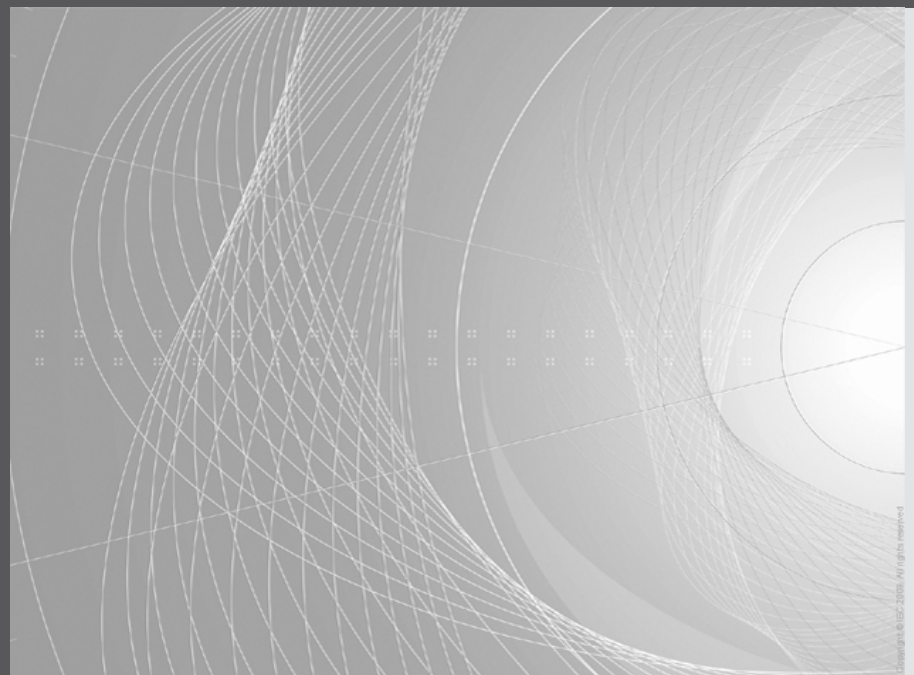
IEC SYSTEM FOR CERTIFICATION
TO STANDARDS RELATING TO EQUIPMENT
FOR USE IN EXPLOSIVE ATMOSPHERES

Electrical Safety in Oil & Gas Industries

Challenges & Solutions for Industrializing Countries



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Tel Aviv, Israel, 2009-10-20

Electrical Safety

as seen by a major oil & gas operator

The TOTAL E/P company viewpoint

Who is TOTAL ?

- A global oil & gas company
- 5th ranked international oil majors
- # 97000 employees in over 130 countries*
- Sales # 180 G€*
- Net income # 13.9 G€*
- Investments # 13.6 G€*
- 3 business segments:

  Upstream – Downstream – Chemicals

•Figures extracted from "TOTAL in 2008-Global report" www.total.com

Upstream

Exploration/Production (E/P)

- Production: 2.3 M bep/d*
- Proved reserves: 10.5 Gbep (12 y)*
- Proved & Probable reserves: 20 Gbep (20 y)*

Gas & Power

- LNG plants, power plants, cogeneration
- Renewable energy: wind power, solar, biomass…

•Figures extracted from "TOTAL in 2008-Global report" www.total.com

Downstream

Refining & Marketing

- 12 Refineries (in direct)*
- 13 Refineries (assets)*
- 16 500 service stations*
- refining capacity: 2.6 Mb/d*

Trading & Shipping

•Figures extracted from “TOTAL in 2008-Global report” www.total.com

Chemicals

- Petrochemicals
- Fertilizers
- Speciality chemicals
  - Rubber (Hutchinson)
  - Adhesive
  - Resin
  - Electroplating

Safety awareness

- Safety is a key issue in the O&G industry
- Handling of oil and gas products is a potentially dangerous business
- Every year fatal accidents are recorded in the world , a few of them being catastrophic
- O&G companies have funded an international association with the following mission:
  - Representing the Upstream industry to international regulatory bodies
  - Achieving continuous improvement in safety and health and environmental performances
  - Promoting awareness of Corporate Social Responsibility issues within the industry and among stakeholders.

