Pyrotechnic and Explosive Substances in the Context of the Seveso II Directive

A Summary Report from Seminars held on 27 September 2000 (Marseille, France) and 28 – 30 March 2002 (Ispra, Italy)

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The Committee of the Competent Authorities for the Implementation of the Seveso II Directive staged two seminars on management of fireworks hazards under the Directive, the first on 27 September, 2000, in Marseille, France and a follow-up seminar in Ispra, Italy on 28-30 March 2001. The seminars were held in the aftermath of the catastrophic explosion at a fireworks storage facility (SE Fireworks) in the Dutch city of Enschede on 13 May 2000 that claimed 22 lives and injured almost 1.000 people. The explosion triggered a general concern within the EU about the safe management of explosives and pyrotechnic substances at European fireworks installations.

The purpose of the first seminar was to review recent serious incidents involving explosives and pyrotechnic substances. It also aimed at increasing the understanding of how regulations in the EU Member States are structured to prevent such accidents, challenges presented in implementing such regulations, and opportunities for improvement. The second seminar was convened to solicit expert opinions concerning actions that should be taken in response to the Enschede incident and in particular in response to the conclusions that resulted from the Marseille seminar.

This document represents an agreed account of both seminars with additional information supplied by various Member States to clarify certain technical points and issues.

The Enschede incident, and the analyses of causes and remedies arising from the subsequent investigation, drove much of the discussion during both seminars. However, the seminars sought to determine whether there were lessons from Enschede that would be applicable in a European context and not just the Netherlands. As a result, the actual seminar conclusions were not derived directly from the Enschede incident, but from the discussions that took place during the seminars around the issues raised by the incident. Specifically, the comparison of experiences within the Competent Authorities and expert exchanges concerning explosive properties of fireworks served to confirm and further define certain weaknesses in the Directive's coverage of fireworks as well as its implementation.

The final outcome of both seminars was a proposed amendment to the Seveso II Directive to remove ambiguities concerning coverage of fireworks installations. More precisely, it was concluded that the criteria for identifying fireworks hazards covered by the Directive was inadequate and, in some circumstances, could lead to the inappropriate exclusion of certain hazardous installations from coverage under the Directive. The seminars also produced recommendations for improving implementation and enforcement of the Directive.

Coverage of Fireworks under Seveso II

The table contained in Annex 1, Part 2 of the Seveso II Directive identifies the categories of substances that are covered by the Directive and the thresholds at which the two levels of Seveso coverage are triggered. Discussion at the seminars

concerning fireworks coverage was primarily aimed at the description and thresholds assigned to the categories of explosive substances within the Directive.

Currently, explosive substances are classified in two substance categories within the Directive, that is, Categories 4 and 5. Category 4 explosives generally refer to substances that have properties associated with Risk Phrase R2, i.e.

> " a substance that creates the risk of an explosion by shock, friction, fire or other sources of ignition ..."

Category 4 explosives also includes pyrotechnic substances defined as:

> "a substance (or mixture of substances) designed to produce heat, light, sound, gas or smoke or a combination of such effects through non-detonating, self-sustained exothermal reactions, or ... an explosive or pyrotechnic substance or preparation contained in objects ..."

Category 4 explosives are considered less hazardous than those in Category 5, whose definition corresponds to Risk Phrase R3, that is:

> "a substance or preparation which creates extreme risk of an explosion by shock, friction, fire or other sources of ignition ..."

Thresholds for Article 6 and 7 coverage (includes the requirement to produce a Major Accident Prevention Plan or MAPP) are 50 tonnes (Category 4) and 10 tonnes (Category 5). Thresholds for Article 9 coverage (includes the requirement to produce a safety report) are 200 tonnes (Category 4) and 50 tonnes (Category 5).

SEMINAR ON EXPLOSIVES AND PYROTECHNIC SUBSTANCES MARSEILLE, FRANCE – 27 September 2000

The Marseille seminar was composed of two parts. The first part consisted of presentations on several recent incidents that have occurred within the European Union within the previous six months. In the second part of the seminar, several Member States each described their regulations covering explosive and pyrotechnic substances at fixed installations, particularly in relation to the Seveso II Directive. In addition, their observations on the strengths and weaknesses of these systems, how they may have had influence on recent incidents, as well as recommendations for improvements were shared with seminar participants.

Recent Industrial Incidents Involving Fireworks

According to statistics compiled by France's Bureau for Risk and Industrial Pollution Analysis (BARPI --Bureau d'Analyse des Risques et des Pollutions Industrielles), at least 93 serious incidents involving explosives occurred around the world within the ten year period covering 1990 through 1999. Over the last 30 years, 129 serious incidents involved explosives are recorded to have occurred world-wide; 103 of these incidents caused fatalities, including nine fatalities within the general population.

The following are case descriptions of incidents that are known to have occurred in Europe recently.

