OHS Responsibilities and Industry-Supported Safe Work Practices for the Handling, Dismantling, Storage and Transportation of Electric Vehicles and High Voltage Batteries

Prepared by

AUTOMOTIVE RETAILERS ASSOCIATION
Driving Industry Excellence

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Part I

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Purpose of This Document

The purpose of this document is to:

- Provide employers, supervisors, and employees with information about workplace health and safety; and,
- Provide the automotive recycling and towing and recovery industries with safe work practices to eliminate or control hazards associated with the recovery, transportation, handling, dismantling and storage of Electric Vehicles (EVs) and High Voltage (HV) batteries.

Objectives

Objectives for this document include:

- Increase awareness of OHS responsibilities, worker rights, and OHS program requirements;
- Provide general knowledge and recommendations for controlling hazards associated with the recovery, transportation, handling, dismantling and storage of Electric Vehicles (EVs) and High Voltage (HV) batteries; and,
- Assist employers and other workplace parties to comply with the requirements of the *Workers Compensation Act* (the *Act*), the *Occupational Health and Safety Regulation* (the *Regulation*) and other laws and statutes.

Scope

The scope of this document is specific to the automotive towing and recovery and automotive recycling industries. It includes information and safe work practices on the following topics:

- Legal Responsibilities for Health and Safety
- Meeting Due Diligence
- *Occupational Health and Safety Program* Requirements
- Risk Assessments
- Identifying Hazards
- Hierarchy of Safety Controls
- EV and HV battery types and hazards
- Conducting a Scene Risk Assessment and Identifying EVs
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This document is intended to provide workplaces in the automotive towing and recovery and automotive recycling industries with information on their basic legal responsibilities and to provide a consistent approach in identifying and safely controlling workplace hazards associated with the recovery, transportation, handling, dismantling and storage of Electric Vehicles (EVs) and High Voltage (HV) batteries. It is not intended to provide a "ready-made" health and safety program. While the hazards and controls described in this document may be common to many auto towing and recovery and auto recycling companies, employers — with input from their supervisors and workers — need to develop and implement an effective health and safety program that is specific to their operation.

Legal Disclaimer

The information presented in this document does not take the place of professional occupational health and safety advice and is not guaranteed to meet the requirements of applicable laws, regulations, and rules, including workplace health and safety laws and motor vehicle and traffic laws. The Automotive Retailers Association (ARA) and their respective employees, officers, directors, or agents assume no liability for, or responsibility for any loss or damage suffered or incurred by any person arising from or in any way connected with the use of or reliance upon the information contained in this document including, without limitation, any liability for loss or damage arising from the negligence or negligent misrepresentation of the ARA in any way connected with the information contained in this document. The information provided in this document is provided on an "as is" basis. The ARA does not guarantee, warrant, or make any representation as to the quality, accuracy, completeness, timeliness, appropriateness, or suitability of any of the information provided, and disclaims all statutory or other warranties, terms, or obligations of any kind arising from the use of or reliance upon the information provided, and assumes no obligation to update the information provided or advise on future developments concerning the topics mentioned.

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Definitions

Explanation of OHS Terms Used in This Document:

- **BEV**: Battery Electric Vehicle
- **Classification Unit**: similar businesses share the same WorkSafeBC classification unit and pay the same base premium rate for their WorkSafeBC insurance.
- **Due Diligence**: due diligence requires that an employer take all reasonable steps to identify all workplace hazards, implement all necessary preventive measures, and communicate appropriately to all necessary personnel.
- **ERG**: Emergency Response Guide
- **Employer**: a self-employed proprietor, partnership, corporation, society, or any other type of legal entity that hires workers or unregistered subcontractors.
- **Ergonomics**: a process that safely matches workplace conditions and job demands to a person's capabilities.
- **HEV**: Hybrid Electric Vehicle
- **First Aid Requirements:** employers are responsible for providing workers with prompt, easily accessible, and appropriate first aid treatment.
- **Hazard**: a hazard means a thing or condition that may expose a worker to a risk of injury or occupational disease.
- **Hierarchy of Controls**: a listing of safety control measures in order of their effectiveness (see Part III of this document).
- **Incident**: a workplace occurrence which resulted in or has the potential to cause an injury or occupational disease.
- **Injury Rate**: the number of non-health care only claims per one hundred person-years of covered employment, where one hundred person-years is the equivalent of one hundred full-time & part-time employees working in the year.
- **Musculoskeletal Injury**: an injury which can affect muscles, tendons, ligaments, nerves, blood vessels, and joints of the neck, shoulders, arms, wrists, legs, and back. MSIs are a common type of workplace injury in all industries, accounting for about one-third of claims accepted by WorkSafeBC.
- Near miss incident: a work-related incident that has the potential for serious injury, death, or significant property damage.
- **OHS Guidelines**: information from WorkSafeBC to help with the interpretation of many sections of the *OHS Regulation* and sections of the *Workers Compensation Act* that relate to health and safety.
- **OHS Policies**: the official policies of WorkSafeBC that an organization must apply when making decisions.
- **OHS Program**: an occupational health and safety requirement for all employers, the type of which depends on the size of the workforce and the nature and extent of the risks and hazards in the workplace.
- ***Occupational Health and Safety Regulation* (*OHS Regulation*)**: contains legal requirements for workplace health and safety that must be met by all workplace parties in B.C.
- **Order**: a WorkSafeBC directive to comply with the *Act* and or *OHS Regulation*.
- **PHEV**: Plug-in hybrid electric vehicle.
- **Procedure**: a written list of sequential processes for safely performing a work- related task.

- **Risk**: the chance or likelihood of injury or occupational disease.
- **Risk Assessment**: A health and safety process that identifies hazards that exist in the workplace and how they may put workers at risk of injury or occupational disease. Specific risk assessment requirements are defined in different parts of the *OHS Regulation*.
- **Safe Work Practice**: a description of non-sequential activities to help workers safely perform a task.
- **Standards**: certain sections of the *OHS Regulation* refer to standards recognized by WorkSafeBC.
- **Supervisor**: a person who instructs, directs, and controls workers in the performance of their duties.
- **Stranded Energy**: defined asthe energy remaining in a cell after efforts to safely discharge the stored energy in damaged lithium-ion cells
- **Time-Loss Claims**: the number of claims where the injuries occurred in a given year and were accepted for short-term disability, long-term disability, or survivor benefits in that year or in the first three months of the following year.
- **Training**: hands-on, job-specific instruction that may include demonstrations by workers so that supervisors can confirm that workers understand written safe work practices and procedures.
- **Traffic Control Devices**: includes cones, signs, and barricades, flashing Lights, flashing arrow boards or any other item that warns drivers of a change in the road circumstance.
- **Violence**: attempted or actual physical force or any threatening statement or behavior which gives a worker cause to believe they are at risk of injury.
- **WHMIS 2015**: a system that provides information on hazardous products used in the workplace. Employers must use this information, as well as information specific to their workplaces, to educate and train workers to work safely with and near hazardous products.
- **Worker**: a person who is deemed to be a worker under the *Act*.
- **Workers Compensation Act**: a Statute to promote a culture of commitment on the part of employers and workers to a high standard of occupational health and safety. Part 3 of the *Act* addresses matters "such as the rights and responsibilities of workplace parties, joint committees, and worker representatives, protection against OHS-Related discrimination, incident reporting, investigations, enforcement, offences, administrative procedures, and regulation-making authority." Some sections of the *Act* have associated policies and guidelines.
- **Workplace Health and Safety Policy**: a document that describes an employer's commitment to protect the health and safety of workers and their commitment to the OHS program, among other details.
- **New and Young Worker**: new worker includes any worker who is new to the workplace, returning to a workplace where the hazards have changed, or relocated to a new workplace if the hazards in that workplace are different from the hazards in the worker's previous workplace. Young worker means any worker less than 25 years of age.

Information Resources

Automotive Retailers Association

The Automotive Retailers Association (ARA) represents the automotive industry in B.C. We're here to ensure the key issues and needs of our dynamic industry are being addressed so our members can focus on their own business growth and success. The ARA is the largest trade association of its kind in Canada, with over 1000 business members across British Columbia. For more information visit *www.ara.bc.ca*.

www.WorkSafeBC.com

WorkSafeBC is an independent provincial statutory agency committed to safe and healthy workplaces and providing legislated compensation benefits to workers injured as a result of their employment.

WorkSafeBC was born out of a compromise between B.C.'s workers and employers in 1917 where workers gave up the right to sue their employers or fellow workers for on-the-job injuries in return for a no-fault insurance program fully paid for by employers. For more information visit *www.WorkSafeBC.com*.

WorkSafeBC Prevention Information Line at 1-888-621-SAFE (7233)

https://www.worksafebc.com/en/contact-us/departments-and-services/health-safety-prevention

Operating independently of WorkSafeBC, the Employers' Advisers Office provides free advice, assistance, representation, and education to employers related to the workers' compensation system. For more information visit *www.gov.bc.ca*.

Workers' Advisers Office

Operating independently of WorkSafeBC, the Workers' Advisers Office provides free advice and assistance to workers and their dependants concerning WorkSafeBC decisions. For more information visit *www.gov.bc.ca*.

Additional Health and Safety Resources

ARA Health and Safety Resources for the Automotive Industry

The Automotive Retailers Association (ARA) is committed to improving the health and safety performance of the automotive industry by providing guidance and resources to reduce the barriers members may face when trying to implement proactive health and safety programs for their employees.

The ARA's occupational health and safety website was created as a one-stop source of occupational health and safety information and resources for B.C.'s aftermarket automotive industry.

https://ohs.ara.bc.ca

National Fire Protection Association

The National Fire Protection Association (NFPA) is an international non-profit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards.

https://www.nfpa.org

Tow Spec.com

Tow Spec provides important information regarding safety tips for towing electric and conventional vehicles, manufacturer recommendations for loading and transport as well as other important materials such as owner manuals.

https://towspec.com

Part II

This section includes information on the following:

- OHS Legal Responsibilities for Employers, Supervisors, and Workers; and,
- Meeting Due Diligence.

OHS Legal Responsibilities for Employers, Supervisors, and Workers

Employer Responsibilities

Employers have health and safety responsibilities under the *Workers Compensation Act* (the *Act*) and *Occupational Health and Safety Regulation* (*OHS Regulation*). These responsibilities include:

- Ensuring the health and safety of their workers and other workers present at the workplace;
- Establishing occupational health and safety policies and an OHS program;
- Providing general direction to management, supervisors, and workers about their responsibilities and roles in providing a safe and healthy workplace;
- Providing specific direction and delegate authority to those responsible for health and safety;
- Consulting and cooperating with individuals carrying out health and safety duties including joint committee members, OHS representatives, and WorkSafeBC prevention officers;
- Providing workers with information, instruction, training, and supervision necessary to protect their health and safety;
- Providing supervisors with the support for health and safety training;
- Providing and maintaining Personal Protective Equipment (PPE), devices, and clothing, and ensuring they are properly used;
- Ensuring adequate first aid;
- Conducting regular inspections and fixing reported problems;
- Investigating incidents under *Workers Compensation Act* section 71 and a full investigation under *Workers Compensation Act* section 72 respecting any accident or other incident that (a) is required to be reported under section 68, (b) resulted in injury to a worker requiring medical treatment, (c) did not involve injury to a worker, or involved only minor injury not requiring medical treatment, but had a potential for causing serious injury to a worker, or (d) was an incident required by regulation to be investigated.; and,
- Reporting all injuries to WorkSafeBC that required medical attention and submitting necessary forms.

Employers set the tone for workplace safety. Strong leadership and commitment to improve health and safety, backed by action, is key to an effective safety program that helps to keep workers safe.

Supervisor Responsibilities

Supervisors have health and safety responsibilities under the *Act* and *OHS Regulation*. A supervisor provides instruction, direction, and controls workers in the performance of their duties. A supervisor can be any worker — an owner, manager, lead-hand or staff — who performs these duties, whether or not he or she has the title of supervisor. Depending on the circumstance, a supervisor may also be a worker.

Supervisor duties include:

- Ensuring the health and safety of all workers under their direct supervision;
- Ensuring that workers under their supervision are made aware of known or reasonably foreseeable health and safety hazards;
- Knowing applicable WorkSafeBC requirements and ensuring that they are being followed;
- Consulting and cooperating with Joint Occupational Health and Safety Committee (JOHSC) members or worker health and safety representatives, and co-operate with others carrying out occupational health and safety duties (including WorkSafeBC prevention officers);
- Ensuring that the appropriate PPE and clothing are available, properly inspected, maintained, and worn;
- Ensuring that workers are trained and competent to deliver first aid;
- Conducting regular inspections and fixing reported problems.

Supervisors play a critically important role in keeping workers safe and should give workplace health and safety the same priority as productivity. Healthy and safe workers are more productive than ill and injured workers.

Workers Responsibilities and Rights

Workers have responsibilities for their own health and safety and that of other workers. These include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor;
- Using the protective clothing, devices, and equipment provided;
- Performing work in a safe manner and not engaging in "horseplay" or working while impaired by alcohol, drugs, or other causes.