This organisation is called:

International association of Oil & Gas Producers (OGP)

- IOCs (International oil companies):
  - Exxon/Mobil,Shell, BP, Chevron/Texaco, Total, etc.
- NOCs (National oil companies):
  - Saudi Aramco, Petrobras, QP, etc.
- OGP publishes various reports every year and in particular the "OGP Safety Performance indicators" giving the performances of the Upstream Industry
- The following slides are extracted from the 2008 Publication (2007 statistics) www.ogp.org.uk

FAR: Fatality Accident Rate

- 11 companies + 76 contractors reported in 2007
- FAR = 3.0 fatalities per 100 million workhours (24% improvement over last year)
- Increase in the deaths resulting from vehicle accidents
- Highest number of fatalities = 8 people (shipwreck)

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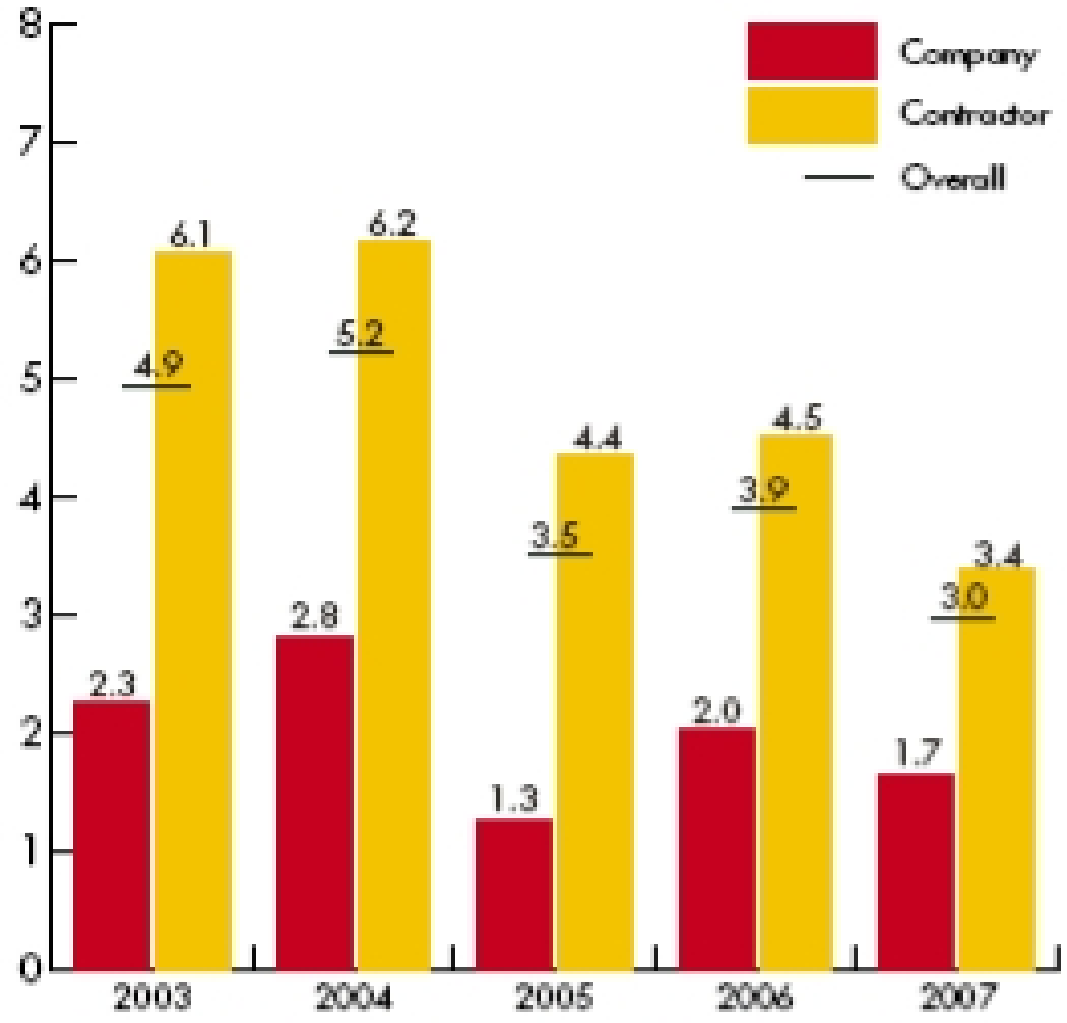
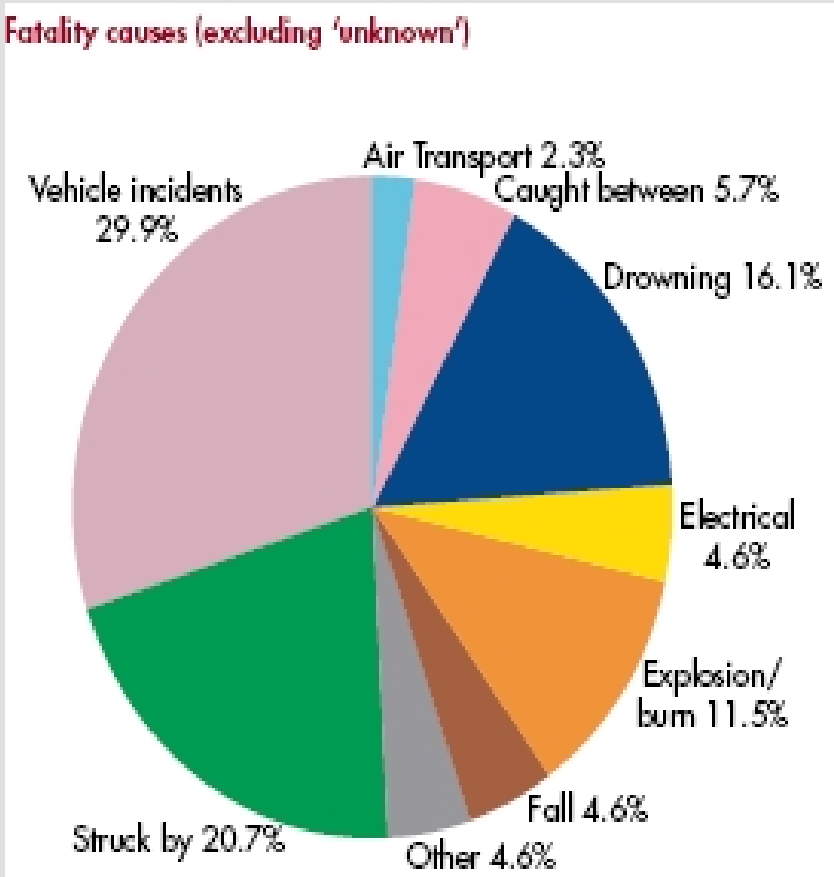


