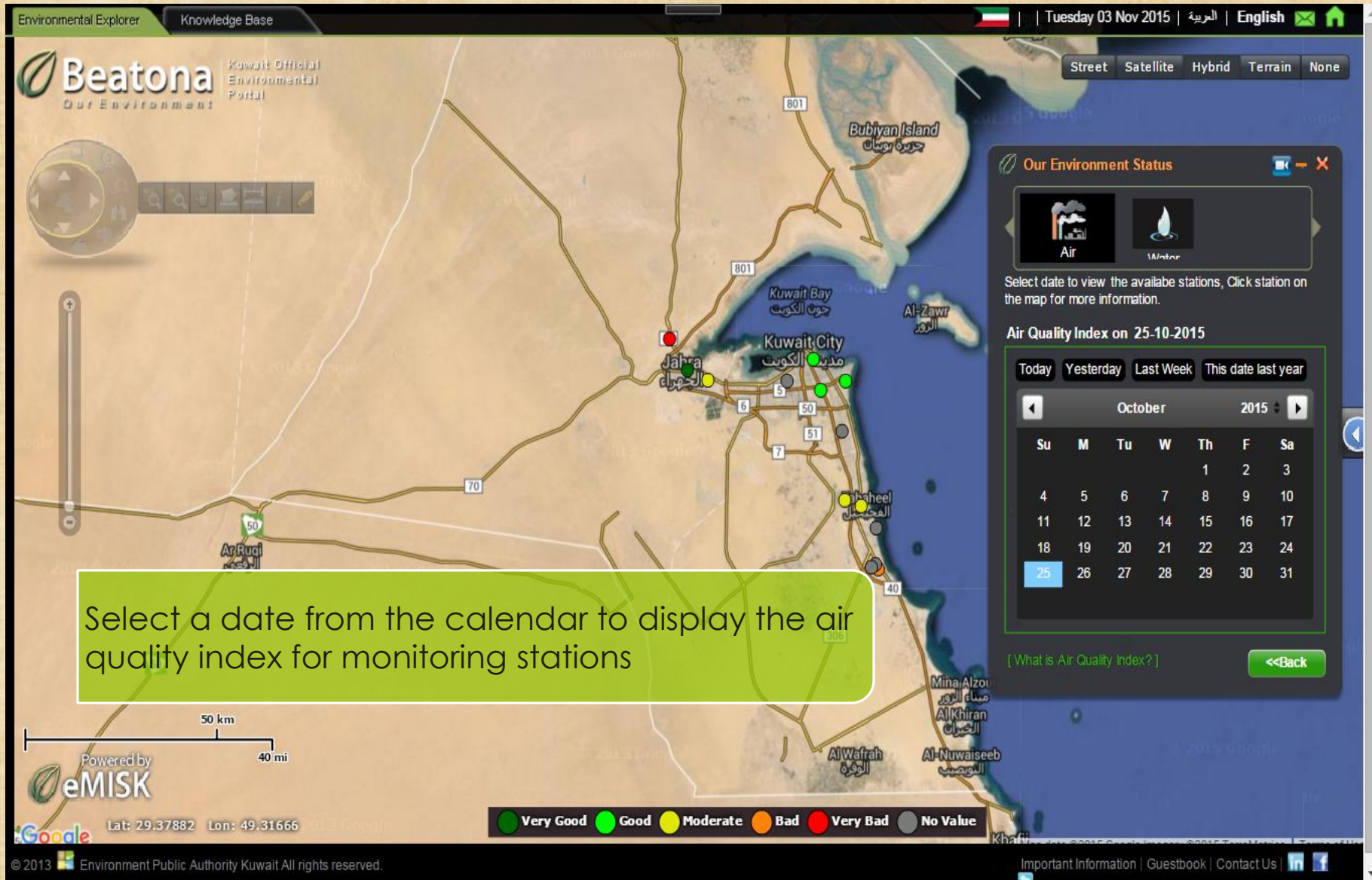
50 km 40 mi

Powered by eMISK

Lat: 29.37882 Lon: 49.31666

Very Good Good Moderate Bad Very Bad No Value

© 2013 Environment Public Authority Kuwait All rights reserved. Important Information | Guestbook | Contact Us



The screenshot displays the Beatona Kuwait Official Environmental Portal. The main map shows Kuwait with various monitoring stations marked by colored dots. A green callout box is overlaid on the map, containing the text: "Select a date from the calendar to display the air quality index for monitoring stations". To the right of the map is a panel titled "Our Environment Status" with tabs for "Air" and "Water". Below this is a calendar for October 2015, with the date 25 selected. A legend at the bottom of the map indicates the color coding for the air quality index: Very Good (green), Good (light green), Moderate (yellow), Bad (orange), Very Bad (red), and No Value (grey). The page footer includes copyright information for the Environment Public Authority Kuwait and navigation links for Important Information, Guestbook, and Contact Us.

Our Environment Status

Display Air Quality Index & Station Details

Environmental Explorer Knowledge Base | Tuesday 03 Nov 2015 | العربية | English

Street Satellite Hybrid Terrain None

Beatona Kuwait Official Environmental Portal
Our Environment

Our Environment Status

Air Station
Al-Fahaheel
Last Updated : 31-10-2015

Address:
Fahaheel New Health Centre.

Location: Lat: 29.08033
Lon: 48.11601

Site Description:
This station is located in the south of Al-Fahaheel residential area on the roof of the new health care centre. This site is close to AlAhmadi Port and Al-Shuaiba and Mina Abdulaah Industrial Areas in the south and the oil fields

Air Quality Index on 25-10-2015
Moderate

Click on pollutant for more details.

O₃ 18	NO₂ 113	SO₂ 7
PM₁₀ 32	CO 23	

The AIR QUALITY was Moderate because Nitrogen Dioxide levels were above the national air quality standards.

[What is Air Quality Index?]

<<Back Exit

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)