All workers have four basic health and safety rights:

- The right to know (orientation and training) all work-related hazards;
- The right to participate in OHS at the workplace;
- The right to refuse work that they have reason to believe would create an undue hazard;
- The right to no discrimination for refusing to do unsafe work.

For more information on the responsibilities of other workplace parties, visit *www.WorkSafeBC.com*.

Meeting Due Diligence

According to WorkSafeBC, due diligence is a defense against penalties and performance based orders and requires taking all reasonable steps to protect workers from harm. 'All reasonable steps' is based on the level of judgment and care that a person would reasonably be expected to do under the circumstances. An organization that actively manages health and safety and takes all reasonable steps to protect workers from harm is being duly diligent.

The due diligence requirements of employers includes, but not limited to:

- Knowing and understanding their OHS responsibilities;
- Having a process to identify and control hazards;
- Committing the necessary resources to health and safety;
- Assigning safety responsibilities to supervisors and workers and providing education, information and training;
- Keeping records, including training records and records related to OHS disciplinary action; and,
- Having a process to review your program annually.

Documentation of an effective formal or less formal OHS program is required to meet the test of due diligence. The documentation required to meet this test includes:

- The steps the employer took to control or eliminate specific hazards;
- Written safe work practices and procedures that are understood and followed by workers; and,
- Evidence of adequate instruction, training, and supervision.

If an OHS requirement has been violated, an employer must prove that they took all reasonable actions to ensure the health and safety of the worker or workers injured. WorkSafeBC may not impose monetary penalties or recommend prosecution if an employer was duly diligent. However, order may be issued by WorkSafeBC to correct the unsafe condition that led to the incident.

For more information on meeting due diligence, visit *https://www.worksafebc.com/en/health-safety/create-manage/enhancing-culture-performance/due-diligence*.

Part III

This section includes information on the following:

- OHS Program Requirements for Large and Small Employers; and,
- How to Use This Guide as a Teaching Resource.

OHS Program Requirements for Large and Small Employers

Employers are required to have an OHS program, the purpose of which is to:

- Eliminate or minimize the potential for work-related injuries, death and occupational disease;
- Identify and promptly control hazards;
- Support safe work behaviors;
- Deal effectively with any incidents; and,
- Ensure compliance with WorkSafeBC regulations; which is the minimum level of requirement.

A business with a smaller workforce (less than 20 employees) requires a less formal OHS program. A less formal program includes, at a minimum:

- Effective orientation, training, education and supervision of workers;
- Regular inspections and corrective actions;
- Monthly meetings with workers that focus on correcting unsafe conditions and practices;
- Making and retaining written OHS records;
- First aid provisions (requirements are listed in the *OHS Regulations*); and,
- Incident investigations that meet minimum compliance requirements.

A WorkSafeBC prevention officer may require some smaller workplaces to update their program from a less formal program to a formal program (see below) in situations when there is:

- High-risk work and/or a high number of injury claims;
- Serious injuries or fatalities; and,
- Repeat non-compliance with the *Act* and *OHS Regulations*.

A "formal" OHS Program is required when there is a workforce of 20 or more workers, and at least one workplace at which there is a moderate or high risk of injury or a workforce of 50 or more workers. Elements of a formal OHS program include the following:

- A written safety policy;
- Supervision;
- Written safe work practices or procedures;
- Workplace inspections;
- Effective orientation, training, and education of workers;
- Joint OHS committee (or a worker OHS representative in firms with more than nine but fewer than 20 regularly employed workers);
- First aid provisions (requirements are listed in the *OHS Regulations*);
- Management meetings that focus on safety;
- Investigations that meet minimum compliance requirements; and,
- Maintenance of OHS records and statistics.

Written Safety Policy

An important part of a safety program is a health and safety policy that is specific to your workplace. An effective OHS policy is a signed statement of an employer's commitment to workplace health and safety and includes language describing:

- The employer's commitment to protect workers;
- Policy goals and objectives (e.g. preventing injuries, complying with the *Act* and *OHS Regulations*); and,
- OHS responsibilities and worker rights.

All workers should be made aware of policy and its importance. The policy should be reviewed annually. For more information on developing an OHS policy visit *www.WorksafeBC.com* or *https://ohs.ara.bc.ca*.

Supervision

Supervision activities include:

- Ensuring workers are properly trained on, and working in accordance with, all applicable safe work procedures;
- Making less formal inspections to ensure practices and procedures are being followed;
- Enforcing safety rules, practices, and procedures; and,
- Conducting discussions (crew talks) to discuss specific safety issues.

For more information see WCA Part 2 Division 4 General Duties of Employers, Workers and Others, *https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/workers-compensation-act/part-2-occupational-health-and-safety#SectionNumber:Part2Div4Sec23*.

Safe Work Practices and Procedures

A written safe work practice provides general guidance about a work-related task. A written safe work procedure is different from a practice in that it provides step-by-step instructions to guide workers when initiating and completing a specific work process.

When determining what is required of a written safe work practice, consider the following:

- The requirements of the *OHS Regulations*;
- Hazards present at the workplace;
- The number of workers performing the task;
- The severity of injuries that might result if practices or procedures are not followed; and,
- Recommendations from inspections or investigations.

Workplace Inspections

A thorough workplace inspection helps identify and document all of the potential hazards that may harm workers and subcontractors. Inspections may be scheduled on a daily, weekly, or monthly basis depending on the types of hazards and other requirements (eg. manufacturer's instructions or compliance requirements set out in the *OHS Regulations*).

General inspection categories include:

- Regular inspections (e.g. the workplace, equipment, and work methods that might cause injury);
- Equipment inspections (e.g. vehicles, tools, and equipment); and,
- Special inspections (required after an incident or malfunction).

When conducting an inspection, consider the following criteria:

- Environmental hazards;
- Non-routine operations, maintenance, or changes in schedules;
- Previous first aid incidents, time-loss incidents, and near misses; and,
- Injury information provided by WorkSafeBC, the ARA, and health and safety associations.

When conducting your inspections, consult and involve your supervisors, workers and subcontractors, joint safety committee member, or safety representative. Promptly respond to any workplace health and safety issues brought to your attention.

Orientation, Education, and Training

Employers are required to provide a health and safety orientation to a young or new worker before they begin their work duties. WorkSafeBC Officers always check to ensure all parts of 3.23 *OHS Regulations* are included in the orientation. Information that must be addressed and documented during the orientation and training includes the following:

- Supervisor's name and contact information;
- The employer's responsibilities to safety under the *Act* and *OHS Regulations*;
- The young or new worker's OHS rights and responsibilities;
- Workplace OHS practices and/or procedures (eg. working alone, violence in the workplace, emergency situations, and PPE);
- Workplace hazards and how to report unsafe conditions;
- Location of first aid facilities and how to request first aid;
- Instruction and demonstration of the work task or work process;
- WHMIS information, where applicable; and,
- Contact information for the health and safety committee or safety representative.

For more information on young and new worker orientations, visit: *https://ohs.ara.bc.ca/orientation-guides*.

Employers must ensure that every worker receives instruction on how to work safely. This is usually done through a combination of education and training. Education generally refers to instruction that can include lectures, discussions, videos, or online tutorials. Training generally refers to hands-on, job-specific instructions provided individually or to small groups of workers. Following training sessions, workers should be able to demonstrate to their supervisors that they can perform specific tasks safely.

How to Use This Guidebook as a Teaching Resource

Part 2 Division 4 of the *Workers Compensation Act - General Duties of Employers, Workers and Others* 21(e) states every employer must: "provide to the employer's workers the information, instruction, training and supervision necessary to ensure the health and safety of those workers in carrying out their work and to ensure the health and safety of other workers at the workplace." The materials contained in this guidebook help serve as a tool for instructing workers in good safe work practices. This section will offer strategies for helping implement and maintain a health and safety program for your workplace.

Organize the Information

The best place to start in setting up a training program for your employees is to select relevant content then organize into manageable parts. This will mean that at a minimum holding regular safety meetings to go through and discuss with your staff the relevant topics you have chosen.

It is important not to overwhelm your employees by trying to cover everything all in one meeting. Instead, choose a relevant topic from a list, or discuss a recent incident and what everyone can do to help rectify the situation and ensure that proper control measures are established to reduce the likelihood of that incident from occurring again.

Toolbox Meetings

A toolbox or tailgate meeting is a less formal safety meeting, which is generally conducted at the job site prior to the commencement of a job or work shift. Job supervisors can draw attention to hazards, processes, equipment, tools, environment and materials to inform all workers of the risks in their surroundings.

Meetings should be regular and consistent (daily, weekly, etc.) and should last no longer than 5–10 minutes. Below are some best practices for a successful toolbox meeting:

1. Choose a relevant topic: a most recent hazard, concern or incident that is relevant to your workplace.
2. Use this guidebook and resources to learn what others are doing.
3. Understand and explain why this is important and why this topic has been chosen.
4. Prepare notes about what you want to discuss.
5. Use real-life examples to help demonstrate your point.
6. Remind your employees about best practices and employer and worker responsibilities.
7. Invite questions and feedback and be prepared to answer questions.

8. Keep records of all tailgate meetings, including the topic covered, who attended, and action items or takeaways.
9. Follow-up with workers to ensure that best practices are being adhered to.

Demonstration and Participation

Use of visual aids can greatly enhance your ability convey relevant information to your employees. Supply copies of this guidebook or prepared notes to your employees so they can review the materials discussed. Use of pictures and videos can also help the employee visualize the process.
People generally learn best when they are actually involved in the learning process. Wherever possible, offer a visual demonstration to emphasize safe work practices or under supervision have the worker go through the procedure modelling safe work practices and procedures.

Training New & Young Workers

Adults and young workers often learn in different ways. Understanding this will allow you to be flexible in meeting their needs. Training for young and new workers will have to be customized and delivered in a manner that matches their learning styles. Vary your method for delivering the information; this will help keep their interest.

Joint Occupational Health and Safety (OHS) Committee

A joint OHS committee — comprised of worker and employer representatives — meets monthly to identify any health and safety problems. The legal duties of the joint committee include:

- Identifying unsafe situations and making written recommendations to the employer;
- Promptly responding to health and safety issues;
- Consulting on issues related to occupational health and safety, including changes to work processes;
- Participating in inspections, investigations, and inquiries; and,
- Reporting on the effectiveness of the committee.

Note: For smaller operations, the worker safety representative has similar duties to that of a Joint OHS committee.

For more information on workplace inspections or joint OHS committees, visit *https://www.worksafebc.com/en/health-safety/create-manage/joint-health-safety-committees*.

First Aid Provisions

Employers are responsible for determining and providing a minimum level of first aid in the workplace. This information is set out in the *OHS Regulation Schedule 3-A: Minimum Levels of First Aid*.

Management Meetings

A formal OHS program requires management to meet periodically to review health and safety activities, incidents, and trends. Such meetings can be used to:

- Review existing policies and procedures;
- Review feedback from workers;
- Consider reports and information or written recommendations provided by the joint OHS committee;
- Address questions or concerns brought directly to management; and,
- Review reports and industry OHS information.

Incident Investigations

The purpose of an incident investigation is to:

- Identify the cause or causes of workplace incidents and near misses;
- Prevent similar events from reoccurring; and,
- Compliance with WorkSafeBC requirements.

Employers are responsible for investigating certain incidents or near-misses that take place in the workplace:

- Serious injury to a worker or a worker's death;
- Injury requiring medical treatment;
- Minor injury, or no injury, but had the potential for causing serious injury;
- Major structural failure or collapse;
- Major release of hazardous substances ;
- Diving incident, as defined by the *Occupational Health and Safety (OHS) Regulation*; and,
- Dangerous incident involving explosive materials blasting incident causing personal injury.

It is recommended that incident investigations be carried out by persons knowledgeable about the work. An incident investigation must involve:

- A worker representative;
- An employer representative; and,
- Safety representative or members of the joint OHS committee.

Employers are responsible for completing up to four separate incident reports — each representing the investigation's status at a specific point in the process. These report types include:

1. Preliminary investigation.
2. Interim corrective actions.
3. Full investigation.
4. Final corrective actions.

Preliminary Investigation

Employers must complete a preliminary investigation and produce a report within 48 hours of an incident.

Interim Corrective Actions

Between an incident and the conclusion of the full investigation, an employer must take all actions necessary to prevent a repeat of the incident. Interim, documented corrective actions during this period may include a full or partial shutdown of the worksite, removal of equipment, or reassignment of workers to other duties.

Full Investigation

A full written investigation — which must be completed within 30 days of the incident — identifies the underlying factors that led to the incident. (E.g. what factors made the unsafe condition possible)

Final Corrective Actions

Once the full investigation has been completed, an employer must prepare a final corrective action report that describes:

- The unsafe conditions that led to the incident;
- What corrective action is necessary; and,
- The steps the organization will take to implement those actions.

Note: The aforementioned incident investigation reports must contain the information required by WorkSafeBC Prevention Policies D10-175-1 and D10-176-1. For information on these requirements, visit *https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-policies/policies-for-the-workers-compensation-act#SectionNumber:P2-71-1*.

When to Notify WorkSafeBC

Employers must immediately notify WorkSafeBC of any serious incidents that:

- Resulted in serious injury to a worker or the death of a worker;
- Involved a major structural failure or collapse of a crane or hoist, or major release of a hazardous substance; and,
- There is a dangerous incident involving a fire or explosion that had potential for causing serious injury to a worker.

