MDEC: 2nd Annual MVPC 2024

Presentation# S2P2

CSA M424.4:25 – TSC Meeting #3
Self-propelled, electrically driven, non- rail-bound mobile machines for use in non-gassy underground mines

Nam (John) Le, P.Eng (CanmetMINING)

October 21st, 2024
MDEC MPV Conference

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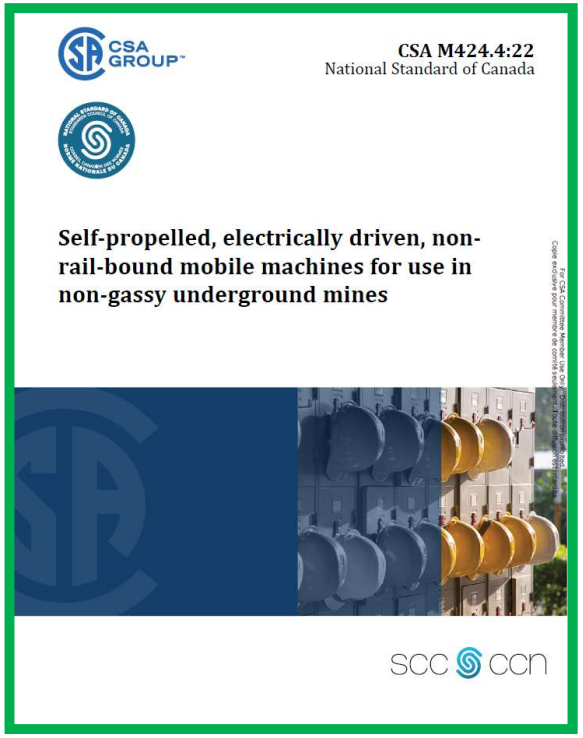
01. Background and Objectives – Revise M424.4:25



Revise M424.4:25

- ~~Move section 6: Hydrogen-fuel-cell-electric powered machine to a new Standard M424.5:25~~
  - ~~Add handle, transport and storage hydrogen fuel~~
- Review, correct, revise and add content where applicable in M424.4:25
- Add handle, transport and storage battery in M424.4:25

01. Background and Objectives – Sample of battery fires

Samples of battery fire at the mine sites

Borden Mine on Surface, 2019

Southern district U/G, 2019

Onaping district U/G, 2020

Credit photos to Ontario Mine Rescue presentation, 2022

01. Background and Objectives - Battery fires at Macassa Mine

- Between 2022-2023, Macassa Operation have experience (6) fires involving batteries (1) in 2022, (5) in 2023

DATE:	BATTERY UNIT / EVENT LOCATION
August 14th	BI-0013 - On-Site - U/G
June 30th	BZ0007 - On-Site - Surface
July 10th	Trailer Fire - Off-Site - Surface
July 15th	BZ0055 - On-Site - Surface
July 17th	BZ0055 - On-Site - Surface
August 11th	BZ0082 - On-Site - Surface

Reference: Battery Fire Events_Agnico Eagle presentation, 2024

Current Codes and Regulations for transporting battery on surface roads and air transportation

- UN regulation: Transport of Dangerous Goods_Volume I & II
- Canada SOR-2001-286 Transportation of Dangerous Goods Act
- USA Code of Federal Regulations, 49 CFR Ch 1 & 173-185
- IATA Standards

Battery is clasified as dangerous goods, the shipper (Consignor) required to have TDG training certificate

Credit photo to UN Regulation, V1

01. Background and Objectives - Important questions

How to minimize and mitigate the risk of performing the following tasks in an underground mine?

