Guide to Transportation of Dangerous Goods

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This guide was prepared by the Simon Fraser University (SFU) department of Environmental Health and Safety. For questions or comments, contact Catherine Peltier, EHS Program Manager by email: cpeltier@sfu.ca or phone: 778-782-8633.
Guide to Transportation of Dangerous Goods

**Record of changes**

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<th>Revised by</th>
<th>Revision</th>
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<td>n/a</td>
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Guide to Transportation of Dangerous Goods

1. Introduction
The federal Transportation of Dangerous Goods (TDG) Act and Regulations require that a person who handles, offers for transport, or transports dangerous goods must be adequately trained and hold a training certificate. Therefore, if faculty, staff and students at Simon Fraser University (SFU) are involved with the transport or transport-related handling of regulated dangerous goods, they must have valid training certification.

Dangerous goods are solids, liquids or gases that are capable of posing a significant risk to people, health, property or the environment when transported in quantity. Included are items that are corrosive, flammable, explosive, spontaneously combustible, toxic, oxidizing, water reactive, asphyxiating, infectious and/or radioactive.

This document sets out guidelines and requirements for the safe handling and transportation of dangerous goods at SFU to ensure compliance with all relevant federal and provincial regulations.

2. Purpose
This document is intended to supplement, not replace, TDG certification training, and serve as a reference for trained faculty, staff and students. For the movement of dangerous goods exempted from the training requirement, individuals may use this document for information but must also contact a TDG-certified individual for assistance.

3. Responsibilities

Department Chairs/Directors will support and direct the required practices to ensure compliance with the TDG Act and Regulations.

Supervisors (including Principal investigators, faculty, and instructors) will ensure that all personnel under their supervision (including, but not limited to, grad students, post-doctoral fellows, research assistants, teaching assistants, visiting scholars, co-op students, staff and undergraduate students), who are, or could be, involved in the shipping, handling, and/or transporting of dangerous goods, are trained and certified as prescribed by the TDG Act and Regulations.

Science Stores and Receiving personnel will be TDG trained and certified, and provide advice and assistance with shipping, handling and receiving in compliance with the TDG Act and Regulations (all classes except Class 6.2 Infectious substances and Class 7 Radioactive materials).

Environmental Health and Safety (EHS) will be TDG trained and certified and provide advice, assistance, procedures and other services to support compliance with the TDG Act and Regulations as they apply to all classes (including Class 6.2 and 7); will also organize periodic training certification courses via an external provider and maintain training records.

TDG-certified faculty, staff and students will provide the appropriate documentation, labels, packaging materials and advice as per their training, to ensure SFU compliance with the TDG Act and Regulations.
4. Training

In general, dangerous goods training is required for individuals involved with handling, shipping, importing or transporting of dangerous goods by air or by ground, which includes road, rail and ship (e.g., BC Ferries). An untrained individual may handle, offer for shipment or transport dangerous goods provided it be in the presence and under the direct supervision of an individual who holds a valid training certificate. Training exemptions exist for movement of small quantities of some dangerous goods, but shipments must still meet certain requirements for packaging, labelling and/or documentation. See Exemptions below and contact EHS for assistance.

EHS periodically hosts TDG training for SFU faculty, staff and students, maintains training records and signs training certificates issued by the trainer. The training certificate is SFU-specific and is not transferrable to another workplace or institution. Trained individuals must always be able to produce their training certificate upon request by a TDG inspector.

There are four different courses offered:

1. TDG Ground – for ground/road/rail shipments of all classes of dangerous goods except Class 6.2 (Infectious substances) and Class 7 (Radioactive materials). Certification is valid for 3 years.

2. International Air Transportation Association (IATA aka TDG Air) – for air shipments of all classes of dangerous goods except Class 6.2 (Infectious substances) and Class 7 (Radioactive materials). Certification is valid for 2 years.

3. TDG + IATA Class 6.2 – for ground and air shipments of biological and infectious substances, and covers requirements for dry ice (Class 9) which often accompanies Class 6.2 shipments. Certification is valid for 2 years.

4. TDG + IATA Class 7 – for ground and air shipments of radioactive materials. Contact Radiation Safety for more information.

Refer to the SFU Safety & Risk Services/Training website for information about the next available training sessions.

5. Shipping and receiving

The following section covers shipping and receiving for all dangerous goods except Class 7 Radioactive materials. Refer to Appendix A for a list of all dangerous goods classes.

For shipping and receiving of Class 7 Radioactive materials, see Appendix B.

5.1 Receiving

Individuals receiving dangerous goods shipments do not require the valid TDG training certificate unless they are receiving imported shipments. Imported shipments are those coming from anywhere outside Canada. Receivers must complete all other relevant workplace safety training (e.g., WHMIS 2015) for the goods to be handled.

For dangerous goods entering Canada, a person named in the shipping record as the person in Canada to whom the dangerous goods is to be delivered is deemed to be importing the dangerous goods and they require a valid TDG training certificate.
Faculties and departments receiving shipments of dangerous goods should have a designated receiver for these packages. Packages destined for the Faculty of Science must pass through Burnaby campus Science Receiving.

Receivers should follow these steps:

1. Examine package - Visually inspect each package of dangerous goods to ensure the packaging is intact and undamaged, and that no leaks or spills have occurred during transport. If the package is damaged or leaking, note the damage on the accompanying shipping documentation and notify the shipper for reimbursement. Damaged goods should be disposed of through the SFU hazardous waste disposal system.
2. Unpacking – Remove items from packaging, then deface or remove all TDG labels on the package exterior.
3. Confirm contents – Review the shipping document and check the contents of the shipment to ensure they agree. Report any omissions or errors to the shipper.
4. Holding – Keep received items in a suitable location and under recommended storage conditions (e.g., separate from incompatibles) until they can be delivered or retrieved by the end user.
5. Recordkeeping – For imported shipments only, the receiver must retain shipping documents for at least 2 years. Documents may be scanned and kept electronically.

5.2 Shipping

Dangerous goods must only be shipped (i.e., handling goods to prepare shipment and offering for shipment) by a person who holds a valid TDG training certificate or by someone working in the presence and under the direct supervision of an individual with a training certificate. Many departments have designated, certified staff members who can act as shipper (consignor) or oversee the shipping process. For labs in the Faculty of Science, Science Receiving has certified staff members who can prepare dangerous goods shipments. If unsure who to contact in your department, contact EHS.

Follow the general steps for preparing a shipment below and refer, as needed, to the online TDG regulations (https://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm) and the IATA Dangerous Goods regulations (current edition available at Science Receiving and EHS).

For shipping of biological and infectious substances, see Appendix C.

For shipping of lithium batteries, see Appendix D.

1. Classify – Determine the proper classification (includes the shipping name, primary class, UN number, and packing group) for the dangerous good. Shippers must keep on file a “proof of classification” for all dangerous goods offered for transport or imported into Canada for a 5-year period from the date on the shipping document.

