TWENTY YEARS OF ENFORCEMENT OF EXPLOSIVES SAFETY REGULATIONS IN FRANCE IN VIEW OF AN EUROPEAN UNION DIRECTIVE

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ABSTRACT

IPE (Inspectorate for Propellants and Explosives) has been providing for decades the technical expertise to the french departments of labour, environment and defense in order to enforce explosives safety regulations and particularly since 1979. Activities concerned are either civilian (space, automobile safety, explosives for mines and quarrels, fireworks, anti-hail, avalanche release, ...) or military (manufacturing, handling, maintenance and storage of high explosives, propellants, missiles and munitions). The activities covered exclude the use of these explosives or explosive components for their own explosive properties or effects. As far as transport is concerned, there are United Nations and European Union regulations.

The explosives safety assessment process consists in evaluating, for each phase of the operations considered, the risks faced by people manufacturing, handling and testing explosive goods as well as the danger for the environment of the explosives storages or processing areas. Probabilities of occurrence of accidents / incidents are proposed, either empirically or applying stringent approaches such as that applied in nuclear safety: an updated list of accidents / incidents and the steering of enquiring committees on major accidents may modify these probabilites, as necessary.

This approach is considered stringent by the industry but, till today, it has been ensuring the safety of the activities analysed and approved by the local representatives of the administration. It has been checked that, on one hand, there are less and less major accidents caused by explosives and, on the other hand, most of them (particularly those with fatalities) happened because the rules were not fully applied or the remarks not taken into account.

At last and in view of an European Union directive, a comparison between the major european approaches is attempted and proposals are made for its draft.

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1. THE FRENCH APPROACH AS REGARDS EXPLOSIVES SAFETY

As early as 1928, a law imposed in France for storage magazines the respect of Q/D safety distances (Q standing for the TNT equivalent quantity of explosives) between each other in order to prevent sympathetic detonation and also between storage magazines and other buildings, including civilian buildings or houses. These distances came from the NATO approach which took account of Q/D distances between magazines on the basis of an extensive scale 1 testing database. Many of these tests were carried out in the USA. Hence, the origin of the distances of $0.5\ Q^{1/3}$ and $2.4\ Q^{1/3}$ for designing storage magazines on a given zone.

In 1979 and 1980, a decree (décret 79-846) regarding the protection of workpeople against the specific risks to which they are exposed in explosives storages and processing areas was issued: it extended the previous approach to the other donors and imposed a comprehensive set of rules and minimum distances between all donors and acceptors, from the building to the workshop down to the individual workplace. The activities concerned are either civilian (space, automobile safety, explosives for mines and quarrels, fireworks, anti-hail, avalanche release, ...) or military (manufacturing, handling, maintenance and storage of high explosives, propellants, missiles and munitions). The activities exclude the use of these explosives or explosive components for their own explosive properties or effects, e.g. use in service. As far as transport is concerned, there are United Nations and European Union regulations.

It means that a so-called "étude de sécurité pyrotechnique", standing for explosives safety analysis, has to be drafted by those in charge of the activities for approval within 3 months by the local labour and / or environmental administrations. These administrative levels have to request the technical expertise of IPE for activities managed by industry. The Ministry of Defense departments have their own approval authorities and advice is given by IPE on request. This file takes account of the environmental explosives safety aspects, hence applying the European Union directive Seveso on the protection of the environment.

One of the specificities of the french regulations regarding explosives safety is the approach chosen in order to determine the minimum distances to be respected between a so-called "potential explosion site - PES" or "donor" building or facility and another one called "exposed site - ES" or "recevor" subject to the hazards initiated by the donor. These distances are functions of the potential damage caused by the explosives incident / accident but also of the yearly probability of occurrence of such an incident / accident. Four steps are necessary in order to check if the building or the facility, considered as a "recevor", meets the regulations applied to the whole environment, considered as a complex and multiple "donor". The four steps are as follows:

1.1. Determination of the hazardous zones.

The french regulations consider five hazardous zones, called Z_i (ie. Z_1, Z_2, Z_3, Z_4, Z_5) as a function of the damage probably inflicted to respectively people and facilities, as described below:

- Z_1: injuries are letal in more than 50% of the cases.
- Z_2: important injuries, potentially letal.
- Z_3: injuries.

- Z_4: injuries are possible.
- Z_5: very small probabilities of light injuries.

