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](http://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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Fatal accident rate per 100 million hours worked

Fatality causes (excluding ‘unknown’)

- Vehicle incidents: 29.9%
- Drowning: 16.1%
- Air transport: 2.3%
- Caught between: 5.7%
- Explosion/burn: 11.5%
- Electrical: 4.6%
- Struck by: 20.7%
- Fall: 4.6%
- Other: 4.6%
The pie charts show the percentage of fatalities within each of the reporting categories for 2007 and for the 5 year period 2002-2006.
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

![Graph showing Fatal Incident Rate (FIR) for company and contractors per 100 million hours worked from 1998 to 2007.](image)
Significant incident causes have been Electrical for 6% and 26% explosion/burns compared to an average rate of 3% and 14% on the previous 5 years.

Electrical + explosion/burns have accounted for 32% of 2006 compared to 17% previously.
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 !)
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
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
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
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 IECEEx 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).
IEC SYSTEM FOR CERTIFICATION TO STANDARDS RELATING TO EQUIPMENT FOR USE IN EXPLOSIVE ATMOSPHERES

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Thank you for your attention!