Considerations about market surveillance and quality control of fireworks

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CONSIDERATIONS ABOUT MARKET SURVEILLANCE AND QUALITY CONTROL OF FIREWORKS

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ABSTRACT

A basic characteristic of the supply chain of fireworks is that most manufacturers are located in the Far East. Considering control results on tests made by CERL and INERIS on fireworks coming from this area (mainly from China), and taking into account that a new Directive has been published in 2007 in Europe for the certification of pyrotechnic articles (including fireworks), it seems clear that it is necessary to put in place an additional system for checking and certifying the fireworks, when importers of fireworks cannot check the imported batches by themselves according to the existing or newly arriving standards. This system could be applicable to manufacturers not belonging to the European Union or to control laboratories, and can be extended to any other country wishing to improve the safety of use of fireworks.

We present in this paper our views concerning such a system;

- a comparison between the checking procedure applied by the Canada (CERL) – i.e. on all imported batches - and those made by France (INERIS) – i.e. on samples taken on the spot in the importers warehouses on imported fireworks from the far east, and some results
- some proposals on criteria of minimal competence (qualified or accredited testing laboratory, competent people, testing equipment, testing procedures, …) to put in place in order to qualify the manufacturers exporting into Europe, or local control bodies.

INTRODUCTION

Market surveillance, the verification of products to ensure that they meet the essential safety requirements, is an essential tool for enforcing "so called" New Approach European directives. It will allow non-compliant products to be brought into compliance and sanctions to be applied when necessary. There is an obligation for Member States to organise and carry out market surveillance, not only to protect the interests of consumers, workers and other users, but also the interests of economic operators from unfair competition.

A new European Directive 2007/23/EC of 23 May 2007 [1] on the placing on the market of pyrotechnic articles, including fireworks, published on 14 June 2007 in the Official Journal of the European Union, establishes the essential safety requirements which pyrotechnic articles must fulfil with a view to their being placed on the European market.

This Directive explains in its article 4 that the responsibility of guaranteeing the compliance with these essential safety requirements (ESR) lies within the duties of the manufacturer, or if it is not established within the European Community, of the importer. The ESRs are described in Annex I of the Directive, the compliance of fireworks with these ESR is generally done during the so-called module B, the complete process of certification is achieved after application of a quality module (C, D, E, except for module H).

MARKET SURVEILLANCE IN FRANCE

After certification (e.g. initial approval procedure), each Member State shall take all appropriate measures (market surveillance according to article 14) to ensure that fireworks may be placed on the market, by carrying out regular inspections of fireworks on entry, at storage and on manufacturing site.
In France, for pending the implementation of the Directive 2007/23/EC, the market surveillance is organised under the responsibility of the Ministry of Industry, by the way of samples arbitrarily taken on the spot by inspectors (DRIRE) in the importers warehouses.
The tests performed on the samples consist of measuring dimensions, total and net explosive contents of sub-elements, functioning observation, height of explosion, sound level and full composition analysis if applicable, and labelling. These results are compared to the original test results obtained during the agreement process and a decision is taken.

In the following Table 1, a summary of the full test results obtained during the 5 last years on theses samples is presented:

Table 1: *Summary of test results from France*

	2002	2003	2004	2005	2007 (6 month)
Overall sampling quantity	75	40	135	76	118
% passing	73	0	70	8	25
% failing on labelling*	27	0	29	46	61
% failing on functioning*	13	50	7	66	35
% failing on net explosive content*	13	50	15	39	71

** a fail can be attributed to more than one test*

Only 42 % of the samples are in compliance with the original test results during official agreement. 85 % of the samples were manufactured in China, 3 % in Spain and 12 % in France.

AUTHORISATION APPROVAL IN CANADA

The Canadian Fireworks Standard lays out the requirements for fireworks to be "authorised" in Canada. It also lays out a plan for deciding if samples are required for testing. If a manufacturer applies to have 100 products authorised, only about 10 products would be requested for testing and the authorisation of the complete set of products will be based on the results of those 10 products.

All testing is performed at CERL. Testing has not been contracted out to any other government or private laboratory or the manufacturers. Test procedures exists for consumer and display fireworks, such as measuring dimensions, masses, likelihood of toppling over, attachment of fuses and bases. The charge masses are also dismantled and measured, and chemical analysis are tested, mainly for ClO_3, Pb and other heavy metals, one composition per product.

In the following Table 2, a summary is presented, the percentage of failure is similar than for the France market surveillance.

Table 2: *Summary of test results from Canada*

	2003	2004	2005	2006
Number of authorisation recommendations	115	111	147	120
% passing	63	71	46	41
% failing in packaging	0	0	4	0
% failing on labelling	10	1	22	28
% failing on functioning	13	18	25	14
% failing on mass or charge mass	6	5	12	23
% failing on chemical analysis	8	14	18	19

At present, CERL is wrestling with high failure rates. Ideally, CERL would like the submitter to ensure that the product meets the Canadian standards before sending the samples. One way were to ask to the Chinese manufacturers to get their products pre-tested by an independent laboratory before sending the samples to Canada. To date, this has only been partially successful because Chinese manufacturers have only contracted to perform a limited set of tests in order to minimise the costs, and recent samples at CERL have failed on some relatively basic criteria like fuse times or their physical integrity which were not tested by the independent laboratory.