Powered by eMISK

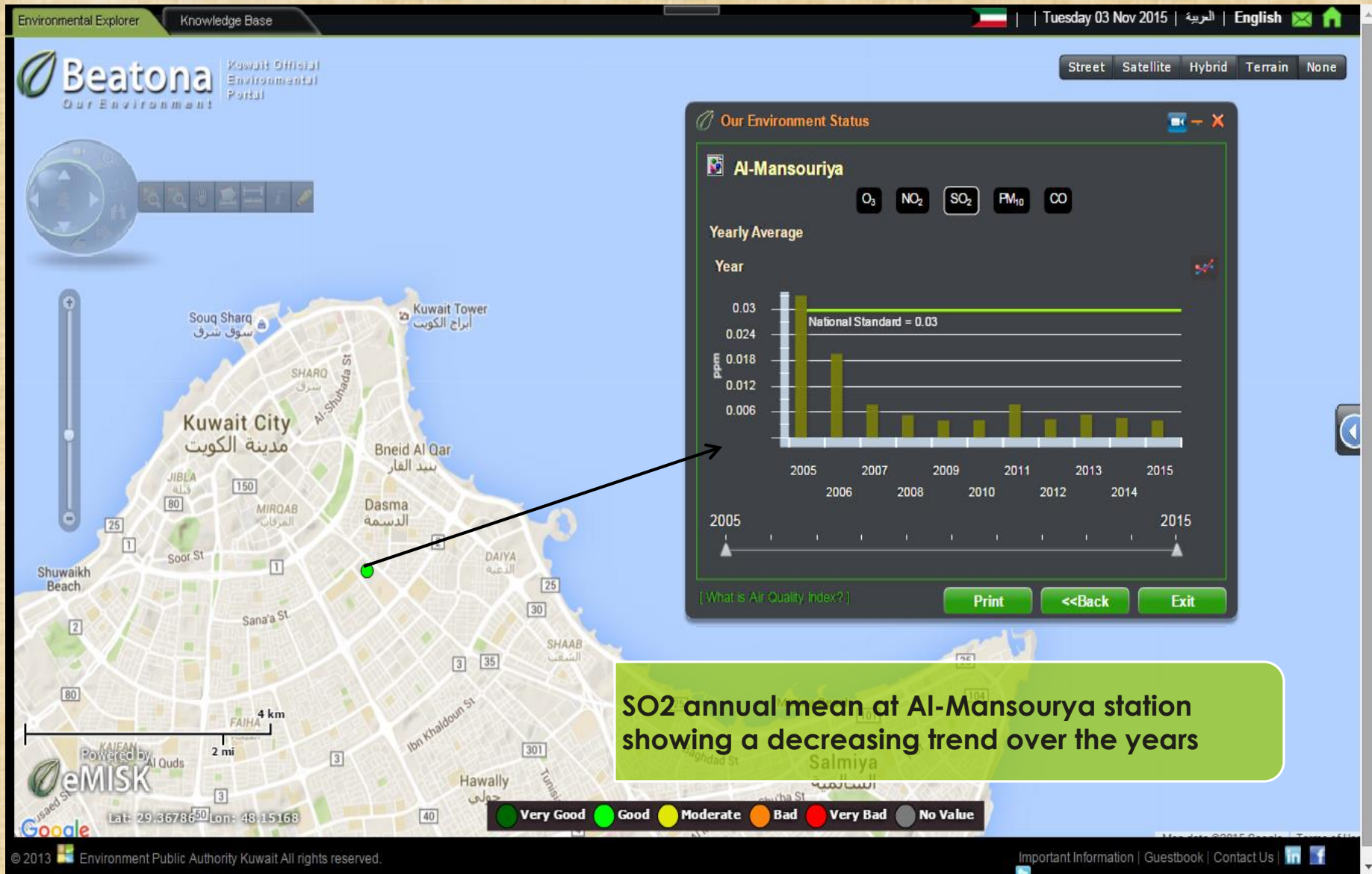
Lat: 29.15805 Lon: 48.39202

Very Good Good Moderate Bad Very Bad No Value

© 2013 Environment Public Authority Kuwait All rights reserved. Important Information | Guestbook | Contact Us

Our Environment Status

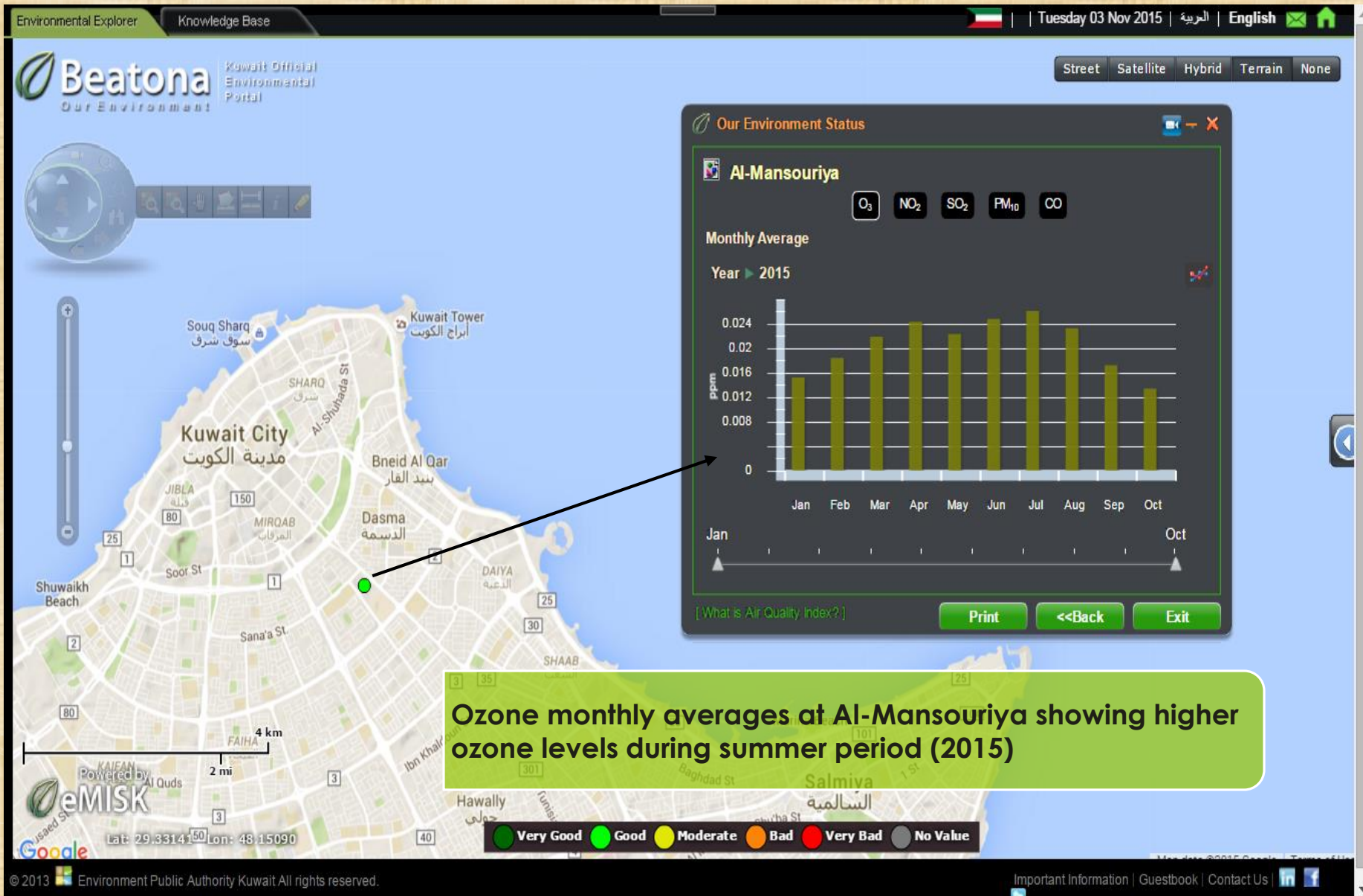
Display Air Quality Data for Primary Air Pollutants



