SAFEX NEWSLETTER
No. 29, 2nd Qtr. 2009

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About this Newsletter

We intend bringing a new feature on the front page, *This is Your Captain Speaking*, as all our Governors have now been introduced in past Newsletters. In this feature we hope to get leaders of organizations with a stake in explosives manufacture to share their safety philosophies and approaches with us. Many members participated in our survey about the Interim Event which the Board proposed to hold between Congresses. The results of this survey are summarised under *SAFEX Events*. The other new feature is *Get to Know the Expert Panel*. This Panel is a valuable SAFEX resource and we would like members to know more about its capabilities. Phil Lightfoot elaborates on the new UN 6(d) test in *Research Notes from CERL*. In *Our Regulatory World* Ben Barrett discusses the shipping of explosives by air. Because hand safety has been an issue in some recent incidents, we focus on it in *Safety Snippets*.

We hope you find this Newsletter of interest and look forward to receiving your contributions and suggestions for improving it.

This is Your Captain Speaking

Let's Talk Safety

Having battled through airport security you had to rush to the gate from which your aircraft is about to depart. You are one of the last to board the aircraft and struggle to find a place for your cabin luggage in an overhead bin. As you sit down in your assigned seat you hear the doors of the aircraft close and are relieved you made the flight in time. Your thoughts are interrupted by a voice over the intercom system: "This is your captain speaking." His voice is calm and confident as he welcomes you aboard. You feel a sense of assurance especially when he goes on to say: "My first priority is to get you to your destination safely. For that I can rely on the help of our First Officer up here in the cockpit with me. We are ably assisted by the cabin crew who will do everything they can to ensure your safety and comfort during the flight." My safety is the crew's priority - what a comforting thought!

While airline safety has been much in the news lately, air travel is still one of the safest forms of transport. The airline industry isn't perfect or necessarily the standard to follow. It has its incidents; some with enormous consequences as we know too well. However, it does take extraordinary measures in the design, construction, maintenance and operation of an aircraft to ensure its safety. Notwithstanding the importance of these "technical" measures, the commitment of the captain and his crew to safety remains paramount. In the airline industry safety is undoubtedly a business imperative.

We can draw all sorts of parallels between the safety culture of the explosives and airline industries. The question is do our stakeholders (employees, customers, suppliers, the public at large, etc.) believe that safety is a business imperative in our industry. Is safety also paramount in the lives of our captains and crews? As a regular feature in the SAFEX Newsletter we would like to give captains in our industry a chance to share their safety perspectives and beliefs. We, therefore, invite leaders from our member companies, industry associations, standards authorities and even major customers and suppliers to give us in about 500 words (roughly the length of this article) their personal views about safety in our industry. Do they have a personal safety philosophy? How do they implement that philosophy in their organisation? What would they like to see happen in the industry and how do they believe we can achieve it? They will be free to address any issue to convince stakeholders that safety is a priority for their organisation's captain and crew - that it is a business imperative as in the airline industry. Any senior executives reading this article should feel free to let the Secretariat have their views.

When those executives say "This is your captain speaking," what would they like to convey to those on board.

Incident Reporting

Monitoring our Reporting Performance

"Incident reporting is the life blood of SAFEX. Are you doing your bit to keep it alive?"

Incident reports provide SAFEX with the means of extracting learning points from the experiences of its members. By applying these learning points we can prevent a recurrence of similar incidents. Because of the importance of incident reporting we track our performance using the following charts:

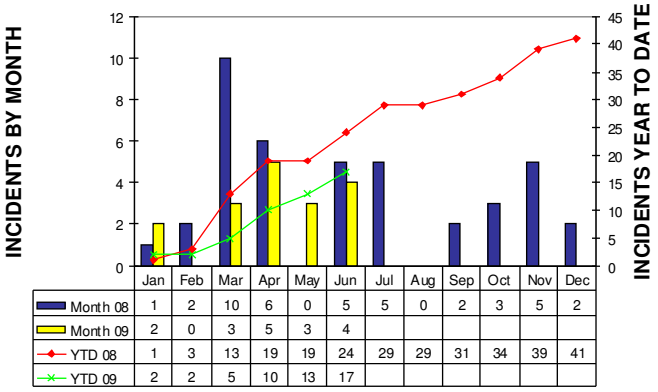
All the incidents reported. In this chart the sum of non-member and member incidents reported to SAFEX every month this year is compared to those of the previous year. There were fewer incidents reported in 2008 than previous years so 2008 provides a significantly lower base for comparison. Despite this lower base we have had even fewer incidents reported so far this year. Are we having fewer incidents or are we not reporting the incidents we are having? Every incident not reported is a lost learning opportunity. Remember, it's never too late to report an incident.

Member incidents reported. Incidents which Members experience are properly investigated and relevant learning points highlighted. Therefore, member incidents (MI's) give us the best learning opportunities and for that reason we track them separately in this chart. The chart uses an indicator we call PAR (a golfing term). PAR is an estimate of how many MI's are occurring based on the severity of the MI's reported. The gap between the number of MI's reported and PAR is our Reporting Gap. The Reporting Gap in the chart is insignificant which suggests that members are reporting most of the incidents that are taking place.

Contributors of member incidents. This chart identifies those members who have taken the trouble to report their incidents (MI's). It shows the number of MI's each of these members have reported relative to the total number of MI reports received. The chart distinguishes between Groups and Companies merely to indicate the performance of the two membership categories. Each of these categories has about the same number of operating units.

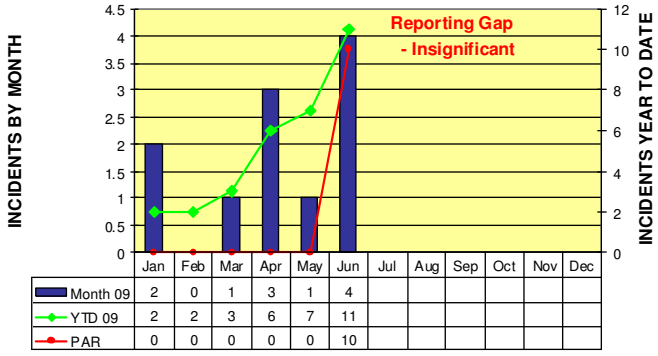
SAFEX is indebted to these members for making the effort to report their MI's.