Following an incident or near-miss, a WorkSafeBC investigation may be conducted. Findings from WorkSafeBC investigation reports are posted online and are intended to help employers and workers understand the underlying factors that contributed to workplace incidents so similar incidents can be prevented. In addition, the investigation process will determine if enforcement action, such as imposing an administrative penalty or proceeding to prosecution, is appropriate.

For more information on incident investigations, visit *https://www.worksafebc.com/en/health-safety/create-manage/incident-investigations*.

Records and Statistics

Required OHS program records may include:

- Inspection reports and records of corrective actions taken;
- Preliminary investigation, interim corrective actions, full investigation, and final corrective action reports;
- Worker orientation and training records for workers and training records for supervisors;
- Records of safety meetings and crew talks;
- Joint committee meeting reports showing steps taken to address health and safety issues;
- Equipment logbooks and maintenance records; and,
- First aid records.

For larger employers, injury statistics (such as near misses, first aid only, health care only, and time-loss injury) may be useful for identifying trends and for measuring the effectiveness of the OHS program.

Part IV

This section includes information on the following:

- Risk Assessment;
- Ergonomic Risk Assessment;
- Hazard Controls;
- Identifying Hazards Through a Job Task Analysis;
- Risk Matrix; and,
- Industry Specific Hazard Assessment.

Risk Assessment

Employers need to identify the specific hazards that exist at their workplace (or workplaces) and how these hazards may put their workers at risk. A risk assessment is a process to help determine:

- ***Who*** may be harmed by specific workplace hazards?
- ***How*** they may be harmed?
- ***What*** control measures are required to eliminate or control the harm?

Specific risk assessment requirements are defined in the OHS Regulations. A number of required processes are types of risk assessment, such as workplace inspections and incident investigations discussed previously.

In most situations employers should conduct a risk assessment with input and participation from their workers. Risk assessments should be reviewed whenever new equipment, materials, or work processes are introduced or modified following a near-miss incident or injury. At minimum, employers must update the assessment annually.

When conducting your risk assessment, consider the following:

- Workers and their different job functions;
- New and young workers, temporary workers, workers who work alone, contractors, maintenance workers;
- The kinds of injury or illness which could be suffered;
- Possible injury severity; and,
- The length of time exposed to the hazard.

Ergonomic Risk Assessment

Work-related musculoskeletal injuries — injuries that can affect muscles, tendons, ligaments, nerves, blood vessels, and joints of the neck, shoulders, arms, wrists, legs, and back — are a leading cause of time-loss claims and require special consideration. In addition, the *OHS Regulations* require that an employer must identify factors in the workplace that may expose workers to a risk of musculoskeletal injury. An employer must eliminate, or, if that is not possible, minimize the risk of musculoskeletal injuries (MSI) to workers.

Knowing and understanding the risk factors for musculoskeletal injury will help you employ strategies to reduce the possibility of those injuries. When planning your work there are several things to consider:

- Awkward postures (reaching, lifting, sitting, twisting, or bending);
- Forceful or heavy lifting;
- Repetitive lifting of awkward objects or equipment;
- Poor design of a workstation;
- Maintaining bent postures and poor body mechanics;
- Poor weather or environmental conditions;
- Poor footing such as slippery surfaces or constrained posture;
- Equipment and truck vibrations; and,
- Fatigue or poor health and physical condition.

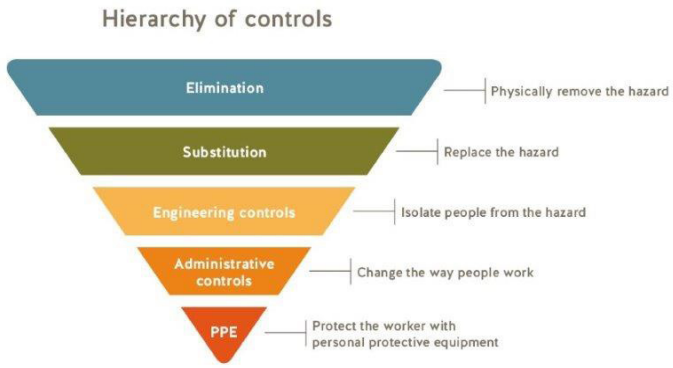
Lifting a load that is too heavy increases the risk of injury. Therefore, assess the load or the job and be able to determine if they can perform the task. Determining safe lifting limits can be challenging as there is no standard; determining safe limits usually depends on any number of factors including:

- Physical condition of the operator;
- Body posture;
- Proximity to the load;
- Lift height;
- Motions required (eg. twisting, bending); and,
- Frequency of the lift.

For more information on ergonomic best practices see *OHS Responsibilities and Industry Supported Safe Work Practices for the Mechanical Repair Industry* pp 49-66, available from *https://ohs.ara.bc.ca*.

Hazard Controls

As discussed in the "OHS Responsibilities" section of this document, employers must take steps to ensure the safety of their workers and other workers present at the worksite. Employers must eliminate (where possible) or minimize workplace hazards. To do this, it is recommended that employers follow the health and safety "hierarchy of controls." The hierarchy lists safety controls in order of their effectiveness:



Elimination

Identifying ways to completely eliminate a workplace hazard is the most effective way to ensure worker safety.

Substitution

If eliminating a workplace hazard is not possible, then substitution — which involves replacing the material or process with a less hazardous one — should be considered next.

Engineering Controls

Engineering controls means the physical arrangement, design or alteration of workstations, equipment, materials, production facilities or other aspects of the physical work environment, for the purpose of controlling risk. In the event that a hazard cannot be eliminated or a safer approach introduced you should consider implementing an "engineering control." Engineering controls may include lifting devices or hoists, guarding for where crush injuries may occur, barriers (which can include the placement of vehicles to reduce the likelihood a worker is struck near incidents), and other control measures.

Administrative Controls

Administrative controls means the provision, use and scheduling of work activities and resources in the workplace, including planning, organizing, staffing and coordinating, for the purpose of controlling risk. Administrative (or process) controls typically involve the development and implementation of effective safe work practices and procedures. Examples of administrative controls include implementing working alone procedures and prohibiting the use of handheld electronic devices when behind the wheel.

Personal Protective Equipment (PPE)

The use of PPE, such as a suitable high-visibility vest, protective eyewear, and suitable gloves can help to reduce exposure risk.

When developing or strengthening your controls, all five types of controls should be evaluated. A combination of controls — such as engineering and administrative controls — may be effective in reducing risks.

Finally, employers need to monitor the effectiveness of their hazard controls measures. This involves:

- Conducting regular safety inspections to evaluate if the controls are effective, or if new
- Hazards have been created;
- Responding to issues in a timely manner;
- Organizing monthly meetings to discuss and address workplace hazards; and,
- Keeping a record of your activities.

It is recommended that employers involve supervisors, workers, safety representative, or joint OHS committee member when identifying and implementing hazard controls.

Identifying Hazards Through a Job Task Analysis

A job task analysis (also known as a job hazard analysis) is a process to help identify hazards that exist within each job and select the appropriate safety control measure (or combination of measures) to eliminate, where possible, or minimize the risk to workers.

When conducting a job hazard analysis consider the following process:

- Break each job down by duties and tasks;
- Identify, assess, and catalogue hazards and the risks they pose to the worker;
- Determine if a control measure (or measures) can eliminate the hazard; if the control measure or measures can't eliminate the hazard, develop a safe work practice or step-by-step safe work procedure;
- Provide education, information, training, and supervision to workers; and,
- Providing effective supervision.

Risk Matrix
An Approach to Identifying and Controlling Hazards

Risk, as defined by WorkSafeBC, means the chance or likelihood of injury or occupational disease.

Risk is evaluated based on the likelihood of occurrence. Risk Matrix factors are found by multiplying the **Likelihood** by the **Consequences** to equal the final **Risk Rank**.

Hazard x Frequency = Risk

Hazard identification and Risk Assessment is taking a known hazard, such as an EV recovery, and evaluating the likelihood of that hazard occurring. Known hazards are analyzed for the level of risk using the following risk matrix to assign a number called the **Risk Rank**. Hazards can then be prioritized based on their risk rating.

1. **High risk** activities must be addressed immediately and reviewed often to ensure control measures are accurate and adequate.
2. **Moderate** risk activities are then addressed once all the high risk activities have adequate control measures in place.
3. **Low risk** activities are then reviewed and control measures put in place to address them.

Risk Matrix	Consequences	Low Impact	Serious	Catastrophic
Likelihood	Ranking	1	2	3
Remote	1	1	2	3
Possible	2	2	4	6
Probable	3	3	6	9

- 1-3 = Low Risk
- 4-5 = Moderate Risk
- 6-9 = High Risk

This matrix is an industry supported method for assessing risks, developed in consultation with the ARA's OHS Technical Advisory Committee. The table details common hazards associated with the recovery, transportation, handling, dismantling and storage of Electric Vehicles (EVs) and High Voltage (HV) batteries and their associated risk ranking based on likelihood of occurrence and degree of consequences. The table references safe work guidelines in order to reduce the likelihood of a hazard occurring. You may use the table as quick reference chart. This chart serves as a guide only and it is for each employer to conduct their own hazard assessment of their facility.

Industry Specific Hazard Assessment

Industry Specific Hazard Assessment						
Factor	**Likelihood**	**Consequences**	**Hazards**	**Recommended Controls**	**References**	**Risk Level**
Towing and Recovery Scene Assessment	2	2	Sudden movement of vehicle. Thermal runaway (rise in temperature) leading to fire. Exposed wiring.	Stay out of the way of potential travel path. Always assume the vehicle may be electric until you now otherwise.	*OHS Responsibilities and Industry Supported Safe Work Practices: Part VII, p 36.* *OEM ERGs.* *https://towspec.com*	**Moderate**
Towing and Recovery Secure and Disable	2	3	Struck by vehicle. Electric shock. Proximity key left in vehicle.	Always have an escape path. Set parking brake. Ensure that the proximity key is at least 16 feet away.	*EV Types and Safety Features.* *OEM ERGs.* *Isolate, Secure & Disable (ISD) Approach Identify, Secure and Disable.*	**High**
Towing and Recovery Service Calls and Emergency Incidents	2	3	Exposed wiring. Over-turned or inverted vehicles may still be running. Thermal runaway event.	Consult with emergency personnel if on scene. Perform ISD before attempting to recover the vehicle. Listen and watch for signs of thermal runaway.	*OHS Responsibilities and Industry Supported Safe Work Practices: Part VII, p 49 & 54.* *https://www.nfpa.org* *https://towspec.com* *https://tesla.com* *OEM ERGs.*	**High**

Factor	Likelihood	Consequences	Hazards	Recommended Controls	References	Risk Level
Towing and Recovery Vehicle Loading	2	2	Thermal event while in transit. Exposed wiring. Electric shock. Vehicle has not been properly disabled.	Always be aware of dislodged HV cables or components. If you detect smoke, sparks, flames, gurgling popping or hissing noises, especially during transport or from a vehicle with a damaged high voltage battery, immediately pull over and exit the truck.	*OHS Responsibilities and Industry Supported Safe Work Practices: Part VII, pp 42-45.* *OEM ERGs.* *https://towspec.com*	**Moderate**
Towing and Recovery Temporary Vehicle Storage	2	2	Vehicle coming into close contact with flammable substances. Exposed wiring. Extreme weather. Irritation (eyes, throat, etc.) caused by off-gassing.	Notify employees of hazards and distancing guidelines. EVs with damaged batteries need to be stored at least 50 feet away from flammable substances.Identify all stored EVs in yard.	*OEM ERGs.* *EV Types and Safety Features* section of these guidelines. *https://www.nfpa.org*	**Moderate**
Towing and Recovery Water Recoveries	2	3	Coming into contact with submerged HV cables or components. Submersion in water (especially salt water) can damage low and high voltage components. Although not a common occurrence, this could result in an electrical short and potential fire once the vehicle is no longer submerged.	Avoid any contact with HV cabling or components. Consult the manufacturer ERG for HV locations prior to connecting any recovery lines. The vehicle should be shut down and disabled before removal from the water. If you are unable to shut-down the vehicle first remove it from the water, allow the vehicle to drain fully then initiate the recommended disable procedure.	*OEM ERGs.* *EV Types and Safety Features* section of these guidelines. *https://www.nfpa.org* *OHS Responsibilities and Industry Supported Safe Work Practices: Part VII, p 62.*	**High**

Factor	Likelihood	Consequences	Hazards	Recommended Controls	References	Risk Level
Receiving Hybrid or BEV into a Recycling Facility	2	2	Electric shock. Exposed wiring. Hidden damage. Silent movement or instant restart capability exists until vehicle is fully shut down.	Documentation and Communication. Drop off vehicle in designated area. Perform hazard assessment prior to any further processing.	*OEM ERGs.* *EV Types and Safety Features* section of these guidelines. *Identifying an EV p 33.*	**Moderate**
Moving a Hybrid or BEV manually on the ground or with a forklift	2	3	Electric shock Exposed wiring Hidden damage The ability of these vehicles to move silently and without warning.	Keep remote operation keys away from vehicle. Conduct hazard assessment before moving. Limit the distance the vehicle is moved along the ground to a minimum. Always use caution when placing the forks under a BEV, PHEV, or Hybrid vehicle. Consider the weight and location of the battery when transporting with a forklift. Do not contact the HV cables or battery case with the forks of the forklift.	*WSBC OHS Regulation Part 16: Mobile Equipment.* *OHS Responsibilities and Industry Supported Safe Work Practices for the Mechanical Repair Industry: Part VIII, p 94.*	**High**

Factor	Likelihood	Consequences	Hazards	Recommended Controls	References	Risk Level
Dismantling a Hybrid or BEV	2	3	Strains, musculoskeletal injuries, struck by object. Electro Shock.	Conduct an ergonomics risk assessment. Remove battery only in a clearly marked area. Always follow manufacturer's recommended procedures for safety disconnects and battery removal. All safety equipment such as HV insulated gloves, CAT3 voltmeter, and shepherds hooks should be within reach of the dismantler before any work is performed.	*OHS Responsibilities and Industry Supported Safe Work Practices for the Mechanical Repair Industry, Automotive Hoists pp 100-102.* *Conducting an Ergonomics Risk Assessment* section of these guidelines.	**High**
Hybrid and BEV HV Battery Storage	2	2	HV battery coming into close contact with flammable substances. Risk of fire: smoke from fire is toxic; and, Irritating fumes caused by off-gassing.	Clearly marked storage area. Potential fire sources should be done at a 50 foot radius of the battery storage area. Batteries must be strapped to pallet. Do not stack or store in upright position or on their side. Do not lean other objects against batteries.	*OEM ERGs.* *EV Types and Safety Features* section of these guidelines. *https://www.nfpa.org*	**Moderate**

Part V

This section includes information on the following:

- Electric Vehicles and High Voltage Batteries.