- Z_1: very important damage.
- Z_2: important damage.
- Z_3: light and average damage.
- Z_4: light damage.
- Z_5: very light damage.

The extent of these zones depend obviously on the nature (which explosives?, which hazard divisions?, which type of charge?) and of the quantity of explosives at their origin but also on the nature of the ground, the protection devices set, etc ... Formulae enable in simple cases to calculate these zones with simple hypotheses (flat ground, no protection devices) but modifications may and even in some cases are to be taken into account at the frontier of these zones because of particular properties of the explosive charge and its environmental conditions.

1.2. <u>Determination of the yearly probability of occurrence of an explosive incident / accident.</u>

As a function of the nature of the explosive goods potential cause of the explosive event in a given facility and the type of operations taking place, the yearly probability of an event P_j has to be estimated or calculated (P_1, P_2, P_3, P_4, P_5 standing respectively for extremely rare, very rare, rare, rather frequent, frequent). They mean: $P_1 < 0.0001$, $P_2 < 0.001$, $P_3<0.01$, $P_4<0.1$, $P_5>0.1$.

They have not to be confused with the probabilities P_1, ..., P_5 referred to in the NATO AOP 15 and relative to munitions.

Three evaluation methods of these probabilities can be applied:

- the first one is intuitious and is based on experience; it refers to the following examples which should be used as a guideline, particularly in order to compare activities with each other:
  - P_1: Storage of packaged goods and handling of goods (excluding primary explosives) in packages qualified for transport.
  - P_2: Packing, mixing, drying, casting and loading in cartridges of low sensitive goods and handling of these goods in transfer containers. Some tightly-controlled nitrations.
  - P_3: Phases when explosives are at certain times directly exposed (manufacturing of explosives, nitrations, ...), mixing, drying, casting and loading in cartridges of sensitive explosives and handling of these goods in transfer containers.
  - P_4: Process on explosive goods with very sensitive compositions or dry primary explosives. Manufacturing of primary explosives.
  - P_5: Mixing and compression of primary explosives

These examples do not cover all types of activities, e.g. the probability of the combustion to explosive reaction transition during the combustion test of a rocket motor.

- the second one is empirical and is based on statistics on real experience, e.g. the probability of accident in a dynamite magazine can be drawn from the statistics available in the whole manufacturing industry of dynamite or the probability of an incident in a small arms ammunition plant can be based on a high number of objects manufactured and facilities used. But who knows perfectly these statistics? Given the fact that experience is known for only several years or tens of years, the absence of accident can not reliably prove that the probability of an accident happening in the next year of activities for the operation considered is significantly lower than P_4 (it is reminded that this probability corresponds to a maximum of an accident occurrence in a period of 10 to 100 years). One will easily understand that only P_3, and particularly P_4 and P_5 can be proved by the second method.

- the last one is analytical and deals with each step of a process.

Of course, most of the times, the three methods are applied in order to estimate the probabilities of accidents. But common sense is the most useful and the cheapest tool, either for the requestor or for the technical approval authority.

1.3. Inventory of the environment (ie. the neighbouring facilities)

The following list describes the three various categories of facilities to be protected versus the effects of an accident caused by a given facility, called "a_0" (that includes its necessary nearby access lanes and annexes).

a) Facilities or places inside an explosives plant

- a_1) explosives facilities (working places, workshops, depots, magazines) as well as their accesses and annexes which have to be set near a_0
- a_2) explosives facilities, but not to be considered as "a_1".
- a_3) buildings and facilities with activities not dealing with explosives.

b) roads outside an explosives plant

- b_1) low level trafic (under 200 vehicles per day)
- b_2) frequent trafic (between 200-2,000 vehicles per day)
- b_3) very frequent trafic (above 2,000 vehicles per day)

c) buildings and places outside an explosives plant

- c_1) uninhabited building not frequently visited (shelters in gardens, farm goods depots, ...)
- c_2) buildings inhabited or visited, linked to the plant or single houses.
- c_3) industrial, commercial or farm facilities or buildings inhabited or visited, not necessarily linked to the plant. Above ground water or utilities distribution, such as high and average voltage electrical networks, tanks and pipes for inflamable goods, air-pump networks, ...
- c_4) meeting places for people (stadiums, worship places, markets, schools, hospitals, ...) , densely-populated places, high buildings or buildings serving as mitigators.