ALL INCIDENTS REPORTED: 2009 vs 2008



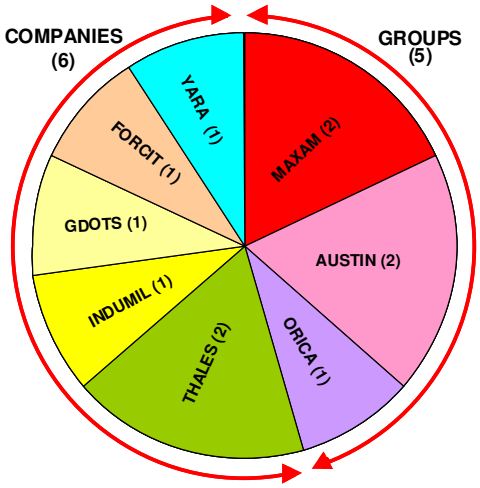
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Month 08	1	2	10	6	0	5	5	0	2	3	5	2
Month 09	2	0	3	5	3	4						
YTD 08	1	3	13	19	19	24	29	29	31	34	39	41
YTD 09	2	2	5	10	13	17						

MEMBER INCIDENTS REPORTED: 2009



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Month 09	2	0	1	3	1	4						
YTD 09	2	2	3	6	7	11						
PAR	0	0	0	0	0	10						

CONTRIBUTORS
MEMBER INCIDENTS: YTD JUN 2009



SAFEX Events – Interim Event

In our previous Newsletter we reported that the Board of Governors is considering holding an Interim Event between the 3-yearly Congresses. It was suggested that the first Interim Event should be a 3-day Training Course that focuses on developing HS&E leadership in line management. The Course will target competencies to help line managers and HS&E professionals contribute directly to the bottom line of their companies through improved HS&E performance. The Course will be conducted in English and SAFEX will cover the cost of this, the first Course. However, travel and accommodation expenses will have to be borne by the participants themselves.

Survey Preliminary Results Available

Background

The Board wanted to know:

- How SAFEX Members feel about the concept of an Interim Event between Congresses.
- The possible Member support for the Training Course. This will include HOW MANY participants are interested as well as WHEN and WHERE it should be held.

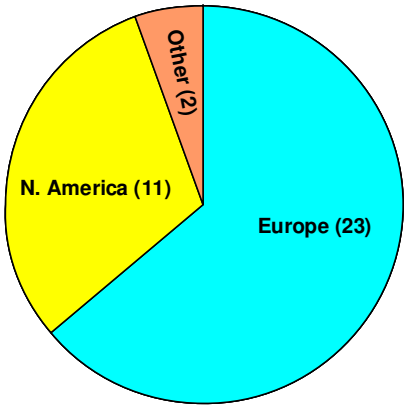
The Survey

To assist the Board we asked our members for their views in a Survey that was sent earlier this quarter to 6 Group members and 55 Company members. We received replies from 5 Groups and 27 Companies giving us in total just over a 50% response.

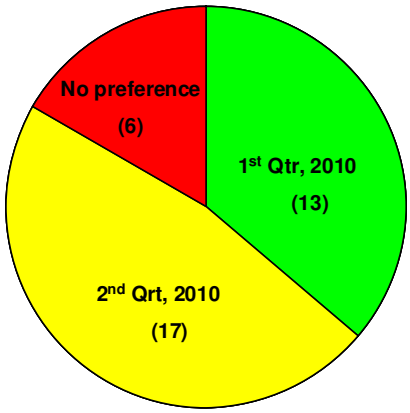
Interim Event – the concept

Most of the entities (87%) supported the idea of an Interim Event between Congresses. Remember for the purpose of this exercise we regarded the Groups as a single entity and not a collection of operating units as we normally do. The biggest reservation among those that opposed the idea was the additional cost associated with it. Those in favour expressed very much the same sentiments we picked up in the Congress feedback. This can be summarized as a need for more frequent get-togethers to exchange experiences.

Location Preferences



Timing Preferences



Training Course

20 of the 32 entities that responded were interested in participating in the proposed Training Course. The estimated number of participants from interested members amounted to 36 (13 from Group and 23 from Company members). The charts alongside illustrate the preferences for WHERE and WHEN the Course should be held. Once the Training Task Group has finalized its plans for the Course, we will be notifying all members of the details. Members will then have another opportunity to indicate whether they are interested in participating. Depending on the demand for the Course and the availability of resources, we can consider running more than one class – perhaps in different locations.

Course Content

As this is a specialized course, SAFEX will have to compile the training materials with the help of Member companies, Associate Members and Expert Panel members. Session facilitators will also be drawn from members of the SAFEX community. We have already had offers of material from members and will be approaching them for more details in due course. SAFEX will also issue a certificate to participants who successfully complete the Course

Get to Know the Expert Panel

The **Expert Panel** comprises individuals who were nominated by members and approved by the Board. Such an individual must be associated with the explosives industry and have acquired expertise in specific fields. He must also be willing to make his expertise available to SAFEX members as a consultant. The commercial basis will be agreed between the Expert and the Member. SAFEX merely "connects" the Expert and the Member who has a need and does not get involved in the detail arrangements.

To access the services of a SAFEX Expert, a client Member accurately defines the need it wishes the Expert to address. This requirement is captured in a Brief which is e-mailed or faxed to the Secretary General. The Member will be notified of the details of those Experts that could meet this need. It is then up to the Member to select an Expert and enter into an agreement directly with him.

Brian Allison

PERSONAL

Position: Director
Company: B.A. Projects Ltd.
Location: Scotland, UK
Education: BSc Mech Eng (Hons) - Stratchclyde (1971)
Affiliations: Institute of Mechanical Engineers
Languages: English;

CAREER OUTLINE

With ICI Explosives:

- Research /Development Engineer
- Project Engineer / Project Manager
- Explosives Engineering Manager

With ORICA Europe:

- Explosives Project Manager
- International member Pump Panel
- International member Packaged Emulsion Panel
- European Engineering Manager

EXPERTISE

- All aspects of explosives project management and implementation.
- Explosive factory, plant and special purpose machine design
- Incident investigation, hazard studies, auditing
- Training

TYPICAL ASSIGNMENTS

1996 – 1997	Project Manager Packaged Emulsion Plants
1996 – 2004	Engineering audits, hazard studies, due diligence exercises in Europe
1998 - 2002	Project Manager bulk emulsion plants, Eastern Europe.
2004 – 2005	Special decontamination and site remediation Projects,
2006	Packaged emulsion plant design review
2007 – 2008	Project Manager PETN Plant project, U.S.A.