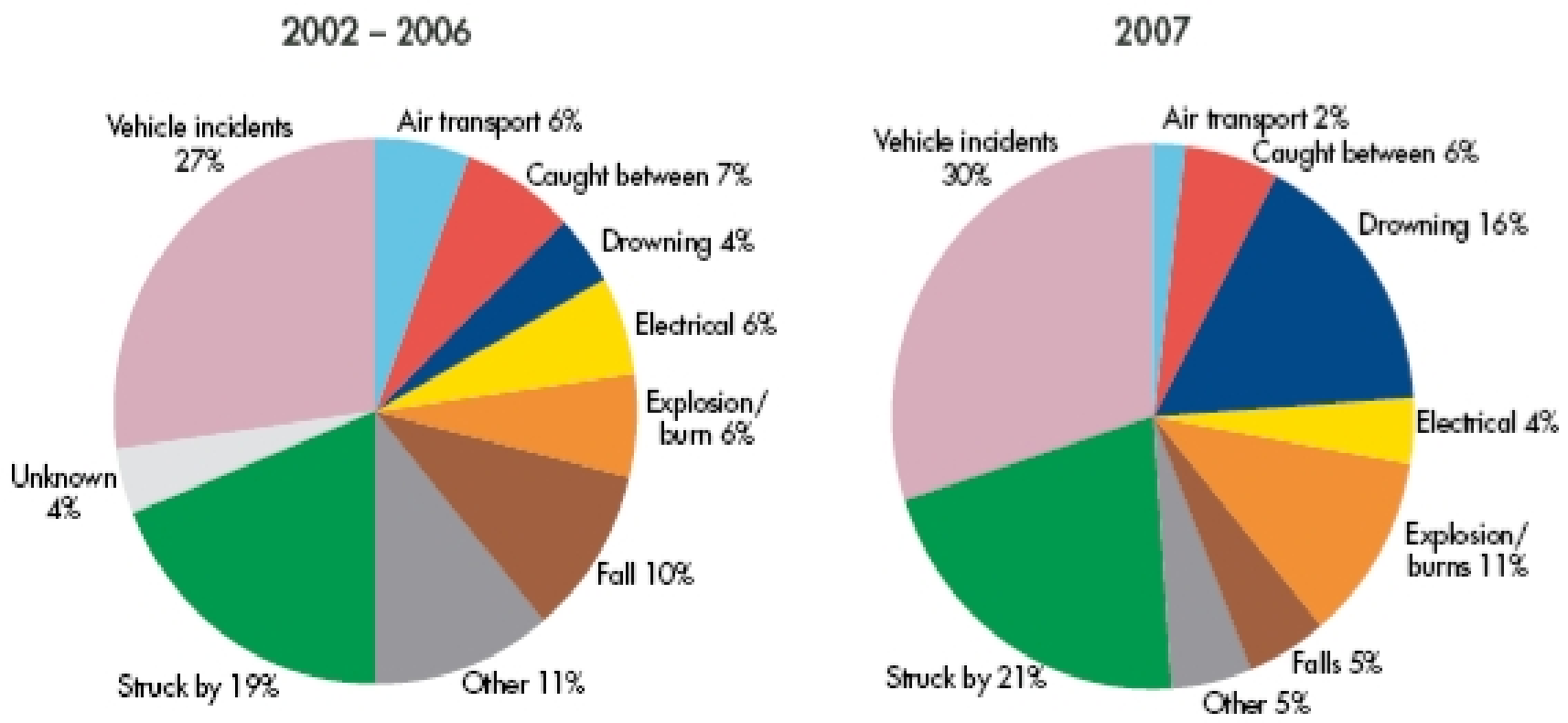


Fatality causes (excluding 'unknown')

FATALITY CAUSES

Fatality causes

% fatalities associated with each reporting category (excluding 'unknown')



The pie charts show the percentage of fatalities within each of the reporting categories for 2007 and for the 5 year period 2002-2006.

