

Frank Lees Centre for Safety and Loss Prevention

Safety Related Research at Loughborough University

Geoff Hankinson

17th September 2003

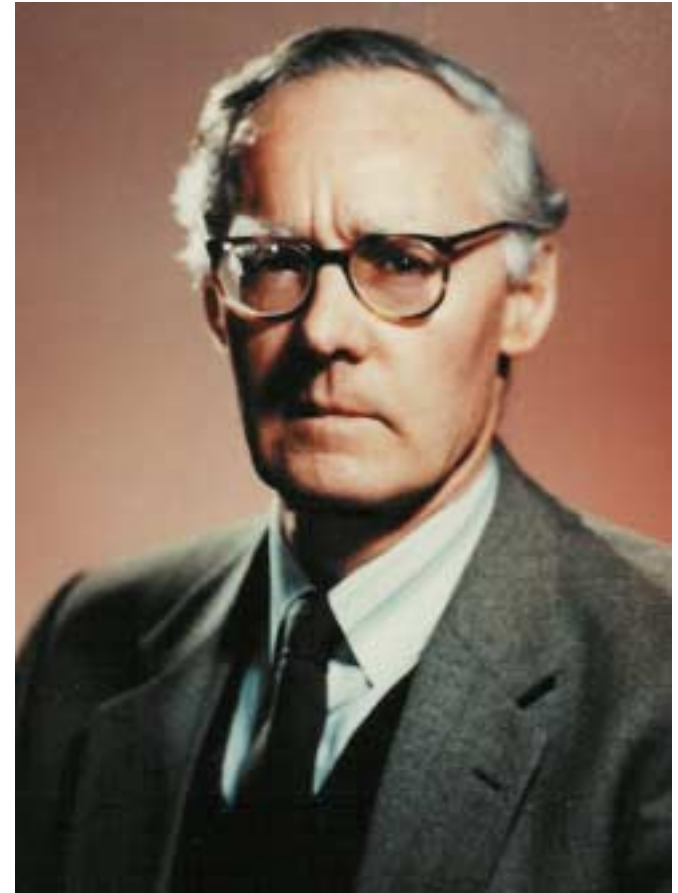
Outline

- Professor Frank Lees.
- The FL Centre for S&LP
- Process Risk and Loss Prevention Network
- Outline of work undertaken/ongoing/proposed within the FL Centre for S&LP :
 - Computing Sciences
 - Systems Engineering
 - Centre for Hazard and Risk Management (CHaRM)
 - Chemical Engineering

Professor Frank Lees

(5th April, 1931 – 18th March 1999)

- Pioneer in the field of process safety
- Joined Loughborough University in 1967 and established an outstanding research group



Professor Frank Lees

(5th April, 1931 – 18th March 1999)

- He was appointed by the DTI as technical assessor to the Piper Alpha enquiry
- His work will best be remembered for his classic book *Loss Prevention in the Process Industries*



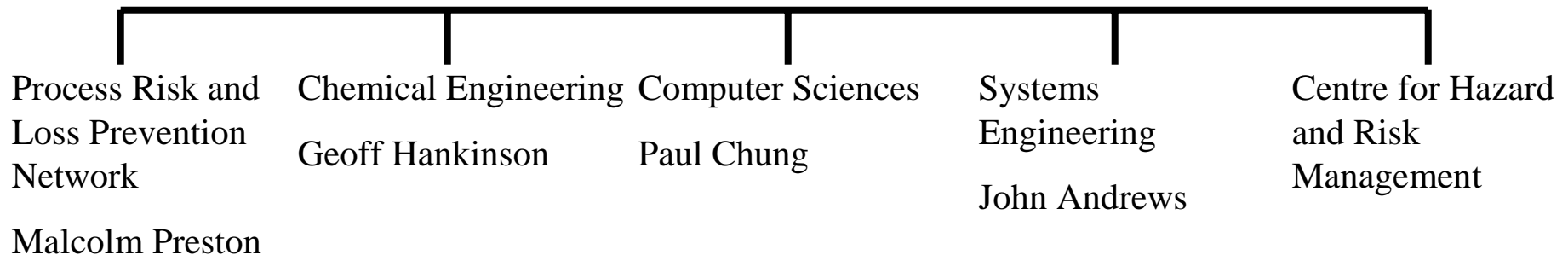
Frank Lees Centre for Safety and Loss Prevention

- FL Centre for S&LP was officially opened by Elizabeth Lees (Frank's widow) on 14th November 2001
- The objectives of the Centre are:
 - To establish a thematic network in process risk and loss prevention
 - To foster Safety and Loss Prevention research within and between several departments at Loughborough University

Frank Lees Centre for Safety and Loss Prevention

- Currently there are 4 departments within the university actively engaged in research linked to the FL Centre for S&LP
 - Chemical Engineering
 - Computer Sciences
 - Systems Engineering
 - Centre for Hazard and Risk Management (CHaRM)
- In addition a major activity within the centre is the Process Risk and Loss Prevention Network

FL Centre for S&LP



Process Risk and Loss Prevention Network

- The inaugural meeting and workshop of the EPSRC Network was held on the day that FL Centre for S&LP was officially opened, 14th November 2001
- The objectives of the Network are:
 - To share and disseminate best practice and research ideas within the membership and with wider academic and industrial sectors.
 - To identify areas of research and development that will be of benefit to industry and academia and to support the establishment of this work.
 - To increase the capability of the participating organisations and more generally the UK base in awareness and understanding of process risk and loss prevention and help improve performance in this field.
 - To help participating organisations achieve international academic excellence in the field of chemical process safety.