A Safety Data Sheet (SDS) is an acceptable proof of classification if it includes an explanation describing how the dangerous good was classified (e.g., under Transportation information or Regulatory information).
2. Verify limits, special provisions, or exemptions – Based on the classification and quantity to be shipped, check the limited quantity index (Schedule 1, column 6), special provisions (Schedule 1, column 5), Emergency Response Assistance Plan (ERAP) index (Schedule 1, column 7) and passenger indices (Schedule 1, column 8 and 9). Based on the information, determine if the shipment is fully regulated. If an ERAP is required for your shipment, consult with EHS.

3. Package the material – Select the appropriate packaging for your dangerous good. In general, it must be compatible with all contents and able to withstand the normal conditions of transport. Fully regulated shipments require packaging that meets TDG requirements (for ground shipments) or IATA requirements (for air shipments).

Packages are purchased from approved suppliers (e.g., ICC Compliance Center) and will have certification safety marks stamped or embossed directly on the container (e.g., preceded by the “UN” packaging symbol). Follow the manufacturer’s instructions.

4. Apply safety marks and labels – Ensure the outer package displays the following information:
   - UN identification number
   - SHIPPING NAME listed in upper case letters
   - hazard class label(s)
   - package certification mark
   - orientation label (for liquids only)
   - net quantity, if shipping by air
   - flash point (°C) for Class 3 flammable liquids, if shipping by ocean
   - marine pollutant label (if applicable), if shipping by ocean
   - “To” and “From” information on the outer package (required for air shipments, recommended also for ground shipments).

5. Prepare shipping documents – Fill out the Straight bill of lading form, for ground shipments, or the Shippers declaration of dangerous goods form, for air shipments. These can be obtained from couriers or online. The document must contain:
   - date of preparation
   - full name and address of consignor (shipper)
   - “24-hour number” (sometimes shown as Emergency contact 24-hour number), use “CANUTEC 1-613-996-6666” (collect calls accepted)
   - shipping description in the following order: UN number, shipping name (in upper case letters), hazard class(es) and packing group
   - total quantity by appropriate measure
   - certification statement with shipper’s name

Note that if non-dangerous goods and dangerous goods are shipping together, the dangerous goods must stand out on the shipping document by using one of the following: a “DG” column, separate headings for the dangerous goods and non-dangerous goods, or highlighting the dangerous goods.
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Shippers are responsible for maintaining shipping documentation on record for two years following the date of shipment.

6. Placards – A placard is not required to be displayed on a road vehicle if the gross mass of dangerous goods is ≤ 500 kg, except in certain cases, for example:
   - Dangerous goods requiring an ERAP
   - Class 2.1 Flammable gases, transported by ship
   - Class 2.3 Toxic gases
   - Class 4.3 Water-reactive substances
   - Class 5.2 Organic peroxides, Type B (liquid/solid) that require a control/emergency temperature
   - Class 6.1 Toxic substance (subject to special provision 23)

   Provide the carrier (transporter) with the placards for the primary class of certain dangerous goods as required.

7. Contact carrier – Once the dangerous good has been classified, packaged and labelled and the shipping document is complete, contact the carrier (transporter) to arrange a pickup.

6. Transporting

It is recommended to use a dangerous goods courier to transport regulated dangerous goods. Use a carrier that is certified for the class requiring transportation.

If you are planning to use your personal vehicle to transport regulated dangerous goods, you must have a full class 5 driving license and be TDG certified. You must ensure your vehicle policy has a minimum $2 million liability coverage and has an added clause: “vehicle used to transport dangerous goods”. If the vehicle will transport other passengers (not from SFU), verify the passenger carrying road vehicle index (Schedule 1, column 9) which restricts the quantity of dangerous good permitted.

If you are planning to use an SFU vehicle to transport dangerous goods, contact SFU Risk Management.

The carriers of dangerous goods are responsible for:

1. Refusing to handle dangerous goods with insufficient packaging.
2. Reporting any classification errors to the Shipper.
3. Verifying the UN specification packaging.
4. Ensuring the proper display and removal of safety marks (includes replacing labels that become illegible or damaged).
5. Loading and securing the package(s) in such a way as to prevent, under normal conditions of transport, damage that could lead to accidental release of the dangerous good(s).
6. During transport, keeping the shipping document within reach when the driver is in the vehicle and within view of the driver’s door when the driver is out of the vehicle.
7. Handing off a copy of the shipping document upon transfer of goods.
8. Keeping a copy of the shipping document for two years.
9. Reporting any incident while goods are in their care and control. See Reporting.
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7. Exemptions

Several exemptions exist which simplify the shipping of dangerous goods. Some are summarized here, but it is recommended that the full regulatory text be checked to ensure you are in compliance. Contact the TDG-certified, designated staff member in your department or EHS for assistance.

7.1 Limited quantities – TDG regulations (TDGR) 1.17

Certain dangerous goods packed in small quantities present a reduced risk compared to the same goods transported in larger volumes. Under this provision, a dangerous good needs to be classified, but TDG documentation, safety marks (e.g., labels), packaging, training, ERAP and reporting are not required if the quantity of the dangerous good is below a specific threshold. This exemption may be used for transport by road, rail or ship within Canada, but not for shipments that leave Canada. The overall package must be designed, constructed, filled, closed, secured and maintained to avoid any accidental release and the outer package must display the limited quantity mark, as shown at right (either version is acceptable for ground).

The limited quantity index shown in column 6a of TDGR Schedule 1 indicates the maximum volume in L (for liquids or gases) or mass in kg (for solids) permitted in each inner package (e.g., plastic bottle) of a shipment. Several inner packages can be combined in an outer package up to a maximum gross weight of 30 kg. For example, isopropanol has a limited quantity index of 1 L (see below), so you may combine several 1 L bottles of isopropanol in a strong outer package as long as the maximum gross weight is less than or equal to 30 kg.

Note there is also a limited quantity exemption for certain dangerous goods by air, which reduces packaging requirements, but other sections still apply such as documentation, labelling, and training.

<table>
<thead>
<tr>
<th>Col.1</th>
<th>Col.2</th>
<th>Col.3</th>
<th>Col.4</th>
<th>Col.5</th>
<th>Col.6</th>
<th>Col.7</th>
<th>Col.8</th>
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<tbody>
<tr>
<td>Number</td>
<td>Name and Description</td>
<td>Class</td>
<td>Group</td>
<td>Limit</td>
<td>Quantity</td>
<td>Limited</td>
<td></td>
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<tr>
<td>UN1219</td>
<td>ISOPO PANOL,</td>
<td>3</td>
<td>II</td>
<td>L</td>
<td>E2</td>
<td>5 L</td>
<td></td>
</tr>
<tr>
<td>or</td>
<td>ISOPROPNAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
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7.2 Test samples

Under TDGR 1.19.1, TDG regulations do not apply for ground transport of samples that are reasonably believed to be dangerous goods (with the exception of explosives, infectious substances or radioactive materials) if the samples are being transported to a laboratory for the purposes of classifying, testing or analysis, and the gross mass is less than or equal to 10 kg. Ensure the package is designed, constructed, filled, closed, secured and maintained so that under normal conditions of transport, there will be no accidental release. The exterior of the package must be marked “Test samples.”

