A proposal for an inFIRE networking activity aiming at consolidating fire and explosion accidents databases

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Outline of the presentation

- Introduction : Accidents recording and analysis
- Information source available to INERIS library and researchers
- A focus on some recent INERIS initiatives regarding accidents analysis & data mining
- Our proposal for a collaborative action in the field
- Concluding comments

Introduction

Accident recording and analysis: general issues

Accidents are the tribute paid by mankind to progress on safety -including fire safety- issues

- They still occurr today, although significant progress has been achieved in many industrial sectors and built environments

The in-depth analysis of major accidents must be done for a variety of reasons :

- Societal, technical, economical…
- Major accidents often preceed improvements in regulations

However, tracking and reporting on pertinent information on accidents is not an easy task:

- concerned people feel reluctant to do so
- rarely done on a voluntary basis
- information from the media very transient

Accident recording and analysis: general issues

In Addition, all significant incidents have intrinsic value and deserve at least recording and regular review and analysis :

- Statistics rely on large numbers…
- Lessons may be learnt from « happy ends » events and near-misses

Learning from accidents and incidents of all sorts also allow to optimise (fire) intervention and improve fire-figthers security

Information sources available to the INERIS library and researchers in the field of industrial safety

Information sources available to the INERIS library and researchers in the field of industrial safety

two fold:

- a) **the INERIS library**, called CIVS
  - French acronym for « management des Connaissances, Information scientifique et technique, Veille Stratégique »
  - means « knowledge management, scientific and technical information, strategic watch »
- b) **networking activity** developed by experts at different levels (local, national, European and international)

naturally, also serve as source for information in other topics within INERIS' scope

a) INERIS library, as an information source:

- about 30,000 books and reports

examples : recent purchases

Lee's Loss Prevention in the Process Industries : Hazard Identification, Assessment and Control. Sam MANNAN. Elsevier, 3e Ed., 2005.

The Handbook of Tunnel Fire Safety. Alan BEARD ALAN & Richard CARVEL. Thomas Telford. 2005

- subscriptions to national and international scientific journals :
  - about 300 titles

    in paper format

example :Accident records bulletins

(such as: Lloydd's Casualty Week)

  - about 3050 titles

    accessible electronically

examples : Fire Safety Journal, Fire and Materials, …

a) INERIS library, as an information source:

- watch bulletin :

example : Bulletin de Veille (previously "Bib Info") of ANPI (an inFIRE member)

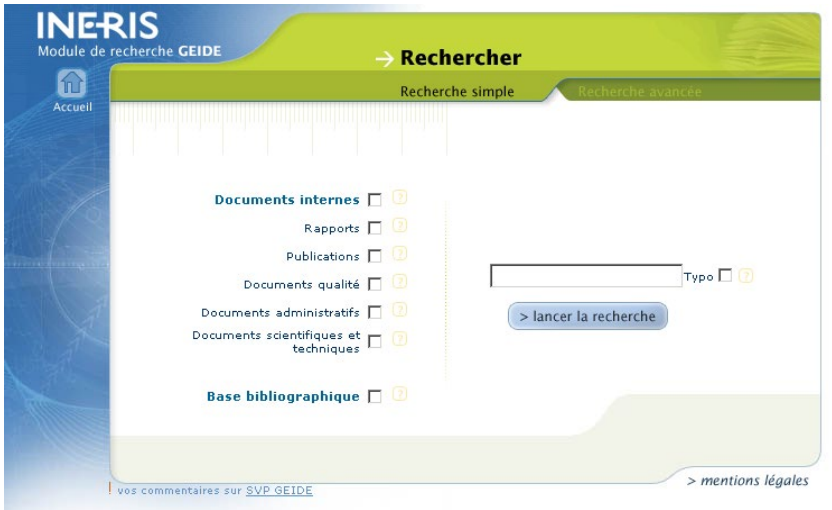
- standards :
  - NF, EN, ISO, IEC, other foreign standards…
  - electronic access to www.ili.co.uk for standards tracking
- databases search at INERIS from :
  - specific databases existing on accidents :
    - *examples : BARPI, Mars…*
  - databases accessible from external servers:
    - servers such as STN, Dialog, Questel, EINS

    thematic databases : *example : MHIDAS…*

a) INERIS library, as an information source:

- The ‘GEIDE’ tool (EDMS) :

=> To manage and share knowledge inside the institute :
by access the reports and papers made previously at INERIS



- Purchasing/loaning documents through contacts with libraries from other institutes

Examples : French university libraries, the British Library, INIST, ANPI…

⇒ **many resources**

b) From networking activity of INERIS experts :

Involvement in research projects or in technical and / or scientific collaborations

- *examples : in the domain of tunnel safety:*
  - *FIT (Fire In Tunnel), 2001-2005*
  - *UPTUN (Cost-effective, sustainable and innovative Upgrading methods for fire safety in existing TUNnels), 2002-2005*

Membership in professional associations and learned societies

- *examples : in domain of fire safety: Guy MARLAIR representing INERIS in*
  - *NFPA (National Fire Protection Association)*
  - *IAFSS (International Association for Fire Safety Science)*

From networking activity of INERIS experts :

Attendance to congresses or symposiums

- *examples :*
  - *in the domain of tunnels : 2nd International Symposium on Tunnel Safety & Security (Madrid, 17-17/03/2006) : MM. Marlair , Waymel, Ruffin*
  - *in the domain of energetic materials : IGUS EOS and EPP technical annual meetings (see www.oecdigus.org) : MM Michot, Kordek, Branka, Marlair*

Participation in standardisation and regulation working groups

- *examples :*
  - *work of Marie-Astrid KORDEK in the field of classification of hazardous materials*

⇒Exchange with other experts

Recent activity developed by INERIS in three domains raising significant (fire) safety issues

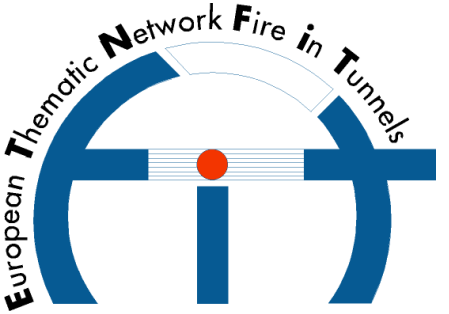
Domains selected:

- Tunnels
- Ammonium Nitrate-based fertilizers
- Automotive biofuels

1) Tunnels safety

- Tremendously increased interest as the aftermath of a series of real disasters starting by the Mont-Blanc disasters (March 1999)
- INERIS involvement in the area (non exhaustive):
  - Developed from early expertise in mine safety
  - safety studies of the Channel tunnel since the early stages, including full-scale testing validation of safety principles in the Shuttle wagons for the transportation of passengers (1988-1991)
  - stakeholder of early fire safety research area:
    - member of the Eureka 499 Firetun project consortium (1990-1992):
      - large-scale testing on hazards pertaining from burning vehicles (trains, cars, trucks) in tunnels
    - lead contributor to 'post Mont-Blanc' EU research programs like FIT (fires in tunnels), UPTUN, L-SURF
  - lead contributor to the analysis of the Mont-Blanc (1999) and the Daegu (2004) fire disaster
- Significant contribution to dissemination of results in the open literature

FIT = Fire In Tunnels



- European Thematic Network that dealt with Fire in Tunnels (2001-2005)
  - Grouping 33 members from 12 European Countries
  - see web site www.etnfit.net

- Provided -with sponsorship of the EU- a European platform for dissemination of up-to-date and consolidated knowledge in the form of databases and reports in the field of tunnel fire safety
  - no more activity today, as program completed...

INERIS contribution to FIT

Comprised (among other actions) the development of a database on tunnel fire accidents (database #5)

- a) expanded version
  - with full data reporting
- b) simplified version
  - with less than 10 fields by entry

Tunnel fire in Toulon (France, 2001)

Source : Internet

The Daegu metro fire (Korea, 2003)

After Marlair et al papers (Daegu, 2004 & Madrid, 2006)

Accidents Database in FIT (access from web site)