Electric Vehicles and High Voltage Batteries

Vehicle Types

- **Hybrid Electric Vehicle (HEV)** – these vehicles use and electric motor and internal combustion engine (ICE) for propulsion. The ICE also charges the battery.
- **Plug-in Hybrid Electrical Vehicle (PHEV)** – hybrids that can also be charged by an external electrical outlet.
- **Battery Electric Vehicle (BEV)** – these vehicles use only electric motors for propulsion…charged only from an external power source.

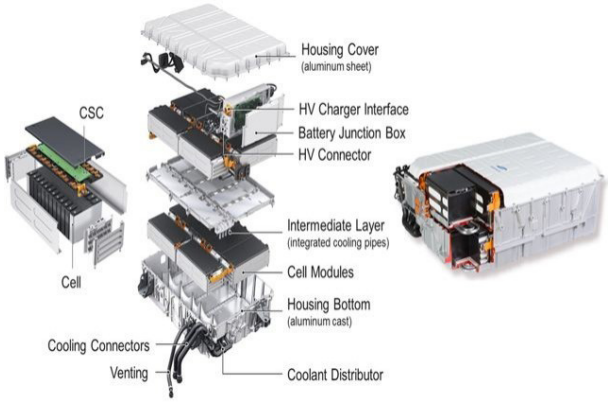
Battery Types

There are two types of High Voltage (HV) Batteries found in production vehicles:

- **Lihium Ion Battery (Li-Ion)**: Made up of carbon and highly reactive lithium, the Lithium Ion stores high amounts of energy. It is primarily used in BEV and PHEV vehicles because of the increased capacity; and,
- **Nickel Metal Hydride Battery (NiMH)**: Most hybrid vehicles on the market use a Nickel Metal Hydride battery. The battery uses hydrogen to store energy, plus nickel and another metal, such as titanium, to secure the hydrogen ions.

Note: Some battery recyclers may only ever receive one type of battery for end of life battery recycling.

The composition of an electric vehicle (EV) battery might vary slightly depending on the types of electric vehicles, but generally EV batteries are composed of cells, modules and a pack.



HV Battery Safety

HV batteries have a safety label affixed to the case indicating the construction type of the battery. See example below:

Li-Ion batteries have greater risks than the NiMH batteries and therefore additional safety measures need to be followed when handling and storing them. You should consider the following when handling and storing HV batteries:

- A relatively small fire source, such as a spark, is sufficient to start a lithium battery fire;
- Batteries of the same type, but from different manufacturers, exhibit varying flammability characteristics;
- Fully charged batteries can ignite more violently;
- A Li-Ion battery that has been excessively discharged is no longer usable, is more unstable and has a greater fire risk;
- Do not attempt to manually charge with external equipment a battery that has been removed. Only charge the battery through the vehicle's charge port, and only if the vehicle is able to safely perform this;
- Do not ever attempt to extinguish a Li-Ion battery pack fire. Evacuate the building and call the fire department; and,
- In the unlikely event the electrolyte does leak, it can be easily neutralized with a dilute boric acid solution or vinegar.

When working on or near electric vehicles and high voltage batteries be aware of the following:

- All EVs have at least two batteries — a high voltage battery that supplies power to the electric motor and drive system, and a standard 12-volt battery that runs the vehicle's low voltage systems;
- High voltage (HV) systems typically produce 100-400 volts DC…enough to cause serious injury from direct contact with damaged high voltage components;
- HV batteries are protected by the vehicle's structure or enclosed in a metal case;
- In hybrids (HEV), HV batteries are mostly in the rear of the vehicle and typically in the trunk for passenger

vehicles, or under the second-row seat for trucks and SUVs. Since BEVS require a larger battery capacity in passenger vehicles they are typically found under the passenger compartment;

- In Hybrids and BEVs the HV system is controlled by vehicle's 12 volt or low volt battery. When the ignition is turned on, energizing the 12-volt system, it closes a relay in the HV battery, allowing the HV current to flow. When the 12-volt system is interrupted by turning off the ignition the relay opens and the HV system is shut down. In newer vehicles, shutting off the ignition also shuts down the 12-volt source to supplemental restraint systems, disabling the air bags;
- After shutting down the HV system there may be residual power in the system capacitors until the energy dissipates. The same is true for airbags and other SRS components which have their own capacitors independent of those in the HV system;
- After the HV system has been shut off the airbags can still deploy, even after their capacitors drain down. For specific details on how long it can take these systems to drain down refer to the OEM Emergency Response Guide (ERG);
- Reconnecting the 12-volt power will reenergize the supplemental restraint systems. **Warning:** It is important to remember that even after the system has been shut down and the capacitors are drained the HV battery retains its charge;
- In some cases the OEMs recommend disconnecting the vehicle's HV electrical system by removing the High Voltage Service Disconnect. This is also referred to as a manual disconnect or service plug; and,
- This disconnect is located on the battery itself. If you plan to use the service disconnect check the OEM ERG.

EV Vehicle Safety Features

- HV systems are isolated from the vehicle's chassis so the vehicle can be touched even after a severe crash without coming into contact with HV electricity.
- HEVs, PHEVs and BEVs have a number of built-in safety systems:

    a) High voltage system shut-down: this is activated in the event of a crash. It is initiated when the vehicle's occupant protection systems deploy. If airbags have been deployed expect that the HV shut-down has automatically been deployed; and,

    b) EV systems include fuses and fault protection: these disable the HV systems in the event that circuits are compromised. They occur in the case of a fault, short or other damage to the system.

Even though electric vehicles have these built-in safety features you should always:

- Double check to ensure that the vehicle is off during the disabling step;
- Always avoid contact with damaged high voltage components and wiring;
- Always ensure that a person never comes into contact with, never touch, disconnect, or work on any of these components without the proper training, equipment and/or certifications;
- Li-ion batteries have a large risk of fire and a fire plan should be in place whenever stored, dismantled or transported; and,
- Most Ni-MH batteries are relatively small and can be moved with the help of a co-worker and pushed around on a cart. However, Li-ion batteries are too large to be manually lifted and require lifting devices such as a power-train lift or a forklift.

Part VI

This section includes information on the following:

- Safe Work Practices.

Safe Work Practices

Towing and Recovery Scene Assessment and Vehicle Identification

EVs look like conventional internal combustion engine (ICE) vehicles and can pose hazards for tow operators. Compromised high voltage electrical systems and cables can lead to serious injury or death if not handled properly. Understanding these hazards will help keep you, vehicle occupants and by-standers safe.

Every recovery begins with the dispatcher taking the initial request. It is important that the dispatcher conveys as much relevant information to the operator before he/she arrives at the scene. When possible, the dispatcher should gather as much information about the vehicles(s) being recovered. This will include the make and/or model/type of vehicle; the location of the vehicle; and proximity to the road (on-road/off-road/off on the shoulder, etc.). Record the position of the vehicle and side of traffic (facing traffic, right-side of traffic, other side of traffic, etc.).

Ask what is wrong with the vehicle: a) Are there keys with the vehicle? b) Are emergency services on the scene?

For more dispatch guidelines see *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Part VII, p 36*.

Employer Responsibilities Include:

- Identifying hazards that workers may be exposed to;
- Educating, training, and supervising workers on safe work procedures, including the proper use of personal protective equipment; and,
- Instructing employees to report any unsafe conditions.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor;
- Performing work in a safe manner;
- Wearing appropriate PPE; and,
- Workers have the right to refuse unsafe work: If workers are concerned that a work process may be exposing them to HV shock, fire, burn or any other hazard associated with EVs, they must stop the work immediately and report the concern to a supervisor. The supervisor must ensure any unsafe condition is addressed without delay.

Hazards Include:

- The ability of these vehicles to move silently and without warning can pose a danger to workers and others on scene. Vehicle may move suddenly and without warning;
- Thermal runaway leading to fire; and,
- Exposed wiring and damaged components.

Workers must follow written safe work procedures when conducting a scene assessment. These procedures may include the following actions:

Scene Assessment

- Always follow standard safety practices when you first arrive at a scene (For more dispatch guidelines see *OHS Responsibilities and Industry Supported Safe Work Practices: Part VII, p 36*).
- Assess the scene for any existing hazards (scattered debris, spills, traffic, etc.).
- Always approach the vehicle from the passenger side when possible to stay out of a potential travel path. It can be difficult to determine if the motor is running due to the absence of engine noise.
- Assume that any vehicle could be a HEV, PHEV or BEV until proven otherwise.
- Always remember your scene safety. Safety is always your first priority!

How to Identify Whether the Vehicle Is a HEV, PHEV, BEV or a Conventional Vehicle

Identification may not always be easy at first glance: Look for a vehicle emblem on the trunk, fenders or doors as they will often feature an EV or some other logo indicating electric propulsion. Some EVs, however, have no emblems at all to indicate they are hybrid or electric.

In some cases you can identify through the model name (e.g. Nissan Leaf or Chevy Volt). But keep in mind that emblems may have become hidden or damaged due to a crash. If you can't tell by exterior or inside the engine compartment look, for emblems that identify the warning labels on high voltage components and wiring. Orange coloured cables indicate that it is high voltage.

If you have access to the cabin interior there may be a logo on the dashboard or special indicators only found on electric vehicles. These may include: battery charging or status indicators, ready indicator, or other icons indicating it is an HEV, PHEV or BEV. The ready indicator also informs you that the vehicle is on and will move if it is in gear and the brake is released, or, if the vehicle is in gear and the accelerator is pressed.

If the vehicle is on its side or roof you may see cables on its underside. ***Note:*** Although cables are required to be orange they may be covered by protective material that is another colour which can hide them. The absence of orange cables on the vehicle's under-side does not mean that it is a conventional vehicle. Some vehicles may have a casing underneath, hiding the cable (e.g. Tesla).

Once a vehicle has been identified as a HEV, PHEV or BEV check the OEM towing specifications for recovery and transport specifications. Towing specifications can be obtained from *towspecs.com*.

Once you have completed your scene assessment and have identified the vehicle as either HEV, PHEV or BEV you can begin the next steps of securing then disabling the vehicle.

Towing and Recovery Securing and Disabling an Electric Vehicle

Only after a scene assessment has been conducted and the vehicle identified as either a HEV, PHEV or BEV should an attempt to secure and disable the vehicle be made. This is known as the **ISD approach**: a) identify; b) secure; and, c) disable.

For more information about the different types of EVs and their safety features please see the *EV Types and Safety Features* section of these guidelines.

Employer Responsibilities Include:

- Implementing control measures to minimize the risk to workers;
- Ensure that drivers have suitable PPE;
- Informing, educating, training, and supervising workers; and,
- Respond to worker reports of hazards.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor;
- Performing work in a safe manner; and,
- Wearing appropriate PPE.

Hazards Include:

- Failing to identify the vehicle as electric;
- Being struck by vehicle;
- Electric shock from exposed wiring; and,
- Proximity key left in vehicle.

Workers must follow written safe work procedures when securing and disabling an EV. These procedures may include the following actions:

Secure (Stopping the vehicle from moving)

- Always approach the vehicle from the passenger side (if possible) until it is secured. EVs can be running without any sound and can move without warning. Always assume the vehicle is on and ready to move until you can confirm otherwise;
- Ensure that you have an escape route should the vehicle begin to move;
- Chock the wheels first (if you are able); and,
- Set the emergency parking brake and put vehicle into park. Some models may have electric parking brake switches or push-button gear selectors. In these cases an electric motor is used to apply and release the parking brake. To determine if a specific vehicle model has an electronic park brake refer to the vehicle's owner manual or other reference source.

