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Management of Air Emissions in Kuwait Oil Company

Emissions Reduction and Control Strategy – Gas Facilities

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*Kuwait Oil Company
HSE (WK) & HSE (Gas) Team
October 2017*



Agenda:

- Introduction
- KOC Operations
- Visions, Mission and HSE Strategic Objective
- Air Emission
- Air Compliance Management Program
- Emissions Inventory Data
- Baseline of Air pollutants Emissions
- Emissions Index
- Overview of Emissions Index in All Areas
- Analysis of 2016-2017 Emissions Index
- Emission Trend For (GHG / CP) and (VOC / HAPs) in NK, WK, And S&EK
- Emissions Reduction and Control Strategy – Gas Facilities
- The Way Forward For the Control Strategy Implementation
- Conclusion

1.0 Introduction

- *Kuwait Oil Company (KOC) is a major subsidiary of the Kuwait Petroleum Corporation and involve the Exploration, Drilling, and Production of oil and gas within the State of Kuwait.*
- *All the company's activities have impact to health, safety and environment either beneficial or adversely. The company is committed to managing the risks associated with its activities and products.*
- *Furthermore, Health, Safety and Environment (HSE) policy and management system has been established and designed as a comprehensive set of requirements that set a framework for management and personnel to achieve the HSE goals and target.*
- *KOC is managing resources responsibly and taking care of the environment is embedded in our organization. However, management of the air emissions is one of the approach for KOC to be complied with the company's HSEMS and to be reduced the emissions which emitting from the facilities.*

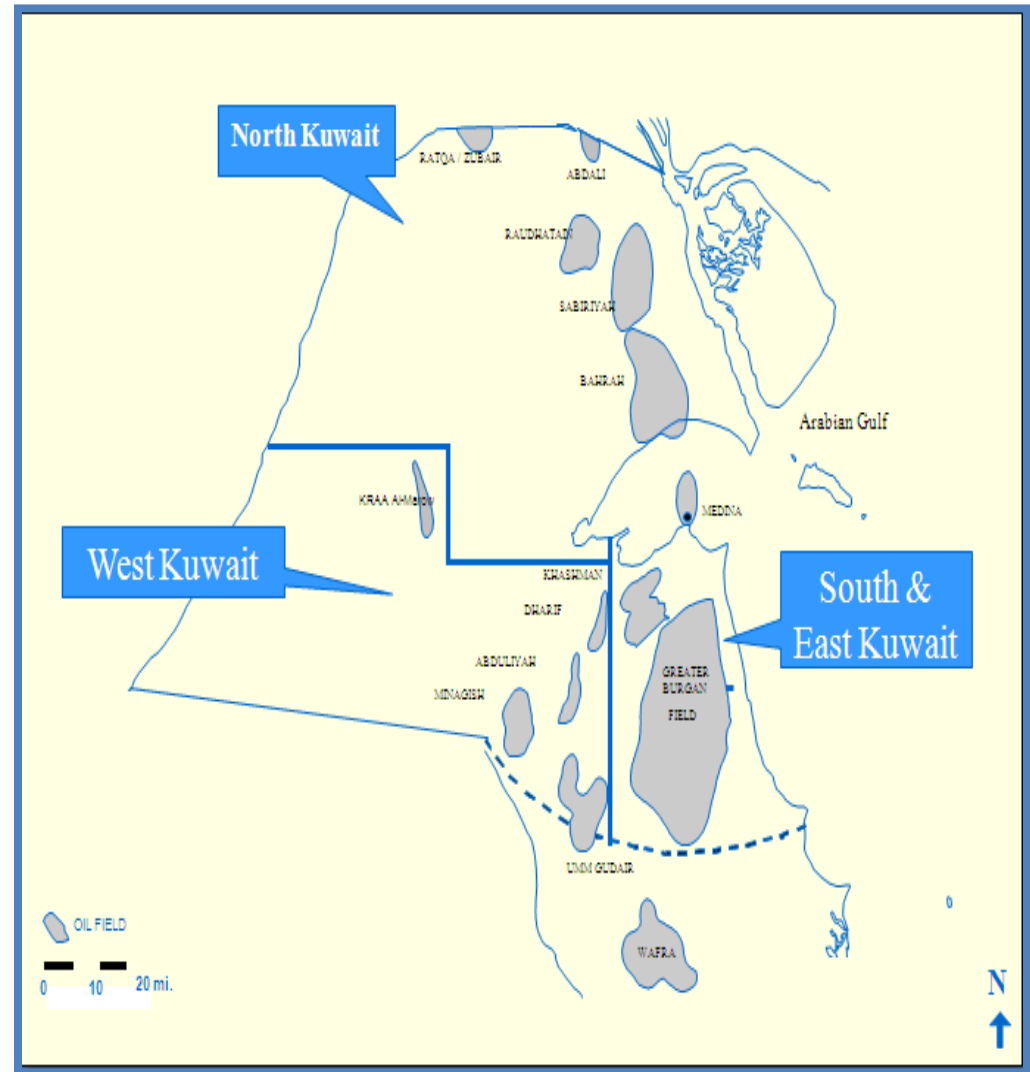
1.1 KOC Operations

➤ Spread over 3 Assets

- South and East Kuwait
- West Kuwait
- North Kuwait

➤ Producing Assets

- Gathering Centers
- Booster stations
- Well heads
- Water Injection Plants
- Water disposal plants



1.1 KOC Gas Operations

- *The Gas Assets are spread in all Kuwait Area (West, North and S&EK) as per the following:*
- *West Kuwait (BS 170, BS 171)*
- *North Kuwait (BS 131, BS 132)*
- *S&EK Kuwait (BS 180, BS 160, BS 150 & BS 140)*



1.2 Visions, Mission and HSE Strategic Objective

KOC HSE VISION

KOC will maintain high industrial standards and continuous commitments towards the health, safety, and environmental performance in its operations to create a work and business culture of HSE leadership practices.