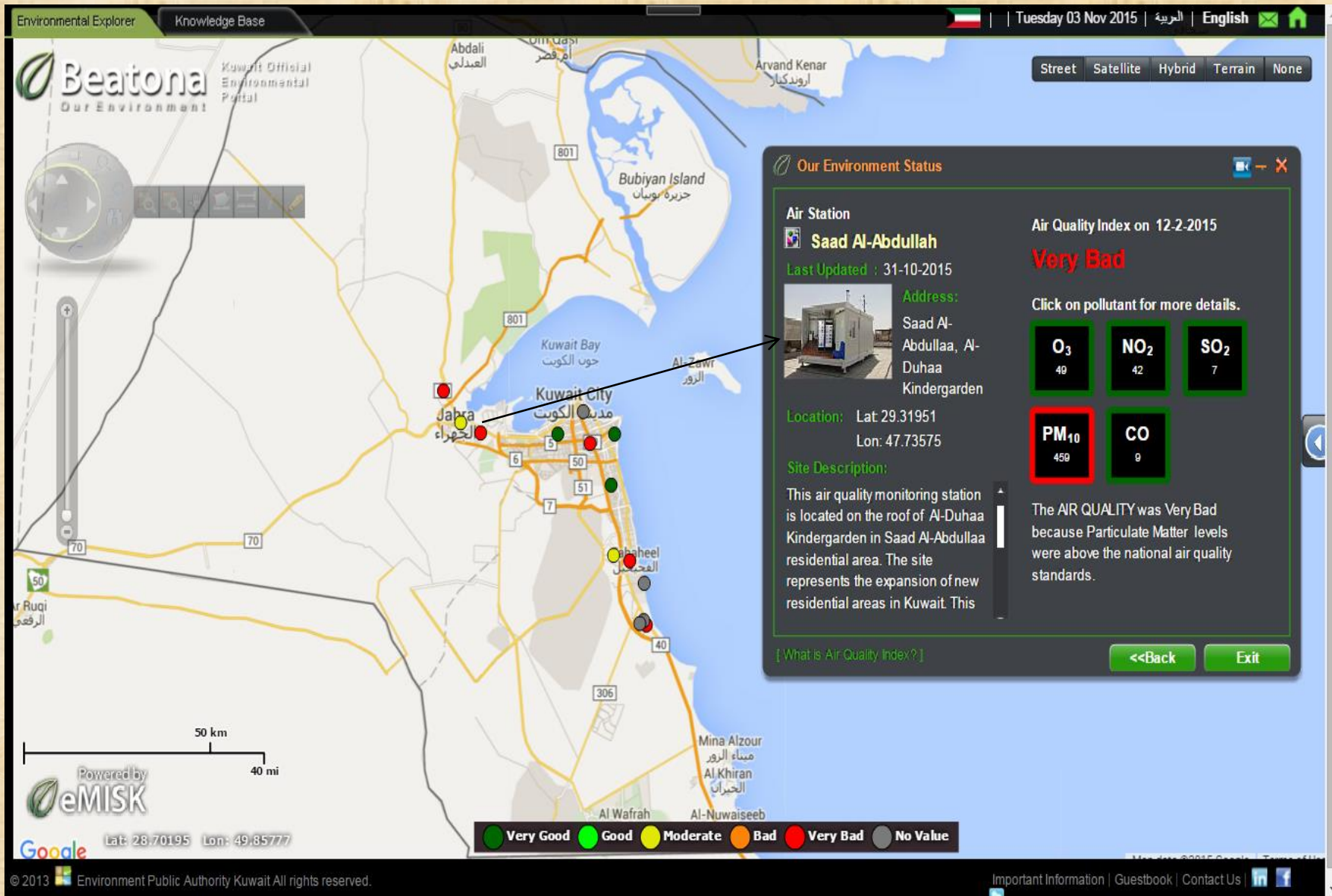
SO₂ annual mean at Al-Mansouriya station showing a decreasing trend over the years

Our Environment Status

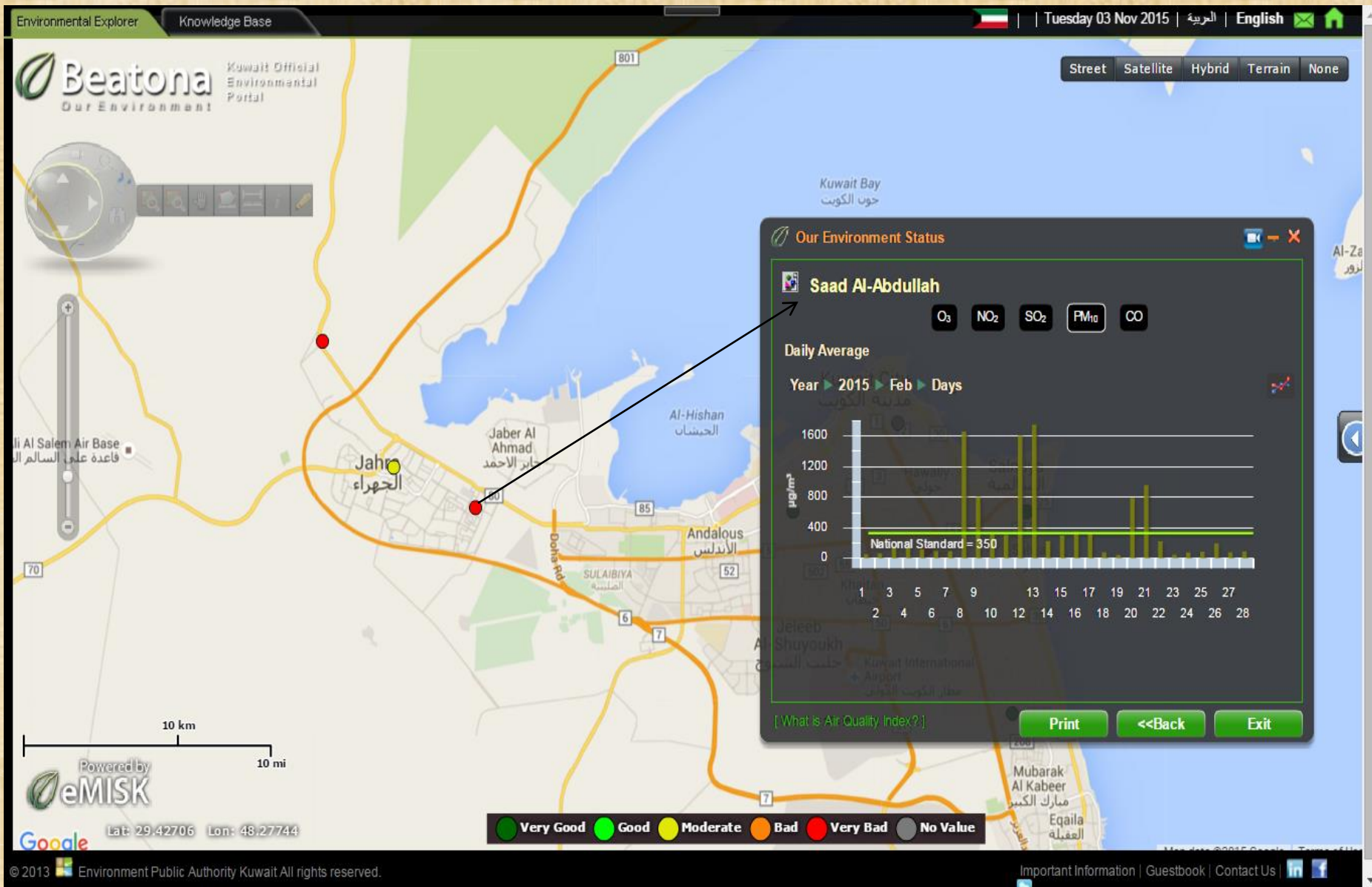
Display Air Quality Data for Primary Air Pollutants