Research Notes from CERL

Towards a better understanding of the new UN 6(d) test

Dr Phil Lightfoot

Introduction

There has been a lot of interest in the new UN 6(d) "Unconfined package test" for 1.4S classification. After much debate over a number of years, the new test has now officially been adopted and will be incorporated in the next versions of the UN Transportation of Dangerous Goods Manual of Tests and Criteria and the UN Transportation of Dangerous Goods Model Regulations [1,2].

Ben Barrett has provided a couple of nice updates on the status of the new test in the SAFEX Newsletter over the last two years [3,4], largely from a regulatory point of view. The purpose of the present article is partly to provide a summary of the final version of the 6(d) test which was adopted at the last meeting of the UN Sub-Committee of Experts on the Transportation of Dangerous Goods (UNSCETDG) in December 2008, but mostly to provide some insight into the extensive technical discussions that typically accompany a proposal for a new UN TDG test.

In Canada, we have a particular interest in the 6(d) test, as the proposal originally came from Canada and we have been heavily engaged in moving it forward, both through the efforts of our representatives at UNSCETDG meetings and technical work at CERL. The many working papers and information papers that the "expert from Canada" and others have presented at UNSCETDG meetings can be found on the UN TDG web site (http://www.unece.org/trans/main/dgdb/dgsubc/c3age.html). What follows is not completely unbiased, but I will try to be objective.

Why a new test was needed

There was a lot of debate over whether or not a new test was needed and it is not my intention to get into all the pros and cons here. However, it is important to note that the UN TDG system does not use the concept of risk. Although it is obviously very unlikely that there would be accidental initiation of, e.g., a detonator in transport, it means the UN TDG scheme is only interested in the potential consequences of such an event. From our point of view, the need for the test comes directly from the definition of Compatibility Group S:

Substance or article so packed or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder or prohibit fire fighting or other emergency response efforts in the immediate vicinity of the package.

Most applications of the 1.4S classification are for articles, rather than substances, so I will refer only to articles from here on.

The effects of fire on packages of articles have been evaluated using the 6(c) test (bonfire test) for a long time. The 6(c) test is well established and largely addresses the hazards that might be faced by first responders during an incident. Until now, the 6(c) test has been the only test used to establish 1.4S classifications. However, the 6(c) test does not look at the situation where the package has not been degraded by fire: typically, articles are initiated once the fire has burned through the packaging. Furthermore, articles are initiated by fire in the 6(c); accidental initiation by any other means is not considered. This is important, as a 1.4S classification has important ramifications, providing significant relief from transportation regulations in many cases. An extreme case, often quoted, is the ability to transport 1.4S packages on passenger aircraft. The question then becomes not one of whether fully-equipped first responders can safely approach a fire, but one of whether an accidental initiation would endanger the passengers and crew of an aircraft. The standards of due diligence expected by the public are very different in the two cases.

The 6(a) test (single package test) looks at the effect of deliberately initiating an article in a package to determine whether there is a mass explosion hazard. As such, it does investigate the effects of accidental ignition of an article in packaging that has not been degraded by fire. Unfortunately, the 6(a) test is designed to simulate bulk transport and the package is buried under 1 m of sand or inert packages to provide the necessary confinement. As a result, many hazardous effects might easily be obscured. The assessment criteria for the 6(a) test are also not appropriate for the 1.4S classification.

As none of the existing UN TDG tests were considered to be adequate, another test was judged to be needed by the majority of the Explosives Working Group of the UNSCETDG. The new 6(d) test is essentially an unconfined 6(a) test, with a new set of criteria to define what it meant by "hazardous effect outside the package". Some details for both the test setup and the criteria to be applied are provided below. Note that this is not the official version of the test, which can be found in Reference 2.

Experimental details

The test setup is very simple and should not require a large test range, as the items to be tested are not expected to present a mass-explosion hazard. The following items are required: an appropriate initiation device (a detonator, the intended initiation device, or an igniter just sufficient to ensure ignition of the article), plus a sheet of 3.0-mm-thick mild steel to act as a witness plate. Video equipment may be used and has proved, in our experience at CERL, to be most helpful in evaluating the pass-fail criteria.

The test is applied to packages of explosive articles in the condition and form in which they are offered for transport. For packaged articles provided with their own means of initiation or ignition, the functioning of an article near the centre of the package is stimulated by the article's own means of initiation. Where this is impracticable, the article's own means of initiation is replaced by another form of stimulus having the required effect.

For packaged articles not provided with their own means of initiation, an article near the centre of the package is caused to function in the designed mode, or an article near the centre of the package is replaced by another article which can be caused to function with the same effect.

The package is placed on a steel witness plate on the ground without confinement (see Figure 1 below). The donor article is initiated and observations made. The test is performed three times, in different orientations, unless a decisive result (an obvious failure) is observed earlier.

The competent authority may wish to take into account the expected effect of the initiator when assessing the results of the test, if these are expected to be significant when compared to the articles being tested. Note that it is not required that the effect of the initiator be taken into account, if the competent authority decides that the effect is either negligible, or small compared to the effect of the article being tested. The intent here was to avoid always being obliged to do a control shot with non-reactive (dummy) articles.

Criteria and examples

The criteria adopted for the test were the subject of considerable debate, as might be imagined! In an ideal world, all criteria are easy to interpret and completely unambiguous. Sadly, we can not always reach this ideal state, but the intent is for a competent authority to be able to reach a decision. I should note that the final criteria are significantly more stringent than those we in Canada originally proposed, as result of discussions concerning the transport of 1.4S packages on passenger aircraft.

For the purposes of the 6(d) test, evidence of a hazardous effect outside the package includes:

Figure 1. Example of the experimental setup for the 6(d) test at CERL. The white material on the ground is a very effective Canadian solution for reducing the probability of grass fires!