Index

Consultable Databases		Last updates	
Database n°1	RTD projects description on fire safety in tunnels	New entries during the last month:	0 entries
Database n°2	Specialised test sites for the study of fire in tunnels	New entries during the last month:	0 entries
Database n°3	Numericial Models for tunnel fires	New entries during the last month:	0 entries
Database n°4	Safety equipment in tunnels	New entries during the last month:	0 entries
Database n°5	Assessment reports on fire accidents in tunnels	New entries during the last month:	0 entries
Database n°6	Upgrade activities on tunnels	New entries during the last month:	0 entries
Database n°7	Corresponding Members	New entries during the last month:	24 entries

Notes

Icon Info

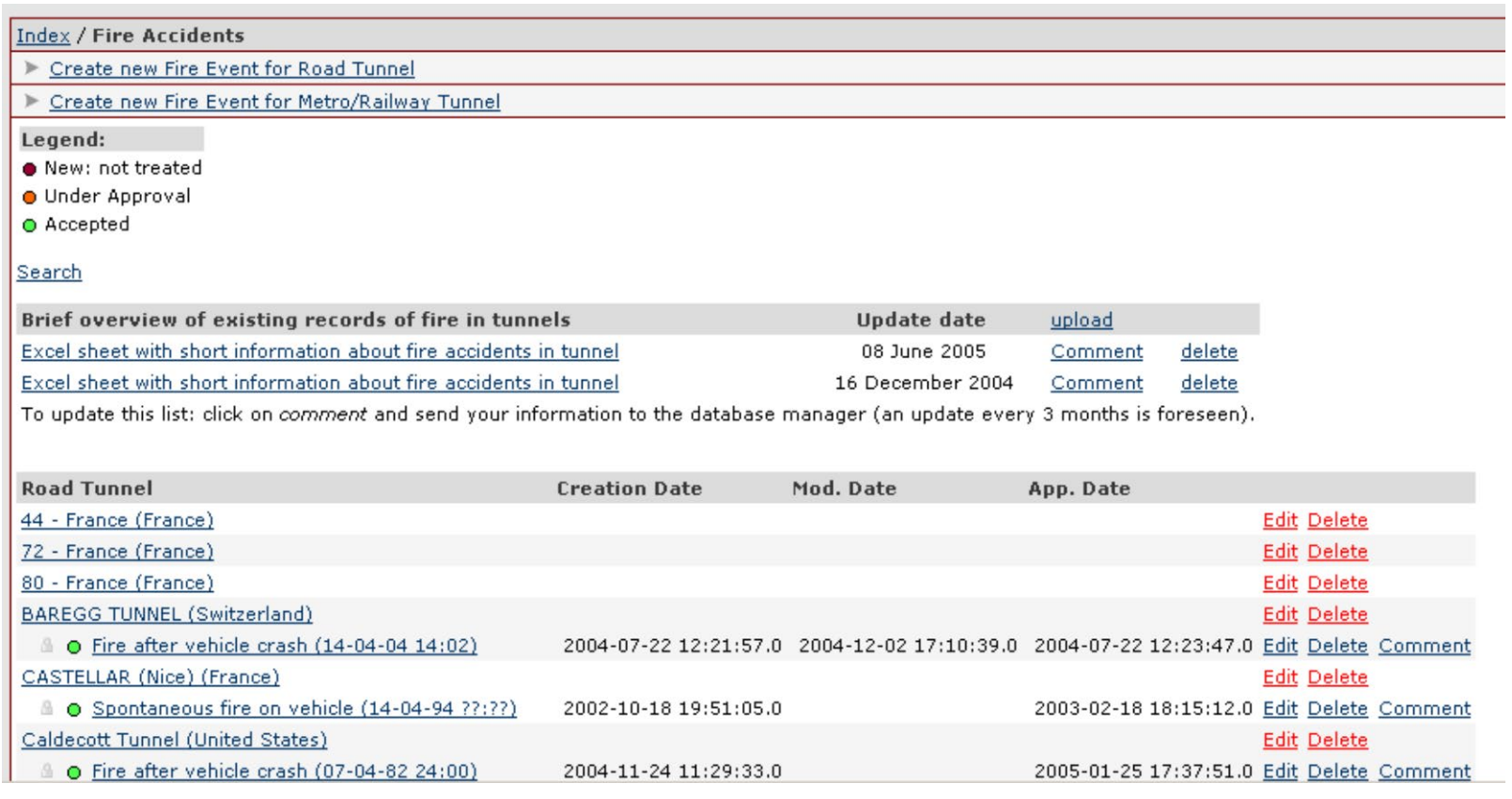
An error occured during the action

Action succesfully taken

LOGOUT

Accidents Database

- View of the expanded version with well documented records



Index / Fire Accidents

Create new Fire Event for Road Tunnel

Create new Fire Event for Metro/Railway Tunnel

Legend:

- New: not treated
- Under Approval
- Accepted

Search

Brief overview of existing records of fire in tunnels	Update date	upload	
Excel sheet with short information about fire accidents in tunnel	08 June 2005	Comment	delete
Excel sheet with short information about fire accidents in tunnel	16 December 2004	Comment	delete

To update this list: click on *comment* and send your information to the database manager (an update every 3 months is foreseen).

Road Tunnel	Creation Date	Mod. Date	App. Date			
44 - France (France)				Edit	Delete	
72 - France (France)				Edit	Delete	
80 - France (France)				Edit	Delete	
BAREGG TUNNEL (Switzerland)				Edit	Delete	
Fire after vehicle crash (14-04-04 14:02)	2004-07-22 12:21:57.0	2004-12-02 17:10:39.0	2004-07-22 12:23:47.0	Edit	Delete	Comment
CASTELLAR (Nice) (France)				Edit	Delete	
Spontaneous fire on vehicle (14-04-94 ??:??)	2002-10-18 19:51:05.0		2003-02-18 18:15:12.0	Edit	Delete	Comment
Caldecott Tunnel (United States)				Edit	Delete	
Fire after vehicle crash (07-04-82 24:00)	2004-11-24 11:29:33.0		2005-01-25 17:37:51.0	Edit	Delete	Comment

Insight of the simplified version of the FIT DB

1							
2	last update :	08-juin-05	*Fire accidents in tunnels: brief overview of real cases, attachment to DB5*				
3	implemented by :	G. Marlair, INERIS	*update in 25th version :*		Frejus accident 4th of June 2005		
4	# of entries	203			explosion event involved		
5	*# countries involved*	*29*	(source : Sapeur-pompier magasine, special issue, Sept 2004))		check of information still required		
6	*# records with fatalities*	*51*					
7			other minor amendments... (tunnel data)		standard record		
8	**Date of accident**	**Name of tunnel**	**type of tunnel**	**Country**	**Length of tunnel**	**vehicles involved**	**Casuality**
9	**04/06/2005**	**Frejus tunnel**	**Road**	**France/Italy**	**12870 m**	**4 trucks + fire engine**	**2 deaths**
10	17/12/2004	Sveti Rok tunnel	Road	Croatia	6000 m	Bus with 38 passengers	
11	15/12/2004	Semmering tunnel	road	Austria	3414 m	TMD truck	none
12	31/10/2004	Grand Lucy cut and cover T	road	Switzerland	?	Corsa' car crash, then fire	1 injured (car driver)
13	02/10/2004	tunnel de la Béroche	road	Switzerland	not pertinent	fire in technical room	none
14	09/09/2004	La Clusette tunnel	road	Switzerland	1100 m	simulated crash between tr	2 trainers intoxicated !
15	***08/09/2004***	***Kure mine tunnel***	***mine (freight)***	***Turkey***	***unknown***	***equipment (welding torch)***	***19 deaths, 17 injured***
16	28/06/2004	Sedrun St Gotthard base tun	Rail	Switzerland	19000 m (expected	no vehicle, conveyor belt	no injured
17	22/06/2004	Naxberg tunnel	Road	Switzerland	515	1 car and one truck	1 injured (car driver)
18	**14/04/2004**	**Baregg tunnel**	**Road**	**Switzerland**	**1080 m**	**1car and one truck**	**1 dead, 1 injured**
19	25/03/2004	Göschenen tunnel	Road	Switzerland	?	coach engine fire	none
20	25/03/2004	St-Gotthard tunnel	Road	Switzerland	16.92 km	1 coach	no injury
21	08/03/2004	Steg St Gotthard base tunne	Rail	Switzerland	?	Jumbo drilling machine	no injury
22	12/03/2004	St-Gotthard tunnel	Road	Switzerland	16,92 km	1 truck	no injury
23	03/03/2004	Bargias tunnel (A 13)	Road	Switzerland	416 m	trailer truck	no
24	21/02/2004	Frejus tunnel	Road	France/Italy	12,87 km	1 truck fire (brakes)	no
25	**06/02/2004**	**Moscow metro**	**Metro**	**Russia**	**not pertinent**	**rail carriages**	**39**
26	10/02/2004	Trojane Tunnel	Road	Slovenia	2900 m	diesel powered air compres	no
27	03/02/2004	Kinkempois tunnel (Cointe)	Road	Belgium	635 m	refrigerated truck (small)	no

small fire that was put under control rapidly ; tunnel closed some 2.5 hours according to press releases