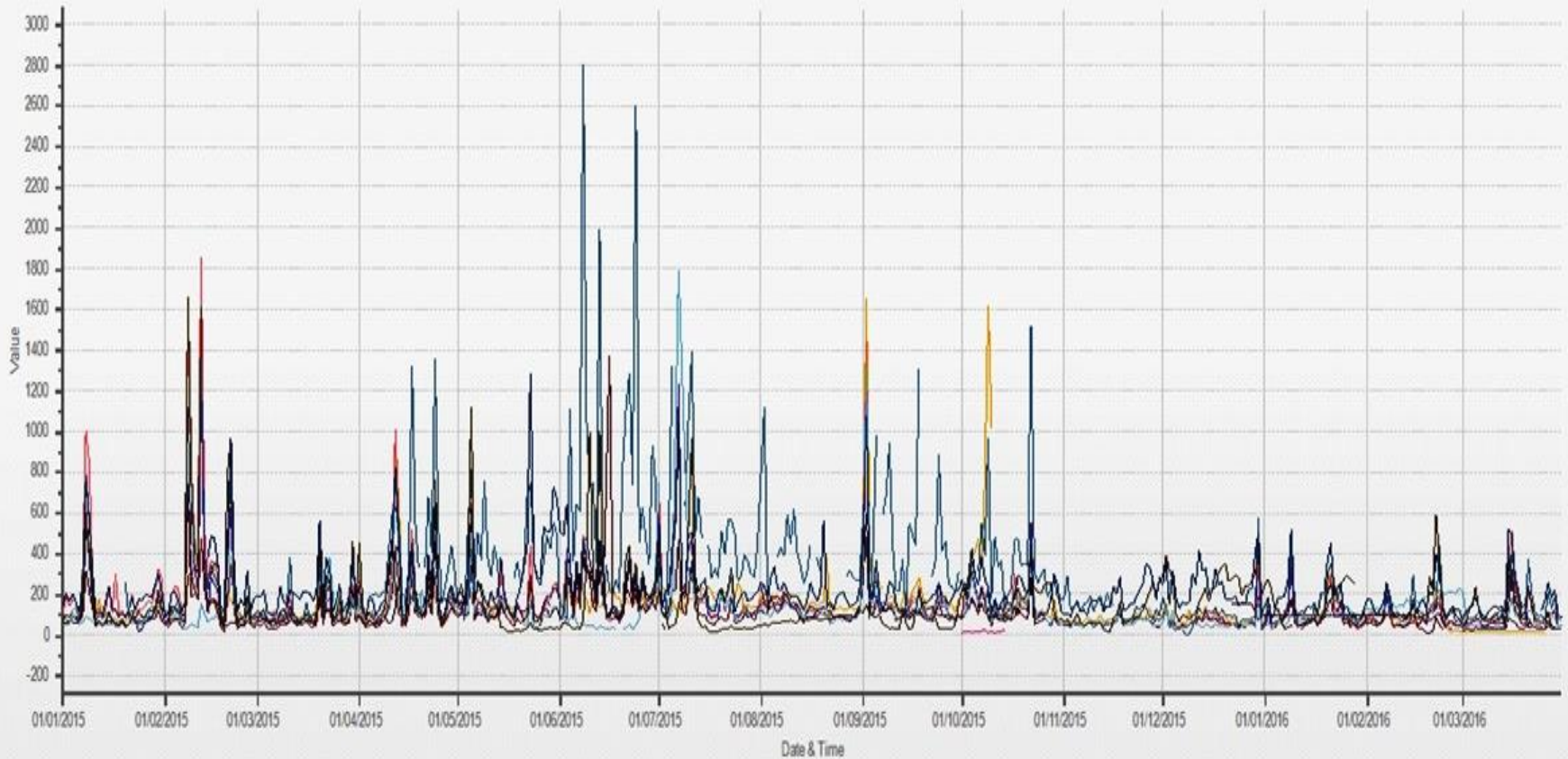
AQI during Dusty Days



AQI during Dusty Days



Daily averages of PM10 concentration in Kuwait during 2015 showing high levels ($2800 \mu\text{g}/\text{m}^3$) during dust storms and dusty days



Legend for PM10 concentration monitoring stations:

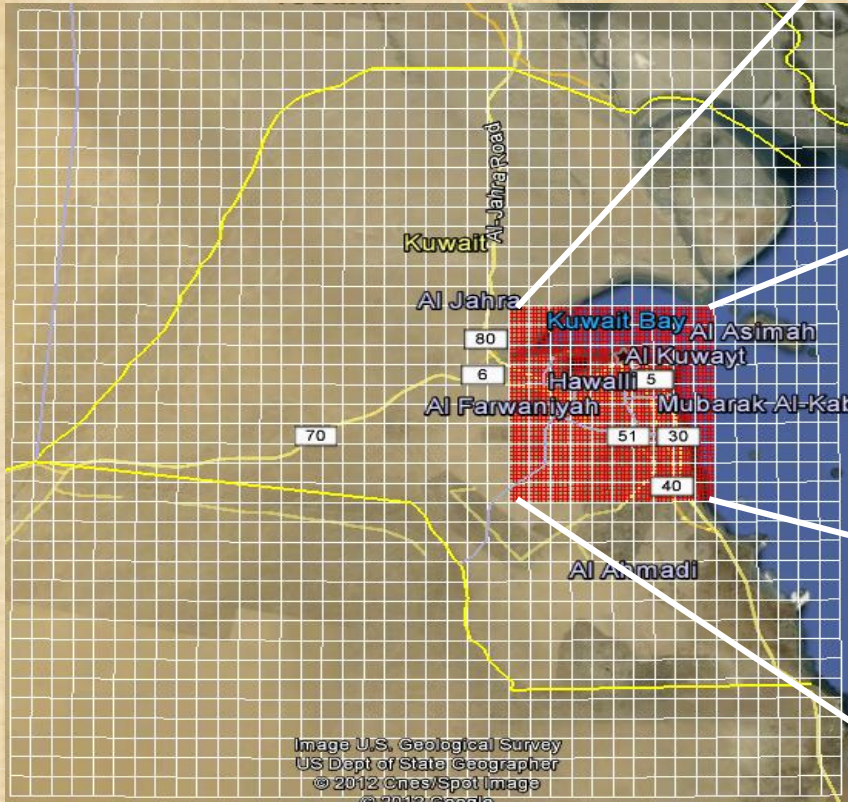
- Ahmadi (PM10[$\mu\text{g}/\text{m}^3$])
- Al Salam (PM10[$\mu\text{g}/\text{m}^3$])
- Ali Sabah Al Salem (PM10[$\mu\text{g}/\text{m}^3$])
- Fahaheel (PM10[$\mu\text{g}/\text{m}^3$])
- Jahra (PM10[$\mu\text{g}/\text{m}^3$])
- Jahra new (PM10[$\mu\text{g}/\text{m}^3$])
- Mobile Lab 3 (PM10[$\mu\text{g}/\text{m}^3$])
- Mobile Lab 4 (PM10[$\mu\text{g}/\text{m}^3$])
- Riqqa (PM10[$\mu\text{g}/\text{m}^3$])
- Rumaiitha (PM10[$\mu\text{g}/\text{m}^3$])
- Saad abduallah (PM10[$\mu\text{g}/\text{m}^3$])
- Shuaiba (PM10[$\mu\text{g}/\text{m}^3$])
- Shuwaikh (PM10[$\mu\text{g}/\text{m}^3$])

(6)

Air Emissions Inventories

1st Attempt to establish the National Emission Inventory (PM_{10} , $PM_{2.5}$, SO_2 , NO_x , CO)

