Benchmarking of HSE Performance
For Oil & Gas Industries

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Outline of the Presentation

- Background & Observations
- Advantages of Benchmarking
- What is Benchmarking of HSE Performance
- What is to be done to Benchmark HSE Performance?
- Sources to Benchmark HSE Performance
- Benchmarking of Safety/Environment/Health Indicators-Case Studies
- Leading & Lagging Indicators @ KOC & its HSE Performance!
- Recommendations!



Background & Observations

- It is observed that most of the companies are focusing only on:
  - Lost Time Injuries
  - Man hours Achieved without Lost Time Injuries

> - This may some times mislead the companies !!!!!!
> - Can we say that if a company has "Zero LTIs", it is the best!

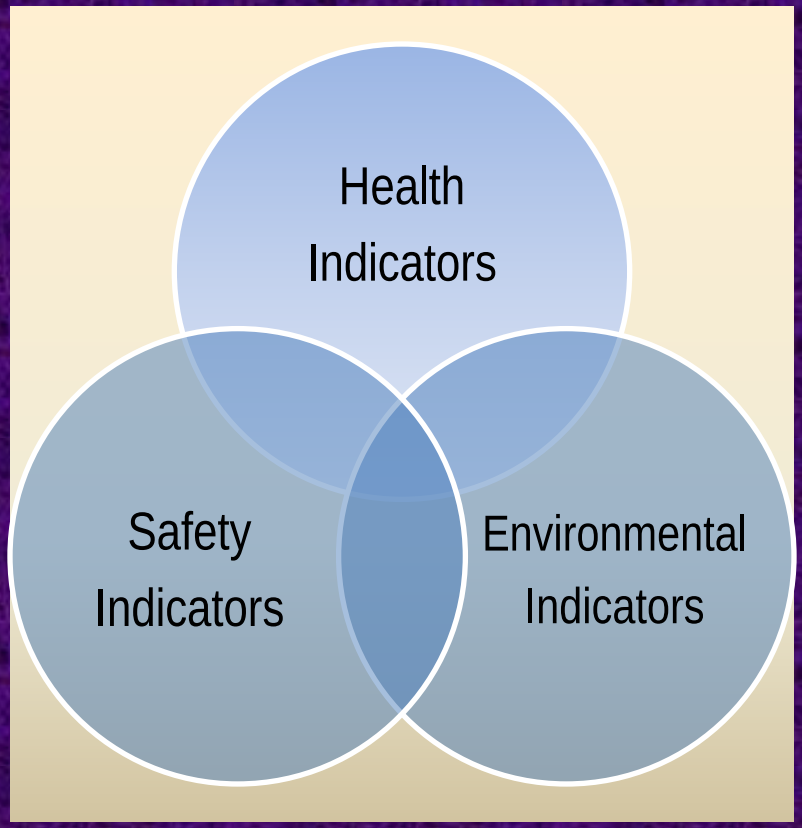
- What about :
  - Major Environmental Incidents without personal Injuries?
  - Fire Incidents without Injuries?
  - Motor Vehicle Accidents without Lost Time Injuries?
  - Asset Damages without Injuries?



Background & Observations-Contd....

- In order to achieve Continual Improvement in HSE Performance, we need to have wide variety of Indicators covering the issues of:
  - Health
  - Safety
  - Environment

- Note: Now a days Security is also being added in most of the companies. If that is the case, you need to pick up some good indicators on "Security" also.



Advantages of Benchmarking the HSE Performance?

- Benchmarking of HSE Performance will facilitate the companies:
  - To asses the HSE Performance with respect to the industry average
  - To understand the trend of various indicators?
  - To know what kind of Indicators are being used by the industry
  - To evaluate what is the overall average performance in the industry?
  - To determine the basis while setting the targets
  - And to Move forward based on the best practices being followed…..

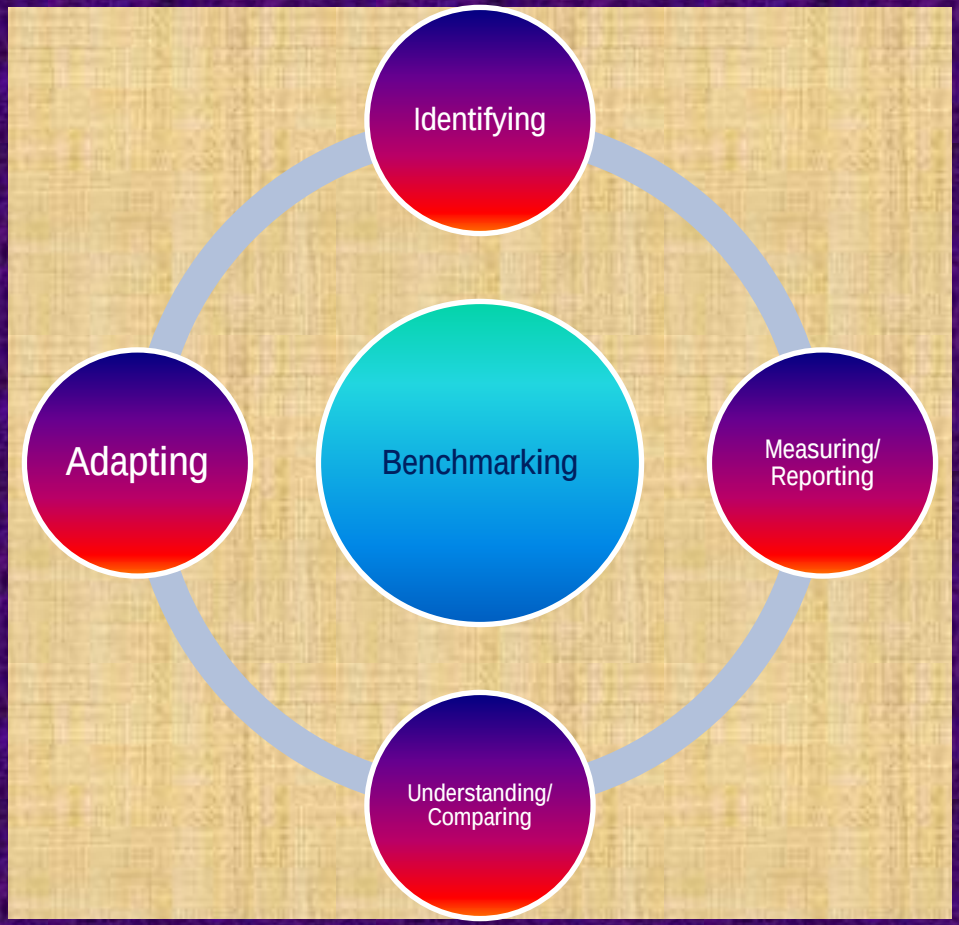


What is Benchmarking?

- Benchmarking is the process of measuring an organization's internal processes then identifying, understanding, and adapting outstanding practices from other organizations considered to be best-in-class.

- Benchmarking is not simply about comparing the data…

- Benchmarking is more about continuously learning from others….



What is Benchmarking of HSE Performance?

- Benchmarking of HSE Performance is a planned process by which an organization compares its health, safety and environmental performance with others to:
  - Asses the Industry Trends & Average values of each indicator?
  - Verify what kinds of indicators are being used ?
  - Asses where your company stands
  - Set your goals as per the evaluation & focus to improve further.

Compare HSE Performance

1. Assess the industry trends & Average values of each indicator!
2. Verify what are the Indicators being used by the industry?
3. Evaluate where your company stands with respect to the industry average?
4. Set your goals based on the evaluation & focus to improve further!!



Sources to Benchmark HSE Performance

- OGP Safety Indicators Performance Reports
- OGP Environmental Indicators Performance Reports
- OGP Health Performance Indicators Reports
- GCC Petroleum Companies Loss Prevention Statistical Reports
- IADC Reports

- OGP : International Association of Oil & Gas Producers
- GCC : Gulf Cooperation Council
- IADC : International Association of Drilling Contractors

Note: These are some of the sources suitable for Oil Industry.



Way forward to Benchmark HSE Performance?

1. Unify the definitions ; HSE Measures; Formulas etc…
   - Inline with OGP or any other best entity….

2. Identify what are the indicators that you want to benchmark?
3. Start Measuring those in your companies (If not being done)
4. Select the partner/ entity suitable to your organization such as OGP/GCC…and start reporting to them as well…
5. Compare the Performance with respect to the industry performance based on the reports published & assess where you are?
6. Compare the results
7. Set the new goals & adapt the new approaches to improve HSE Performance.



Sample Reports and trend analysis of HSE Measures based on OGP/GCC



Benchmarking of FAR (Fatal Accident Rate)!

Fig 2.1.1: Number of fatalities and fatal accident rate
2003-2012 [data page B-2]

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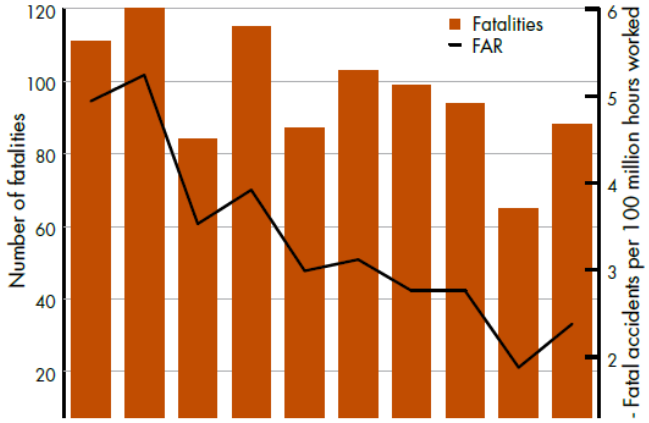
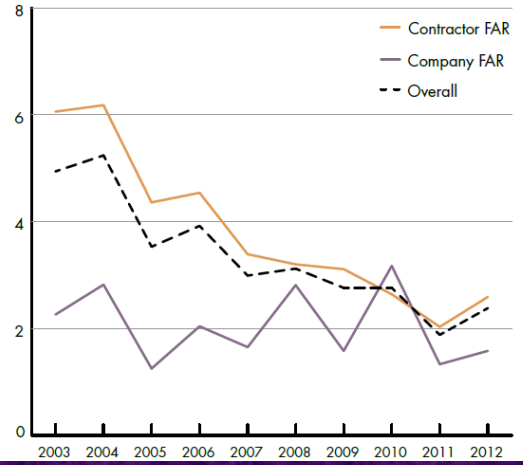
2003-2012 [data page B-2]



2.2 Fatal accident rate (FAR)

Fig 2.2.1: Fatal accident rate – company & contractors
per 100 million hours worked [Data page B-2]



	2012 (2011) FAR	Relative to 2011 FAR
Company	1.58 (1.33)	(19% higher)
Contractor	2.59 (2.03)	(28% higher)
Overall	**2.38 (1.88)**	**(27% higher)**
Onshore	2.87 (1.94)	(48% higher)
Offshore	0.89 (1.67)	(47% lower)

- In 2012 there were 12 company fatalities (10 in 2011) as a result of 6 separate incidents.
  - 5 of the company fatalities were as a result of a single incident involving a gas leak and explosion following the loss of mechanical integrity of a pipeline in Mexico.
- In 2012 there were 76 contractor fatalities (55 in 2011).
  - 26 of the contractor fatalities were as a result of a single incident involving a gas leak and explosion

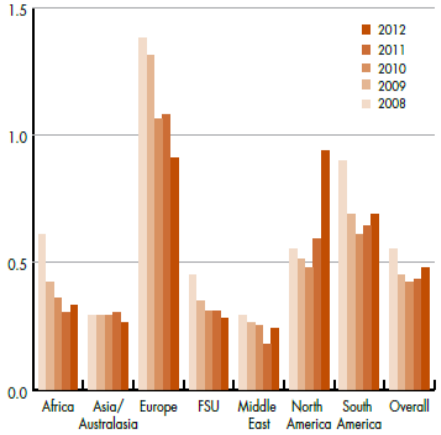
Benchmarking of Safety Indicators-As Per OGP Safety Indicators Performance Report 2012

Benchmarking of TRIR & LTIF!