KOC HSE MISSION

KOC will provide a safe and healthy work environment by implementing a high quality and cost effective health, Safety and Environmental Management System.

KOC 2030 HSE STRATEGIC OBJECTIVE

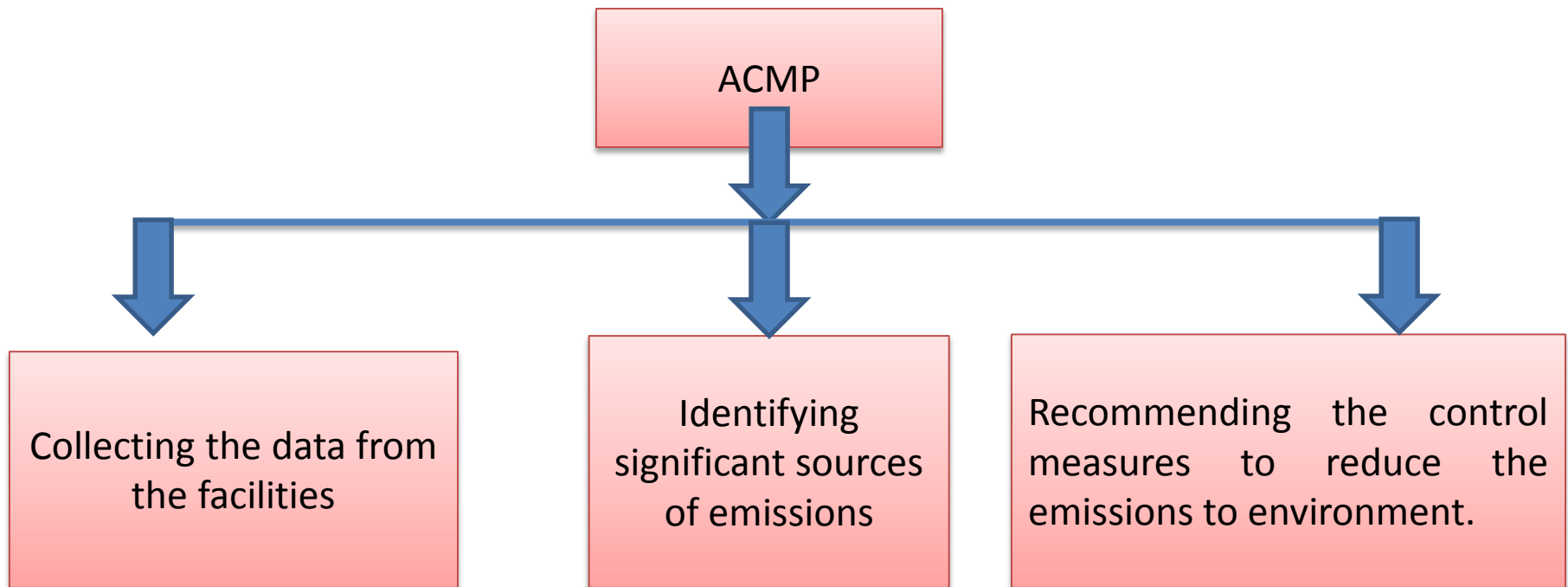
To achieve world class Health, Safety and Environmental performance.

2.0 Air Emission

- *KOC has along history in managing Air Emissions through Gas Flaring reduction.*
- *Started in 1990's with an inventory of 6 major pollutants "CO₂,CO,CH₄HC,Non-CH₄HC,SO_x,NO_x"and estimated from "Gas Flaring" in all GC's.*
- *Currently a range of sources are included with about 21 pollutants.*
- *Main drivers for Emission Management and Inventory are to preserve the environment, Conserve Energy and Safeguard human health as "Air Pollution" can cause chronic health impacts for the local population and other global Environmental complications like Ozone Depletion & Global Warming,etc...*

3.0 Air Compliance Management Program

- “Kuwait Oil Company (KOC) has been developed a program entitled Air Compliance Management Program – ACMP” in order to monitor emissions from KOC gas facilities and ensure the compliance with national/local regulations and legislations.
- The ACMP includes the following: collecting the data from the facilities, identifying significant sources of emissions and recommending the control measures to reduce the emissions to environment.



3.0 Air Compliance Management Program

- *This ACMP established with best available technology for emission reduction as well as monitoring in gas facilities. This presentation highlights the strategy for air emission reduction and controlled manner for KOC gas facilities to comply the company's requirement.*

The primary sources of atmospheric emissions from the operations arise from: Flaring, venting and purging gases:

Combustion process such as diesel engines and gas turbines.