(a) *Denting or perforation of the witness plate beneath the package.* It is fairly straightforward to determine whether a witness plate has been perforated, as can be seen in Figure 2 below, following the testing of a package of perforating charges. Denting of the plate is a little more subjective, but the intention is clearly not that the competent authority take a magnifying glass to the plate to see if there is a tiny dent in it.

(b) *A flash or flame capable of igniting an adjacent material such as a sheet of 80 ± 3 g/m² paper at a distance of 25 cm from the package.* This criterion created a lot of discussion at UNSCETDG meetings. The intention is to determine whether or not a package creates a significant ignition source outside the package. At CERL we do a lot of work with flammable gas mixtures, many of which can be initiated with sparks of a few millijoules, such as could be produced by an electrostatic discharge from the human body. It is not the intention of this criterion to go to such extremes. A transport truck filled with a sensitive flammable gas mixture would have plenty of other ignition sources to worry about. Similarly, it would not be appropriate to go the other extreme and choose as a reference a material that requires the steady application of a flame for several minutes in order to produce ignition.

Another issue that was difficult to resolve was the definition of "adjacent". When energetic articles are functioned in a package, it is often not clear where the flame, if there is one, will exit. Also, the top of the package will often pop open, causing proximate witness material to be disrupted. One can imagine building a framework, covered with flammable material, to surround the package at a fixed distance. Of course, then it would not be possible to see the package…
In the end, the judgment of whether or not a package passes this criterion is left to the competent authority, but an example is given of a sheet of paper of a particular weight at a certain distance. **Note that this is an example, not a requirement. It is not necessary to seek out 80 ± 3 g/m² paper and place it at a distance of 25 cm from the package.** It is our experience at CERL that video taping the test is more than sufficient to determine if there is a significant flash or flame outside the package. For example, some packaged power cartridges tested at CERL ignited one by one, producing flames up to 2-m high and ultimately consuming the entire package as in Figure 3 below. No ambiguity there.

(c) *Disruption of the package causing projection of the explosives contents.* The question that arose here is when does disruption of the packaging create a hazardous effect? In some cases, the result is quite clear. For example, when testing 19-g perforating charges in packages of 50 articles at CERL, initiating one of the charges typically led to the initiation of two or three others in the box. As a result, the packages were blown apart, scattering the remaining charges over a wide area. We considered this to be a hazardous effect, as the unreacted charges and the fragments from the casings of the reacted charges would clearly be hazardous to people in the vicinity of the package.

In contrast, when testing some electric detonators, the initiation of one of 50 detonators in a package did not cause any of the other detonators to fire and the only

Figure 2. Damage to witness plate following the testing of a package of perforating charges, each with a with net explosive quantity of 19 g

Figure 3:. Image taken during a 6(d) test involving propellant power cartridges. The box has burst open and there are obvious flames. In this case, the entire box and contents were subsequently consumed.

visible effect was to pop open one of the box flaps. We did not consider this to be a hazardous effect, even if the package was visibly disrupted.

(d) *A projection which passes completely through the packaging (a projection or fragment retained or stuck in the wall of the packaging is considered as non hazardous).* The wording here was chosen to emphasize fast-moving projectiles that pass completely through the packaging and that would present a hazard to someone or something close by.

Scope of the UN 6(d) test

The scope of the UN 6(d) does not include all articles that have 1.4S classification. It was agreed at the UNSCETDG that the test would presently only apply to eight of the entries in the Dangerous Goods List that have 1.4S classification: UN0323 (Cartridges, power device), UN0366 (Detonators for ammunition), UN0441 (Charges, shaped), UN0445 (Charges, explosive, commercial), UN0455 (Detonators, non-electric), UN0456 (Detonators, electric), UN0460 (Charges, bursting, plastics bonded) and UN0500 (Detonator assemblies, non electric). The rationale behind this decision is that these are the UN Numbers that are of most concern. There are other UN Numbers that have 1.4S classification and it was considered that it was unnecessary to have them to pass through the UN 6(d) test as they represent a lesser hazard. In the table that comprises the Dangerous Goods List, the UN Numbers that are subject to the 6(d) test will be marked as being subject to Special Provision 347, which reads:
"This entry shall only be used if the results of Test series 6 (d) of Part I of the Manual of Tests and Criteria have demonstrated that any hazardous effects arising from functioning are confined within the package." Of course, competent authorities, as always, have the ability to waive or require testing based on their judgment.

Conclusions

This short article reviews the new UN 6(d) "Unconfined Package Test", as it will be implemented in the next versions of the UN TDG Manual of Tests and Criteria and the UN TDG Model Regulations. The new test took a number of years to put in place and required extensive work in the Explosives Working Group of the UNSCETDG to bring it to this point. As part of the process, there were many technical discussions, and a multitude of working papers and information papers presented at UNSCETDG meetings. In this article, I have tried to provide a flavour of some of the technical considerations. There were necessarily a number of compromises made, and it would be an exaggeration to suggest that full consensus was achieved at meetings of the Explosives Working Group of the UNSCETDG, but a clear majority of the voting members were in favour of the new test. We in Canada certainly believe that the end result presents a significant improvement in the way we regulate the transportation of dangerous goods

References

[1] ST/SG/AC.10/36/Add.1 "Amendments to the fifteenth revised edition of the Recommendations on the Transport of Dangerous Goods, Model Regulations (ST/SG/AC.10/1/Rev.15) http://www.unece.org/trans/doc/2009/ac10/ST-SG-AC10-36a1e.pdf

[2] ST/SG/AC.10/36/Add.2 "Amendments to the fourth revised edition of the Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria (ST/SG/AC.10/11/Rev.4)" http://www.unece.org/trans/doc/2009/ac10/ST-SG-AC10-36a2e.pdf

[3] B. Barrett "Report from the UN Explosives Working Group – Update on 6(d) Test" SAFEX Newsletter #26, September 2008.

[4] B. Barrett "New 6(d) test approved" SAFEX Newsletter #23, December 2007.

Our Explosives Regulatory World

Shipping Explosive by Air

Ben Barrett

Ben Barrett, an Expert Panel member, is an independent consultant specializing in regulation of explosives. DG Advisor, Ben's consultancy, is dedicated to participation in the development and modification of international dangerous goods regulations and helping clients comply with US and international regulations. Ben also provides training in the handling of dangerous goods including that required by ICAO.

Results of a fire on a UPS aircraft.

