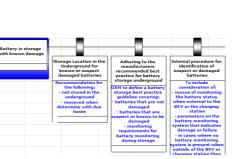
Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Red = need to confirm Blue = add on content

Barriers & Escalation Factors (Original)	Revised Barries & Escalation Factors (working content)
Storage Location in the Underground for known or suspect damaged batteries	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)	Recommendation for the following: - store at proper proximity distance from explosive storage or flammable / combustible materi storage for safe installation, operation, maintenance and accessing in emergency situations. Also keep proper distance to minimize flame propagation to the next battery package - store in the return air system that directly flows to surface (i.e. does not flow across a drift, of level) - 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, equipped with man door and fire monitoring system ensure storage location far away from ref. station or emergency egress - 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 (tool to assess the max. quantity?) stored in storage/shop? locatio 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)
Adhering to the manufacturers recommended best practice for battery storage or in charging underground	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	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	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	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
Monitoring capabability	Monitoring capabability
Recommendation to have: - means of remotely monitoring the status of the batteries - means of remotely diagnosing issues associated with the batteries	Recommendation to have: - means of remotely monitoring the status of the batteries from surface - means of remotely diagnosing issues associated with the batteries - means of monitoring the status of the batteries locally - find way to monitor the battery malfunction status if wireless communication is not available

Barriers & Escalation Factors	Barriers & Escalation Factors (working content)		
Storage Location in the Underground for known or suspect damaged batteries	Storage Location in the Underground for known or suspect-damaged batteries		
Recommendation for the following:	Recommendation for the following:		
not stored in the underground	- not stored in the underground		
removed when determine with due haste	- removed when determine with due haste		
Adhering to the manufacturers recommended best practice for battery storage underground	Adhering to the manufacturers recommended best practice for battery storage underground		
DEM to define a battery storage best practice guideline covering:	OEM to define a battery storage best practice guideline covering:		
batteries that are not damaged	- batteries that are not damaged		
· batteries that are suspect or known to be damaged · monitoring requirements for battery monitoring during storage	batteries that are suspect or known to be damaged monitoring requirements for battery monitoring during storage		



Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery

- go / no go decision points indicative of potential damage to the battery

identification of whom needs to be involved in the evaluation.

identification of whom needs to be involved in the evaluation

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery

- go / no go decision points indicative of potential damage to the battery

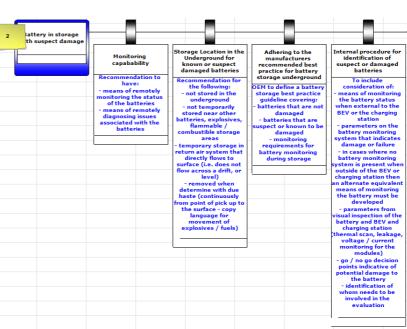
identification of whom needs to be involved in the evaluation

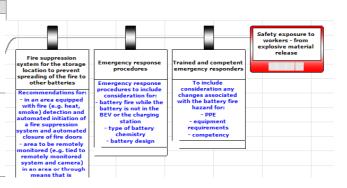
identification of whom needs to be involved in the evaluation

Battery in storage with suspect damage	
Barriers & Escalation Factors	Barriers & Escalation Factors
Monitoring capabability	Monitoring capabability
Recommendation to have:	Recommendation to have:
- means of remotely monitoring the status of the batteries	- means of remotely monitoring the status of the batteries
- means of remotely diagnosing issues associated with the batteries	- means of remotely diagnosing issues associated with the batteries
Storage Location in the Underground for known or suspect damaged batteries	Storage Location in the Underground for known or suspect damaged batteries
Recommendation for the following:	Recommendation for the following:
- not stored in the underground	- not stored in the underground
 not temporarily stored near other batteries, explosives, flammable / combustible storage areas 	- not temporarily stored near other batteries, explosives, flammable / combustible storage
 temporary storage in return air system that directly flows to surface (i.e. does not flow across a drift, 	
or level)	- temporary storage in return air system that directly flows to surface (i.e. does not flow across
- removed when determine with due haste (continuously from point of pick up to the surface - copy language for movement of explosives / fuels)	a drift, or level) - removed when determine with due haste (continuously from point of pick up to the surface -
language for movement of explosives / fuels)	copy language for movement of explosives / fuels)
	copy language for movement of explosives y radio)
Adhering to the manufacturers recommended best practice for battery storage	Adhering to the manufacturers recommended best practice for battery storage
underground	underground
OEM to define a battery storage best practice guideline covering:	OEM to define a battery storage best practice guideline covering:
- batteries that are not damaged	- batteries that are not damaged
- batteries that are suspect or known to be damaged	- batteries that are suspect or known to be damaged
- monitoring requirements for battery monitoring during storage	- monitoring requirements for battery monitoring during storage
Internal procedure for identification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries
To include consideration of:	To include consideration of:
- means of monitoring the battery status when external to the BEV or the charging station	- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure	- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station	- in cases where no battery monitoring system is present when outside of the BEV or charging
then an alternate equivalent means of monitoring the battery must be developed	station then an alternate equivalent means of monitoring the battery must be developed
 parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) 	- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
leakage, voltage / current monitoring for the modules)	reakage, voicage / current monitoring for the modules)

Safety exposure to workers - from explosive material release **Barriers & Escalation Factors Barriers & Escalation Factors** Fire suppression system for the storage location to prevent spreading of the fire to other Fire suppression system for the storage location to prevent spreading of the fire to other batteries batteries Recommendations for: Recommendations for: - in an area equipped with fire (e.g. heat, smoke) detection and automated initiation of a fire - 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 suppression system and automated closure of fire doors - area to be remotely monitored (e.g. tied to remotely monitored system and camera) 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.) - in an area or through means that is protected from damage (blast, ground fall, etc.) Emergency response procedures Emergency response procedures Emergency response procedures to include consideration for: Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry battery fire while the battery in the BEV, charging station and storage location battery design during tranporting the damaged battery to surface type of battery chemistry battery design

charging station then an alternate equivalent means of monitoring the buttery must be provided to the state of the state of the state of the buttery and BEV and thermal scan, leakage, voltage / current monitoring for the op of no go decision points indicative of potential damage to the buttery of the buttery of the buttery of the state of the buttery of the state of the buttery of the buttery of the state of the state of the buttery of the state of the sta





	Top event	Battery fire while in storage or charging while in the underground		
Trained and competent emergency responders		ergency responders	Trained and competent emergency responders	
To include consideration any changes associated with the battery fire hazard for:		ny changes associated with the battery fire hazard for:	To include consideration any changes associated with the battery fire hazard for:	
	- PPE		- PPE based on SDS	
	- equipment requirements		- equipment requirements	
	- competency		- competency	

Rechargable batters for Battery Electric Vehicles

protected from damage (blast, ground fall, etc.) UNCLASSIFIED - NON CLASSIFIÉ

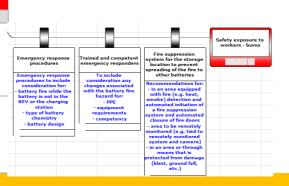
CDC

Hazard

Barriers & Escalation Factors	Barriers & Escalation Factors
Emergency response procedures	Emergency response procedures
Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design	Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design
Trained and competent emergency responders	Trained and competent emergency responders
To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency	To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency
Fire suppression system for the storage location to prevent spreading of the fire to other batteries	Fire suppression system for the storage location to prevent spreading of the fire to other batteries
Recommendations for: - 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.)	Recommendations for: - 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.)

Emergency response procedures Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging	Trained and competent emergency responders To include consideration any changes associated with the battery fire hazard for: - PPE	Fire suppression system for the storage location to prevent spreading of the fire to other batteries Recommendations for: - in an area equipped with fire (e.g. heat, smoke) detection and automated initiation of	Health exposure to workers - toxic gases from combustion
station - type of battery chemistry - battery design	- equipment requirements - competency	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.)	

Safety exposure to workers - burns Barriers & Escalation Factors **Barriers & Escalation Factors** Emergency response procedures Emergency response procedures Emergency response procedures to include consideration for: Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - type of battery chemistry battery design - battery design Fire suppression system for the storage location to prevent spreading of the fire to other Fire suppression system for the storage location to prevent spreading of the fire to other batteries Recommendations for: Recommendations for: - in an area equipped with fire (e.g. heat, smoke) detection and automated initiation of a fire - 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 suppression system and automated closure of fire doors - area to be remotely monitored (e.g. tied to remotely monitored system and camera) - 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.) - in an area or through means that is protected from damage (blast, ground fall, etc.)



