CEAEC | Canadian Explosives Industry Association
Association Canadienne de l'Industrie des Explosifs

CEAEC MEETING
SSE Committee

Ottawa Meeting – November 9th, 2023

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Safety, Security and Environmental Committee members

Hughes Brassard
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Safety, Security and Environmental Committee

1. Open Burning (OB)
2. Code of Good Practices
3. Tetra Amine Copper Nitrate (TACN)
4. New topics

1- Open Burning (OB)

Down sides :

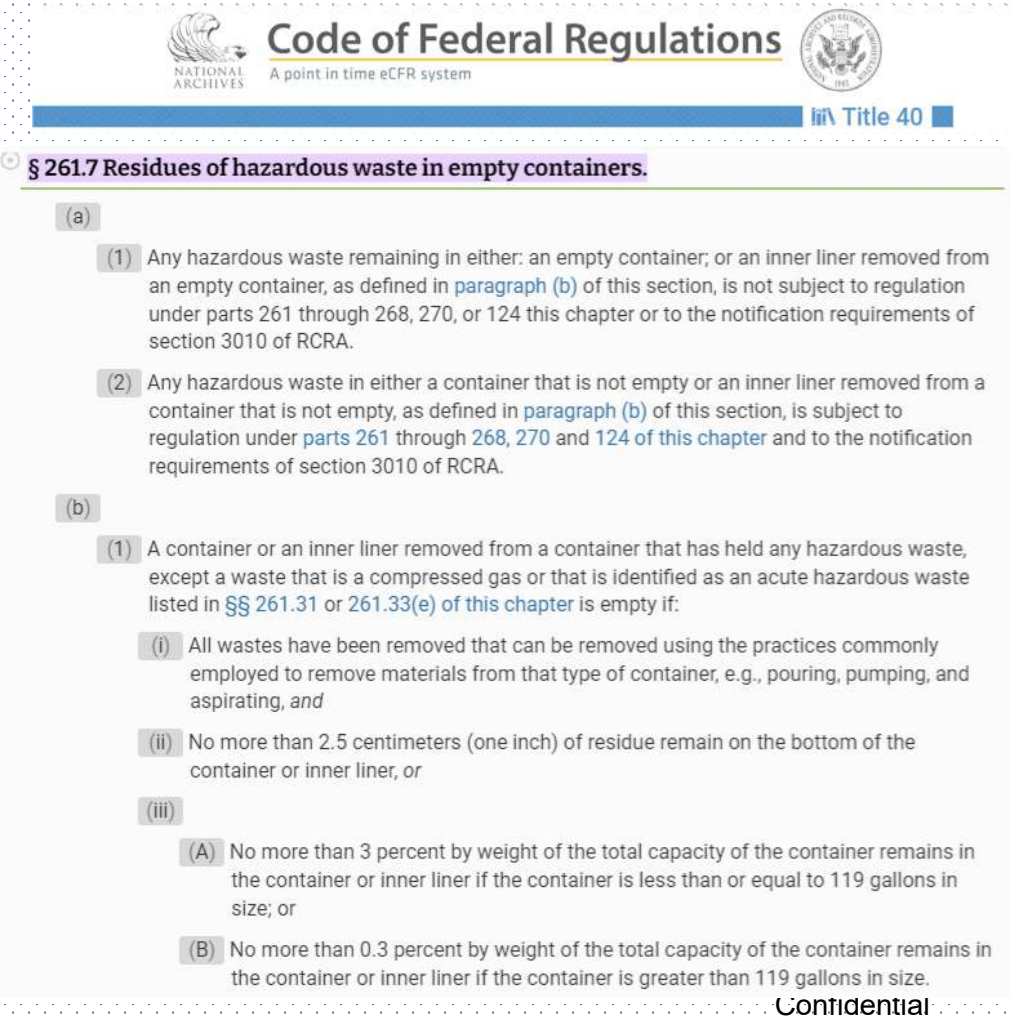
- ✓ Air pollution
- ✓ Complaints from neighbors
- ✓ Permitting required
- ✓ Ash management/disposal
- ✓ May become forbidden
- ✓ Safety incidents

Open Burning (OB)

- 90 % of empty packaging is destroyed by open burning in Canada.
- Estimated quantities (2022)
  2 M+ cardboard boxes & 2 M+ plastic bags

Open Burning Alternatives
What other countries are doing ?

USA Management



Code of Federal Regulations
A point in time eCFR system

Title 40

§ 261.7 Residues of hazardous waste in empty containers.

(a)

(1) Any hazardous waste remaining in either: an empty container; or an inner liner removed from an empty container, as defined in paragraph (b) of this section, is not subject to regulation under parts 261 through 268, 270, or 124 this chapter or to the notification requirements of section 3010 of RCRA.