COMPARISON BETWEEN THE 2 COUNTRIES

Table 3: *Comparison of test results from France and Canada*		
	FRANCE	CANADA
Number of testing, period of 5 years	444	493
% passing	42	54
% failing in packaging/labelling	37	16
% failing on functioning	29	16
% failing on mass or charge mass or chemical analysis	37	27

The percentages (see Table 3) and causes of non conformities are very similar between both countries, which seems reasonable as basically same producers are supplying both markets.

QUALITY MODULES OF THE 2007/23/EC DIRECTIVE

Considering these very poor results (only one half of the products pass the criteria), it seems clear that any given standard or specification that are used in the initial approval procedure cannot guarantee the essential safety requirements for the consumers. Therefore, it is necessary to put in place in any case an additional system for checking and certifying the fireworks manufacturers or importers. This is the goal of the new 2007/23/EC European directive concerning the CE marking of pyrotechnic articles.

This directive applies to all pyrotechnic articles (except articles covered by other directives or not intended for general consumption), which are principally fireworks. Fireworks shall be classified in 4 categories and the manufacturers shall ensure that all fireworks placed on the European market comply with the essential safety requirement described in Annex I of the directive.

If the manufacturer is not established in the Community, the importer shall ensure that the manufacturer has fulfilled his obligations, or assume these obligations himself, and may be liable by authorities with regard to those obligations. Distributors shall verify that the fireworks comply with the CE marking and are accompanied by the required documents.

To obtain the CE marking, the manufacturers shall submit the fireworks to a notified body who performs an examination according to one of the following procedures:

- an EC type examination of the product (checking of the conformity to the essential safety requirements – ESRs - according to module B) and an examination of the quality system applied by the manufacturer according to a module (C, D or E) depending on the level of his quality system. Figure 1 hereafter give an idea of the quality levels according to the modules.
- A verification of each unit (module G)
- A verification of the quality system only in case of full quality assurance (module H) and for category 4 fireworks only.

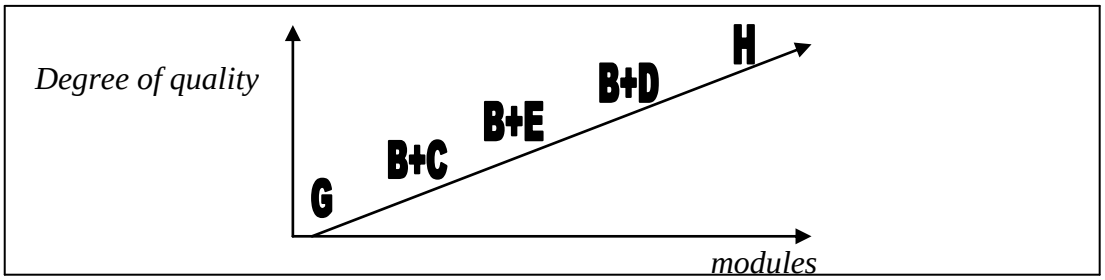

Figure 1: quality control process according to EU directive modules

INCOMING PROBLEMS

The main problems likely to be faced are that ;

- very few manufacturers in China (a large majority of fireworks used in Europe comes from China) have a quality system certified by a body accredited by the CNAS (Chinese member of IAF[2]): modules D and E cannot be applied, module C implies taking samples on the spot and testing them
- very few importers are ISO 9001 certified in Europe (20% in France for example), only module C can be applied
- there is no list of known distributors in the majority of European states, how to verify their duties ?
- the number of Chinese manufacturers is huge and the number of future European notified bodies will remain low (10 to 20), the number of tests to be performed for the module B by the NBs is therefore extremely high (the number of fireworks already agreed in Europe according to the national existing procedures can be estimated to more than 100 000, including variants), and in addition module C tests should be organised in a majority of cases
- the application of modules D and E needs not only a verification of an existing quality system but also a verification of the procedures for manufacturing, testing and archiving corresponding records
- the existing independent Chinese laboratories able to perform tests on fireworks are generally not positioned for testing all the lots manufactured by local applicants, and are generally not fully equipped to perform the required tests for CE marking (according to ESRs)

PROPOSAL

According to the current situation described in the previous sections, it can be proposed in the following tables, according to the levels of quality of the applicants, different fields of interventions of the NB, taking in account the different possibilities concerning certification, accreditation, quality ensured by an importer,…This is only a proposal, to be discussed.