	<u> </u>
Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground
Hazard	Rechargeable battery for battery electric vehicles
Top event	Battery fire during access and handling in the underground

Damage to battery during handling

Battery is dropped

Battery is damaged through collision with other equipment

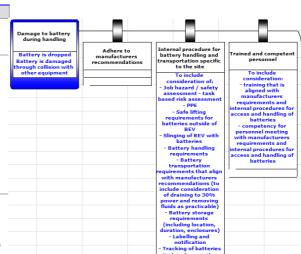
Barriers & Escalation Factors					
Adhere to manufacturers recommendations	Adhere to manufacturers recommendations	Damage to battery during handling			
Internal procedure for battery handling and transportation specific to the site	Internal procedure for battery handling and transportation specific to the site	Battery is dropped Battery is damaged through collision with	Adhere to manufacturers recommendations	Internal procedure for battery handling and transportation specific to the site	Trained and competen personnel
To include consideration of: Job hazard / safety assessment - task based risk assessment PPE Safe lifting requirements for batteries outside of BEV Slinging of BEV with batteries Battery handling requirements Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable) Battery storage requirements (including location, duration, enclosures) Labelling and notification Tracking of batteries Updated as per the internal requirements for the site	To include consideration of: Job hazard / safety assessment - task based risk assessment PPE Safe lifting requirements for batteries outside of BEV Slinging of BEV with batteries Battery handling requirements Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable) Battery storage requirements (including location, duration, enclosures) Labelling and notification Tracking of batteries Updated as per the internal requirements for the site	other equipment		To include consideration of: Job hazard / safety assessment - task based risk assessment PEE - Safe lifting requirements for batteries - Slinging of BEV with batteries - Battery transportation requirements that align with manufacturers unclude consideration include consideration	To include consideration: - training that is aligned with manufacturers manufacturers of the constant of the c
Trained and competent personnel To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries	Trained and competent personnel To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries			of draining to 30% power and removing fluids as practicable) - Battery storage requirements (including location, duration, enclosures) - Labelling and notification - Tracking of batteries Updated as per the internal requirements for the site	

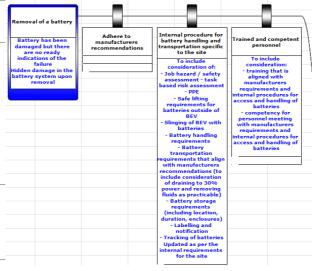
Removal of a battery

Battery has been damaged but there are no ready indications of the failure Hidden damage in the battery system upon removal

Barriers & Escalation Factors	Barriers & Escalation Factors
Adhere to manufacturers recommendations	Adhere to manufacturers recommendations
Internal procedure for battery handling and transportation specific to the site	Internal procedure for battery handling and transportation specific to the site
To include consideration of: - Job hazard / safety assessment - task based risk assessment - PPE - Safe lifting requirements for batteries outside of BEV - Slinging of BEV with batteries - Battery handling requirements - Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable) - Battery storage requirements (including location, duration, enclosures) - Labelling and notification - Tracking of batteries Updated as per the internal requirements for the site	To include consideration of: Job hazard / safety assessment - task based risk assessment PPE Safe lifting requirements for batteries outside of BEV Slinging of BEV with batteries Battery handling requirements Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable) Battery storage requirements (including location, duration, enclosures) Labelling and notification Tracking of batteries Updated as per the internal requirements for the site
Trained and competent personnel	Trained and competent personnel
To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries	To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Removal of a suspect damaged battery





Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Known damage to the BEV but no confirmation of damage to the battery itself Collision with other equipment

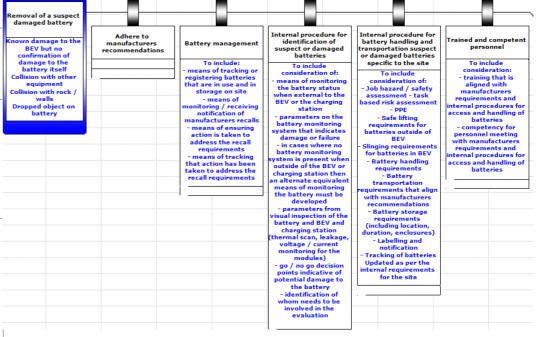
Collision with rock / walls Dropped object on battery

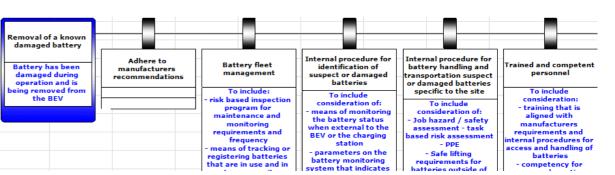
Barriers & Escalation Factors	
Adhere to manufacturers recommendations	Adhere to manufacturers recommendations
Battery management	Battery management
To include: - means of tracking or registering batteries that are in use and in storage on site - means of monitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements - means of tracking that action has been taken to address the recall requirements	To include: - means of tracking or registering batteries that are in use and in storage on site - means of monitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements - means of tracking that action has been taken to address the recall requirements
Internal procedure for identification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries
To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation	To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scar leakage, voltage / current monitoring for the modules) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation
Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site
To include consideration of: - Job hazard / safety assessment - task based risk assessment - PPE - Safe lifting requirements for batteries outside of BEV - Slinging requirements for batteries in BEV - Battery handling requirements - Battery transportation requirements that align with manufacturers recommendations - Battery storage requirements (including location, duration, enclosures) - Labelling and notification - Tracking of batteries Updated as per the internal requirements for the site	To include consideration of: Job hazard / safety assessment - task based risk assessment PPE Safe lifting requirements for batteries outside of BEV Slinging requirements for batteries in BEV Battery handling requirements Battery transportation requirements that align with manufacturers recommendations Battery storage requirements (including location, duration, enclosures) Labelling and notification Tracking of batteries Updated as per the internal requirements for the site
Trained and competent personnel	Trained and competent personnel
To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries	To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Removal of a known damaged battery

Battery has been damaged during operation and is being removed from the BEV

Barriers & Escalation Factors	
Adhere to manufacturers recommendations	Adhere to manufacturers recommendations
Battery fleet management	Battery fleet management
To include: - risk based inspection program for maintenance and monitoring requirements and frequency - means of tracking or registering batteries that are in use and in storage on site - means of managing and monitoring preventive and corrective maintenance associated with the batteries - means of knowing storage locations - means of monitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements - means of tracking that action has been taken to address the recall requirements	To include: - risk based inspection program for maintenance and monitoring requirements and frequency - means of tracking or registering batteries that are in use and in storage on site - means of managing and monitoring preventive and corrective maintenance associated with the batteries - means of knowing storage locations - means of monitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements - means of tracking that action has been taken to address the recall requirements





	Don't is croup. Non Don't is croup		
Hazard Rechargable batters for Battery Electric Vehicles			
Top event	Top event Battery fire while in storage or charging while in the underground		
Internal procedure for identification of suspect or damaged batteries Internal procedure for i		Internal procedure for identification of suspect or damaged batteries	

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries
- Updated as per the internal requirements for the site

- training that is aligned with manufacturers requirements and internal procedures for access and

- competency for personnel meeting with manufacturers requirements and internal procedures for

Barriers & Escalation Factors

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Internal procedure for battery handling and transportation suspect or damaged hatteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries
- Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- handling of hatteries
- access and handling of batteries

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of hatteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Barriers & Escalation Factors

charging statio

Charging the battery at the battery charging station Need technical content **Barriers & Escalation Factors**

Degradation of battery and components (aging, wear etc.)