FIT action on accidental databases: a summary

- Clearly a major achievement in the FIT program:
  - FIT expanded database: some 50 detailed records
    - Exemples of significant road, rail, metro traffic tunnel fires or even disasters
    - Many information entry fields
  - FIT simplified database: close to 200 records
    - Allows more user-friendy introduction of:
      - first information of new incidents from media reporting to keep track
      - not so well documented accidents and significant tunnel fire incidents
      - near miss cases
- Deserves further valorisation and updating in some way
  - was used to write « **A history of tunnel fire incidents** » published as a chapter by Carvel and Marlair in the book: ''The handbook of tunnel fire safety'' (Ed.Beard & Carvel), Thomas Telford P (UK), 2005

2) Ammonium nitrate based products

INERIS active for decades for the promotion of safety for both main use of ammonium nitrate (NH_4NO_3) :

- as an ingredient of mineral fertilizer
- as an ingredient of industrial explosive (ANFO)

type of work :

- testing and testing development (e.g. on detonability of AN based fertilizers)
- certification of explosives (EC marked explosives)
  - according to framework directive 93/15/EC
- research devoted to safety (fire & explosion hazards):
  - e.g. behaviour of the products in the molten phase
- accidents investigation, analysis and recording (Toulouse…)
- support to concerned authorities (in F and EU) for development and updates of safety regulations regarding AN based fertilizers
  - sectorial WG established under the auspices of MEDD

Ammonium nitrate (AN) based fertilizers - INERIS viewpoint on accidentology

a) The pre 60's area - majors disasters

- Major disasters serve -fortunately- a first 'significant improvement' of those products through better manufacturing practice and implementation of quality standards:
  - OPPAU (Germany), 1921 > 500 fatalities
  - Texas City, 1947 581 fatalities + 1900 injured
  - Brest (France), 1947 >20 fatalities

b) The 'Nantes' case with NPK fertilizers (1987) in France

- major consequences :
  - environmental
  - emergency management response: evacuation of 15000 people in town
- focus on pollution problems with self decomposition of NPK V type formulation fertilizers

Ammonium nitrate (AN) based fertilizers - INERIS viewpoint on accidentology

c) The Toulouse accident (21st Sept. 2001) and the aftermath

- explosion without preceding fire scenario
- 30 fatalities, many injured people
- difficult investigation, still much debate on detailed explanation
- ended up by closure of the factory
- the evidence of a problem arising from 'off-spec' AN based products
- marked a key step in further addressing safety related issues:
  - brand new EU regulation n°2003/2003
  - modification of the so-called 'SEVESO II' directive
    - (2003//105/CE)
  - started on the EU level the debate on security related issues, in addition to safety (a post 9/11 rising issue…)

Ammonium nitrate (AN) based fertilizers

d) Post Toulouse accidentology :

- significant accidents still involve both straight AN fertilizers and NPK type fertilizers:
  - high dosage straight AN fertilizers:
    - Saint-Romain en Jarez (France), storage (Oct 2003)
    - Barracas (Spain), bulk transport (Febr. 2004)
    - **Mihailesti (Rumania) transport, 50 kg bags (May 2004)** ■
  - fires involving NPK fertilizers
    - Murcia (Spain) 2002
    - Deneb (Saint-Nazaire, France), 2002
    - **Köping, [Yara site], 2004** ■
- reveal that unsolved remaining problems exist and need further examination...

