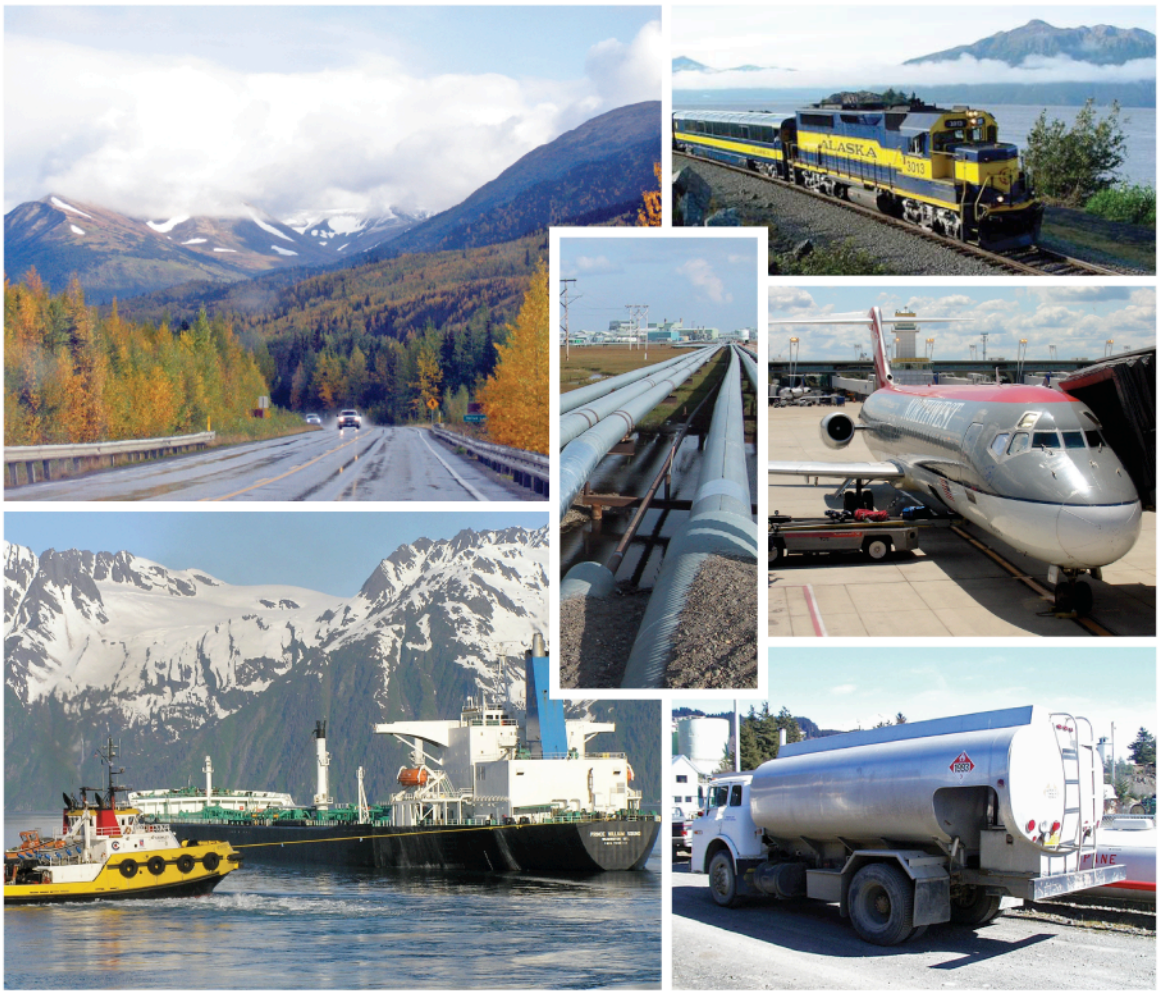
STATEWIDE
Hazardous Materials
COMMODITY FLOW STUDY



SEPTEMBER 2010

Prepared for:
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
and
ALASKA DEPARTMENT OF MILITARY AND VETERANS AFFAIRS

Prepared by:
Nuka Research and Planning Group, LLC

ADEC SPAR Term Contract 18-3009-10 and18-3009-21
Planning, Management, Operational, and Technical Assistance in Support of Emergency Response to Oil and Hazardous Substance Spills

TABLE OF CONTENTS

List of Figures

List of Tables

EXECUTIVE SUMMARY

This report was prepared by Nuka Research and Planning Group, LLC (Nuka Research) for the Alaska Department of Environmental Conservation (ADEC) and the Alaska Department of Military and Veterans Affairs (DMVA). The report provides an updated, comprehensive Hazardous Materials Commodity Flow Report for the State of Alaska. The purpose of the report, which updates a similar 2005 study, is to compile data on the transportation of extremely hazardous substances (EHS), hazardous substances (HS), and oil/petroleum products through local communities in Alaska, as well as provide critical information to first responders on the transportation routes and hazardous materials commodities shipped within their local jurisdiction.

