



Shipping Hazardous Materials

College of Science and
Emergency Preparedness and Safety

Created: June 2018

Updated: January 9, 2024



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Introduction

Shipments of hazardous materials are regulated by governmental and non-governmental organizations. Hazardous materials shipping regulations administered by the International Air Transport Association (IATA – Dangerous Goods Regulations, 59th ed, 2018) and the US Department of Transportation (DOT – [49 CFR parts 100-185](#)) are the most comprehensive and widely applicable, however some shipping companies have developed specific rules, which are stricter than DOT and/or IATA regulations. Examples of these companies include the US Postal Service (USPS), Federal Express (FedEx) and United Postal Service (UPS). Penalties ([49 CFR 107.329](#)) for non-compliance with regulations are significant and can result in:

- The maximum civil penalty for a hazardous material shipping violation is \$99,756 per violation per day;
- Violations that result in serious illness, substantial property damage, or death are now \$232,762 per violation per day;
- Finally, the minimum penalty for failure to provide hazmat training to a hazmat employee is \$601 per employee per day; and
- When the violation is a continuing one, each day of the violation constitutes a separate offense.

Individuals who are involved with the shipping process, including marking, labeling, packaging, preparing shipping documents, or signing for transport of a shipment including hazardous materials must receive Hazardous Materials Transportation Training. This training must be updated every three (3) years for domestic ground shipments, and every two (2) years for air shipments.

These regulations must be followed by any individuals wishing to:

1. Ship a research sample for testing;
2. Send hazardous materials to a collaborator in industry or at another university;
3. Return a hazardous Material to the manufacturer; or
4. Ship a sample packaged in dry ice.

Definitions

The definitions of dangerous goods and hazardous materials as defined by IATA and DOT are described below.

Dangerous Goods – As defined by IATA, “Articles or substances which are capable of posing a significant risk to health, safety or to property when transported by air and which are classified according to” the UN hazard classes.

Hazardous Material – As defined by DOT, “A hazardous material is defined as any substance that could adversely affect the safety of the public or the environment, handlers, or carriers during ground transportation. Hazardous materials are any substance that appears in the [49 CFR 172.101](#) Hazardous Materials Table. Hazardous material regulations may apply to commercial products, chemical mixtures, and newly synthesized compounds.”

Hazmat Employee – A person employed by Benedictine University (“University”) who directly affects hazmat transportation safety including:

1. A person who:
 - Loads, unloads, or handles hazmat;
 - Designs, manufactures, fabricates, synthesizes, inspects, tests, marks, or otherwise represents packaging as qualified for use in the transportation of hazmat;
 - Prepares hazmat for transportation;
 - Is responsible for safety of transporting hazmat; or
 - Operates a vehicle used to transport hazmat.

Material of Trade (MOT) - A Material of Trade is defined at 49 CFR 171.8 as a hazardous material, not a hazardous waste, that is carried on a motor vehicle for one of three purposes:

1. To protect the health and safety of the motor vehicle operator or passengers (e.g., bug spray, fire extinguisher).
2. To support the operation or maintenance of a motor vehicle (e.g., spare battery, gasoline).
3. Or, by a **private motor carrier** in direct support of a principal business that is other than transportation by motor vehicle. And just what is a “private motor carrier”? It’s a carrier that transports their own products and does not provide such transportation services to other businesses.

Training – A systematic program that ensures a hazmat employee has familiarity with the general provisions of the Hazardous Materials Regulations (HMR – 49 CFR 172.704), is able to recognize and identify hazardous materials, has knowledge of specific requirements applicable to functions performed by the employee, and has knowledge of emergency response information, self-protection measures and accident prevention methods and procedures.

Classes of Hazardous Materials

All dangerous goods or hazardous materials are divided into nine Hazard Classes, some of which have divisions. According to Dangerous Goods Regulations (DGR) 4.1.2.2, “When the hazard class of a substance is uncertain and it is being transported for further testing, a tentative hazard class, proper shipping name and UN number must be assigned on the basis of the shipper’s knowledge of the substance...” Generic and Hazard Class Proper Shipping Names are listed in Table 4.1A of the DGR. All specific dangerous articles and substances are listed in the DGR in Section 4.2 – List of Dangerous Goods and in CFR 49 Part 172.101 – Hazardous Materials Table. In all cases, the dangerous good or hazardous material must be checked to determine if it is a forbidden item. A list of forbidden dangerous goods on aircraft is in Table 2.1A of the DGR and in the List of Dangerous Goods or Hazardous Materials Table. Any sample of known waste or product that falls into a defined classification must be shipped according to regulatory requirements. See below:

Hazard Classes and Applicable Regulations		
Hazard Class	DGR Reference	CFR 49 Reference
Class 1: Explosives*	3.1	173.50-173.63
Class 2: Compressed Gases Div. 2.1 - Flammable gases Div. 2.2 - Non-flammable gases; non-toxic gases Div. 2.3 - Toxic gases	3.2	173.115-173.116
Class 3: Flammable Liquids	3.3	173.120-173.121; 173.150
Class 4: Flammable Solids Div. 4.1 - Flammable solids Div. 4.2 - Spontaneously combustible substances Div. 4.3 - Water reactive substances	3.4	173.124-173.125; 173.151
Class 5: Oxidizing Substances and Organic Peroxide Div. 5.1 - Oxidizers Div. 5.2 - Organic peroxides	3.5	173.127-173.129; 173.152
Class 6: Toxic and Infectious Substances Div. 6.1 - Poisonous liquids or solids Div. 6.2 - Infectious/biohazardous substances	3.6	173.132-173.134; 173.153
Class 7: Radioactive Materials	3.7	173.401-173.476
Class 8: Corrosive Materials	3.8	173.136-173.137; 173.154
Class 9: Miscellaneous Dangerous Goods	3.9	173.140-173.141; 173.155

* There are six divisions of Class 1:

Division 1.1 - Articles and substances having a mass explosion hazard

Division 1.2 - Articles and substances having a projection hazard but not a mass explosion hazard

Division 1.3 - Articles and substances having a fire hazards, a minor blast hazard and/or a minor projection hazard but not a mass explosion hazard

Division 1.4 - Articles and substances presenting no significant hazard

Division 1.5 - Very insensitive substances having a mass explosion hazard

Division 1.6 - Extremely insensitive articles, which do not have a mass explosion hazard

Small Quantities Exceptions (domestic ground transportation)

If shipping or transporting small quantities of hazardous chemicals using non-commercial transport on public roads, then the Materials of Trade (MOT) exception applies. See Appendix D for details.