3.4 Lost time injury frequency (LTIF) by region

	2012	2011	2010	2009	2008
Africa	0.33	0.30	0.36	0.42	0.61
Asia/ Australasia	0.26	0.30	0.29	0.29	0.29
Europe	0.91	1.08	1.06	1.31	1.38
FSU	0.28	0.31	0.31	0.35	0.45
Middle East	0.24	0.18	0.25	0.26	0.29
North America	0.94	0.59	0.48	0.51	0.55
South America	0.69	0.64	0.61	0.69	0.90
Overall	0.48	0.43	0.42	0.45	0.55

Fig 3.4.1: Lost time injury frequency
per million hours worked



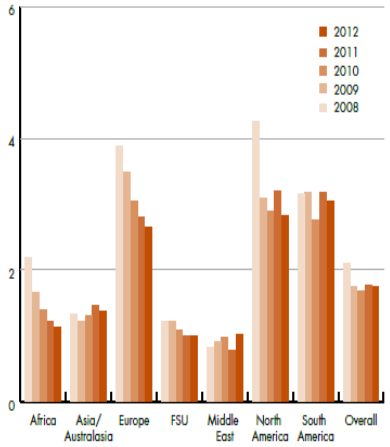
Further analysis of the lost time injuries is presented in Section 3.5, where 5-year rolling averages of LTIF are presented for each of the regions.

Lost time injury frequency (LTIF)

The number of lost time injuries (fatalities + lost workday cases) per 1,000,000 hours worked.

3.3 Total recordable injury rate (TRIR) by region

Fig 3.3.1: Total recordable injury rate
per million hours worked



	2012	2011	2010	2009	2008
Africa	1.14	1.22	1.40	1.65	2.18
Asia/ Australasia	1.37	1.46	1.30	1.22	1.34
Europe	2.64	2.81	3.05	3.48	3.89
FSU	0.99	0.99	1.08	1.21	1.22
Middle East	1.02	0.78	0.98	0.92	0.83
North America	2.82	3.19	2.89	3.08	4.25
South America	3.05	3.17	2.76	3.17	3.15
Overall	1.74	1.76	1.68	1.75	2.09

Submissions without information on medical treatment cases were filtered out, leaving a database of 3,651 million hours, almost 100% of the database (see Appendix A).

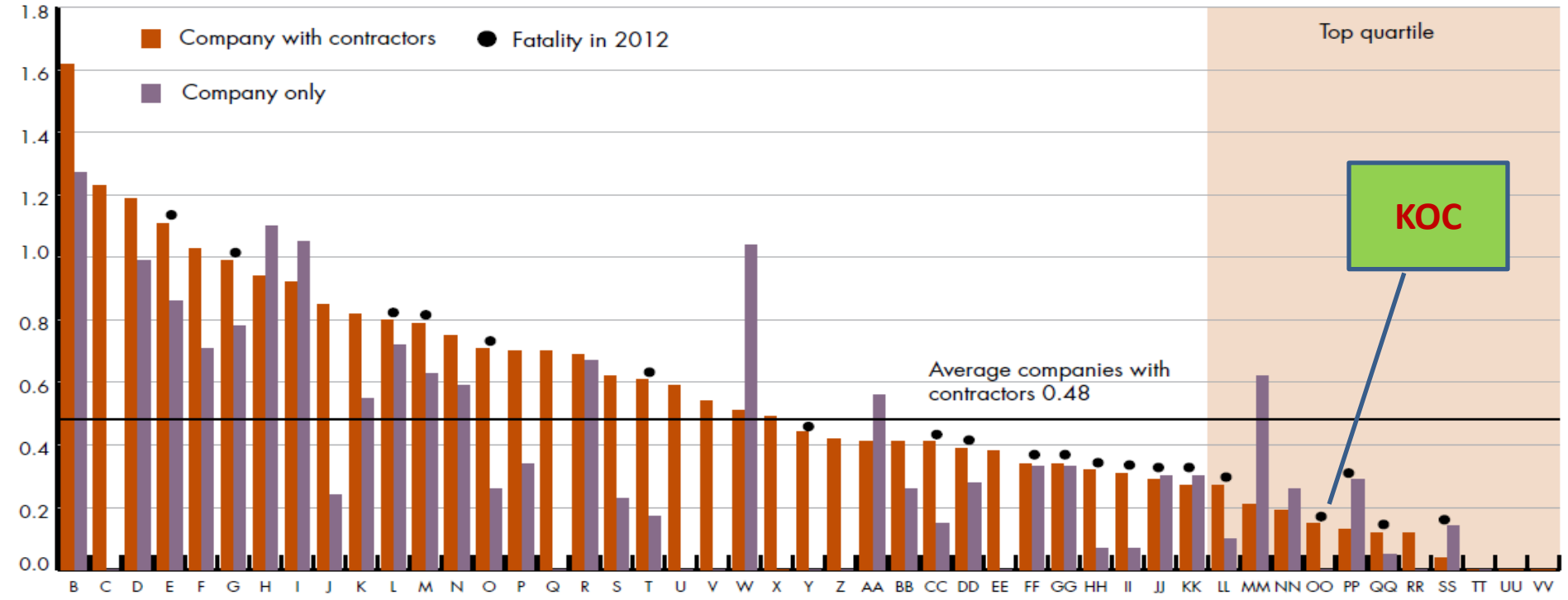
Total recordable injury rate (TRIR)

The number of recordable injuries (fatalities + lost work day cases + restricted work day cases + medical treatment cases) per 1,000,000 hours worked.

Benchmarking of Safety Indicators-As Per OGP Safety Indicators Performance Report 2012

Benchmarking of LTIF (Lost Time Injury Frequency Rate)

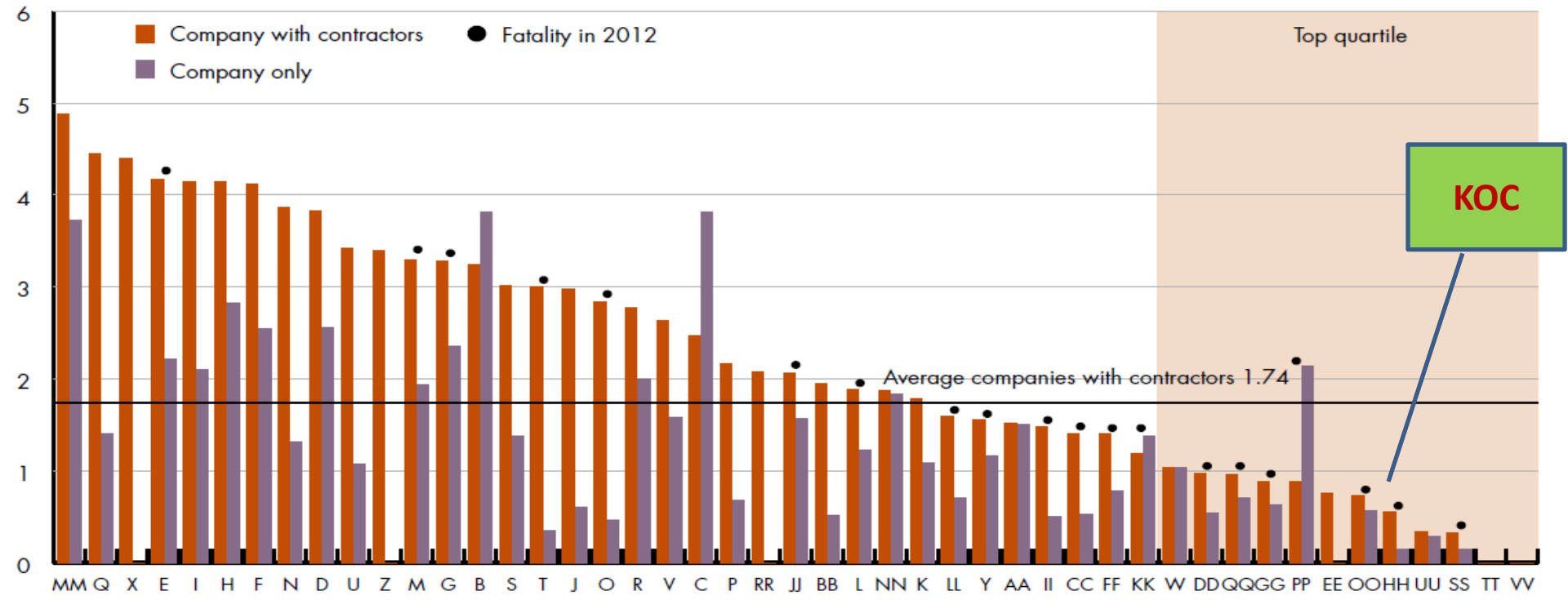
Fig 5.1.3.1: Performance ranking of companies jointly with contractors – lost time injury frequency per million hours worked *[Data page B-14]*



Benchmarking of Safety Indicators-As Per OGP Safety Indicators Performance Report 2012

Benchmarking of TRIR (Total Recordable Injury Rate)

Fig 5.1.2.1: Performance ranking of companies jointly with contractors – total recordable injury rate per million hours worked *[Data page B-14]*



Benchmarking of Safety Indicators-As Per OGP Safety Indicators Performance Report 2012

Analysis of Lost Workday Cases by Category/ By Activity

Fig 2.7.2: Lost work day cases – by category
Company [Data page B-4]

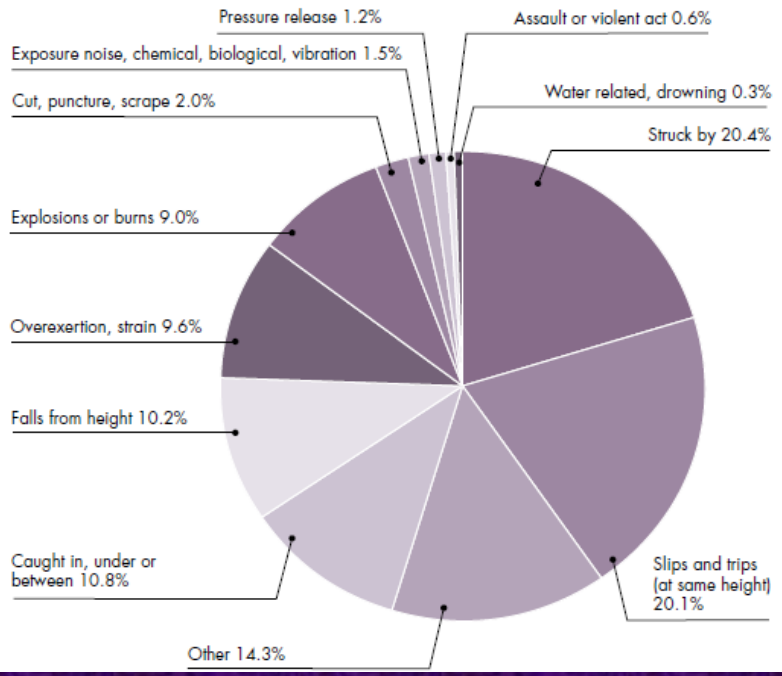
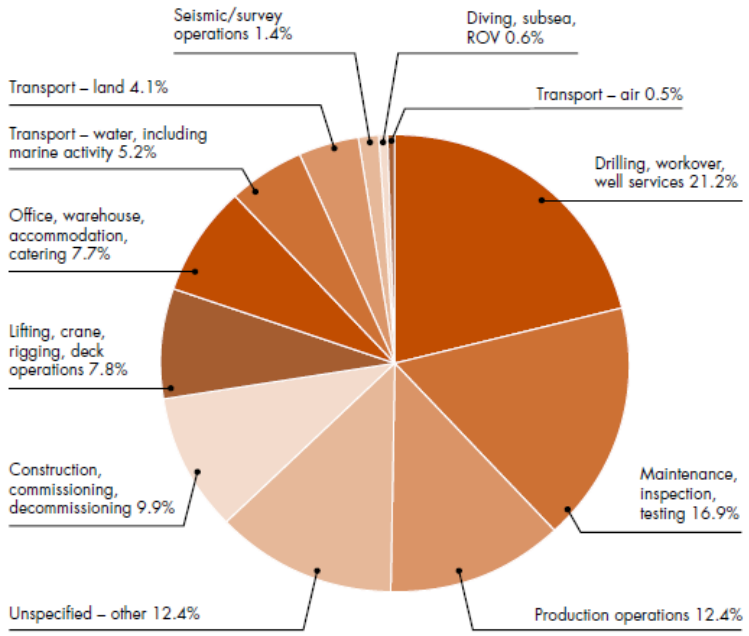