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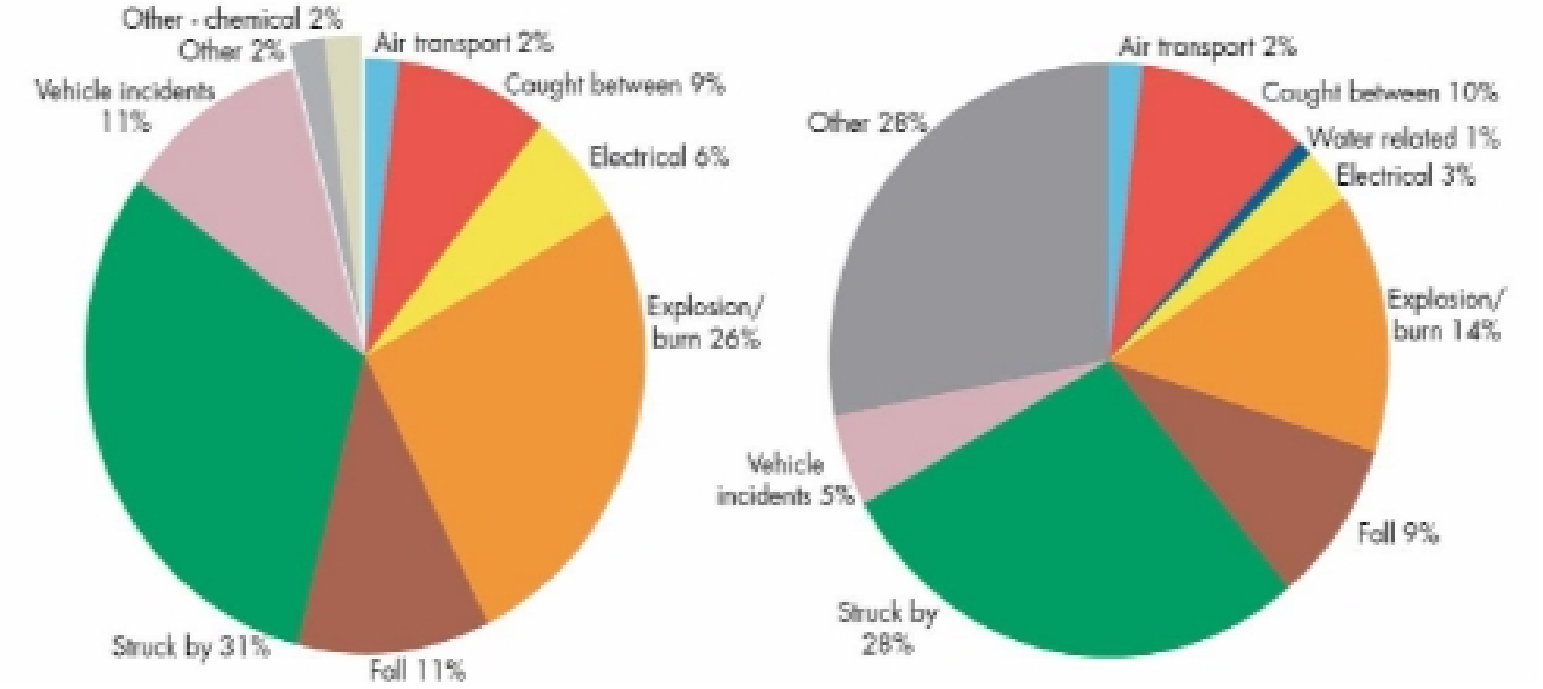
- In 2007, fatalities caused by **electrical reasons** have accounted for **4%** compared to a rate of **6%** in the 5 previous years
- and by **explosions/burns** for **11%** compared to a rate of **6%** in the 5 previous years.

