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2

About the speaker

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- Experience: 20 years of experience as a practicing engineer in the construction and insurance industry. Prior to creating his own Risk Consulting company, he was the Property Technical Manager of a large Corporate Insurance Company.
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3

3

Agenda

CBC



- 1 Overview of Composite CBC Features & Fire Risks
- 2 Global Incident Case Studies
- 3 Global Regulatory Issues & Limitations
- 4 Advancements in CBC Designs & Protection Systems
- 5 Summary & Conclusions



4

4

Warning / disclaimer

We all make mistakes

- We will be reviewing several critical regulatory issues regarding fire protection in this presentation
 - A set of information references is included at the end of the presentation.
 - Information in this presentation is not intended to provide, nor should it be construed as legal advice.
- The author has taken great care to provide consistent and objective facts. But I would be happy to correct any of the information if anyone would identify an error or a misinterpretation.
- This presentation will be made at the NFPA Conference 2022. It has been developed with my co-speaker **Mike Snyder from Dekra**, and credit should be given to him and my thanks for being able to use this material during another conference.

Overview of Composite IBC Features & Fire Risks

What is a Composite IBC (CIBC)?

- This presentation focuses on CIBC, but most issues raised may apply to portable containers made of plastic with a volume of more than 30 liters.
- CIBC: A family of "mini-bulk" containers knowing the most common units are 275 gallons (1041 liters)
- "Composite" refers to multiple materials of construction, typically polyethylene (inner container) & steel (outer system)
- Good to know
 - European technology with leading players that are German and Italian,
 - Size of the market: 3.5 Billion € (only for CIBC) / Expected to grow to 7 Billion € in 2025 (CIBC).
 - Main users: Europe / USA / Asia
 - 25 million units sold per year / if properly maintained, an IBC can last for years



Overview of Composite IBC Features & Fire Risks

What are the Advantages of CIBCs?

- Improved space utilization
- Optimized transportation footprint
- Handling & filling simplification
- Recycling & environmental advantages
- Many units are approved as a Packing Group II container (UN 31H1, UN 31H2, UN 31HZ1)
 - Can hold a variety of "medium hazard" products
 - Includes Class B, C, II, and III Ignitable Flammable & Combustible Liquids



Overview of Composite IBC Features & Fire Risks

Fire Risks Involving Composite IBCs

- Operation hazards for ignitable flammable liquid transfer
 - NFPA 30 limits material in CIBCs to Class II & III liquids, but this is not consistent, especially in Europe
- Cascading domino effect: the pool fire is the enemy
 - While not typically the "start" of a fire, large leaks of ignitable combustible liquids serve as a significant fuel source
 - CIBCs can fail rapidly during fire exposure and rush 275 gallons (1000 liters) of fuel into an existing fire: cascading domino effect
- This may overwhelm fire sprinkler designs, particularly when lower flashpoint liquids are involved.
- NFPA 30 (2021) has a robust framework and limitations, but other codes requirements are not restrictive enough with inconsistent regulation for storage and use of CIBCs



Global Incident Case Studies

Overview of incidents

- Europe
 - Italy, Germany (2), France (3), the UK (3), Finland, Ukraine, The Netherlands, etc.
- Asia
 - Singapore (2), Australia (2), Malaysia, etc.
- America
 - USA (5), Brazil (2), etc.
- CIBC is not systematically:
 - The ignition source
 - Used for storing ignitable flammable liquids
- Events with a lack of dramatic consequences rely on ... luck