Fig2.7.6: Lost work day cases – by activity
% LWDCs associated with each reporting category [Data page B-3]

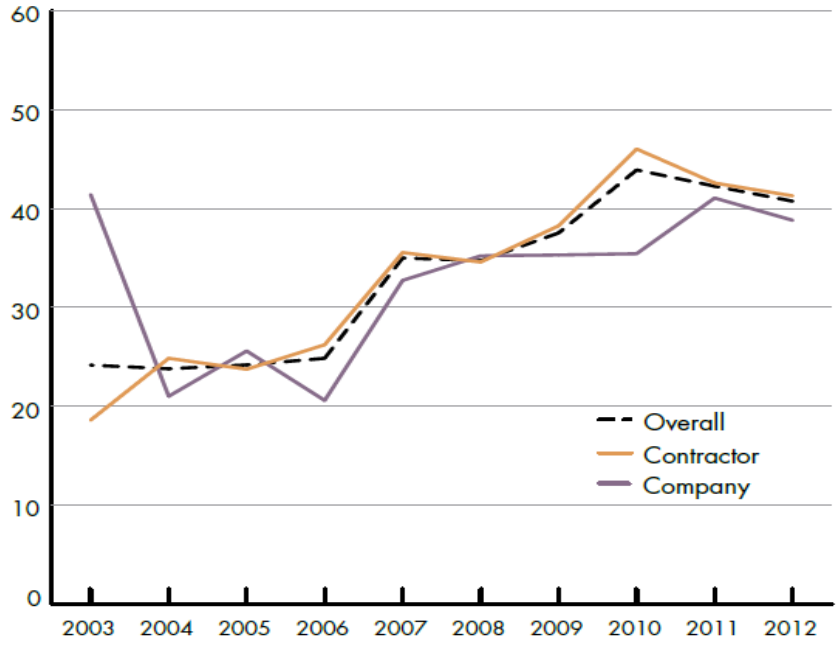


Benchmarking of Safety Indicators-As Per OGP Safety Indicators Performance Report 2012

Benchmarking of Severity of Lost Work Day Cases

2.8 Severity of lost work day cases

Fig 2.8.1: Severity of lost work day cases – company & contractors
average days lost per LWDC [Data page B-4]



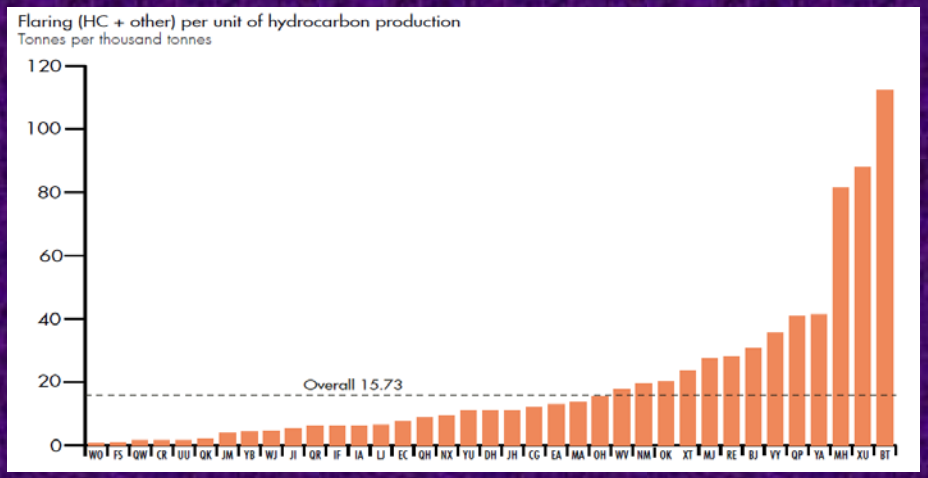
	2012 (2011) severity	Relative to 2011 severity	Relative to 2007-2011 average severity
Company	38.81 (41.06)	5% lower	9% higher
Contractor	41.28 (42.58)	3% lower	6% higher
Overall	**40.74 (42.26)**	**4% lower**	**7% higher**
Onshore	36.83 (39.84)	8% lower	5% higher
Offshore	45.99 (46.42)	1% lower	2% higher

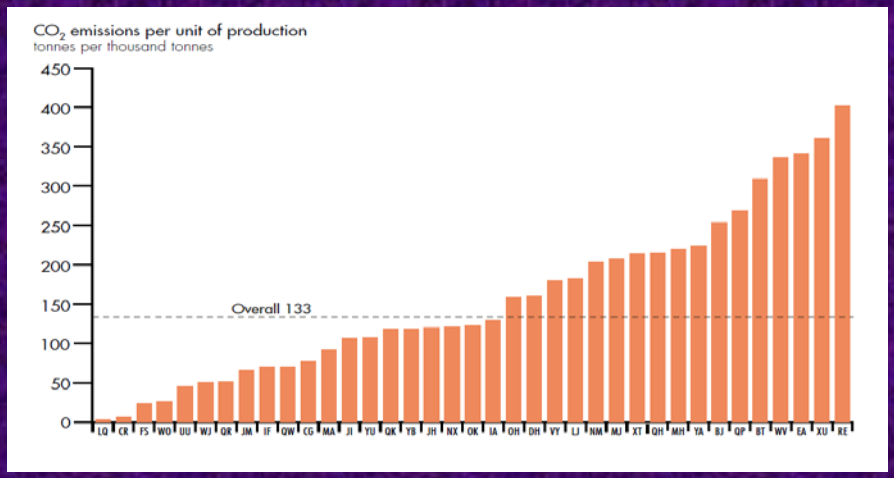
- OGP member companies reported 53,325 days of work lost through injuries.
- The number of days lost was reported for 78% of the lost work day cases.
- The difference between company and contractor severity levels is 7% (contractor is 7% higher).
- The offshore LWDC severity is 25% higher than onshore.

Benchmarking of Safety Indicators-As Per OGP Safety Indicators Performance Report 2012



Benchmarking of Environmental Indicators





1.3 Greenhouse Gas (GHG)

For E&P activities, CO_2 and CH_4 are the principal contributors to greenhouse gas emissions, with other gases such as N_2O playing a minor role. The CO_2 and CH_4 data presented above are used to calculate an estimate of the GHG emissions for the contributing OGP reporting companies, using the conversion to CO_2 equivalent ($GHG = CO_2 + 21 \times CH_4$).

1.3.1 Emissions per unit of production

Participating companies reported normalised emissions of 160 tonnes of GHG per thousand tonnes of hydrocarbon production in 2012. This represents a 1% increase in intensity compared with 2011 results (see Figure 1.3.1.1).

Regional averages for quantity

Figure 1.3.1.1: GHG emissions per unit of production
tonnes per thousand tonnes of hydrocarbon prod

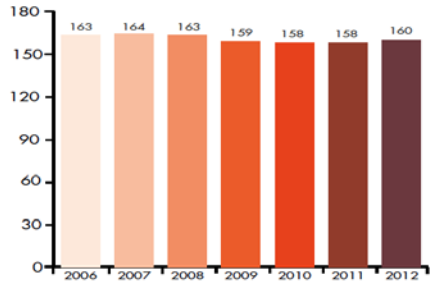
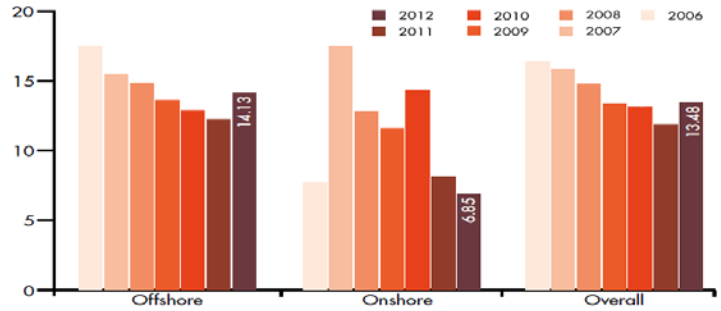


Figure 1.3.1.2: GHG emissions per unit of production
tonnes per thousand tonnes of hydrocarbon production

4.1 Quality (oil content) of produced water discharges

Figure 4.1.1: Oil discharged per unit of produced water discharged
milligrammes oil per litre of produced water discharged



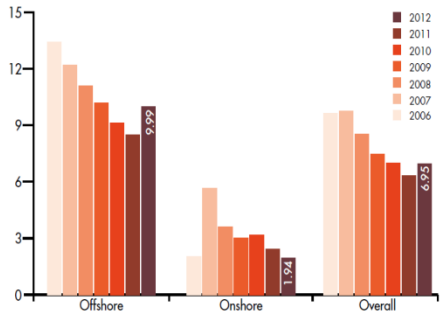
Benchmarking of Environmental Performance -As Per OGP EPI Report

Benchmarking of Environmental Indicators

4.2 Quantity of oil discharged in produced water per unit of production

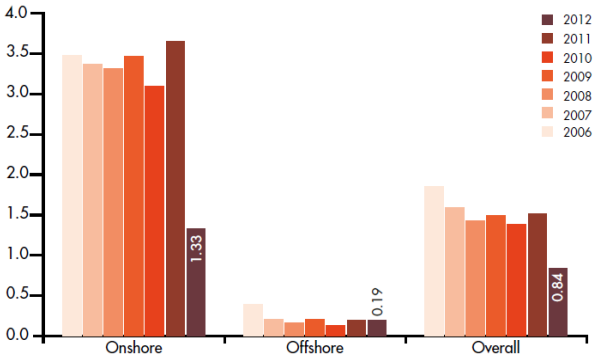
Figure 4.2.1: Oil discharged per unit of production

tonnes per million tonnes of hydrocarbon production



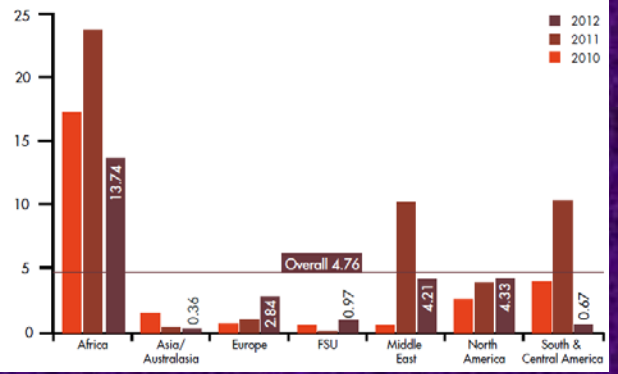
Number of oil spills > 1 barrel per unit of hydrocarbon production

spills per million tonnes



Quantity of oil spilled (spills > 1 barrel) per unit of hydrocarbon production—by r

tonnes per million tonnes



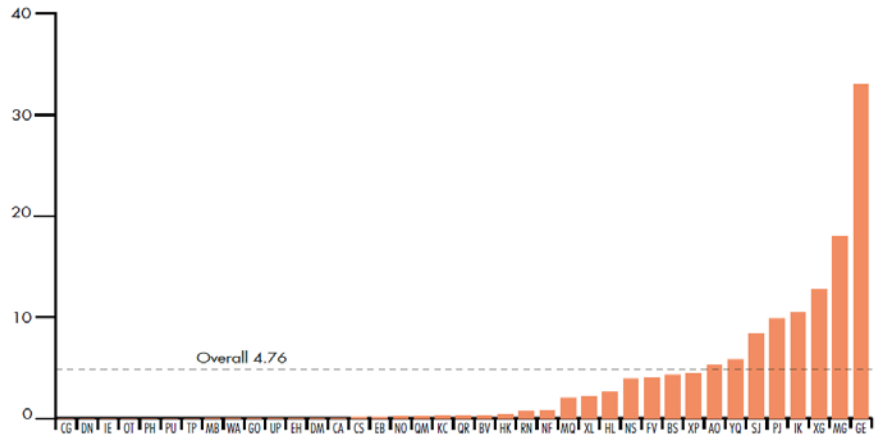
Number of oil spills >1 barrel in size and quantity spilled per unit of hydrocarbon production—by region *(Figures 6.1.2, 6.1.4)*

