

# Joint Research Project

## Further Work Towards Area Classification for Oil Mists [MISTS2]

Research  
Industry  
Collaboration  
Process  
Oil  
Explosion  
Fire  
Ignition  
Pressure  
SAFETY  
Classification  
Spray  
Flammability  
Mist  
Leak  
ATEX  
Hazards  
DSEAR

Mists of high-flashpoint fluids such as hydraulic oils, lubricating oils, diesel and heavier fuels can ignite and produce explosions at temperatures below their flashpoints.

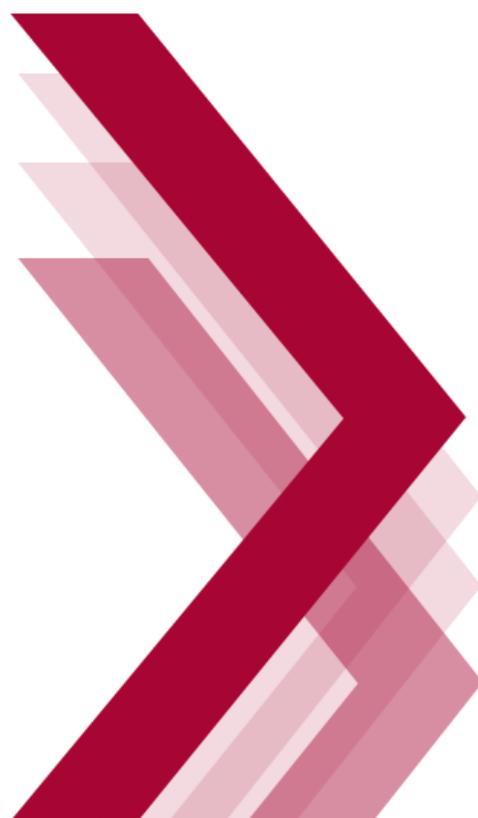
In the UK and the rest of the EU, there is a legal requirement to consider hazardous area classification for flammable mists. Whilst area classification for explosive gases is well established, available guidance for flammable mists is limited, brief and largely qualitative when it comes to controls for such risks.

To address this issue, a project on the formation and mitigation of flammable mists [MISTS1] was initiated by the Health and Safety Executive (HSE) in December 2011 and jointly sponsored by 16 industry and regulatory partners. The objective was to develop practical criteria to define the likelihood of flammable mist formation that could be used as part of an area classification exercise. The scope of work included the formation of flammable mists, methods to predict the extent of the flammable cloud, protected equipment concepts and equipment selection.

MISTS1 represented a major step forward, however HSE and industry recognise that there are still knowledge gaps associated with the formation and mitigation of flammable mists. **As such, HSE are seeking co-sponsors to fund a second project [MISTS2] to further develop our knowledge and understanding in this important area.**

### HSE JOINT RESEARCH CENTRE

HSE has a longstanding history of supporting science and research to address a range of cross-sector safety issues. Building on this heritage, the HSE Joint Research Centre provides a platform to identify and co-fund applied research projects that are of interest to both industry and regulatory bodies.



## Overview of Technical Work Packages

The work packages present an overview of the work to be completed and the deliverables. The technical detail of each work package will be defined and agreed on a collaborative basis via the steering committee which shall be formed when the project commences. The committee is expected to be a partnership of operators and the regulator (HSE). In addition to the deliverables below, it has been discussed with the Energy Institute (EI) that results will be a potential input to revise EI guidance on hazardous area classification (EI *Model code of safe practice Part 15: Area classification for installations handling flammable fluids*, 4<sup>th</sup> edition, July 2015).

### APPROACH

In order to shape the joint research project, HSE held a scoping workshop. The workshop was attended by operators, regulatory bodies and other interested parties. Based on the knowledge gaps identified and a prioritisation exercise, a number of work streams have been defined as a series of distinct but interrelated work packages.

#### **Work Package 1: Where does diesel fuel fit in the MISTS1 classification scheme?**

Tests will build on the work in the previous Mists JIP. Experimental studies will be conducted in partnership with Cardiff University's Gas Turbine Research Centre. Testing will directly replicate the procedure used in the previous work, and will involve assessing the ignitability of diesel fuel mists. A secondary element of this work will seek out a fluid which is borderline ignitable, which can be used in other work packages to investigate how different leak scenarios affect the ignitability of the mist.

##### **Deliverables**

- Advice on categorisation of diesel fuel.
- Identification of a fluid to use in further studies.
- A report on the detailed results for those who wish to perform further analysis.

#### **Work Package 2: Does the shape of the defect affect a leak's ignitability?**

The simple round hole used in the Mists1 tests will be replaced with other likely defects such as a plain slit, screw thread, leaking flange and a corrosion-induced defect. Ignition tests will show the effect of the defect shape, and detailed measurements of the mist will provide information on what changes affect ignition. These tests will be performed in partnership with Cardiff University's Gas Turbine Research Centre.

##### **Deliverables**

- Clear information on the effect of the defect on ignitability of otherwise similar leaks.
- Advice on the worst case for ignitability.
- A report on the detailed results for those who wish to perform further analysis.

#### **Work Package 3: What is the zone extent?**

The ignition assessment used in Mists1 will be expanded to look at the full extent of the ignitable cloud by using a much larger test space. Tests will look at the effect that pressure, leak rate, fluids and fluid temperature has on the maximum extent of the flammable cloud. This experimental study will be carried out at HSE Buxton.

##### **Deliverables**

- Clear zone extents for specific release scenarios.
- Data to allow a wider range of scenarios to be modelled.
- Predicted zone extents from modelling.
- A report on the detailed results for those who wish to perform further analysis.

#### **Work Package 4: Are mist explosions the same as gas explosions?**

Experimental tests at HSE Buxton will establish the severity and consequences associated with a mist ignition event. This will establish whether there is a minimum concentration or droplet size threshold below which a mist ignition event results in a fire rather than an explosion. The magnitude of any mist explosion will be benchmarked against an equivalent vapour cloud explosion.

##### **Deliverables**

- Advice on when an oil mist explosion needs to be considered.
- Advice on the use of existing gas explosion predictions for assessing oil mist explosion effects.
- A report on the detailed results for those who wish to perform further analysis.

### PRICE AND PROJECT DURATION

The total funding required for this joint research project is estimated to be between £600k-900k depending on the specifics of the programme of work. It is therefore anticipated that with financial support from HSE, each project sponsor would need to contribute between £50k-75k depending on the total number of partners. The project is anticipated to commence Q3 2017 and take 24 months to complete.

For further details or on how to join please contact Dr Paul Grant, 01298 218197, paul.grant@hsl.gsi.gov.uk