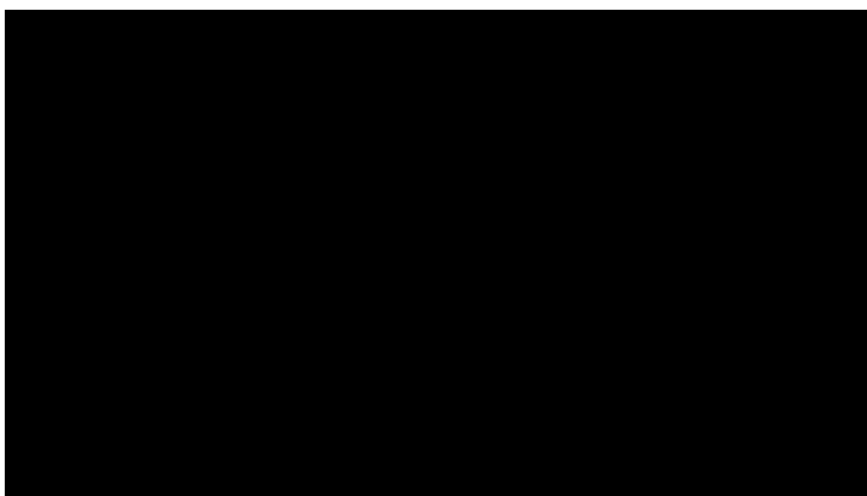


9

Global Incident Case Studies

Focus on transfer operation losses

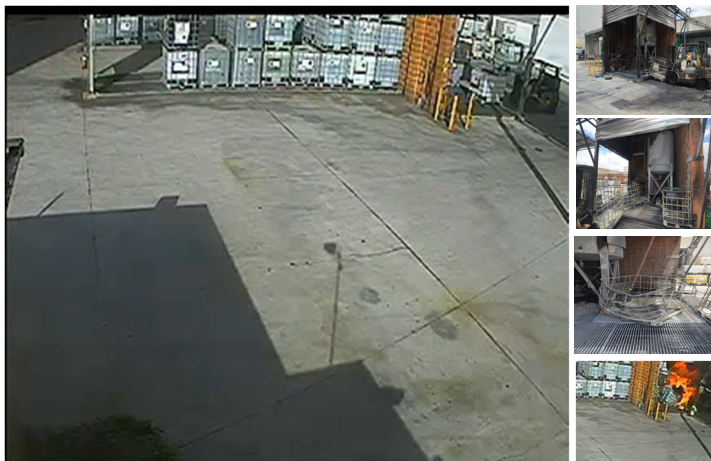
- What limited the loss
 - Segregation, flat floor, spill containment in the room, a limited number of BC (around 20)
 - Reactive fire brigade
- Cause and what worsened the loss
 - Static Electricity
 - Inadequate transfer operation (gravity)
 - Lack of drainage, local spill containment, and fire protection system
 - Mix of storage and transfer operations



10

Global Incident Case Studies

Focus on transfer operation losses



- What limited the loss
 - Excellent Containment: it prevents the pool fire from spreading
- Cause and what worsened the loss
 - Static Electricity inadequate transfer operation
 - Flare-up effect

Global Incident Case Studies

Focus on the cascading effect involving ignitable combustible liquids



- Seveso site with ignitable COMBUSTIBLE liquids
- Cause and origin of the fire
 - Not determined and under investigation
- The client made a lot of investment, and this area was the remaining poorly protected area
- What worsened the loss
 - Toxic storage that influenced the manual response strategy
 - Lack of adequate containment and drainage
 - Issues with the water supply
 - 1700 CBCs either empty or filled with ignitable combustible liquids
- Consequences
 - Change in the French law and regulations
- More information
 - References or more information in the appendices

Global Regulatory Issues & Limitations

Why this is a complicated topic and why education is of importance

- US Prohibits the use of Composite IBCs for Class II Liquids
 - Practices & Enforcement are not consistent
 - UN Designation as Packing Group II adds to the confusion
- French Regulations prohibiting IB Liquids in CBCs
 - Better than before but still insufficient as non-listed / approved CBC can be used for other ignitable liquids
- Various lack of knowledge regarding
 - Electrostatic risks VS Fire Storage Risks
 - Mechanical resistance / drop test
 - Fire scenario involving ignitable combustible liquids
 - Recertification process
 - Limits on the use of listed / approved CBC

Advancements in CIBC Designs & Protection Systems

Overview



- 1 Production of Static Dissipative Composite IBCs
- 2 FM 6020 and UL 2368 Developments
- 3 Single Composite IBC Containment Units
- 4 Active Drainage Systems
- 5 Advanced Integrated Protection Designs

Advancements in CIBC Designs & Protection Systems

Production of Static Dissipative CIBC

- The external surface of CIBC units can become charged and present static risk: **Verla, Vinilak, etc.**
- The technology (some are options)
 - Inner bottle has either a thin antistatic or a conductive outer layer.
 - A conductive connection on the valve prevents the filling product from becoming statically charged.
 - Protection for sensitive filling goods against light and UV radiation to avoid polymerization (even if the temperature is the cause of most events referenced)
 - A permeation barrier can be integrated as an inner layer.
- This makes the process operations safer but brings **CONFUSION** to the end-user that a CIBC can be used for Class I liquids
- Keep in mind that flashpoint is not an adequate characteristic to look at regarding conductivity
 - Ultra low sulfur Diesel is a good example, even if this is very rare to observe this liquid stored in CIBC
 - Nevertheless, most of the issues are linked to Class II liquids



| Classification | Charge Movement | Resistance | Ohms | Is it Antistatic? | Is it Conductive? |
|----------------|--|------------|-----------------|-------------------|-------------------|
| Conductive | Very Fast | Low | 1.E+03 - 1.E+05 | Yes | Yes |
| Dissipative | At a controlled speed: Fast but Slower than Conductive | Medium | 1.E+06 - 1.E+10 | Yes | No |
| Insulative | Slow or No Movement | High | 1.E+11 - 1.E+12 | No | No |