	Africa	Asia/ Australasia	Europe	FSU	Middle East	North America	South & Central America	Overall
2012								
Number of spills (t/10^6t)	1.45	0.16	0.48	0.26	0.38	2.1	0.43	0.84
Quantity spilt (t/10^6t)	13.74	0.36	2.84	0.97	4.21	4.33	0.67	4.76
Production (10^6t)	393	301	370	113	308	306	187	1977
2011								
Number of spills (t/10^6t)	1.37	0.17	0.43	0.12	0.44	1.65	9	1.51
Quantity spilt (t/10^6t)	23.78	0.45	1.08	0.11	10.28	3.95	10.4	7.94
Production (10^6t)	386	309	430	121	304	271	184	2006
2010								
Number of spills (t/10^6t)	1.25	0.24	0.33	0.19	0.35	1.63	8.17	1.38
Quantity spilt (t/10^6t)	17.27	1.57	0.70	0.58	0.62	2.67	4.04	4.49
Production (10^6t)	398	334	461	111	329	313	194	2139

NB: Excludes spills <1 barrel in size

Oil spilt per unit of hydrocarbon production

tonnes per million tonne



Benchmarking of Environmental Performance -As Per OGP EPI Report

Benchmarking of Health Performance Indicators

Table 1
Gap Analysis Tool 2012 by company (16 companies took part)
Sorted by: average by company worst to best

IPIECA / OGP Elements									
Company	Health Risk Assessment (1)	Industrial Hygiene (2)	Medical Emergency Management (3)	Management of Ill-health (4)	Fitness for Task / Surveillance (5)	Health Impact Assessment (6)	Health Reporting (7)	Public Health/ Promotion (8)	Av. by Company
H	2.9	2.8	3.4	2.9	2.0	1.0	2.9	1.0	2.4
M	1.9	2.1	3.1	2.9	3.0	1.1	3.2	2.0	2.4
A	2.8	2.9	3.0	3.0	2.9	2.4	2.9	2.6	2.8
G	1.9	3.0	3.2	3.9	3.4	1.0	3.4	3.6	2.9
K	2.3	3.3	3.5	3.6	3.4	2.5	3.2	2.4	3.0
D	3.1	3.0	3.5	3.6	3.7	1.7	3.4	2.8	3.1
L	2.5	3.1	4.0	3.1	3.4	2.3	3.4	3.2	3.1
J	3.0	3.6	3.5	3.4	3.1	3.3	3.3	3.2	3.3
O	3.3	3.2	3.6	3.6	3.5	3.0	3.6	3.0	3.4
C	3.1	3.6	3.7	3.7	3.4	2.8	3.8	3.0	3.4
P	3.0	3.6	3.3	3.9	3.8	3.0	3.6	3.8	3.5
I	3.3	3.8	3.7	3.4	3.8	3.0	3.8	3.4	3.5
B	3.8	3.6	3.8	3.9	3.9	2.8	3.8	3.0	3.6
F	3.8	4.0	4.0	3.7	4.0	2.6	4.0	3.2	3.7
E	3.7	3.4	3.9	3.7	3.6	3.8	3.9	3.4	3.7
N	3.8	3.9	4.0	3.9	3.9	3.8	3.8	3.2	3.8
Av. by Element	3.0	3.3	3.6	3.5	3.4	2.5	3.5	2.9	

Benchmarking of Health Performance Indicators-As Per OGP



Benchmarking of HSE Performance as per GCC.

GCC PETROLEUM COMPANIES LOSS PREVENTION STATISTICS - 2010

COUNTRY	NAME OF COMPANY	NUMBER OF EMPLOYEES	HOURS WORKED	ON-JOB INJURIES									MOTOR VEHICLE ACCIDENTS				FIRES	
				FAI	MTC	RDI		LTI		FAT	TRC		Number of Vehicles	Number of Kilometers Driven	Number of Motor Vehicle Accidents (MVAs)	MVA Incident Rate [4]	Number of Fires	Amount of Fire Loss (U.S. Dollars)
				Number	Number	Number	Incident Rate [1]	Number	Incident Rate [2]	Number	Number	Incident Rate [3]						
BAHRAIN	BAHRAIN NATIONAL GAS COMPANY	481	822,883	3	0	0	0.00	0	0.00	0	0	0.00	105	1,648,284	0	0.00	1	[8]
BAHRAIN	BAHRAIN PETROLEUM COMPANY	3,140	6,412,860	48	0	3	0.11	4	0.16	0	7	0.26	864	21,080,000	78	3.70	14	128,000
KUWAIT	KUWAIT NATIONAL PETROLEUM COMPANY	5,248	10,183,288	24	17	1	0.02	3	0.06	0	21	0.41	1,027	20,640,000 [5]	1	0.05	3	[8]
KUWAIT	SAUDI ARABIAN CHEVRON	872	1,883,050	2	0	1	0.12	0	0.00	0	1	0.12	514	4,791,200	0	0.00	1	[8]
KUWAIT	KUWAIT OIL COMPANY	6,788	12,017,500	8	12	2	0.03	11	0.18	0	26	0.42	2,724	186,128,000	21	0.11	16	16,823
QATAR	QATAR PETROLEUM COMPANY	12,116	26,811,000	11	12	0	0.00	7	0.05	0	18	0.14	1,667	33,143,841	61	1.84	20	[8]
SAUDI ARABIA	AL KHAFJI JOINT OPERATIONS	2,384	4,773,835	17	1	1	0.04	1	0.04	0	3	0.13	481	12,888,257	2	0.16	4	[8]
SAUDI ARABIA	SAUDI ARAMCO LUBRICATING OIL REFINING COMPANY	421	842,000	2	2	0	0.00	0	0.00	0	2	0.48	60	830,755	2	2.41	0	0
SAUDI ARABIA	SAUDI ARAMCO MOBIL REFINERY COMPANY	719	1,681,106	5	1	2	0.26	0	0.00	0	3	0.38	83	1,782,147	4	2.24	3	[8]
SAUDI ARABIA	SAUDI ARAMCO SHELL REFINERY COMPANY	662	1,535,277	11	1	0	0.00	0	0.00	0	1	0.13	103	1,953,975	3	1.54	0	0
UAE	ABU DHABI COMPANY FOR ONSHORE OIL OPERATIONS	3,034	5,579,788	7	1	1	0.04	1	0.04	0	3	0.11	588	12,922,313	2	0.15	1	2,000
UAE	ESNAAD	1,063	6,867,383	6	1	9	0.30	2	0.07	0	12	0.40	45	762,943	0	0.00	0	0
																		[8]

Benchmarking of HSE Performance -As Per GCC



As per IADC!

- LTI INCD Rate:
  - (LTIs+ FTLs) *200,000/ Total Man hours.
- DART INCD Rate:
  - (RWTCs+ LTIs+ FTLs) *200,000/ Total Man hours.
- RCRD INCD Rate:
  - (MTOs+ RWTCs+ LTIs+ FTLs) *200,000/ Total Man hours.
- LTI FREQ Rate:
  - (LTIs+ FTLs) *1000,000/ Total Man hours.
- DART FREQ Rate:
  - (RWTCs+ LTIs+ FTLs) *1000,000/ Total Man hours.
- RCRD FREQ Rate:
  - (MTOs+ RWTCs+ LTIs+ FTLs) *1000,000/ Total Man hours.

(DART-Days Away (LTI) cases + Restricted Work/Transfer Cases); RCRD-Total Recordable



As per GCC Petroleum Companies Loss Prevention Statistical Report

- **Incident Rate:**
  - On-job lost workday cases with days away from work per 200,000 hours worked.
- **Incident Rate:**
  - Total On-Job recordable Cases (MTC+RDI+LTI+FAT) per 200,000 hours worked.
  - No of Accidents*1000,000/ Total Hours worked during the period
- **Incident Rate:**
  - Restricted duty cases per 200,000 hours worked
- **Motor Vehicle Accident Rate:**
  - No of MVIs per million kilometers driven.



Important Safety Indicators!

- Fatal Incident Rate:
  - The number of Company/ Contractor fatalities per100 million hours worked.
- Lost Time Injury Frequency Rate
  - The number of Lost time injuries (Fatalities + Lost workday cases) per 1,000,000 hours worked.
- Total Recordable Injury Rate
  - The number of recordable incidents per 1000,000 hours worked. (Recordable injuries: FACs+ MTOCS+ RWCs)
- Severity Rate of LWCs (Lost workday Cases)
  - Average Days Lost per LWDC(Lost Work Day Case)



Important Environmental Indicators!

- Gaseous Emissions
  - Emissions per thousand tonnes of Hydrocarbon Production
  - Carbon Dioxide (CO_2)- Emissions per Unit of Production
  - Methane (CH_4) -Emissions per Unit of Production
  - Green House Gas Emissions--Emissions per Unit of Production
  - Sulphur Dioxide (SO_2)-Emissions per Unit of Production
  - Nitrogen Oxides-Emissions per Unit of Production

- Flaring (%of Gas Flared)- Flaring per Unit of Hydrocarbon Production
- Spills of Oil & Chemicals
  - Oil Spilt per Unit of Hydrocarbon Production (Tons per Million Tons)
- Aqueous Discharges- Oil Discharged per unit of produced water discharged
- Discharges of Non Aqueous Drilling Fluids (NADF) on Cuttings
- Energy Consumption- Energy Consumed per Unit of Hydrocarbon Production



Let us have a look!