(2) Any hazardous waste in either a container that is not empty or an inner liner removed from a container that is not empty, as defined in paragraph (b) of this section, is subject to regulation under parts 261 through 268, 270 and 124 of this chapter and to the notification requirements of section 3010 of RCRA.

(b)

(1) A container or an inner liner removed from a container that has held any hazardous waste, except a waste that is a compressed gas or that is identified as an acute hazardous waste listed in §§ 261.31 or 261.33(e) of this chapter is empty if:

(i) All wastes have been removed that can be removed using the practices commonly employed to remove materials from that type of container, e.g., pouring, pumping, and aspirating, *and*

(ii) No more than 2.5 centimeters (one inch) of residue remain on the bottom of the container or inner liner, *or*

(iii)

(A) No more than 3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is less than or equal to 119 gallons in size; or

(B) No more than 0.3 percent by weight of the total capacity of the container remains in the container or inner liner if the container is greater than 119 gallons in size.

- ANFO bags – Landfill
- Cardboard boxes - Recycling when available or landfill if not.

Open Burning Alternatives
What other countries are doing ?

Australia Management

Part 3 Areas in which burning of anything other than vegetation is prohibited, except with approval or in relation to certain domestic waste

City of Albury	Gwydir	Orange City
Armidale Regional	City of Hawkesbury	City of Penrith
Ballina	Hay	Port Macquarie-Hastings
Balranald	Hilltops	Port Stephens
Bathurst Regional	Hornsby	Queanbeyan-Palerang Regional
Bega Valley	Inverell	Richmond Valley
Bland	Junee	City of Shoalhaven
City of Blue Mountains	Kempsey	Snowy Monaro Regional
Bourke	Kiama	Snowy Valleys
Brewarrina	Ku-ring-gai	Tamworth Regional
Central Coast	Kyogle	Temora
City of Cessnock	City of Lake Macquarie	The Hills Shire
Clarence Valley	Leeton	Tweed
Coffs Harbour City	Lismore City	Upper Hunter Shire
Coolamon	City of Lithgow	Upper Lachlan Shire
Coonamble	Lockhart	Uralla
Dubbo Regional	City of Maitland	Wagga Wagga City
Dungog	Mid-Coast	Walcha
Eurobodalla	Mid-Western Regional	Warren
Federation	Murray River	Warrumbungle Shire
Forbes	Muswellbrook	Wentworth
Glen Innes Severn	Nambucca	Wingecarribee
Goulburn Mulwaree	Narrabri	Wollondilly
Greater Hume Shire	Narrandera	Yass Valley
City of Griffith	Narromine	
Gunnedah	Oberon	

- Open burning banned
- ANFO bags – Landfilled at Mine sites (buried)
- Cardboard boxes - landfilled at Mine sites.

Open Burning Alternatives

- Landfilling
- Recycling cardboard fibers
- Composting
- Reusable container (ANFO)

Landfilling option

- When sent to landfill, cardboard will decompose (3 months to several years).
- Since decomposition will occur mostly without oxygen, it will release methane gas.
- Several landfill operators recover methane gas for beneficial use.
- Landfilling is expected to have less environmental impact than open burning.

Recycling option

- Recycling cardboard saves a considerable amount of energy.
- It saves a lot of trees.
- Recycling is a labor-intensive procedure.
- Recycled cardboard can be used for many different purposes, such as cereal boxes, paper towels, tissues and paperboard.

Composting option

- Cardboard is biodegradable and can be used as compost material.
- Cardboard can completely break down into organic matter within two months unless coated with wax.
- Cardboard need to be broken into small pieces, which will require mechanical aid (shredder).
- Benefit of composting is that it eliminates methane generation in a landfill.