A provision for samples of uncertain class (with the exception of explosives, infectious substances or radioactive materials) also exists in IATA (3.11), however the samples must still be assigned a tentative
hazard class, shipping name and UN number (based on knowledge of the goods), and transported in accordance with the requirements applicable to the tentative proper shipping name.

7.3 Excepted quantities – TDGR 1.17.1 and IATA 2.6
This provision is useful for air shipments, as it has reduced requirements compared to the limited quantity provision for air. It allows very small quantities of certain goods to be shipped by ground or by air with simplified requirements. Under this exemption, a dangerous good still needs to be classified, but TDG documentation, safety marks (e.g., labels), packaging, training, ERAP and reporting are not required if the quantity of the dangerous good is below a specific threshold.

Check the allowed excepted quantity for your dangerous good by referring to the assigned alphanumeric code in the table of dangerous goods. In IATA, the code is shown in the column under the heading “EQ.” The code corresponds to a maximum net quantity per inner package and maximum net quantity per outer package. For example, isopropanol has the code E2, which signifies the maximum net quantity per inner package is 30 mL and the maximum net quantity per outer package is 500 mL.

Other requirements for the excepted quantity package include:

- leak-proof inner packaging with lid secured by positive means (e.g., with tape or wire);
- “intermediate packaging” or cushioning material to protect and absorb the contents of the inner packaging in case of breakage;
- outer packaging that is strong and rigid, such as a fibreboard box;
- entire package able to withstand a 1.8 m drop test and 24 hr stack test; and
- outer package to display the label at right (replace * with primary hazard class and ** with the name of the shipper or consignee, if not otherwise marked on the package).

The Shippers Declaration of Dangerous Goods form is not required but the air waybill must include the words Dangerous goods in excepted quantities plus the number of packages.

7.4 De minimis quantities – TDGR 1.17.1 and IATA 2.6.10
This exemption is beneficial for very small quantities of certain dangerous goods shipped by air or by ground. The goods still need to be classified, but TDG documentation, safety marks (e.g., labels), packaging, training, ERAP and reporting are not required. To use this provision, the dangerous good must be assigned code E1, E2, E3, E4 or E5 as per the previous section on excepted quantities, and the maximum net quantity of material per inner packaging is 1 mL for liquids and gases and 1 g for solids.

Other requirements for the de minimis quantities provision include:

- leak-proof inner packaging with lid secured by positive means (e.g., with tape or wire);
- cushioning material to protect and absorb the contents of the inner packaging in case of breakage;
- outer packaging that is strong and rigid, such as a fibreboard box;
- entire package able to withstand a 1.8 m drop test and 24 hr stack test; and
- maximum net quantity of dangerous goods per outer packaging not greater than 100 mL for liquids and gases or 100 g for solids.
7.5 Diesel or gasoline (ground only)
If you need to transport fuel (e.g., for fieldwork), the 150 kg gross mass exemption (TDGR 1.15) allows you to transport either gasoline or diesel without documentation, safety marks (e.g., labels), packaging, training, or reporting. Each container (i.e., jerry can) must have a gross mass $\leq$ 30 kg and the gross mass of all containers must be $\leq$ 150 kg. The gross mass includes the weight of the container and its contents.

For a refueling truck, TDGR 1.35 exempts the requirements for shipping documents and training certification for quantities up to 2000 L. The tank or tanks must be secured to the vehicle, be visible from outside the vehicle, and each tank must display the required placard or label on a side where it is visible from outside the vehicle.

7.6 Gas cylinders (ground only) – TDGR 1.32.3
Certain compressed gases are exempt from the requirement for shipping documents and training certification when transported on a road vehicle. This exemption is not intended for laboratory members, but rather for Facilities maintenance staff, for example when transporting welding equipment. The exemption applies to the following compressed gases in regular cylinders (e.g., K size):

- Acetylene
- Air, compressed
- Argon
- Carbon Dioxide
- Methylacetylene and propadiene mixture, stabilized
- Nitrogen
- Oxygen
- Propane

A maximum of five cylinders is permitted in the vehicle, the gross mass of the dangerous goods must not exceed 500 kg, and the labels on each cylinder must be visible from outside the vehicle.

7.7 Dry ice or Carbon dioxide, solid used as a refrigerant
When dry ice is used in ground shipments as a refrigerant, the TDG requirements do not apply provided the package is designed and constructed to permit the release of carbon dioxide (i.e., not airtight).

For air shipments, the packaging must allow the release of the carbon dioxide and the outside of the package requires the following information (included on label at right):

- class 9 label
- UN1845
- DRY ICE or CARBON DIOXIDE, SOLID and
- net weight of the dry ice in the package.

Furthermore, unless the goods being shipped on dry ice require one, a shipper’s declaration is not required and the following information is to appear on the air waybill under “Nature and quantity of goods”:

- UN1845
- DRY ICE or CARBON DIOXIDE, SOLID
- number of packages and
- net weight of the dry ice in each package.
See example of the intra-Canada air waybill from FedEx below, which includes the required fields:

8. Reporting
Report all TDG incidents to EHS, even those involving dangerous goods exempt from reporting requirements under TDG and IATA. Locate the online incident report form through SFU Safety & Risk Services/incident reporting.

In the case of an incident, first take all reasonable response measures to protect the public (e.g., evacuate the area around a spill), then determine if the spill must be reported as per TDG and IATA.

8.1 Immediate Report
The person in charge of a shipment of dangerous goods must make an immediate report if there is:

- accidental release above the specified quantity
- imminent accidental release above the specified quantity
- incident or accident at an airport or on board an aircraft (any quantity)

The specified quantities are:

<table>
<thead>
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<th>Class</th>
<th>Class name</th>
<th>Packing Group or Category</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>1</td>
<td>Explosives</td>
<td>II</td>
<td>Any quantity</td>
</tr>
<tr>
<td>2</td>
<td>Gases</td>
<td>Not applicable</td>
<td>Any quantity</td>
</tr>
<tr>
<td>3, 4, 5, 6.1 or 8</td>
<td>Flammable liquids; Flammable solids, Substances liable to spontaneous combustion, Water-reactive substances; Oxidizing substances and organic peroxides; Toxic substances; Corrosives</td>
<td>I or II</td>
<td>Any quantity</td>
</tr>
<tr>
<td>3, 4, 5, 6.1 or 8</td>
<td></td>
<td>III</td>
<td>30 L or 30 kg</td>
</tr>
<tr>
<td>6.2</td>
<td>Infectious substances</td>
<td>A or B</td>
<td>Any quantity</td>
</tr>
<tr>
<td>7</td>
<td>Radioactive materials</td>
<td>n/a</td>
<td>A level of ionizing radiation greater than the level established in section 39 of “Packaging and Transport of Nuclear Substances Regulations, 2015”</td>
</tr>
<tr>
<td>9</td>
<td>Miscellaneous products, substances or organisms</td>
<td>II or III, or without packing group</td>
<td>30 L or 30 kg</td>
</tr>
</tbody>
</table>
Call the following authorities/contacts to provide the immediate report:

- local police (911)
- BC provincial emergency programme: 1-800-663-3456 or appropriate authority if in another jurisdiction
- SFU (as the employer) – call Campus Public Safety 778-782-4500 and ask for EHS to be contacted
- shipper of the dangerous goods (if applicable)
- owner of the road vehicle
- for Class 6.2 Infectious substances – CANUTEC 613-996-6666
- for Class 7 Radioactive materials – The Canadian Nuclear Safety Commission 1-844-879-0805
- for a cylinder that has suffered catastrophic failure – CANUTEC 613-996-6666

The immediate report will include:

- shipping name or UN number
- quantity of dangerous goods that was in the package before the release and is known or suspected to have been released
- condition of the package
- location of the accidental release
- number of deaths, injuries, people evacuated

8.2 Follow-up report
A person, who made an immediate report, or the person’s employer, must make a follow-up report in writing to the Director General of Transport Canada within 30 days of the immediate report.

9. References and resources
International Air Transport Association 2017 Lithium Battery Guidance Document (December 2016)
International Air Transport Association Dangerous Goods Regulations 60th ed. (2019)
TDG Bulletin Dangerous Goods Safety Marks (March 2018)
TDG Bulletin Shipping Documents (March 2018)
TDG Bulletin Shipping Infectious Substances (September 2016)
TDG Bulletin TDG Training (July 2016)
Transportation of Dangerous Goods Regulations (SOR/2001-286)

10. Appendices
A. List of TDG classes and related safety marks
B. Radioactive materials
C. Biological and infectious materials
D. Lithium batteries
# Appendix A. List of TDG classes and related safety marks

## Class 1 – Explosives

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Mass explosion hazard</td>
</tr>
<tr>
<td>1.2</td>
<td>Projection hazard</td>
</tr>
<tr>
<td>1.3</td>
<td>Fire hazard</td>
</tr>
<tr>
<td>1.4</td>
<td>Insignificant hazard</td>
</tr>
<tr>
<td>1.5</td>
<td>Very insensitive</td>
</tr>
<tr>
<td>1.6</td>
<td>Extremely insensitive</td>
</tr>
</tbody>
</table>

## Class 2 – Gases

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Flammable gases</td>
</tr>
<tr>
<td></td>
<td>e.g., acetylene, hydrogen, propane</td>
</tr>
<tr>
<td>2.2</td>
<td>Non-flammable, non-toxic gases</td>
</tr>
<tr>
<td></td>
<td>e.g., nitrogen, helium, argon, compressed air, oxygen (has a yellow label)</td>
</tr>
<tr>
<td>2.3</td>
<td>Toxic gases</td>
</tr>
<tr>
<td></td>
<td>e.g., chlorine, ammonia, hydrogen bromide</td>
</tr>
</tbody>
</table>

## Class 3 – Flammable liquids

Liquids with a flash point ≤ 60 °C  
**Examples:** gasoline, diesel fuel, acetone, toluene, methanol, xylenes

## Class 4 – Flammable solids; substances liable to spontaneous combustion; substances that on contact with water emit flammable gases (water-reactive substances)

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
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<tbody>
<tr>
<td>4.1</td>
<td>Flammable Solids</td>
</tr>
<tr>
<td></td>
<td>e.g., matches, emergency flares</td>
</tr>
<tr>
<td>4.2</td>
<td>Spontaneously combustible</td>
</tr>
<tr>
<td></td>
<td>Pyrophorics, self-heating substances</td>
</tr>
<tr>
<td></td>
<td>e.g., organometallics, metal catalysts, phosphorus</td>
</tr>
<tr>
<td>4.3</td>
<td>Dangerous when wet</td>
</tr>
<tr>
<td></td>
<td>React with water, emit flammable gases</td>
</tr>
<tr>
<td></td>
<td>e.g., metal hydrides, alkali metals</td>
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</tbody>
</table>

## Class 5 – Oxidizing substances and organic peroxides

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
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<tbody>
<tr>
<td>5.1</td>
<td>Oxidizing substances</td>
</tr>
<tr>
<td></td>
<td>Cause or promote combustion of other materials</td>
</tr>
<tr>
<td></td>
<td>e.g., oxygen, hydrogen peroxide, nitric acid</td>
</tr>
<tr>
<td>5.2</td>
<td>Organic peroxides</td>
</tr>
<tr>
<td></td>
<td>Types B, C, D, E, F</td>
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<tr>
<td></td>
<td>Generally are reactive, can be sensitive to impact or friction and/or burn rapidly</td>
</tr>
<tr>
<td></td>
<td>e.g., dibenzoyl peroxide, methyl ethyl ketone peroxide</td>
</tr>
</tbody>
</table>
**Guide to Transportation of Dangerous Goods**

<table>
<thead>
<tr>
<th>Class 6 – Toxic and infectious substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1 Toxic substances</td>
</tr>
<tr>
<td>e.g., phenol, sodium cyanide, trichloroethylene</td>
</tr>
<tr>
<td>6.2 Infectious substances</td>
</tr>
<tr>
<td>Category A or Category B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class 7 – Radioactive materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classified as per Packaging and Transport of Nuclear Substance Regulations, represented by categories (activity groups) from I to III, with category III being the most dangerous.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class 8 – Corrosives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substances which cause destruction of human tissues or exhibit corrosion of metal</td>
</tr>
<tr>
<td>e.g., sulfuric acid, sodium hydroxide, glacial acetic acid, hydrochloric acid</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class 9 – Miscellaneous products, substances, or organisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substances not included in Classes 1 – 8, but that still pose a hazard if released during transport</td>
</tr>
<tr>
<td>e.g., dry ice, asbestos, PCBs, elevated temperature materials, lithium batteries, marine pollutants, environmentally hazardous substances</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marine pollutant mark</td>
</tr>
<tr>
<td>Elevated temperature sign</td>
</tr>
</tbody>
</table>
Appendix B. Radioactive materials

Simon Fraser University follows a complete cradle-to-grave approach for management of radioactive materials. Contact the EHS Radiation Safety Program Manager (who acts as the Radiation Safety Officer or RSO), the EHS Radiation Safety Technician or another EHS staff member who is TDG Class 7 trained and certified to supervise or carry out all classification, packaging, marking and labelling, preparation of documents, offering for transport and receiving of TDG Class 7 radioactive materials.