What are the measures

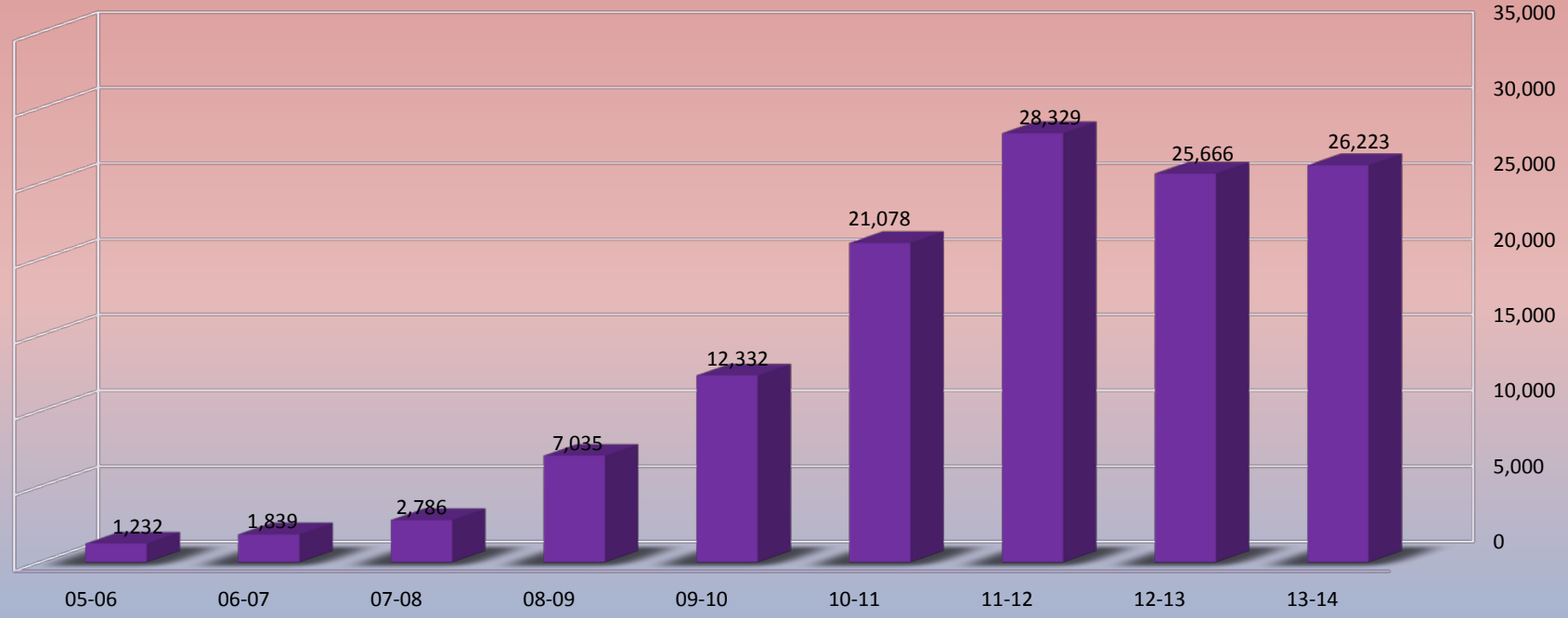
(Leading Indicators & Lagging Indicators)

that are being maintained by KOC & it's Performance?

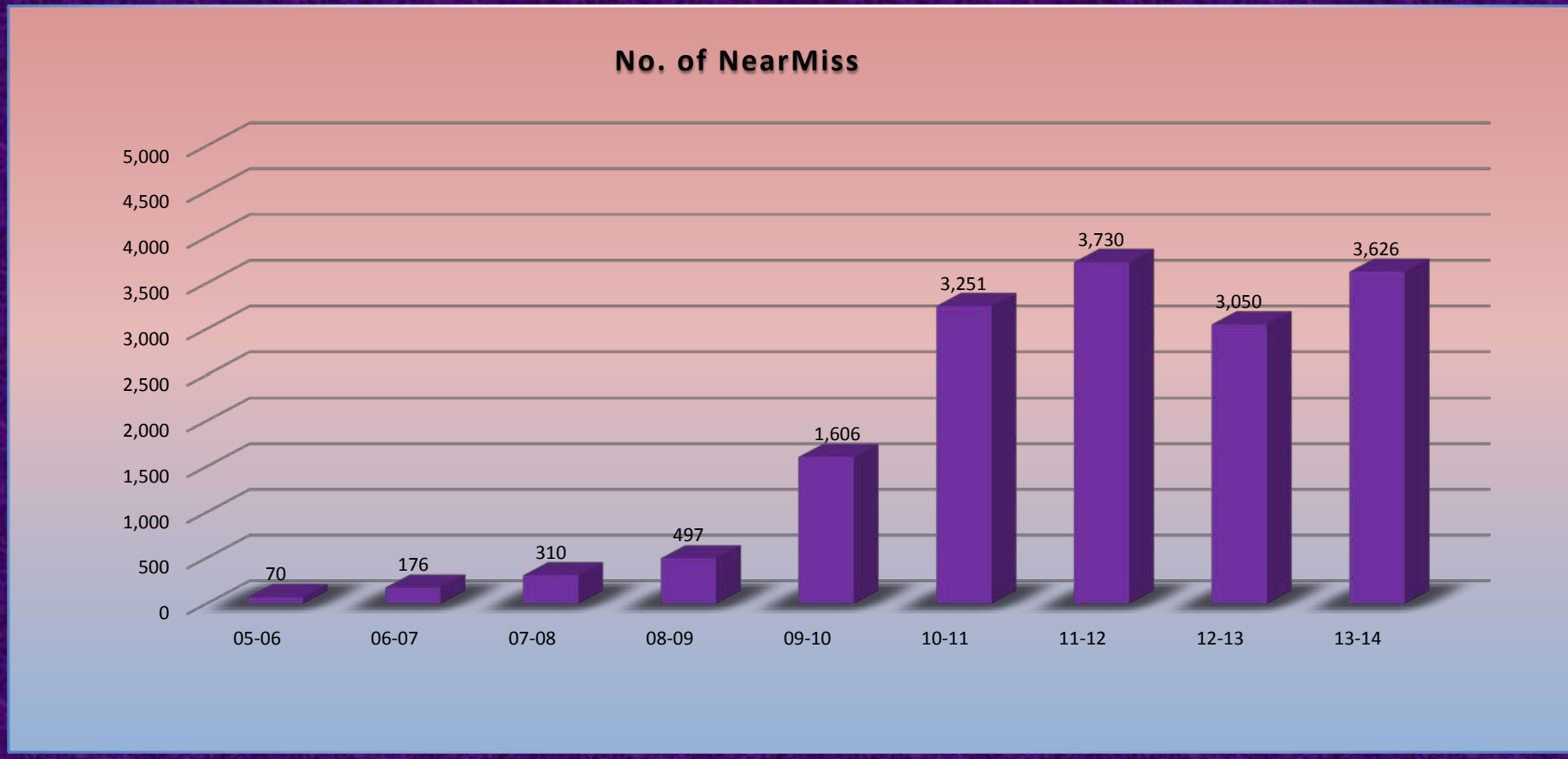
(As Best Practices Being Shared)



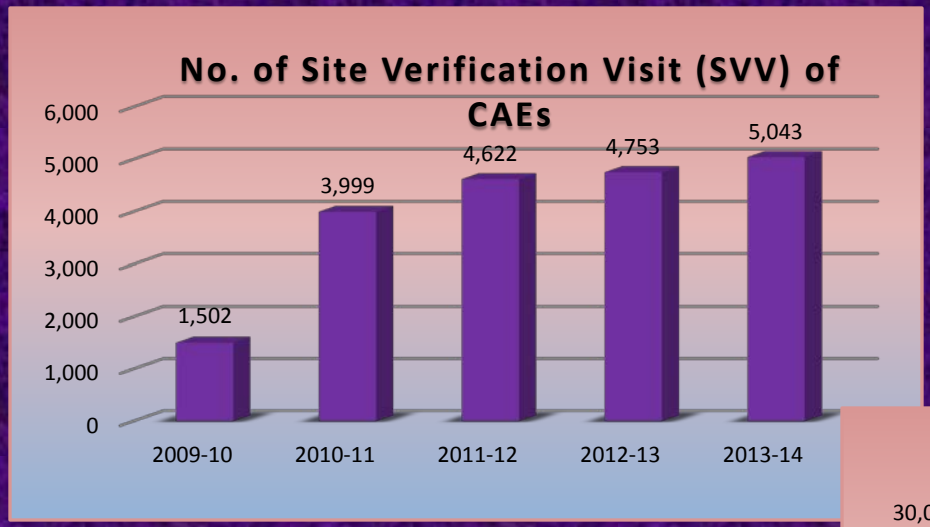
Safety Observations & Conversations (SOC)