Battery chemistry degradation Electrical wiring degradation

Adhere to manufacturers recommendations	Adhere to manufacturers recommendations
Battery fleet management	Battery fleet management
To include: - risk based inspection program for maintenance and monitoring requirements and frequency - means of tracking or registering batteries that are in use and in storage on site - means of managing and monitoring preventive and corrective maintenance associated with the batteries - means of knowing storage locations - means of monitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements - means of tracking that action has been taken to address the recall requirements	To include: - risk based inspection program for maintenance and monitoring requirements and frequency - means of tracking or registering batteries that are in use and in storage on site - means of managing and monitoring preventive and corrective maintenance associated with the batteries - means of knowing storage locations - means of monitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements - means of tracking that action has been taken to address the recall requirements

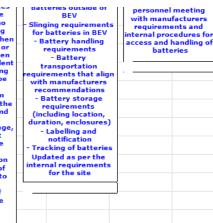
means of managing and monitoring preventive and ective maintena associated with the batteries means of knowing storage locations - means of onitoring / receiving notification of manufacturers recalls - means of ensuring action is taken to address the recall requirements means of tracking

storage on site

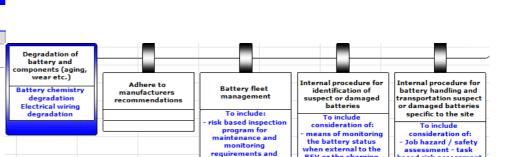
that action has been taken to address the

recall requirements

damage or failure in cases where no battery monitoring ystem is present whei outside of the BEV or charging station then in alternate equivalent means of monitoring the battery must be developed - parameters from ual inspection of the battery and BEV and charging station thermal scan, leakage voltage / current monitoring for the modules) go / no go decision points indicative of potential damage to the battery identification of whom needs to be involved in the evaluation



UNCLASSIFIED - NON CLASSIFIÉ



frequency

means of tracking o

registering batteries that are in use and in

BEV or the charging

station

parameters on the

battery monitoring

pased risk assessmen

- PPE

- Safe lifting

requirements for

Hazard	Rechargable batters for Battery Electric Vehicles	
Top event	Battery fire while in storage or charging while in the underground	
Internal procedure fo	r identification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries
- parameters on the bat - in cases where no batt then an alternate equiva - parameters from visua leakage, voltage / curre - go / no go decision po	ion of: ne battery status when external to the BEV or the charging station tery monitoring system that indicates damage or failure ery monitoring system is present when outside of the BEV or charging station lent means of monitoring the battery must be developed I inspection of the battery and BEV and charging station (thermal scan, not monitoring for the modules) Ints indicative of potential damage to the battery needs to be involved in the evaluation	To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation
Internal procedure fo specific to the site	r battery handling and transportation suspect or damaged batteries	Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site
To include considerat	ion of:	To include consideration of:
- Job hazard / safety assessment - task based risk assessment		- Job hazard / safety assessment - task based risk assessment
PPE		- PPE
	ts for batteries outside of BEV	- Safe lifting requirements for batteries outside of BEV
 Slinging requirements Battery handling requirements 		- Slinging requirements for batteries in BEV - Battery handling requirements
	requirements that align with manufacturers recommendations	- Battery transportation requirements that align with manufacturers recommendations
	ements (including location, duration, enclosures)	- Battery storage requirements (including location, duration, enclosures)
 Labelling and notificati 		- Labelling and notification
- Tracking of hatteries		- Tracking of batteries

Updated as per the internal requirements for the site

Battery exposure to adverse conditions (water, heat, cold, fire)

BEV in water BEV operated in hot or cold conditions Charging station flooded Charging station in hot or cold conditions External fire impacting battery

Updated as per the internal requirements for the site

Barriers & Escalation Factors	Barriers & Escalation Factors	
Adhere to manufacturers recommendations	Adhere to manufacturers recommendations	
Internal procedure for identification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries	
To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - parameters from external use conditions (submerged, excessive heat exposure, damage to BEV itself etc.) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation	To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - parameters from external use conditions (submerged, excessive heat exposure, damage to BEV itself etc.) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation	
Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	
Site	batteries specific to the site	
To include consideration of:	To include consideration of:	
- Job hazard / safety assessment - task based risk assessment - PPF	- Job hazard / safety assessment - task based risk assessment - PPF	
- Safe lifting requirements for batteries outside of BEV	- Safe lifting requirements for batteries outside of BEV	
- Slinging requirements for batteries in BEV	- Slinging requirements for batteries in BEV	
- Battery handling requirements	- Battery handling requirements	
- Battery transportation requirements that align with manufacturers recommendations	- Battery transportation requirements that align with manufacturers recommendations	
- Battery storage requirements (including location, duration, enclosures)	- Battery storage requirements (including location, duration, enclosures)	
- Labelling and notification - Tracking of batteries	- Labelling and notification - Tracking of batteries	
Updated as per the internal requirements for the site	Updated as per the internal requirements for the site	
opatica as per the memor requirements for the site	opulated as per the internal requirements for the site	

Damage during maintenance / improper maintenance activities

system that indicates storage on site damage or failure - means of managin - in cases where no and monito battery monitoring preventive and rective maintenar outside of the BEV or associated with the charging station then batteries an alternate equivalent means of monitoring the battery must be means of knowing storage locations - means of developed onitoring / receiving notification of - parameters from ual inspection of the manufacturers recalls battery and BEV and - means of ensuring charging station hermal scan, leakage, action is taken to address the recall voltage / current monitoring for the modules) means of tracking

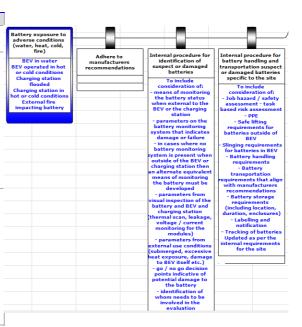
that action has been

taken to address the

recall requirements

go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation

batteries outside of Slinging requirements for batteries in BEV - Battery handling requirements - Battery transportation quirements that alig with manufacturers - Battery storage requirements (including location, duration, enclosures) - Labelling and notification - Tracking of batteries Updated as per the nternal requirement for the site



Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Electrical components

Damage to battery cells

Damage to the battery cell compartments

Improper access to the battery components

Incorrect replacement parts etc.

Barriers & Escalation Factors	Barriers & Escalation Factors	
Adhere to manufacturers recommendations	Adhere to manufacturers recommendations	Damage during maintenance /
- includes requirements to meet manufacturers recommendations for parts and components	- includes requirements to meet manufacturers recommendations for parts and components	improper maintenance activities
Trained and competent maintenance personnel	Trained and competent maintenance personnel	Electrical components Damage to battery
To include consideration:	To include consideration:	cells Damage to the
- training that is aligned with manufacturers requirements	- training that is aligned with manufacturers requirements	battery cell
- competency for maintenance personnel meeting with manufacturers requirements	- competency for maintenance personnel meeting with manufacturers requirements	compartments Improper access to the battery
Internal procedure for identification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries	components Incorrect
To include consideration of:	To include consideration of:	replacement parts
- means of monitoring the battery status when external to the BEV or the charging station	- means of monitoring the battery status when external to the BEV or the charging station	etc.
- parameters on the battery monitoring system that indicates damage or failure	- parameters on the battery monitoring system that indicates damage or failure	
- in cases where no battery monitoring system is present when outside of the BEV or charging station	- in cases where no battery monitoring system is present when outside of the BEV or charging	
then an alternate equivalent means of monitoring the battery must be developed	station then an alternate equivalent means of monitoring the battery must be developed	
- parameters from visual inspection of the battery and BEV and charging station (thermal scan,	- parameters from visual inspection of the battery and BEV and charging station (thermal scan,	
leakage, voltage / current monitoring for the modules)	leakage, voltage / current monitoring for the modules)	
 parameters from external use conditions (submerged, excessive heat exposure, damage to BEV itself etc.) 	- parameters from external use conditions (submerged, excessive heat exposure, damage to BEV itself etc.)	
- go / no go decision points indicative of potential damage to the battery	- qo / no go decision points indicative of potential damage to the battery	
- identification of whom needs to be involved in the evaluation	- identification of whom needs to be involved in the evaluation	
Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	
To include consideration of:	To include consideration of:	
- Job hazard / safety assessment - task based risk assessment	- Job hazard / safety assessment - task based risk assessment	
- PPE	- PPE	
 Safe lifting requirements for batteries outside of BEV Slinging requirements for batteries in BEV 	- Safe lifting requirements for batteries outside of BEV - Slinging requirements for batteries in BEV	
- Battery handling requirements	- Battery handling requirements	
- Battery transportation requirements that align with manufacturers recommendations	- Battery transportation requirements that align with manufacturers recommendations	
Battery storage requirements (including location, duration, enclosures) Labelling and notification	Battery storage requirements (including location, duration, enclosures) Labelling and notification	
- Tracking of batteries	- Tracking of batteries	
Updated as per the internal requirements for the site	Updated as per the internal requirements for the site	