Research Activities of Paul Chung

Computer Sciences

Computer Systems

- Safer design of computer controlled process plants
- Integration of accident data base with other computer tools used in the process industry
- Modular method for hazard and operability studies of process plant
- Automated hazard identification
- Managing the compliance of dynamic and complex processes

Research Activities of John Andrews

Systems Engineering

Optimisation and Reliability

- Automatic Fault Tree Construction for Railway Safety Systems
- Optimal safety system design using Genetic Algorithms
- Improving the Efficiency and Accuracy of Fault Tree Analysis
- Reliability Modelling of Systems with Dependencies
- Reliability of Rotating Equipment

Research Activities of CHaRM

Human Factors

- Human factors and safety culture
- Organisational health and safety management
- Security management
- Risk and continuing professional development
- Environmental pollution control

Research Activities of Geoff Hankinson

Chemical Engineering

Pipeline Technologies

- Assessment of the performance of safety information management
- Decision support tool for the strategic assessment of options for the development of oil, gas and chemical industry in a country
- High strength steel pipelines
- Preparing for hydrogen as an energy carrier in next generation sustainable energy systems (NATURALHY)



The NATURALHY project - Smooth and cost effective introduction of hydrogen into society by use of the existing natural gas infrastructure

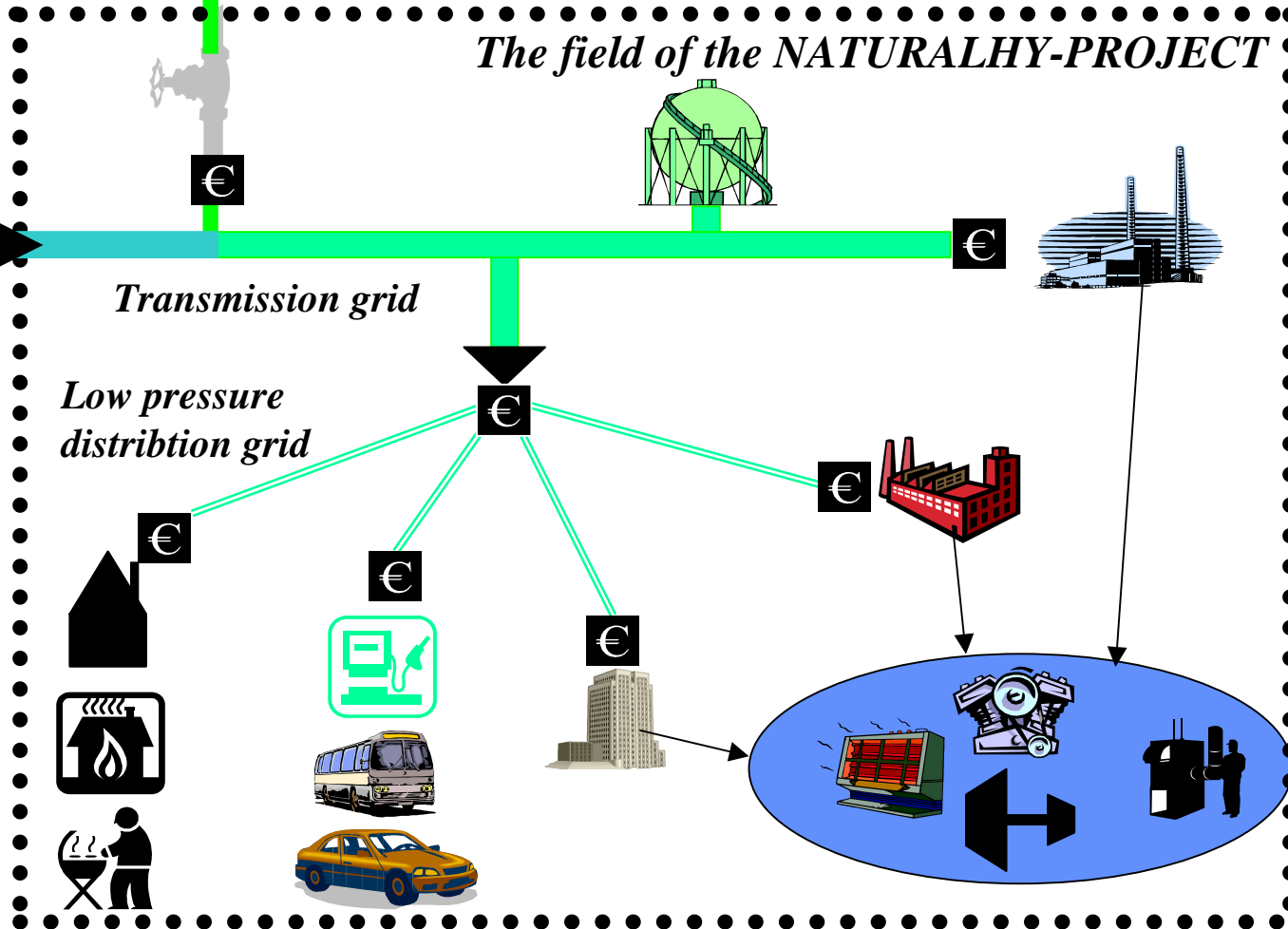
Prepared by O.
Florisson
Gasunie



H2 PRODUCTION

The field of the NATURALHY-PROJECT

Natural gas →



€ = Measurement for custody transfer

Prepared by O.
Florisson
Gasunie



Demands regarding:

- Safety;
- Security of supply (quantity and quality);
- Durability and Integrity of the network;
- Acceptance by the end user & enthusiasm of the gas company.

Prepared by O.
Florisson
Gasunie

Naturalhy Project Safety Work Package

Participants in the Safety Work Package

Safety Work Package Leader – Loughborough University

Participants –

- CEA
- HSE
- Leeds University
- Shell Hydrogen
- Transco
- University of Sheffield

Support –

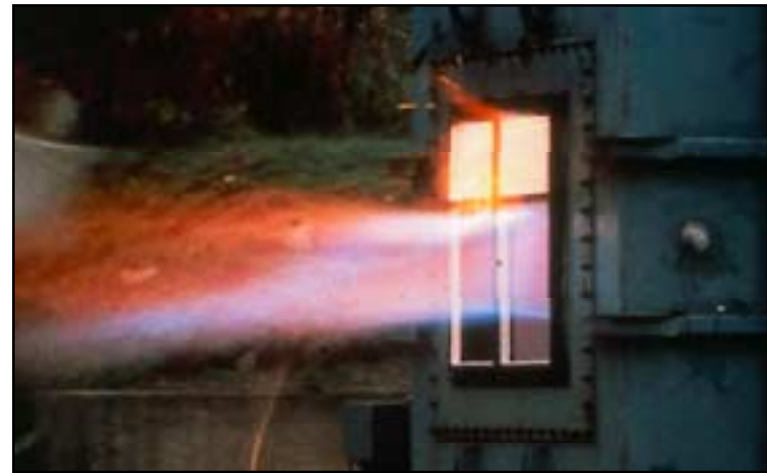
- Advantica
- HSL
- Shell Global Solutions

Approach

- Introduction of hydrogen will require that risks remain below levels that are acceptable to the regulator
- Identify appropriate information on hydrogen/natural gas mixtures to enable the use of current risk assessment methodologies to determine risk levels and the variation in these levels with changes in the amount of hydrogen, the operating conditions (i. e. operating pressure) and the introduction of risk reduction measures