The methodology for this study involved five major tasks: (1) comprehensive literature review; (2) data compilation; (3) data review and scoping; (4) analysis; and (5) final report. This report represents the final deliverable for the ADEC issued contract. The final report compiles data for the calendar years 2007, 2008, and 2009. EHS, HS and oil/petroleum product transportation and storage data is analyzed by transportation mode, hazardous material class, and Potentially Impacted Subarea.

While the EHS Commodities transported within the State of Alaska varied slightly in year-to-year volume for certain commodities, the ranking of the top six (6) commodities were very consistent. The top EHS Commodities by volume shipped were (1) Sodium Cyanide, (2) Chlorine, (3) Sulfuric Acid, (4) Anhydrous Ammonia, (5) Formaldehyde, and (6) Phosgene. The Subareas that experienced the greatest volumes of EHS shipments were (1) Cook Inlet, (2) Interior Alaska, (3) Kodiak Island, (4) Prince William Sound, (5) the Aleutians, (6) North Slope, and (7) Northwest Arctic. According to the data received and analyzed, the remaining Subareas (Southeast Alaska, Western Alaska, and Bristol Bay) saw little (less than 150 lbs) to no volume of EHS commodities shipped during the three-year time period evaluated.

The top three HS commodities transported within the State of Alaska were Hazard Classification (HC) 2 (Gas Materials), HC 3 (Flammable Liquid Materials), and ORM-D (Other Regulated Materials). These commodities dominated the total volumes by several orders of magnitude due primarily to natural gas, crude oil, and produced water production and transport volumes within the State, and particularly on the North Slope and within Cook Inlet. After these commodities, HC 9 (Miscellaneous Materials), HC 5 (Oxidizer & Organic Peroxide Materials), and HC 8 (Corrosive Materials) consistently dominated the volumes of hazardous materials shipped year-to-year. Following the trend noted above for the top three hazardous substances, the Subareas with the highest total volumes of hazardous materials shipped were (1) North Slope, (2) Cook Inlet, (3) Interior Alaska, and (4) Prince William Sound. These

Subareas dominated the total volumes shipped over the three-year period by several orders of magnitude making up 99.99% of the total volume.

The top petroleum commodities transported within the State of Alaska remained very consistent in terms of product by volume year-to-year. Crude oil shipments via the Trans-Alaska Pipeline and Cook Inlet Pipeline dominate the petroleum products shipped within the State. The Anchorage Fueling and Service Company (AFSC) Pipeline transports significant volumes of jet fuel from the Port of Anchorage to the Ted Stevens International Airport day-to-day as well. As a direct result, the primary Subareas potentially impacted by these commodities are the North Slope, Cook Inlet, Interior Alaska and Prince William Sound. In general, the petroleum products most prevalent in Southeast Alaska, Kodiak Island, Aleutians, Bristol Bay, Western Alaska, and Northwest Arctic were primarily gasoline, diesel and heating oil type commodities.

The hazardous materials commodity flow transportation modes considered in this report were air cargo, highway corridor, marine corridor, pipeline corridor, and rail corridor. Data was compiled from shippers representing each of the transportation methods. The 'completeness' of the data received varied significantly between sources, but it all provided a solid foundation for the completion of this study.

In general, for the less detailed shipment information received for this study (e.g. rail and air) the types and volumes of hazardous materials shipped remained fairly consistent year-to-year. For the transportation modes where more detailed information was available (e.g. highway, marine and pipeline), the volumes did vary for some commodities from year to year.