Aftermath of a fireworks explosion on the Hanjin Pennsylvania ship. The ship suffered a significant explosion without sinking.

These photographs illustrate only one of the many differences that exist between shipments by air and the other modes of transport – road, rail and vessel. In case of an emergency, personnel can exit a truck or train, and vessels may confine an emergency to a compartment, or use life boats, and they can wait for rescue if necessary. But an aircraft is the only conveyance which is not on the Earth's surface, and loss of control implies immediate loss of life and property. As a result, most aspects of air transport are regulated more strictly than other modes, and dangerous goods ("hazardous materials" in the US) are likewise more strictly and prescriptively regulated.

International dangerous goods regulations for air are promulgated by the International Civil Aviation Organization (ICAO), based in Montreal. The ICAO Dangerous Goods Panel (DGP) promulgates these regulations, which are called the "Technical Instructions For "The Safe Transport Of Dangerous Goods By Air", otherwise known as the "T.I.". The DGP holds a plenary meeting biennially, with working group meetings occurring annually. The ICAO TI is published every two years, with the latest version dated 2009. Like the IMDG Code (SAFEX Newsletter No.28) for vessel transport, the ICAO TI harmonizes with the UN Model Regulations on Dangerous Goods. The changes coming out of the UN every two years are incorporated into the model regulations with a two year lag. For example, changes found in the 2009 edition of the UN Model Regulations would first appear in the TI in 2011, unless special measures are taken to advance the schedule, which recently happened with the 6(d) test, discussed later in this article. The International Air Transport Association (IATA) issues an adaptation of the TI called the IATA Dangerous Goods Regulations (DGR). The DGR is considered the "field guide" for the transport of dangerous goods by air, and contains all of the ICAO TI provisions and in addition contains specific operational requirements not contained in the TI.

Cover of the TI

Employees must be trained in the ICAO regulations every two years. In the US, training for other modes is required every three years, so ICAO is stricter in this regard. In-house training programs are available from various sources. If a suitable instructor exists within a company then an outside instructor is not necessary.

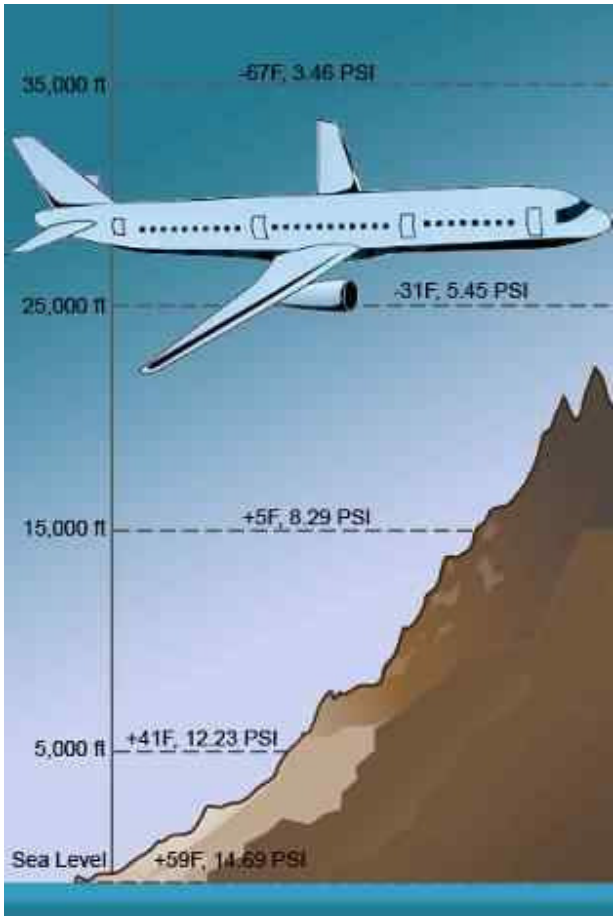
US shipments may comply with the TI instead of the US DOT Hazardous Materials Regulations (HMR) provided they meet the HMR requirements for emergency response information, employee training, security, packaging (for US exports) and registration (these requirements are listed in 49 CFR 171.22(g)). They must also include the additional shipper's certification in 49 CFR 172.204 for air.

The purpose of this dispensation is to allow shipments to change modes without changing the package or package markings and labels. Principally this allows all air shipments to arrive or leave from airports by truck without repackaging. When this dispensation is used, US importers must provide the forwarding agent at the place of entry into the United States with timely and complete written information as to the requirements of the HMR applicable to the particular shipment

In addition to the inherent hazard of traveling far above the earth's surface, aircraft are exposed to temperature and pressure variations that exceed those of the surface modes (highway, rail and vessel), which particularly impact liquid packages. These differentials may cause leakage, and packages of liquids must generally be tested to confirm their ability to withstand leakage under these conditions. Additionally, new clarifications are being enacted which will enforce current suggestions requiring absorbent material to be placed in every package for Packing Group I liquids. Packages, particularly for liquids, may also require redundant closure protection, such as tape or a seal holding a lid on tight. Explosive articles have the advantage of being inherently unlikely to leak. They are typically composed of solids and are thus less restricted with regard to leak prevention.

Passenger rated air shipments are more desirable than "cargo air only" (CAO). Passenger rated cargo may go on a passenger or a cargo airplane, but as the name indicates, CAO products may only shipped on cargo aircraft. Passenger aircraft fly more frequently and serve more locations than cargo aircraft. Some locations may not be served at all by cargo aircraft. CAO products must have a special label and documentation, and special requirements exist, such as limitations on overpacking.

Classification in the TI follows the UN scheme for Class 1. ICAO requirements were recently modified to require the new UN 6(d) test on 8 UN numbers of existing 1.4S products as of January 1, 2010. Any product not being tested by that date must revert to 1.4 other than S. However, some countries maintain a special classification system requiring government permission before shipment of explosives, and there the products may not be self-classified. The US has issued a proposed plan of handling reauthorization or reclassification of 1.4S products based on the ICAO requirement. They have proposed multiple options to overcome the logistical challenges of affirming or re-classifying thousands of existing approvals.