- Handle, transport and storage: good/suspected/bad battery
- Handle, transport battery contained in equipment or packed with equipment
- Fire Suppression (safety specific)
- Battery emergency alert protocol

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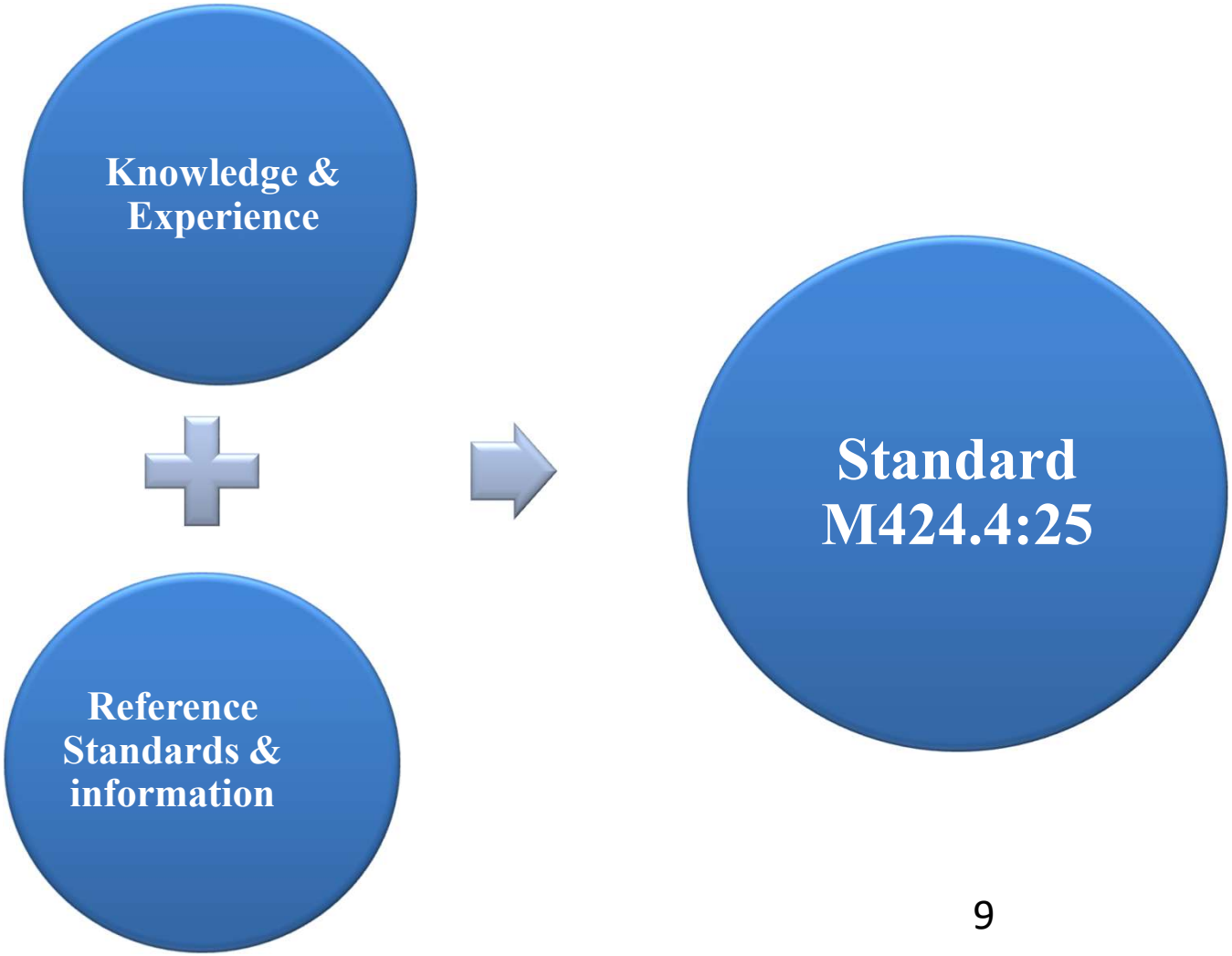
2.0 General Approach - Revise Standard M424.4:25



2.0 General Approach - Working group structure

Each working group review, revise, add more technical information and provide the final content for M424.4 Standard.