Air cargo transportation routes were analyzed by number of hazardous materials shipments from Ted Stevens International Airport in Anchorage to airports statewide, as reported by one air cargo carrier. The primary hazardous material commodities transported were HC 1 (Explosives), HC 3 (Flammable Liquid Materials), HC 8 (Corrosive Materials), and HC 9 (Miscellaneous Materials). In general, it is suspected that this combination of hazardous material commodities is fairly representative of what the other air cargo carriers would carry within the State. Based on the limited data received and analyzed, Bethel and Kotzebue consistently experienced the highest number of hazardous material shipments via air cargo from year to year. As there are over 30 air carriers that could transport hazardous materials within the State of Alaska, the preliminary conclusion could change significantly if additional air cargo data were made available.

The top 5 highway corridors in terms of volume of hazardous materials shipped are (1) Alaska Highway, (2) North Slope Haul Road, (3) Glenn Highway, (4) Richardson Highway, and (5) Sterling Highway. In general, the primary highway corridors that are utilized to transport hazardous materials are located in and around, and in between the cities of Anchorage,

Fairbanks, Valdez, and locations on the North Slope. Highway transportation is the dominant method for transportation of hazardous materials in terms of the total number of shipments in any given year.

In general, the primary marine corridors for hazardous materials transportation are in and around Cook Inlet and associated ports, Southeast Alaska's Inside Passage and associated ports, routes that transit the Aleutians Subarea in innocent passage while enroute to other domestic or international ports, and routes from Cook Inlet through the Aleutians and up to the North Slope. Marine transportation of hazardous materials is second to highway transportation in terms of the total number of shipments in any given year.

The top pipeline corridors identified for the movement of hazardous materials are primarily located in the Cook Inlet Subarea, on the North Slope, and between the North Slope and Valdez. Volumes of hazardous materials commodities and petroleum products shipped were significant and dominate the total volume of all hazardous materials commodities shipped within the State.

The top rail corridors identified for the movement of hazardous materials are located within the Cook Inlet Subarea. Like pipeline shipments, commodities are consistent from year to year and second to pipelines in dominating the total volumes of hazmat shipped within the State.

The Subareas with the highest total volumes of hazardous materials shipped were (1) North Slope, (2) Cook Inlet, (3) Interior Alaska, and (4) Prince William Sound. As stated earlier, these Subareas dominated the total volumes shipped over the three-year period by several orders of magnitude making up 99.99% of the total volume. In order of total volume shipped, the remaining six subareas are ranked as follows: (5) Western Alaska, (6) Northwest Arctic, (7) Southeast Alaska, (8) Aleutians, (9) Bristol Bay and (10) Kodiak Island.

In general, by volume, the commodities transported by pipeline dominate the total volume of hazardous materials shipped within the State by several orders of magnitude. Specifically, the primary commodities are natural gas, crude oil and produced water. For all other remaining modes of transportation, the volume of shipments by rail is significantly higher given the capacity of the various railcar options.

The North Slope experiences the highest volume of hazardous materials transported, and is nearly 44% higher than the next highest Subarea (Cook Inlet). The Cook Inlet Subarea, however, experiences the highest number of shipments of any other Subarea nearly doubling the number of shipments in Interior Alaska and more than tripling the number of shipments in the North Slope Subarea.

Of the over 28 trillion pounds of hazardous materials transported Statewide via all transportation modes, 98.96% were HC 2 (Gas Materials) commodities, specifically natural gas/methane. The remaining 1.04% (302 billion pounds) is primarily dominated by HC 3 (Flammable Liquid Materials), which accounts for 91% of the remaining volume and includes petroleum crude oil, aviation fuel, diesel and gasoline as the primary commodities.

This study should help raise the awareness of the State Emergency Response Commission (SERC) and the Local Emergency Planning Committees (LEPC) with regard to the types and volumes of hazardous materials being shipped through their respective areas of responsibility. More importantly, the information will be of significant value to first responders in preparing for and responding to oil and hazardous substance releases within their local jurisdiction. Additionally, it will augment the hazardous material information contained in the Subarea Contingency Plans and may serve as the foundation for future Statewide hazardous materials commodity flow studies.

1. INTRODUCTION

1.1 Purpose and Scope

This report presents data and analysis compiled during the 2010 Hazardous Materials Commodity Flow Study, which expands upon a 2005 study (Ecology and Environment, 2005). The purpose of the 2010 report is to provide an updated comprehensive study for use by the State of Alaska DEC, SERC, LEPCs, and local jurisdictions to plan for and respond to the potential risks associated with hazardous materials transportation through Alaska's communities.

This study evaluates the hazardous materials commodities transported via five transportation modes into and within the State of Alaska: air, highway, marine, pipeline, and railroad over a three-year period including the calendar years of 2007, 2008, and 2009.