Advancements in CIBC Designs & Protection Systems

FM 6020 & UL 2368 "Fire Resistant" CIBC Progress

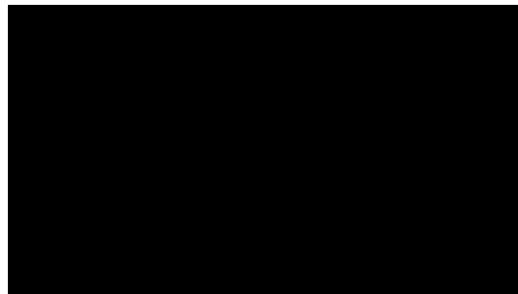
- First Container Produced that has received FM 6020 Approval and UL 2368 listing
 - HDPE Bottle; Steel Hull Containment
 - Top Loading/Unloading Configuration
- Another Major Manufacturer has UL 2368 Conformance
 - HDPE Bottle; "Fire Blanket" Outer Layer
- Continued Research involving the Use of these Containers for Class I liquids are needed as they are only approved for Class II and III Tests should be performed in France with Class I
- Good to know :
 - It is unknown how the blanket may age
 - The cost is higher (around five times)
 - The production capacity is limited



Advancements in CIBC Designs & Protection Systems

Localized CIBC Containment Units

- Designed to Provide Localized Containment & Limited Pool Size
- Provides the Ability to have limited use of non-Listed CIBCs and limited fire exposure risk
- Hold approximately 150% of Container Volume
- FM Approved – Storage Containers for CIBCs; Class 6086
- Good to know :
 - Cost is limited
 - The intent is not to multiply these units in a storage location
 - This is important to prescribe well-manufactured products



17

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17

Advancements in CIBC Designs & Protection Systems

Active Drainage Systems

- Designed to Limit Pool Fire Size Through Channeling and Remote Spill Collection.
- Active subfloor waterspray system
- FM Approved – Ignitable Liquid Floor Drainage Assemblies; Standard 6090
- Advanced Configurations for CIBC Storage and to limit fire risk exposure from non-listed CIBCs.
- Good to know :
 - This is not tested for bulk storage of unlisted CIBC, but it's guessed that it can dramatically reduce the magnitude of the fire and stop the cascading effect
 - Not available in Europe
 - Additional tests are needed
 - Various companies work to develop a similar system



18

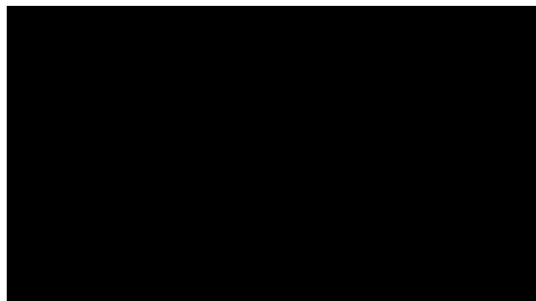
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18

Advancements in CIBC Designs & Protection Systems

A Robust European Concept

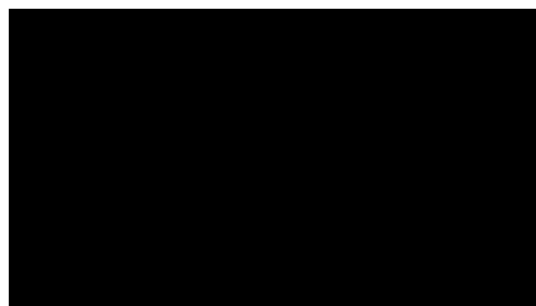
- A brand new fire tested VdS Approved concept is now available
- Based on three pillars
 - A premixed sprinkler fire protection system (in-rack and ceiling levels). Sprinkler heads at every pallet placement
 - A low expansion foam sprinkler system at the first level of rack storage
 - Design Features: spill containment in the aisle to limit the pool fire area, the local passive drainage system in the racks, the elevation of the rack structure (10 cm, which is four in.) to avoid them a lextposition
- Good to know :
 - More than 100 fire tests performed
 - More than ten different low ignitable flammable liquids tested
 - Worst case scenario tested: Sudden release of 110 gallons (500 liters) of ignitable flammable liquid and continuous flow of 40 GPM (150 l/m in) during 3 m in