Materials covered by the small quantity exceptions are exempt from all other requirements of 49 CFR 173.4 when they are shipped according to eleven requirements outlined below. These requirements are:

- Inner receptacle contains not more than the quantities listed in Appendix D;
- Inner receptacle is at least 0.2 mm thick and is not liquid full at 55°C;
- Closure of inner receptacle is positively secured;
- Chemically compatible absorbent and/or cushioning;
- Inner receptacle is secured in outer packaging;
- Packaging must pass a drop test and compressive load test;
- Package must not contain forbidden materials (49 CFR 172.101);
- Package does not exceed 29 kg;
- Package is not opened or altered during transportation;
- Package is marked with the statement, "This package conforms to 49 CFR 173.4 for domestic highway or rail transport only."; and
- Lithium batteries and cells must be shipped as fully regulated Dangerous Goods.

Drop Test**: The package must sustain free drops made from a height of 1.8 m (5.9 feet) directly onto a solid unyielding surface without breakage or leakage of internal containers and without reduction in the effectiveness of the package from replicating success in this test. Drops include flat onto package top, bottom, sides, as well as a corner junction.

Compressive Load Test**: Applicable when shipping multiple identical packages concurrently.

**The Drop Test and Compressive Load Test would only need to be done if using a non-UN specific shipping container.

De Minimis Quantities Exceptions (air transportation)

Dangerous goods assigned codes E1, E2, E4, or E5 are not subject to IATA regulation when carried as cargo provided:

- Maximum net quantity of material per inner packaging is limited to 1 mL for liquids and gases, and 1 g for solids;
- Each inner packaging must be leak proof and securely packed in an outer packaging with cushioning and absorbent material so that in normal conditions of transport, they cannot break, be punctured, or leak their contents out of the outer packaging;
- Each outer packaging must be documented to survive a drop test from 1.8 m (5.9 feet), and a 24-hour compressive load equivalent to the total mass of equivalent packages stacked to a height of 3 m (9.8 feet); and

- The maximum net quantity of dangerous good per outer packaging does not exceed 100 mL for liquids and gases, and 100 g for solids.

IATA DGR Excepted Quantities (air transportation)

Small quantities of dangerous goods assigned codes E1, E2, E3, E4, or E5 are only subject to the following provisions within IATA Regulations: training requirements, dangerous goods in air mail requirements, classification and packing group criteria, packaging requirements loading restrictions, accident and incident reporting, and radioactive materials shipping requirements.

1. Classification Requirements

Dangerous goods must be classified according to class and division according to Regulation guidelines. Classifications must be based on listing within the Regulations. If a material is not listed by name then a generic or n.o.s. (not otherwise specified) proper shipping name must be selected from IATA DGR Table 4.1.A that most accurately describes the substance. Classification results in quantity limitations are as follows:

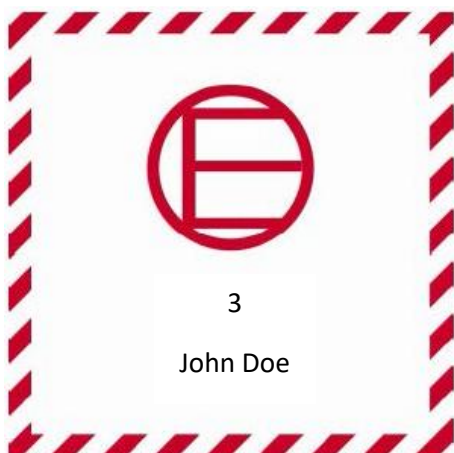
EQ Code	Maximum net quantity per inner packaging	Maximum net quantity per outer packaging
E0	Not permitted as Excepted Quantity	
E1	30 g/30 mL	1 kg/1 L
E2	30 g/30 mL	500 g/500 mL
E3	30 g/30 mL	300 g/300 mL
E4	1 g/1 mL	500 g/500 mL
E5	1 g/1 mL	300 g/300 mL

2. Packaging Requirements

- Inner packages must be strong, leak-proof, and have secured closures;
- Each inner package must be within a leak-proof intermediate package complete with cushioning and absorbent material;
- Intermediate packaging must be securely packed in a strong outer packaging (wood, fiberboard, or equivalent);
- The complete package must be documented to survive a drop test from 1.8 m (5.9 feet), and a 24 hour compressive load equivalent to the total mass of equivalent packages stacked to a height of 3 m (9.8 feet);
- The package must be of adequate size to apply all necessary markings on a package face;
- Overpacks may be used and may contain packages with or without other dangerous goods; and
- An Excepted Quantities package must not contain any dangerous goods that require a Shipper's Declaration.
 - Dry Ice is allowed within Excepted Quantities packages when the requirements of Packing Instruction 954 (section 5 of the IATA DGR) are met.