Disable (Ensuring the vehicle cannot start)

- Once you have secured the vehicle, ensure it is disabled, and if equipped with a traditional key remove it from the ignition.
- In many new vehicles a proximity key (or smart key) controls the ignition system, which allows it to be controlled without putting the key into a traditional key slot. These vehicles have a push-button to start or stop the motor. If the vehicle has a proximity key, manufacturers recommend moving it at least 16 feet away. It may be difficult to locate the key, as it could be in a vehicle compartment or the driver's personal belongings, such as a purse. If the proximity key is within 16 feet of range, the vehicle has the potential to start again if the power button is pushed.
- Some models such as Tesla allow you to access the vehicle through use of an app. The app runs off Bluetooth so its range will be whatever the range of the Bluetooth is.
- Disconnect the 12-volt battery.
- Once the vehicle has been successfully disabled it is safe to begin to prepare it for the tow or recovery operation.

For more information on controlling hazardous energy see *https://www.worksafebc.com/en/health-safety/tools-machinery-equipment/lockout*.

Towing and Recovery Service Calls and Emergency Incidents

Once the vehicle has been rendered safe and any other operations completed, the vehicle is safe to be recovered and/or serviced. For more information about approaching the scene for a service call and vehicle recoveries see *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Part VII, p 49 & 54*.

Employer Responsibilities Include:

- Informing, educating, training, and supervising workers about how to safely conduct a service call;
- Ensuring that trucks and equipment are suitably maintained and fit for purpose; and,
- Responding to worker reports of hazards.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor; and,
- Performing work in a safe manner.

Hazards Include:

- Exposed wiring or high voltage (HV) components;
- Vehicle has not been properly disabled before attending service or recovery; and,
- Inverted vehicles may still be running.

Workers must follow written safe work procedures when attending a service call or vehicle recovery. These procedures may include the following actions:

When conducting service calls

- Always familiarize yourself with OEM recommendations. Emergency Response Guides (ERGs) can be found at *https://www.nfpa.org/* and towing specific recommendations can be found at *https://towspec.com* and *https://tesla.com*, including vehicle-specific recommendations for towing and recovery.
- Conduct a pre-service walk-around and always approach the vehicle from the passenger side for safety. Ensure that the vehicle is shut-down and secured from movement as soon as possible.
- Conducting service calls will be the same with an EV as it is for a conventional vehicle, but with a few additional precautions:
    a) When changing a tire on an electrical vehicle always refer to manufacturer guidelines for safe jacking points. Vehicle's such as Tesla must be put in tow mode to disable the airbag suspension if equipped;
    b) Always check underneath to ensure there are no HV wires or components in the way;
    c) Not all hybrids or BEVs come with a spare tire, some come with a sealant kit and a compressor; and,
    d) Jump starting a hybrid or BEV is similar to a conventional vehicle, but always consult with manufacturer recommendations prior to starting. Due to the location of the battery, there will often be a jump block under the hood. Connection should only be made at this block or the 12-volt battery directly.

- Never make a connection to or try to jump a HV battery; and,
- High or medium voltage cables should never be disconnected or touched.

When arriving at the scene for emergency incidents (accident towing)

- When arriving at the scene always consult with fire or police (if on scene) to determine the type of vehicle(s) involved and their current status. Remain in communication with emergency personnel throughout the recovery.
- Questions to ask emergency personnel or to ascertain include: Verify as per lock-out procedures that the vehicle has been secured and disabled. Ask: What is the extent of the damage to the vehicle? Has the High Voltage (HV) system or battery been compromised? If so, is there a potential electrical or shock hazard? Is there a fire concern? Is any special equipment needed?
- If you are the first to arrive at the scene, be sure to identify, secure and disable the vehicle before attempting to recover or transport. Be prepared to give an update to law enforcement or emergency crews that may arrive later.
- While at the scene, use standard traffic incident management (see *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Part VII, p66*).
- Always wear appropriate personal protective equipment, including vests, gloves, and eye protection.

Vehicle Recovery Safe Work Procedures

When recovering a vehicle there are considerations above and beyond those methods used to recover conventional vehicles. These include:

- Be sure to identify, secure and disable the vehicle before attempting any recovery.
- Always approach from the passenger side of the vehicle (if possible) and out of the way of any potential travel path. Remember, it may be difficult to determine whether the motor is on, due to the lack of engine noise.
- Begin your vehicle inspection and note any of the following:

  a) Location and severity of damage;
  b) Any high voltage or battery damage;
  c) Damage to the wheel or tires; and,
  d) Any fire damage.

- If you detect fluid leak, sparks, smoke, flames, increased temperature, or gurgling, popping or hissing noises from the HV battery compartment, contact the fire department immediately if they are not already on scene. These indicators can be signs that the battery is experiencing a thermal runaway event, which can lead to a fire. ***Note:*** These indicators should be monitored even after removal from the scene.
- Prior to beginning the recovery, always check with your supervisor or the manufacturer Emergency Response Guide (ERG) and other resources like *towspec.com* or *tesla.com* for any special instructions. If necessary, contact a vehicle manufacturer representative for any additional steps you should take to safely recover and/or transport the vehicle.

- Do not attempt to recover and/or load a vehicle for transport until all information has been gathered and the vehicle has been secured and disabled. For further information on recovery procedures see: *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Part VII, p 54-65.*
- Place the vehicle into neutral: If it is necessary to turn the vehicle on to place it in neutral, be certain that no other problems exist. If the vehicle is dead or there is no fob key the vehicle may be equipped with a shift lock override. This may be located near the shifter, or, on some models, beneath the cup holders. In most cases the override can be accessed by using a screwdriver and removing the plug.
- Release the parking brake to free the vehicle for movement. ***Note:*** Some models may use an electric parking brake, which cannot be disengaged once 12-volt power has been disconnected.
- If available, place the vehicle into tow mode.

As you recover the vehicle, consider the following:

- Damaged HV components and wiring, especially on the underside of the vehicle, can be made worse by dragging the vehicle over rough terrain or guard rails. The use of specialty equipment, such as a rotator/ crane may be required based on the extent of damage to the vehicle, terrain or location of the vehicle (see *OHS Responsibilities and Industry Supported Guidelines for the Towing and Recovery Industry*).
- Electric vehicle batteries could be operable in an inverted position unless the severity of the damage has triggered the automatic shut-down feature.
- Be sure to safely control the movement of the vehicle while it is being placed back on its wheels.
- Never come into contact with high voltage cabling or components, as the system can remain energized for up to ten minutes after shut-down.
- Never cut orange high voltage (HV), or yellow or blue medium (MV) voltage cabling.
- HEVs, PHEVS and BEVs may be heavier than their conventional counterparts and may have a different centre of gravity because of the weight of the HV battery. ***Note:*** BEVs have even larger batteries than hybrids.
- Consider the weight and location of the battery during vehicle recovery. The location of the battery can be determined by looking at the manufacturer's ERG.
- Due to the battery location, attachment points should be carefully considered to ensure that they are strong enough. Ensure they do not damage the battery or charging system.

Towing and Recovery Vehicle Loading and Transport

Never assume that all electric vehicles should be towed the same way. Always consult OEM recommendations or *towspec.com* for recommended loading and towing procedures. It is typically recommended that HEVs, PHEVs and BEVs be loaded on a flat-bed deck truck. The regenerative braking system requires that these vehicles be towed with the drive wheels off the ground.

Note: Towing them with the drive wheels on the ground during transport could generate electricity that could potentially start a fire within the vehicle's electrical system. An additional option is to use a wheel lift with dollies.

For additional information on loading and transporting see *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Part VII, pp 42-45*.

Employer Responsibilities Include:

- Developing and implementing safe work procedures;
- Educating, training, and supervising workers on safe work procedures; and,
- Ensuring that trucks and equipment are suitably maintained and fit for purpose.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Stay alert for workplace hazards and listen carefully to safety instructions;
- Performing work in a safe manner;
- Wearing appropriate PPE: and,
- Report any unsafe condition conditions or any hazard you cannot fix yourself.

Hazards Include:

- Thermal event while in transit;
- Towing with drive wheels on ground may cause electrical fire;
- Exposed wiring;
- Electric shock; and,
- Vehicle has not been properly disabled.

Workers must follow written safe work procedures when loading and transporting an EV. These procedures may include the following actions:

Vehicle Loading Safe Work Procedures

- Consult the manufacturer's ERG or other resources such as *towspec.com* for vehicle specific information.
- When loading the vehicle onto a flat-bed, winch the vehicle up onto the deck in neutral. Use skates and slides if the vehicle will not go into neutral.
- If it is necessary to turn the vehicle on to place it in neutral, be certain that no other problems exist. If the vehicle is dead, or there is no fob key, the vehicle may be equipped with a shift lock override. This may be

located near the shifter, or, on some models, beneath the cup holders. In most cases the override can be accessed by using a screwdriver and removing the plug.
- Some EVs have no conventional neutral in the transmission, which will make pushing the disabled vehicle more difficult because the electric motor/generator system is also being turned.
- Always be aware of dislodged HV cables or components when loading or unloading an electric vehicle.

The securing of an electric vehicle remains the same as that of a conventional vehicle, but make sure no rigging is in contact with high voltage cable or components (see *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Booms and other Equipment pp 50-53*).

Vehicle Transport

If you detect smoke, sparks, flames, or gurgling, popping, or hissing noises, especially during transport or from a vehicle with a damaged Li-ion battery, immediately pull over and exit the truck. Immediately call the fire department or 911.

Special considerations when loading and transporting an electric vehicle:

- Structural damage can expose HV wiring and components.
- Never tow an EV with drive wheels on ground. Always tow with a deck or with dollies. Towing with drive wheels on the ground may cause an electrical fire.
- As with conventional vehicles, it is possible that vehicle attachment points can be damaged as well.
- Always avoid contact with any HV cabling or components.

Towing and Recovery Electric Vehicle Water Recoveries

A vehicle's electrical system is isolated from the chassis. Therefore the HV electricity does not come into direct contact with the vehicle's structural components. There are other safety and fault detection systems to protect against a shock hazard (see section on *EV Types and Safety Features*). If the system detects a short circuit due to water intrusion it is designed to immediately shut-down.

If you see bubbles coming from the battery of a sub-merged vehicle — called micro bubbling — it is the result of an electrical current flowing through the water between the positive and negative terminals. This is not a sign that the water surrounding the vehicle is energized. The bubbles are hydrogen and oxygen gas being released as water molecules are broken down.

If a recovery requires workers to be at risk of entrapment or depths greater than one metre, a professional certified commercial diver may be required to assist in the recovery. If the operator has to recover a vehicle in a way that could place them at risk of being submerged, or caught in a current, a water recovery escalates to a complex recovery. This type of recovery requires the completion and communication of a complex recovery scene assessment before work can begin. A complex recovery may require the services of a commercial dive team.

For more information about performing water recoveries, see *OHS Responsibilities and Industry Supported Safe Work Practices for the Towing and Recovery Industry: Part VII, p62*.

Employer Responsibilities Include:

- Conducting a risk assessment that identifies the hazards that workers may be exposed to during water recoveries;
- Implementing control measures to minimize the risk to workers;
- Providing health and safety information, education, training, and supervision to workers; and,
- Ensuring that trucks and equipment are suitably maintained and fit for purpose.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor; and,
- Performing work in a safe manner.

Hazards Include:

- Coming into contact with submerged HV cables or components; and,
- Submersion in water (especially salt water) can damage low and high voltage components. Although not a common occurrence, this could result in an electrical short and potential fire once the vehicle is no longer submerged.

Workers must follow written safe work procedures when recovering electric vehicles from water. These procedures may include the following actions:

- Never attempt a water recovery without proper support, training or equipment.
- Always avoid any contact with HV cabling or components.
- Consult the manufacturer ERG for HV locations prior to connecting any recovery lines.
- The vehicle cannot should be shut down and disabled before removal from the water.
- If the vehicle cannot be shut-down first, remove it from the water, allow the vehicle to drain fully, then initiate the recommended disable procedure. ***Note:*** Do not attempt to remove a manual service disconnect while in the water.
- ***Note:*** The vehicle weight and location of the battery will affect the way the vehicle will behave when winching. Removing an electric vehicle from the water is similar to the process for a conventional vehicle, with the exceptions noted above.
- Damaged HV batteries can produce flammable gas. Venting the passenger compartment is recommended once the vehicle is out of the water. Do not store the vehicle indoors.

Towing and Recovery Temporary Vehicle Storage

After removing an EV from the scene a determination must be made as to the best way to store the vehicle. Stranded energy (the energy remaining in a lithium-ion cell) and the potential for re-ignition will determine how the vehicle is to be stored.

Stranded energy is of concern when there is damage to the HV components or battery. Exposed wiring and components could present a safety hazard. ***Note:*** even when the system has been shut-down the battery will still retain its charge.