FIR : Fatal Incident Rate

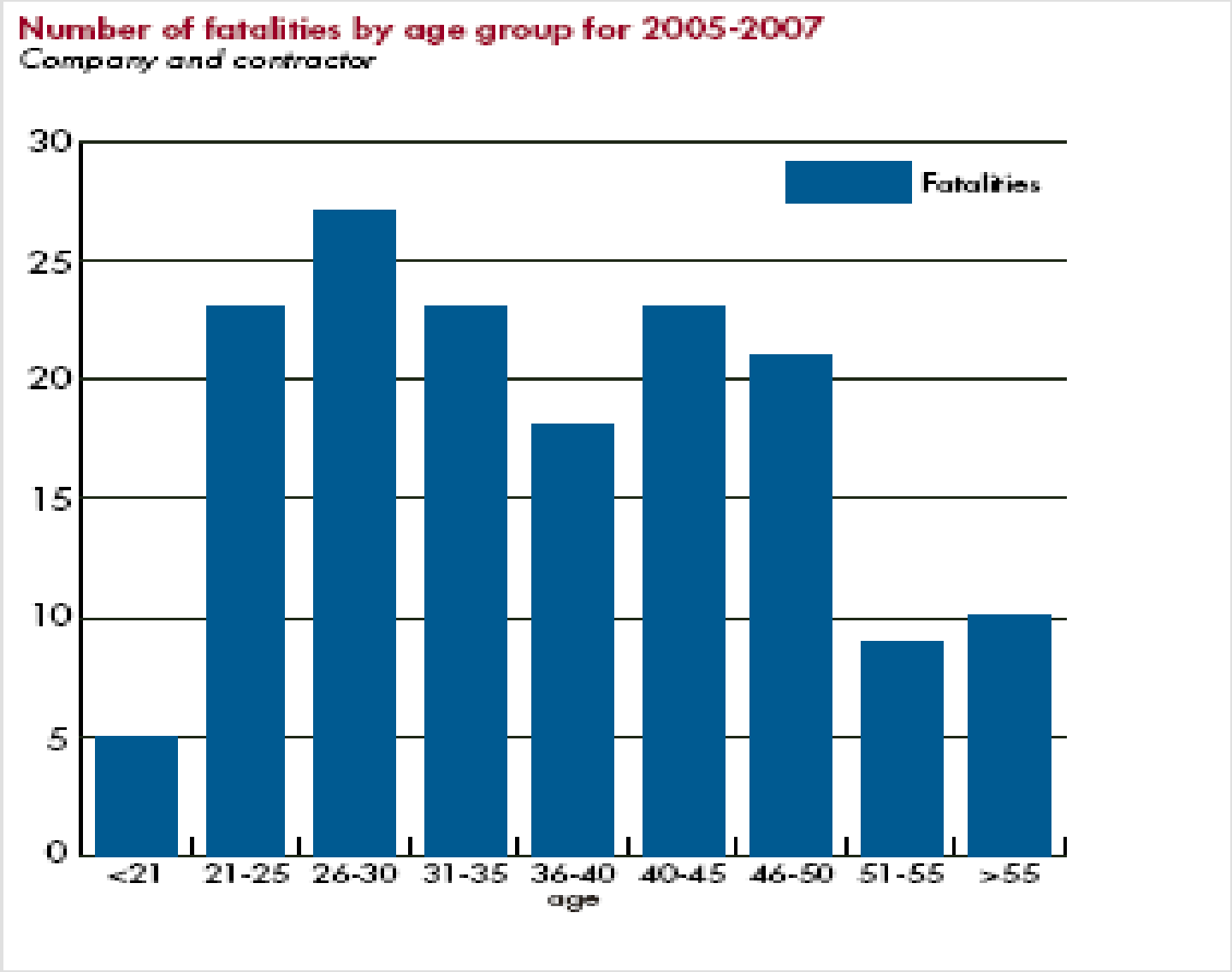
Significant incidents causes

Significant incidents by category



- Significant incident causes have been Electrical for 6% and 26% explosion/burns compare to an average rate of 3% and 14% on the previous 5 years.
- Electrical + explosion/burns have accounted for 32% of 2006 compare to 17% previously.

Demography


Number of fatalities by age group for 2005-2007
Company and contractor
30
25
20
15
10
5
0
Fatalities
<21
21-25
26-30
31-35
36-40
40-45
46-50
51-55
>55
age

Conclusion & comments on 2007 OGP data

- 38 of 65 OGP member companies operating in 93 countries have responded to this survey
- Largest data base used in the analysis of the industry's safety performance
- Figures show that although electrical accidents/incidents are not the most critical ones, explosions which may be linked to an ignition source (including electrical source) which is not mastered have still a high accident rate
- Vehicle incidents and individuals being struck by falling or moving objects remain the 2 most significant causes of fatalities reported by the OGP… **Human behaviour !!**

Challenges for an oil company

- Design, build and operate safely numerous type of facilities throughout the world (desert, arctic areas, jungle, offshore)
- Obtain the highest availability of the electrical system to minimise costly shutdown
- Keep the electrical system in good state during all the duration of the exploitation (20- 30- 40…. years) for reliability and safety reasons
- Face with equipment ageing and obsolescence
- Adapt permanently the facilities to the new oil field needs, by expansion, modification, revamping of existing facilities, without stopping production (works with live plant !)

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- Large increase in power requirements in the last decades (from a few MW 30 years ago to more than 100 MW today and soon 1000 MW with “all electric LNG plants”
- Growing complexity of the management of large projects with numerous international stakeholders (several oil companies, engineering, contractors & sub-contractors) involved in the same project at the same time…coordination issues
- Quality of construction works becomes more and more questionable (!) requiring more supervision from the client/operator side as safety may be jeopardized

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- New types of facilities to be mastered:
  - extra heavy oil (eg Venezuela)
  - tar sand (eg Canada)
  - deep offshore with FPSO in water depth =1500 m and above (eg West Africa)
  - subsea development
  - arctic projects (eg Russia)
- Respond to the recent governmental requirements from industrializing countries to ensure a certain percentage of the plant construction be made in the country itself (Local content)
- Ensure an appropriate training of electrical teams (at head office and on sites) especially in the Ex domain

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- To be kept posted of the growing worldwide legislation and standardization and integrate the corresponding inputs in the Corporate specifications
- Manage international teams having different approaches, views, practices, experience…
- Ensure a common “philosophy” is shared by all the electrical engineers and technicians
- Integrate the requirements of the global warming issues in the design of the electrical system (energy efficiency, renewable energies)
- Favour the movement of engineers/technicians between the various sites in the world to foster exchanges among people having different practices and perspectives for the mutual benefit of everyone (transportability)