3. Marking Requirements

A 100 mm x 100 mm Excepted Quantity packaging mark is required. The mark must indicate the primary hazard class, and division when assigned, of each dangerous goods contained in the package. When the name of the shipper is not legibly shown elsewhere on the package, this information must also be included within the marking. An example for a flammable liquid (Class 3) is provided for review.



An overpack must display all required markings, and the work “overpack”, unless the markings on internal packages are clearly visible.

4. **Documentation**

Accompanying bills of lading, or air waybills, must include the statement “Dangerous Goods in Excepted Quantities”. A Shipper’s Declaration of Dangerous Goods is not required.

5. **Handling**

Transport, operator requirements included loading restrictions, and reporting of dangerous goods accidents, incidents and other occurrences.

Shipper’s Responsibilities

The regulations are complex. A shipper must comply fully with the DOT and IATA regulations when shipping a hazardous material or dangerous good.

OSHA’s Hazard Communication Standard (HCS) 29 CFR 1910.1200 “requires that manufacturers prepare and transmit SDSs with the initial shipment of all hazardous chemicals. Research facilities, which synthesize or produce chemicals are considered chemical manufacturers, if they ship hazardous chemicals, and **must** develop SDSs for the hazardous chemicals that they produce and distribute to other workplaces. While the HCS is based on known information and does not require testing of chemicals in determining health effects, any relevant information, which is known about the chemical or the mixture, must be conveyed in the SDS.

While the researcher may not have information concerning the precise nature of the synthesized chemicals, it is likely that they have a significant amount of important and relevant information concerning the chemical mixture. The SDS must include the hazard information for the un-reacted components.

Although the researcher may not be aware of the exact formulation of experimental mixtures and may have limited information on the health hazards, any information, which is known about the mixture, must be conveyed. Additional information, which must be included when available, includes: the presumed chemical structure(s) or name(S); the physical description of the mixture; and other information in the possession of the generating laboratory (e.g., melting point, boiling point, vapor pressure, etc.). All applicable sections of the SDS must be filled out. If no information is known for a specific section of the SDS, there must be a statement on the SDS that such information is either not known or not applicable.

In short, while much of the specific information for the newly synthesized chemical may not be available, the SDS must be as complete as possible and must be transmitted when the hazardous chemicals are shipped.” ([OSHA Standard Interpretation, 2004](#))

1. Identify: Determine if your material is hazardous

Consult the DOT Table of Hazardous materials

2. Classify: Determine what class of hazardous material is it.

Consult the relevant parts of 49 CFR: DOT Table of Hazardous Materials (172.101), Special Provisions (172.102), Packaging (173), Reportable Quantities (172.101 App. A), Marine Pollutants (172.101 App. B), and Small Quantity Exceptions (173.4).

3. Package: Determine the approved containers and methods of packaging (49 CFR 178.500).

If the material you wish to ship meets the standards of a Limited Quantity or a Small Quantity Exception, a UN specified package is **not** required. Otherwise, the appropriate UN specified outer/inner packaging and labels are required.

4. Mark/Label: Mark and label the container appropriately (49 CFR 172.300).

Apply the appropriate labeling (proper shipping name, technical name, UN number, etc.) and hazard stickers.

5. Document: Complete the proper shipping papers (49 CFR 172.200).

Some carriers (e.g. FedEx) provide online interactive forms to assist in the preparation of these documents. A copy of the shipping papers must be kept on file for at least two years.

Packing groups are designated in Column 5 of the § 172.101 Table (see Appendix A) and indicate the degree of danger presented by the material. Packing groups are not assigned to all classes of materials. The shipper is responsible for determining the appropriate packing group.

Packing Group I	PG I	Great Danger
Packing Group II	PG II	Medium Danger
Packing Group III	PG III	Minor Danger

If more than one packing group is indicated for an entry, the packing group for the hazardous material must be determined using the criteria found in Subpart D of Part 173. To determine how to assign a packing group see

http://www.chemsafetypro.com/Topics/TDG/How_to_Assign_UN_Packing_Group_for_Dangerous_Goods.html

For Example: Ketones, liquid, n.o.s. is listed in the HMT as a PG II and III material. The shipper must determine the packing group for the material by applying the criteria in § 173.121, Class 3 – Assignment of packing group.

Packing Group	Flash Point	Initial Boiling Point
I		<35°C (95°F)
II	<23°C (73°F)	>35°C (95°F)
III	>23°C, <60.5°C (141°F)	>35°C (95°F)

USPS, FedEx and UPS are carriers that are willing to accept dangerous goods or hazardous materials. Special handling fees will be applied.

USPS Dangerous Goods Shipping Restrictions

<https://www.usps.com/ship/shipping-restrictions.htm>

FedEx Hazardous Materials Shipping (Ground)

<http://www.fedex.com/us/service-guide/ship-dg-hazmat/hazardous-materials/>

FedEx Dangerous Goods Shipping (Air)

<http://www.fedex.com/us/service-guide/ship-dg-hazmat/dangerous-goods/>

UPS Hazardous Materials Shipping (Ground)

<https://www.ups.com/us/en/help-center/packaging-and-supplies/special-care-shipments/hazardous-materials.page>

UPS Dangerous Goods Shipping (Air)

https://www.ups.com/assets/resources/media/dangerous_goods.pdf

Training

According to 49 CFR 172.704 of the Hazardous Materials Regulations, there are specific training requirements that must be followed by anyone classified as a hazmat employee. The training must include the following:

- a. General awareness/familiarization training.
- b. Function-specific training.
- c. Safety training.
- d. Security awareness training.
- e. In-depth security training.
- f. OSHA, EPA, and other training.
- g. Initial and recurrent training.
- h. Relevant training.
- i. Compliance
- j. Recordkeeping. The record must include:
 - i. The hazmat employee's name;
 - ii. The most recent training completion date of the hazmat employee's training;
 - iii. A description, copy, or the location of the training materials used to meet the requirements;
 - iv. The name and address of the person providing the training; and
 - v. Certification that the hazmat employee has been trained and tested.