‘fire’ incident in Köping, Sweden (3300 t of NPK fertilizers), 2 July 2004

Foto: PRB
Sources : Internet

Self sustained decomposition of NPK type fertilisers

Other examples of self-sustained decomposition of NPK fertilizers (so-called fertilizer 'fires')

Murcie (Spain Jan. 2002):

- NPK 15 15 15

Source : Spanish Ministry of the environment

St-Nazaire (transport, Sept. 2002)

Source : Internet

May 2004, near Bucharest (Rumania)

View of the scenario just before the explosion: fire, then delayed mass explosion

Source: after Marlair et al poster paper, IAFSS symposium September 2006

May 2004, near Bucharest (Rumania) (Cont'd)

View of the crater – 18 fatalities from the detonation

Date / location	Activity/ description	Product	Accident type/ casualties	Time to explosion
1972 Taroon Australia]	Road transport : fire then explosion	Low density AN prills in bags	3 fatalities	45 min
1973,Cheeroke, OK (USA)	Storage severe fire in AN store of wooden structure, fuel tank in pay-loader, difficulty with fire fighting	14000 tons of AN fertilizers in the warehouse, but only a limited amount of it (< 10 t) participated in the accidental scenario	A fire is the initial event A few tons only of the AN fertilizer stock exploded No injury	~50 min
1997, Brazil	Road Transport	Truck loaded with AN fertilizer trapped in a fire scenario caused by a nearby petrol tanker Quantity unknown	Delayed explosion, possibly initiated by an exploding propane bottle on the trailer	unknown
2000, Florida, (USA)	Road transport. Collision between AN truck and gasoline tanker. Fire allowed to burn out	AN fertilizer, quantity unknown	Fire only	(-)
October 2003 St Romain en Jarez France	End user storage	AN fertilizers (33,5) in bags (some 5 tons)	3 heavily injured	~60 min
February 2004 Barracas, Spain	Road transport : fire then explosion	25 tons AN fertilizers (33,5) in bags	2 fatalities, 3 people injured	~30 min
May 2004, some 50 km far from Bucharest, Romania	Road transport : truck road accident then fire followed by explosion	Some 25 tons of AN fertilizers, packaging unknown	18 fatalities (including truck driver, firemen and policemen) and numerous injured people	~55 min

The explosion following a fire potential scenario (source: MARLAIR et al, 2005)

3) The development of biofuels and safety related issues

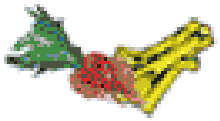
EU by far, world leader for biodiesel :

- close to 2 million tonnes produced in the EU25 (2005):
  - Germany, France, Spain, Italy...
- some 75 operational production sites across EU
- in the same time EU increasingly short in diesel and long in gasoline
- also producing ethanol for use in blends (bioETBE)

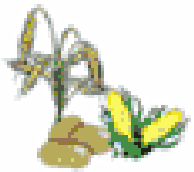
Brazil and the USA currently leading production and use of bioethanol

- some 12000 million litres each (2005)
- 86 sites of production of **bioethanol** (from corn) in the USA

Traditional processing



Sugar beet, sugar cane



Wheat, corn, potato → Starch

Vegetable oils (soybean, sunflower, rapeseed, etc.)

Sugars → Fermentation → Ethanol → Etherification → ETBE → Gasoline Pool

Ethanol → Gasoline Pool

Transesterification → Fatty Acid Esters or Biodiesel → Diesel Pool

Processes of the future

Dedicated cultures (crops, grass…)

Wood waste

Adapted from : Idé/IFP (on Axens website)

Safety issues from biofuels: the background

Underscored problem ?

- Bioethanol:
  - a flammable product
  - volatility issues
  - what about knowledge transfer from edible alcohol production ?
  - Experience from Brazil?
  - Polar solvent; requires special fire-fighting procedures
  - environmental issues (odors…)
- Biodiesel:
  - the high flash point is hiding the danger, as:
  - many flammable materials are used in processing biodiesel:
    - reactants (solvents, catalysts)
    - proven accidentology in manufacturing and transport
- **Biogas ?**

Are there significant accidents in the biofuel industry ?