Enschede, 13 May 2000. A series of explosions at a company that stored and assembled fireworks in the city of Enschede, the Netherlands, caused the death of 21 persons and injury to 944 more. The incident inflicted extensive damage to a large

area immediately surrounding the factory that included a residential area as well as the Grolsch brewery (containing a large ammonia refrigeration system). Investigations into the physical and organisational causes were expected to eventually clarify how the accident could have happened, as it was not clear at this time how an explosion involving fireworks could have resulted in an accident of this significance, even if 158 tonnes had been present as was permitted within the operating licence.

As a consequence of this major accident, it was expected that the legislation on fireworks within the Netherlands was predicted to become more stringent. New integrated legislation was being prepared that will cover all elements within the chain of fireworks activities: import, production, storage, assembling and use. Stringent safety distances would also form part of the new regime. Moreover, how to ensure reliable classification and labelling of different types of fireworks was an issue that should receive ongoing attention.

Rafelcofer, Spain, 15 May 2000. An explosion and subsequent fire at a fireworks factory in Rafelcofer, a town located in the Spanish province of Valencia, claimed the lives of seven people and injured eight more. The incident also destroyed twelve buildings on the site.

It has been speculated that a spark generated during a colour mixing process may have set off the first explosion. Poor handling procedures, exacerbated by an excessive confidence among workers in handling the dangerous materials, were suspected to have contributed to the accident.

Libório Fernandes (Lanhelas), Portugal, 2 July 2000. A fire and explosion at a fireworks assembly plant caused nine injuries and destroyed two buildings at a plant site and a number of nearby residences in Libório Fernandes, Portugal. The incident was thought to have been triggered by a reaction that occurred while the fireworks were in the drying phase. The fire lit a stockpile of pyrotechnic materials nearby resulting in several explosions.

The facility was licensed for a total of 6.1 tonnes of raw materials, prepared and finished products. According to the owners of the facility, the capacity of the storage areas had not been exceeded but the dramatic consequences suggest that either the capacity had been exceeded or predictions for the impacts from an explosion involving this quantity and type of material had been drastically underestimated. A government investigation underway was also seeking to determine whether internal and external safety distances and safety management processes at the plant were adequate, and whether stricter legislation was necessary to reduce the probability that such an incident could occur elsewhere.

Fougueyrolles, France, 8 June 2000. An explosion in a pyrotechnic workshop in Fougueyrolles, a small municipality in the Dordogne region of France, destroyed the building which had contained it and scattered debris along a 90 meter trajectory from the site.

The workshop was apparently operating without the required licence to store and handle fireworks in accordance with existing French regulations. Improper classification of imported fireworks also may have been a contributing factor to the incident as in Rafelcofer and possibly Enschede.

Description and Comparison of European Regulations Covering Manufacturing and Storage of Explosive and Pyrotechnic Substances

This description is extracted from the presentation of nine Member States (Austria, Belgium, Finland, France, Germany, Portugal, Spain, Sweden and the United Kingdom) who gave presentations at the first seminar on their regulatory systems for managing manufacturing and storage of explosive and pyrotechnic substances. Each EU Member State is required to transpose the minimum requirements of the Seveso II Directive. Nonetheless, the coverage and structure of regulatory systems varied widely among the different Member States, largely because the history of fireworks regulation is much older than that of Seveso II. Most, if not all, of the Member States had systems based on regulations and regulatory structures that had been in place prior to the enactment of the Seveso II Directive. Any additional requirements of the Directive were then incorporated into the existing systems.

The most significant differences were in the areas of threshold quantities, methods used for classification of explosives and pyrotechnics, and details of requirements. In several Member States the scope of facilities covered under the national system went well beyond those covered by Seveso II.

Thresholds. The Directive establishes thresholds of 50 tonnes and 10 tonnes for lower tier coverage of Category 4 (which includes pyrotechnic substances) and Category 5 explosives respectively. In contrast, there were virtually no thresholds for application of minimum requirements in some countries, that is, the presence of a pyrotechnic substance was in itself enough to activate Seveso coverage, or a similar regulatory control.

Classification systems. None of the Member States relied exclusively on the risk phrases, R2 and R3, to identify whether fireworks fell into Category 4 or 5 of Seveso II. To identify hazard potential of fireworks materials, most Member States applied the UN/ADR (Accord Européen Relatif au Transport International des Marchandises Dangereuses Par Route or European Agreement concerning the International Carriage of Dangerous Goods by Road) [1]. Using the hazard divisions to classify fireworks, they would thereby identify which installations were covered under Seveso.

However, other Member States took the view that this classification system does not fully ensure proper classification of the explosive hazard associated with pyrotechnic substances. Hence, some Member States have created a modified system, based on the UN/ADR classification scheme but including additional definitions or subcategories. At least one Member States has developed a completely new system to differentiate further the hazard potential of explosives and pyrotechnics in storage conditions, maintaining that UN/ADR classifications are not adequate for Seveso II as they take only transport conditions into considerations.