Origin of applicant	*ISO 9000 series certified*	*ISO17025 accredited*	*Quality control ensured by importer*	*Modules possibly applied (choice of applicant)*	*Periodic audits performed by*	*Quality system to be applied*
EU	Yes	Yes	n.a.	G, B+E, B+D, H	NB	- Full quality system certified - Laboratory accredited for fireworks testing - Testing procedures during manufacturing checked by NB - ESRs checked by NB or independent laboratory (checked by the manufacturer for module H) - CE marking, archiving and labelling procedures - having personnel with proven experience concerning design, manufacturing and testing the fireworks (module H)
EU	Yes	No	n.a.	G, B+E, B+D	NB	- quality system certified - Testing procedures during manufacturing checked by NB - ESRs checked by NB or independent laboratory - CE marking, archiving and labelling procedures
EU	No	Yes	n.a.	G, B+C	NB	- Laboratory accredited for fireworks testing - Quality system checked by NB - Testing procedures during manufacturing checked by NB - ESRs checked by NB or independent laboratory - CE marking, archiving and labelling procedures
EU	No	No	n.a.	G, B+C	NB	- Quality system checked by NB - Testing procedures during manufacturing checked by NB - ESRs checked by NB - CE marking, archiving and labelling procedures

Origin of applicant	*ISO 9000 series certified*	*ISO 17025 accredited*	*Quality control ensured by importer*	*Modules possibly applied (choice of applicant)*	*Periodic audits performed by*	*Quality system to be applied*
Non EU	Yes*	Yes**	Yes	G, B+E, B+D, H	NB + I	- Full quality system certified - Laboratory accredited for fireworks testing - Testing procedures during manufacturing checked by NB and I (different periodicity) - ESRs checked by NB or independent laboratory (checked by the manufacturer for module H) - CE marking, archiving and labelling procedures - having personnel with proven experience concerning design, manufacturing and testing the fireworks (module H)
Non EU	Yes*	Yes**	No	G, B+E, B+D	NB	- quality system certified - Laboratory accredited for fireworks testing - Testing procedures during manufacturing checked by NB - ESRs checked by NB or independent laboratory - CE marking, archiving and labelling procedures
Non EU	Yes*	No	Yes	G, B+E, B+D	NB + I	- quality system certified - Testing procedures during manufacturing checked by NB and I (different periodicity) - ESRs checked by NB or independent laboratory - CE marking, archiving and labelling procedures
Non EU	Yes*	No	No	G, B+E, B+D	NB	- quality system certified - Laboratory accredited for fireworks testing - Testing procedures during manufacturing checked by NB

						- ESRs checked by NB - CE marking, archiving and labelling procedures

Origin of applicant	***ISO 9000 series certified***	***ISO 17025 accredited***	***Quality control ensured by importer***	***Modules possibly applied (choice of applicant)***	***Periodic audits performed by***	***Quality system to be applied***
Non EU	No	No	Yes	G, B+C	NB + I	- Quality system checked by NB - Testing procedures during manufacturing checked by NB and I (different periodicity) - ESRs checked by NB or independent laboratory under the responsibility of the importer - CE marking, archiving and labelling procedures
Non EU	No	No	No	G, B+C	NB	- Quality system checked by NB - Testing procedures during manufacturing checked by NB - ESRs checked by NB - CE marking, archiving and labelling procedures

** i.e. applying a quality system certified by a body accredited in accordance with international accepted rules (like IAF - International Accreditation Forum Multilateral Recognition Arrangement (MLA) Signatories, for example CNAS in China - China National Accreditation Service*

*** i.e. accreditation as a testing laboratory according to ISO17025 by a body accredited in accordance with international accepted rules (like ILAC - International Laboratory Accreditation Cooperation), for example CNAS in China (China National Accreditation Service). If the manufacturer or importer is accredited for testing fireworks, the tests results can be taken in account by the NB for modules B or C*

NOMENCLATURE

NB: Notified Body
I: Importer, if the importer ensure the quality system of a non European manufacturer, it should be certified according to an ISO9000 series standard
EU: European Union
Module G: Unit verification
Module B: Checking of the ESRs by the NB or an independent laboratory
Module C: Conformity to type, with samples taken on the spot by the NB and tested by the NB or an independent laboratory
Module D: Production quality assurance
Module E: Product quality assurance
Module H: Full quality assurance, category 4 fireworks only
Testing procedures during manufacturing: taking sample on each manufactured lot according to a recognised international standard – i.e. ISO2859 for example
Minimum requirements for an independent laboratory:

- accreditation as a testing laboratory according to ISO17025 by a body accredited in accordance with international accepted rules (like ILAC [3]),
- periodic audits from a NB in order to check their availability and capability to performed the necessary tests for ensuring the ESRs
- having personnel with proven experience concerning the fireworks technology for manufacturing, handling and testing

REFERENCES

[1] Directive 2007/23/EC of the European Parliament and of the Council of 23 May 2007 on the placing on the market of pyrotechnic articles, Official Journal of the European Union, page L154/1-21, published 14 June 2007

[2] IAF - International Accreditation Forum: Accreditation reduces risk for business and its customers by assuring them that accredited bodies are competent to carry out the work they undertake. Accreditation bodies which are members of IAF are required to operate at the highest standard and require the bodies they accredit to comply with appropriate international standards. Certificates issued by bodies accredited by members of the IAF Multilateral Recognition Arrangement (MLA) are relied upon all over the world because the MLA assures customers that the certificate is credible.

[3] ILAC - International Laboratory Accreditation Cooperation, equivalent to IAF for testing and calibration laboratories