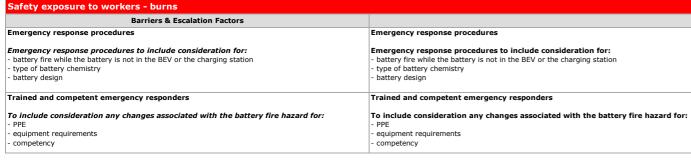
transportation suspect or damaged batteries specific to the site - includes requirements to meet manufacturers recommendations for parts and components To include consideration: - training that is aligned with manufacturers Damage to the battery cell compartments improper access to the battery components Incorrect means of monitoring the battery status when external to the BEV or the charging Job hazard / safety station - PPE - Safe lifting requirements for batteries outside of BEV - parameters on the battery monitoring system that indicates damage or failure replacement parts etc. oanage or failure in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent Slinging requirements for batteries in BEV - Battery handling requirements - Battery transportation equirements that align with manufacturers recommendations an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - parameters from external use conditions (submerged, excessive heat exposure, damage to BEV itself etc.) - go / no go decision - Battery storage - Labelling and notification - Tracking of batterie Updated as per the internal requirement for the site go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation

Adhere to

manufacturers recommendations

Trained and competent

maintenance personnel



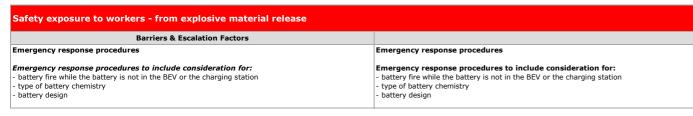


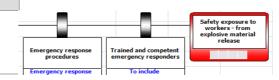
UNCLASSIFIED - NON CLASSIFIÉ

Internal procedure for identification of

suspect or damaged batteries

Internal procedure for battery handling and





Rechargable batters for Battery Electric Vehicles

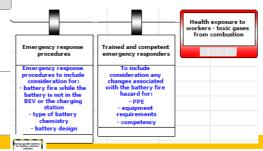
Hazard

lop event Battery fire while in storage or charging while in the underground	
Trained and competent emergency responders Trained and competent emergency	cy responders
To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency To include consideration any chan - PPE - equipment requirements - competency	nges associated with the battery fire hazard for:

procedures to include consideration for: - battery fire while the		ch wit
battery is not in the BEV or the charging station - type of battery chemistry - battery design		_
, acaign	П	_

consideration any changes associated with the battery fire hazard for:	
nazard for: - PPE - equipment	
requirements - competency	
	1

Barriers & Escalation Factors	Barriers & Escalation Factors
Emergency response procedures	Emergency response procedures
Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design	Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design
Trained and competent emergency responders	Trained and competent emergency responders
To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency	To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency



	<u> </u>
Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground
Hazard	Rechargeable battery for battery electric vehicles
Top event	Battery fire during transportation (from the portal or the collar into the underground)



Transportation of a known damaged battery

Battery has been damaged during operation and is being removed from the BEV

Barriers & Escalation Factors	Barriers & Escalation Factors
Internal procedure for identification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries
To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation	To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation
Adhering to the manufacturers recommended best practice for battery transportation	Adhering to the manufacturers recommended best practice for battery transportation
OEM to define a battery transportation best practice guideline covering: - batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during transportation	OEM to define a battery transportation best practice guideline covering: - batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during transportation
Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site
To include consideration of: - Job hazard / safety assessment - task based risk assessment - PPE - Safe lifting requirements for batteries outside of BEV - Slinging requirements for batteries in BEV (may include draining residual charge to 30% and removal of fluids if practicable) - Battery handling requirements - Battery transportation requirements that align with manufacturers recommendations - Battery storage requirements (including location, duration, enclosures) - Labelling and notification - Tracking of batteries Updated as per the internal requirements for the site	removal of fluids if practicable) - Battery handling requirements - Battery transportation requirements that align with manufacturers recommendations - Battery storage requirements (including location, duration, enclosures) - Labelling and notification - Tracking of batteries Updated as per the internal requirements for the site
Trained and competent personnel To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries	Trained and competent personnel To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries
Battery transportation in cage conveyances and shafts	Battery transportation in cage conveyances and shafts
Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged battery.	Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged battery.
If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of: - job hazard / safety risk assessment - task based risk assessment	If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of: - job hazard / safety risk assessment - task based risk assessment

Transportation of a suspect damaged battery

Known damage to the BEV but no confirmation of damage to the battery itself

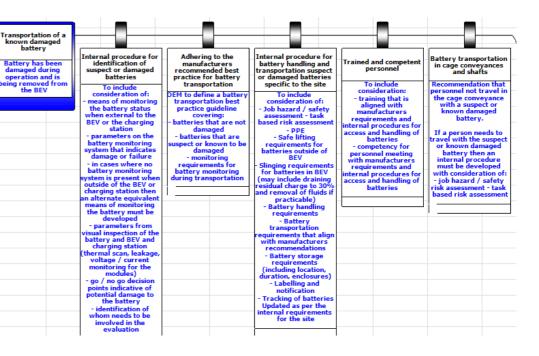
Collision with other equipment

Collision with rock / walls

Dropped object on battery

Barriers & Escalation Factors	Barriers & Escalation Factors
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Rechargable batters for Battery Electric Vehicles

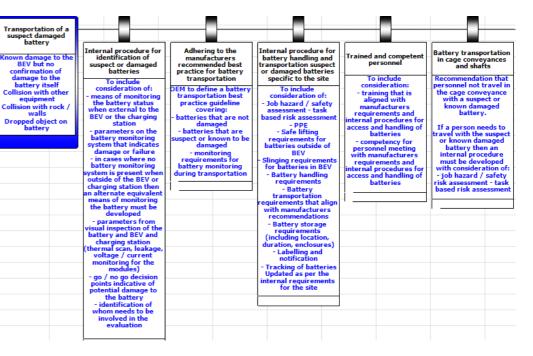
Hazard	Rechargable batters for Battery Electric Vehicles		
Top event	Battery fire while in storage or charging while in the underground		
Internal procedure for ide	ntification of suspect or damaged batteries	Internal procedure for identification of suspect or damaged batteries	
- parameters on the battery r - in cases where no battery r then an alternate equivalent - parameters from visual insp leakage, voltage / current m - go / no go decision points i	Ittery status when external to the BEV or the charging station monitoring system that indicates damage or failure nonitoring system is present when outside of the BEV or charging station means of monitoring the battery must be developed pection of the battery and BEV and charging station (thermal scan,	To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station - parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules) - go / no go decision points indicative of potential damage to the battery - identification of whom needs to be involved in the evaluation	
Adhering to the manufact	urers recommended best practice for battery transportation	Adhering to the manufacturers recommended best practice for battery transportation	
 batteries that are not dama batteries that are suspect of 		OEM to define a battery transportation best practice guideline covering: - batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during transportation	
Internal procedure for bat specific to the site	ttery handling and transportation suspect or damaged batteries	Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site	
- PPE - Safe lifting requirements for b Slinging requirements for b Battery handling requireme - Battery transportation requ - Battery storage requiremen - Labelling and notification - Tracking of batteries - Updated as per the internal recommenders.	ment - task based risk assessment r batteries outside of BEV atteries in BEV nts irements that align with manufacturers recommendations ts (including location, duration, enclosures) equirements for the site	To include consideration of: Job hazard / safety assessment - task based risk assessment - PPE Safe lifting requirements for batteries outside of BEV Slinging requirements for batteries in BEV Battery handling requirements Battery transportation requirements that align with manufacturers recommendations Battery storage requirements (including location, duration, enclosures) Labelling and notification Tracking of batteries Updated as per the internal requirements for the site	
handling of batteries	manufacturers requirements and internal procedures for access and neeting with manufacturers requirements and internal procedures for	Trained and competent personnel To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries	
Battery transportation in	cage conveyances and shafts	Battery transportation in cage conveyances and shafts	
Recommendation that person battery.	nnel not travel in the cage conveyance with a suspect or known damaged	Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged battery.	
must be developed with cons	ith the suspect or known damaged battery then an internal procedure ideration of: essment - task based risk assessment	If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of: - job hazard / safety risk assessment - task based risk assessment	