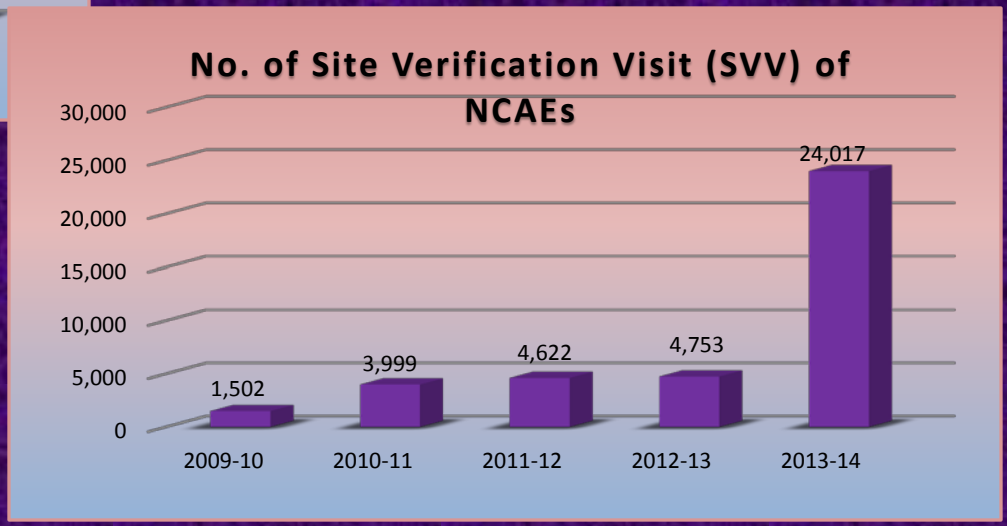


HSE Performance @ KOC

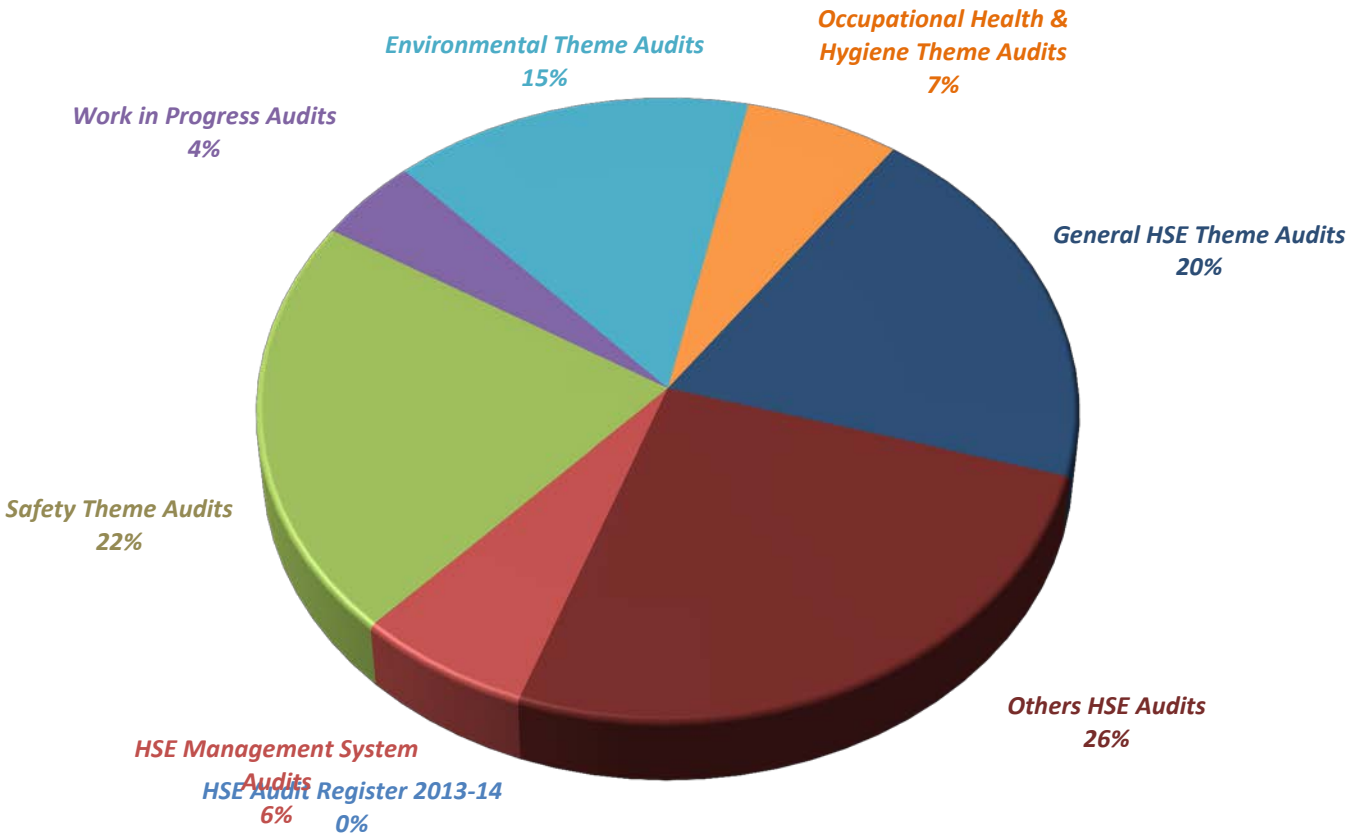


HSE Performance @ KOC





HSE AUDITS CONDUCTED DURING 2013-14



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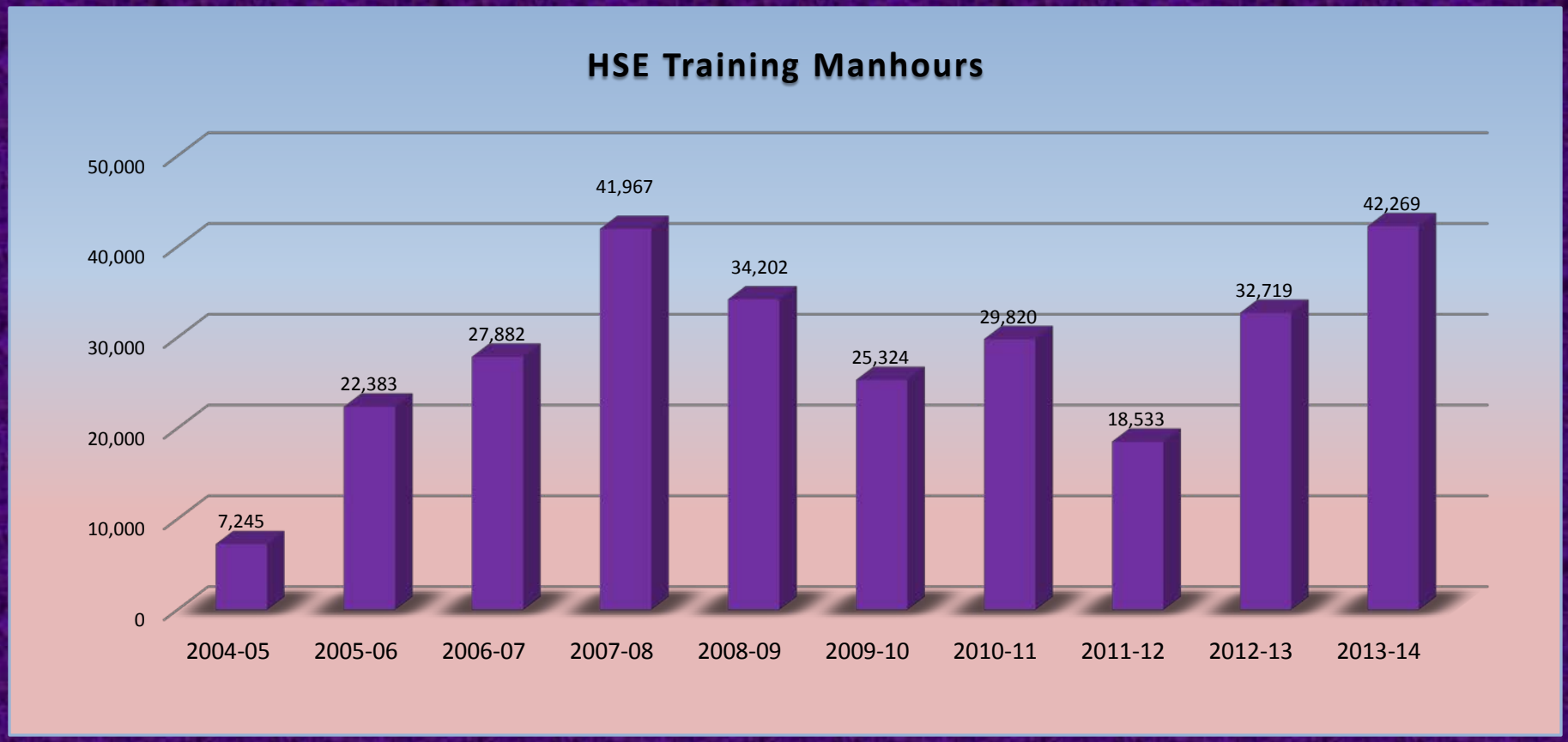
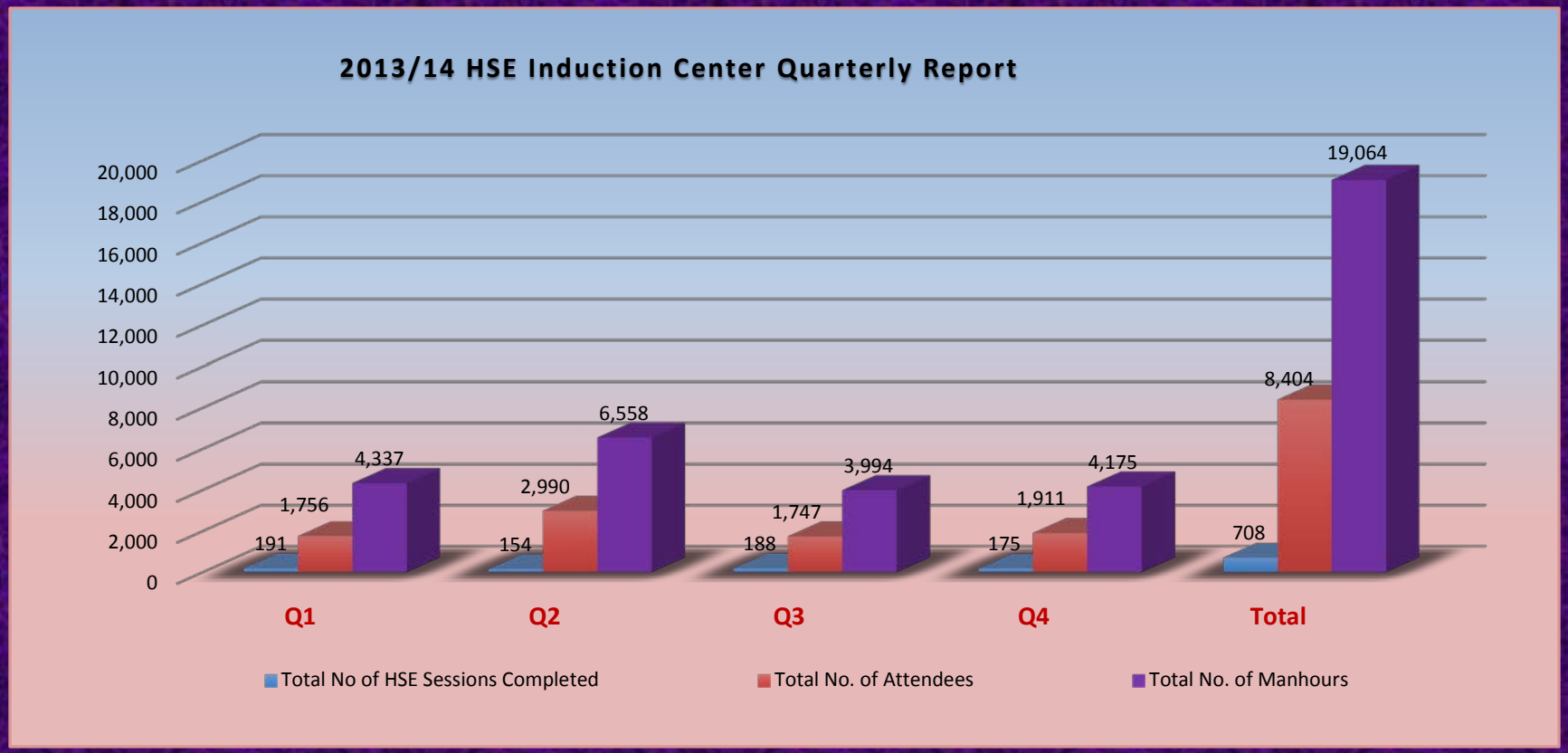


HSE Performance @ KOC



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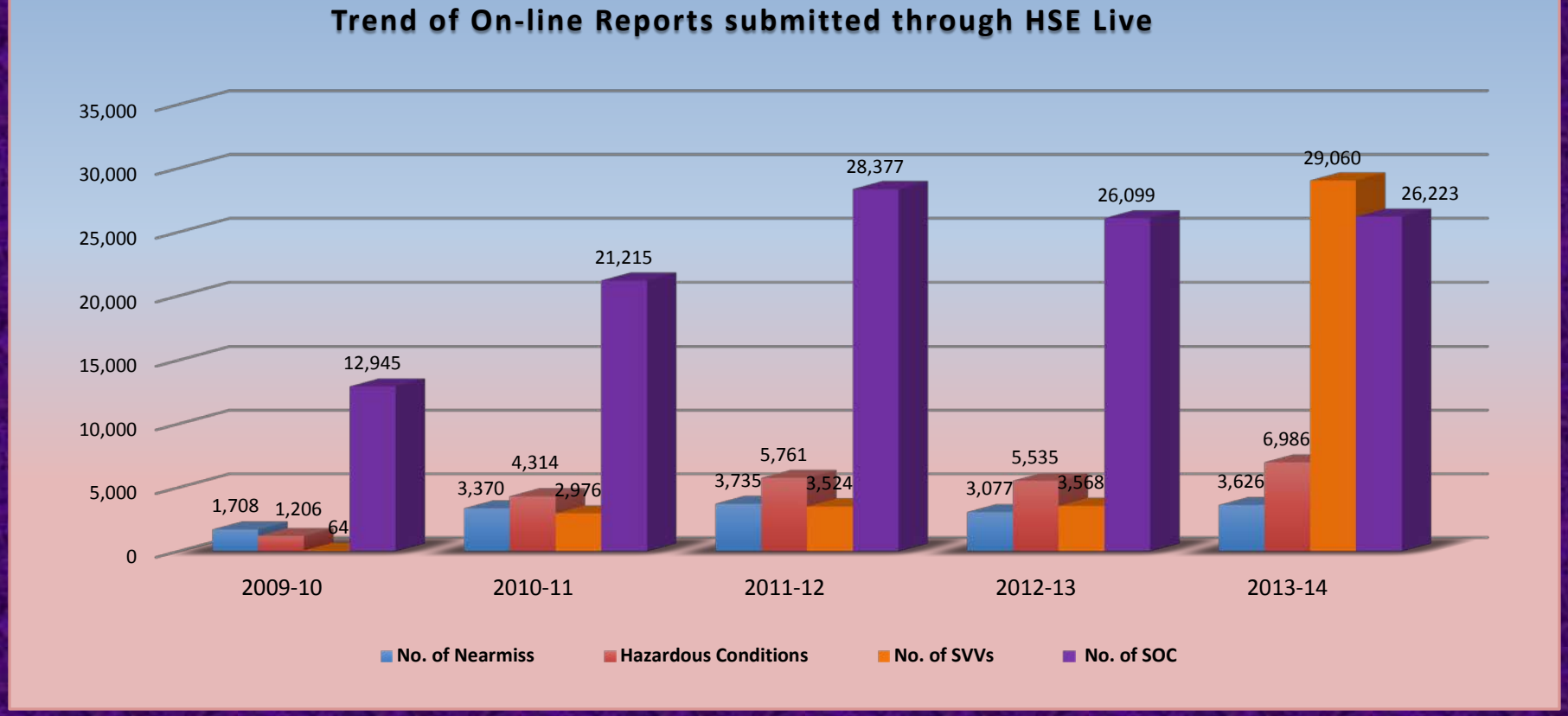