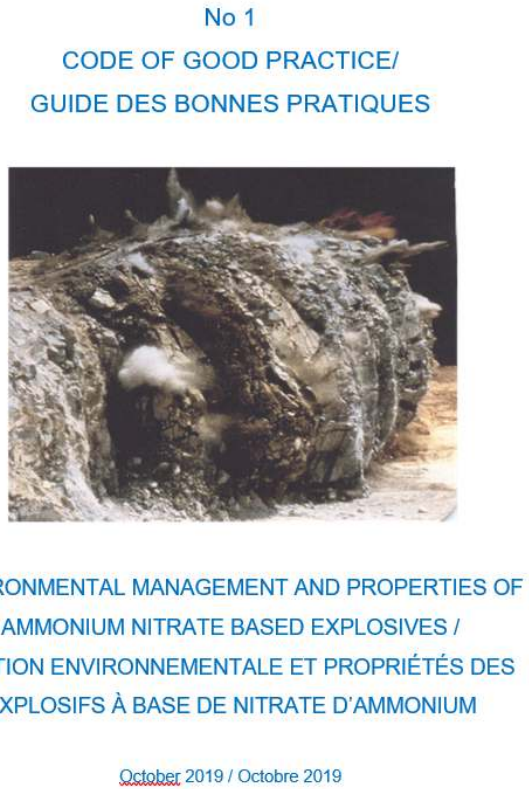
Path forward

- Establish a "clean" criteria.
- Finalize an empty packaging inspection procedure.
- Talk to landfill operators.
- Talk with cardboard recyclers.
- Recyclable container for ANFO and/or push for use of bulk trucks/pots.
- Apply for an EC with TC to allow for transportation of empty packaging without removing safety marks.
- Work with ERD to remove legal hurdles for new management methods.

2- Code of good practices

First code : Environmental Management & Properties of AN based explosives

- Disclaimer – available.
- Insurance Coverage – available
- Bilingual – To be translated
- Standard format - to be finalized
- References – To be finalized
- Other codes to likely be published by CEAEC:
  - Empty packaging inspection method;
  - Use of common carriers;
  - Transportation of ANE's in tank vehicles.
- External resources needed. TBD



3-Tetra Amine Copper Nitrate (TACN)

$Cu(NH_3)_4(NO_3)_2$

3-Tetra Amine Copper Nitrate (TACN)

TACN is formed when air, moisture, ammonia, copper and electrical currents combine. It is a deep purple, as opposed to the blues and greens of copper nitrates. If copper nitrates are exposed to air, the purple TACN will begin to form underneath. The photos below show TACN formation on a brass locking lever of a cam-lock fitting