Differentials in temperature and air pressure with altitude

Packing and packaging tests and specifications for solids are essentially the same in the TI as they are in the UN regulations. However a significant difference between the air regulations and other modes is that every UN number has a specific net mass maximum per package. For instance, 1.4S detonators identified as UN 0456 "Detonators, electric" have a maximum net weight per outer package of 25kg for passenger aircraft. The net weight of a package is the weight of the dangerous goods contained in a package excluding the weight or volume of any packaging material. In this case, net weight is the weight of all the detonators in one shipping case. Different maximums are set for each UN number for shipment as a "Limited Quantity", passenger aircraft or cargo aircraft only. Therefore the weight of a package will determine if it may ship on passenger aircraft, cargo aircraft only, or is forbidden for transport by air. UN 0456 may contain 100kg net weight or less on a cargo aircraft per outer package. Electric detonators are prohibited from air transport if they exceed 100 kg net per package. No Class 1 product is currently allowed to ship as a Limited Quantity.

All 1.4S explosives have a limit of 25kg net per package on passenger aircraft. If the shipment is confined to only shipping on cargo aircraft, 1.4S explosives may weigh up to 100 kg net per package on cargo aircraft. Only 1.4S explosives are allowed to be shipped on passenger aircraft. Cargo aircraft may include some but not all Division 1.3 Compatibility groups C, G and Division 1.4 Compatibility groups B, C, D, E, G, S. Typically these packages can weigh up to 75 kg net mass each. Exceptions to the rule include UN 0186 "Rocket motors" at 220 kg net max per package and UN 0494 "Jet perforating guns, charged" at 300 kg net max per package. Most packages shipped by air do not begin to approach the maximum of the packaging specification, for example 4G fiberboard boxes are limited to 400 kg gross.

There is no limit on the size of a shipment. One notable exception is the 25kg limit per compartment in the US for passenger aircraft. This does not exist elsewhere in the world. The US rule states in 49 CFR 175.75 and state variation USG-13 that no more than 25 kg of hazardous materials may be stowed on a passenger aircraft in an inaccessible cargo compartment. Very few passenger aircraft have accessible cargo compartments, so this amounts to a prohibition on shipping significant amounts of hazardous materials by passenger aircraft on any shipment to, from, through or over the US. This is the only significant air regulation in the US relevant to Class 1 shippers which is significantly different than ICAO.

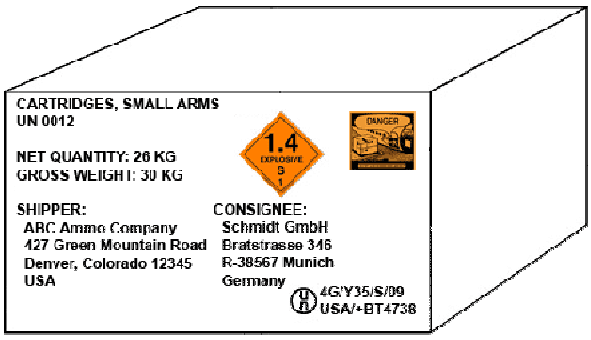


Illustration of marking & labeling of an explosives package

Marking requirements are principally the same as those in the UN Model Regulations. However the net weight must be marked on the package, and both the full consignor and consignee names and addresses must be marked, instead of one or the other as required in certain national regulations. When a consignment includes more than one overpack (e.g. more than one shrink wrapped pallet) each overpack must be marked with a unique identifier and the total net quantity of dangerous goods in the overpack. This must also appear on the shipping document. Currently there is a special requirement to also mark the gross weight of explosives packages on the package. However, this is marked for elimination at the May 2009 working group meeting, subject to ratification in October 2009. The gross weight requirement will cease to apply when the 2011 TI comes into use.

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identification				Quantity and type of packing	Packing Inst.	Authorization
UN or ID No.	Proper Shipping Name	Class or Division (Subsidiary Risk)	Pack-ing Group			
UN0012	CARTRIDGES, SMALL ARMS	1.4S		65 FIBREBOARD BOXES X 12.35 KG OVERPACK USED #1 OF 4 TOTAL NET QUANTITY 802.75 KG 50 FIBREBOARD BOXES X 4.56 KG OVERPACK USED X 3 #2 - #4 TOTAL NET QUANTITY 228 KG 1 STEEL BOX X 14 KG	130	DOT 49 CFR 173.56 ATTACHED
UN0044	PRIMERS, CAP TYPE	1.4S		5 FIBREBOARD BOXES X 3.4 KG	133	EX# 9837204 EX# 9837309 USG-05 APPROVAL ATTACHED
UN0055	CASES, CARTRIDGE, EMPTY WITH PRIMER	1.4S		9 FIBRE DRUMS X 21 KG	136	USG-05; DOT 49 CFR 172.102 SPECIAL PROVISION 50 And Competent Authority Letter ATTACHED

Example of ICAO documentation requirements

Labeling requirements for air are also based on the UN. However "cargo air only" shipments must have the CAO label put on the box. Shippers should study the marking and labeling requirements for relative location. Packages must be big enough to affix the labels and markings as required.

The requirements for ICAO documentation have been markedly augmented by IATA and constitute a significant difference from the requirements of other modes. While sharing the same basis as the UN, ICAO requirements are much more prescriptive than the UN. Only a certain form may be used, and the information in the form is highly controlled for both content and format. The form, which is illustrated on the previous page, is called the "Shipper's Declaration for Dangerous Goods" or "Shipper's Dec" for short. Like other regulations, each product listing contains the UN number, proper shipping name, hazard class and packing group. Also similar, the net weight is required, but in the case of air the weights are required for every package in the shipment. Beginning in 2011, the document will require the net explosive quantity for each entry, a change motivated by harmonization between modes on behalf of electronic shipping documents. Multiple packages of the same material and weight may be described together. The Packing Instruction number must be listed for each entry, which is not required by any other dangerous goods regulations. Any special provisions or government authorizations must be listed, per entry, including the authorization number. This applies to explosives approvals, which must also be attached to the Shipper's Declaration. This number must be in the format "EX 20090701555 Attached". This completes the detail information given per entry. Below that, applicable additional handling information must be included on the form. An example is the emergency response phone number required by many countries.

In addition to the Shipper's Declaration, specific information is required on the air waybill. This is not extensive, and for example might read "Dangerous Goods As Per Attached Shipper's Declaration". When products are designated as cargo aircraft only, that must be noted. Further information is available on how to document mixed shipments.