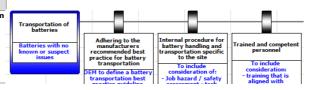
Transportation of batteries

Hazard

Batteries with no known or suspect issues

Barriers & Escalation Factors	Barriers & Escalation Factors
Adhering to the manufacturers recommended best practice for battery transportation	Adhering to the manufacturers recommended best practice for battery transportation
OEM to define a battery transportation best practice guideline covering: - batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during transportation	OEM to define a battery transportation best practice guideline covering: - batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during transportation





Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Internal procedure for battery handling and transportation specific to the site
To include consideration of:

- Job hazard / safety assessment - task based risk assessment

- Safe lifting requirements for batteries outside of BEV
- Slinging of BEV with batteries
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable)
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration: - training that is aligned with manufacturers requirements and internal procedures for access and

- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Internal procedure for battery handling and transportation specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- Safe lifting requirements for batteries outside of BEV
- Slinging of BEV with batteries
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations (to
- include consideration of draining to 30% power and removing fluids as practicable)
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries - competency for personnel meeting with manufacturers requirements and internal procedures

for access and handling of batteries

	- batteries that are not damaged - batteries that are suspect or known to be damaged - monitoring requirements for battery monitoring during transportation	ased risk assessment - PPE - PPE - Pagara Fara Fara Fara Fara Fara Fara Fara	requirements and internal procedures for access and handling batteries - competency for personnel meeting with manufacturers requirements and access and handling batteries
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practice guideline assessment - task manufacturers

Transportation of suspect or known damaged batteries in a cage conveyance

Barriers & Escalation Factors Barriers & Escalation Factors Battery transportation in cage conveyances and shafts Battery transportation in cage conveyances and shafts Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged

If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of:

- job hazard / safety risk assessment - task based risk assessment

Recommendation that personnel not travel in the cage conveyance with a suspect or known

If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of:

job hazard / safety risk assessment - task based risk assessment



Safety exposure to workers - burns

Barriers & Escalation Factors	Barriers & Escalation Factors
Emergency response procedures	Emergency response procedures
- battery fire while the battery is not in the BEV or the charging station	Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design
Trained and competent emergency responders	Trained and competent emergency responders

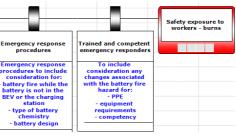
To include consideration any changes associated with the battery fire hazard for: - PPF

- equipment requirements - competency

To include consideration any changes associated with the battery fire hazard for:

equipment requirements competency

Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of batter chemistry - battery desig



Safety exposure to workers - from explosive material release

Barriers & Escalation Factors	Barriers & Escalation Factors	
Emergency response procedures	Emergency response procedures	
Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design	Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design	
Trained and competent emergency responders	Trained and competent emergency responders	
To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency	To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency	

evolosive materia procedures emergency responders battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design - PPE

Health exposure to workers - toxic gases from combustion

Hazard	Rechargable batters for Battery Electric Vehicles
Ton event	Battery fire while in storage or charging while in the underground

Barriers & Escalation Factors	Barriers & Escalation Factors
Emergency response procedures	Emergency response procedures
Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design	Emergency response procedures to include consideration for: - battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design
Trained and competent emergency responders	Trained and competent emergency responders
To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency	To include consideration any changes associated with the battery fire hazard for: - PPE - equipment requirements - competency

Emergency response procedures to include consideration for:
- battery fire while the battery is not in the BEV or the Charging - type of battery charging - type of battery complete complete complete complete complete complete consideration for:
- battery fire while the battery fire while the battery fire while the battery fire with the battery fire consideration any changes associated with the battery fire hazard for:
- complete consideration and co

Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Battery in storage or being charged

Barriers & Escalation Factors (Original)

Storage Location in the Underground for known or suspect damaged batteries

Recommendation for the following:

- store at proper proximity distance from explosive storage or flammable / combustible material storage for safe installation, operation, maintenance and accessing in emergency situations. Also keep proper distance to minimize flame propagation to the next battery package
- store in the return air system that directly flows to surface (i.e. does not flow across a drift, or level)
- 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, equipped with man door and fire monitoring system.
- ensure storage location far away from ref. station or emergency egress
- 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 (tool to assess the max. quantity?) stored in storage/shop? 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)

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

Monitoring capabability

Recommendation to have:

- means of remotely monitoring the status of the batteries from surface
- means of remotely diagnosing issues associated with the batteries
- means of monitoring the status of the batteries locally
- find way to monitor the battery malfunction status if wireless communication is not available

Battery in storage with known damage

Barriers & Escalation Factors



RowTie Group: New RowTie Group UNCLASSIFIED - NON CLASSIFIÉ

Bow He Gloup. New Bow He Gloup		
Hazard	Rechargable batters for Battery Electric Vehicles	
Top event	Battery fire while in storage or charging while in the underground	
Storage Location in the Under	ground for known damaged batteries	
Recommendation for the followard of the stored in the underground	5	

- removed when determine with due haste

Adhering to the manufacturers recommended best practice for battery storage 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 identification damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Battery in storage with suspect damage **Barriers & Escalation Factors** Monitoring capabability

Recommendation to have:

- means of remotely monitoring the status of the batteries

- means of remotely diagnosing issues associated with the batteries

Storage Location in the Underground for suspect damaged batteries

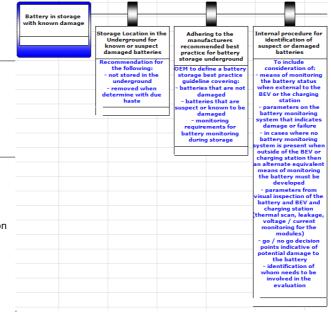
Recommendation for the following:

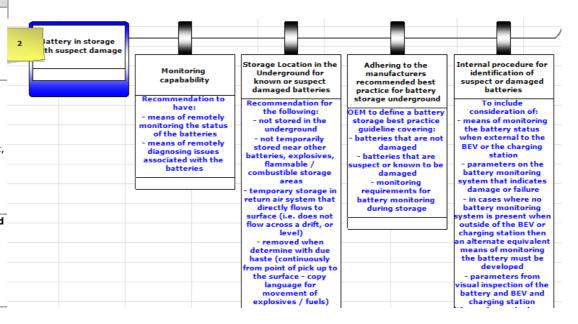
- not stored in the underground
- not temporarily stored near other batteries, explosives, flammable / combustible storage areas
- temporary storage in return air system that directly flows to surface (i.e. does not flow across a drift, or level)
- removed when determine with due haste (continuously from point of pick up to the surface copy language for movement of explosives / fuels)

Adhering to the manufacturers recommended best practice for battery storage 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





BowTie Group: New BowTie Group UNCLASSIFIED - NON CLASSIFIÉ

Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Internal procedure for identification of suspect damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Safety exposure to workers - from explosive material release

Barriers & Escalation Factors

Fire suppression system for the storage location to prevent spreading of the fire to other batteries

Recommendations for:

- 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.)

Emergency response procedures

Emergency response procedures to include consideration for:

- battery fire while the battery in the BEV, charging station and storage location
- during tranporting the damaged battery to surface
- type of battery chemistry
- battery design

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- PPE based on SDS
- equipment requirements
- competency

SDS

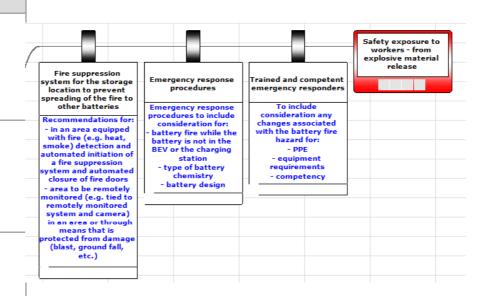
Health exposure to workers - toxic gases from combustion

Barriers & Escalation Factors

Emergency response procedures

Emergency response procedures to include consideration for:

- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design



thermal scan, leakage,

voltage / current monitoring for the modules)

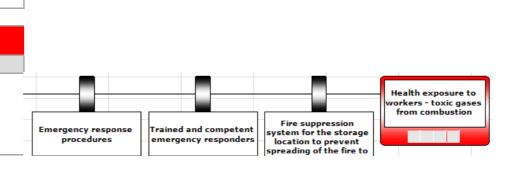
go / no go decision

potential damage to the battery

- identification of

whom needs to be involved in the

evaluation



BowTie Group: New BowTie Group UNCLASSIFIED - NON CLASSIFIÉ Rechargable batters for Battery Electric Vehicles

Bowile Group: New Bowile Group		
Hazard	Rechargable batters for Battery Electric Vehicles	
Top event	Battery fire while in storage or charging while in the underground	

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- PPF
- equipment requirements
- competency

Fire suppression system for the storage location to prevent spreading of the fire to other batteries

Recommendations for:

- 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.)