Requirements. Member States require permits with stringent operating conditions for installations when the quantity of explosive substances present there attain the specified threshold quantity. Such permits generally include safety distance requirements, construction conditions, and verification of management safety

[1] Note: The system of classification of dangerous goods under ADR follows as closely as possible the Recommendations on the Transport of Dangerous Goods, drawn up by United Nations Economic and Social Council's Committee of Experts on the Transport of Dangerous Goods, published in a document popularly known as the "Orange Book" (from the colour of its cover). This system, designed to apply world-wide to all transport modes, assigns the goods to nine different classes according to the main type of danger they could present in transport, e.g. explosion, toxicity, etc. (Source: UNECE)

expertise. In most Member States the same permit requirements apply to pyrotechnic installations if quantities reach the threshold level for the substance in question, according to its hazard category.

Safety distances. As part of their presentation, Member States were also asked to calculate the safety distances required from different land uses for two types of situations: Case A – 20 tonnes of black powder, and Case B – 100 tonnes of fireworks. Methodologies for calculating distances varied widely, making it difficult to compare safety distances between Member States. In many countries, exact calculations required more precise details than the case descriptions allowed. Still, limited as it was, the data indicated that there are some differences, possibly significant, between Member States in what is considered a large enough protection zone for protecting certain land uses from incidents involving explosive and pyrotechnic substances. For example, one Member State calculated 814m versus another Member State's 1400m as the distance required to separate a residential area from an installation with 100 tonnes of fireworks. However, distances provided were mostly generalisations and so it is difficult to draw firm conclusions from comparisons of the data.

Conclusions

The seminar highlighted certain challenges faced by EU Member States in preventing incidents involving explosive and pyrotechnic substances in the European Union:

Systems for classifying explosive and pyrotechnic substances are suspected as being too imprecise in some technical details and hence do not always lead to adequate prevention measures. The experience of several Member States in implementing Seveso II, and notably that of the Netherlands in regard to the Enschede incident, suggest that the definition of Category 4 substances, particularly the provisions of Note 2 (a)(ii) and (iii) (Annex I, Part 2) requires additional interpretation for implementation. As a result, a number of Member States are using the UN/ADR classification system to give the Seveso definitions more precision[2].

[2] The notation HD 1.1, 1.2, 1.3, 1.4, 1.5 and 1.6 refer to hazard divisions (HD) in the explosive class of the UN/ADR (Accord Européen Relatif au Transport International des Marchandises Dangereuses Par Route or European Agreement concerning the International Carriage of Dangerous Goods by Road), transposed into European law within Council Directive 94/55/EC of 21 November 1994 on the approximation of the laws of the Member States with regard to the transport of dangerous goods b road (OJ No L 319, 12.12.1994, p. 7-13). The system of classification of dangerous goods under UN/ADR follows as closely as possible the Recommendations on the Transport of Dangerous Goods, drawn up by United Nations Economic and Social Council's Committee of Experts on the Transport of Dangerous Goods, published in a document popularly known as the "Orange Book" (from the colour of its cover). This system, designed to apply world-wide to all transport modes, assigns the goods to nine different classes according to the main type of danger they could present in transport, e.g. explosion, toxicity, etc.

The hazard divisions of the explosives class of the UN/ADR classification scheme are as follows:
1.1 Substances and articles which have a mass explosion hazard. (A mass explosion is an explosion which affects almost the entire load virtually instantaneously).
1.2 Substances and articles which have a projection hazard but not a mass explosion hazard.
1.3 Substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard:
(continued on the next page)

Nonetheless, some Member States have suggested that current test procedures and criteria used to establish the UN/ADR classifications, intended to define hazard levels relative to particular explosive and pyrotechnic substances in transport, may not adequately account for hazards presented by these substances in storage facilities. According to this view, storage conditions for explosives and pyrotechnics (for example, safety distances) must properly consider the relevant risks pursuant to the substance classification and in proportion to the quantities stored, building construction, etc.

The thresholds for determining coverage of explosive and pyrotechnic substances under the Seveso II directive may not always lead to effective accident prevention. It has also been suggested that, if current Seveso categories for explosives (Categories 4 and 5) have not fully accounted for storage hazards associated with some explosive and pyrotechnic substances, then likewise threshold levels currently assigned to substances covered by these definitions and classifications may also not adequately account for their hazard potential.

The methodology for calculating the applicable thresholds for mixtures and composites of explosive and pyrotechnic substances under the Seveso II directive may not always lead to effective accident prevention. Individual country experiences, including the Enschede incident, have raised concerns about the methodology for calculating threshold levels assigned to mixtures of and composite articles containing Category 4 substances. For example, if the item is a composite article, such as a firework, of which a portion is not a hazardous or "active" substance but packaging material that contains and shelters the active substance, the threshold only applies to the portion of the article that is active.