The hazardous materials commodities included were Extremely Hazardous Substances (EHS)[1], Hazardous Substances (HS)[2], and major petroleum products such as crude oil, natural gas, gasoline, aviation fuel, and diesel fuel.

The primary purpose of a commodity flow study is to identify the types and amounts of commodities transported through a specified geographic area, such as a single community, a state, or large urban area, and the routes used for transporting these commodities. A hazardous materials commodity flow study identifies the hazardous substances (HS) or extremely hazardous substances (EHS) transported, either specifically or by hazard class, as well as the routes by which they are transported[3].

This report compiles and analyzes hazardous materials commodity flow data based on the State and federal hazardous materials transportation and storage regulations, and the hazardous material classification systems used by industry.

[1] The Emergency Planning & Community Right-to-Know Act (EPCRA) identifies several hundred hazardous substances for their extremely toxic properties. EPA establishes the list of extremely hazardous substances in 40 CFR Part 355, Appendices A and B.

[2] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) defines a hazardous substance as substance designated as hazardous under section 102 or CERCLA, any hazardous substance designated under sections 311 (b)(2)(a) and 307(1) of the Clean Water Act (CWA), any hazardous waste having characteristics identified in section 3001 of the Resource Conservation & Recovery Act, any hazardous air pollutant listed in section 112 of the Clean Air Act (CAA), and any imminently hazardous chemical substance or mixture which the EPA Administrator has "taken action under" section 7 of the Toxic Substances Control Act.

[3] U.S. Department of Transportation, Research and Special Programs Administration, "Guidance for Conducting Hazardous materials Flow Surveys." January 1995.

1.2 Background

By statute, the Alaska Department of Environmental Conservation (ADEC) has primary State responsibility for ensuring appropriate containment and cleanup actions are taken for a hazardous substance incident (AS 46.08.130). These incidents are commonly referred to as hazardous materials (HAZMAT) incidents for the purposes of planning and response.

Understanding the types and quantities of hazardous materials moving through the State of Alaska's major transportation corridors – highway, railway, marine, air, and pipeline – helps the State to better prepare for and respond to hazardous materials releases.

ADEC completed a statewide hazards analysis in 2005 to identify the known hazardous substance (HS, including oil) and extremely hazardous substance (EHS) facilities and transportation routes in the State.[4] This analysis was used in hazardous materials spill prevention and response planning at the local, state and federal levels, including the Alaska Federal and State Preparedness Plan for Response to Oil and Hazardous Substance Discharges and Releases (Unified Plan) and the ten Subarea Contingency Plans (SCPs); State of Alaska Emergency Response Plan; Regional and local all-hazard mitigation and emergency response plans; and Community Right-to-Know programs. This 2010 report provides updated data compilation and analysis to support future hazardous materials planning.

1.3 Hazardous Materials Regulations.

1.3.1 Reporting Requirements

State and federal regulations require that companies prepare reports on the types and quantities of hazardous materials that they store and transport. Companies are also required to report any hazardous substance spills that occur in Alaska lands or waters to both state and federal agencies.

Under the Federal Emergency Planning and Community-Right-to-Know Act (EPCRA)[5], certain businesses are required to annually report information about hazardous substances used and stored at their facility. This report, known as the Tier Two Report, is submitted to the Local Emergency Planning Committees (LEPCs), the State Emergency Response Commission (SERC), and local fire departments. ADEC receives these reports on behalf of the SERC. The report identifies HS and EHS chemicals used or stored at the facility during the previous year. ADEC typically receives 800 to 1,000 Tier Two reports each year. This information is used by State and local planners to update the inventory of reporting facilities, develop emergency response plans for potential releases, and to identify ways of reducing the risks to their communities. ADEC, in conjunction with EPA, periodically prepares summary reports of the Tier Two

[4] "Statewide Hazardous Materials Commodity Flow Study," Ecology and Environment, 2005.
[5] 42 U.S.C. 116, Emergency Planning and Community Right-to-Know Act of 1986, SARA Title III

information and provides the data to first responders, LEPCs, and the SERC. These reports provide the information required for fixed facilities.