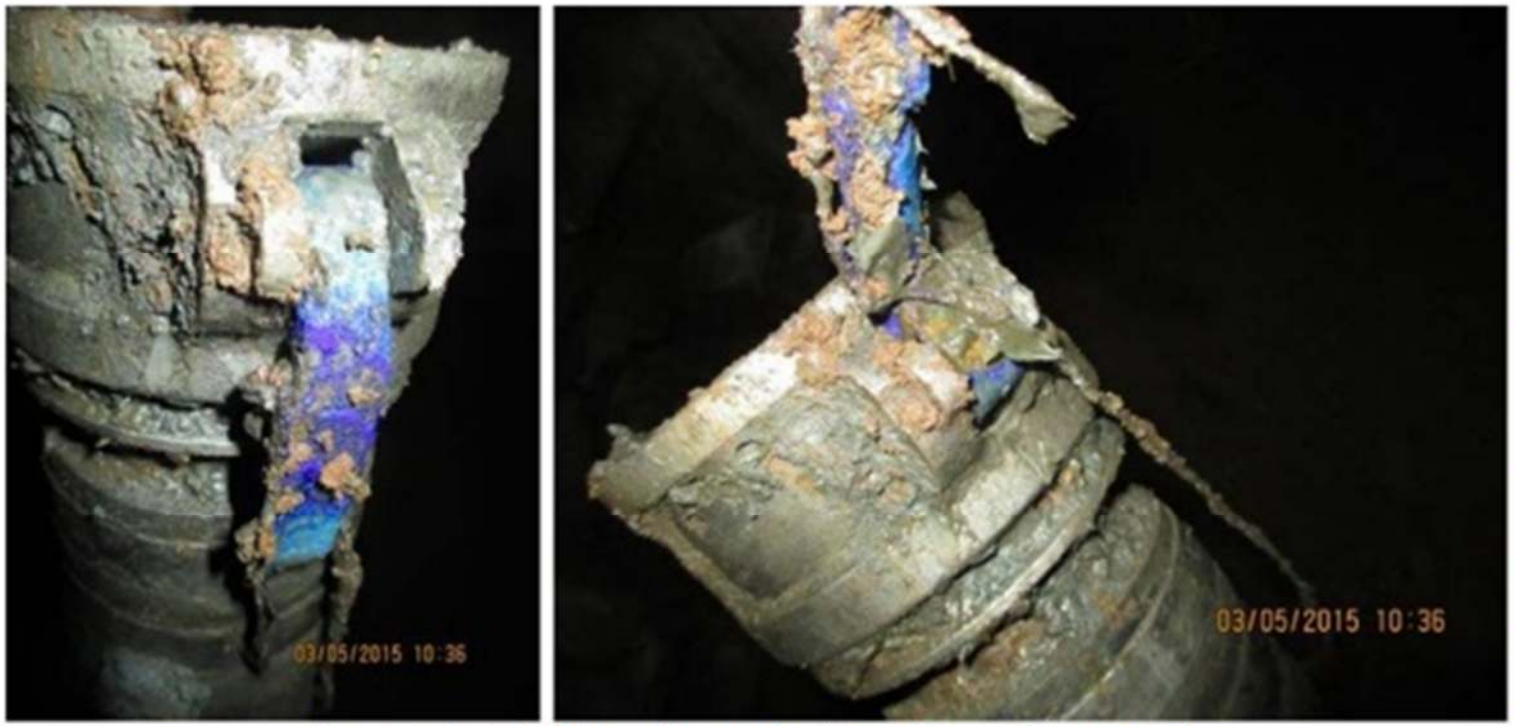


Image 1 - TACN on brass locking lever of cam-lock

3-Tetra Amine Copper Nitrate (TACN)

Copper(II) nitrate

$Cu(NO_3)_2$

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3-Tetra Amine Copper Nitrate (TACN)

Explosives Inspectorate
Resources Safety & Health
Queensland

ALERT | ALERT | ALERT | ALERT | ALERT

Explosives Inspectorate | Alert | No.112 V | 13 June 2023

Formation of Tetra-Amine Copper Nitrate (TACN) on copper fittings located on Mobile Processing Unit (MPU)

What happened?

During a routine inspection by the Explosives Inspectorate the formation of Tetra-Amine Copper Nitrate (TACN) was identified on a brass padlock and copper fittings located on an explosive Mobile Processing Unit (MPU).

How did it happen?

Lack of knowledge and awareness of the potential for the formation of TACN on copper fittings exposed to ammonium nitrate.

3-Tetra Amine Copper Nitrate (TACN)

- TACN is an impact sensitive explosive compound formed when reactive metals such as zinc, copper or its alloys (brass) are exposed to an aqueous solution of ammonium nitrate.
- The impact required to initiate TACN is reported to be equivalent to dropping a 2 kg weight from a height of approximately 20 cm.
- Persons working on equipment contaminated with TACN can be exposed to the potential for a small, localized explosion caused by impact or heat to the TACN affected areas.

3-Tetra Amine Copper Nitrate (TACN)

Recommendations

Operators who store, transport, use and manufacture ammonium nitrate should:

- replace reactive metal fittings on MPU with non-reactive materials wherever possible.
- replace all reactive metals in ammonium nitrate and emulsion storage and handling facilities with non-reactive materials (e.g., stainless steel, aluminium, or plastic where climatically suitable).
- ensure engineering standards include the above recommendations.
- review workshop procedures to ensure that they highlight the hazards associated with the use of reactive metals on vehicles and storage areas exposed to ammonium nitrate.
- train employees including maintenance workers to identify TACN.
- refer to explosive's technical advice on cleaning methods to remove possible TACN compound.
- never use impact or hot-work tools on an item known or suspected to contain TACN.
- regularly wash down areas exposed to ammonium nitrate spillages or dust.

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HEALTH & SAFETY
LESSONS LEARNED BULLETIN

DYNO Dyno Nobel

Review: Exposing copper/brass to AN forming TACN

SHAERS Number:	Date Issued:	Doc. ID / SHAERS ID:	Site:
INC-1391713 INC-1392417	16 October 2023	LL 24-2023 / HNOT-1000433	Canada

ISSUED AS REVIEW – A DNA employee at Brucejack, British Columbia was performing routine maintenance of an underground carrier and discovered fittings with purple/blue coloured corrosion forming. Upon further investigation, it was found that the nozzles were made from brass and the reaction is believed to be the formation of TACN. The carrier was purchased directly from the manufacturer by Dyno Nobel.

A second event a week later at Amaruq, Nunavut identified that the grounding wires below the ANSol tanks was forming purple/blue colored corrosion forming. The copper wires were replaced with aluminium ground wires by an electrician.

3-Tetra Amine Copper Nitrate (TACN)

KEY LEARNINGS / ACTIONS

- Ensure the inspection process on company owned or leased equipment and plants has a verification that copper based metals are not used in conjunction with any AN materials.
- All fittings that could be exposed to AN should be made of aluminum or stainless steel when possible or fittings must be protected from direct exposure to AN. (i.e. paint)
- Ensure a process is in place to inform our customers who purchase, lease or operate Dyno Nobel equipment of the dangers of exposing brass or copper based metals to AN found in our explosive products.
- Review this hazard alert with all employees and ensure they are aware of the dangers associated with TACN formation.

4- New topics – SSE committee

- ✓ Emulsion waste management
- ✓ General public awareness about explosives safety
- ✓ Emergency response explosives awareness training for first responders
- ✓ Overnight parking UN 3375 requirements (electronic surveillance, etc.)