1.4. Checking that a recevor facility meets the rules.

The following table yields all the situations meeting the french explosives safety rules, as a function of the type of danger and of the probability of accident, caused by a facility "a_0". As a consequence, different groups of people / facilities benefit from different levels of protection. In particular, some situations / activities are allowed but with restrictions.

Types of risks facilities can be submitted to

	P_1	P_2	P_3	P_4	P_5
Z_1	a_0	a_0	a_0(*)	a_0(**)	a_0(**)
Z_2	a_1, a_2	a_1, a_2(*)	a_1	a_1(*)	a_1(**)
Z_3	a_1, a_2, a_3 b_1 c_1	a_1, a_2 b_1 c_1	a_1, a_2	a_1	a_1(*)
Z_4	a_1, a_2, a_3 b_1, b_2 c_1, c_2	a_1, a_2, a_3 b_1, b_2 c_1, c_2	a_1, a_2 b_1 c_1	a_1, a_2	a_1
Z_5	a_1, a_2, a_3 b_1, b_2, b_3 c_1, c_2, c_3	a_1, a_2, a_3 b_1, b_2, b_3 c_1, c_2, c_3	a_1, a_2, a_3 b_1, b_2, b_3 c_1, c_2, c_3	a_1, a_2, a_3 b_1, b_2, b_3 c_1, c_2, c_3	a_1, a_2, a_3 b_1, b_2, b_3 c_1, c_2

(*) means that the staff necessary for the facility considered should not be submitted more than 10% of his / her standard working time to hazards similar to those faced in this facility.
(**) means that nobody should be in the zone considered.

2. STATISTICS REGARDING EXPLOSIVES SAFETY IN FRANCE

2.1. Historic accident scenarios

The following examples are interesting. The more stringent currently applied regulations would make very unlikely the situations which led in the past to these scenarios:

- during grenades demilitarization operations in the 1990es, one grenade accidently detonated in the bottom of a hole (others sympathetically detonated) leaving one man dead; the detonation front and fragments traveled over the heads of 4 other staffs who were just injured. One should know how explosives and charges aged before disposing them.
- in the Saint-Chamas TNT manufacturing plant in 1936, fire began in the manufacturing line and spread to other workshops or buildings. At some point, melted TNT got confined. Because there was a gentle fire, a crowd of firefighters and curious people gathered. The fire had been taking place for a long time when a detonation occurred, caused by confined TNT: the deathtoll was 40 people. This detonation was unexpected, hence the number of onlookers allowed on-site. Now, this situation would be forbidden and the number of people close to the site restricted to a minimum.
- during WW2, a train fully loaded with gun-cotton stored for years in bad conditions and transported also in bad conditions was allowed to enter the Ripault gunpowder plant. There were too many people present in the unloading zone and neighbouring magazines. The current rules would not allow such a situation that caused 50 fatalities and the destruction of the magazines, which were also too close to the platform, playing the role of detonation relays.

2.2. The period 1990-1997

These statistics do not take account of accidents relating to operations when explosives are used for their specific effects, as highlighted previously. The average deathtoll in the years 1990-1997 is 4 persons per year. As of 20 July 1998, the most recent fatal accident dates back to September 1997. The improvement is significant when one compares the current situation with the situation of the 1970s or earlier: the probabilities of accidents were higher and the consequences were often fatal because no efficient organization or protection of the working places was set (due to the lack of a comprehensive risk assessment).

2.3. The year 1997

For the year 1997, statistics are as follows:

- 6 fatalities (including 5 onboard the Marine Nationale (French Navy) ship "La Fidèle" during demilitarization operations and one during fireworks storage /manufacturing;
- 8 badly hurt people;
- 14 lightly hurt people.

The number of events addressed in 1997 is about 40% lower than those relating to previous years. This fact is difficult to analyze but the same trend is verified for the first half of 1998. Either there are less events forwarded to IPE or there are really less accidents. In that case, one could suppose that this might be due to a lower level of activities but only defense has suffered a significant decrease of activities, particularly the manufacturing of munitions. Space, pyrotechnics and automobile safety most probably compensate most of the decrease of defense activities.

Among the 21 major accidents or incidents analysed for 1997 (half of them involved manufacturing of explosives or explosive charges):

- 14 had no consequence on people
- 5 caused casualties
- 2 caused fatalities (munitions demilitarization, fireworks storage / manufacturing)

The total number of accidents with casualties or fatalities represent a third of the total number, which is a steady proportion over the years.

