Agrichemical Warehousing Standard Association

WAREHOUSING STANDARDS BULLETIN

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CORRECT STORAGE PATTERNS
FOR FLAMMABLE AND COMBUSTIBLE LIQUIDS AND DANGEROUS GOODS
C2 to C7

Audit Protocol C2
Reference NFC

Storage heights of flammable and combustible liquids meet NFC standards.
The intent of this protocol is to store all liquids with a flash point below 93.3°C at heights consistent with the NFC classes of product. The NFC classes of products and their storage heights are as follows:

	Storage Heights (m)		
	Unsprinklered Building	**Sprinklered Building**	**In rack Sprinklered Building**
Class IA – flash point below 22.8°C and boiling point below 37.8°C	1.5	1.5	7.5
Class IB – flash point below 22.8°C and boiling point at or above 37.8°C	1.5	2.0	7.5
Class IC – flash point at or above 22.8°C and below 37.8°C	1.5	2.0	7.5
Class II – flash point at or above 37.8°C and below 60.0°C	3.0	3.0	7.5
Class IIIA – flash point at or above 60.0°C And below 93.3°C	4.5	6.0	12.0

Class IA, IB and IC are flammable liquids under the NFC and
Class II and IIIA are combustible liquids under the NFC.
For an unsprinklered warehouse, this translates into the following National Fire Code classes:

Class IA, IB and IC - one pallet high (approx. 5 ft.)
Class II - two pallets high (approx. 10 ft.)
Class IIIA - three pallets high (approx. 15 ft.)

The NFC does not allow storage of class II product on top of IA, IB or IC products or the storage of class IIIA on top of IA, IB, IC, or II class of products if they exceed the maximum height for the most restrictive classification. It is therefore the NFC and Protocol C2 intent to follow the NFC code in this regard.

Audit Protocol C3
Reference NFC

Protocol C3 reads:

Flammable and combustible liquids are stored in:

(a) individual storage areas (ISA's) and

(b) in accordance with the maximum quantity limitations in the National Fire Code.

The key in this protocol is to understand the definition of an" individual storage area" (ISA.). An ISA is an area occupied by piles, bin boxes, racks or shelves, including subsidiary aisles providing access to the stored products, which is separated from adjacent storage by aisles not less than 2.4m (8 ft.) in width. The aisle separating the two ISAs must be kept free of any storage.

Therefore, all NFC Classes of flammable and combustible liquids (all liquid T.D.G. classes of products and all liquid non regulated products with a flash point below 93.3°C) should be stored in an ISA designated as an NFC liquid ISA.

In addition, in an ISA designated as flammable and combustibles liquid, any class (note must still comply with TDG regulations (appendix A)) of agrichemicals can be stored (including non-flammable and non-combustible liquids such as granular or powders) provided the height (protocol C2) and quantity restrictions (protocol C3 (b)) for the product with the **lowest flash point** is met.

As an example, in unprotected storage, you can store 9000 litres of a class IC liquid and 1000 litres of say, glyphosate not regulated under TDG and with a flash point at or above 93.3° C) in the same ISA and in the same fire compartment. These combined totals of both products equal 10,000 litres and would all be considered as IC product for the purposes of quantity limitation and stacking heights. Also, buildings that meet the spatial separation requirements or have the 4 hour fire rating requirements have **unlimited** volumes per fire compartment but the restrictions for the individual storage area (ISA) must still be complied with.

How much product can be stored in an ISA? The NFC Table 4.2.7.5.A lists the maximum quantity per ISA in litres as follows.

NFC class	Unsprinklered	Sprinklered
NFC class 1A	2,500 litres	2,500 litres
NFC class IB and IC	10,000 litres	20,000 litres
NFC class II	15,000 litres	40,000 litres
NFC class IIIA	50,000 litres	60,000 litres

Most warehouses have a product mix that includes various quantities of all NFC classes of flammable and combustible liquids except Class IA as well as non regulated products and other TDG classes of products. How then do we store products when we have 2 or more classes of flammable and combustible liquids?

Where containers for 2 or more NFC classes of products are stored together in an ISA, the maximum quantity permitted in the ISA. shall equal that permitted for the liquid with the **lowest flash point.**

If, in an **unsprinklered warehouse**, we want to store 3000 litres NFC class IC and 8000 litres of NFC class II in one (1) ISA, how can this be done?