WG leader provides progress update

Working Group	Section	Members
WG1	Preface, (1) Scope, (2) Reference, (3) Definitions & Abbreviations	**Leader: David Rezansoff**
WG2	(4) General Requirements: * BEV & hybrid * Risk assessment * Transport and storage batteries	**Leader: William Hughes**
WG3	Review and revise sections: * (5) Battery electric-power machines * (6) Diesel-electric powered machines Annex (informative)	**Leader: Gaurav Mahajan**

2.0 General Approach - Team Members M424.4:25

TSC Membership				
First Name	**Last Name**	**Position**	**Group**	**Company**
John	Le	Chair	Government	NRCan - CanmetMINING
Cheryl	Allen	Co-Chair	Mine Operation	Vale Canada
William	Hughes	Co-Chair	OEM	Prairie Machine
Ana	Andronescu	Project Manager	Standard Organization	CSA

Total 26+ Team Members

2.0 Participants Bowtie Risk Assessment

Draft Minutes
Virtual Meeting of the Technical Subcomittee on
Electrically-powered machines for use in underground mines (M424.4)
September 20, 2024, 11:00 a.m. - 2:00 p.m. ET

First Name	Last Name	Company	Attendance
John (TSC Chair)	Le	CanmetMINING	V
Cheryl (Vice Chair)	Allen	Vale	V
William (Vice Chair)	Hughes	Prairie Machine	
Alex	Lenz	Maclean Engineering	V
Blair	Baldwin	Baldwin Services Inc.	V
Brailyn	Johnsgaard	Nutrien	V
Brent	Rubeli	CanmetMINING	
Carry	Ingram	WSCC	V
Cornelius	Powel	Hudbay	
Craig	Allair	Vale	V
Craig	Harris	Glencore	V
Cynthia	Matikainen	MLITSD	V
David	Schmidt	Kovatera	
David	Lyon	Zero Nexsus	
David	Rezansoff	Gov of Saskatchewan	
Gaurav	Mahajan	CanmetMINING	V
George	Lobay	Consultant	
Ian	Smith	SWRI	V
Jason	Flanagan	Caterpillar Inc.	
Jerry	Davis	Komatsu	V
Joe	Benoit	Hudbay	V
Joel	Thon	Nutrien	V
Paul	Summers	Miller Technology Inc	
Scott	Secord	Ontario Gov.	
Shawn	Sauve	Glencore	V

CSA Staff			
Ana	Andronescu	CSA Group	V
Guest(s)			
Heather	Dobson	Vale	V

Draft Minutes
Virtual Meeting of the Technical Subcomittee on
Electrically-powered machines for use in underground mines (M424.4)
September 23, 2024, 10:30 a.m. - 12:30 p.m. ET

First Name	Last Name	Company	Attendance
John (TSC Chair)	Le	CanmetMINING	V
Cheryl (Vice Chair)	Allen	Vale	V
William (Vice Chair)	Hughes	Prairie Machine	
Alex	Lenz	Maclean Engineering	V
Blair	Baldwin	Baldwin Services Inc.	
Brailyn	Johnsgaard	Nutrien	V
Brent	Rubeli	CanmetMINING	
Carry	Ingram	WSCC	V
Cornelius	Powel		
Craig	Allair		
Craig	Harris		V
Cynthia	Matikainen	MLITSD	V
David	Schmidt	Kovatera	
David	Lyon	Zero Nexsus	
David	Rezansoff	Gov of Saskatchewan	V
Gaurav	Mahajan	CanmetMINING	
George	Lobay	Consultant	
Ian	Smith	SWRI	
Jason	Flanagan	Caterpillar Inc.	V
Jerry	Davis	Komatsu	V
Joe	Benoit	Hudbay	
Joel	Thon	Nutrien	V
Paul	Summers	Miller Technology Inc	
Scott	Secord	Ontario Gov.	V
Shawn	Sauve	Glencore	V