The regulations include a section on handling that is mainly relevant to air line operators. Carriers are required to complete an acceptance checklist on all dangerous goods shipments before accepting them, provide a notice to the aircraft captain that dangerous goods are included, report incidents and store documents. Handling also includes requirements for segregation and explosive compatibility. Segregation is generally less strict on an aircraft than other modes. Products of Division 1.4S may be shipped with any other dangerous goods, whereas by vessel they only ship in the same container with Division 6.1, Class 9 or Limited Quantities. Class 1 other than 1.4S must be segregated from any other hazmat. 1.4B must be separated from any 1.3 products by 2 meters and intervening cargo. There is no prohibition against stowing Compatibility Groups B and D together.

State and operator variations have been lodged with ICAO throughout the regulations. In summary, compliance for air shipments demands attention to details and thorough employee training.

Safety Snippets

Hand Safety

Andy Begg (Individual Associate) came across a presentation on hand safety which he brought to our attention. He goes on to say: "In our industry we have more injuries caused by "background" factors than by explosions and fires. I recently encountered an incident when an operator lost the tips off his fingers when he put his hand into a feeder to clear a blockage. In incident IN20-08 an operator sustained serious hand injuries while operating an auger on a bulk truck. It may be worth reminding members of these "common injuries" in our Newsletters".

SAFEX would like to thank the US Government Office of the Director of Information Systems for Command, Control, Communication, and Computers and the US Naval Safety Center for permission to use this information which they published on the World Wide Web as a public service.

How important are your hands?
The hand is one of the most complex parts of your body - the movement of the tendons, bones, tissues and nerves allows you to grip and do a wide variety of complex jobs. Without your hands it would be extremely difficult to do routine simple tasks, such as opening doors, using a fork, or tying your shoes. Your hands make you a skilled, valuable worker

The improper use or misuse of hand tools cause minor to serious hand injuries. Hand injuries are likely when the wrong tool is used or the right tool is used improperly

Hand Injuries
Hand injuries occur when working with

- machinery or equipment
- materials or job processes that are hazardous
- Hand tools or powered hand tools that are faulty or improperly used

The most common causes of hand injuries are:

- Carelessness
- Lack of awareness
- Boredom
- Disregard for safety procedures
- Distractions

Hand injuries are difficult to repair because of the complexity of the hand. After a hand injury, the hand may not function as it did before the injury due to loss of:

- Motion
- Dexterity
- Grip
- Ability to complete the simplest of tasks

Hand injuries can be avoided by:

- Knowing the hazards and dangers in the job to be done
- Being aware of pinch points
- Being aware of hot areas
- Being aware of rotating or moving surfaces
- Knowing that automated machinery can start automatically if controlled by remote control or delayed timing devices
- Eliminating loose clothing and jewellery which can be caught up in moving machinery
- Never removing machine safeguards or operating machinery with safeguards removed

Injury Statistics
According to the US Bureau of Labor Statistics, in 2006 there were nearly 205,000 injuries and illnesses involving days away from work to the wrists, hands and fingers. This is 27% of the total for that year. Hand injury (as defined above) Incidence Rates per 10,000 full-time workers were:

- All private industry = 29.6
- Manufacturing = 65.6
- Construction = 71.4

Hand Protection
OSHA Regulation 29 CFR 1910.138 on hand protection states that employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as:

- Skin absorption of harmful substances
- Severe cuts or lacerations
- Severe abrasions
- Punctures
- Chemical burns
- Thermal burns
- Harmful temperature extremes

Other OSHA Regulations related to hand safety include:

- Hand and Portable Powered Tools and Equipment (29 CFR 1910.242)
- Control of Hazardous Energy – Lockout/ Tagout (29 CFR 1910.147)
- Machinery and Machine Guarding (29 CFR 1910 Subpart O)

Good practices
Such practices can be summarized under the following headings

- Awareness of Hazards and Prevention Measures
- Personal Protective Equipment (PPE)
- Good Hygiene and First Aid

<u>Awareness and Prevention</u>
There are accepted good practices for each of the most commonly used tools. They include:

Screwdrivers

- When using screwdrivers, place the object on a flat surface or in a vise - don't hold it in your hand!
- Don't use screwdrivers as chisels or pry bars
- Use the correct size driver for the screw
- Don't use screwdrivers with chipped tips

Knives

- Use safety knives whenever possible

- Keep knife blades sharp
- Cut away from your body
- Do not use knife blades as screwdrivers
- Avoid working on the same object when a co-worker is using a knife

Hammers
- Never use a hammer with a splintered, cracked, or loose handle
- Don't use hammers with rounded striking faces
- Use the correct hammer for the job
- Don't strike a hammer face with another hammer
- Don't use nail hammer claws as a pry bar

Hand Saws
- Use moderate pressure on hack saws to prevent blade failure
- Spray saw blades lightly with lubricant prior to use
- Keep blades sharp

Chisels
- When possible use a safety chisel

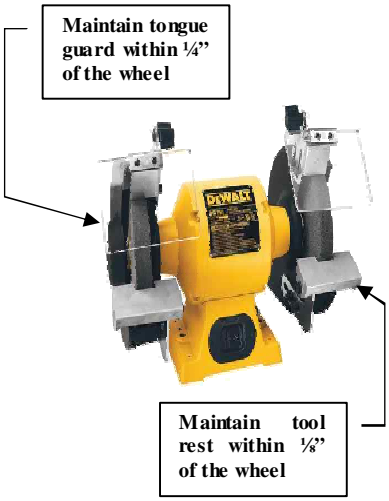
- Don't use chisels with mushroomed heads
- Use the correct chisel for the job
- Don't use chisels as pry bars.

Wrenches
- Use the correct sized wrench for the job
- Don't use pliers with worn grooves or crescent wrenches with worn or sprung jaws
- Don't use pliers or crescent wrenches on over-tight bolts and nuts
- Pull on wrenches rather than pushing them
- Never use a cheater bar on a wrench

Portable Power Tools
- Disconnect power tools when not in use and before changing bits, blades, and other accessories
- If a power tool binds STOP! and reassess the job
- Wear anti-vibration gloves when using power tools that vibrate excessively
- Never remove guards!
- Ground power tools unless double insulated
- Don't wear gloves if they can get caught on rotating parts
- Secure work in a vice or on a bench - Don't hold it in your hand!