Transportation of radioactive materials is governed under Transport Canada’s Transportation of Dangerous Goods Act and Regulations and the Canadian Nuclear Safety Commission’s (CNSC’s) Packaging and Transport of Nuclear Substances (PTNS) Regulations. The CNSC has generally adopted the International Atomic Energy Agency (IAEA) Regulations for the Safe Transport of Radioactive Material. Both the TDG and PTNS regulations apply to all persons who handle, offer for transport, transport or receive nuclear substances.

Under PTNS, there are exemptions and therefore the regulations do not apply to the following:

- materials in a human or animal (e.g., injected patients),
- materials in certain consumer products once sold to consumers,
- materials in animal tissue or remains (certain limits apply), and
- natural material or ore (certain limits apply).

Nuclear materials that do not meet the above exemptions will fall under TDG class 7 Radioactive materials.

Note that radioactive materials are not permitted in the mail by Canada Post or for transport via commercial airlines whether in carry-on baggage, in checked baggage or carried on a person.

Responsibilities

At SFU, the EHS Radiation Safety Program Manager (who acts as the RSO), Radiation Safety Technician or another EHS staff member with TDG Class 7 training and certification supervise or carry out all classification, packaging, marking and labelling, preparation of documents, offering for transport and receiving of TDG Class 7 radioactive materials.

All researchers intending to purchase radioactive materials or equipment containing radioactive sources must first contact EHS radiation safety staff for purchase approval. For more information, refer to the Radiation Safety Manual, section V.

If SFU is preparing a shipment of radioactive material, the person receiving the shipment must in general also be a CNSC licensee. The transporter (carrier) must have TDG 7 certification. If unsure, check their website.

Classification

Radioactive material being shipped to and from SFU will generally not be exempt from the regulations because the activity levels are too high. The CNSC uses the exemption limits based on the A₁ and A₂ values listed in the IAEA Standard SSR-6. See table below with common radionuclides found at SFU (see next page):
Guide to Transportation of Dangerous Goods

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>$A_1$ (TBq)</th>
<th>$A_2$ (TBq)</th>
<th>Activity concentration for exempt material (Bq/g)</th>
<th>Activity limit for an exempt consignment (Bq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium – 45</td>
<td>40</td>
<td>1</td>
<td>100000</td>
<td>$1 \times 10^7$</td>
</tr>
<tr>
<td>Carbon – 14</td>
<td>40</td>
<td>3</td>
<td>100000</td>
<td>$1 \times 10^7$</td>
</tr>
<tr>
<td>Cesium – 137</td>
<td>2</td>
<td>0.6</td>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>Cobalt – 60</td>
<td>0.4</td>
<td>0.4</td>
<td>10</td>
<td>$1 \times 10^5$</td>
</tr>
<tr>
<td>Iodine – 125</td>
<td>20</td>
<td>3</td>
<td>10000</td>
<td>$1 \times 10^6$</td>
</tr>
<tr>
<td>Phosphorus – 32</td>
<td>0.5</td>
<td>0.5</td>
<td>1000</td>
<td>10000</td>
</tr>
<tr>
<td>Phosphorus – 33</td>
<td>40</td>
<td>1</td>
<td>100000</td>
<td>$1 \times 10^8$</td>
</tr>
<tr>
<td>Strontium – 90 (a)</td>
<td>0.3</td>
<td>0.3</td>
<td>100 (b)</td>
<td>1000 (b)</td>
</tr>
<tr>
<td>Sodium – 22</td>
<td>0.5</td>
<td>0.5</td>
<td>10</td>
<td>$1 \times 10^6$</td>
</tr>
<tr>
<td>Sulfur – 35</td>
<td>40</td>
<td>3</td>
<td>10000</td>
<td>$1 \times 10^8$</td>
</tr>
<tr>
<td>Tritium – H-3</td>
<td>40</td>
<td>40</td>
<td>1000000</td>
<td>$1 \times 10^9$</td>
</tr>
</tbody>
</table>

The following table shows basic values for unknown radionuclides or mixtures:

<table>
<thead>
<tr>
<th>Radionuclide contents</th>
<th>$A_1$ (TBq)</th>
<th>$A_2$ (TBq)</th>
<th>Activity concentration for exempt material (Bq/g)</th>
<th>Activity limit for an exempt consignment (Bq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only beta or gamma emitting nuclides are known to be present</td>
<td>0.1</td>
<td>0.02</td>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>Alpha emitting nuclides, but no neutron emitters are known to be present</td>
<td>0.2</td>
<td>$9 \times 10^{-5}$</td>
<td>0.1</td>
<td>1000</td>
</tr>
<tr>
<td>Neutron emitting nuclides are known to be present or no relevant data are available</td>
<td>0.001</td>
<td>$9 \times 10^{-5}$</td>
<td>0.1</td>
<td>1000</td>
</tr>
</tbody>
</table>

Packaging, labelling and marking

Nuclear substances being shipped or received at SFU will most commonly be packaged in “Excepted packages” or “Type A” packages. Packages are purchased from approved suppliers.

Excepted packages

For radioactive material other than articles manufactured of natural uranium, depleted uranium or natural thorium, an excepted package shall not contain activities greater than those shown in the following table:

<table>
<thead>
<tr>
<th>Physical state of contents</th>
<th>Instrument or article</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Item limits</td>
<td>Package limits</td>
</tr>
<tr>
<td>Solids</td>
<td>Special form</td>
<td>0.01 $A_1$</td>
</tr>
<tr>
<td></td>
<td>Other forms</td>
<td>0.01 $A_2$</td>
</tr>
<tr>
<td>Liquids</td>
<td></td>
<td>0.01 $A_2$</td>
</tr>
<tr>
<td>Gases</td>
<td>Tritium</td>
<td>0.02 $A_2$</td>
</tr>
<tr>
<td></td>
<td>Special form</td>
<td>0.001 $A_1$</td>
</tr>
<tr>
<td></td>
<td>Other forms</td>
<td>0.001 $A_2$</td>
</tr>
</tbody>
</table>
Guide to Transportation of Dangerous Goods

The safety mark “RADIOACTIVE” must be visible upon opening the package. The radiation level at any point on the external surface of the package must not exceed 5 µSv/h.

Excepted packages must be durably marked on the outside with the identification of the consignor, the consignee, or both; and the label at right displaying the correct UN number. Refer to the following list for typical UN numbers and proper shipping names:

- UN2908 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – EMPTY PACKAGING
- UN2909 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – ARTICLES MANUFACTURED FROM NATURAL URANIUM or DEPLETED URANIUM or NATURAL THORIUM
- UN2910 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – LIMITED QUANTITY OF MATERIAL
- UN2911 RADIOACTIVE MATERIAL, EXCEPTED PACKAGE – INSTRUMENTS or ARTICLES

Type A packages

Type A packages shall not contain activities greater than:

a. for special form radioactive material – A₁
b. for all other radioactive material – A₂
c. for mixtures of radionuclides whose identities and respective activities are known, the following condition shall apply to the radioactive contents of a type A package:

\[ \sum_{i} \frac{B(i)}{A_1(i)} + \sum_{j} \frac{C(j)}{A_2(j)} \leq 1 \]

where B(i) is the activity of radionuclide ‘i’ as a special form radioactive material and A₁(i) is the A₁ value for radionuclide ‘i’; and C(j) is the activity of radionuclide ‘j’ as other than special form radioactive material and A₂(j) is the A₂ value for radionuclide ‘j’.