To address the issue of calculating threshold levels for composite articles, the Annex I Questions and Answers (Q & A) states:

> "According to Annex I, Part 2, Note 2 (a) (ii), "a pyrotechnic substance is a substance (or mixture of substances) ***designated*** to produce heat, light, sound, gas or smoke or a combination of such effects through non-detonating self-sustained exothermic chemical reactions". However, the container / packaging material will not normally be ***designated*** to produce such effects.
>
> Moreover, in the Classification and Packaging Directive (Directive 67/548/EEC), 7th ATP - Adaptation to the Technical Progress, 1990) it is

(a) combustion of which gives rise to considerable radiant heat; or (b) which burn one after another, producing minor blast or projection effects or both.
1.4 Substances and articles which present only a slight risk in the event of ignition or initiation during carriage …
1.5 Very insensitive substances having a mass explosion hazard which are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of carriage …
1.6 Extremely insensitive articles which do not have a mass explosion hazard. The articles contain only extremely insensitive detonating substances and demonstrate a negligible probability of accidental initiation or propagation. Note: The risk from articles of Division 1.6 is limited to the explosion of a single article. (Source: UNECE and Council Directive 94/55/EC)

Categories 1.3 and 1.4 were most often cited as potentially inadequate when applied to explosives and pyrotechnics in storage.

> clearly stated in Article 22, paragraph 1.b. that "the materials constituting the packaging and fastenings *must not be susceptible* to adverse attack by the contents, or liable to form dangerous compounds with the contents". Therefore, the packaging of explosives should not create risk, since otherwise it would be in conflict with the Classification Directive.
>
> It is therefore recommended not to count the weight of the packaging material in the inventory of fireworks and explosive substances in general."

Yet it has been suggested that this interpretation is not adequate, because labelling of such composite articles in some instances (for example, articles labelled as UN/ADR classifications 1.1, 1.2, or 1.3) does not precisely indicate the portion of the article which is active, and there is no general rule for estimating what this portion should normally be. In effect, there is not a generally accepted method or criterion to assess what percentage of a particular package containing a Category 4 substance counts towards the threshold level quantity when the percentage is not precisely known. Some Member States have established their own guidelines although not all of these countries expressed strong confidence in the adequacy of their methodology.

In fact, Member States have identified three types of situations involving composite articles or mixtures of substances for which no generally accepted rules exist to adequately identify the magnitude of the risk, and therefore the threshold level that should apply (and the above Q & A explanation refers to one of them). These situations are:

- when the substance in question is contained in a pyrotechnic article (what proportion of the article should be considered active?) One solution proposed is to consider the article as 100% active substance if the precise percentage of active substance is not known.
- when an article contains a mix of explosive and pyrotechnic substances (how should the proportions be determined and an appropriate threshold level be calculated?)
- when the substances in storage are a mix of explosives and pyrotechnics of different classes (how does one predict the magnitude of the hazard present?)

Hence, it has been suggested that it would be beneficial to have a standard methodology or methodologies for more precisely assessing the hazards of the above situations (taking into account potential storage conditions) so that appropriate corresponding threshold levels could be identified. It has also been suggested that the issue of calculating thresholds for pyrotechnic articles might be more appropriately addressed by an amendment to the Directive than in a Commission interpretation via a Q&A.

Imported explosive and pyrotechnic products are often incorrectly labelled. Some Member States reported that import products, from China in particular, were routinely labelled UN/ADR Class 1.4 when in fact they more likely qualified as Class 1.3 or lower. Some Member States reclassify imported fireworks on entry into the country in order to address this problem.

Stringent laws and regulations alone are not enough to prevent catastrophic accidents involving explosive and pyrotechnic materials. Recent incidents underscore the difficulty, even with flawless regulations, of assuring that covered installations are

in compliance and that the safety programs they have implemented are effective. A common problem exists in instilling a safety culture within the facility that promotes hazard awareness and strict adherence to proper safety procedures in all stages of handling hazardous materials.

SEMINAR ON EXPLOSIVES AND PYROTECHNIC SUBSTANCES ISPRA, ITALY – 28 – 30 March 2001

While a few important presentations were planned for this seminar, it was expected that a large part of the seminar would consist of discussion how best to address weaknesses in the application and implementation of the Seveso II Directive to fireworks installations. In particular, it was expected that the workshop would discuss the conclusions in the context of an amendment to the definitions and thresholds for explosive categories (Categories 4 and 5) of the Seveso II Directive. It was also recognised that to address the shortcomings highlighted by Enschede comprehensively, recommendations from the workshop were likely to go beyond changing the Seveso II framework. Seminar participants included both policy and technical experts.

At the opening of the workshop, the Netherlands delivered a presentation summarising the findings and conclusions of the Oosting report. Subsequently, several countries gave presentations on how their systems addressed the classification and threshold questions raised by this report and discussions in Marseille.