Solutions

- Experience has shown that quality of electrical facilities is “played” at the design stage (pre-project & basic engineering phases)
- During the design stage, technical requirements are expressed using the particular company specifications prepared for the specific project, based on corporate specifications made mandatory
- Corporate specifications include the company know-how based on experience during many years and constantly updated to incorporate technological progress, standardization and legislation evolution, feedback…)

Standards and regulations impact

- Country regulations must be met in all the cases requiring the knowledge of many different laws (European, American, Russian, Chinese…)
- Electrical equipment and installations are technically defined on the basis of STANDARDS (terms of reference)
- Use of STANDARDS is a must to make sure to get an "expected" quality, to allow comparisons between equipment coming from different manufacturer nationalities
- Selection of the STANDARDS to be used is of the utmost importance

Total has based his choice (30 y ago in the E/P activities)by selecting **IEC standards**, and also CENELEC standards…**WHY ?**

- Need to use international recognized standards due to company involvement in many countries.
- Assume that IEC Standards result from a large international consensus reducing possible trends to favour a dedicated country industry.
- Open the competition by getting offers from many manufacturers in the world, based on the same technical definition, making commercial comparisons easier !
- Intrinsic quality of IEC standards has been recognised with years

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- Preference to have only 1 single set of Standards, used through the world by everybody.
- Selection of IEC standards has never been questioned over the years: **confidence has increased over the years**
- Use of CENELEC standards (only in the Ex domain) as in the past is more and more limited due to the “copy/paste” system between CENELEC & IEC - Dresden agreement.
- It is expected that in a near future CENELEC standards will be identical to IEC standards.
- In the Ex domain, the IECEx System has reinforced the target of TOTAL to have only one single system applicable throughout the world.

- This is the reason why TOTAL supports IECEx activities
- In the Ex domain, an “harmonization” between the ATEX system and the IECEx System is expected in a near future, in order to have a single system to be applied worldwide…

CONCLUSION

- IEC standards have brought a considerable simplification in the design, manufacture and installation of electrical equipment
- IEC standards have also brought a certain degree of "confidence" in the resulting performance
- Aim of IEC standards is to improve efficiency of production, make electrical installations safer and facilitate international trade
- A global company, like Total, can only adhere to this aim

IEC standards are of mandatory application in all the TOTAL projects (a few exceptions for local reasons)

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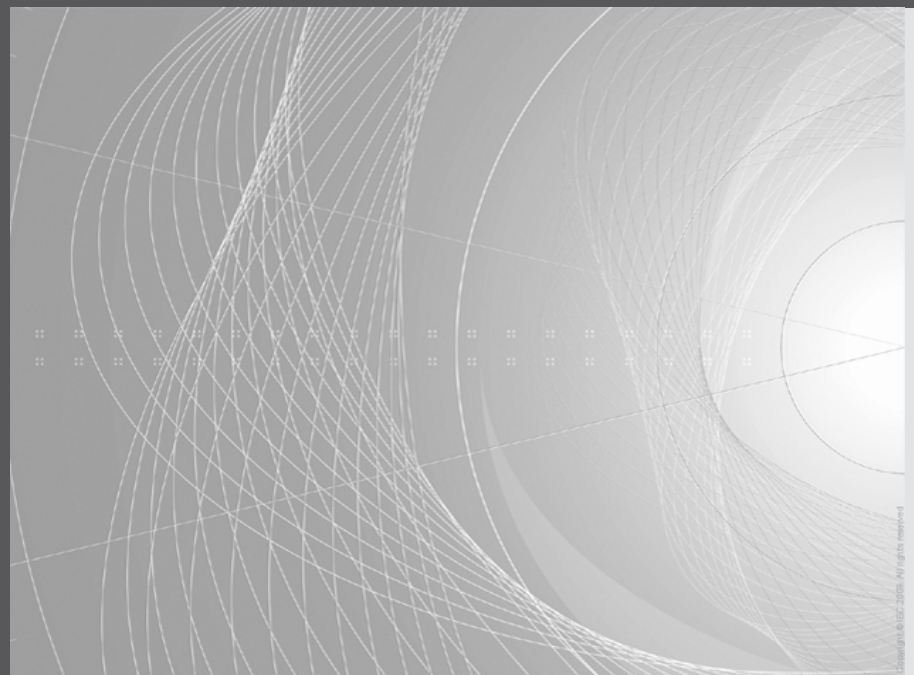

Thank you for your attention!