- **Biodiesel** : Bakersfield, Calif. (USA) 17 February 2006 :
  - biodiesel plant facility, American Biofuels LLC (ABF)
    - fire scenario, started outside of the plant building during transfer of methanol, from a small spill (ignition by static electricity ?)
      - entire plant destroyed due to severe burning for several hours and related massive air pollution
      - No victim, nor injuries
      - significant quantities of methanol, biodiesel and corn oil (in railroad cars) however saved by emergency plans.
- 3 manufacturing plants reported having been destroyed due to unexperienced use of catalysts:
  - (K or Na methoxides)

Are there significant accidents in the biofuel industry ?

Ethanol Storage Tank Blaze, Port Kembla, Australia, January 2004

Source : Internet

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Ethanol Storage Tank Blaze, Port Kembla, Australia, January 2004 (Cont'd)

Sources : Internet

Our proposal for a collaborative action in the field

Our proposal

At the light of what has been presented above :

- We suggest to proceed - as a concerted and continued action- to the implementation of three common databases covering :
  - 1) fire incident records in tunnels
  - 2) fire and explosion records pertaining to AN-based fertilizers
  - 3) fire and explosion records pertaining to the development of biofuels, on the whole value chain (from well to wheel)

These databases would be acessible electronically by all inFIRE members, according to rules to be defined

Our proposal (Cont'd)

Advantages / opportunities

- further valorise previous actions at National and EU levels in the field
- INERIS data may feed inital databases to be built for the two first cases
- starting something in relation with 3) meets INERIS research program named BIOSAFUEL (2006-2008)
- The InFIRE network represents 46 members, covering large proportions of the continent, with significant representation of fire services, often being the only external people (outside the concerned premises) getting some information from the ' field ' experience
- mutualisation of efforts means mutualisation of benefits !

Interest for numerous parties :

- the insurance sector
- the scientific community
- the fire-fighters community
  - all of them well represented in the inFIRE network

Conclusions

Conclusions

1) The basic requirement of drawing lessons from significant incidents to promote better industrial safety has been recalled
2) A description of INERIS means and tools (e.g. the CIVS) available that actually serve such a goal on a daily basis has been provided
3) Examples of current competence and practical tools developed in the field of industrial accidents investigation and analysis by INERIS have been given in two typical areas of interest :
   - tunnel fire safety
   - fire & explosion safety issues pertaining to AN based fertilizers
4) The emerging issue of automotive biofuels safety has been discussed
   - the fire and explosion hazards with both bioethanol and biodiesel a reality...

Conclusions (cont'd)

5) A proposal has been made to the audience to launch an concerted action aiming at two essential goals :

- further expand, maintain and update information available from accidents in two areas where INERIS may provide a good start, namely:
  - a) significant fire-driven accidentology in traffic tunnels
  - b) significant incidents involving fire and explosions of ammonium nitrate based fertilizers
    - can rely on previous INERIS expertise developed from at least 2 decades
- pilot a first attempt on measuring the level of concerns that might arise from the sharp development of automotive biofuels

6) the authors look forward to hearing on any reaction to such a proposal, now and later

Thank you very much for your attention !

Any questions ?

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Support for the open discussion

Practical issues of such a proposal, if agreed, will naturally require further discussions :

- other partial relevant databases might be available from other inFIRE members ?
- who does what?
- How to organize implementation of data and access to databases to in-Fire members…
- How to optimize the collection of data ?
- Data validation issues ?
- Collaboration with external members (non inFIRE members) ?

New members inside the inFIRE network from weakly represented continents such as Asia and South America would greatly help in our view in accessing to pertinent data (Korea, China, India, Japan…, Brazil, Argentina, Mexico)

Support for the open discussion (Cont'd)

INERIS may offer technical solutions to implement the related databases, relying on the CIVS capacities and other contributors from the operational departments concerned :

- DCE (Certification Division)
  - contacts would be : G. Marlair & MA Kordek
- DRA (Accidental Risks Division)
  - contacts would be : F. Waymel & B. Debray

Other possibilities to be examined in due time...