The Oosting Report

The findings of the Oosting report supported the conclusions of the Marseille seminar concerning potential weaknesses in the classifications and thresholds qualify installations storing or handling explosive materials for coverage under Seveso II. SE Fireworks, the installation involved in the Enschede incident, had been licensed to store 159 tonnes (gross weight) of HD 1.4 fireworks, whose net explosive content (NEC) was calculated as approximately 48 tonnes. On the basis of the NEC, the installation would not have fallen under the Seveso II Directive as the lower tier threshold for Category 4 explosives is 50 tonnes. However, the investigation found that nearly 90 per cent of the fireworks that were stored at SE Fireworks should have been classified as HD 1.3 and a small percentage (4 %) should have been classified as an even greater hazard (either HD 1.1 or HD 1.2). The clear view of the Oosting Committee was that if the company had only been storing HD 1.4 then the disaster could not have occurred. Hence, erroneous classification and labelling of the materials stored and handled at the installation was a factor that led to gross underestimation of the hazard present at the facility.

Yet, even if the materials had been classified correctly, it is still possible that the installation might not have fallen under the Seveso II Directive. Under the current Seveso II classifications and thresholds, the installation would have qualified (if it had qualified at all) based on storage and handling of Category 4 explosives. Normally, the Dutch authorities assigned both HD 1.4 and HD 1.3 materials to Category 4. At most, the facility might have surpassed the lower tier threshold of Category 4, but would not have tripped the higher tier threshold (200 tonnes). In the view of the Oosting Committee, the facility represented a severe hazard and on the basis of this hazard it should have qualified for the Seveso II upper tier. This analysis suggested

that the Seveso II category definitions were not effectively capturing the risk of HD 1.3 materials.

The Oosting Committee also surmised that the presence of HD 1.1 explosives may have significantly increased the hazard present at the facility despite the fact that they made up a small percentage of the total quantity. In fact, the Committee chastised the Dutch authorities for ignoring a previous incident in Culemborg, Netherlands in 1991 involving the storage of HD 1.1 and 1.3 together. This condition was cited as a contributing factor to the Culemborg incident but the lesson was not incorporated into the Dutch authority's analytical framework for identifying and classifying hazards. Moreover, subsequent investigations, both within the Netherlands and other Member States, have shown that this distribution of fireworks in bulk storage facilities fireworks (i.e., fireworks of different hazard class stored together) is common.

Finally, the calculation of the net explosive content of the fireworks at SE Fireworks came into question as a result of the incident. For packaged articles—such articles normally would include intermediate or finished products—it is the NEC, or percentage of explosive content, that counts towards meeting the Seveso II thresholds. However, there is no uniform and universally accepted methodology for calculating the explosive content of articles (in all categories, HD 1.1 to 1.6). The Oosting Committee commented that the failure to have an accepted practice could contribute to underestimating the risk present at certain storage facilities, even to the extent that facilities with important hazards would not meet the thresholds established under Seveso II.

Classification of Explosive and Pyrotechnic Substances in Other Member States

A few participants made presentations describing how the competent authority in their Member State addressed particular issues raised in the Oosting report. The Marseille seminar had already demonstrated that the experience of the Member States generally supported the conclusions that were expected to be presented in the report. (The Dutch authorities gave a preliminary assessment of possible findings of the report at the seminar.) The presentations at the Ispra workshop elaborated on particular activities in Member States that had been undertaken to compensate for perceived problems in identifying and classifying installations with explosive hazards for the purpose of controlling major hazards.

Revising Seveso II Definitions of Explosive and Pyrotechnic Substances

Accordingly, on the basis of the knowledge gained at the Marseille seminar and the Ispra workshop, and the exchange of experience with and between Member States, it was recommended to revise the definitions used in Annex 1, Part 2 of the Seveso II Directive to more accurately reflect the hazards associated with different types of explosives.

In discussing possible modifications, the workshop participants strove to address the following questions:

- What classification scheme should be used to define the explosive and pyrotechnic categories of Seveso II? In particular, should reference be made to the R2 and R3 risk phrases to identify explosive and pyrotechnic substances, or should reference also be made to the UN/ADR Hazard Divisions?

- What is the risk relationship between pyrotechnic articles, pyrotechnic substances, explosive articles and explosive substances, and how should these

relationships be reflected in establishing category threshold levels?

Risk Phrases and UN/ADR Classification Scheme

The Seveso II Directive distinguishes between explosives on the basis of risk phrases according to the EC legislation on the classification, labelling and packaging of dangerous substances. The risk phrases refer only to the explosive sensitivity of substances (ease of ignition). They generally have less relevance for pyrotechnic materials than the UN/ADR system which allows differentiation between types of pyrotechnics. Notably, the UN/ADR system distinguishes between explosives on the basis of the hazard they represent – which may range from a mass explosion hazard for those explosives in Hazard Division 1.1 to no significant hazard for those in Hazard Division 1.4. It is these distinctions that are of particular relevance to pyrotechnics. As a case in point, HD 1.3 fireworks are considerably more hazardous than HD 1.4 fireworks. This difference is not reflected in the Seveso II Directive that treats pyrotechnics as a single group in Category 4.