The National Response Center (NRC) is the sole national point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories. The National Oil and Hazardous Substances Pollution Contingency Plan charges the NRC with receiving reports of discharges of oil and hazardous substances in accordance with the Federal Water Pollution Control Act (FWPCA) or Clean Water Act.[6]

ADEC also receives spill reports for oil and hazardous substance releases occurring throughout the State. These spill reports are useful in identifying types of releases that occur in the State, along with the primary source, cause, and quantity released. A separate spill summary report is prepared by the ADEC, normally on an annual basis.

1.3.3 Transportation Requirements

While hazardous materials spills from all transportation modes must be reported, State and Federal Tier Two reporting requirements do not apply to hazardous materials transportation. The U.S. Department of Transportation (DOT) in the Code of Federal Regulations has standards for marking, labeling, placarding, shipping papers, emergency response information, packaging, handling, and transporting of hazardous materials,[7] but there are no reporting requirements for HS and EHS transportation. The ability to summarize the EHS and HS chemicals, and major petroleum products transported throughout the State has been an on-going challenge.

There are various federal and state agencies that enforce hazardous materials regulations found in the CFR and state law. Additionally, there are other agency standards and international requirements that certain agencies enforce in addition to those found in the federal regulations. Table 1-1 lists the agencies, their respective enforcement responsibilities, and the associated regulatory cites.

[6] The National Response Center website, http://www.nrc.uscg.mil/nrchp.html
[7] 49 Code of Federal Regulations Part 100-185

Table 1-1. Federal & State Agency Responsibilities & Regulations

AGENCY	ENFORCEMENT RESPONSIBILITY	REGULATION
Federal Railroad Administration (FRA)	Regulations for rail transport.	49 CFR Part 174
Federal Highway Administration (FHA)	Regulations for highway transport.	49 CFR Part 177
Federal Aviation Administration (FAA)	Regulations for air transport International Air Transport Association (IATA) dangerous goods regulations.	49 CFR Part 175 IATA Dangerous Goods Regulations 51st Edition
U.S. DOT Pipeline & Hazardous Materials Safety Administration	Shipment of hazardous materials and the manufacturer, fabrication, marking, maintenance, reconditioning, repair or testing of multi-modal containers	49 CFR Parts 100-185
Federal Motor Carriers Safety Administration (FMCSA)	Regulations for highway transport Regulations for motor carrier safety	49 CFR Part 177 49 CFR Parts 350-399
United States Coast Guard	Regulations for vessel transport International Maritime Dangerous Goods Code (IMDG) requirements.	49 CFR Part 176 IMDG Code
Environmental Protection Agency (EPA)	Emergency Planning & Community Right-to-Know Act (EPCRA) 1986, SARA Title III	42 USC 116[8]
Alaska Department of Transportation & Public Facilities (AKDOTPF)	Transportation of hazardous materials, hazardous substances, or hazardous waste	17 AAC 25.200
Alaska Department of Environmental Conservation (ADEC) on behalf of SERC	Tier Two Reporting for the State of Alaska	AS 29.35.500

1.4 Hazardous Commodity Classification Methods.

Determining the hazardous materials classification for each commodity shipment evaluated in this study was necessary to provide a more complete picture of the specific types of hazardous materials being shipped within the State. This was completed using several common categorization schemes to group each commodity shipped. The classification methods used included the following systems:

United Nations / North America Hazard Identification Number (UN/NA Number). United Nations / North America Identification Number is a four digit number representing a particular chemical or group of chemicals. These numbers are assigned by the United Nations (UN Numbers), the U.S. Department of Transportation (NA Numbers), or Transport Canada (NA Numbers).[9]

[8] This law provides an infrastructure at the state and local levels to plan for chemical emergencies. Facilities that store, use, or release certain chemicals, may be subject to various reporting requirements.
[9] IMDG Code

United Nations Hazardous Materials Classification System. The United Nations (UN) Hazardous Materials (HAZMAT) Classification System uses a numeric designator to categorize hazardous materials according to their hazard potential. This study utilizes the Hazard Classification numbers and the associated definitions, listed in Table 1-2, as the primary identifier for compiling commodities over the various transportation routes. The numerical order of the classes and divisions is not indicative of the degree of danger each poses.[10]

Table 1-2. United Nations Hazardous Materials Classification System[11]