Safety exposure to workers - burns

Barriers & Escalation Factors

Emergency response procedures

Emergency response procedures to include consideration for:

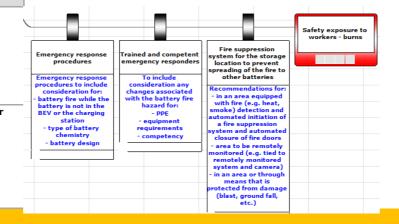
- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design

Fire suppression system for the storage location to prevent spreading of the fire to other batteries

Recommendations for:

- 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.)

other batteries Emergency response To include procedures to include consideration any Recommendations for: consideration for: changes associated in an area equipped with the battery fire battery fire while the with fire (e.g. heat, hazard for: battery is not in the smoke) detection and automated initiation of BEV or the charging - PPE station - equipment requirements a fire suppression - type of battery ystem and automated chemistry - competency closure of fire doors - battery design area to be remotely onitored (e.g. tied to remotely monitored system and camera) - in an area or through means that is otected from damage (blast, ground fall, etc.)



BowTie Group: New BowTie Group			
Hazard Rechargable batters for Battery Electric Vehicles			
Top event	Battery fire while in storage or charging while in the underground		
Hazard	Rechargeable battery for battery electric vehicles		
Top event	Battery fire during access and nandling in the		

Damage to battery during handling

Battery is dropped

Battery is damaged through collision with other equipment

Barriers & Escalation Factors Adhere to manufacturers recommendations

Internal procedure for battery handling and transportation specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- PPF
- Safe lifting requirements for batteries outside of BEV
- Slinging of BEV with batteries
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable)
- · Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

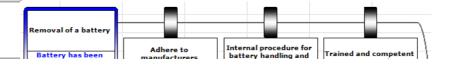
- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

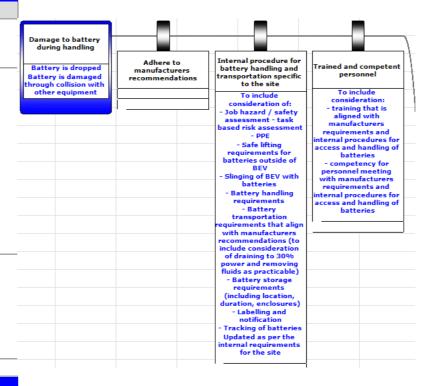
Removal of a battery

Battery has been damaged but there are no ready indications of the failure Hidden damage in the battery system upon removal

Barriers & Escalation Factors

Adhere to manufacturers recommendations





Hazard Rechargable batters for Battery Electric Vehicles Top event Battery fire while in storage or charging while in the underground

Internal procedure for battery handling and transportation specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- _ DDF
- Safe lifting requirements for batteries outside of BEV
- Slinging of BEV with batteries
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable)
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Removal of a suspect damaged battery

Known damage to the BEV but no confirmation of damage to the battery itself Collision with other equipment Collision with rock / walls

Dropped object on battery

Barriers & Escalation Factors

Adhere to manufacturers recommendations

Battery management

To include:

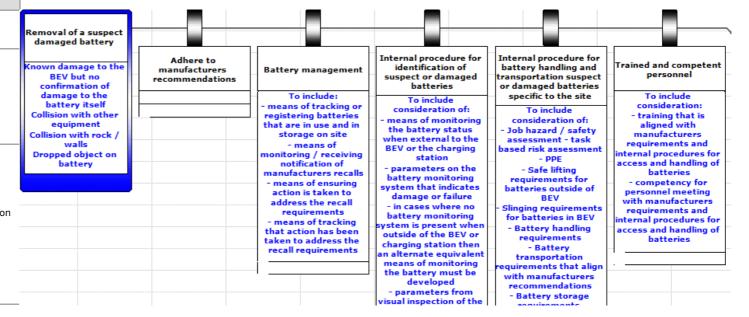
- means of tracking or registering batteries that are in use and in storage on site
- means of monitoring / receiving notification of manufacturers recalls
- means of ensuring action is taken to address the recall requirements
- means of tracking that action has been taken to address the recall requirements

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation





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charging station (thermal scan, leakage, voltage / current monitoring for the modules) - go / no go decision noints indicative of	ing location, n, enclosures) belling and tification ng of batteries and as per the requirements the site

Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

BowTie Group: New BowTie Group

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- DDE
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- · Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Removal of a suspect damaged battery

Known damage to the BEV but no confirmation of damage to the battery itself Collision with other equipment

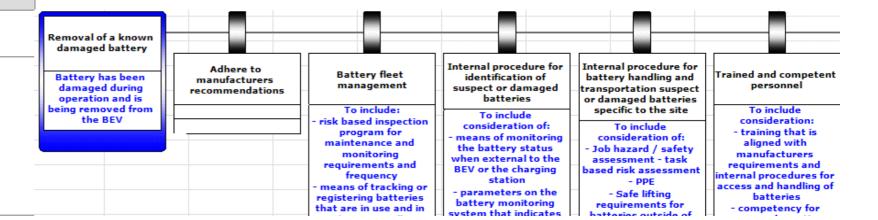
Barriers & Escalation Factors

Adhere to manufacturers recommendations

Battery management

To include:

- means of tracking or registering batteries that are in use and in storage on site
- means of monitoring / receiving notification of manufacturers recalls
- means of ensuring action is taken to address the recall requirements
- means of tracking that action has been taken to address the recall requirements



BowTie Group: New BowTie Group Rechargable batters for Battery Electric Vehicles Battery fire while in storage or charging while in

Internal procedure for identification of suspect or damaged batteries

the underground

To include consideration of:

Hazard

Top event

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Charging the battery at the battery charging station

Need technical content

Barriers & Escalation Factors

Degradation of battery and components (aging, wear etc.)

Battery chemistry degradation Electrical wiring degradation

Barriers & Escalation Factors

Adhere to manufacturers recommendations



harding the hattery at the battery

charging station

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patteries outside of storage on site personnel meeting damage or failure BEV with manufacturers means of managing - in cases where no Slinging requirements requirements and and monitoring battery monitoring for batteries in BEV internal procedures for preventive and ystem is present when - Battery handling access and handling of orrective maintenance outside of the BEV or requirements batteries associated with the charging station then - Battery an alternate equivalent transportation - means of knowing means of monitoring guirements that align storage locations the battery must be with manufacturers developed recommendations monitoring / receiving - parameters from - Battery storage notification of isual inspection of the requirements manufacturers recalls battery and BEV and (including location, - means of ensuring charging station duration, enclosures) action is taken to thermal scan, leakage, - Labelling and address the recall voltage / current notification requirements monitoring for the Tracking of batteries - means of tracking modules) Updated as per the that action has been go / no go decision internal requirements taken to address the points indicative of for the site recall requirements potential damage to the battery - identification of whom needs to be involved in the evaluation

batteries

- means of

Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Battery fleet management

To include:

- risk based inspection program for maintenance and monitoring requirements and frequency
- means of tracking or registering batteries that are in use and in storage on site
- means of managing and monitoring preventive and corrective maintenance associated with the batteries
- means of knowing storage locations
- means of monitoring / receiving notification of manufacturers recalls
- means of ensuring action is taken to address the recall requirements
- means of tracking that action has been taken to address the recall requirements

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- C- 6- 1:6:
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

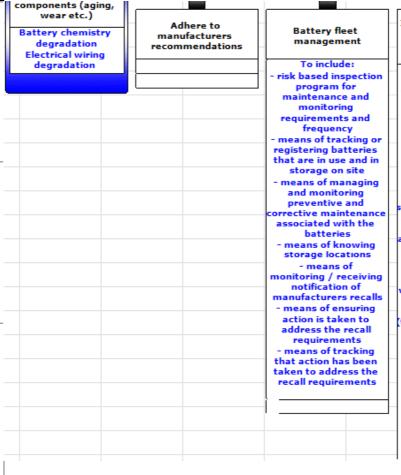
Updated as per the internal requirements for the site

Degradation of battery and components (aging, wear etc.)