2.4. Some conclusions

Most of the accidents with fatalities take place because:

- explosives safety rules are not applied (either at the building level or at the working facilty considered),
- or explosive components / objects are not well known particularly after ageing,
- or people involved have no specific knowledge regarding explosives or explosives safety.

In case the regulations are applied and if an accident takes place, the consequences on the staff and the environment are much less grave than in case the regulations are not applied.

3. DISCREPANCIES BETWEEN THE FRENCH AND THE OTHER APPROACHES

The annex text attempts at highlighting the main characteristics of other european explosives safety rules and in particular some differences with their french counterpart. The investigation could not reach all its objectives, e.g. make a comparative assessment of the statistics on accidents or on the hazardous zones for the main categories of recevors. Part of the text of annex 1 may look wrong or misleading because it was difficult to know who had the best view in a country. As a conclusion of the investigation, it is difficult to compare the other ways of working, in particular the safety standpoints.

Nevertheless, there are situations which are, as of today, fully acceptable in other countries, whereas it would not have been the case at all in France because, in case of an accident, too many people unnecessary for the operations could have been involved. The following examples have been collected after accidents reports or during visits made by several french staff in charge of enforcing explosives safety regulations within the french MOD or industry. They are as follows:

- assembling of large caliber missiles: at least 10 missiles were laid near each other without any protection, such as buffers or armoured walls in order to protect the neighbouring missiles and their operators; in case a missile burns or detonates (these events can not be ruled out in a risk assessment, even if the Safe and Arming Device is not set), the total number of missiles would have been involved as well as the whole staff present in the workshop;

- assembling of explosive charges: during the visit by a high number of outside people (more than 10), the activities were not stopped; in case of an accident, far too many people would have been concerned;
- disposal of rocket motors: during the research of the best method for disposing old rocket motors, a complete rocket motor was put in an oven with the presence of about 10 people; the rocket motor began to burn and then propelled in the workshop where 3 people died; in France, such an operation would have been considered dangerous (hence a high probability of accidental event) because the object was not known (particularly its ageing) and therefore carried out at a safety distance and behind walls;
- electrical testing of rocket motors: even without the SAD, the operation should be considered dangerous and only one person should be allowed in the vicinity.

4. CONCLUSIONS

As far as France is concerned, specific and rather stringent rules have been applied for nearly 20 years now. The french approach differs from the other european approaches partly studied because it refers to probabilities of occurrence of accidental events and considers more hazardous zones where different activities (related to explosives or not at all) can be conducted or not; hence, the french approach looks more flexible (i.e. no "yes or no" answer) and in most of the cases rather stringent according to the industry. Statistics regarding fatalities show a decrease due to the new regulations (compared with the period before 1980) but the period of enforcement is not long enough to show that this number is significantly lower than in countries where the regulations are not as stringent. Anyway, the explosives industry is less dangerous than most of the other industries in France.

Each european country studied seems to benefit from a specific explosives safety law to be applied to explosives storage and processing areas in order to protect the workpeople, the plants and their environment or neighbourhood. Some of the laws are very recent. It is difficult to understand to which extent and how the law is applied in other countries. There are many commonalities, particularly at the workplace standpoint. Discrepancies can be noted relative to safe distances: depending on the hypotheses, they can be more or less stringent. It was not easy to collect statistics regarding the accidents due to explosives because, most of the times, those regarding minor accidents are not disclosed outside the country. Nevertheless, it seems that the number of fatalities in explosives processing areas keeps at reasonable levels, probably as in France. Here again, it was difficult to make a reliable comparison because the level of activities was not known. Several visits highlighted the fact that situations considered daily as normal and safe in other countries would not have been approved in France. This is why, even if the probabilities of accidental events are probably not higher in other countries, consequences could be catastrophic because of the involvement near the site of an accident of unprotected workplaces and of too many people.

The EU directive "Minimal rules for improving the safety and the health of people in charge of manufacturing, storing and using explosives" being prepared for 4 years could take account of the best parts of the regulations of its member nations and, at the same time, be a serious and cost-reasonable compromise. This directive should be an opportunity to highlight the aspects for which no waivers are possible and to take account of the probability of accidental events for the most dangerous operations and situations. Exchange of data relative to accidents could highlight these dangerous situations for the benefit of all members. Twenty years of enforcement of rather stringent explosives safety rules in France could help understand which aspects can be easily enforced and at which cost, set priorities and provide reliable technical solutions, as necessary. IPE is ready to exchange views, data and ideas in order to improve explosives safety in France and Europe.