CSA Staff			
Ana	Andronescu	CSA Group	V
Guest(s)			
Heather	Dobson	Vale	V

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3.0 Technical Content – Review Bowtie Risk Assessment

Bowtie Risk Assessment led by ***Heather Dobson*** (Vale) – Sept/20/2024 (3 hrs), Sept/23/2024 (2 hrs)

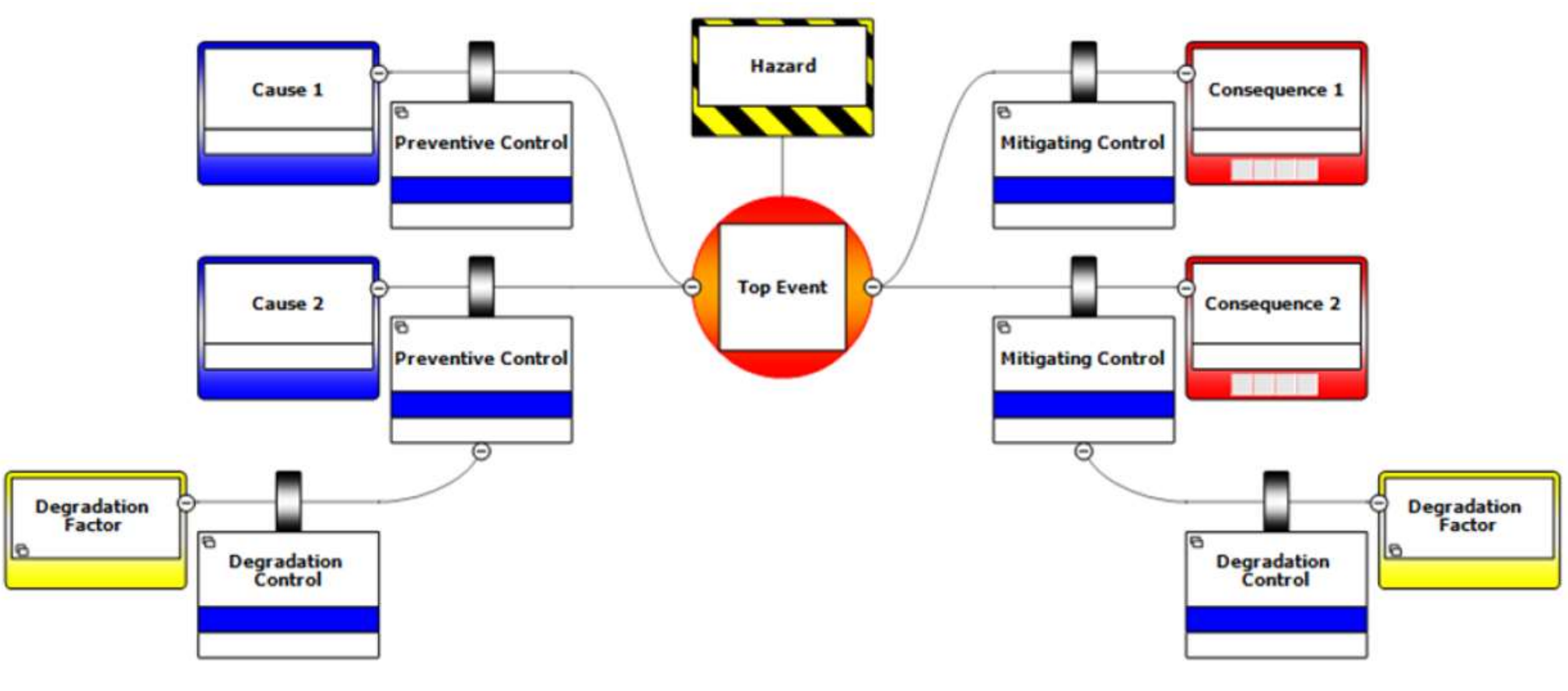
Purpose:

- Brainstorming and capturing knowledge and experiences from the team members
- Evaluate potential hazards and find solutions associated with topics below
- The information will be disseminated throughout the Standard

Topics:

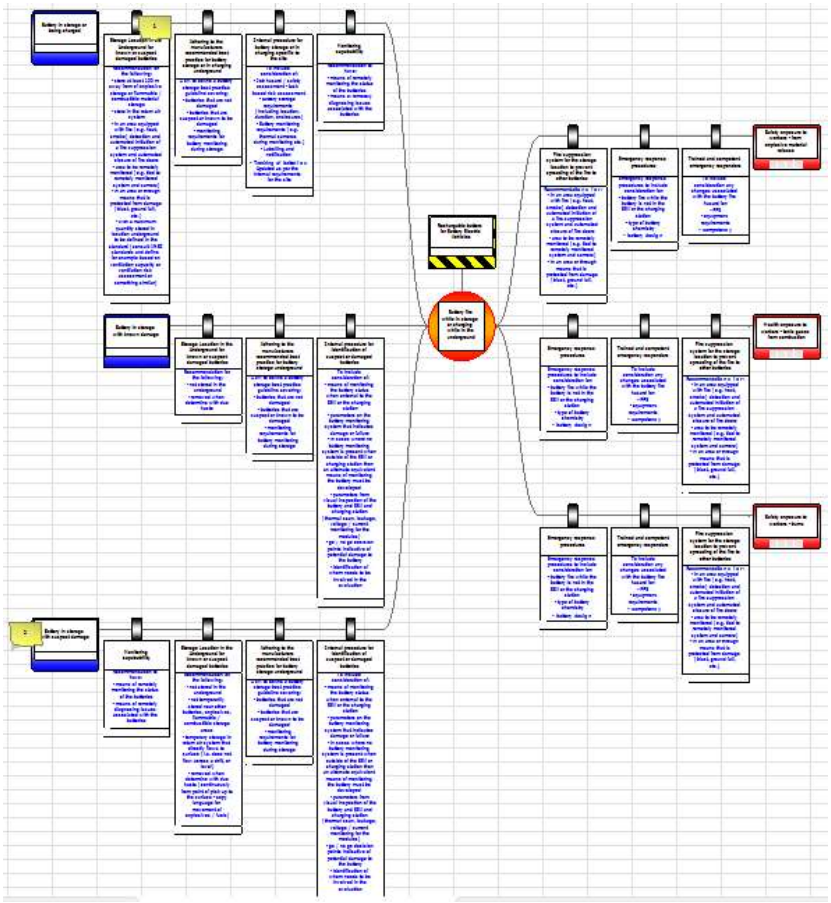
- Battery fire while in storage or charging while in the underground
- Battery fire during access and handling in the underground
- Battery fire during transportation (from the portal or the collar into the underground)

3.0 Technical Content – Review Bowtie Risk Assessment



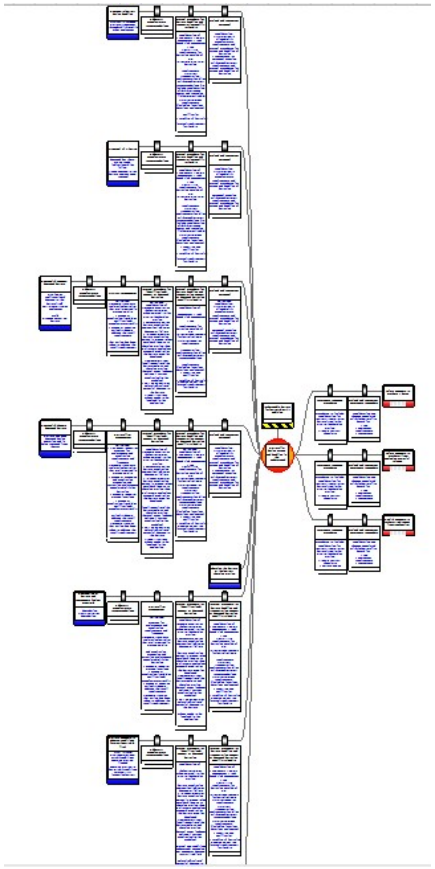
3.0 Technical Content – Review Bowtie Risk Assessment