The workshop experts held the view that the UN/ADR classification scheme better represent the hazards of certain types of explosives, particularly fireworks, than the risk phrases in the context of major hazard control. The tests performed under the risk phrase classification scheme are intended to identify a limited range of hazards applicable to raw substances, but these hazards are not representative of the full range of hazards associated with explosive or pyrotechnic articles in transport or storage. In contrast, the UN/ADR classification scheme, particularly test series 6, according to the experts, provides a much broader assessment of hazards associated with explosive substances and articles alike under different conditions. In fact, an article may sometimes be assigned a lower risk under the risk phrase classification (R2), but assigned a comparatively greater hazard classification under the UN/ADR classification scheme (for example, HD 1.1 or 1.2). However, HD classifications tend to be assigned to packaged goods not to chemical substances in a raw or intermediate form; hence, for these latter materials, the risk phrases are necessary and appropriate.

It was also noted that current test procedures and criteria used to establish the UN/ADR classifications may not account adequately for hazards presented by HD 1.3 and 1.4 materials in storage facilities. The UN/ADR protocols themselves acknowledge that the testing protocols may not cover all possible packaging and transport conditions.[3] Research performed in the United Kingdom, for example, on packaged articles classified as HD 1.4 in bulk storage or heavy confinement has demonstrated that, under these conditions, the hazards may be much more severe than indicated by the UN/ADR tests, designed solely to address transportation conditions. Hence, there is a concern that testing procedures under UN/ADR protocols cannot identify with certainty the level of hazard that may be present when HD 1.3 and 1.4 materials are stored at fixed installations (and research designed to address this problem was welcomed). Despite this reservation, the experts felt that the UN/ADR classification scheme effectively identifies the explosive hazard present in most situations. The scheme has the additional advantage that it is internationally accepted,

[3] Note 2 of Section 2.1.3.2.3 of the UN/ADR Classification Scheme states the following: "The scheme of assessment is only designed for the classification of packaged substances and articles and for individual unpacked articles. Transport in freight containers, road vehicles and rail wagons may require special tests which take into consideration the quantity (self-confinement) and kind of substance and the container for the substance. Such tests may be specified by the competent authorities."

widely used and regularly updated to reflect new information and technology. It also provides a strong basis for developing even more precise hazard criteria for explosives if necessary in future. In this respect, an additional test protocol may be required under Seveso II to make sure that classification of explosive hazards account for the full range of possible storage situations.

There was also a concern expressed that the use of UN/ADR classifications in defining explosive and pyrotechnic materials would set a precedent for using the UN/ADR classification scheme to define other categories in Annex I, Part 2 of the Directive. However, it was recognised that the explosive hazards of pyrotechnic materials pose a unique problem within the Directive and that there was no need nor intention to apply the UN/ADR classification scheme to any other part of Annex I, Part 2.

Thresholds

The definition of categories under Seveso II is directly linked to the establishment of thresholds. If categories are defined too loosely, or if they lack precision, the thresholds may not adequately capture the level of hazard present at an installation, and appropriate thresholds are necessary to achieve (and not grossly exceed) the prevention goals of the Directive. Hence, much of the workshop discussion related to thresholds actually centred on the division of explosive hazards into appropriate categories.

Explosive materials can be stored and handled in many forms. They may include raw substances that are used not only for manufacture of explosive and pyrotechnics but also as ingredients in manufacturing chemical products of a very different nature. They also exist as intermediate products and once manufactured, may be shipped as such to another installation for assembly into a final product. There is also the final product itself. For example, fireworks, both professional and consumer product types, may often be shipped and stored in considerable quantities prior to particular holidays such as New Years' Eve.

Workshop participants agreed that pyrotechnic and explosive substances and articles that possess similar explosive properties should also be categorised similarly under the Seveso II Directive, regardless of whether they are substances rather than articles. Separating substances from articles was thought to add unnecessary complexity to Seveso II implementation, and participants preferred the solution of referring to both the UN/ADR classification scheme and risk phrases in defining the categories where appropriate. Hence, it was recommended that the risk phrases R2 and R3 should be retained for substances, and in the event of any conflict between the two (i.e., a substance has both a risk phrase and a UN/ADR classification), the UN Hazard Division would take precedence.