Battery chemistry degradation Electrical wiring degradation

Barriers & Escalation Factors

Adhere to manufacturers recommendations



Internal procedure for identification of suspect or damaged batteries

To include consideration of: - means of monitoring the battery status when external to the BEV or the charging station

- parameters on the battery monitoring system that indicates damage or failure - in cases where no battery monitoring ystem is present when outside of the BEV or
- charging station then an alternate equivalent means of monitoring the battery must be developed - parameters from
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of: - Job hazard / safety assessment - task based risk assessment - ppr

- Safe lifting requirements for
- requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling
- requirements
 Battery
 transportation
- quirements that align with manufacturers recommendations
- Battery storage requirements (including location,
- duration, enclosures)
 Labelling and
- notification
- Tracking of batteries
 Updated as per the
 nternal requirements
 for the site



Hazard	Rechargable batters for Battery Electric Vehicles
	Battery fire while in storage or charging while in the underground

Battery fleet management

To include:

- risk based inspection program for maintenance and monitoring requirements and frequency
- means of tracking or registering batteries that are in use and in storage on site
- means of managing and monitoring preventive and corrective maintenance associated with the batteries
- means of knowing storage locations
- means of monitoring / receiving notification of manufacturers recalls
- means of ensuring action is taken to address the recall requirements
- · means of tracking that action has been taken to address the recall requirements

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- PPE
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Damage during maintenance / improper maintenance activities

Electrical components

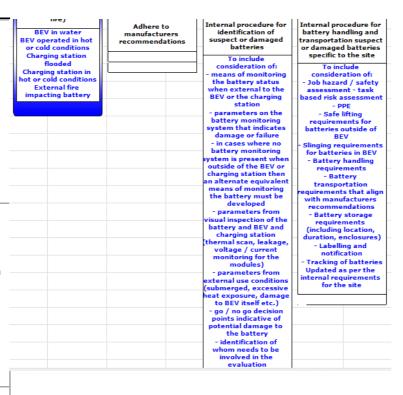
Damage to battery cells

Damage to the battery cell compartments

Improper access to the battery components

Incorrect replacement parts etc.

Barriers & Escalation Factors



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10p event	the underground	_				
Adhere to manufacturers r	recommendations meet manufacturers recommendations for parts and components	Damage during maintenance / improper				
- includes requirements to	meet manufacturers recommendations for parts and components	maintenance activities	Adhere to	Trained and competent	Internal procedure for	Internal procedure for
Trained and competent	maintenance personnel	Electrical components Damage to battery	manufacturers recommendations	maintenance personnel	identification of suspect or damaged batteries	battery handling and transportation suspect or damaged batteries
To include consideration	n:	cells Damage to the	- includes	To include consideration:	To include	specific to the site
-	ith manufacturers requirements	battery cell	requirements to meet manufacturers	consideration: - training that is	consideration of:	To include
- competency for maintena	ance personnel meeting with manufacturers requirements	compartments Improper access to	recommendations for parts and components	aligned with	- means of monitoring the battery status	consideration of: - Job hazard / safety
Internal procedure for i	dentification of suspect or damaged batteries	the battery components Incorrect		requirements - competency for	when external to the BEV or the charging station	assessment - task based risk assessment
To include consideration	n of:	replacement parts		maintenance personnel	- parameters on the	- PPE - Safe lifting
	battery status when external to the BEV or the charging station	etc.		meeting with manufacturers	battery monitoring system that indicates	requirements for batteries outside of
	ry monitoring system that indicates damage or failure			requirements	damage or failure	BEV
- in cases where no batter	y monitoring system is present when outside of the BEV or charging station				- in cases where no battery monitoring	- Slinging requirements for batteries in BEV
•	nt means of monitoring the battery must be developed				system is present when outside of the BEV or	- Battery handling
	nspection of the battery and BEV and charging station (thermal scan,				charging station then an alternate equivalent	requirements - Battery
	monitoring for the modules) at use conditions (submerged, excessive heat exposure, damage to BEV itself				an alternate equivalent means of monitoring	transportation requirements that align
etc.)	di use conditions (submerged, excessive neat exposure, damage to BLV itself				the battery must be developed	with manufacturers
,	s indicative of potential damage to the battery				- parameters from visual inspection of the	recommendations - Battery storage
	eeds to be involved in the evaluation				visual inspection of the	requirements (including location, duration, enclosures)
					battery and BEV and charging station (thermal scan, leakage,	duration, enclosures)
Internal procedure for h	pattery handling and transportation suspect or damaged batteries				voltage / current	- Labelling and notification
specific to the site	battery framiding and transportation suspect of damaged batteries				monitoring for the modules)	- Tracking of batteries
					- parameters from	Updated as per the internal requirements
To include consideration	n of:				external use conditions (submerged, excessive	for the site
	ssment - task based risk assessment				heat exposure, damage to BEV itself etc.)	
- PPE	6 1 11 1 6051				- go / no go decision	
- '	for batteries outside of BEV				points indicative of	
 Slinging requirements for Battery handling requirer 					potential damage to the battery	
,	equirements that align with manufacturers recommendations				 identification of whom needs to be 	
, ,	nents (including location, duration, enclosures)				involved in the	
					ovaluation	

Safety exposure to workers - burns

Updated as per the internal requirements for the site

Barriers & Escalation Factors

BowTie Group: New BowTie Group

Rechargable batters for Battery Electric Vehicles Battery fire while in storage or charging while in

Emergency response procedures

Emergency response procedures to include consideration for:

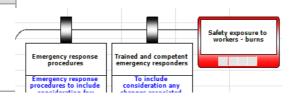
- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry

- Labelling and notification - Tracking of batteries

- battery design

Hazard

Top event



evaluation

Bowlie Group: New Bowlie Group			
Hazard	lazard Rechargable batters for Battery Electric Vehicles		
Top event	Battery fire while in storage or charging while in the underground		

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- PPF
- equipment requirements
- competency

consideration for: battery fire while the battery is not in the BEV or the charging station - type of battery chemistry - battery design

changes associated with the battery fire	
hazard for: - PPE	
 equipment requirements 	
- competency	

Safety exposure to workers - from explosive material release

Barriers & Escalation Factors

Emergency response procedures

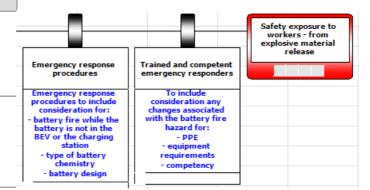
Emergency response procedures to include consideration for:

- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- PPE
- equipment requirements
- competency



Health exposure to workers - toxic gases from combustion

Barriers & Escalation Factors

Emergency response procedures

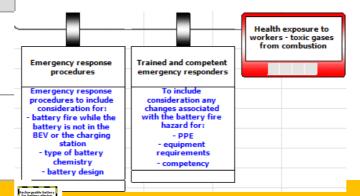
Emergency response procedures to include consideration for:

- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- DDE
- equipment requirements
- competency



Bowlie Group: New Bowlie Group		
Hazard	Rechargable batters for Battery Electric Vehicles	
Top event	Battery fire while in storage or charging while in the underground	
Hazard	Rechargeable battery for battery electric vehicles	
Top event	or the collar into the underground)	

Battery fire during transportation (from the portal or the collar

Transportation of a known damaged battery

Battery has been damaged during operation and is being removed from the BEV

Barriers & Escalation Factors

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Adhering to the manufacturers recommended best practice for battery transportation

OEM to define a battery transportation best practice guideline covering:

- batteries that are not damaged
- batteries that are suspect or known to be damaged
- monitoring requirements for battery monitoring during transportation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