Battery fire while in storage or charging while in the underground



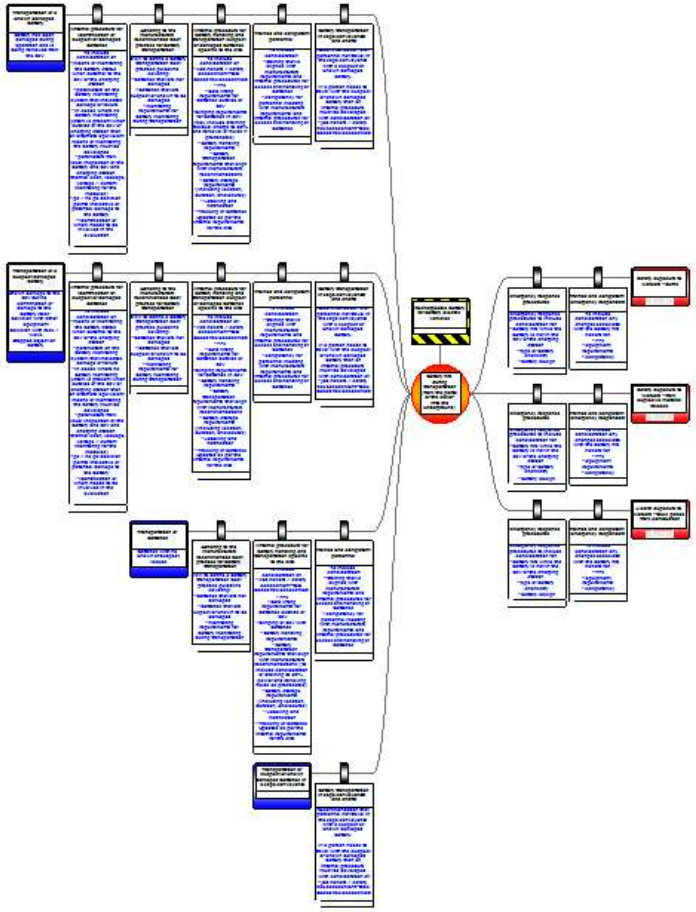
3.0 Technical Content – Review Bowtie Risk Assessment

Battery fire during access and handling in the underground



3.0 Technical Content – Review Bowtie Risk Assessment

Battery fire during transportation



3.0 Technical Content – Review Bowtie Risk Assessment

Battery in storage or being charged	
Barriers & Escalation Factors	**Barrier Actions**
Storage Location in the Underground for known or suspect damaged batteries ***Recommendation for the following:*** - store at least 100 m away (too specific) from of explosive storage or flammable / combustible material storage - store in the return air system - in an area equipped with fire (e.g. heat, smoke) detection and automated initiation of a fire suppression system and automated closure of fire doors - area to be remotely monitored (e.g. tied to remotely monitored system and camera) - in an area or through means that is protected from damage (blast, ground fall, etc.) - with a maximum quantity stored in location underground to be defined in the standard (consult ANSI standards and define for example based on ventilation capacity or ventilation risk assessment or something similar)	• 1 Battery storage quantity - ANSI CAN UL 9540 / UL 9540A - determine means to evaluate quantity that can be stored
Adhering to the manufacturers recommended best practice for battery storage or in charging underground OEM to define a battery storage best practice guideline covering: - batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during storage	
Internal procedure for battery storage or in charging specific to the site ***To include consideration of:*** - Job hazard / safety assessment - task based risk assessment - Battery storage requirements (including location, duration, enclosures) - Battery monitoring requirements (e.g. thermal cameras during monitoring etc.) - Labelling and notification - Tracking of batteries Updated as per the internal requirements for the site	