Type A packages must display the corresponding radiation warning label:

<table>
<thead>
<tr>
<th>Category 1-WHITE</th>
<th>Category II-YELLOW</th>
<th>Category III-YELLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does not exceed 5 µSv/h at any location on the external surface of the package.</td>
<td>Does not exceed 500 µSv/h at any location on the external surface of the package and the transport index does not exceed 1.</td>
<td>Does not exceed 2 mSv/h at any location on the external surface of the package and the transport index does not exceed 10.</td>
</tr>
</tbody>
</table>
Guide to Transportation of Dangerous Goods

The transport index is the maximum radiation level in microsieverts per hour at one metre from the external surface of the package, divided by 10. See example:

\[ 1 \frac{\mu Sv}{h} \text{ or } 0.1 \frac{mrem}{h} \text{ at } 1 \text{ m equals } T I \text{ of } 0.1 \]

The appropriate label is to be affixed to two opposite sides of the outside of the package and completed with the name(s) of the radionuclide(s), listing the most restrictive nuclides first and as space permits; the maximum activity of the radioactive contents (expressed in Bq with the appropriate SI prefix symbol); and the transport index (except for Category I – white).

Each package shall be durably marked on the outside with:

- the identification of the consignor, the consignee, or both;
- the words “TYPE A”
- the UN number and the proper shipping name (see typical UN numbers and shipping names listed in capital letters below):
  - UN2915 RADIOACTIVE MATERIAL, TYPE A PACKAGE non-special form, non-fissile or fissile excepted
  - UN3332 RADIOACTIVE MATERIAL TYPE A PACKAGE, SPECIAL FORM non fissile or fissile-excepted

**Documentation**

The consignor is responsible for preparing the transport document, which contains a description of the package being transported, the shipping name of the dangerous good, the UN number, the form of the material, the isotope, the maximum activity, the category of package, the transport index and the applicable identification mark for each approval certificate.

**Receiving**

All radioactive material packages must be received, examined and opened by the EHS Radiation Safety Program Manager, EHS Radiation Safety Technician or another EHS staff member with TDG Class 7 training and certification.

Upon receipt of a package containing nuclear substances, keep your distance. Using appropriate shielding, examine the package for damage or leakage. If the package is damaged or leaking, contain and isolate it to minimize radiation exposure and contamination, and comply with Section 19 of the PTNS Regulations.

If no signs of damage or leaking are observed, take the following steps:

1. If an appropriate survey monitor is available, monitor the radiation fields around the package. Note any discrepancies.
2. Avoid unnecessary direct contact with unshielded containers.
3. Verify the nuclear substance, the quantity, and other details with the information on the packing slip and with the purchase order. Log the shipment details and any anomalies in the inventory record.
4. Report any anomalies (radiation levels in excess of the package labeling, incorrect transport index, contamination, leakage, short or wrong shipment) to the Radiation Safety Officer (RSO):

   **Radiation Safety officer**  
   Phone number: 778-782-3633

When opening packages containing unsealed nuclear substances, additional steps should be taken:

5. Wear protective clothing and use appropriate shielding while handling the package.

6. If the material is volatile (unbound iodine, tritium, radioactive gases, etc.) or in a powder form, open the package in a fume hood.

7. Open the outer package and check for tampering, possible damage to the contents, broken seals, or discoloration of the packing materials. If the contents appear damaged, isolate the package to prevent further contamination, and notify the RSO.

8. If no damage is evident, proceed with standard protocol: wipe test the outside and inside of the package, as well as the outside of the source vial-holding container and the outside of the source vial. If contamination is detected, monitor all packaging and if appropriate, all locations in contact with the package, for contamination. Contain the contamination, decontaminate, and dispose in accordance with the conditions of the Nuclear Substances and Radiation Devices license.
Appendix C. Biological and infectious materials

Transportation of dangerous goods regulations (TDGR) for ground and International Air Transportation Association dangerous goods regulations (IATA) for air do not use Risk Group classifications used by the Public Health Agency of Canada and the Canadian Food Inspection Agency. Biological substances must be assessed and classified, if applicable, as dangerous good Class 6.2 Infectious Substances, and assigned to Category A or Category B.

Note that Category A or B infectious substances are not permitted for transport via commercial airlines in carry-on or checked baggage and must not be carried on a person. Packages containing Exempt human or animal specimens may be carried in checked or carry-on baggage provided they meet the applicable packaging requirements.

Definitions

Infectious substance means a substance known or reasonably believed to contain viable microorganisms such as bacteria, viruses, rickettsia, parasites, fungi and other agents such as prions that are known or reasonably believed to cause disease in humans or animals. It might be contained in blood, tissue, organs, body fluids, vaccines or cultures.

Category A means an infectious substance that is transported in a form such that, when it is released outside of its means of containment and there is physical contact with humans or animals, it is capable of causing permanent disability or life-threatening or fatal disease in humans or animals.

Category B means an infectious substance that does not meet the criteria for inclusion in Category A.

Classification

Both TDGR and IATA provide a non-exhaustive list of Category A infectious substances. Some organisms present in any form, even in diagnostic samples, must be shipped as Category A (e.g., Ebola virus), whereas many other organisms are Category A only if shipped as cultures (e.g., Hepatitis B or HIV virus).

Laboratories are required to have a valid SFU biosafety permit in order to ship or receive biological substances. In general, shipments of biological substances from SFU will be classified either Category B or non-infectious according to several exceptions.

Non-infectious exemptions

The following are exempt from TDG and IATA regulations unless they meet criteria for inclusion in another class:

- micro-organisms which are non-pathogenic to humans or animals;
- pathogens which have been neutralized or inactivated;
- environmental samples (e.g., from food or water) not considered to pose a significant risk of infection;
- dried blood spots, faecal occult blood screening samples, blood or blood components for the purpose of transfusion; and
- patient specimens for which there is minimal likelihood that pathogens are present (See Shipping exempt human or animal specimens).
Genetically modified micro-organisms

Genetically modified microorganisms not meeting the definition of an infectious substance are not subject to the TDG regulations for ground transport, unless they meet the criteria for inclusion in another class. For air transport, if they do not meet the definition of toxic or infectious substances, they must be classified under Class 9 and assigned UN 3245 as per IATA section 3.9, unless authorized for use by the appropriate national authorities in the states of origin, transit and destination.