In addition to the above training requirements, each hazmat employee must also be trained in the specific packaging requirements as detailed in the International Air Transportation Association (IATA) Dangerous Good Regulations.

This training must be updated every three (3) years for domestic ground shipments, and every two (2) years for air shipments.

DOT training - <https://www.gpo.gov/fdsys/pkg/CFR-2006-title49-vol2/xml/CFR-2006-title49-vol2-part172-subpartH.xml>

IATA training - <https://www.iata.org/whatwedo/cargo/dgr/Documents/DGR-Training-Requirements-15.pdf>

References

Amherst College – DOT and IATA Regulations,

https://www.amherst.edu/offices/enviro_health_safety/hazardous-materials/dot_iata_reg

ChemSafetyPro – How to Assign Packing Group,

http://www.chemsafetypro.com/Topics/TDG/How_to_Assign_UN_Packing_Group_for_Dangerous_Goods.html

Department of Transportation (DOT) – 49 CFR parts 100 -185 - https://www.ecfr.gov/cgi-bin/text-idx?SID=1d49a3b137cb1b6fc45251074e634b44&tpl=/ecfrbrowse/Title49/49tab_02.tpl

Department of Transportation (DOT) – 49 CFR 172.101 subpart B – Table of Hazardous Materials and

Special Provisions - <https://www.gpo.gov/fdsys/pkg/CFR-2008-title49-vol2/pdf/CFR-2008-title49-vol2-sec172-101.pdf>

Department of Transportation (DOT) – Hazmat Transportation Training Requirements,

https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/Hazmat_Transportation_Training_Requirements.pdf

Department of Transportation (DOT) – Guide for Preparing Shipping Papers,

https://hazmatonline.phmsa.dot.gov/services/publication_documents/Guide%20for%20Preparing%20Shipping%20Papers.pdf

Department of Transportation (DOT) training - <https://www.gpo.gov/fdsys/pkg/CFR-2006-title49-vol2/xml/CFR-2006-title49-vol2-part172-subpartH.xml>

FedEx Hazardous Materials Shipping (Ground)

<http://www.fedex.com/us/service-guide/ship-dg-hazmat/hazardous-materials/>

FedEx Dangerous Goods Shipping (Air)

<http://www.fedex.com/us/service-guide/ship-dg-hazmat/dangerous-goods/>

Harvard University – Shipping of Hazardous Materials,

http://chemistry.harvard.edu/files/chemistry/files/hazmat_shipping_0.pdf

International Air Transport Association (IATA) – Dangerous Goods Regulations, 59th ed. 2018

International Air Transport Association (IATA) training -

<https://www.iata.org/whatwedo/cargo/dgr/Documents/DGR-Training-Requirements-15.pdf>

State of New Jersey - <http://www.nj.gov/dep/srp/guidance/fspm/pdf/chapter11.pdf>

University of Oregon – Shipping Hazardous Materials,

https://safety.uoregon.edu/sites/safety1.uoregon.edu/files/shipping_hazardous_materials_150427.pdf

UPS Hazardous Materials Shipping (Ground)

<https://www.ups.com/us/en/help-center/packaging-and-supplies/special-care-shipments/hazardous-materials.page>

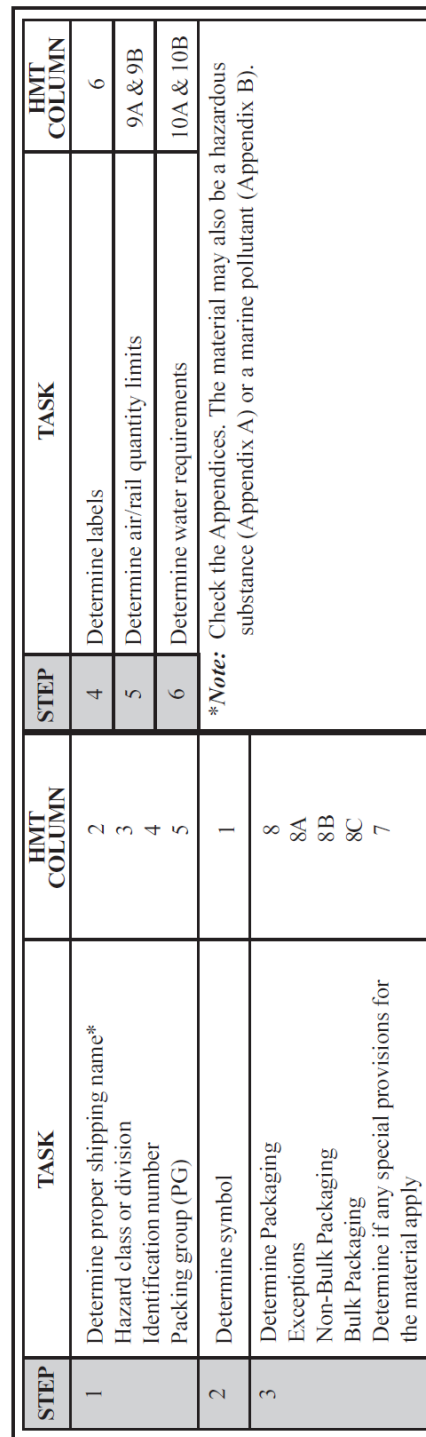
UPS Dangerous Goods Shipping (Air)

https://www.ups.com/assets/resources/media/dangerous_goods.pdf

USPS Dangerous Goods Shipping Restrictions

<https://www.usps.com/ship/shipping-restrictions.htm>

Example of HMT, § 172.101



Appendix B – Hazard Classes, Divisions, and Associated Labels



Explosives – 1.1, 1.2, 1.3, 1.4, 1.5, 1.6



Gases – 2.1, 2.2, 2.3



Flammable Liquids – 3



S-13915



S-13916



S-13917

Flammable/Reactive Solids – 4.1, 4.2, 4.3



S-2566



S-14647

Oxidizers and Organic Peroxides – 5.1, 5.2



Toxic and Infectious Substances – 6.1, 6.2

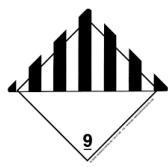


Labels and
Optional Placards

Radioactive Materials – 7



Corrosives – 8



Miscellaneous Dangerous Substances – 9

Appendix C – Checklist

Hazardous Materials (DOT) and Dangerous Goods (IATA) Shipment Checklist

Instructor Name:

Sample Name:

There must be a mark in each row to have a completed checklist. For question 1c, refer to Attachment 3 to get the appropriate class/division; for question 1d, please see Dr. Rose Rakers for proper packaging group; for question 2b, refer to Attachments 1 and 2 to get the appropriate statement(s) to go on the SDS. If additional assistance is needed with creating the SDS for your sample, please refer to the following links:

<https://pubchem.ncbi.nlm.nih.gov/>

<http://www.ilpi.com/msds/>

<https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2020-08/ERG2020-WEB.pdf>

To be Completed by the Researcher	YES	NO	N/A
1. Has the sample been properly classified?	☐	☐	☐
a. Proper shipping name? (The word " Sample " must be included in the proper shipping name.)	☐	☐	☐
b. Hazard Class/Division? (See Attachment 1)	☐	☐	☐
2. Do you have an SDS created for the sample being shipped? *	☐	☐	☐
a. Section 1 - Provide the Identification of the sample.	☐	☐	☐
b. Section 2 - Provide the Hazard Identification of the sample. (See Attachments 2 and 3 for Hazard and Precautionary Statements.)	☐	☐	☐
c. Section 3 - Provide the Composition/information on ingredients of the sample.	☐	☐	☐
d. Section 4 - Provide the First-aid measures of the sample.	☐	☐	☐
e. Section 5 - Provide the Fire-fighting measures of the sample.	☐	☐	☐
f. Section 6 - Provide the Accidental release measures of the sample.	☐	☐	☐
g. Section 7 - Provide the Handling and storage information on the sample.	☐	☐	☐
h. Section 8 - Provide the Exposure controls/personal protection information on the sample.	☐	☐	☐
i. Section 9 - Provide the Physical and chemical properties on the sample.	☐	☐	☐
j. Section 10 - Provide the Stability and reactivity information on the sample.	☐	☐	☐
k. Section 11 - Provide the Toxicological information on the sample.	☐	☐	☐
l. Section 12 (Optional) - Provide the Ecological information (if applicable) on the sample.	☐	☐	☐
m. Section 13 (Optional) - Provide the Disposal considerations (if applicable) on the sample.	☐	☐	☐
n. Section 14 (Optional) - Provide the Transport information (if applicable) on the sample.	☐	☐	☐

o. Section 15 (Optional) - Provide the Regulatory information (if applicable) on the sample.	☐	☐	☐
p. Section 16 - Provide Other information, including date of preparation of the SDS.	☐	☐	☐
3. What quantity are you shipping?			
4. What shipping carrier will you be using? FedEx, USPS			
a. Are all appropriate forms completed? (SDS and Checklist)	☐	☐	☐

Signature of Researcher

Date

Signature of Department Chair

Date

To be Completed by the Chemical Hygiene Officer	YES	NO	N/A
1. Has the sample been properly classified?	☐	☐	☐
a. UN/ID/NA number? (A code number used to quickly identify different hazardous materials. Generally, UN (United Nations) numbers will be used.)	☐	☐	☐
b. Packaging Group? (PG I, PG II, PG III)	☐	☐	☐
c. Does the packaging used conform to the requirements for DOT and/or IATA? (See pages 5 -7 of Policy)	☐	☐	☐
2. Does the sample meet the small quantities exception for DOT?	☐	☐	☐
a. If so, is the package marked "This package conforms to 49 CFR 173.4 for domestic highway or rail transport only."	☐	☐	☐
3. Does the sample meet the excepted quantities for IATA?	☐	☐	☐
a. If so, does the package have the IATA Excepted Quantity Package Mark, including the hazard class/division number and the name of the shipper or consignee? (See pages 6 & 7 of Policy)	☐	☐	☐
4. Is the package labeled properly for DOT and/or IATA transportation?	☐	☐	☐
5. Do you have a copy of all shipping papers, SDS and checklist on file? (Must be kept on file for two years.)	☐	☐	☐

IF ANY BOX IS CHECKED "NO", DO NOT SUBMIT FOR, OR ACCEPT, SHIPMENT.

***A safety data sheet (SDS) shall include the information specified in 29 CFR 1910.1200 under the section number and heading indicated for sections 1-11 and 16. If no relevant information is found for any given subheading within a section, the SDS shall clearly indicate that no applicable information is available. Sections 12-15 may be included in the SDS, but are not mandatory.**

Signature of Chemical Hygiene Officer

Date

Attachment 1 – Hazard Class/Division Table

Class 1: Explosives*
Class 2: Compressed Gases Div. 2.1 - Flammable gases Div. 2.2 - Non-flammable gases; non-toxic gases Div. 2.3 - Toxic gases
Class 3: Flammable Liquids
Class 4: Flammable Solids Div. 4.1 - Flammable solids Div. 4.2 - Spontaneously combustible substances Div. 4.3 - Water reactive substances
Class 5: Oxidizing Substances and Organic Peroxide Div. 5.1 - Oxidizers Div. 5.2 - Organic peroxides
Class 6: Toxic and Infectious Substances Div. 6.1 - Poisonous liquids or solids Div. 6.2 - Infectious/biohazardous substances
Class 7: Radioactive Materials
Class 8: Corrosive Materials
Class 9: Miscellaneous Dangerous Goods