Fugitive gases from loading operations and losses from process equipment

Airborne particulates from soil disturbances during construction and from vehicle traffic

Emissions Reduction and Control Strategy – Gas Facilities

Gas & condensate pipelines

Large quantity of chemical used as additive for finished products

Dehydrators

Separators (Glycol)



3.0 Air Compliance Management Program

Air Emissions of 21 Pollutants using US EPA AP-42 methodologies

Greenhouse Gases	Hazardous Air Pollutants	Criteria Pollutants	VOCs and Hydrocarbons
<ul style="list-style-type: none">• Carbon Dioxide• Methane• Nitrous Oxide	<ul style="list-style-type: none">• Benzene• Hydrogen Sulphide• Toluene• Xylene (Mixed Isomers)• Acetaldehyde• Ethyl benzene• Formaldehyde• Hexane• Naphthalene• Polyaromatic hydrocarbons	<ul style="list-style-type: none">• Carbon Monoxide• Nitrogen Oxides• Sulphur Dioxide• PM10• PM2.5	<ul style="list-style-type: none">• VOC Total• Total Hydrocarbon• Total Non Methane Hydrocarbons

3.1 Emissions Inventory Data

Gas facility emissions have been estimated by:

- *first collecting a series of fixed and variable data from a total of individual source or process types. Fixed data includes, for example, the dimensions of hydrocarbon storage tanks or the maximum heat input rating for a boiler, which do not change from month to month. Variable data includes, for example, the number of operating hours in the month or throughput of product.*
- *Air Emissions of 21 Pollutants using US EPA AP-42 methodologies. These fixed and variable data were then used as inputs to various US EPA AP-42 prediction methods¹ that provide formulas and factors for calculating emissions for a wide range of pollutants.*
- *The Air Emission is calculated for the major sources: Heaters, Flares, Burning Pits, Vents, Turbines, and Equipment leaks.*

3.2 Baseline of Air pollutant Emissions

<i>Emissions Source</i>	<i>Baseline (2013-2015 Average ; Ton/yr)</i>			
	<i>GHG</i>	<i>CP</i>	<i>VOC</i>	<i>HAPs</i>
<i>Boiler/Heater</i>	433,226	784	20	7
<i>Burning Pit/Flare</i>	1,085,045	<u>64,310</u>	-	2,475
<i>Compressor</i>	105,345	2,595	86	48
<i>Gas Turbine</i>	<u>1,385,312</u>	4,970	26	12
<i>Process (Dehydration, Surge, Incinerator)</i>	-	30,363	3,747	<u>3,553</u>
<i>Equipment Leaks</i>	90,707	-	1,555	-

3.3 Emissions Index:

$$\text{Emission Index (Year)} = 100 * \frac{\text{2016 – 2017 Yearly Emission}}{\text{Baseline Emission}}$$

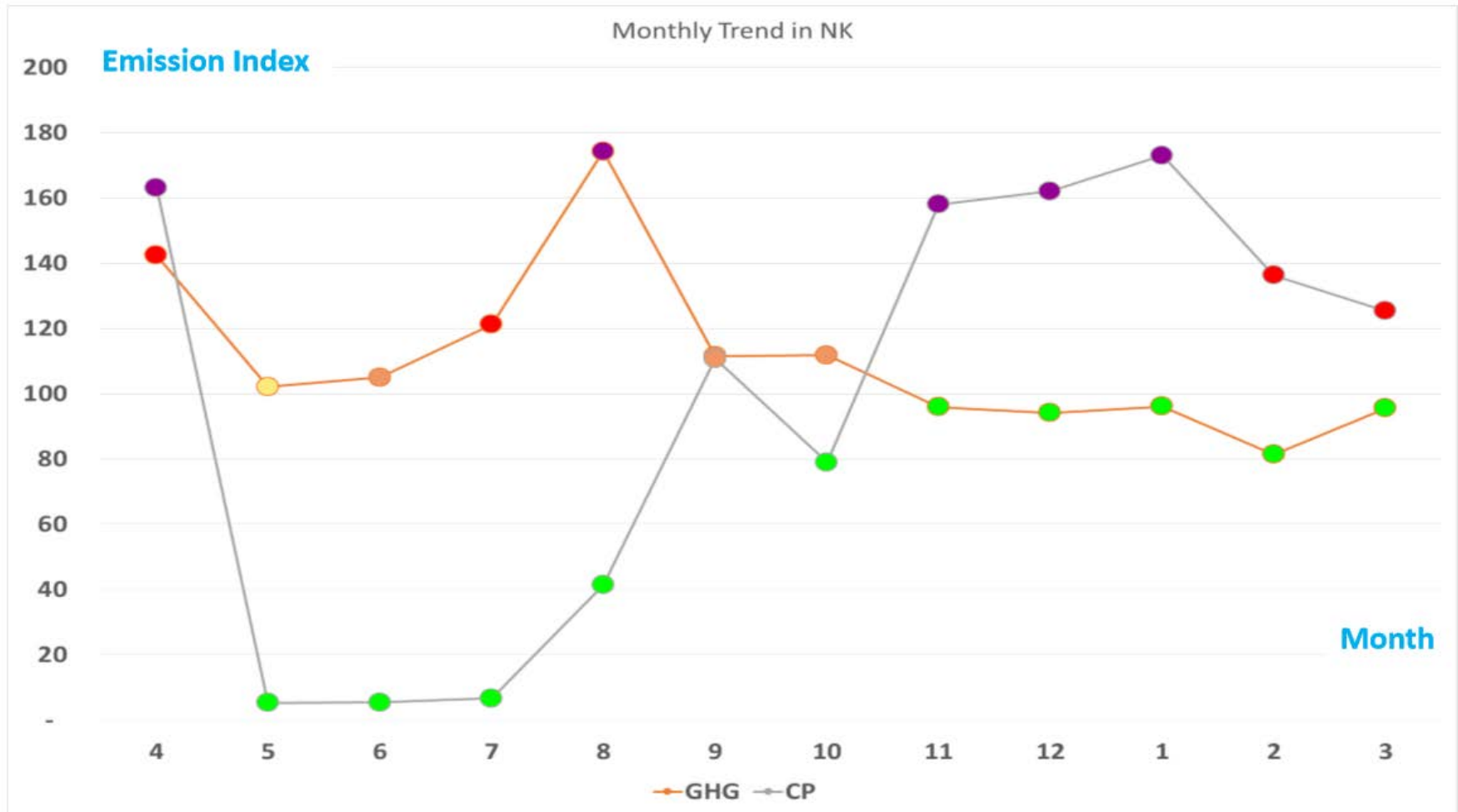
<i>El Group</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Value Range	El <100	100 < El ≤ 105	105 < El ≤ 120	120 <El ≤ 150	El > 150
Color Code	Green	Yellow	Orange	Red	Violet