Shop Tools
- Use a push stick to cut small pieces
- Unplug or Lockout tools before changing blades
- Keep tools sharp
- Never remove guards
- Use a drill press vise when drilling – Don't hold parts with your hands

Bench Grinders
- Don't wear gloves when operating bench grinders
- Never remove guards!
- Maintain proper clearances on tool rests and tongue guards



- Use vice grips when grinding small parts
- Don't use grinders on aluminum unless the wheel is specifically intended for use with aluminum!
- Use face and eye protection when using grinding equipment.

Here are some **specific situations** that pose a particular risk for hand injuries and require precautionary measures:

Extreme Temperatures
Use tongs or high-temperature gloves to handle hot or cold parts and equipment

Bites and Stings
- Use caution when moving debris piles or equipment which has been sitting for a long time
- Don't stick your hands in holes, crevasses and other secluded places, including work boots which have been sitting for a while
- Avoid areas where insects nest or congregate (garbage cans, stagnant pools of water, uncovered foods and areas where flowers are blooming)
- Avoid dressing in clothing with bright colors
- Don't use scented soaps, perfumes or hair sprays

Equipment Handling
- Use tag lines (cable for steadying a suspended loads)
- Wear leather gloves
- Never place your hand on top of the load or between the load and a fixed object
- Inspect hooks and chain slings before use
- Never hang load from the hook tip, unless it is designed for that

Jewellery
- Remove jewellery before using power tools or working on machines
- Keep sleeves buttoned

The photograph on the previous page illustrates the consequences of a ring being caught in machinery

Personal Protective Equipment

Gloves are most commonly used for hand protection. The following practices apply for the care of gloves:

- Inspect gloves before use for tears, excessive wear, and punctures
- Store in a clean, dry location
- Discard leather and cloth gloves if they become saturated with oil or other chemicals
- Leak test chemical gloves by sealing the wrist and filling the glove with air. Use a clean plastic tube or low pressure air line – not your mouth!

Good Hygiene and First Aid

Hand Care

- Avoid washing your hands with solvents, harsh soaps, or abrasives
- Clean and bandage all cuts and abrasions
- Immediately remove any imbedded foreign materials
- Wash immediately after using any chemical – even if you did not detect glove leakage
- Pay attention to skin rashes - get an immediate medical evaluation
- Wear cotton gloves under rubber gloves to reduce sweating

First Aid

- **Cuts**: Apply direct pressure to a large or bleeding cut and elevate the hand above the shoulder - Clean a small cut with soap and warm water and cover it with a sterile bandage
- **Burns:** Immerse in cool water or run cool water over the burned area
- **Broken** bones: Keep the hand still and get professional help
- **Amputations:** Apply pressure to the injured area immediately - Preserve the amputated part in a plastic bag and put it in ice water or ice, but Do Not allow the amputated part to come in contact with the ice!
- **Sprains:** Apply cold compresses to reduce pain and swelling
- **Chemical burns:** Rinse with running water for at least 15 minutes
- **Heat burns:** Soak minor burns in cold water, then apply a sterile bandage - A burn that is charred or blistered requires medical attention

Care for your hands. This could be yours!

Inbox @ SAFEX-International.org

From time to time we receive e-mails from members of the SAFEX community on a variety of issues. It is important we share such experiences and insights and if necessary debate them. Our quarterly Newsletter may just be the forum for doing so.

We therefore invite ALL readers to drop us a line at secretariat@safex-international.org if they want to raise an explosives health, safety or environmental issue or comment on any of the opinions received from our correspondents.

Possible initiation mechanism for IN11-09

SAFEX recently notified members about a propellant fire which occurred in the hunting powder facility of one of our members. The fire occurred when a charge of wet, single base propellant was being discharged from the mixer. The burning solvent fumes triggered the sprinkler system but there were no injuries or damage to equipment. Based on the limited amount of information available at this stage Maurice Bourgeios (GD-OTS) suggested a possible explanation for this incident:

He writes:

This may be a case of Brush Discharge. The green propellant and ether are good electric insulators. During the mixing operation the propellant builds-up a charge which does not dissipate because most of the grains are not in contact with the grounded mixer wall. When electrically charged

grains come in contact with the grounded mixer wall, a brush discharge occurs. If the solvent vapours are in the flammable range, the brush discharge has more than enough energy to ignite the flammable vapours. (Brush Discharge can be as high as 3,6 mJ and solvent vapours ignite at 0,2 mJ)

There are several ways to prevent this situation:

- Discharge the propellant in an enclosed vapour rich atmosphere or in an inert gas atmosphere
- Discharge the propellant in a well ventilated, vapour poor atmosphere. In this case the discharge layer thickness of the propellant on a chute for example must not be too thick to prevent a flammable atmosphere at the bottom of the layer.
- Maintain high humidity above 65%RH if possible and determine the proper waiting time for the static charge to dissipate.

Lone Worker Alarm Responses to be Shared with Members

Members may recall John Higgins' (Irish Industrial Explosives - IIE) request for advice and suggestions in the use of a "lone worker alarm" in an explosives production environment. He was interested in the specific devices or mechanisms SAFEX members use as an alarm for individuals that work alone. Do members use a panic button or another type of alarm which lone workers can wear on their persons and activate when they are in difficulty? John wants to thank those Members who responded with their advice and suggestions.

He writes:
We are in the process of consolidating the "lone worker alarm" inputs which SAFEX members generously contributed. Our intention is to provide a summary for the Newsletter as our way of recognizing those contributions. Ashley Haslett is leading the initiative and will be responsible for the summary. We are taking a risk based approach and are working through internal groups to get their inputs and reaction to the suggestions we received. It will take us another couple of months to complete the work and we ask members to bear with us on this subject.

SAFEX International thanks the following for their contributions to this Newsletter:

- **Brian Allison,** SAFEX Expert Panel member
- **Dr Phil Lightfoot,** Manager, Canadian Explosives Research Laboratory
- **Ben Barrett,** SAFEX Expert Panel member
- **Andy Begg**, Individual Associate member and the **US Naval Safety Center**
- Our correspondents: **Maurice Bourgeois** (GD-OTS) and **John Higgins** (IIE)

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