Employer Responsibilities Include:

- Conducting a risk assessment that identifies the hazards that workers may be exposed to when storing electric vehicles;
- Implementing control measures to minimize the risk to workers, including written rescue and evacuation procedures;
- Developing and implementing a written hazardous materials control plan;
- Informing workers about the hazards electric vehicles may present, their warning signs and how they may be exposed to these hazardous; and,
- Responding to worker reports of hazards.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor;
- Follow procedures for safe use, handling, storage and disposal of HV batteries;
- Report any unsafe condition conditions or any hazard you cannot fix yourself;
- Stay alert for workplace hazards and listen carefully to safety instructions; and,
- Be alert to hazards. Report them immediately to your supervisor or employer.

Common Hazards Include:

- Vehicle coming into close contact with flammable substances;
- Exposed wiring;
- Extreme weather;
- Stranded energy;
- Smoke from fire is toxic; and,
- Irritating fumes caused by off-gassing.

Workers must follow written safe work procedures when temporally storing EVs. These procedures may include the following actions:

- The vehicle should be identified as an HEV, PHEV or BEV using some type of visual indicator or signage.
- If damaged, the hybrid or BEV should be stored in an area away from other vehicles.
- Employees should be notified of the vehicle's presence and told not to interact with it unless authorized.

- In order to reduce hazards, the National Fire Protection Association guidelines recommend the vehicle be stored outside and at least 50 feet from any combustible materials when stored post fire or if there has been any damage to the HV battery. These guidelines are for passenger vehicles and there should be even greater distance for larger vehicles.
- The guidelines should be in writing and all employees trained on them.
- Continue to monitor the stored vehicle for any signs of thermal runaway.

If the HV Battery Has Been Damaged:

HV batteries can remain energized after the vehicle has been shut down and disabled. If the battery has been damaged it poses a potential electrical hazard. Direct contact with any components internal to the battery will result in shock. Electrolyte leakage should be minimal due to construction of the battery, but, if present, you should avoid all contact.

Consider the following when storing an electric vehicle that has sustained damage to the battery:

- Information on neutralization of electrolytes can be found in manufacturer's ERGs.
- Physical damage to the battery can also result in a thermal event, which could release harmful or flammable gases or even catch fire. This is called 'off-gassing' and it can take hours, days or even weeks to occur. Never assume it is safe to approach an electric vehicle with a damaged battery.
- The warning signs of damage to a HV battery can include fluid leakage, smoke, sparks, increased temperature, or a bubbling or gurgling sound coming from the battery. Irritating fumes in or around the vehicle may be another indicator of off-gassing. If this occurs, evacuate the area immediately and call the fire department or 911.
- In the event the HV battery or components have been ejected from the vehicle, speak with the fire department for the safest method of removal.

In Case of Vehicle Fires:

- Never try to extinguish a HV battery fire with a fire extinguisher as it may be ineffective and may interact with the electrolyte. Fumes are considered toxic. Only trained fire-fighters should extinguish a high voltage battery fire.
- High voltage (HV) battery fires may take much longer to extinguish than conventional fires.
- When removing an EV that has been in a fire, consider that hidden fires can remain inside the HV battery.

Other Temporary Storage Considerations

- Impounded vehicles for police may pose additional considerations and protocols. Work with law enforcement to resolve.
- If tarping is required in order to protect the vehicle from the weather, be aware that any gases released from the battery may be contained underneath the tarp. Allow for proper ventilation. Alert employees of the hazards.
- If the tower transports the vehicle directly to a repair facility or salvage yard, safety and storage considerations should be noted.
- The receiving facility should be notified of any safety or storage considerations.

Receiving Hybrids and Electric Vehicles at a Recycling Facility

Upon receiving a Hybrid or BEV it is important to communicate as much information as possible to employees and especially to any employee who is involved with the care and handling of the vehicle. Only a trained and designated employee should be permitted to receive and inspect a Hybrid or BEV upon arrival. The salvage seller is required to inform the receiver of all hazards related to the high voltage vehicle (BEV, PHEV or HEV). However, it is up to each facility to conduct their own risk assessment and to obtain as much relevant information about the vehicle before it is processed.

For more information on conducting a Risk Assessment, see Part IV of these guidelines.

Employer Responsibilities Include:

- Conducting a risk assessment that identifies the hazards that workers may be exposed to;
- Implementing control measures to minimize the risk to workers; and
- Ensuring only designated and trained employees are permitted to receive a hybrid or electric vehicle, communicating all known hazards to workers.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor; and,
- Performing work in a safe manner.
- Workers have the right to refuse unsafe work: If workers are concerned that a work process may be exposing them to HV shock, fire, burn or any other hazard associated with EVs, they must stop the work immediately and report the concern to a supervisor. The supervisor must ensure any unsafe condition is addressed without delay.

Hazards Include:

- Electric shock;
- Exposed wiring;
- Hidden damage; and,
- Silent movement or instant restart capability exists until vehicle is fully shut down.

Workers must follow written safe work procedures when receiving vehicles into their facility. These procedures may include the following actions:

- Document as much information on the work order before assigning a worker to begin processing the vehicle. Record and document all applicable information provided by the seller and use other resources (e.g. VIN decoder) to gather additional information and/or other safety considerations.
- If possible, speak directly to the tow operator delivering the vehicle. The tow operator may have pertinent knowledge about the vehicle, the accident it was involved in, any hidden damage, or any other safety considerations not provided by the seller.

- Have the tow operator drop the vehicle off in a designated electric vehicle queue area. The area should be clearly marked as storing HV Electric Vehicles. The queue should be separate from the long term storage area.
- Ensure that all relevant information is provided to the receiver prior to receiving the vehicle. Only designated and trained employees are permitted to process Hybrids or BEVs. Create a list of all employees who have been designated and trained in receiving EVs.
- The receiver is required to clearly and visually mark the vehicle (i.e. windshield) as EV (Electric Vehicle) or HV (High Voltage).
- Upon receiving the vehicle, a properly trained worker is required to conduct a walk-around of the vehicle. This will consist of the following:

    a) A 360-degree visual inspection of the vehicle for any damage.
    b) Inspecting for any damaged or exposed high voltage cables.
    c) Inspecting for any signs of water intrusion or signs of fire damage.
    d) Inspecting the engine compartment and checking to see if the battery has sustained any damage.
    e) If fluid leak, sparks, smoke, flames, increased temperature, or gurgling, popping or hissing noises from the HV battery compartment are detected, contact the fire department immediately if they are not already on scene.

- Cover the vehicle in a tarp if it's likely to have further water intrusion that could cause damage to the vehicle.
- Continue to monitor the vehicle for any signs of off gassing, as this could be a symptom of a thermal event.
- Immediately report any hazards to a supervisor and document on the work order.

At this time you may want to do a HV battery quality check if the vehicle is only superficially damaged and no HV risks have been found. Please see HV Battery Qualifying and Testing in the Appendix.

If safe to do so, and only after an initial hazard assessment has been conducted and it is determined safe to do so, ensure that the HV battery has been disconnected. These procedures may involve the following actions:

a) Always follow manufacture's guidelines when performing any work on the HV system of a vehicle.
b) As a general rule, start by disconnecting the vehicle's 12-volt or low voltage battery.
c) Gain access to the HV disconnect switch using approved HV insulating gloves and gently disconnect the HV interlock connection.
d) If the interlock is removable, store it in a designated area away from the vehicle as to prevent a bystander from activating the HV system.
e) Always verify at the designated test location that the HV power has been disabled before working on the HV system.

Other Safety Procedures Should Include the Following:

- Receiver and purchaser are responsible for reporting any known hazards received from the tower or seller to the dismantler and/or recording on the work order.
- It is recommended for BEVs, PHEVs or HEVs that you have the battery and environmental contaminants removed as soon as possible after receiving the vehicle.

- Never store a BEV, PHEV or HEV that still contains the HV battery for long term storage or in the general storage area. The HV battery must be removed prior to long term storage for all BEVs, PHEV or HEVs. Failure to do this increases the chances of electric shock or fire.
- If a vehicle shows signs of fire damage, water submersion, or a battery thermal event, a 50-foot isolation area is required unless the vehicle has been sitting for more than 30 days without incident. If a dismantler facility does not have access to a 50-foot isolation area, the dismantler should not receive vehicles that have had fire damage, water submersion or a battery thermal event.

Moving a Hybrid or BEV Manually on the Ground or with a Forklift

Always exercise caution when moving an EV on the ground or by using a forklift. There are substantial differences in the designs of Hybrids and BEVs that may alter how they are handled. Having information specific to the manufacturer and the vehicle being moved is important in identifying what actions are necessary to work safely.

Employer Responsibilities Include:

- Ensure that workers have had appropriate training;
- Ensure that trucks and equipment are suitably maintained and fit for purpose;
- Ensure that workers are made aware of the hazards associated with working on or near electric vehicles and hybrids; and,
- Ensure only trained and certified employees move an EV with a forklift.

Worker Responsibilities Include:

- Report any unsafe conditions to a supervisor; and
- Be alert to hazards and immediately report unsafe conditions to your supervisor.

Hazards Include:

- Electric shock;
- Exposed wiring;
- Hidden damage;
- Imbalanced load; and,
- The ability of these vehicles to move silently and without warning can pose a danger to workers and others on scene. Vehicle may move suddenly and without warning.

Workers must follow written safe work procedures when manually moving vehicles or with a forklift around their facility. These procedures may include the following actions:

Moving an EV on the Ground

- Remote operation keys should be kept away from vehicle. If a key is required, the person working on the vehicle should check to see that the vehicle is in safe condition before retrieving the key.
- Always check the vehicle for any signs of damage to high voltage cabling or electrical components before any attempt to move the vehicle.
- When a BEV, PHEV or HEV has been in a MVA always have the HV battery disconnect or interlock removed to disable the HV battery before moving the vehicle. This disconnect must be performed by trained personnel.
- Avoid towing an electric vehicle or hybrid unless it is determined it is safe to do so.
- When a BEV, PHEV or HEV is pushed or rolled along the ground an electrical charge can be produced by the electric drive motors. Always limit the distance the vehicle is moved along the ground to a minimum, being careful not to contact any HV cables and connections.

Transporting HV Batteries Using a Fork Lift

Forklifts offer a practical materials-handling solution. However, while they are compact and manoeuvrable, they can become unstable when carrying loads. Even at low speeds, forklifts can cause serious injuries. It's not just the operator who may be injured: pedestrians/other workers/visitors can also be struck by a forklift or its load.

For a complete list of OHS guidelines for transporting vehicles with a forklift see *OHS Responsibilities and Industry Supported Safe Work Practices for the Mechanical Repair Industry: Part VIII, p 94*.

- The preferred method to move HV vehicles is to use a forklift. Only employees that have been trained and certified to work safely with forklifts are permitted to transport EVs.
- Place the forks perpendicular to the side of the vehicle when lifting on the pinch seam of the vehicle. Do not contact the HV cables or battery case with the forks of the forklift.
- If a forklift fork should pierce a battery case there is a potential risk of electric shock and fire. Always use caution when placing the forks under a BEV, PHEV, or Hybrid vehicle.
- HEVs, PHEVS and BEVs may be heavier than their conventional counterparts and may have a different centre of gravity because of the weight of the HV battery. Note: BEVs have even larger batteries than hybrids. Improper handling procedures can cause the load to become unstable during transport. Consider the weight and location of the battery when transporting with a forklift. The location of the battery can be determined by looking at the manufacturer's ERG.
- Damaged HV components and wiring, especially on the underside of the vehicle, can be made worse by dragging the vehicle on the ground or improper lifting procedures. For badly damaged EVs, or where there is known damage to wiring or components on the vehicle's underside, consider using forklift mats or cushions.
- Batteries placed on a pallet must be strapped down before transporting with a forklift.
- Pallet must be of a suitable size and in good condition to transport a HV battery.
- Always follow WorkSafeBC's forklift safety protocol when using a fork lift. See WSBC *OHS Regulation Part 16: Mobile Equipment*.

Dismantling a Hybrid or BEV and Removing HV Battery

Only a trained and designated employee should carry out dismantling of a hybrid or BEV or removing a high voltage battery. High voltage batteries should be removed as soon as a possible after receiving a hybrid or BEV. Removal of parts should not be carried out until the HV battery has been removed. An appropriate time to remove a HV battery from a Hybrid or BEV is when the vehicle is environmentally processed.

Employer Responsibilities Include:

- Ensure that workers have had appropriate training; and
- Ensure that workers are made aware of the hazards associated with working on or near electric vehicles and hybrids.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor;
- Wearing appropriate PPE;
- Performing work in a safe manner; and,
- Workers have the right to refuse unsafe work: If workers are concerned that a work process may be exposing them to HV shock, fire, burn or any other hazard associated with EVs, they must stop the work immediately and report the concern to a supervisor. The supervisor must ensure any unsafe condition is addressed without delay.

Hazards Include:

- Strains, musculoskeletal injuries, struck by object; and,
- Electro Shock.

