

What to do to be ExSafer

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IEC and ExSafety

What is IEC?

The International Electrotechnical Commission (IEC) is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

The **International Electrotechnical Commission** is the international standards and conformity assessment body for all fields of electrotechnology

Relations between IEC and ExSafety?

Looking at the list of TC it is seen that among more than 100TC only two relates to ExSafety : TC 89 Fire Hazard Testing and TC101 – Electrostatics

IECEx branch what is it?

The objective of the IECEx System is to facilitate international trade in equipment and services for use in explosive atmospheres, while maintaining the required level of safety:

reduced testing and certification costs to manufacturer

reduced time to market

international confidence in the product assessment process

on international database listing

maintaining International Confidence in equipment and services covered by IECEx Certification

But certification is almost the last but not final stage of Ex Safety efforts

Ex areas can be known by different names such as "Hazardous Locations", "Hazardous Areas" "Explosive Atmospheres", and the like and relate to areas where flammable liquids, vapors, gases or combustible dusts are likely to occur in quantities sufficient to cause a fire or explosion.

The modern day automation of industry has meant an increased need to use equipment in Ex areas. Such equipment is termed "Ex equipment"

Electricity in industry – safety aspect

Electricity is a main (if not only) source of energy in manufacturing. Before the industrial revolution electricity was known as lightning – still one of the ignition sources . Below – lightning beyond manufacturing



Lightning strikes the United States about 25 million times a year. Although most lightning occurs in the summer, people can be struck at any time of year. Lightning kills an <u>average of 51</u> <u>people</u> in the United States each year, and hundreds more are severely injured

Advantages of electrical energy

Easy transmission to any place

- Elasticity of use large range of power up to GW
- Relatively low cost with high efficiency
- Diversity of use forms from storage in batteries to driving of powerfull motors
- Easy transmission for long distances
- Electronics

Nobody has enough imagination to imagine the world without electricity (perhaps the terrorists have, but not for a long time)

Disadvantages of electricity

- Complicated, multicomponent devices, instruments, facilities requiring certification
- Need of well trained staff : workers . technicians, engineers, scientists
- Need of simple but efficient regulations of construction and maintenance, standards included
- Need of continuos surveying
- As a result :possible and likely ignition source of gases , vapor and dust in industrial facilities (sparks, arcs, heating)

Possible ignition sources (EN1127-1)

-Hot surfaces

-Flames and hot gases

-Mechanically generated sparks

-Electrical apparatus

-Stray electric currents

-Static electricity

-Lightning

-radio frequency (RF) electromagnetic waves

from 10⁴ to 3x10¹¹Hz

-Electromagnetic waves from 3x10¹¹ to 3x10¹⁵Hz

- Ionizing radiation

- Ultrasonics

Electricity in underground mining

The industry which was faced first the problem of explosion and use of electricity in continouos presence of flammable gas and dust was underground coal mining.

The use of electrically driven machines is reported first in "Science" in October 1889 in the US. It was a shaft hauling machine made by Thomson – Houston Company.

In 19th century and beginning of 20th the number of disasters- methane and coal - dust was high . Impressive example was Courrieres disaster , 1906 with 1099 fatalities. It was not electricity in this mine but management had understood that it is necessary to introduce in spite of dangerous conditions.



Courrieres disaster – March 20, 1906, beginning of serious approach to ExSafety and use of electricity in underground. First research stations created in the US, France , UK, Germany

We are not safe- explosion threat is real



Deep Water Horizon 11 fatalities ; BP losses- \$37b

Transportation Disaster - Lac Megantic (Canada) 7.07.2013



Derailing of the unmaned train with 72 carrieges of crude , hauled by 5 locomotives. Derailing took place near the small town Lac Megantic (Quebec). Explosion results - 72 fatalities , leveling of 42 buildings



Kaoshiung , Taiwan , 1.08.2014 , 25 fatalities, 267 injured , destroyed city center – cause – gas release



One of the consequences of Courrieres disaster was creation of Research Stations (often named Experimental Mines) loaded with tasks of recognizing the mine explosions and finding and implementation of measures for their mitigation. It happened just before WW I in France, Germany, Great Britain(UK), Belgium and the US.

After WWII one of the main tasks was certification of electrical equipment for underground mines. After WW I further Research Stations were organized in other coal producing countries - Poland (Experimental Mine "Barbara") included. In the begining of sixties first publications on industrial explosions had appeared (Safety in Mines Research Establishment in UK). With declining of mining industry research Station worked more and more for other industries (certification)

Experimental Mine in Pittsburgh (Pa) – 1910



What to do to be ExSafer- current state in Europe

Historical changes in Europe came with foundation of European Coal and Steel Community (1950) – which initiated its transformation into European Union. It highly influenced the ExSafety problem by introduction and implementation of the two ATEX Directives ATEX95 (for manufacturers) and ATEX 137 (for users) and Seveso Directive (Major Accidents Hazard). The another positive change is obligatory Risk Assessment (fire and explosion included)

What to do to be ExSafer- in the near future

Main directions :

- Education, training
- Inspection, surveying
- Knowledge exchange
- Research

What to do to be ExSafer in the near future-Education

Two stages are important : basic – education of beginners (graduates) and postgraduates – short courses on the newest problems Proposed idea : European text book with elementary knowledge about combustion and physics of explosion, international regulations ,principles of inspection ,Directives, case studies etc.

What to do to be ExSafer- in the near future Inspection

Hot subject because of costs for enterprises Idea- unified European technical inspection principles in the field of

ExSafety – with clear rules . The idea of Central European Technical Inspection Office is useless

What to do to be ExSafer- in the near future Knowledge exchange

International Conferences and Symposia :

International Symposium of Hazard , Prevention and Mitigation of Industrial Explosions , every two years , last events in Yokohama (2010) , Kraków (2012) and Bergen (2014), next : Dalian , 2016(China) Global Congress on Process Safety (11th in Houston , 26-30 April,2015) Annual Loss Prevention Symposium (it was 49)

International Journals: Journal of Loss Prevention in the Process Industry (JLP)

Journal of Hazardous Material (HazMat _)

What to do to be ExSafer- in the near future Research(1)

New Challenges : nanoparticles –explosibility , safety rules New fuels – for example DME (Dimethylether)



Tanker lorry for DME transportation beside Kushiro demonstration plant

What to do to be ExSafer- in the near future Research(2)

It would be very useful to built European Large Scale Explosion Test Center (ELSET Center) for large scale fire and explosions investigate transportation accidents, test new devices. It requires of selection of pre-project leader and IECEx is just one IECEx is natural (or should be) the leader in industrial explosion safety being the only stable organization with ability to considerably improve **EXSafety**