The maximum quantity that can be stored in this warehouse in one (1) ISA. is 10,000 litres of Class IB and IC. Therefore, the storage of 11,000 litres in one ISA is not permitted because when the products are in one (1) ISA., you must consider that **all** the products are a NFC class IC, that with the lowest flash point.

There is still 1000 litres to be stored, so we must develop a second ISA. to store the 1000 litres of NFC class II. In this ISA., we could store an additional 14,000 litres of NFC class II products to reach the maximum quantity per ISA. of 15,000 litres or we could store 14,000 litres of glyphosate in this ISA.

These two (2) ISA's now must be separated from each other and from other adjacent storage by clear aisles not less than 2.4 m (8 ft.) in width or by a 2 hour fire rated separation wall which will create a new fire compartment.

In larger warehouse facilities where other non-agricultural dangerous goods are stored within the same fire compartment as agrichemicals, follow the same guidelines.

Audit Protocol C4
Reference NFC

TDG regulated products are stored in compliance with the NFC separation chart (3.2.7.6) for storage of Dangerous Goods Table reprinted as Appendix "A" in the Audit Protocol Manual. The NFC 3.2.7.5 chart includes WHMIS classes but pest control products are exempt from WHMIS and therefore will not be referenced for determining the proper separation distances.

This protocol includes flammable and combustible liquids (all liquid products with a flash point below 93.3°C) because all TDG class products, not just the flammable and combustible liquids, must comply with the separation chart. For the use of the separation chart, combustible liquids will be classified as TDG class 3 flammable liquids.

Where the storage of products coincides with an “X”, you are **not** permitted to store in the same fire compartment. If, however, the volumes of one of the products stored falls under the small

quantity exemption found in the NFC reprinted as Appendix "D" in the Audit Protocol Manual, then it is considered not to be in storage.

Where the storage of products coincides with an "A", in the separation chart, they must be separated by a minimum 1 metre horizontal distance. This does not say a 1 metre clear aisle or space – just a minimum 1 metre horizontal distance. Therefore, to maximize warehouse space, this 1 metre horizontal distance could be utilized by the storage of compatible products – those where the storage of products coincide with a "P".

Where the storage of products coincides with a "DS", this refers to the information provided in the SDS for the specific dangerous good.

Audit Protocol C5
Reference NFC

Storage heights of TDG regulated products other than flammable and combustible liquids meet NFC standards.

This protocol deals only with dangerous goods with a flash point at or above 93.3°C and are not classified as NFC flammable and combustible liquids.

In some cases, manufacturers may restrict the storage heights based on the integrity of the packaging material. If the manufacturers do not have any restrictions, then the method of storage of these dangerous goods shall be determined to ensure stability of the stored products and not to exceed the maximum heights of storage as follows:

Classification	No Sprinkler	Protected Sprinkler	In-rack Sprinkler
Packing Group I	1.8 m	2.4 m	unlimited
Packing Group II	2.4 m	4.0 m	unlimited
Packing Group III	4.5 m	6.0 m	unlimited

Storage heights for a protected storage area are permitted to be exceeded provided the dangerous goods are stored on racks or shelves.

Stack heights of products must not be breached by piling a product with a lessor risk requirement on top of one with a more stringent risk requirement unless the pile height meets the requirement for the most stringent product in a non-sprinklered building.

Example: You cannot stack a pallet of T.D.G. class 6.1, P.G. II on top of a pallet of T.D.G. class 6.1, P.G. I. unless the pile is 1.8 meters or less.

Audit Protocol C6
Reference NFC

TDG regulated products (other than flammable and combustible liquids) are stored in a separate ISA. The sum of the TDG products excluding class 9 and the NFC classified product in one fire compartment may not exceed 100 m^2 in unprotected storage. This 100 m^2 storage requirement only applies to warehouses that are not protected by a suppression or sprinkler system.

Note: Non regulated products with a flash point at or above 93.3°C can be stored in this dangerous goods ISA.

You can, in addition, store any quantity of T.D.G. class 9 and non regulated products in the balance of any space available in the warehouse.

Pallets are normally 1 m x 1.5 m in size and therefore the area taken up by 100 m^2 of floor space would be 66 pallets.

It is therefore the NFC and Protocol C6 intent to follow the NFC code in this regard.

Audit Protocol C7
Reference NFC

A plan view of the storage area must be posted in the warehouse to show:

a) the aisles
b) the storage (ISA's)
c) the T.D.G. class of product being stored in each storage area (ISA)
d) the NFC classes of product being stored in each storage area (ISA)
e) the plan view must meet the standards outlined in C2, C3, C4, C5 and C6.