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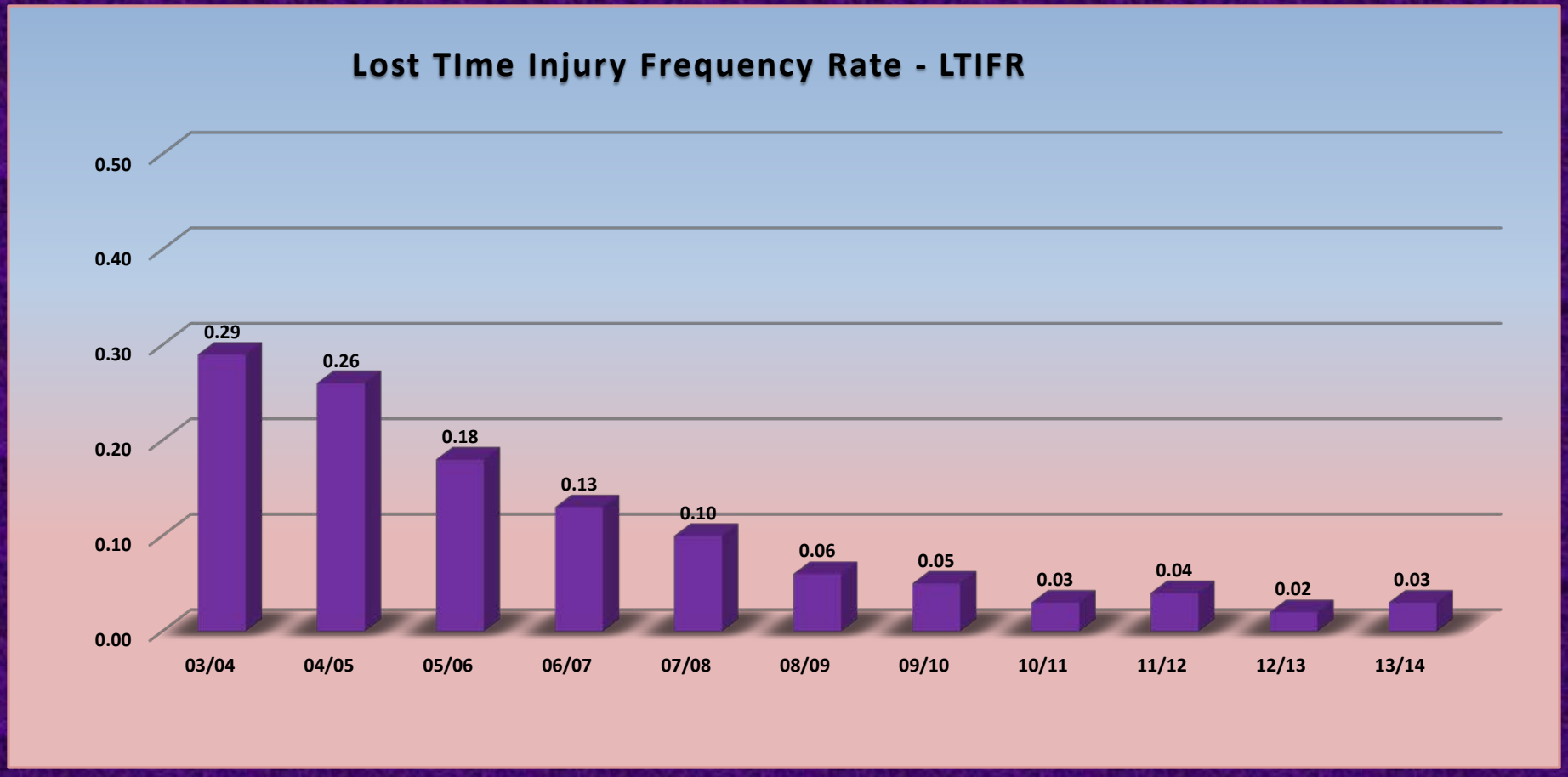