Bibliographical data : Some contributions by INERIS (1/4)

Fire safety in tunnels (1/2)

- Six technical databases addressing fire safety in tunnels : a major deliverable of the FIT European thematic network. VAN DESSEL J., MARTIN Y., MARLAIR G. Proceedings of the 10th Interflam Conference, 5-7 july 2004, Edinburgh, Scotland. Interscience Communications, 2004, pp. 809-814.
- Fire in road tunnels and life safety : lessons to be learnt from minor accidents. BODART X., MARLAIR G., CARVEL R. Proceedings of the 10th Interflam Conference, 5-7 july 2004, Edinburgh, Scotland. Interscience Communications, 2004, pp. 1517-1527.
- Human behavior as a key factor in tunnel fire safety issues. MARLAIR G., LE COZE J.C., WOON-HYUNG K., GALEA E.R. In : Proceedings of the 6th Asia-Oceania Symposium on Fire Science & Technology, 17-20 march 2004, Daegu, Korea. KIM E.S., KIM J.D., PARK Y.H., DLUGOGORSKI B.Z., KENNEDY E.M., HASEMI Y. (Eds.). Korean Institute of Fire Sience & Engineering, 2004, pp. 658-668.
- Programme européen FIT. Bilan de fonctionnement d'un réseau thématique sur le risque incendie en tunnel. MARLAIR G., MARTIN Y. Préventique Sécurité, 2005, n° 81, pp. 30-34
- La sécurité incendie dans les tunnels. MARTIN Y., VAN DESSEL J., MARLAIR G. Les dossiers du CSTC, 2005, n°4, 8 p.
- La sécurité incendie dans les tunnels. MARTIN Y., VAN DESSEL J., MARLAIR G. Construction, novembre 2005, pp. 41-44.

Bibliographical data : Some contributions by INERIS (2/4)

Fire safety in tunnels (2/2)

- The Daegu metro fire : a review of technical and organisational issues. MARLAIR G., LE COZE J.C., KIM W.H. Proceedings of the 2nd international symposium on tunnel safety & security, 15-17 march 2006, Madrid, Spain, pp. 15-25.
- A history of fire in tunnels. CARVEL Richard and MARLAIR Guy. In : The Handbook of Tunnel Fire Safety. BEARD Alan & CARVEL Richard. THOMAS TELFORD, 2005.
- A history of experimental tunnel fires. CARVEL Richard and MARLAIR Guy. In : The Handbook of Tunnel Fire Safety. BEARD Alan & CARVEL Richard. THOMAS TELFORD, 2005.

Bibliographical data : Some contributions by INERIS (3/4)

Fertilizers

- First lessons of the Toulouse ammonium nitrate disaster, 21st september 2001, AZF plant, France. DECHY N., BOURDEAUX T., AYRAULT N., KORDEK M.A., LE COZE J.C. Journal of Hazardous Materials, 2004, vol.111, pp. 131-138.
- First lessons of the Toulouse ammonium nitrate disaster, 21st september 2001, AZF plant, France. DECHY N., BOURDEAUX T., AYRAULT N., KORDEK M.A. Proceedings of the JRC-ESReDA International Seminar on Safety Investigation of Accidents, 12-13 mai 2003, Petten (Nederland).
- Safety and security relating to low capacity storage of AN-based fertilizers. MARLAIR G., KORDEK M.A. Journal of Hazardous Materials, 2005, vol. 123, n° 1-3, pp. 13-28.
- Les engrais solides à base de nitrate d'ammonium : risques, types d'accidents, enjeux. Marie-Astrid KORDEK. RAPPORT D'ÉTUDE N° 65281. 2/05/2005. Réf. : INERIS –DCE–65281 version 5. Available online : http://www.ineris.fr
- Analyse des dommages causés par l'explosion d'un hangar agricole survenue le 2 octobre 2003 à Saint-Romain-en-Jarez (Loire). O. DOLLADILLE, E. LEPRETTE. INERIS, 2004. Available online : http://www.ile-de-france.drire.gouv.fr/environnement/engrais/engrais_GT.htm
- Accident (explosion succeeding to fire) at St Romain en Jarez, 2 October 2003. IGUS – EPP meeting, Ottawa (Canada), 19-21 April 2004.
- Tests results on molten ammonium nitrate fertilisers. KORDEK M.A., MARLAIR G., MICHOT C. IGUS-EOS annual meeting, Washington DC (USA), 5-7 avril 2006.

Bibliographical data : Some contributions by INERIS (4/4)

Biofuels

- Automotive biofuels : the INERIS R&D project BIOSAFUEL. MARLAIR G., ROTUREAU P. IGUS-EOS annual meeting, 5-7 avril 2006, Washington DC(USA).