Attachment 2: GHS Hazard Statements and H Codes

List of GHS Hazard Statements and H Codes

H200: Unstable explosive

H201: Explosive; mass explosion hazard

H202: Explosive; severe projection hazard

H203: Explosive; fire, blast or projection hazard

H204: Fire or projection hazard

H205: May mass explode in fire

H206: Fire, blast or projection hazard; increased risk of explosion if desensitizing agent is reduced

H207: Fire or projection hazard; increased risk of explosion if desensitizing agent is reduced

H208: Fire hazard; increased risk of explosion if desensitizing agent is reduced

H220: Extremely flammable gas

H221: Flammable gas

H222: Extremely flammable aerosol

H223: Flammable aerosol

H224: Extremely flammable liquid and vapor

H225: Highly flammable liquid and vapor

H226: Flammable liquid and vapor

H227: Combustible liquid

H228: Flammable solid

H229: Pressurized container: may burst if heated

H230: May react explosively even in the absence of air

H231: May react explosively even in the absence of air at elevated pressure and/or temperature

H232: May ignite spontaneously if exposed to air

H240: Heating may cause an explosion

H241: Heating may cause a fire or explosion

H242: Heating may cause a fire

H250: Catches fire spontaneously if exposed to air

H251: Self-heating; may catch fire

H252: Self-heating in large quantities; may catch fire

H260: In contact with water releases flammable gases which may ignite spontaneously

H261: In contact with water releases flammable gas

H270: May cause or intensify fire; oxidizer

H271: May cause fire or explosion; strong oxidizer

H272: May intensify fire; oxidizer

H280: Contains gas under pressure; may explode if heated

H281: Contains refrigerated gas; may cause cryogenic burns or injury

H290: May be corrosive to metals

H300: Fatal if swallowed

H301: Toxic if swallowed

H302: Harmful if swallowed

H303: May be harmful if swallowed

H304: May be fatal if swallowed and enters airways

H305: May be harmful if swallowed and enters airways

H310: Fatal in contact with skin

H311: Toxic in contact with skin

H312: Harmful in contact with skin

H313: May be harmful in contact with skin

H314: Causes severe skin burns and eye damage

H315: Causes skin irritation

H316: Causes mild skin irritation

H317: May cause an allergic skin reaction

H318: Causes serious eye damage

H319: Causes serious eye irritation

H320: Causes eye irritation

H330: Fatal if inhaled

H331: Toxic if inhaled

H332: Harmful if inhaled

H333: May be harmful if inhaled

H334: May cause allergy or asthma symptoms or breathing difficulties if inhaled

H335: May cause respiratory irritation

H336: May cause drowsiness or dizziness

H340: May cause genetic defects

H341: Suspected of causing genetic defects

H350: May cause cancer

H351: Suspected of causing cancer

H360: May damage fertility or the unborn child

H361: Suspected of damaging fertility or the unborn child

H361d: Suspected of damaging the unborn child

H362: May cause harm to breast-fed children

H370: Causes damage to organs

H371: May cause damage to organs

H372: Causes damage to organs through prolonged or repeated exposure

H373: May cause damage to organs through prolonged or repeated exposure

H400: Very toxic to aquatic life

H401: Toxic to aquatic life

H402: Harmful to aquatic life

H410: Very toxic to aquatic life with long-lasting effects

H411: Toxic to aquatic life with long-lasting effects

H412: Harmful to aquatic life with long-lasting effects

H413: May cause long-lasting harmful effects to aquatic life

H420: Harms public health and the environment by destroying ozone in the upper atmosphere

Attachment 3: GHS Precautionary Statements and P Codes

List of GHS Precautionary Statements and P Codes

General Precautionary Statements

- P101 If medical advice is needed, have product container or label at hand.
P102 Keep out of reach of children.
P103 Read label before use

Prevention Precautionary Statements

- P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat, hot surface, sparks, open flames and other ignition sources. - No smoking.
P211 Do not spray on an open flame or other ignition source.
P212 Avoid heating under confinement or reduction of the desensitized agent.
P220 Keep away from clothing and other combustible materials.
P221 Take any precaution to avoid mixing with combustibles/...
P222 Do not allow contact with air.
P223 Do not allow contact with water.
P230 Keep wetted with ...
P231 Handle under inert gas.
P232 Protect from moisture.
P233 Keep container tightly closed.
P234 Keep only in original container.
P235 Keep cool.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof [electrical/ventilating/lighting/...] equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P244 Keep valves and fittings free from oil and grease.
P250 Do not subject to grinding/shock/friction/...
P251 Do not pierce or burn, even after use.
P260 Do not breathe dust/fume/gas/mist/vapors/spray.
P261 Avoid breathing dust/fume/gas/mist/vapors/spray.
P262 Do not get in eyes, on skin, or on clothing.
P263 Avoid contact during pregnancy/while nursing.
P264 Wash ... thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P272 Contaminated work clothing should not be allowed out of the workplace.
P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P281 Use personal protective equipment as required.

