TECHNICAL SAFETY BC

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TECHNICAL SAFETY BC
Safe technical systems. Everywhere.

PROVINCIAL REGULATOR

BC Ministry	Safety Authority Act	Re-Branded
1895	2004	2017

TECHNICAL SAFETY BC

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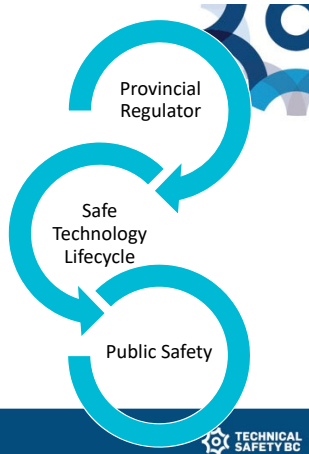
Safe technical systems. Everywhere.

technicalsafetybc.ca



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TSBC INVESTIGATIONS

SCAN ME	SCAN ME	SCAN ME
Incident Investigation Public Reports	2019 Sea to Sky Gondola Collapse	2017 Fernie Memorial Arena Incident

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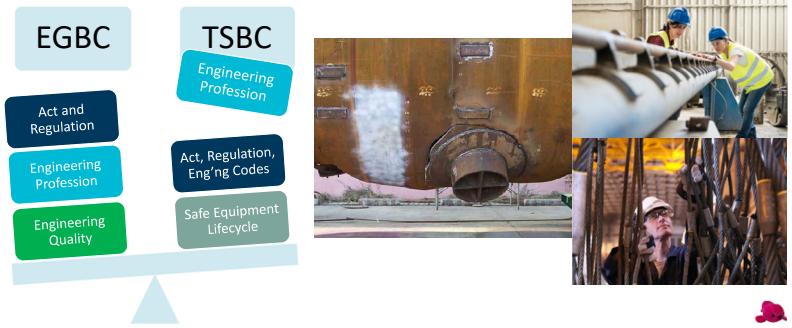
ENGINEERING AT TSBC



CASE STUDIES

2019 Incident Investigations:

1. Ammonia Release
2. Rack and Pinion- Construction Elevator

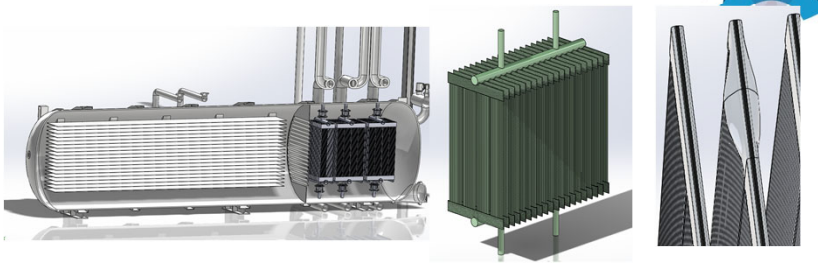
Learnings:
1. Roles of Professional Engineers – Safe Design
2. Root Causes of the studies

CASE STUDY: AMMONIA RELEASE

Report link

BACKGROUND

WHAT HAPPENED?



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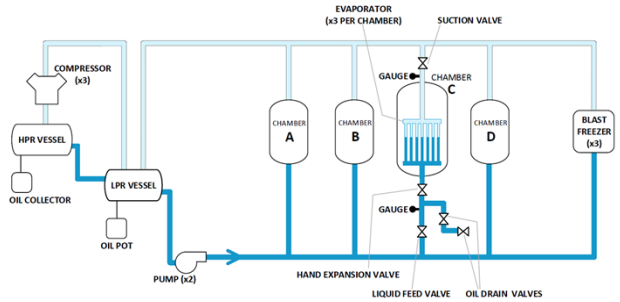
WHAT HAPPENED?



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FAILURE SCENARIO

Isolation of liquid ammonia caused an overpressure condition, rupturing the evaporator at a location of high stress and a manufacturing defect.

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FAILURE SCENARIO

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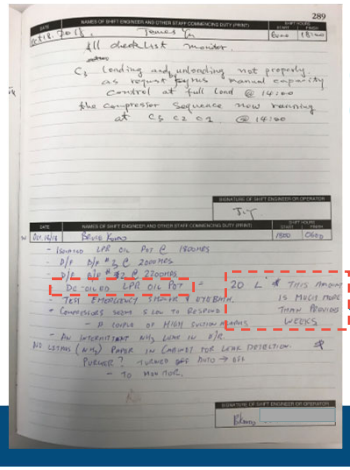
COMPRESSOR OIL MIGRATION

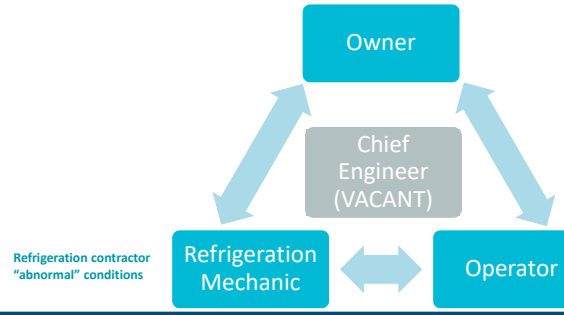


Operator's log book

October 18, 2018

"DE-OILED LPR OIL POT 20 L * THIS AMOUNT IS MUCH MORE THAN PREVIOUS WEEKS

EQUIPMENT RESPONSIBILITY AND LEADERSHIP AT INCIDENT



Refrigeration contractor "abnormal" conditions

Power engineers (employees) "regular" or "normal" operations

CONCLUSIONS

- Refrigeration system equipment failure
  - Trapped refrigerant → ruptured evaporator (structural overload)
- Operational decisions
  - System operated with hand expansion valves fully open, contrary to design specifications → evaporator flooded with ammonia, no room for expansion
  - No chief engineer for the facility and no effective chief engineer function
- Uncontrolled discharge of ammonia
  - System components not designed or approved as an ammonia leak control system
- **Professional Engineer did not consider overpressure hazards**

CASE STUDY: RACK AND PINION

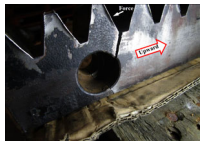
Construction Hoist:

- Each "car" uses three pinions (drive gear) to transport itself along the Hoistway.
- Modular, temporary installations that move from site to site

CASE STUDY: RACK AND PINION

Pinion Tooth Failure

Rack Overload



Spline Fatigue Failure

CASE STUDY: RACK AND PINION

Engineering Takeaways:

- Material Selection for application
- Quality Control
  - Manufacturing
  - Material Processing
- Maintenance and Inspection of aging equipment