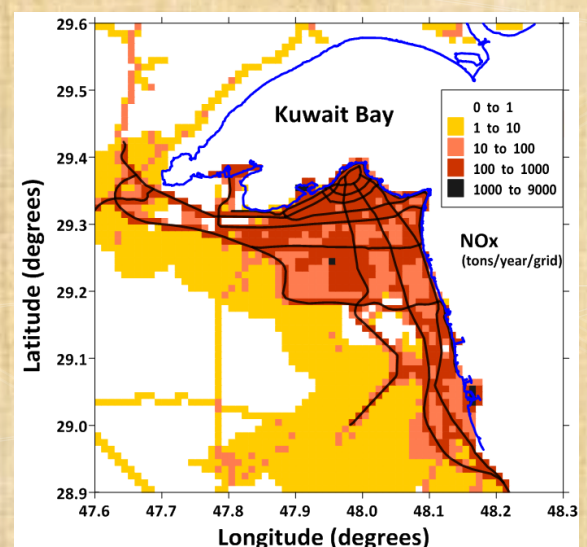
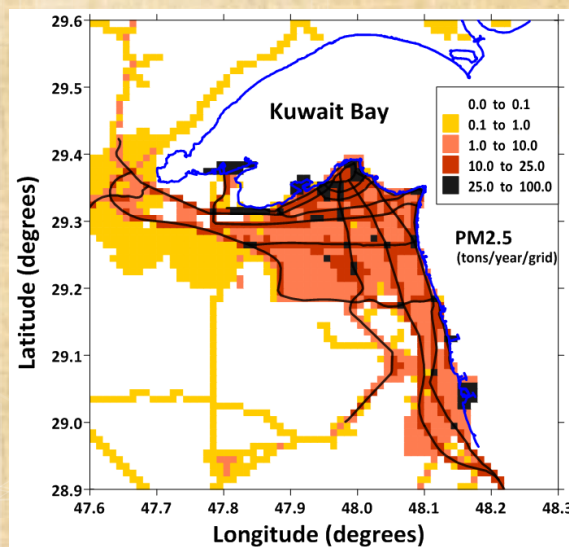
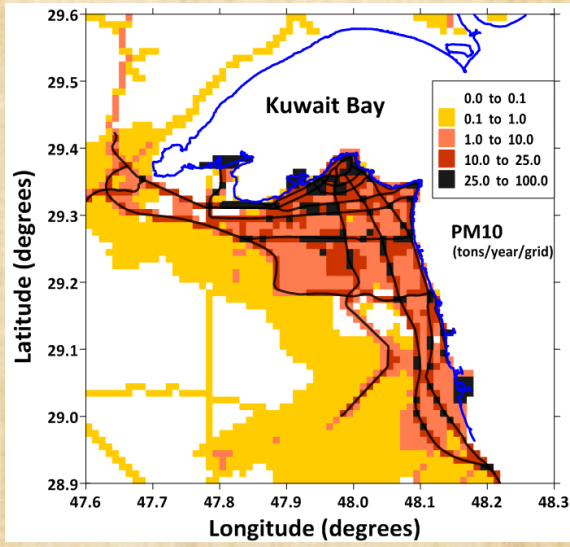
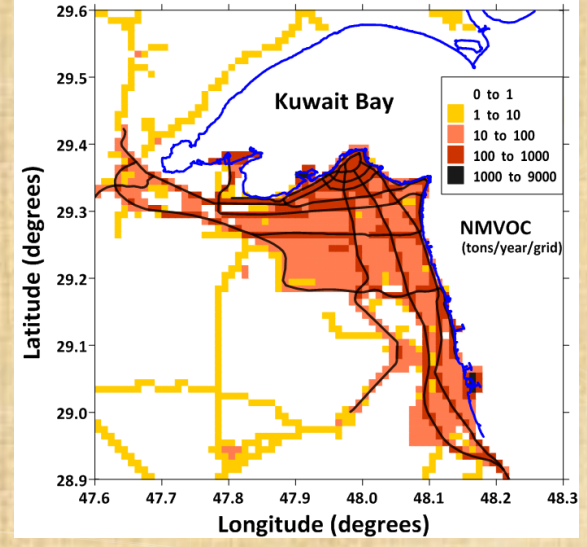
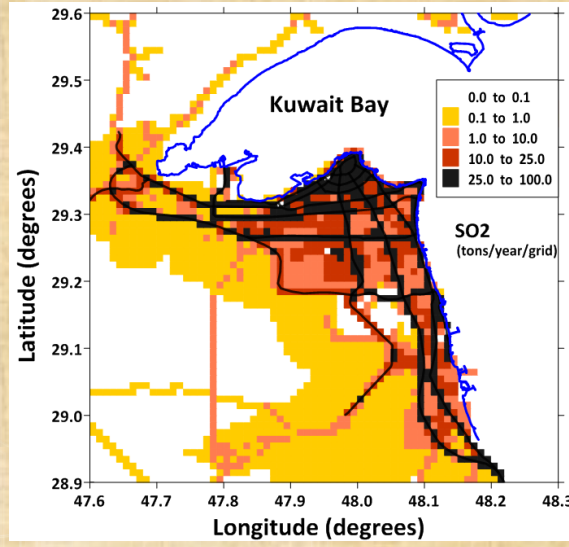
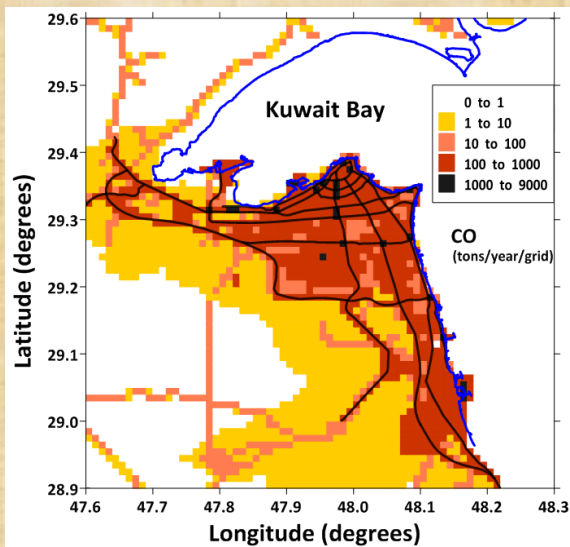
Outer grid (5km x 5km resolution)
covering an area of 200km x 200km



Inner grid (1km x 1km resolution)
covering an area of 70km x 70km



Kuwait City emission maps (2010-Base Year)

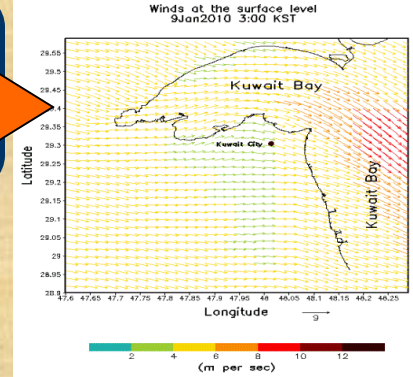


Dispersion Modeling Architecture

Meteorological outputs from RAMS

wind velocities, temperature, pressure, relative humidity, precipitation, cloud cover,

Meteorological Data Processing



CAMx Ozone Particulates Toxics
Comprehensive Air Quality Model with Extensions

An open-source modeling system for multi-scale integrated assessment of gaseous and particulate air pollution.

Version 5.40 is now available

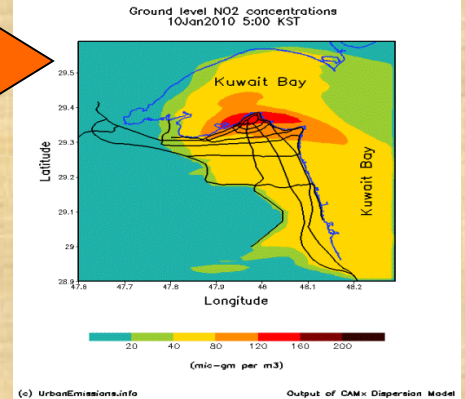
Get CAMx Now! FREE Fortran source code and User's Guide

Why CAMx

- Simulate air quality over many geographic scales
- Treat a variety of inert and chemically active pollutants

CAMx In Action... Modeling North American Background Ozone.