Domestic and Industrial Utilisation

- Gather information on leak frequency and ignition probability
- Undertake experimental studies on gas build-up and confined explosions sufficient to draw comparisons with available information and predictive tools developed for natural gas
- Particular emphasis will be placed on identifying conditions (if any) which might result in a transition to detonation



Distribution Network

- Undertake work to identify the movement of hydrogen/natural gas mixtures through the ground following leakage from a distribution pipe compared with natural gas
- Undertake a number of selected low pressure pipeline fire experiments sufficient to compare with data and predictive tools available for natural gas



Transmission Network (Rupture)

- Undertake a number of selected transmission pipeline fire experiments to study the important early stages of fireball development and the generation of overpressure
- The data generated will be compared with data and predictive tools available for natural gas
- Information gathered in this area is essential for land use planning



Transmission Network (Jet Fire)

- Undertake a number of selected high pressure jet fire experiments to study heat transfer to objects within and outside of the flame envelope
- The data generated will be compared with data and predictive tools available for natural gas



Transmission Network (VC Expl'n)

- Undertake sufficient experimental studies on high pressure gas releases into congested regions to study gas build-up and explosion to draw comparisons with available information and predictive tools developed for natural gas
- Particular emphasis will be placed on identifying conditions (if any) which might result in a transition to detonation



Risk Assessment

- Incorporate the information identified in the above work into risk assessment methodologies
- Undertake risk assessment analysis of 2 or 3 selected examples of gas infrastructure and utilisation of hydrogen/natural gas mixtures and compare the results with those obtained for natural gas

Incorporate Work Package Information into Assessment Tool

- Provide guidance on the integration of the results of the Safety Work Package into a tool to be developed to assess gas networks as to their suitability to handle hydrogen/natural gas mixtures (one of the main deliverables of the Naturalhy project)

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