P282	Wear cold insulating gloves/face shield/eye protection.
P283	Wear fire resistant or flame-retardant clothing.
P284	[In case of inadequate ventilation] Wear respiratory protection.
P285	In case of inadequate ventilation wear respiratory protection.
P231+P232	Handle under inert gas/... Protect from moisture.
P235+P410	Keep cool. Protect from sunlight.
Response Precautionary Statements	
P301	IF SWALLOWED:
P302	IF ON SKIN:
P303	IF ON SKIN (or hair):
P304	IF INHALED:
P305	IF IN EYES:
P306	IF ON CLOTHING:
P307	IF exposed:
P308	IF exposed or concerned:
P309	IF exposed or if you feel unwell
P310	Immediately call a POISON CENTER or doctor/physician.
P311	Call a POISON CENTER or doctor/...
P312	Call a POISON CENTER or doctor/... if you feel unwell.
P313	Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.
P315	Get immediate medical advice/attention.
P320	Specific treatment is urgent (see ... on this label).
P321	Specific treatment (see ... on this label).
P322	Specific measures (see ...on this label).
P330	Rinse mouth.
P331	Do NOT induce vomiting.
P332	IF SKIN irritation occurs:
P333	If skin irritation or rash occurs:
P334	Immerse in cool water [or wrap in wet bandages].
P335	Brush off loose particles from skin.
P336	Thaw frosted parts with lukewarm water. Do not rub affected area.
P337	If eye irritation persists:
P338	Remove contact lenses, if present and easy to do. Continue rinsing.
P340	Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P341	If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
P342	If experiencing respiratory symptoms:
P350	Gently wash with plenty of soap and water.
P351	Rinse cautiously with water for several minutes.
P352	Wash with plenty of water/...
P353	Rinse skin with water [or shower].

P360	Rinse immediately contaminated clothing and skin with plenty of water before removing clothes.
P361	Take off immediately all contaminated clothing.
P362	Take off contaminated clothing.
P363	Wash contaminated clothing before reuse.
P364	And wash it before reuse [Added in 2015 version]
P370	In case of fire:
P371	In case of major fire and large quantities:
P372	Explosion risk.
P373	DO NOT fight fire when fire reaches explosives.
P374	Fight fire with normal precautions from a reasonable distance.
P376	Stop leak if safe to do so.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P378	Use ... to extinguish.
P380	Evacuate area.
P381	In case of leakage, eliminate all ignition sources.
P390	Absorb spillage to prevent material damage.
P391	Collect spillage.
P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/...
P301+P312	IF SWALLOWED: call a POISON CENTER/doctor/... IF you feel unwell.
P301+P330+P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P302+P334	IF ON SKIN: Immerse in cool water [or wrap in wet bandages].
P302+P335+P334	Brush off loose particles from skin. Immerse in cool water [or wrap in wet bandages].
P302+P350	IF ON SKIN: Gently wash with plenty of soap and water.
P302+P352	IF ON SKIN: wash with plenty of water.
P303+P361+P353	IF ON SKIN (or hair): Take off Immediately all contaminated clothing. Rinse SKIN with water [or shower].
P304+P312	IF INHALED: Call a POISON CENTER/doctor/... if you feel unwell.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P304+P341	IF INHALED: If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do - continue rinsing.
P306+P360	IF ON CLOTHING: Rinse Immediately contaminated CLOTHING and SKIN with plenty of water before removing clothes.
P307+P311	IF exposed: call a POISON CENTER or doctor/physician.
P308+P311	IF exposed or concerned: Call a POISON CENTER/doctor/...
P308+P313	IF exposed or concerned: Get medical advice/attention.
P309+P311	IF exposed or if you feel unwell: call a POISON CENTER or doctor/physician.
P332+P313	IF SKIN irritation occurs: Get medical advice/attention.
P333+P313	IF SKIN irritation or rash occurs: Get medical advice/attention.

P335+P334	Brush off loose particles from skin. Immerse in cool water/wrap in wet bandages.
P337+P313	IF eye irritation persists: Get medical advice/attention.
P342+P311	IF experiencing respiratory symptoms: Call a POISON CENTER/doctor/...
P361+P364	Take off immediately all contaminated clothing and wash it before reuse.
P362+P364	Take off contaminated clothing and wash it before reuse.
P370+P376	in case of fire: Stop leak if safe to do so.
P370+P378	In case of fire: Use ... to extinguish.
P370+P380	In case of fire: Evacuate area.
P370+P380+P375	In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.
P371+P380+P375	In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.
Storage Precautionary Statements	
P401	Store in accordance with ...
P402	Store in a dry place.
P403	Store in a well-ventilated place.
P404	Store in a closed container.
P405	Store locked up.
P406	Store in corrosive resistant/... container with a resistant inner liner.
P407	Maintain air gap between stacks or pallets.
P410	Protect from sunlight.
P411	Store at temperatures not exceeding ... °C/...°F.
P412	Do not expose to temperatures exceeding 50 °C/ 122 °F.
P413	Store bulk masses greater than ... kg/lbs. at temperatures not exceeding ... °C/...°F.
P420	Store separately.
P422	Store contents under ...
P402+P404	Store in a dry place. Store in a closed container.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P403+P235	Store in a well-ventilated place. Keep cool.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P410+P412	Protect from sunlight. Do not expose to temperatures exceeding 50 °C/122°F.
P411+P235	Store at temperatures not exceeding ... °C/...°F. Keep cool.
Disposal Precautionary Statements	
P501	Dispose of contents/container to ...
P502	Refer to manufacturer or supplier for information on recovery or recycling

Appendix D – Materials of Trade (MOT) Exception

Transporting chemicals can be one of the riskiest procedures carried out, because at no other time is accidental release and exposure more likely. However, by using the same care and caution before and during transportation that one would for any experimental procedure, danger to oneself, others, and the environment can be minimized. The purpose is to ensure that safe and efficient transport between collaborators at Benedictine University and other nearby universities and research facilities of hazardous materials and samples that qualify for the Department of Transportation (DOT) material of trade (MOT) exception. MOTs are hazardous materials, other than hazardous waste, that are carried using a motor vehicle.