CAMx – Eulerian Chemical Transport Model



Road transport

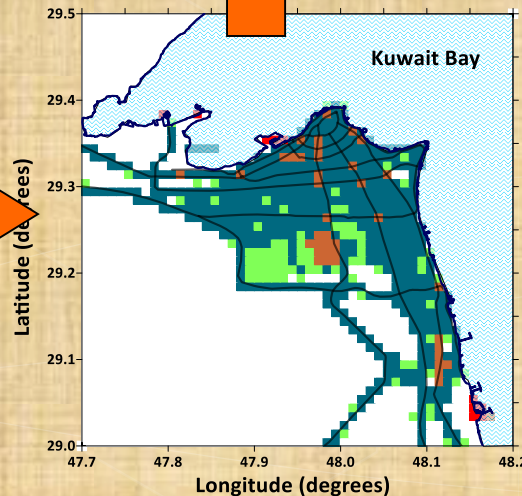
Power Generation

Industrial sector

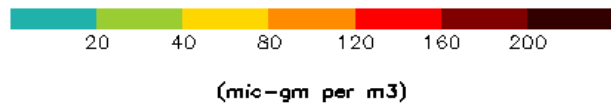
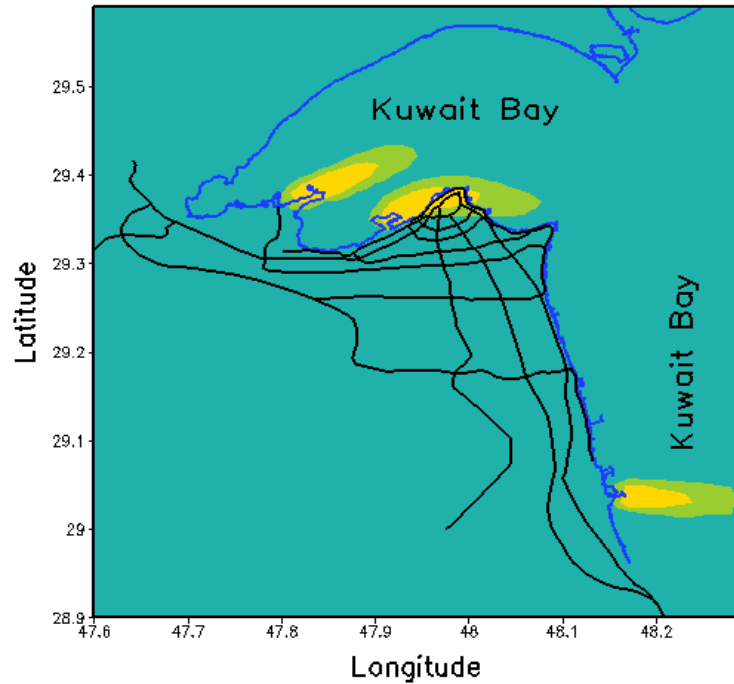
Natural Emissions

Anthropogenic Area Emissions

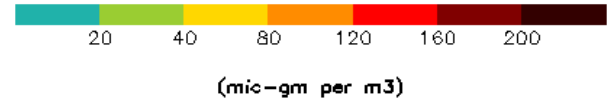
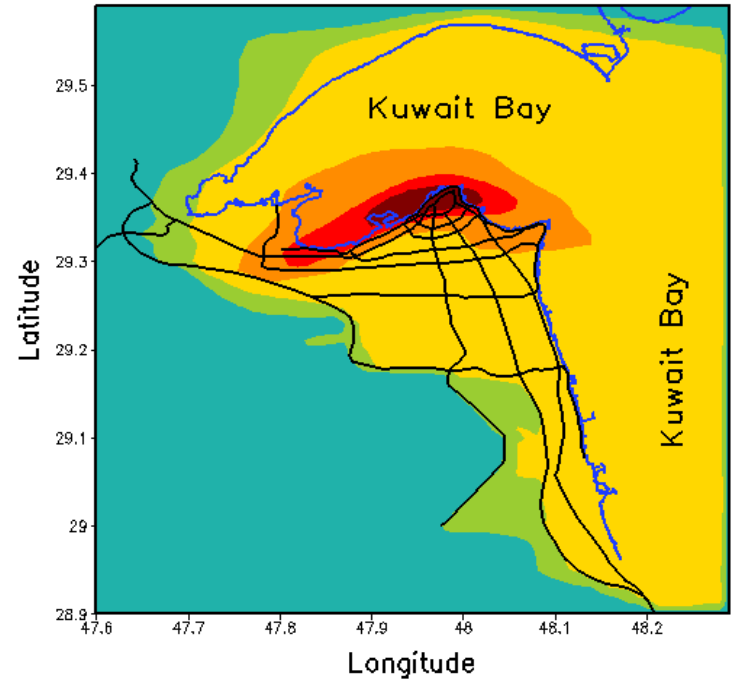
Emissions Processing



Ground level S02 concentrations
10Jan2010 4:00 KST



Ground level NO2 concentrations
10Jan2010 4:00 KST



Air Quality Management Information System (AQMIS)

The screenshot displays the AQMIS web application interface. The browser address bar shows the URL <http://www.emissions.pro/AQMIS/Input/All/NavInput>. The application header includes the AQMIS logo and the text "Air Quality Management Information System". The main navigation menu includes "Home", "Input", "Map", "Models", "Output", "AMIS", "Tools", "Reports", and "Admin". The user is logged in as "user8".

The main content area is divided into several sections:

- Emissions Inventory:** Includes links for Sources, Tanks, User Calculators, Emission Controls, and Inventory Control.
- Air Dispersion Modeling:** Includes links for Met Data, AMIS Sites, Receptors, and Buildings.
- Risk Modeling:** Includes links for Risk Receptors, Exposure Scenarios, Pollutants, and AIEC.
- Permit & Enforcement:** Includes links for Permits, Compliance, Financials, Enforcement, Equipment, Stack Tests, CBM Monitors, and Facility Contacts.

On the right side of the screenshot, a list of features is provided:

- 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**

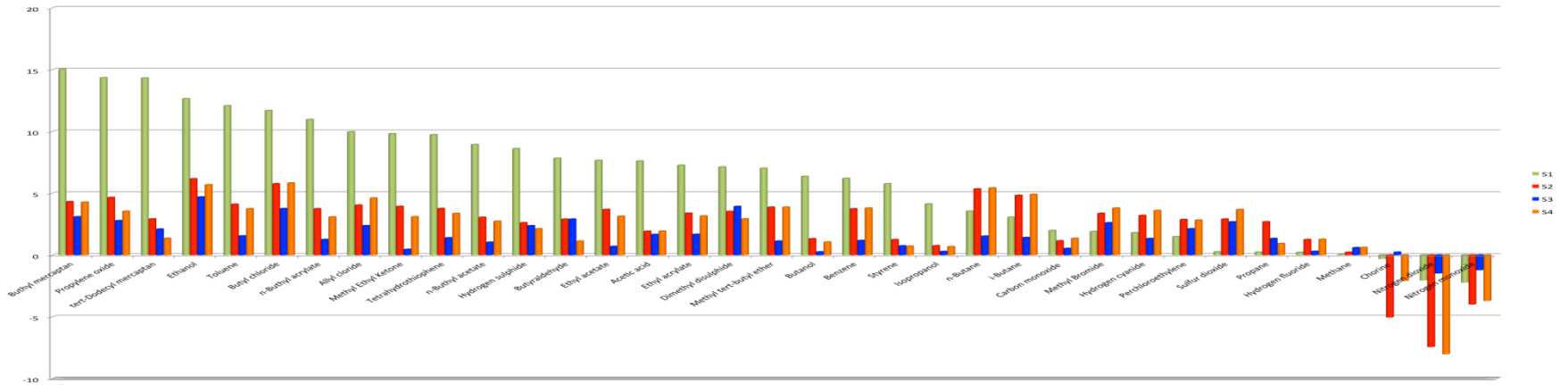
The Windows taskbar at the bottom shows the system tray with the date and time (11:24 AM) and various icons. A notification bubble indicates "Screenshot Added" and another shows "Dropbox 2.4.6 Downloading file list...".