United Nations Hazardous Materials Classification System	
Classification	Definition
1	49 CFR Part 173.50 - Explosive Materials. An explosive means any substance or article, unless otherwise classified, which is (a) designed to function by explosion, or (b) which (by chemical reaction within itself, is able to function in a similar manner even it not designed to function by explosion.
1.1	**Division 1.1** consists of explosives, which have a mass explosion hazard. A mass explosion is one, which affects almost the entire load instantaneously.
1.2	**Division 1.2** consists of explosives, which have a projection hazard but not a mass explosion hazard.
1.3	**Division 1.3** consists of explosives, which have a fire hazard and either a minor blast hazard or a minor projection hazard, or both, but not a mass explosion hazard.
1.4	**Division 1.4** consists of explosives, which present a minor explosion hazard. The explosive effects are largely confined to the package, and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.
1.5	**Division 1.5** consists of very insensitive explosives. This division is comprised of substances that have a mass explosion hazard, but they are so insensitive that they offer very little probability of initiation or of transition from burning to detonation under normal transport conditions.
1.6	**Division 1.6** consists of extremely insensitive articles, which lack a mass explosive hazard. This division is comprised of articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.
2	**49 CFR Part 173.115 – Gas Materials**
2.1	**Division 2.1** means that any material that is a gas at 20C (68F) or less and 101.3 kPa (14.7 psi) of pressure, and that (a) is ignitable when in a mixture of 13% or less by volume with air, or (b) has a flammable range with air of at least 12%, regardless of the lower limit.
2.2	**Division 2.2** materials are nonflammable, nonpoisonous compressed gases including compressed gas, liquefied gas, pressurized cryogenic gas and compressed gas in solution. They include any material or mixture that (a) exerts in the packaging an absolute pressure of 280 kPa (41psia or greater at 20C (68F), and (b) does not meet the definition of Divisions 2.1 and 2.3.
2.3	**Division 2.3** materials are gases that are poisonous by inhalation and are (a) known to be so toxic to humans that they pose a health hazard during transportation, or (b) in the absence of adequate data on human toxicity, are presumed toxic to humans because when tested on laboratory animals they have an LC50 value of not more than 5000 ml/m3.

[10] IMDG Code
[11] 49 Code of Federal Regulations Part 173 Definitions

United Nations Hazardous Materials Classification System	
Classification	Definition
3	**49 CFR Part 173.120 – Flammable Liquid Materials**
	A flammable liquid is (a) any liquid having a flash point of not more than 60.5C (141F), or (b) any material in a liquid with a flash point at or above 37.8C (100F) that is intentionally heated and offered for transportation, or transported, at or above its flash point in a bulk packaging. A distilled spirit of 140 proof or lower is considered to have a flash point no lower than 23C (73F).
	A combustible liquid is any liquid that does not meet the definition of any other hazard class and has a flash point above 60.5c (141F) and below 93C (200F). The classification of a material as a combustible liquid is strictly for transportation within the United States and is not recognized internationally. However, 49CFR Part 173.120(b)(2) provides for Class 3 Flammable Materials with flash points at or above 38C (100F) and up to 60.5C (141F) which do not meet the definition of any other hazard class, to be reclassified as combustible liquids for transportation by highway and rail. For shipments involving any air, water, or international movement, these materials are Class 3 Flammable Materials.
4	**49 CFR Part 173.124 – Flammable Solid Materials**
4.1	**Division 4.1** Flammable Solid includes any of the following three types of flammable solid material: Wetted explosives, which, when dry, are explosives of Class 1, other than those of compatibility group A, which, when wetted, suppress the explosive properties, and materials specifically authorized by name in the HMT or by the Associate Administrator for Hazardous Materials Safety. Self-reactive materials that are liable to undergo, at normal or elevated temperatures, a strongly exothermal decomposition caused by excessively high transport temperatures or by contamination. Readily combustible solids that may (a) cause a fire through friction, or (b) show a burning rate faster than 2.2 mm (0.087 inch) per second under specified test procedures, or any metal powders that can be ignited and react over the whole length of a sample in ten minutes or less under specified test procedures.
4.2	**Division 4.2** Spontaneously Combustible material includes (a) liquid or solid pyrophoric material, which (even in small quantities and without an external ignition source), can ignite within five minutes after coming in contact with air under specified test procedures, or (b) self heating material which (when in contact with air and without an energy supply), is liable to self-heat and which exhibits spontaneous ignition, or under specified test procedures would be classed as a Division 4.2 material.
4.3	**Division 4.3** Dangerous When Wet material are ones which (a) by contact with water are liable to become spontaneously flammable, or (b) give off flammable or toxic gas at a rate greater than one liter per kilogram of material per hour under specified test procedures.
5	**49 CFR Part 173.127 & 128 – Oxidizer & Organic Peroxide Materials**
5.1	**Division 5.1** Oxidizer material is a material which may (generally by yielding oxygen), cause or enhance the combustion of other materials.
5.2	**Division 5.2** Organic Peroxide material is any organic compound containing oxygen (O) in the bivalent -O-O- structure which may be considered a derivative of hydrogen peroxide, where one or more of the hydrogen atoms have been replaced by organic radicals, with some exceptions.
6	**49 CFR Part 173.132 & 134 – Poison Materials**
6.1	**Division 6.1** those materials, other than gases, which (a) are known to be so toxic to humans as to afford a hazard to health during transportation, or (b) in the absence of adequate data on human toxicity, are presumed to be toxic to humans because they fall within specified oral, dermal, or inhalation toxicity ranges when tested on laboratory animals, or (c) are irritating materials (with properties similar to tear gas), which cause extreme irritation, especially in confined spaces.