ANNEX

APPROACHES IN OTHER EUROPEAN COUNTRIES-

This text attempts at highlighting other european explosives safety rules and in particular the differences with the french rules. The investigation could not reach all its objectives, e.g. make a comparative assessment of the statistics on accidents and the safety zones for the main categories of recevors. Part of the text may look wrong or misleading because it was difficult to know who had the best view in a country. IPE apologizes but the whole paper has been drafted in order to have a better understanding of each other's way of working in order to help those in charge of the draft of the EU directive "Minimal rules for improving the safety and the health of people in charge of manufacturing, storing and using explosives" .

BELGIAN APPROACH

There is in Belgium a SDE ("service des explosifs de Belgique", or Belgian Explosives Department) in charge of enforcing the regulations dating back to 1956 "Loi relative aux substances et mélanges explosibles ou susceptibles de déflagrer et aux engins qui en sont chargés", standing for "Act relating to explosive substances and mixtures and charges containing them ".

In case of an application, the applicant has to mention the type of activities in each building, the means to mitigate the effects for those inside the plants and those outside, the number of workpeople. There is an attachment to the law dated January 1995 dealing with a comprehensive list of relevant data to be made available when an explosive is designed, manufactured, stored and supplied.

The "service des explosifs" has to be reported all the accidents (fire, inflamation, decomposition, explosion) during manufacturing, storing and transport. Inspections are conducted by civil servants from the SDE and the "ingénieurs des mines".

BRITISH APPROACH

The explosives acts 1875 and 1923 modified by various statutory instruments and "a guidance for applicants for a license for an explosives factory and magazine" published by Health and Safety Executuve in April 1997 are the key documents ruling on the safety standpoint the activities taking place in an explosives factory or magazine.

The guide to the explosives act 1875 for licensing of factories and magazines for gunpowder mentions that an applicant for a license should specify the boundaries of the land forming the site of the factory, the quantity-distances required between the explosives buildings and other buildings on the factory site as well as beyond the factory. the situation, character, construction of the buildings and works connected with the factory or magazine, the clear specification of the size and location of buildings and limitations on the quantity and hazard type of explosives to ensure that internal separation distances are met; the nature of the processes to be carried on in the factory, the amount of gunpowder and of ingredients to be allowed at the same time in any building or machine, the situation of each factory magazine, the maximum number of persons to be employed in each building. The application of these successful ancient explosives safety procedures have been extended nowadays to the other explosives. According to explosives safety managers working for the franco-british joint-venture Matra Bae Dynamics, most of the items are addressed the same way by the new french rules.

On the one hand, in a QRA-based license, estimates of the probability of an explosives event (maximum expected frequency of accidental initiation) and of the expected lethality consequent of the maximum credible event are made and yield the maximum annual risk of fatality for an individual at each site exposed to the hazards from handling and storing explosives.. On the other hand, in a simple Q/D license, the safe distances consider both inside (magazines containing explosives or process buildings) and outside buildings / activities and refer only to the hazard division of the donor and its NEQ (net explosive quantity) (mounded or unmounded).

Nowadays, as far as the civilian activities are concerned, it is up to the HSE to accept or reject the application through the Chief Inspector of Explosives, before it is presented to the local authority for final assent, assent with conditions or dissent.

In the case of military facilities, the MOD/Procurement Executive plays the role of the HSE. Each MOD service has an organization implementing the rules (e.g. CINO for the Navy). ESTC is the MOD adviser and has issued a leaflet on "Procedures for licensing MOD explosives facilities" in 1994.

DANISH APPROACH

A Danish regulations for fireworks has been studied. General regulations look similar to these applied in France. There are also safety distances to be met with neighbours, schools, and trails. For example, a storage magazine containing 5,000 kg (Hazard division 1.3) should be at least at a distance of 5 m from neighbours and from the middle of the roads /trails, whereas in France, a minimum of $2 \times 5{,}000^{1/3} = 35$ m (or in case the fireworks burn fast: $3.5 \times 5{,}000^{1/3} = 60$ m) would be required.