In establishing the thresholds, it was also noted that two of the most important prevention tools in the Seveso II Directive are land-use planning and inspections, and indeed if SE Fireworks had fallen under the directive, then these important activities would have uncovered the potential risks associated with the bulk storage of fireworks in urban environments. On this basis, one could argue for lowering the lower-tier thresholds in order to bring sites into land use planning, but maintaining the upper tier as a much more exclusive category. If the upper tier threshold is set too low, there is a danger of losing the important distinction between upper and lower tier sites. This point was taken into consideration in setting the thresholds in the amendment proposal.

Workshop Proposal
As a result of these discussions, it was recommended to:

- amend the definitions for explosive substance categories contained in Note 2 to Annex I, Part 2 of the Directive to include a reference to Commission Directive 96/86/EC of 13 December 1996 adapting to technical progress Council Directive 94/55/EC on the approximation of the laws of the Member States with regard to the transport of dangerous goods by road. This Directive transposes the UN/ADR classification scheme into European law;

- amend Annex 1, Part 2, to divide item 4 into two categories (4a and 4b): one (4a) mainly for explosives presenting a mass explosion hazard (HD 1.1, 1.2, 1.5 and 1.6) and including substances with risk phrase R3, and the other (4b) for HD 1.3 fireworks and including substances with risk phrase R2;

- amend Annex 1 Part 2 to define Category 5 as covering explosives belonging to the HD 1.4 classification, which would therefore cover fireworks with lower hazard potential.

- amend Annex 1 Part 2 to reduce the thresholds for explosives with a mass explosion hazard (currently Category 5, proposed as 4a) from 10 to 5 tonnes for the application of Articles 6/7 and from 50 to 20 tonnes for the application of Article 9;
- amend Annex 1 Part 2 to create new thresholds for HD 1.3 and R2 explosives (proposed Category 4b) of 10 tonnes for the application of Articles 6/7 and 50 tonnes for the application of Article 9.
- amend Annex 1 Part 2 to create new thresholds for HD 1.4 (proposed Category 5) of 50 tonnes for the application of Articles 6/7 and 200 tonnes for the application of Article 9.

It should be noted that the workshop proposal has switched the order of severity between Category 4 and Category 5, such that the Categories 4a and 4b represent substances of with greater hazard potential than those of Category 5. This order was the opposite of that which appears in Annex I, Part 2 of the Directive currently.

Moreover, the current Category 4 thresholds (50 and 200 tonnes) were retained for the proposed Category 5, that is, HD 1.4 materials. Preservation of the status quo in this instance reflected the view of the workshop that thresholds for current Category 4 explosives and pyrotechnics continue to be appropriate for HD 1.4 materials (when they are properly classified).

The workshop proposal also reflected the view of the experts, supported by the findings of the Oosting report, that Seveso II definitions should address the aggregate hazard from storage or handling of substances or articles carrying HD 1.1 together with substances or articles classified as HD 1.3. In such instances, the total quantity should be considered as belonging to HD 1.1.

In addition, it was determined that, if the Seveso II amendment were to reference the UN/ADR classification scheme for explosives, then, to be consistent, it should include references to HD 1.5 and 1.6 substances and articles in the high hazard category along with substances and articles classified as HD 1.1 and 1.2.

The workshop proposal also offered the opportunity to resolve a problem raised concerning the current Seveso II definition of pyrotechnic substances, defined in the Directive as “non-detonating”. In fact, for some pyrotechnic articles that contain a flash component, detonation is possible. Therefore, it was proposed to exclude the phrase "non-detonating" from the amendment.

It was additionally suggested that revised thresholds should take into account the need to ensure broad consistency in the treatment of various hazards. For example, the proposed thresholds for HD 1.1 explosives (5 and 20 tonnes) are in line with those for very toxic substances, and those for HD 1.3 explosives (10 and 50 tonnes) are in line with extremely flammable substances.

Moreover, Annex I, Part 2, Note 2e of the workshop proposal requires that, for explosive or pyrotechnic objects, the entire weight of the object should be used in Seveso II threshold calculations when the percentage of explosive content (or NEC) is not known. This proposed change would address the concern highlighted by the Oosting report that the lack of a standard for calculating such percentages could lead to an underestimation of the hazard.

Classification, Labelling, Licensing and Inspection

Going beyond the specific provisions of Seveso II, the workshop identified classification of fireworks, labelling of fireworks, licensing and inspection of installations as equally important factors in effective prevention of fireworks incidents. For example, the national laws of the Member States for the storage of pyrotechnics and explosives are based on the UN/ADR classification scheme. Moreover, all Member States require licensing of manufacturing and storage of pyrotechnic and explosive substances. Yet recent incidents have occurred not only in the Netherlands, but also in Portugal, Spain and France, in which, in all cases, it was known or suspected that the hazard present at the facility was underestimated prior to the incident. Hence, more protective requirements might have been imposed on the facility or the facility might not have been allowed to operate in the specific location if the level of hazard had been properly recognised. For the incidents in Spain and Portugal, it was suggested that the operating licenses of the installations misrepresented the hazard potential of the materials stored or handled there, and in France the installation was not licensed at all.