Conclusions

Take aways

- In Fire Events, CIBCs will Fail and create significant Pool Fire Exposures. The time to fail is between 2 and 10 minutes.
- Case Studies show that (globally) this presents a significant risk. Limited loss relies on LUCK.
- Global Regulatory Coverage is Inconsistent but does include many additional (non-fire) requirements
- Exciting technology has emerged in Container Design, Containment Solutions, and Advanced Protection Systems to Reduce Fire Risk from CIBC use and storage!
- We have never been so close to being able to propose to our clients, systems that have been designed and tested for safely storing ignitable liquids in CIBC
- Appendix Contains Numerous References for Additional Information and Further Study.



Thank you for your attention

Would you be interested in continuing the discussion:

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21

Protection of global composite intermediate bulk containers (CIBC)

Appendices



22

References

General

- NFPA : Contain BC Fire Risk
 - <http://www.nfpa.org/bc>
- UK Health & Safety Executive BC Testing
 - <http://www.hse.gov.uk/research/rhtm/r564.htm>
- NFPA 30, Flammable and Combustible Liquids Code
 - <http://www.nfpa.org/30>
- Allianz Risk Consulting :
 - [Flammable/Combustible Liquid Storage in Intermediate Bulk Containers - https://www.agcs.allianz.com/news-and-insights/risk-advisory/tech-talk-volume-30-flammable-combustible-liquid-storage-in-intermediate-bulk-containers.html](https://www.agcs.allianz.com/news-and-insights/risk-advisory/tech-talk-volume-30-flammable-combustible-liquid-storage-in-intermediate-bulk-containers.html)
- FM Global Datasheet 7-29 (Ignitable Liquid Storage in Containers)
 - <https://www.fmglobal.com/research-and-resources/fm-global-data-sheets>
- Approval Standard on Ignitable Liquid Floor Assemblies (FM 6090)
 - <https://www.fmapprovals.com/approval-standards>

References

Losses & Claim Experience

- Australia :
 - NSW AFIAGM
- France
 - This event has been scrutinized by the French Parliament (Sénat and Assemblée Nationale). Interviews are public and recorded (fire brigade, CEO, Insurance association, Insurers, etc.). Other information is extracted from insurance documents that the French Press has published. Documents are not confidential anymore.
 - <https://www.youtube.com/watch?v=PmzzxZI-Kc>
 - https://www.lemonde.fr/planete/article/2020/02/07/lubrizon-le-rapport-qui-avait-prevu-le-scenario-de-l-incendie-du-26-septembre-sur-le-site-de-rouen_6028708_3244.html
 - https://www.urps-infirmiers-normandie.fr/page/URPS_PDF.aspx?OID=502&ID=811

References

New technology

- CIBC Design and Fire Rating
 - Schuetz Econobulk SX-D: <https://www.schuetz-packaging.net/schuetz-gemany-hq/en/innovations/ecobulk-sx-d/>
 - Mauser EX UL BC: https://mauserpackaging.com/wp-content/uploads/2022/03/201909_Mauser_BRO_BC_A4.pdf
- Single Composite BC Containment Units
 - Viking BC Spill Containment Unit: <https://www.vikinggroupinc.com/products/flammable-liquid-storage-protection/bc-spill-containment-unit> & <https://www.minimax-moble.com/dienstleistungen-produkte/produkte/brandschutzwanne/fire-protection-trough/>
 - https://www.youtube.com/watch?v=dT2ePZ_A0
 - Shared Courtesy of: Marcel Ruesink - RuesinkM@viking-em.eu
- Active Drainage Systems
 - BC Storage Units: <https://safespill.com/bc-storage-units/>
 - Shared Courtesy of Tristan Mackintosh - tristan@safespill.com
- Advanced Integrated Protection Designs
 - Minimax LiquidProtect™: <https://www.youtube.com/watch?v=2sUFhURkGGU> & <https://www.minimax.com/de/de/solutions/solutions-risks/liquidprotect/>
 - Shared Courtesy of: Matthias Pohl - PohlM@minimax.de