ITALIAN APPROACH

Italy has a law dated 19 september 1994 "Il testo coordinato del decreto 626-bis" dealing with the protection of health and safety for workpeople in all sectors of private and public activities. It has to be applied as from 1997. The company has to provide a risk assessment in particular when using machines. The case of multiple risk, probably taking account the neighbouring machines or magazines, is also addressed and various individual protection devices will be compulsory, in case technical prevention measures, collective protection means, work management / organisation methods have not suppressed the risk or decreased it to an acceptable level.

Each company has to register all incidents meaning at least one day of absence. INAIL is the organization in charge of compiling the data at the country level.

There is a law dated 1931 relative to public security "Testo unico e regolamento di pubblica siccurezza" updated in 1940 with a specific chapter relative to standards for facilities manufacturing explosive materials of the first (propellants), the second (dynamites) and the third (detonators) categories and an other chapter for fireworks (fourth category). The ministry of defense is in charge of its enforcement through the regional and central committees for explosive substances and inflamables.

The detailed safety manufacturing standards will be adapted soon to modern industry.

Stringent safety distances in particular with the neighbourhoods (roads, railways, schools, hospitals, scattered houses, etc...) are requested. These distances can be modified according to the presence of obstacles or shelters.

The distances to be respected between magazines and the neighbourhood depend on the kind of buildings / areas and the type of explosive. The distances to be respected are $d = K C^{1/2}$, C being the weight of explosive and K depending on the type of explosive donor and the type of recevor and varying between 1 and 15. In the case of a city and for 10,000 kg of dynamite, the distance is 1,500 m whereas France would request $44 \times 10{,}000^{1/3} = 950$ m.

The distances to be respected between single facilities or between magazines and laboratories are $d = K C^{1/2}$, K depending on the type of explosive donor and varying between 0.3 and 3. For example, in the case of 1 kg of nitroglycerine-based dynamite worked on a facility, the neighbouring workplace should be at a minimum distance of 1 m (between the outer limits) whereas a distance of $5 \times 1^{1/3} = 5$ m would be requested in France (between the centers). According to the dimensions of the facilities considered, it can mean the same or be even more stringent. In the case of 100 kg, the distances would be respectively 32 and 50 m for Italy and France.

NATO APPROACH

NATO has been applying for decades regulations regarding its storage magazines. About 6 generic types are considered as donors and acceptable Q/D are given as a function of the quantities of explosives (donor and recevor) for about 20 generic types of recevors, mainly storage magazines (15 storage magazines, 3 buildings, 1 road, 1 house outside).

Unlike the french approach taking account mostly of naked charges unless protections are considered efficient (walls, ground buffers, doors ...), the NATO approach takes account of the detailed construction type of the donor and the recevors (doors, recevors).

There is underway within NATO work on an explosives safety risk assessment (a manual AASTP 4).

SPANISH APPROACH

Spain has issued on 8 november 1995 a law on the prevention of risk at work (safety and health) completed by the royal decree 230/1998 dated 16 february 1998 regarding the rules to be applied to explosives "Reglamento de explosivos".

The "Instituto nacional de seguridad e higiene en el trabajo" del Ministerio del Trabajo y Asuntos Sociales has a key role for enforcong this law, as well as analysing safety during work and keeping statistcs on casualties and fatalities. For the period 1990-1996, an average of 10 accidents with fatalities per year was observed (the total number of fatalities is not known).

The risks are assessed as a function of the nature of the activity, in particular in comparison with special risks. There is a detailed risk assessment prescribing some minimum distances or maximum quantities of explosives stored or transported as well as other protections, either passive or active. There is also a comprehensive set of rules relative to manufacturing and storing. In case of change of the chemical substances or mixtures or of the organization of the working position, the risk assessment will be resumed. The employer has to provide the employees with sufficient protection devices, in case the hazard can not be avoided.

In particular, distances betwen the donors and the recevors are d = K Q 1/3, Q being the weight of explosive and K depending on the type of hazard division of the explosive donor and the type of recevor and varying between 4 and 76. For example, for hazard division 1.1 and in case a city is the recevor, the distance to be requested with a magazine or facilities containing Q is 34 $Q^{1/3}$ whereas France requests 44 $Q^{1/3}$. In case the recevor is a road, Spain and France request respectively 20 $Q^{1/3}$ and 8 or 15 $Q^{1/3}$.