United Nations Hazardous Materials Classification System	
Classification	Definition
6.2	**Division 6.2** materials are (a) infectious substances which are viable microorganisms (or their toxins) which cause or may cause disease in humans or animals., (b) those agents listed in 42CFR part 72.3 of the Department of Health and Human Services regulations, or (c) any other agents which cause or may cause severe disabling or fatal disease.
7	**49 CFR Part 173.403 – Radioactive Materials**
	A Radioactive Material is any material having a specific activity greater than 0.002 micro curie per gram (MCi/g).
8	**49 CFR Part 173.136 – Corrosive Materials**
	A Corrosive Material is a liquid or solid which causes visible destruction or irreversible alteration in human skin tissue at the site of contact, or a liquid which has a severe corrosion rate on steel or aluminum in accordance with specified criteria.
9	**49 CFR Part 173.140 – Miscellaneous Materials**
	A Miscellaneous Hazardous Material is one which presents a hazard during transportation but does not meet the definition of any other hazard class. This includes (a) any material, which has an anesthetic, noxious, or other similar property which could cause extreme annoyance or discomfort to any employee so as to prevent the performance of assigned duties, or (b) any material which meets the definition in 49CFR Part 171.8 for an elevated temperature.
ORM-D	**49 CFR Part 173.144 – Other Regulated Materials**
	An ORM-D Material is a material such as a consumer commodity, which (although otherwise subject to the regulations) presents a limited hazard during transportation because of its form, quantity, and packaging. It must be a material for which exceptions are provided in the HMT. In addition to the limited quantity exceptions from labeling, specification packaging and placarding, ORM-D materials are also excepted from the shipping paper requirements unless the material is a hazardous substance, hazardous waste, marine pollutant, or the material is offered or intended for transport by air.

Chemical Abstracts Service (CAS) Registry System. CAS registry numbers are unique numerical identifiers for chemical elements, compounds, polymers, biological sequences, mixtures and alloys. They are also referred to as CAS numbers, CAS RNs or CAS #s. A CAS Registry Number includes up to 10 digits. As there are approximately 12,000 new substances added each day, it is impossible to list them in this document. They are available on-line through the American Chemical Society.[12] An example of a CAS Registry Number is 74-82-8 that corresponds to 'methane' with UN ID Number 1971. In many cases, where the UN ID Number, hazardous material classification division, or hazardous material description was unknown or non-specific, the CAS Registry Number was used to make an association with the corresponding commodity.

Chemical Hazard Response Information System (CHRIS) Code. The Chemical Hazard Response Information System (CHRIS) is designed to provide information needed for decision-making by responsible Coast Guard personnel during emergencies that occur during the water transport of hazardous chemicals. The 3-letter code is designed to facilitate correct identification of chemicals in oral or written communication to assist

[12] American Chemical Society, http://www.cas.org/expertise/cascontent/index.html

first responders in further assessing necessary response needs should there be a release of a particular commodity within their area of responsibility.[13] The total number of CHRIS Codes exceeds 1,300 chemicals and mixtures and therefore the listing of three-letter codes is not provided in this report. However, a CD-ROM, known as CHRIS+, contains the CHRIS database and is available through the U.S. Coast Guard free of charge. This classification, when available, was captured in the dataset. In some cases, the CHRIS Code also helped determine the UN ID Number, hazardous classification division and/or CAS Registry Number.

[13] U.S. Coast Guard Chemical Hazard Response Information System Manual