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)

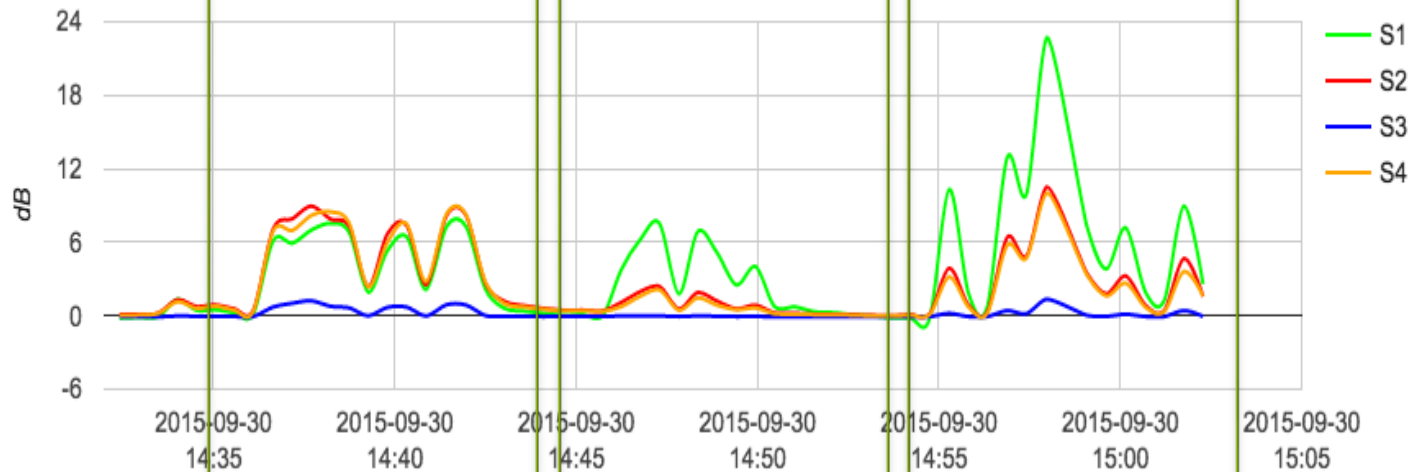


Crude oil

Kerosene

Gasoline

eNose 21901 Sensor values (Auto)



Pinpointing a leaking tank

TK 1202 with wind of Wind
2014-08-01 00:00:00 ~ 2014-08-05 00:00:00



Establishment of eNOSES network in Kuwait



Installation of 150 eNOSES in Kuwait covering urban areas, oil production fields and industrial zones

Residential grid 1000 x 1000 m

Interface grid 500 x 500 m

Industrial grid 250 x 250 m

(7)

GCC-Environmental Portal

GCC-Environmental Portal

<http://gcceportal.com>



البوابة البيئية الرسمية لدول مجلس التعاون لدول الخليج العربية
GCC Official Environment Portal

Enter

دخول



GCC-Environmental Portal

The main screen



The Environmental Portal of
The Cooperation Council for the
Arab States of the Gulf



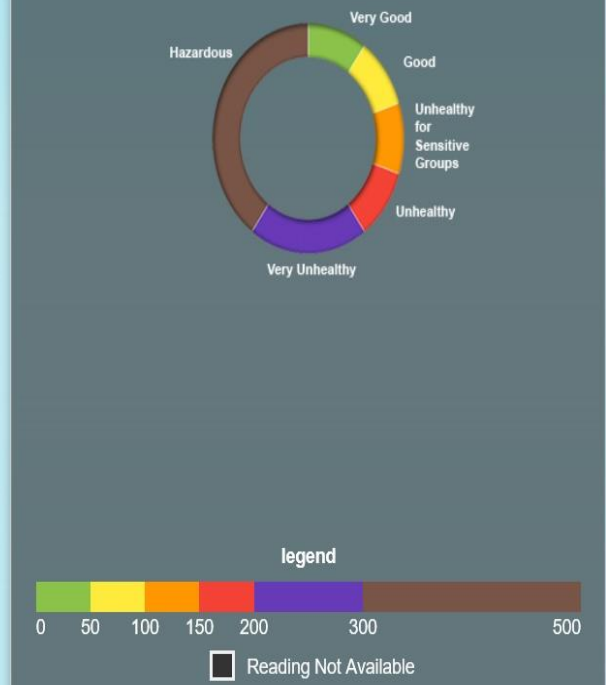
About us Contact us العربية

BETA



- Air Quality
- Maps
- Achievements
- Links

Air Quality in GCC Countries



GCC-Environmental Portal

Kuwait screen



The Environmental Portal of
The Cooperation Council for the
Arab States of the Gulf



