



## CASE STUDY

# Zoning Spray Booths

DEKRA have worked with a producer of high end spray booths including fully automated spray booths for automotive applications and spray booths for marine and aerospace applications. At a client installation, the booth was designated Zone 1, something which was completed without the necessary background work required.

The client had installed a very large spray booth for coating vessels that they manufacture. Their insurers had employed a consultant to assess the spray booth. The consultant had assigned a Zone 1 to the spray booth system without performing the necessary calculations and was intransigent. The consultant insisted on the installation of explosion relief as a solution. Unfortunately, DEKRA encounter this situation regularly – the Zone and extent being assessed by judgement rather than the application of a calculative method or a relevant standard. This often leads to operation difficulties or unnecessary costs for the business.

There are many problems with an assumed Zone 1 designation in this case:

1. The DSEAR hierarchy mandates that options to reduce the extent and persistence of a flammable atmosphere are considered before explosion protection. If the consultant believed this was a Zone 1, the recommendation should have related to the ventilation design rather than explosion protection.
2. The standard for area classification for gases and vapour, BS EN

60079-10-1, has specific guidance on plant design which was not considered by the assessor. Furthermore, specific guidance at the time existed for coating plant design in the form of BS EN 12215:2004+A1:2009.

In particular, Zone 0 or Zone 1 areas should be minimised in number and extent by design or suitable operating procedures. In other words, plants and installations should be mainly Zone 2 or non-hazardous. Where release of a flammable substance is unavoidable, process equipment items should be limited to those which give secondary grade releases or, failing this (that is where primary or continuous grade releases are unavoidable), the releases should be of very limited quantity and rate. In carrying out plant design, these principles should receive prime consideration. Where necessary, the design, operation and location of process equipment should ensure that, even when it is operating abnormally, the amount of flammable substance released into the atmosphere is minimized, so as to reduce the extent of the hazardous area.

3. If the spray booth was actually a Zone 1 this would mean that in

normal operation the concentration of gas was greater than or equal to 25% of the lower explosive limit. For the solvent in question this would mean that even with an air fed hood the operative performing the spraying would be massively over exposed to the solvent.

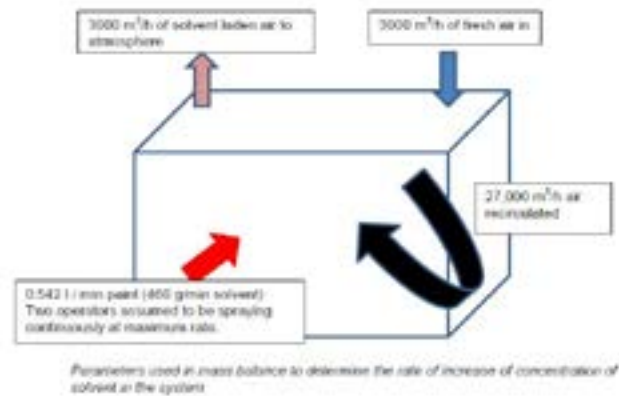
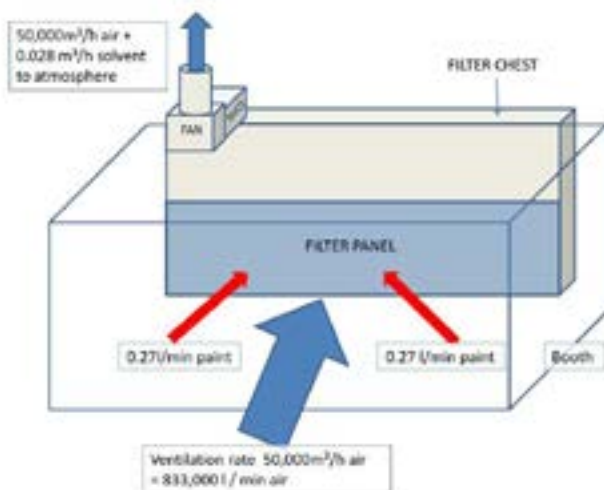
4. The consultant assumed that the ventilation duct would increase the concentration of solvent in the air. The duct does not add solvent or remove air, it only increases the velocity. Therefore, this cannot be true.
5. The enormous volume and ventilation flowrate relative to the spray rate was not considered relevant by the consultant.

|             | L (m) | W (m) | H (m) | Volume (m <sup>3</sup> ) |
|-------------|-------|-------|-------|--------------------------|
| Booth       | 17.1  | 8.2   | 10    | 1402                     |
| Chest       | 7.25  | 0.95  | 10    | 69                       |
| Duct to Fan | 6     | 1     | 1     | 6                        |

**Total - 1477 m<sup>3</sup>**

The client was facing an impossible situation in that the insurer's assessor would not reconsider the conclusions of their original assessment or provide further evidence as to why a Zone 1 designation was appropriate. Therefore, it was necessary to perform fundamental calculations to assess the concentration of solvent in various stress conditions within the booth. Whilst this is not generally required for area classification, the situation in question required irrefutable proof produced by one of DEKRA's chartered chemical engineers. To that end, a mass balance was created for various hypothetical situations within the booth:

- Calculation of the ventilation rate required to form a flammable atmosphere under continuous spraying with two guns.



- Calculation of the effect of forcing the booth into recirculation mode and spraying with two guns continuously.

Whilst there are interlocks to prevent these situations, and continuous spraying would never occur in practice, analysis was of interest to determine whether or not a situation existed, or could exist due to a failure, which could create a flammable atmosphere of any significance.

The results of the study showed that explosion protection was not required and that the potential for formation of a flammable atmosphere was low. As sometimes occurs there was a conflict between the guidance in the British Standard for spray booths (BS EN 12215:2004+A1:2009, since superseded) which indicated a Zone 2 for the spray booth, and the standard for area classification (BS EN 60079-10-1) which indicated that it was non-hazardous. In this case the booth had already been correctly built and specified to the spray booth standard requirement of a Zone 2 designation.

The study satisfied the insurer and allowed the client to continue commissioning the system and also avoided other additional expense that would be incurred if the Zone 1 designation had not been challenged, for example increasing the ATEX rating of all electrical equipment to category 2G or using explosion protection. Since the completion of this study the spray booth standard BS EN 12215:2004+A1:2009 has been superseded by BS EN 16985:2018. DEKRA have used the new standard on several occasions and find that it provides a clear and practical pathway to safe spray booth design and use for both manufacturers and end users.

## DEKRA Organisational & Process Safety

DEKRA Organisational and Process Safety are a behavioural change and process safety consultancy company. Working in collaboration with our clients, our approach is to assess the process safety and influence the safety culture with the aim of 'making a difference'.

In terms of behavioural change, we deliver the skills, methods, and motivation to change leadership attitudes, behaviours and decision-making among employees; supporting our clients in creating a culture of care and measurable sustainable improvement of safety outcomes is our goal.

The breadth and depth of expertise in process safety makes us globally recognised specialists and trusted advisors. We help our clients to understand and evaluate their risks, and work together to develop pragmatic solutions. Our value-adding and practical approach integrates specialist process safety management, engineering and testing. We seek to educate and grow client competence to provide sustainable performance improvement; partnering with our clients we combine technical expertise with a passion for life preservation, harm reduction and asset protection.

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