As discussed in the Marseille workshop, all Member States appear to share a significant problem concerning the labelling of imported fireworks. There are big differences within the EU as to who is responsible for the classification, ranging from automatic acceptance of the classification assigned by the producer (exporter) of the imported fireworks, to self-re-classification by the operator (importer), to re-classification by the competent authority or a third-party. Imports from the Chinese are the most frequently mislabelled but it is not uncommon to find pyrotechnics mislabelled by EU producers as well.

It was the view of the workshop participants, therefore, that fireworks hazards would be consistently underestimated in many Member States if the improper labelling of imports was not systematically addressed. . It was suggested that the Member States act collectively to encourage diligent re-classification of imports in order to achieve this goal.

Some participants considered that improper classification of fireworks hazards by the competent authority, or the failure of the competent authority to recognise when self-

classification by installations is incorrect, could also be a factor leading to routine misidentification of fireworks hazards in some Member States. The science of explosives is a very particular specialisation and international guidance on classification of fireworks in this context is lacking. Consequently, participants suggested that more discussion and exchange of information about classification practices and competencies among Member States should be considered. Some participants were also interested in pursuing greater harmonisation of competency criteria within the Member States.

The participants also discussed the problem of licensing requirements, that is, the ability of competent authorities to impose appropriate safety requirements on fireworks installations within operating licenses. In essence, they said that the challenge of preventing fireworks incidents under Seveso II goes beyond that of classification. Fireworks also pose a challenge in terms of application of appropriate safety provisions to storage installations. In particular, concern over the increased hazard that may result when pyrotechnics are stored in bulk, in heavy confinement, or are stored together with highly explosive materials is relatively recent among explosive experts. Some competent authorities may not be aware of these concerns; and while others may be aware of them, there does not yet exist enough information on how and when these hazards are created to form a consensus on appropriate remedies. It was suggested that Member States should act collectively to support the efforts of licensing authorities to impose appropriate safety requirements on fireworks installations.

The workshop also considered what organisational framework was appropriate for addressing the classification, labelling and licensing issues within the European Union. It was thought that the Article 13 Committee, formed under Directive 93/15/EC on explosives for civil uses, and administered by DG-Enterprise, might be the principle authority over these matters. It was also suggested that the CCA for implementation of Seveso II might have a legitimate role to play in these areas, given that ineffective implementation of existing requirements significantly undermines the effectiveness of the Directive. In any case, it was thought that two or three different Directorates in the Commission might have a strong interest in working on information exchange, harmonisation of practices, or development of guidance on classification, labelling and safety provisions associated with fireworks and fireworks storage. The participants recommended meeting again to discuss alternative strategies for addressing these areas once the bulk of the Commission's activity surrounding the proposed amendment to the Seveso II Directive had passed.

Conclusions and Recommendations from the Ispra Seminar

- The workshop agreed that SE Fireworks should have fallen under the Seveso II Directive, and as such would have been subject to a full risk assessment for land-use planning purposes and a formalised inspection system.
- The workshop agreed that there was universal acceptance of the UN/ADR classification for the transportation of explosives and that this fact should be utilised in the proposed amendment. However, there was a concern that the testing procedures designed for transportation may not in some cases be adequate (e.g., bulk storage of HD 1.4 in confined spaces), and that research designed to resolve these problems should be supported.

- The workshop recognised that HD 1.3 fireworks are considerably more hazardous than HD 1.4 fireworks and that corresponding Seveso II thresholds should also recognise this distinction.
- The workshop recognised the potential hazard of handling and storing HD 1.3 and HD 1.1 explosives or fireworks together. This was thought to be a contributory factor in the explosive yield in the Enschede accident. Therefore the group recommended that if this did occur the total amount of the substance should be counted for the purposes of the directive as if it were HD 1.1.
- To address the above issues, the workshop unanimously agreed on the wording of a new proposal to amend the Seveso II Directive that could be circulated for consideration by the CCA.
- The workshop recognised the problem of misclassification and mislabelling of fireworks. This problem is exacerbated by the significant increase in the demand for professional fireworks and is not limited to fireworks being imported from China.
- It was generally agreed that there was a need for re-classification of fireworks to be done in a consistent manner. At present there are large differences within the EU ranging from automatic acceptance of the classification assigned by the producer, to self-reclassification by the importer, to re-classification by the competent authority or a third party. Closely coupled to this point is the need to assure effective compliance with the law.
- The workshop agreed that information exchange between Member States on best practices for fireworks storage and research on the impact of different storage conditions on hazard potential might help competent authorities better assess hazard potential of installations and identify appropriate safety requirements.
- There was also some concern expressed about the competence criteria for the bodies that oversee licensing of fireworks storage and the classification of fireworks. Greater information exchange on these topics and greater harmonisation of competency criteria were each suggested as possible alternatives to pursue.