About us Contact us العربية

BETA

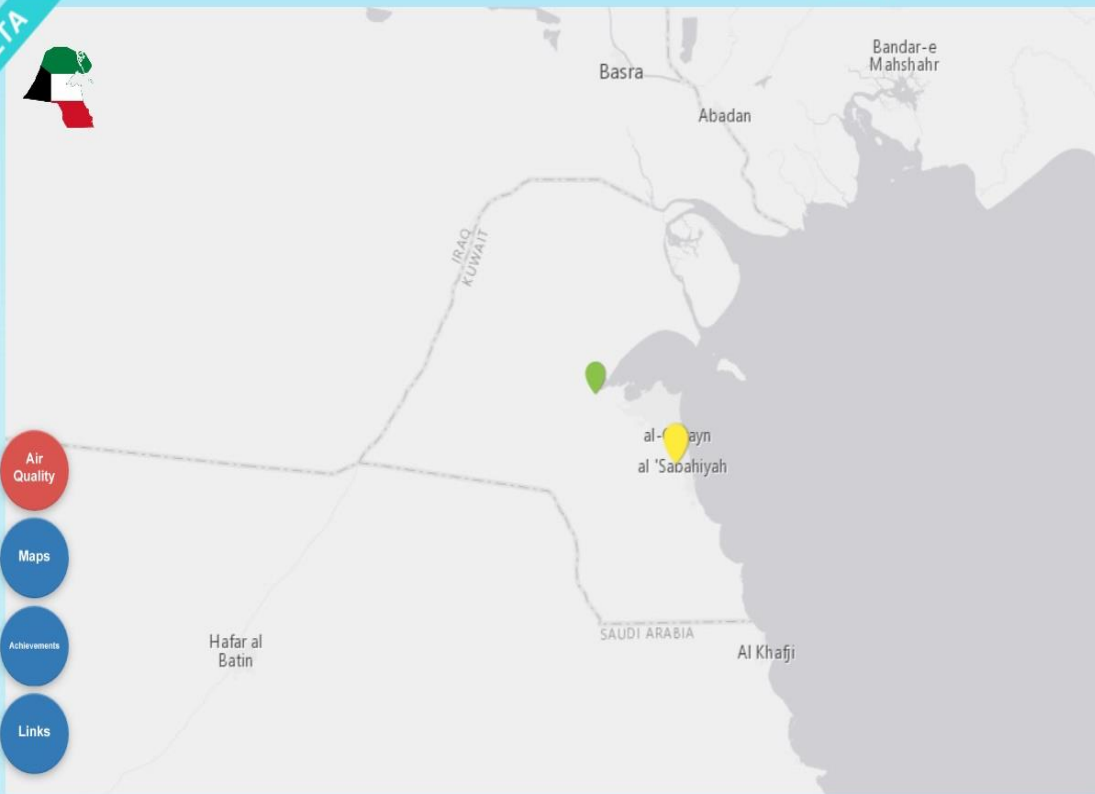


Air Quality

Maps

Achievements

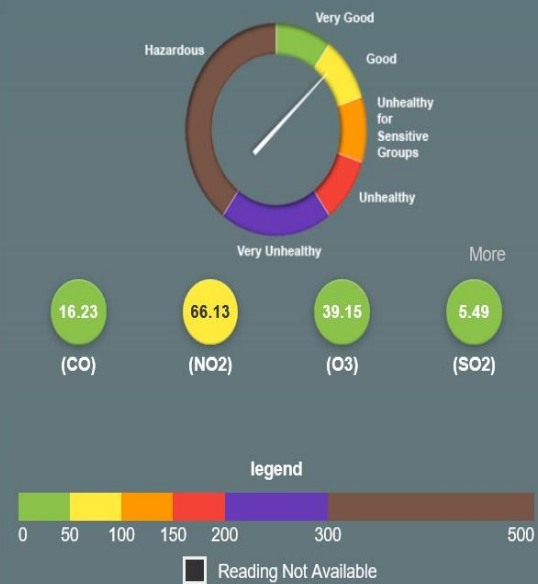
Links



Air Quality in Al-Ahmadi Station Kuwait 2016/11/14

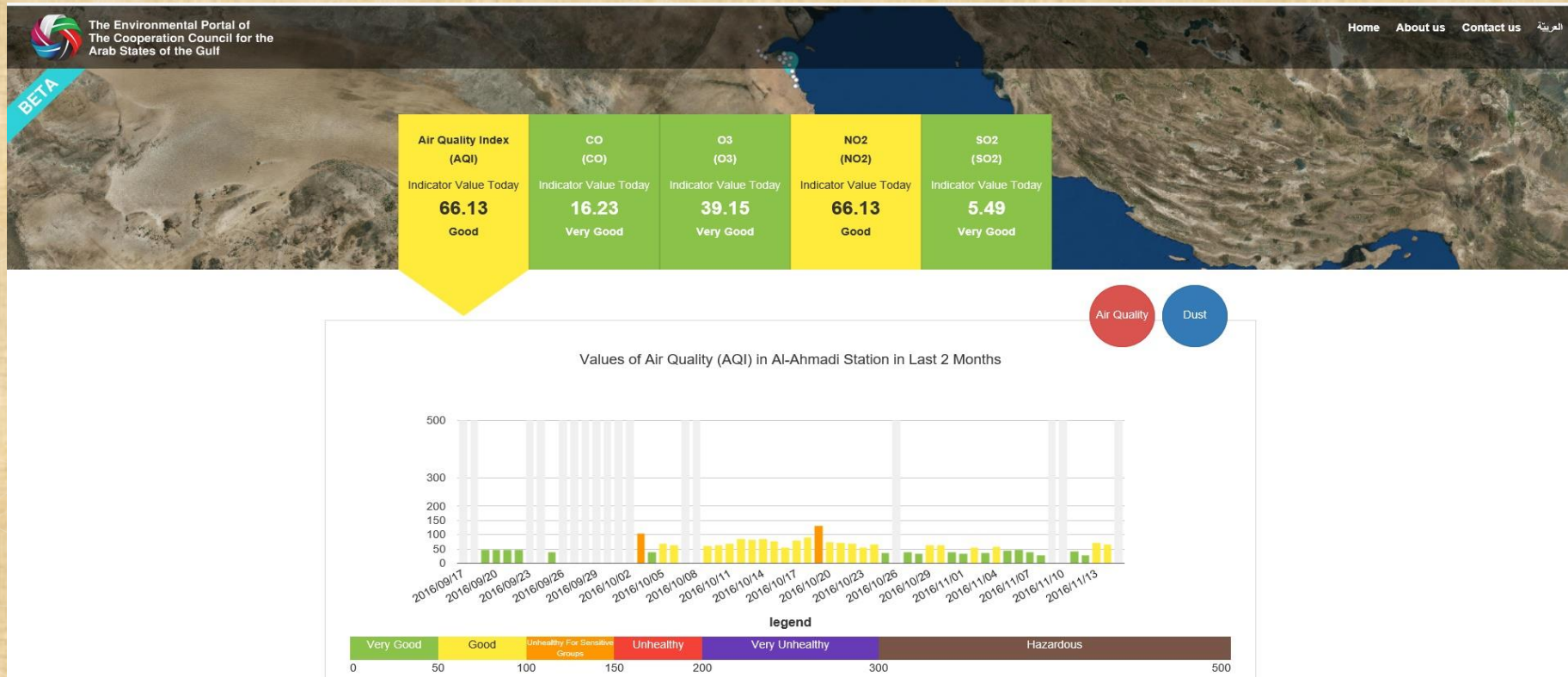
Air Quality Index (AQI)

PM10 (PM10)



Air Quality Index

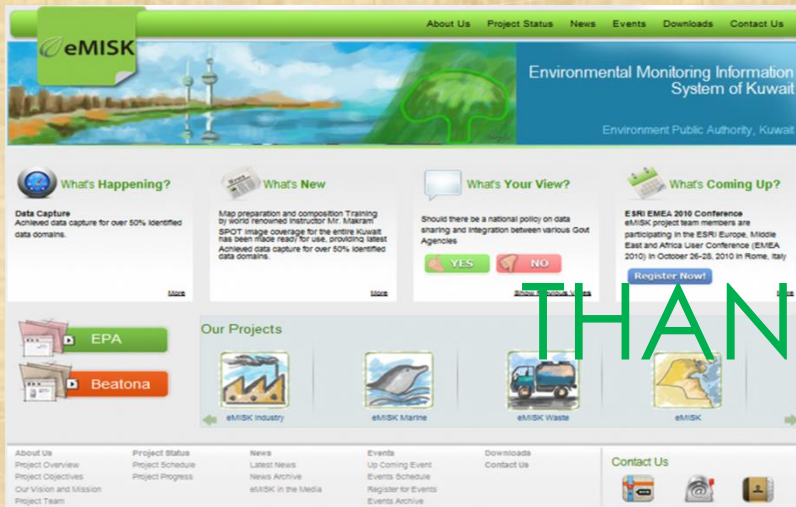
- ✓ Simple way to show air quality in GCC
- ✓ Explore air quality monitoring stations in GCC
- ✓ Show stations readings for air pollutants in GCC on daily bases
- ✓ Five criteria air pollutants (O_3 , CO, NO_2 , SO_2 , PM_{10})



For more information, please visit our websites :



<http://www.epa.org.kw>



www.emisk.org



www.beatona.net

THANK YOU