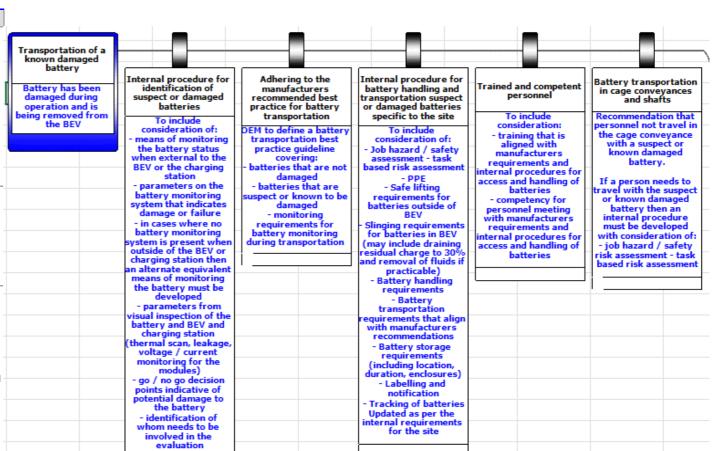
- Job hazard / safety assessment task based risk assessment
- PPE
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV (may include draining residual charge to 30% and removal of fluids if practicable)
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries



BowTie Group:	New	BowTie	Group
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Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Battery transportation in cage conveyances and shafts

Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged battery.

If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of:

- job hazard / safety risk assessment - task based risk assessment

Transportation of a suspect damaged battery

Known damage to the BEV but no confirmation of damage to the battery itself Collision with other equipment Collision with rock / walls Dropped object on battery

Barriers & Escalation Factors

Internal procedure for identification of suspect or damaged batteries

To include consideration of:

- means of monitoring the battery status when external to the BEV or the charging station
- parameters on the battery monitoring system that indicates damage or failure
- in cases where no battery monitoring system is present when outside of the BEV or charging station then an alternate equivalent means of monitoring the battery must be developed
- parameters from visual inspection of the battery and BEV and charging station (thermal scan, leakage, voltage / current monitoring for the modules)
- go / no go decision points indicative of potential damage to the battery
- identification of whom needs to be involved in the evaluation

Adhering to the manufacturers recommended best practice for battery transportation

OEM to define a battery transportation best practice guideline covering:

- batteries that are not damaged
- batteries that are suspect or known to be damaged
- monitoring requirements for battery monitoring during transportation

Internal procedure for battery handling and transportation suspect or damaged batteries specific to the site

To include consideration of:

- Job hazard / safety assessment task based risk assessment
- 0.0.00
- Safe lifting requirements for batteries outside of BEV
- Slinging requirements for batteries in BEV
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Transportation of a suspect damaged battery Known damage to the BEV but no confirmation of damage to the battery itself Collision with other equipment Collision with rock / walls Dropped object on battery

internal procedure for Adhering to the Internal procedure for **Battery transportation** Trained and competent identification of manufacturers battery handling and in cage conveyances suspect or damaged transportation suspect personne recommended best and shafts or damaged batteries batteries practice for battery transportation specific to the site To include Recommendation that To include consideration: personnel not travel in consideration of: DEM to define a battery To include training that is aligned with manufacturers the cage conveyance transportation best practice guideline consideration of: means of monitoring with a suspect or the battery status Job hazard / safety known damaged when external to the assessment - task covering: requirements and ternal procedures for battery. BEV or the charging based risk assessme batteries that are not station - PPE - Safe lifting access and handling of If a person needs to - batteries that are parameters on the travel with the suspect or known damaged batteries battery monitoring system that indicates spect or known to be requirements for - competency for personnel meeting with manufacturers batteries outside of damaged battery then an damage or failure monitoring BEV internal procedure - in cases where no requirements for Slinging requirement for batteries in BEV must be developed with consideration of requirements and battery monitoring battery monitoring nternal procedures for access and handling of ystem is present whe outside of the BEV or during transportation Battery handling iob hazard / safety requirements batteries isk assessment - task charging station then an alternate equivalent means of monitoring based risk assessn - Battery transportation equirements that alig the battery must be developed with manufacturers recommendations - parameters from visual inspection of the - Battery storage requirements (including location, battery and BEV and charging station thermal scan, leakage duration, enclosures) - Labelling and notification voltage / current monitoring for the modules) Tracking of batteries
 Updated as per the go / no go decision points indicative of potential damage to nternal requirements for the site the battery identification of whom needs to be involved in the evaluation

BowTie Group: New BowTie Group Rechargable batters for Battery Electric Vehicles Hazard Battery fire while in storage or charging while in

Trained and competent personnel

To include consideration:

Top event

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries

the underground

- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries

Battery transportation in cage conveyances and shafts

Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged battery.

If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of:

job hazard / safety risk assessment - task based risk assessment

Transportation of batteries

Batteries with no known or suspect issues

Barriers & Escalation Factors

Adhering to the manufacturers recommended best practice for battery transportation

OEM to define a battery transportation best practice guideline covering:

- batteries that are not damaged
- batteries that are suspect or known to be damaged
- monitoring requirements for battery monitoring during transportation

Internal procedure for battery handling and transportation specific to the site

To include consideration of:

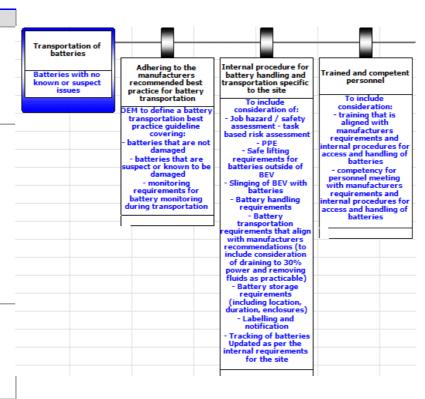
- Job hazard / safety assessment task based risk assessment
- Safe lifting requirements for batteries outside of BEV
- Slinging of BEV with batteries
- Battery handling requirements
- Battery transportation requirements that align with manufacturers recommendations (to include consideration of draining to 30% power and removing fluids as practicable)
- Battery storage requirements (including location, duration, enclosures)
- Labelling and notification
- Tracking of batteries

Updated as per the internal requirements for the site

Trained and competent personnel

To include consideration:

- training that is aligned with manufacturers requirements and internal procedures for access and handling of batteries
- competency for personnel meeting with manufacturers requirements and internal procedures for access and handling of batteries



Hazard Rechargable batters for Battery Electric Vehicles Top event Battery fire while in storage or charging while in the underground

Transportation of suspect or known damaged batteries in a cage conveyance

Barriers & Escalation Factors

Battery transportation in cage conveyances and shafts

Recommendation that personnel not travel in the cage conveyance with a suspect or known damaged battery.

If a person needs to travel with the suspect or known damaged battery then an internal procedure must be developed with consideration of:

- job hazard / safety risk assessment - task based risk assessment



Safety exposure to workers - burns

Barriers & Escalation Factors

Emergency response procedures

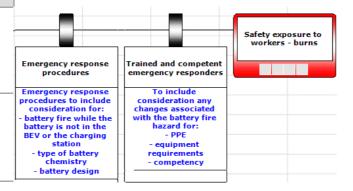
Emergency response procedures to include consideration for:

- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- |- PPE
- equipment requirements
- competency



Safety exposure to workers - from explosive material release

Barriers & Escalation Factors

Emergency response procedures

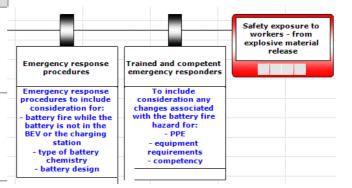
Emergency response procedures to include consideration for:

- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- PPE
- equipment requirements
- competency



Health exposure to workers - toxic gases from combustion

BowTie Group: New BowTie Group	
Hazard	Rechargable batters for Battery Electric Vehicles
Top event	Battery fire while in storage or charging while in the underground

Barriers & Escalation Factors

Emergency response procedures

Emergency response procedures to include consideration for:

- battery fire while the battery is not in the BEV or the charging station
- type of battery chemistry
- battery design

Trained and competent emergency responders

To include consideration any changes associated with the battery fire hazard for:

- DDE
- equipment requirements
- competency