Workers must follow written safe work procedures when manually moving vehicles or with a forklift around their facility. These procedures may include the following actions:

- Any dismantling of a BEV, PHEV or Hybrid vehicle must be performed by trained personnel.
- Prior to any processing or dismantling of a hybrid or BEV, the employee must review the work order and assess all possible hazards before continuing. All relevant information, including any potential hazards, must be included on the work order and/or communicated to the employee prior to commencement.
- Removal of a HV battery from a hybrid or BEV should only occur in a clearly marked designated area.
- Use cones, caution tape and signage to mark off the designated High Voltage area where work on the vehicle will be performed.
- Always follow manufacturer's recommended procedures for safety disconnects and battery removal.
- All safety equipment, such as HV insulated gloves, CAT3 voltmeter, and shepherds hooks, should be within reach of the dismantler before any work is performed.
- Ensure HV battery has been disabled and keep the battery disconnect interlocks away from the vehicle and stored away from bystanders. For HV battery disconnect procedures. See the *Receiving Hybrids and Electric Vehicles at a Recycling Facility* section of these guidelines.

- Disconnect the 12-volt battery before removing the HV battery and disconnecting the HV cables.
- Wear HV insulated gloves and verify there is no HV potential before working on the system by using a CAT3 voltmeter. HV gloves must be tested before each use.
- Drain and dispose of coolant from the battery cooling system if present.
- A vehicle lift hoist must be used when removing a battery from a vehicle that has the HV battery mounted to the undercarriage. For more information on automotive hoists see *OHS Responsibilities and Industry Supported Safe Work Practices for the Mechanical Repair Industry, Automotive Hoists pp 100-102.*
- When removing the battery using a vehicle lift, secure the vehicle to the hoist arms, as weight can shift when the battery is removed and can cause the load to become unbalanced and the vehicle to fall off the hoist.
- For BEVs, or PHEVs that have the HV battery fastened to the undercarriage, a powertrain lift must be used to safely lower the battery down and out of the vehicle. A pallet should be placed between the lift and the battery to allow a forklift to transport the battery to the storage area. The battery should be strapped to the pallet before lifting it with a forklift.
- Hybrid vehicles with smaller batteries can be lifted out with the help of a co-worker. Larger hybrid batteries inside the vehicle may need the use of an engine hoist to pull the battery out of the engine compartment.
- Move the battery to the designated HV battery storage area immediately after removal from the vehicle. See the Moving a Hybrid or BEV manually on the ground or with a forklift section of these guidelines.
- Never leave a vehicle with a partially removed HV battery inside the building overnight. Complete the removal process before leaving the vehicle unattended for any extended length of time.

HV Battery Storage

After removing a HV battery from a hybrid or BEV it must be safely transported to a designated storage area. See *Moving a Hybrid or BEV manually on the ground or with a forklift*. HV batteries should never be left in the vehicles for long term storage.

Employer Responsibilities Include:

- Conducting a risk assessment that identifies the hazards that workers may be exposed to when storing HV batteries;
- Implementing control measures to minimize the risk to workers, including written rescue and evacuation procedures;
- Developing and implementing a written hazardous materials control plan;
- Informing workers about the hazards electric vehicles may present, their warning signs and how they may be exposed to these hazardous; and,
- Responding to worker reports of hazards.

Worker Responsibilities Include:

- Learning and following safe work practices and procedures;
- Being alert to hazards and immediately reporting hazards to their supervisor;
- Following procedures for safe use, handling, storage and disposal of HV batteries;
- Reporting any unsafe condition conditions or any hazard you cannot fix yourself;
- Staying alert for workplace hazards and listen carefully to safety instructions; and,
- Being alert to hazards. Report them immediately to your supervisor or employer.

Common Hazards Include:

- HV battery coming into close contact with flammable substances;
- Falling batteries;
- Risk of fire: smoke from fire is toxic; and,
- Irritating fumes caused by off-gassing.

Workers must follow written safe work procedures when storing HV batteries. These procedures may include the following actions:

- Storage area must be designated and clearly marked for HV batteries. The area must be enclosed, dry, away from any flammable materials and secure from the public.
- Li-Ion batteries have a risk of fire. If Li-Ion batteries are to be stored on site a fire protocol must be in place. Working with sparks, extreme heat and other potential fire sources should be done beyond a 50-foot radius of the battery storage area. Combustible fuel sources should also be stored outside a 50-foot radius of the battery storage area.
- Batteries stored on pallets must be strapped to the pallet. Batteries stored on pallet racks must also adhere to the WorkSafeBC guidelines for pallet racks – WSBC regulations 4.43.1 Storage racks.
- Batteries must not be stacked, or stored in the upright position. Batteries cannot be stored on their side.

Objects in the surrounding area must not contact the batteries. Objects cannot lean against, stack on top of, or have any risk of falling on top of a HV battery.

- HV Interlocks cannot be installed on a HV battery in storage. Interlocks should be kept in a secure place away from the batteries and catalogued to match the correct battery.
- HV batteries stored over 2 years can become fully discharged and may even become unusable. In some cases HV batteries will require internal repairs before being able to be re-sold. These repairs can only be performed by fully qualified personnel while using the proper safety equipment and with the proper training. Batteries with safety shielding/covers removed must be surrounded by a roped-off area and clearly marked as a "Danger High Voltage Work Area". If the battery is being stored during repairs the safety shield/cover must be re-installed.

Part VII

This section includes information on the following:

- Lithium Battery Shipping Guidelines.

Lithium Battery Shipping Guidelines

Electric Vehicles (EV) contain a group of cells within a Lithium Ion Battery or Batteries (rechargeable). The cells and/or batteries may meet the definition of a Class 9. These cells and batteries are based on a Watt-hour (Wh) rating to determine whether it is Class 9 or not. Class 9 Dangerous Goods are those hazards that do not meet the criteria for inclusion in any other Dangerous Goods Class but can still pose a health or safety risk to the public, environment, and property.

A Watt-hour is the voltage (V) that the battery provides multiplied by how much current (Amps) the battery can provide for some amount of time (generally in hours). **Voltage x Amp hours = Wh**.

Lithium Ion Batteries from Electric Vehicles must meet specific conditions listed below to be defined as a Dangerous Good.

These conditions are:

- For a lithium-ion cell, the Watt-hour rating is not more than 20 Watt hours;
- For a lithium- ion battery, the Watt-hour rating is more than 100 Watt hours;
- Lithium ion batteries are marked with the Watt-hour rating on the outside case, except for those manufactured before January 1, 2009;
- Each cell or battery has a safety venting device or is designed to prevent a violent rupture under normal conditions of transport;
- Each cell or battery is equipped to prevent external short circuits;
- The cells and batteries are packed in a means of containment that completely encloses the cells and batteries;
- The gross mass of the cells and batteries does not exceed 30 kg, except when the cells and batteries are installed in or packed with equipment; and,
- Each battery containing cells or a series of cells connected in parallel is equipped with diodes, fuses or other devices that prevent dangerous reverse current flow.

Here are two scenarios to consider

Scenario 1

This battery pack consists of batteries each having three cells. Each cell is 2.22 Wh and the entire battery is 6.66 Wh. Based on the information on the previous page, each cell is less than 20Wh and the battery is less than 100 Wh. **Therefore this is not a Dangerous Good.**

Scenario 2

This battery has 40 V and 40 Ah. This equals 1600 Wh. **Therefore, this battery is a Class 9 Dangerous Good, as it exceeds 100 Wh.**

Once you determine whether the Lithium Ion battery or batteries are a Dangerous Good, you need to give it an identity. Schedule 1 of the TDG Regulations provides shipping descriptions that best represent your battery. In addition, you should check the outside of the battery casing or the technical data sheet of the battery to locate the name.

Each Proper Shipping Description includes the following:

UN Number (United Nations), **Shipping Name**, **Class**, and **Packing Group**. In the case of Lithium Ion Batteries, there are no packing groups.

If the battery is being shipped on its own and not connected to any equipment then there is only one shipping description you CAN use.

United Nations Numbers (UN) – UN3480

Every dangerous good has its own international part number. The initials UN must be in front of the 4 numbers on packaging and documentation.

Shipping Names – Lithium Ion Batterie

Dangerous Goods are identified with a proper shipping name. The proper shipping name must match exactly with the UN number and classification.

Special Provision

Special Provisions are found in Column 5 of Schedule 1 of the TDG Regulations. A Special Provision is a number or set of numbers that can be referenced in Schedule 2 of the TDG Regulations. A Special Provision lets you know whether there are additional requirements, restrictions, exemptions, or any important definitions vital to that dangerous good. Check all Special Provisions before shipping.

Col.1 **UN number**	**Col.2** **Shipping Name and Description**	**Col.3** **Class**	**Col.4** **PG**	**Col.5** **Special Provisions**
UN3480	Lithium Ion Batteries	9		34,123,137,138,149,159

Responsibilities

Everybody

Everybody involved with shipping Electronic Vehicles and HV Batteries must:

- Make sure that the Lithium ion batteries are safe and not leaking or damaged;
- Understand and recognize the TDG hazard of Lithium Ion batteries;
- Be trained and certified by their employer or themselves if self-employed; and,
- Know the reporting requirements.

Shipper/Consignor

Before a dangerous good can leave any location, the person or company offering it must:

- Determine the proper classification and show proof of classification;
- Select the correct packaging and package safely and compliant with the Regulations;
- Apply the TDG labels and markings to the container(s);
- Complete and certify a shipping document;
- Offer placards, display placards, or ensure placards are attached (when required); and,
- Know the reporting requirements.

Note: There are a few other cases when someone could meet the definition of a shipper. These would be an importer receiving from another country or a generator of a hazardous waste which meets TDG as well.

Carrier/Driver

- Check that the shipping document is correct and legible;
- Check that the labels and markings match the shipping document and are visible;
- Confirm that the integrity of the package(s) are safe and not damaged;
- Attach or ensure that placards are on the large means of containment;
- Ensure or engage in the loading and securing of dangerous goods;
- Take a copy of the shipping document with them in the vehicle or truck; and,
- Know the reporting requirements.

Note: Some shippers operate their own fleet of vehicles or may have a truck to move dangerous goods. They may have the responsibilities of both a shipper and a carrier.

Receiver/Consignee

When a dangerous good is delivered to a location, the person or company that will receive it must:

- Inspect the shipment for any damage before it is offloaded;
- Unload and store the dangerous goods safely; and,
- Know the reporting requirements.

Note: If a dangerous good shipment shows signs of damage or is leaking, it cannot be moved. The integrity of the package(s) must be secure and safe before it can be loaded, unloaded, or transported.

Handling

Any person(s) involved in handling dangerous goods must:

- Confirm the dangerous goods are safe; and,
- Know the reporting requirement.

Documentation

Shipping documents for dangerous goods are necessary so that first responders can safely respond to any dangerous goods incidents or accidents. The document provides them key information about the dangerous goods. From that point they can decide whether and how they can respond safely.

The shipper/consignor is responsible to complete the shipping document and to fully comply with the Regulations. If someone else completes it, the shipper must review it prior to allowing it to leave.

The carrier must confirm that all information on the document matches the labels and markings before taking possession.

Shipping documents can be in any format as long as it meets the content requirements of Part 3 of the TDG Regulations. They may be handwritten or typed, just as long as they are easy to read and are in English or French.

What is required on a dangerous goods shipping document:

- Shipper/Consignor's name and address (must be a complete name and address).
- The date (the date the shipment was prepared or offered to a carrier).
- A certification statement and a consignor certification (name printed or signature).

The dangerous goods description, in the following order:

UN Number	**UN3480** *(The initials UN must be in front of the number)*
Proper Shipping Name	**Lithium Ion Batteries**
Primary Class	**Class 9**

e.g.: UN3480, Lithium Ion Batteries, Class 9

For each **Shipping Name** on a document:

- The quantity of dangerous goods and the unit of measure (e.g.: 200 litres or 30 kg). The unit of measure must be shown in metric; and,
- The number of means of containment must be identified (e.g.: The quantity "5" can describe how many boxes).

The 24-Hour Number

A telephone number that will provide responders with technical information about the dangerous goods in transport must be listed. This number is the consignor/shippers responsibility and must be accessible and live at all times during transport.

The number must say 24-Hour Number, Numéro 24 heures, or 24 hr no.

This number must either be the shippers number, CANUTEC (with written permission), or another source with current accurate information on your dangerous goods and you are aware of where the number goes. This includes having a hazardous waste contractor or recycling contractor that may manage your hazardous waste(s).

Certification

The shipping document must include one of the following certification statements:

a) "I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the Transportation of Dangerous Goods Regulations.";
b) The certification set out in 49 CFR, IMDG, ICAO, UN Recommendations.

The certification must be made by an individual who is the consignor or by an individual acting on behalf of the consignor and must set out that individual's printed name or legible signature.

Every other aspect of the document must still comply with TDG.

Note: Lithium batteries that are no longer used for their original purpose must be handled under environmental regulations and are often regulated as hazardous waste as well as a dangerous good. The batteries must comply with TDG and all applicable environmental regulations.

Dangerous goods shipping documents must be kept on file by shippers, importers, hazardous waste generators and carriers for 2 years.

It can be kept as a paper copy or an electronic.

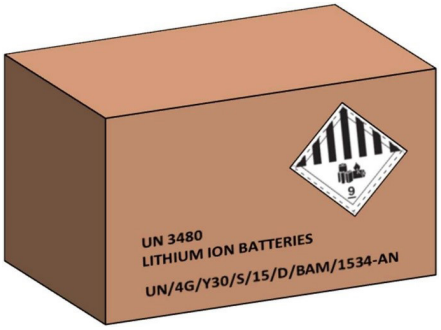
Sample Dangerous Goods Shipping Document

Items in RED are required by the TDG Regulations.