Shipping exempt human or animal specimens

Human or animal specimens are exempt from certain parts of the TDG and IATA regulations if there is no reason to believe that the specimen contains an infectious substance. “Reason to believe” means that, based on professional judgement, there are sufficient factors to support the use of this exemption. Generally, specimens collected for routine analysis may be transported under this exemption, for example, blood or urine samples to monitor cholesterol levels, blood glucose levels, hormone levels, prostate specific antigens (PSA), or organ function.

When sending by ground, as per TDGR 1.42, use a good quality package marked with the wording *Exempt human specimen* or *Exempt animal specimen*.

When sending by air, as per IATA, observe the following requirements:

- Use packaging comprised of 3 components:
  - leak-proof primary receptacle,
  - leak-proof secondary packaging and
  - outer package of adequate strength for its capacity, mass and intended use;
- at least one surface of the outer package has minimum dimensions of 100 mm x 100 mm;
- liquids are packed with enough absorbent material to absorb the entire contents of the specimen and absorbent is placed between the primary receptacle and secondary packaging;
- if multiple fragile primary receptacles are placed in a single secondary packaging, they must be either individually wrapped or separated to prevent contact;
- mark package with “Exempt human specimen” or “Exempt animal specimen”

It is also recommended to include “To” and “From” information on the outer package.

Shipping a Category B substance by ground

Infectious substances in Category B are assigned UN3373 and the proper shipping name is **BIOLOGICAL SUBSTANCE, CATEGORY B**.

Under TDGR 1.39, documentation is not required, but TDG classification, training, packaging, and reporting are required, as are the UN3373 label and “24-hour number” on the outer package. It is recommended to purchase a type P650 packaging kit that conforms to CGSG 43.125 (Transport Canada Standard).
Packaging must be comprised of:

- primary receptacle (sift proof for solids, meaning solids cannot sift through during transit; and leak-proof for liquids);
- absorbent material (enough to absorb entire liquid contents), placed between the primary receptacle and secondary packaging;
- secondary packaging (sift proof for solids, leak-proof for liquids);
- outer packaging, with at least one surface that is 100 mm x 100 mm;
- either the secondary packaging or outer packaging is rigid (e.g., use a box);
- individually wrapped or separated multiple primary receptacles (if applicable).

Outer packaging will have the following elements:

- shipping name and UN3373 mark; and
- “24-hour number” followed by the telephone number of the consignor (i.e., the number at which the consignor can be reached immediately for technical information about the dangerous goods without breaking the call).

**Shipping a Category B substance by air**

For air shipments of Category B substances, it is essential to review packing instruction 650 in the current year IATA book (contact Science Stores or EHS). Category B substances are not permitted in the mail in Canada. Review other state and operator variations if applicable.

Follow the requirements for ground shipments, plus additional rules, such as:

- outer packaging must be rigid;
- primary receptacle for liquids must not contain more than 1 L;
- primary receptacle or secondary packaging must be able to withstand an internal pressure of 95 kPa (tip: use a 95 kPa-rated sealable bag as the secondary packaging);
- outer packaging must not contain more than 4 L or 4 kg (excluding ice, dry ice or liquid nitrogen when used to keep specimens cold);
- include an itemized list of contents between the secondary and the outer packaging; and
- on the air waybill, include the following information:
  - name and telephone number of a “person responsible” and
  - under “Nature and quantity of goods” indicate UN3373, BIOLOGICAL SUBSTANCE, CATEGORY B and the number of packages.

For the 24-hour number, CANUTEC may be used: 1-613-996-6666

**Person responsible/responsible person is knowledgeable about the contents of the shipment.**

The phone number does not need to be a 24-hour number. **Canute cannot be used.**
Outer packaging will have the following elements:

- Category B mark
- Shipping name
- “To” address
- “From” address
- Specific contact at destination (recommended)
- “24-hour number” + number (recommended)
- “Person responsible” + name + number
- Orientation arrows

Shipping a Category B substance or exempt specimen with refrigerant

When dry ice is used as a refrigerant in ground shipments, the TDG requirements do not apply (to the dry ice) provided the package is designed and constructed to permit the release of carbon dioxide (i.e., not airtight).

For air shipments, dry ice must be placed between the secondary and outer packaging, interior supports must be provided to secure the secondary packaging in the original position after the dry ice has dissipated and the packaging must permit the release of carbon dioxide.

The following information is to appear on the air waybill under “Nature and quantity of goods”:

- UN1845
- DRY ICE or CARBON DIOXIDE, SOLID
- the number of packages and
- the net weight of the dry ice in each package.

The outside of the package requires (see handy label with all elements, at right):

- the class 9 label
- UN1845
- DRY ICE or CARBON DIOXIDE, SOLID and
- the net weight of the dry ice in the package.

Commercially available specimen transporters (e.g., cryoshippers) containing refrigerated liquid nitrogen fully absorbed in a porous material are not subject to TDGR or IATA when carried as cargo. The air waybill must include the words “Not restricted” and “A152”, which is the special provision number in IATA for liquid nitrogen insulated packaging.
Appendix D. Lithium batteries

All types of lithium batteries are dangerous goods and must be handled and shipped according to TDG and IATA requirements.

To prepare lithium batteries for shipment, you must know details such as type of battery, quantity, electric capacity or lithium content and charge, and how the batteries will travel – alone, contained inside equipment or packed with equipment (not installed).

Classification

Lithium batteries are classified in Class 9, Miscellaneous Products, Substances or Organisms. There are 2 types:

**Lithium metal batteries (Li-metal)** – generally non rechargeable batteries with lithium metal or lithium alloys as an anode; commonly used in watches, calculators, cameras, temperature data loggers, car key fobs and defibrillators.

**Lithium ion batteries (Li-ion)** – rechargeable batteries where the lithium is only present in an ionic form in the electrolyte; includes lithium polymer batteries; commonly used in mobile phones, laptops, tablets, power tools and e-bikes.

Lithium batteries may exist as a single **cell** or as a **battery**. A **cell** is a single encased electrochemical unit that includes one positive and one negative electrode (e.g., an AA or AAA ‘battery’) whereas a **battery** consists of 2 or more cells connected electrically with casing, terminals and markings.

Ground shipments of small quantities of lithium batteries

If lithium batteries have met the requirements of the *UN Manual of Tests and Criteria*, then they may be exempt (except for classification) from TDGR under special provision 34 (SP34 available online at [www.tc.gc.ca](http://www.tc.gc.ca)). The following table summarizes the parameters and requirements of this provision. Contact EHS for assistance.