3.4 Overview of Emissions Index in All Areas:

Pollutant	S&EK	WK	NK
GHG	130	112	111
CP	105	182	97
VOC	104	42	109
HAPs	106	109	70

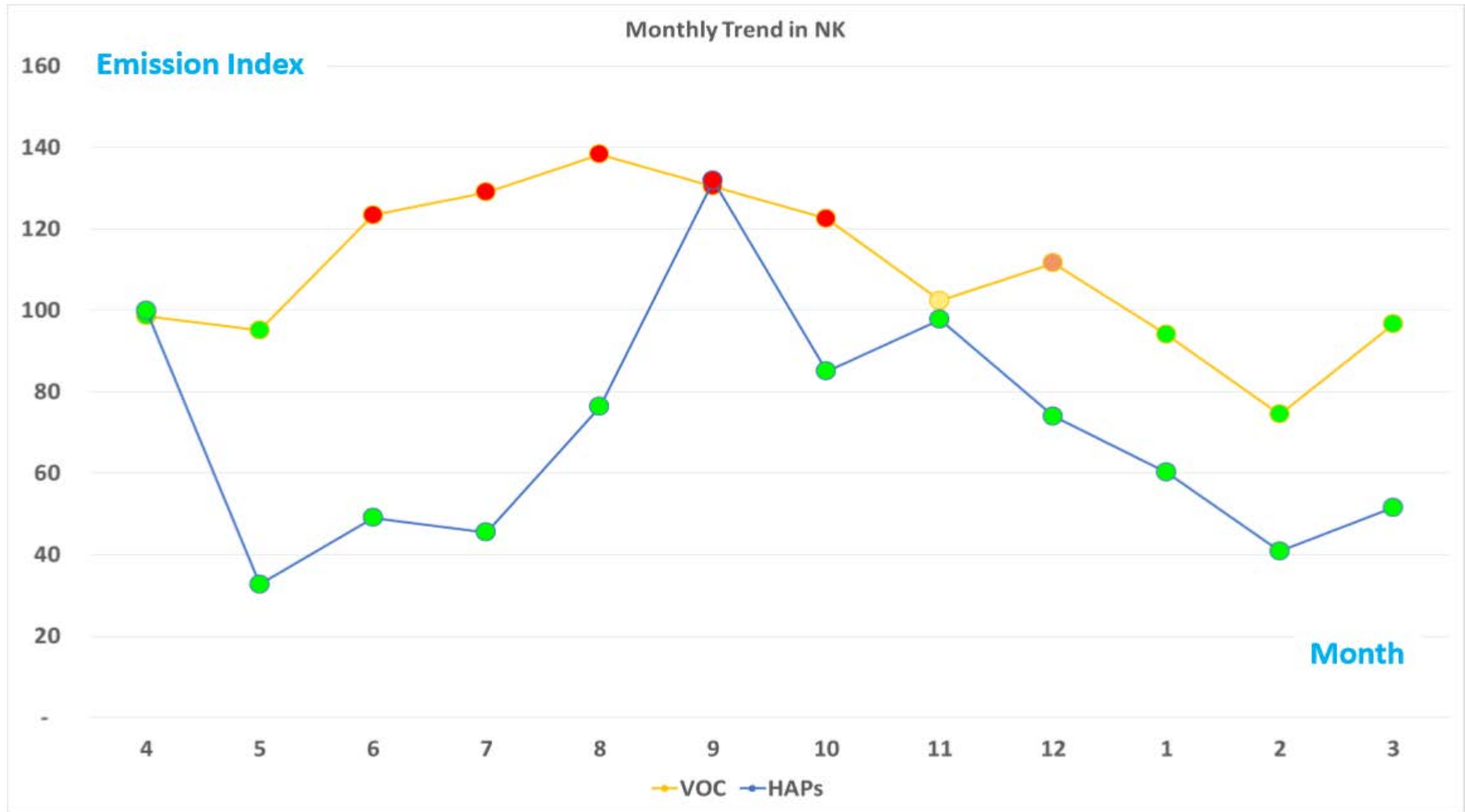
3.5 Analysis of 2016-2017 Emissions Index:

3.5.1 Emission Trend (GHG / CP) in NK:



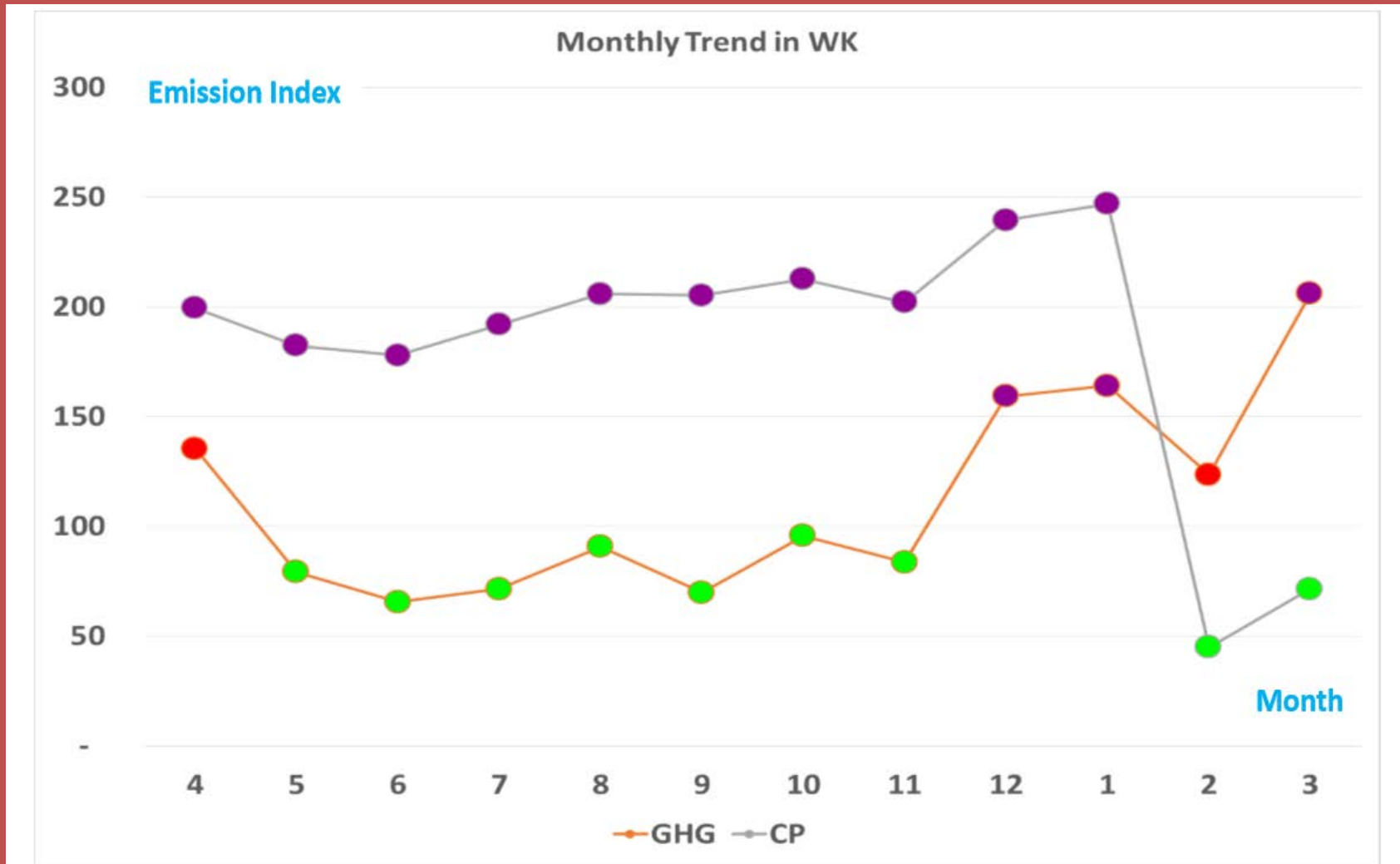
3.5 Analysis of 2016-2017 Emissions Index:

3.5.2 Emission Trend (VOC / HAPs) in NK:



3.5 Analysis of 2016-2017 Emissions Index:

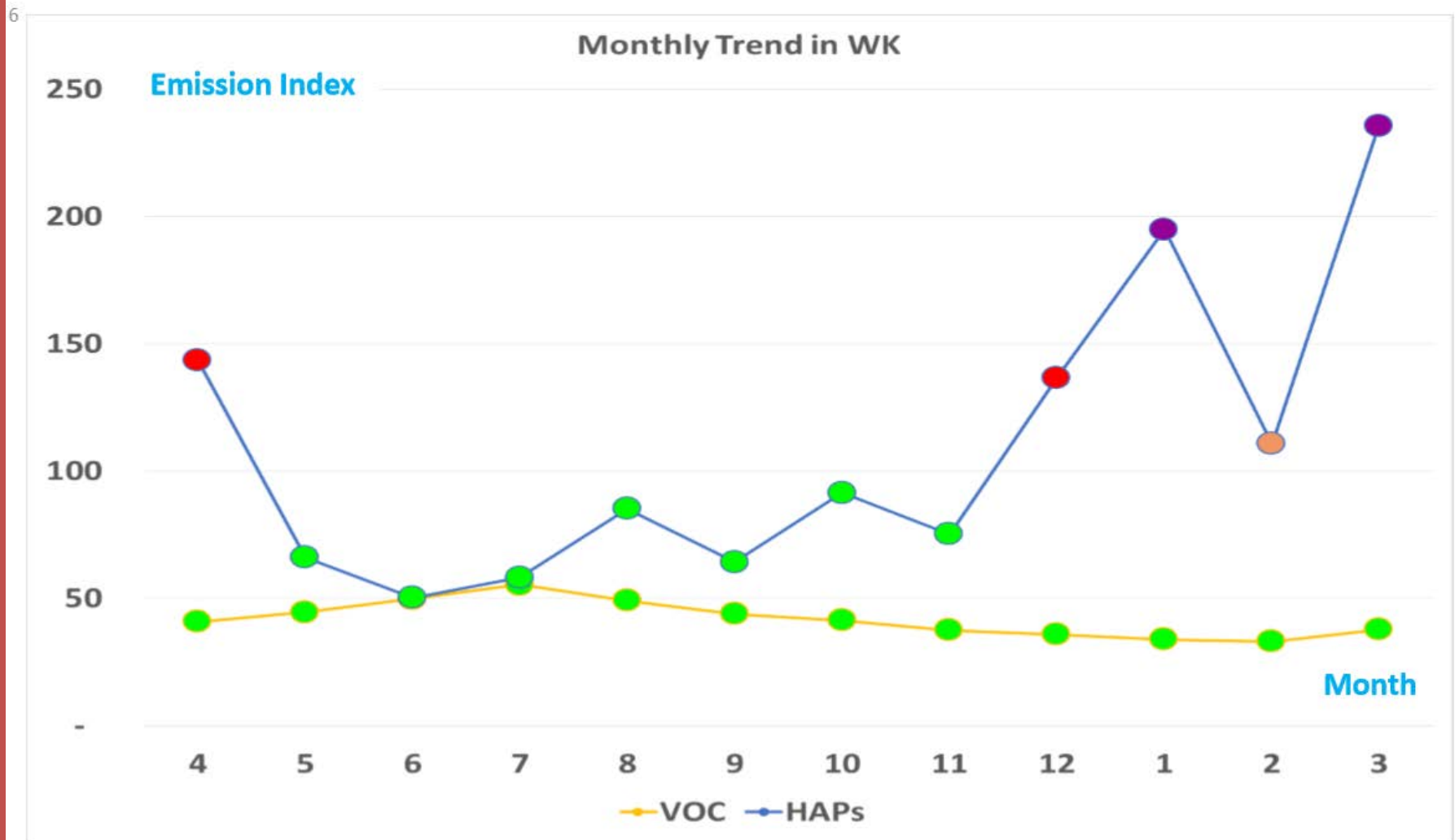
3.5.3 Emission Trend (GHG / CP) in WK:



Emissions Reduction and Control Strategy – Gas Facilities

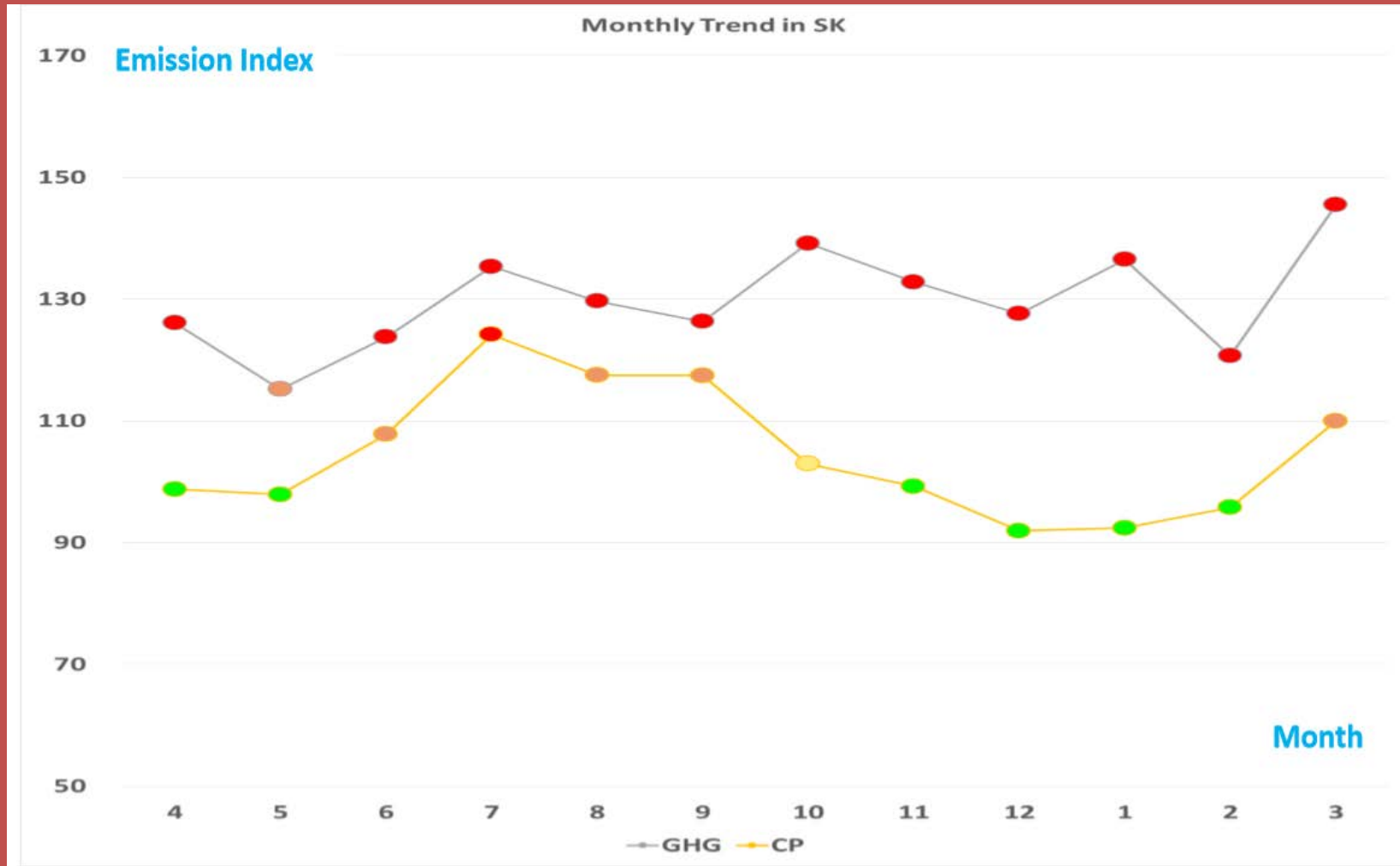
3.5 Analysis of 2016-2017 Emissions Index:

3.5.4 Emission Trend (VOC / HAPs) in WK:



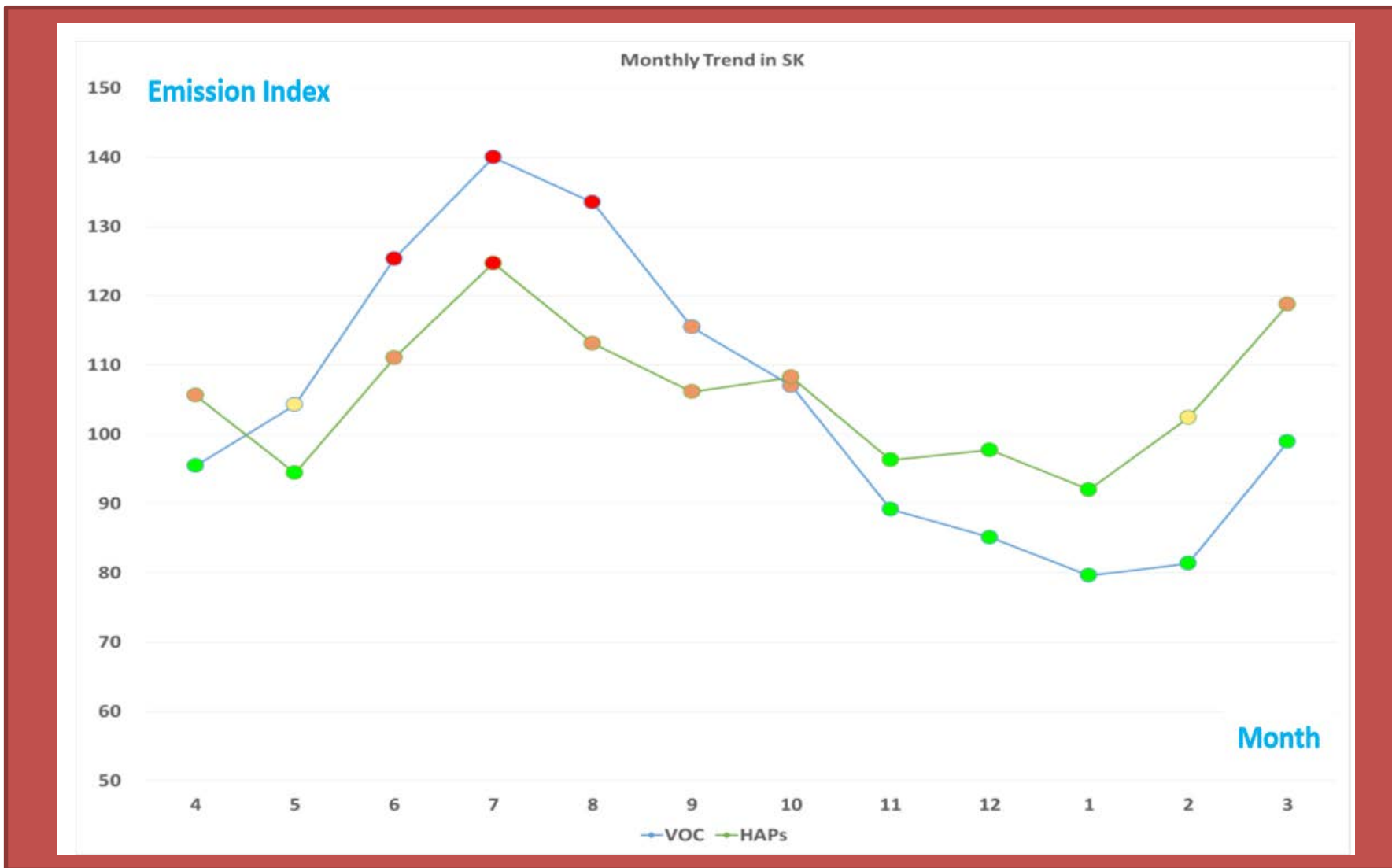
3.5 Analysis of 2016-2017 Emissions Index:

3.5.5 Emission Trend (GHG / CP) in SK:



3.5 Analysis of 2016-2017 Emissions Index:

3.5.6 Emission Trend (VOC/HAPs) in SK:



4.0 Emissions Reduction and Control
Strategy – Gas Facilities

4.1 The Abatement Strategy for the Emission Reduction:

Pollutants

VOCs

***The pollutants
of concern
pertaining to
Gas Facilities***

***Volatile Organic compounds
(VOC's); Organic chemicals that
are released into the
environment by evaporation
(i.e: hydrocarbon storage tanks,
equipment leaks, glycol vents)***

4.1 The Abatement Strategy for the Emission Reduction:

Recommendations

- Undertaking Leak Detection and Repair (LDAR) surveys at the Gas Booster Stations: "LDAR" is a work practice designed to Identify leaking equipment so that emissions can be reduced through repairs.
- Install Incineration or oxidation System to Glycol Vents.