Bowtie Diagram - Storage | Bowtie Diagram - Handling | Bowtie Diagram - Transportation | **Bowtie - Table** | +

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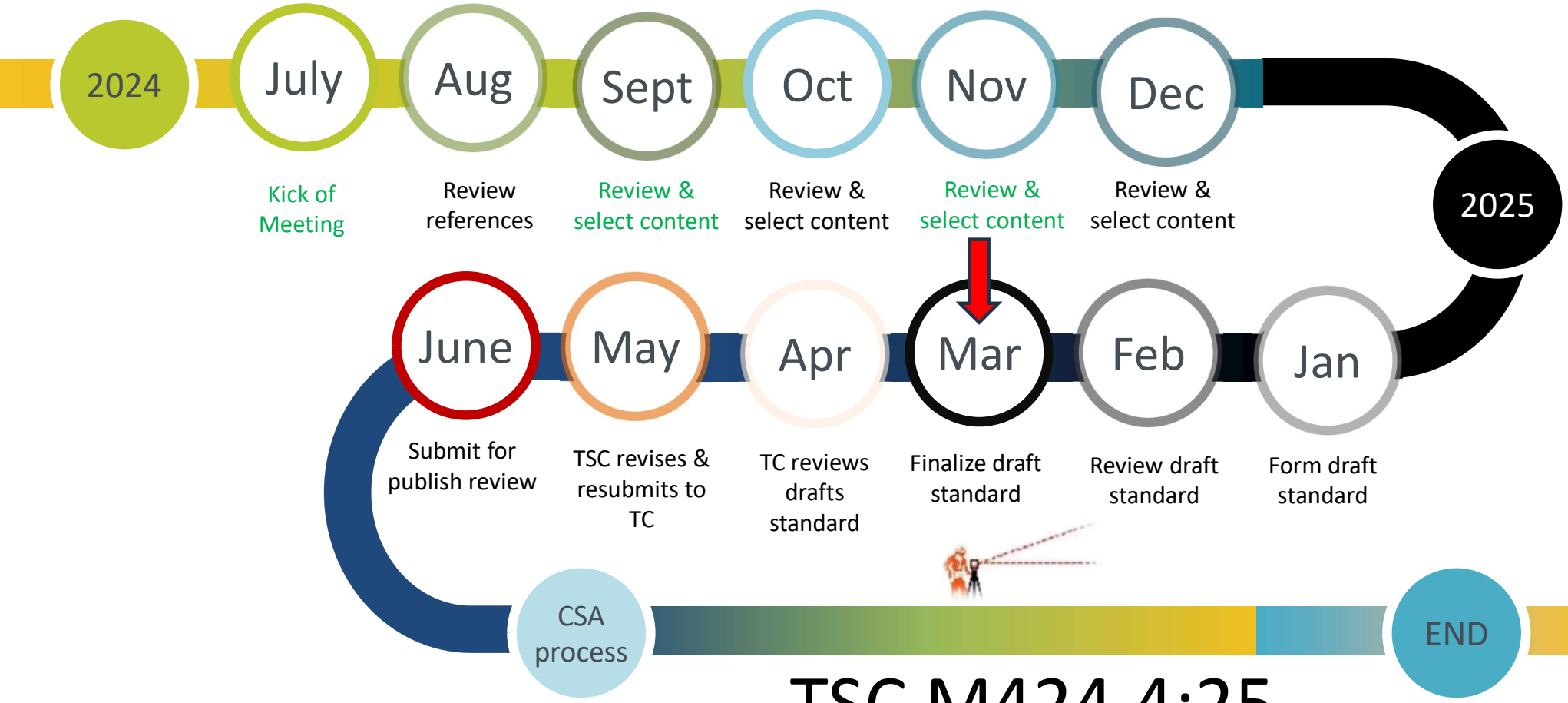
4.0 Next steps



TSC M424.4:25

TSC M424.4 meeting every 1 month of 2025

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