<table>
<thead>
<tr>
<th>UN #</th>
<th>Shipping name</th>
<th>Maximum Li content</th>
<th>Maximum watt-hour rating$^5$</th>
<th>Total gross mass of cells/batteries</th>
<th>Labelling**§§</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN3090</td>
<td>Lithium metal batteries</td>
<td>Cell ≤ 1 g</td>
<td>n/a</td>
<td>30 kg (except when installed or packed with equipment)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Battery ≤ 2 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN3091</td>
<td>Lithium metal batteries contained in equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN3091</td>
<td>Lithium metal batteries packed with equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UN3480</td>
<td>Lithium ion batteries</td>
<td>n/a</td>
<td>Cell ≤ 20 Wh Battery ≤ 100 Wh</td>
<td>30 kg (except when installed or packed with equipment)</td>
<td></td>
</tr>
<tr>
<td>UN3481</td>
<td>Lithium ion batteries contained in equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*It is forbidden to ship damaged, defective, recalled or recycled lithium batteries by aircraft, whether or not the batteries are contained in equipment. Special provision 137 provides guidance for shipping damaged/defective lithium batteries by ground. Contact EHS for assistance.*
Guide to Transportation of Dangerous Goods

| UN3481 | Lithium ion batteries packed with equipment | CANUTEC cannot be used. |

*Batteries manufactured after Jan 1 2009 require the watt-hour rating (Wh) to be marked on the casing. For older batteries, \( Wh = \text{Ampere hours (Ah)} \times \text{Volts (V)} \) OR \( Wh = \text{milliamp hours (mAh)} \times \text{Volts (V)} \div 1000 \).

**Labelling is not required for packages containing button cell batteries installed in equipment, including circuit boards, or no more than 4 cells installed in equipment or no more than 2 batteries installed in equipment.

Provision 34 requires the packaging of cells and batteries to:

- protect against short circuit, including for cells/batteries installed in equipment;
- completely enclose cells and batteries;
- be able to withstand a 1.2 m drop test without damage to cells/batteries;
- prevent accidental activation, in the case of cells and batteries installed in equipment; and
- be designed, constructed, filled, closed, secured and maintained, so that under normal conditions of transport, there will be no release of the dangerous goods.

**Air shipments of small quantities of lithium batteries**

Lithium batteries must meet the requirements of the *UN Manual of Tests and Criteria* in order to be shipped by air. It is essential to review the packing instruction in IATA that corresponds to the type of battery and details of the shipment. Some key information is summarized here for a small shipment of lithium batteries (alone or with equipment). Contact EHS for assistance.

<table>
<thead>
<tr>
<th>UN #</th>
<th>Shipping name</th>
<th>Maximum Li content</th>
<th>Maximum per package</th>
<th>Packing instruction</th>
<th>Restrictions</th>
<th>Labelling**§§ for * and **, see instructions under ground shipments</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN3090</td>
<td>Lithium metal batteries</td>
<td>Per: Cell ≤ 1 g Battery ≤ 2 g</td>
<td>Li content of cells/batteries ≤ 0.3 g, then max net quantity per package = 2.5 kg Li content of cells &gt; 0.3 g but ≤ 1 g, then max # of cells per package = 8 Li content of batteries &gt; 0.3 g but ≤ 2 g, then max # of batteries per package = 2</td>
<td>968 Section II</td>
<td>Forbidden as cargo on passenger aircraft unless prior approval issued by all States (origin, operator and destination), see special provision A201 Only 1 package per shipment</td>
<td></td>
</tr>
</tbody>
</table>

| UN3091 | Lithium metal batteries contained in equipment | Per: Cell ≤ 1 g Battery ≤ 2 g | 5 kg net on passenger aircraft | 970 Section II | |

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### Guide to Transportation of Dangerous Goods

<table>
<thead>
<tr>
<th>UN #</th>
<th>Shipping name</th>
<th>Maximum watt-hour rating&lt;sup&gt;§&lt;/sup&gt;</th>
<th>Maximum per package</th>
<th>Packing instruction</th>
<th>Restrictions</th>
<th>Labelling&lt;sup&gt;§§&lt;/sup&gt; for * and **, see instructions under ground shipments</th>
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</table>
| UN3091  | Lithium metal batteries packed with equipment |                                      | Per: Cell ≤ 1 g  
Battery ≤ 2 g  
5 kg net on passenger aircraft  
969 Section II |                    |                                                                                     |                                                                      |
| UN3480  | Lithium ion batteries                    | Cell ≤ 20 Wh  
Battery ≤ 100 Wh | Watt-hour rating of cells/batteries ≤ 2.7 Wh, then max net quantity per package = 2.5 kg  
Watt-hour rating of cells > 2.7 Wh but ≤ 20 Wh, then max # of cells per package = 8  
Watt-hour rating of batteries > 2.7 Wh but ≤ 100 Wh, then max # of batteries per package = 2 | 965 Section II | Forbidden as cargo on passenger aircraft unless prior approval issued by all States, see special provision A201  
Must be shipped at a state of charge not exceeding 30% of rated design capacity  
Only 1 package per shipment |                                                                      |
| UN3481  | Lithium ion batteries contained in equipment | Cell ≤ 20 Wh  
Battery ≤ 100 Wh  
5 kg net on passenger aircraft  
967 Section II |                    |                                                                                     |                                                                      |
| UN3481  | Lithium ion batteries packed with equipment | Cell ≤ 20 Wh  
Battery ≤ 100 Wh  
5 kg net on passenger aircraft  
966 Section II |                    |                                                                                     |                                                                      |

<sup>§</sup>Batteries manufactured after Jan 1 2009 require the watt-hour rating (Wh) to be marked on the casing. For older batteries, Wh = Ampere hours (Ah) x Volts (V) OR Wh = milliamp hours (mAh) x Volts (V) ÷ 1000.

<sup>§§</sup>The lithium battery mark does not apply to packages containing only button cell batteries installed in equipment (including circuit boards) or 2 packages or less where each package contains no more than 4 cells or 2 batteries installed in equipment.
Air shipment documentation

For small quantities of lithium batteries, add the corresponding text below to the air waybill, under “Nature and quantity of goods:”

- Lithium metal batteries in compliance with Section II of PI 968 Cargo Aircraft Only
- Lithium metal batteries in compliance with Section II of PI 970
- Lithium metal batteries in compliance with Section II of PI 969
- Lithium ion batteries in compliance with Section II of PI 965 Cargo Aircraft Only
- Lithium ion batteries in compliance with Section II of PI 967
- Lithium ion batteries in compliance with Section II of PI 966

Air shipment packaging

Similar to the requirements for ground transport, cells and batteries must be packaged in a way that prevents short circuits, using inner packaging that completely encloses the cell or battery, and in strong outer packaging. The outer package must be capable of withstanding a 1.2 m drop test without damage to the cells/batteries, shifting of the contents (that would allow battery-to-battery or cell-to-cell contact) or release of contents.

Some suggestions for preventing short circuits are:

- packing each battery or each battery-powered device, when practicable, in fully enclosed inner packaging made of non-conductive material (plastic bag);
- separating or packing batteries in a manner to prevent contact with other batteries, devices or conductive materials in the package; and
- protecting exposed terminals or connectors with non-conductive caps, non-conductive tape or other similar means.

Cells and batteries must not be packed in the same outer packaging as other dangerous goods.