<table>
<tr><td colspan="3">Shipper/Consignor
Automotive Retailers Assn.
Unit #1 – 8980 Fraserwood Court
Burnaby, BC V5J 5H7</td><td colspan="2">Receiver/Consignee
123 Recycling Co. Abc Street
Coquitlam B.C. V3E 3A6</td><td colspan="2">Date: (today's)
24-Hour Number:
1-613-996-6666 (CANUTEC)</td></tr>
<tr><td>Number of Containers
1</td><td>DG
X</td><td>UN Number
UN3480</td><td>Shipping Name
Lithium Ion Batteries</td><td>Class
9</td><td>Packing Group</td><td>Total (kg/L)
20 kg</td></tr>
<tr><td colspan="4">I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the Transportation of Dangerous Goods Regulations.</td><td colspan="3">Shipper Certification
Joe Smith</td></tr>
</table>

Labels, Markings and Placards

Dangerous goods labels must be placed on one side of a Small Means of Containment. This is any container less than or equal to 450 litre water capacity (100 gallons).
This includes drums, pail sizes, bags and boxes.



They must consist of three things:

1. Label
2. UN Number
3. Shipping Name

If the packaging of Lithium Ion Batteries are placed in an Overpack such as a crate, shrink wrap or any other material that covers the original labels and markings, the same labels and markings MUST be identified again on the Overpack including the word "OVERPACK".

If the Lithium Ion Batteries are below the Watt-hour ratings for a Dangerous Good, less than 20 Wh per cell and/or 100 Wh per battery, then a Lithium Battery handling mark must be placed on the package. It must include the UN Number of the battery type (UN3480) as well as a telephone number of a person that can answer questions about the shipment or in case of an incident.

Placards

Placards provide to all parties and especially emergency responders a visual description of the hazards in a Means of Containment. This allows for an initial observation of what might be in the container, from a distance.

Dangerous goods transported in Canada are subject to placard requirements based on the type and quantity. Some dangerous goods pose such a significant risk to public safety that they must be placarded at any quantity.

Dangerous Goods must be placarded on all four sides of any vehicle, truck, trailer or unit when the quantity of dangerous goods requires it. However, placarding can be done under the amount as long as the dangerous good is present.

Placards must be displayed when there is:

A gross mass greater than 500 kg (1100 lbs) of Class 9 Lithium Ion Batteries

Means of Containment (Packaging)

Dangerous goods must be packaged in containers that meet Canadian and International standards (e.g. United Nations Standards) for design, testing, and certification. These package tests are conducted in an approved or recognized testing facility or laboratory.

Damaged or Defective Batteries

This shipping name applies to lithium ion cells or batteries, and lithium metal cells or batteries, that are damaged or defective and do not conform to subsection 2.43.1(2) of Part 2 (Classification) of the TDG Regulations.

This would apply to Lithium ion cells or batteries and lithium metal cells or batteries that are damaged or defective, include, but are not limited to, cells or batteries that have leaked or vented, or have sustained physical or mechanical damage, and cannot be diagnosed prior to transport, or that have been identified as being defective for safety reasons.

Lithium ion cells or batteries and lithium metal cells or batteries that are damaged or defective must be packed in accordance with Packing Instructions P908 of the UN Recommendations.

As applicable, the outer means of containment or the over pack must be marked legibly and visibly on a contrasting background, with the words "Damaged/Defective Lithium Ion Batteries", "piles au lithium ionique

endommagées/défectueuses", "Damaged/Defective Lithium Metal Batteries" or "piles au lithium métal endommagées/défectueuses".

It is forbidden to transport lithium ion cells or batteries and lithium metal cells or batteries that are damaged or defective and that, under normal conditions of transport, are liable to disassemble rapidly, react dangerously, produce a flame or a dangerous evolution of heat, or produce a dangerous emission of toxic, corrosive or flammable gases or vapours.

It is forbidden to transport by aircraft lithium ion cells or batteries and lithium metal cells or batteries that are damaged or defective.

Packing Instruction P908

The following packaging are authorized provided the general provisions of 4.1.1 and 4.1.3 are met.

For cells and batteries and equipment containing cells and batteries:

- Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);
- Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2); and,
- Jerricans (3A2, 3B2, 3H2).

Packaging shall conform to the packing group II performance level:

- Each damaged or defective cell or battery or equipment containing such cells or batteries shall be individually packed in inner packaging and placed inside an outer packaging. The inner packaging or outer packaging shall be leak-proof to prevent the potential release of electrolyte;
- Each inner packaging shall be surrounded by sufficient non-combustible and non-conductive thermal insulation material to protect against a dangerous evolution of heat;
- Sealed packaging shall be fitted with a venting device when appropriate;
- Appropriate measures shall be taken to minimize the effects of vibrations and shocks, prevent movement of the cells or batteries within the package that may lead to further damage and a dangerous condition during carriage. Cushioning material that is non-combustible and non-conductive may also be used to meet this requirement;
- Non combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured;
- For leaking cells or batteries, sufficient inert absorbent material shall be added to the inner or outer packaging to absorb any release of electrolyte;
- A cell or battery with a net mass of more than 30 kg shall be limited to one cell or battery per outer packaging; and,
- Cells or batteries shall be protected against short circuit.

Training

It is important that everyone that has involvement with any aspect of shipping Lithium-Ion Batteries as a Dangerous Good be trained and certified. This includes shippers and those that prepare shipments, handlers, receivers, carriers, and all workers involved in the movement of a dangerous good.

Part 6 of the TDG Regulations outlines the requirements of training, certification, and proof of training.

The employer must determine who requires training, what level of training is required based on the employee's duties and the dangerous goods they will be involved with, and how the training will be conducted. The employer must also issue a training certificate to employees when their training is completed.

This guideline will help identify the specific topics applicable to workplace and workers. Employers should be able to thoroughly understand these guidelines and know how to comply with them. If not, you should know who you can ask for help in your workplace.

As there are many types of dangerous goods and many factors, sometimes the general training your employer has provided still does not meet what is needed. Employees may require training that is specific to their job and the dangerous good they will handle.

Please review the Transport Canada Training Guidelines on the following page.

Guidelines for Training Criteria

The following guidelines are meant to help understand the training requirements in Part 6 of the Transportation of Dangerous Goods Regulations, and not replace them.

These guidelines recognize that it is the employer who must determine whether training is required in order for an employee to be a trained person. The guidelines indicate what parts of the regulations should be included in a person's specific training.

Depending on what a worker does, their involvement with Dangerous Goods, and your role/responsibilities will dictate what guideline applies.

Note: the worker does not always have to be the one touching the Dangerous Goods to require training.

GUIDELINE "A":

Training for all persons involved in the HANDLING, offering for TRANSPORT and/or TRANSPORTING of dangerous goods.

Training Required:

- Definition of the nine classes of dangerous goods and their associated hazards;
- Shipping names, classes, UN numbers and packing groups for the dangerous goods that are normally encountered on the job;
- Safety marks such as labels and placards that are used to identify the different classes of dangerous goods that are normally encountered on the job;
- Knowledge of the information that must be on a shipping document;
- The requirements regarding mixed loads and the need for segregation of incompatible dangerous goods.
- The proper selection and use of means of containment for the dangerous goods;
- What to do if the shipping documents, placards, labels, other safety marks or means of containment seem inadequate or incorrect;
- What constitutes an accidental release and the reporting requirements if an accident happens.
- Proper use of all equipment that is used in the handling, offering for transport and/or transportation of dangerous goods; and,
- Emergency Response Assistance Plans (ERAP) requirements if a plan is required.

GUIDELINE "B":

Additional training for all persons involved in the HANDLING of dangerous goods.

Handling means: Loading, unloading, packing or unpacking dangerous goods in a means of containment or transport for the purposes of, in the course of or following transportation, and includes storing them in the course of transportation.

Examples of a Person Handling Dangerous Goods:

Cargo Handler	Lift Truck Operator
Dock Worker	Loader/Unloader
Receiver/Shipper	Forklift/Towmotor Operator
Freight Handler	Warehouse Personnel Shipper

Training Required:

- Types of placards, labels, signs, numbers and other safety marks, what they mean, and when and where to display them;
- A thorough knowledge of the control and emergency features for all handling equipment used in the day-to-day activities of the job;
- Safe practices on the loading and stowage of dangerous goods;
- When to remove placards, UN numbers and other safety marks; and,
- The proper selection and use of means of containment for the dangerous goods.

GUIDELINE "C":

Additional training for all persons involved in the OFFERING for transport of dangerous goods.

Offering for Transport means:

For dangerous goods not in transport, to select or to allow the selection of a carrier to transport dangerous goods; to prepare or allow the preparation of dangerous goods so that a carrier can take possession of them for transport.

Examples of Those Who Offer For Transport:

Dispatcher	Freight Forwarder
Shipper	Biller
Clerical personnel (i.e. preparation of documents)	

Training Required:

- All of the requirements required for documentation except for the location and the rail consist;
- How to communicate the special instructions and precautions for the handling and/or transporting of specific dangerous goods while on the job;
- Types of placards, labels, signs, numbers and other safety marks, what they mean, and when and where to display them;
- The proper selection and use of means of containment for the dangerous goods; and,
- The Emergency Response Assistance Plan requirements (ERAP) if a plan is required.

GUIDELINE "D":

Additional training for all persons involved in the TRANSPORTING of dangerous goods.

Training Required:

- Types of placards, labels, signs, numbers and other safety marks, what they mean, and when and where to display them;
- The location of the shipping documents and the importance of keeping them accurate; and,
- Requirements for parking, loading and vehicle inspection which may apply.

Certification

Once the employer has provided the worker with training that covers the requirements of TDG and is specific to their job duties and the dangerous goods they will be involved with, then they must issue a training certificate.

The TDG certificate must meet the following requirements:

- Is valid for three years from date of training;
- Signed by both the employer and employee;
- Is not transferable (new employer, new training, and new certificate);
- Must be made available for inspectors. Keep it on or near you; and,
- A copy of the certificate must be kept by the employer for two additional years (five years total).

Note: A self-employed person may issue their own training certificate. Since they would not have an employer, they would take the responsibility of both employee and employer.

EV (Electric Vehicle) Battery Checklist

Training

- ☐ Have I completed TDG training applicable to Lithium Ion Batteries?
- ☐ Am I comfortable with understanding TDG relating to Lithium Batteries?
- ☐ Did my employer issue a training certificate and did we both sign it?
- ☐ Is it valid (three years)?
- ☐ Was I provided a test or other proof of my competency?

Container(s)

- ☐ Do I require certified packaging or specialized packaging instructions?
- ☐ Have I reviewed the standards and instructions?
- ☐ Did I package the dangerous goods properly and safely?

Safety Marks

- ☐ Is the primary label shown?
- ☐ Is the proper shipping name identified?
- ☐ Is the UN number identified?
- ☐ Do I require any additional safety marks on the package?
- ☐ Do I require placards for the large means of containment?
- ☐ Are there placard(s) for each end and each side?
- ☐ If not regulated, is the Lithium Battery Mark on?

HV Battery Qualifying and Testing

Only after performing a hazard assessment should you proceed with testing an HV battery. See *Receiving Hybrids and Electric Vehicles at a Recycling Facility* for more information.

Workers must follow written safe work procedures when testing HVC batteries. These procedures may include the following actions:

- Only perform battery quality checks on undamaged or superficially damaged vehicles. Vehicle ignition will need to be turned on to perform testing;
- Record mileage and any physical damage to the battery;
- If the vehicle is a BEV or PHEV note the distance remaining on the battery charge. If possible, fully charge the vehicle outside and record the distance remaining; and,
- Scan the vehicle's battery control module using a factory functioning scan tool. Record any codes, note that some batteries will store crash codes that cannot be cleared without serious intervention.

Some HV batteries can be tested externally with specialized equipment and training.

For more on HV battery testing see:

https://hybridautomotive.com/product/prolongpro-thunderbolt-complete-package

https://evsenhanced.com/product/obd2-to-leaf-battery-adapter

HV Safety Equipment

It is the responsibility of the employer to ensure the right safety equipment is being used when working around and on BEV, PHEV, and Hybrid vehicles.

- Class 0 HV insulating gloves must be worn when working on HV vehicle components. Gloves must be used in conjunction with the leather protectors at all times. Prior to a worker putting on gloves a leak check must be completed on the gloves. This must be done every time the gloves are worn. A leak check is performed by gently rolling the opening of the glove closed so air becomes trapped inside like a balloon. Hold the gloves close to your cheek to feel for air leaks. The gloves must be destroyed immediately if any leaks are found and a replacement set must be used. Gloves must be professionally recertified every 6 months once in use and adhere to the CSA Standard Z462 (SEE G19.10 (2) (A).
- When measuring HV on a BEV, PHEV and Hybrid vehicle a CAT3 multimeter and matching CAT3 leads must be used. Using the wrong testing equipment will cause an electric shock that could injure or kill.
- In the event of a worker suffering from an electric shock, a HV rescue hook must be used to pull the worker away from the voltage source. Never attempt to pull a worker away without the correct safety equipment.