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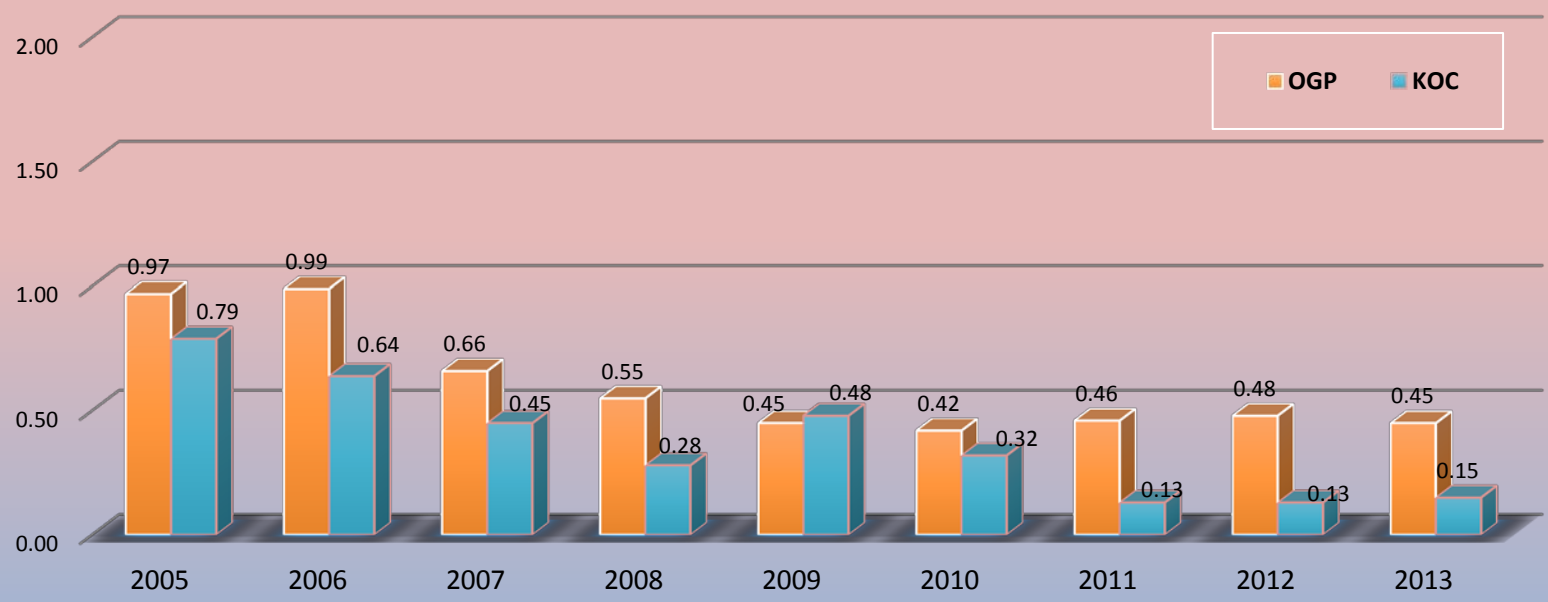
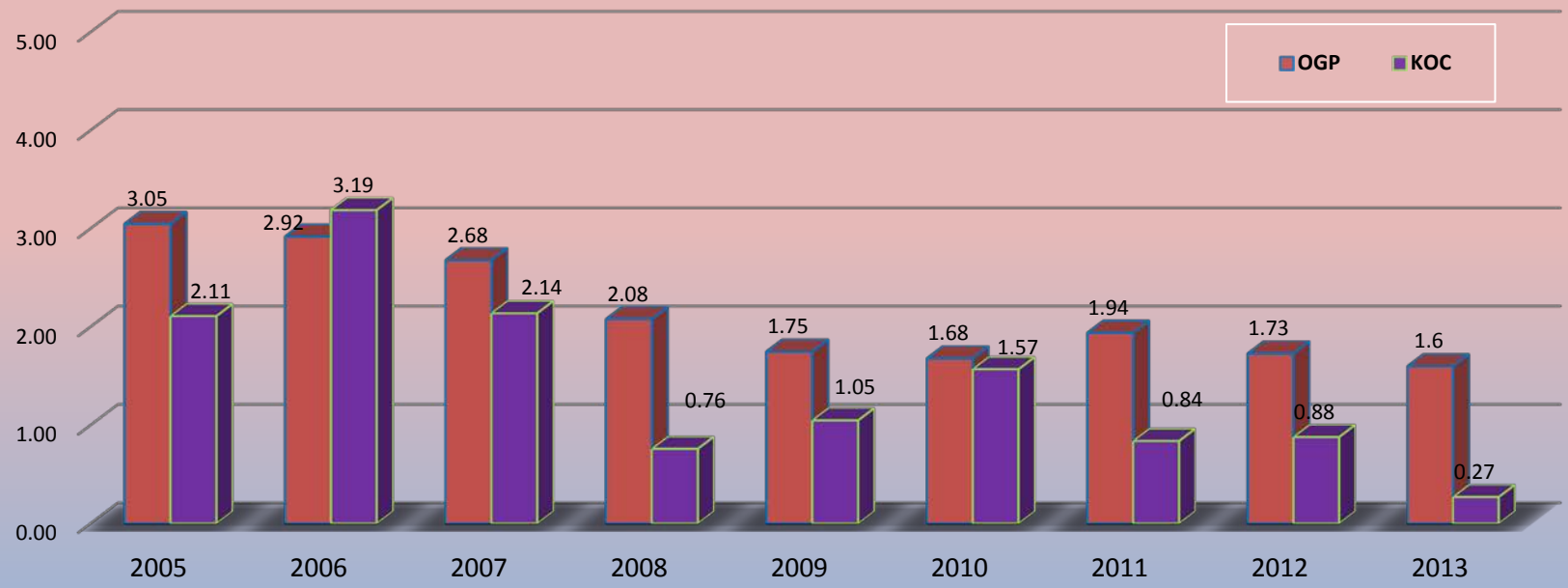
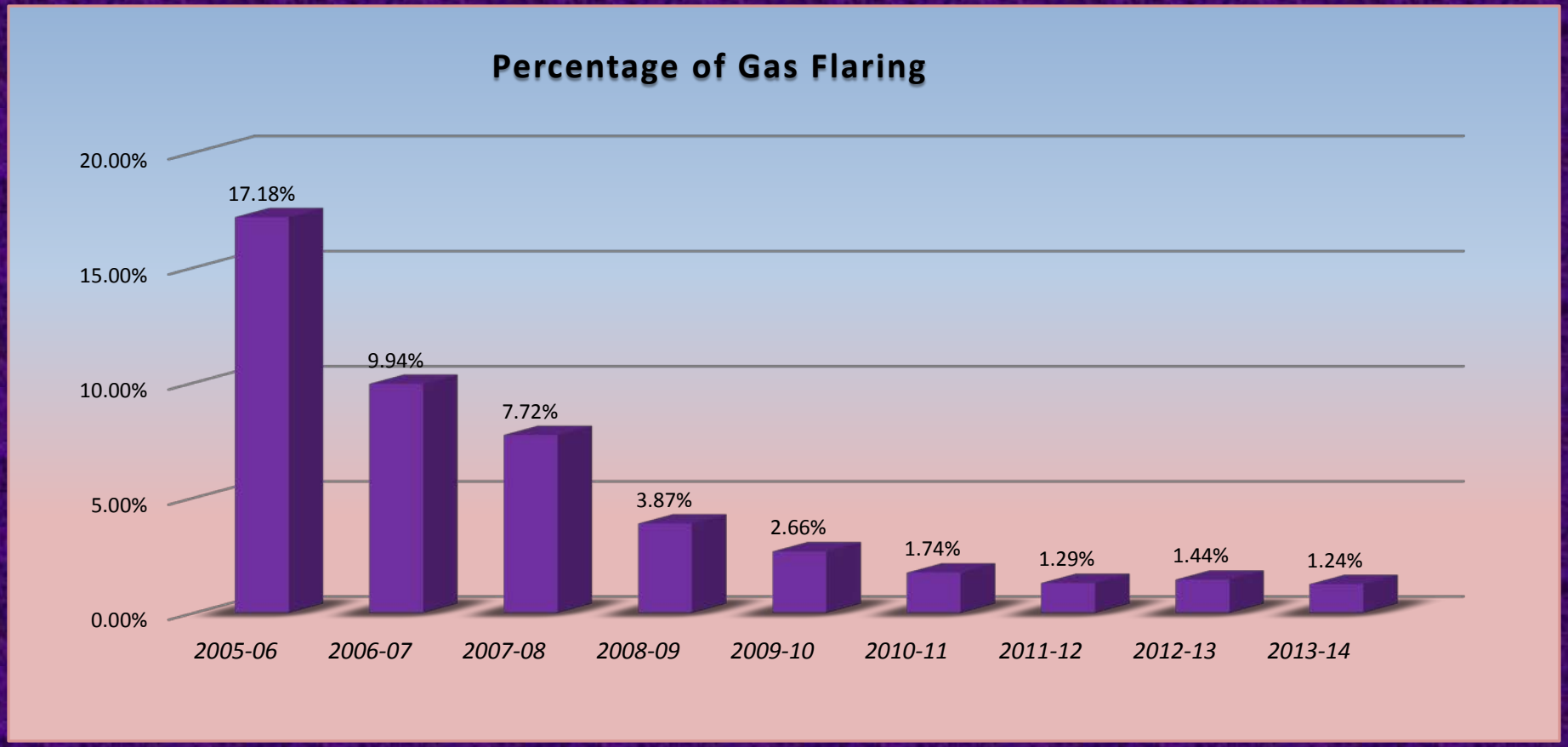
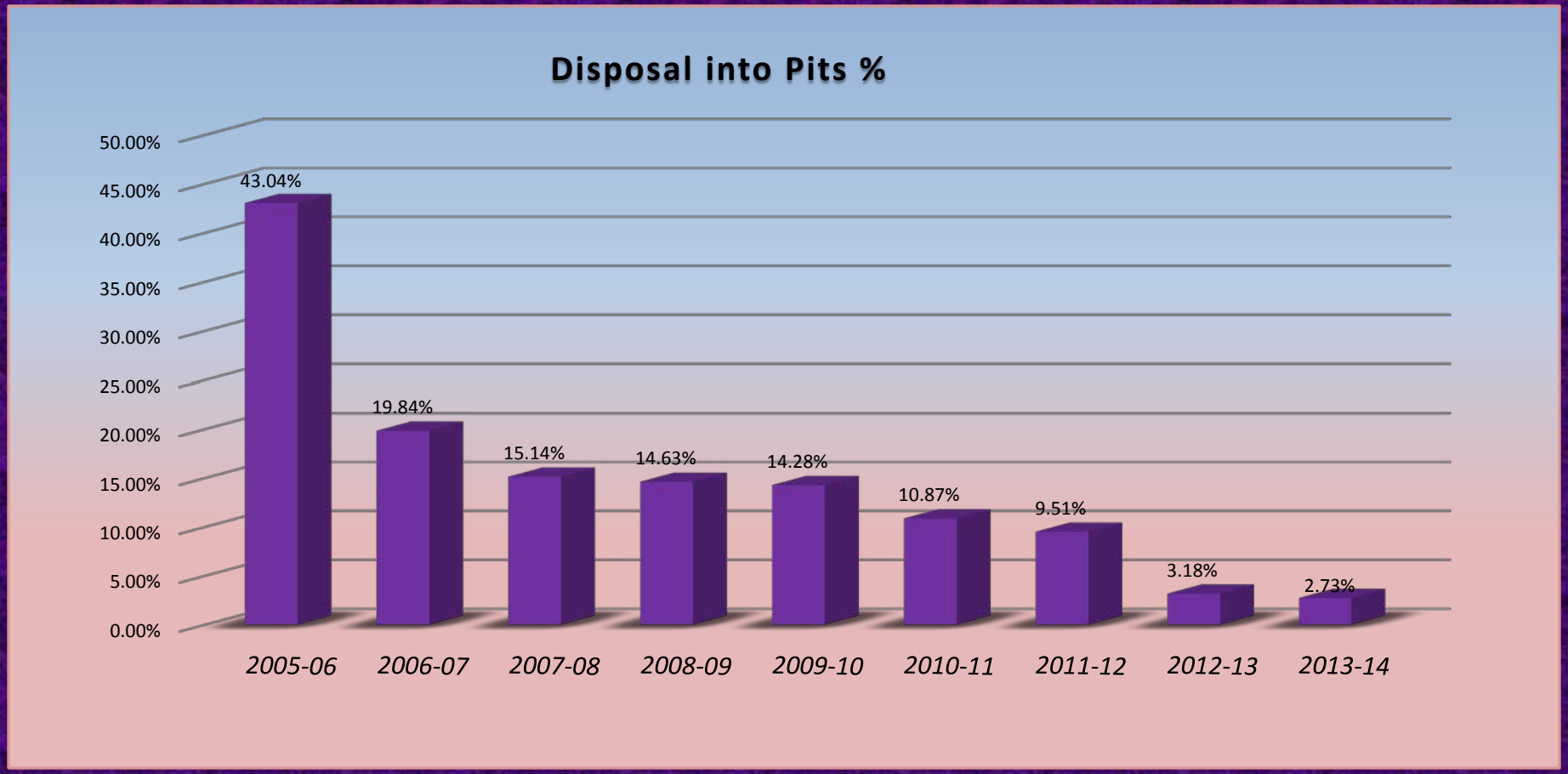


HSE Performance @ KOC

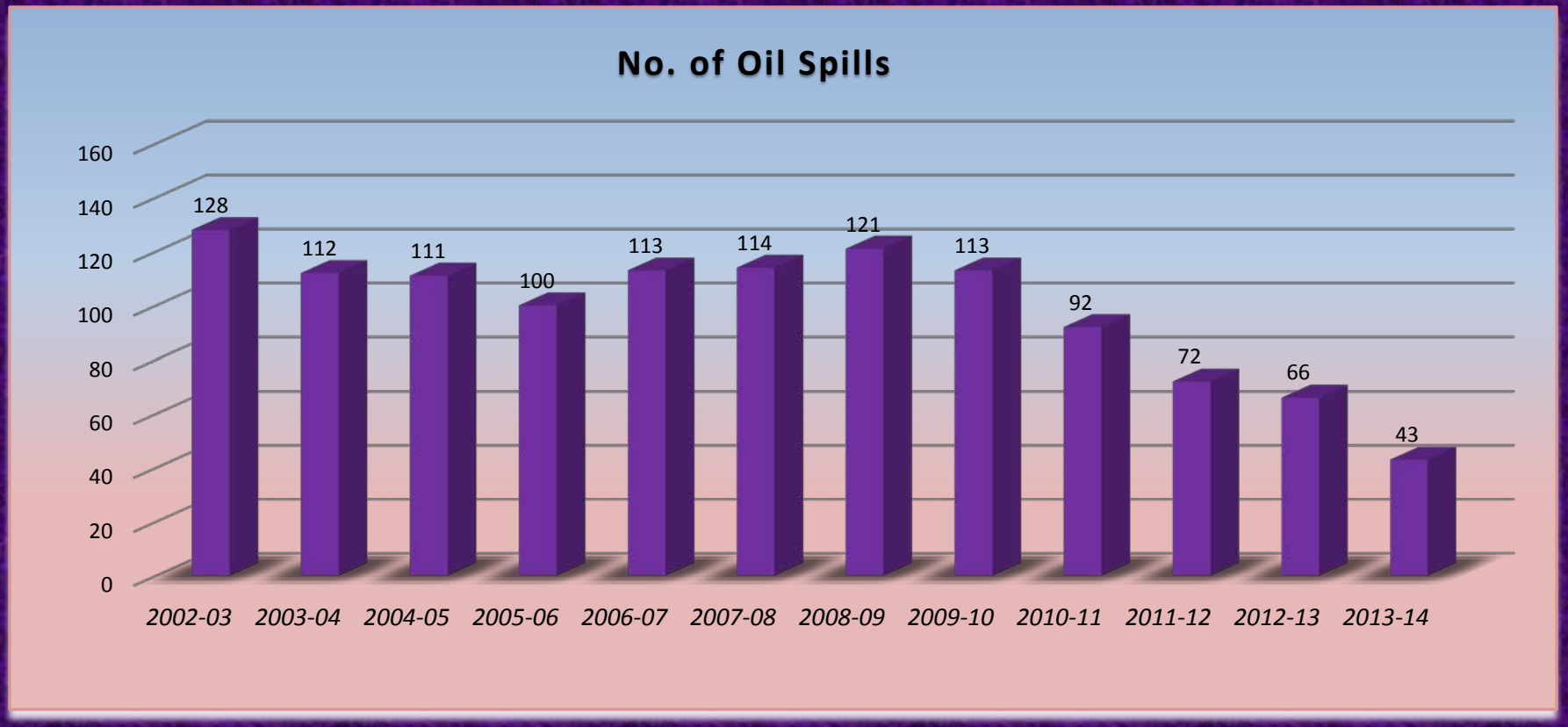



Percentage of Gas Flaring
20.00%
15.00%
10.00%
5.00%
0.00%
17.18%
9.94%
7.72%
3.87%
2.66%
1.74%
1.29%
1.44%
1.24%
2005-06
2006-07
2007-08
2008-09
2009-10
2010-11
2011-12
2012-13
2013-14

HSE Performance @ KOC



HSE Performance @ KOC



Recommendations?

- Always try to Benchmark your HSE Performance
- Make use of the expertise available. Be part of entities such as OGP, GCC, IADC…ETC. which is applicable to your company.
- You need not reinvent the wheel!
- Verify whether your measures are addressing the problems and enhancing the employees commitment to achieve?
- Evaluate your performance periodically
- Choose Right measures for your company Balanced Score Card
- Link each measure with some Tolerances/Targets.
- Set your targets/tolerances based on the Industry average values. If you want to improve further, you can have stringent targets/tolerances
- Have sufficient programs to achieve these targets/tolerances.



Thanks

With Best wishes from

HSE Group,
Kuwait Oil Company