This section covers only non-commercial transport on public roads of DOT hazardous materials meeting MOT requirements. **(The MOT exception does not apply to transport of hazardous materials by air or waterway.)** Materials subject to this procedure are limited to samples (synthesized or purchased) transported by those conducting the research and to MOT materials as defined by the DOT (49 CFR 173.6) in the quantities listed in MOT Table below. This procedure does not cover transport of hazardous, radioactive, or mixed waste or transport on-site.

The MOT exception does not apply to hazardous material that is self-reactive, poisonous by inhalation, or a hazardous waste. The total for any load must not exceed 200 kg (440 lbs.).

Incoming materials to Benedictine University from an outside source must be shipped to and inventoried by the CHO. Safety data sheets (SDS), if applicable, must be on file.

Outgoing materials must be communicated to the CHO. The material being transported must meet the definition of MOT and transport must meet 49 CFR 173.6. This includes those transporting the material having a general knowledge of MOT regulations, quantity limitations, and packaging, marking, and labeling requirements. Contact with the receiving institution is encouraged so that they can expect and prepare for receiving the hazardous materials.

MOT Requirements

A hazardous materials shipment must meet all of the following condition to qualify as MOT:

- Must meet the maximum quantity limits in Table 4.6 for packages for hazard classes and divisions,
- With the exception of tanks containing diluted mixtures of Class 9 materials, no more than a combined gross weight of 200 kg (440 lbs.) of MOT may be transported on any one vehicle, and
- Transporter must be informed of the presence of hazardous materials and have general knowledge of MOT regulations.

If a shipment qualifies as MOT and is being driven by the researcher/collaborator that synthesized the material, the following applies:

- No shipping papers are required,
- No additional emergency response information is required,
- No placarding is required,
- No formal training or retention of training records is required,
- Hazardous material must not be transported in the passenger compartment of the vehicle. Must be kept in the trunk of a passenger vehicle or the bed of a truck (this means that

hatchback vehicles and van with no trunks must not be used for transporting hazardous materials), and

- Any passengers must be informed of the presence of hazardous materials.

If a shipment qualifies as MOT and is being shipped using commercial modes of transportation (UPS, FedEx, USPS):

- Must create an SDS for synthesized materials,
- Must have proper labels and marks on outside packaging; and
- Must have proper packaging for type of material being shipped.

Packaging and Marking Requirements

MOTs have packaging and marking requirements. The packaging must be the manufacturers original packaging or a package of equal or greater strength and integrity. The packaging must be marked with a common name (such as “gas” or “spray paint”) or a proper shipping name from the Hazardous Materials Regulations (HMR) (such as “Isopropyl Alcohol.”) Additionally, the following other requirements apply:

- Packaging must be leak tight for liquids and gases, and sift proof for solids,
- Packages must be securely closed, secured against movement, and protected against damage,
- Outer packaging is not required for receptacles (such as cans or bottles) that are secured against movement in cages, bins, boxes, or compartments,
- Gasoline must be transported in a metal or plastic container meeting DOT or OSHA requirements (Section 173.6 (b) (4) and Section 173.202 in the HMR),
- Cylinders and pressure vessels must conform to the HMR except that outer packaging is not required. These cylinders must be marked with the proper shipping name and identification number and have a hazard class warning label,
- If the package contains a reportable quantity of a hazardous substance, it must be marked “RQ”. Reportable quantities are found in Appendix A of Section 172.101 of the HMR, and
- A tank containing a diluted mixture (not more than 2% concentration) of a Class 9 material must be marked on two opposing sides with the identification number.

MOT Table

Hazard Class or Division	Packing Group	Maximum amount of material in each individual package
2.1 Flammable compressed gases 2.2 Non-flammable, non-toxic gases	Not applicable	Each cylinder may not weigh more than 100 kg (220 lbs.) gross
3 Flammable & combustible liquid 4.1 Flammable solid 5.1 Oxidizer 5.2 Organic peroxide 6.1 Poisons 8 Corrosive 9 Class 9 Consumer commodities (ORM-D)	PG I	Solids: 0.5 kg (1 lb.) Liquids: 0.5 L (1 pint)
3 Flammable & combustible liquid 4.1 Flammable solid 5.1 Oxidizer 5.2 Organic peroxide 6.1 Poisons 8 Corrosive 9 Class 9 ORM-D	PG II and III, or ORM-D	Solids: 30 kg (66 lbs.) Liquids: 30 L (8 gal.)
4.3 Dangerous When Wet	Only PG II and III materials are allowed	30 ml (1 ounce)
6.2 Infectious or biological substance (non-medical waste) excludes Cat. A infectious substances	Not applicable	One or more inner packaging, each no more than 0.5 kg (1 lb.) or 0.5 L (17 ounces), totaling no more than 4 kg (8.8 lbs.) or 4 L (1 gal.) Or A single inner packaging containing not more than 16 kg (35.2 lbs.) or 16 L (4.2 gal.) in a single outer package
Diluted mixtures of Class 9 materials (not exceeding 2% concentration)	Not applicable	May be transported in a tank having a capacity of up to 1500 L (400 gal.)

Appendix E – Acronyms

CFR – Code of Federal Regulations

DGR – Dangerous Good Regulations

DOT – Department of Transportation

EPA – Environmental Protection Agency

EQ (E0, E1, E2, E3, E4, E5) – Excepted Quantity code

FedEx – Federal Express

HCS – Hazard Communication Standard

HMR – Hazardous Materials Regulations

IATA – International Air Transport Association

n.o.s. – Not Otherwise Specified

OSHA – Occupational Safety and Health Administration

PG – Packing Group

SDS – Safety Data Sheet

UN – United Nations

University – Benedictine University

UPS – United Parcel Service

USPS – United States Postal Service