4.1 The Abatement Strategy for the Emission Reduction:

Pollutants

SO_2

***The pollutants
of concern
pertaining to
Gas Facilities***

***Sulphur dioxide (SO₂);
Emitted into ambient air
by means of burning fossil
fuels (i.e. incinerators,
flares, burning pits).***

4.1 The Abatement Strategy for the Emission Reduction:

Recommendations

- *participation in Gas Flaring Reduction Program (GFRP).*
- *Pursue further flare gas reduction measures.*

4.1 The Abatement Strategy for the Emission Reduction:

Pollutants

NO_x

***The pollutants
of concern
pertaining to
Gas Facilities***

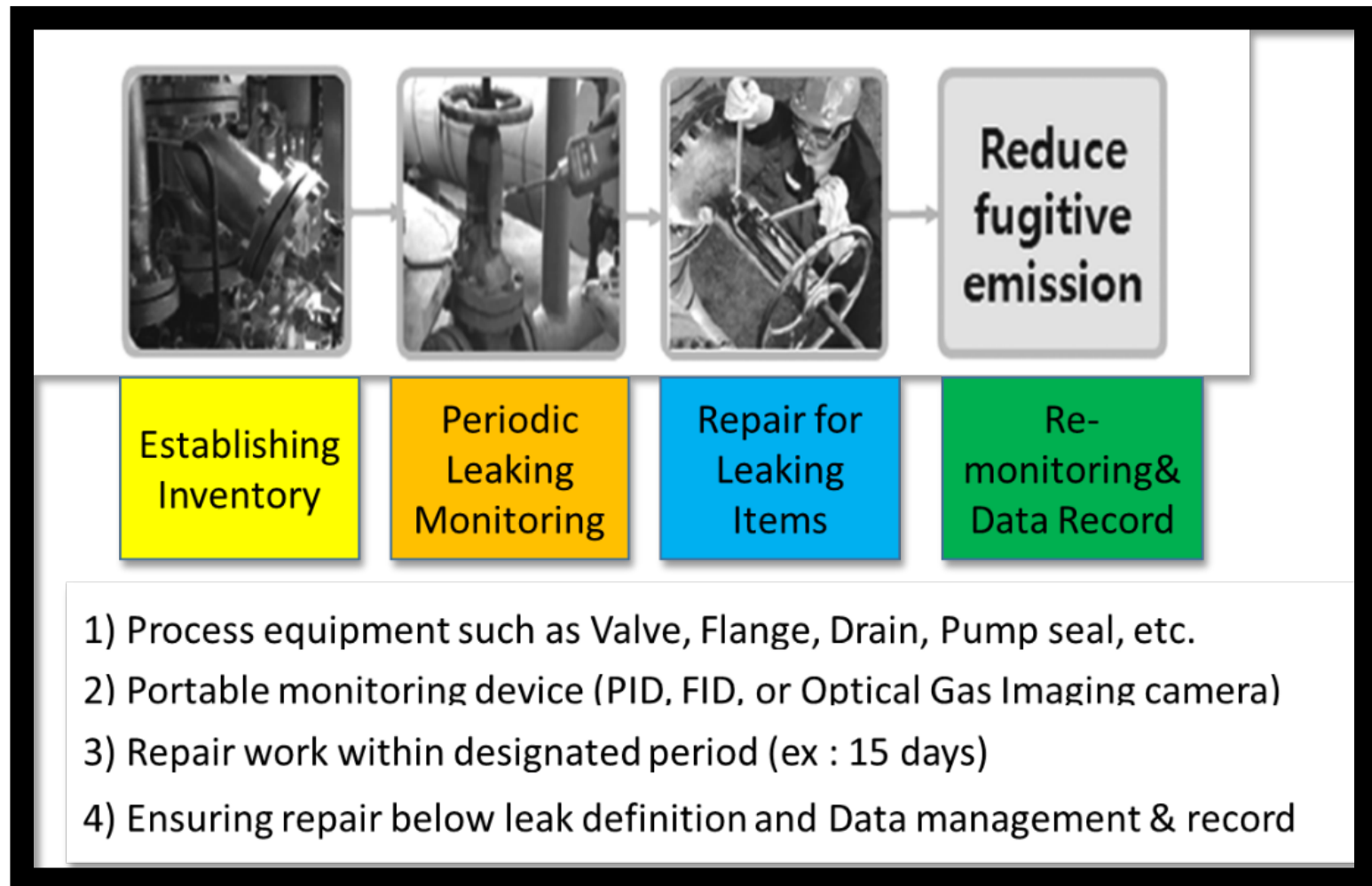
- ***Nitrogen dioxide (NO_2);
Emitted into ambient air
thru burning fuel (i.e.
compressors turbines,
heaters, flares).***

4.1 The Abatement Strategy for the Emission Reduction:

Recommendations

- *Install Selective Catalytic Reduction (SCR) to KOC Compressor Engines.*
- *Install Dry Low NO_x (DLN) Combustors to KOC Turbines.*

LDAR Program



5.0 The Way Forward For the Control Strategy Implementation:

- ***Improve the assumptions & data quality regarding emissions. (Current : EPA AP-42 Guideline).***

- ***Review the Recommended Practices to upgrade inventory quality and minimize the pollutants Emissions.***

- ***Pilot Studies for LDAR shall be developed for one of the identified facility.***

Determine reasonableness of analysis and recommendations and identify the reasonable available control technology for the facilities.

5.0 The Way Forward For the Control Strategy Implementation:

- ***Results of Pilot study shall be analyzed and used to update Air Emissions Abatement Recommendations Report.***

- ***Continue to Investigate other Abatement Options and Update Emissions Abatement Strategy on Annual basis***

6.0 Conclusion

- ***Kuwait Oil Company (KOC) has been developed a program entitled Air Compliance Management Program – ACMP” in order to monitor emissions from KOC gas facilities and ensure the compliance with national/local regulations and legislations.***
- ***The ACMP includes the following: collecting the data from the facilities, identifying significant sources of emissions and recommending the control measures to reduce the emissions to environment.***
- ***Managing our Emissions will Strengthen our Commitment to the Environment & thus will contribute directly to the health of our people and others abroad.***

Thank You!