RAILROAD HAZARDOUS COMMODITY TRAFFIC ANALYSIS FOR REGION 8

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Abstract

The movement of hazardous commodities is critical to interstate commerce in federal Region 8 (which includes the states of CO, MT, ND, SD, UT, and WY). The agricultural economies of the region depend upon the transport of farm chemicals and fertilizers to producers in rural areas. Moreover, industries and homes depend upon the regular flow of petroleum products, gasoline, and other industrial chemicals.

At present, state transportation departments and communities have limited information at their disposal regarding hazardous commodity flows within and through the region. Better identification of major commodity flows and general flow characteristics could be very useful in emergency response planning and risk assessment.

Most of the hazardous materials research and data collection efforts are directed at highway movements. However, more than 1.5 million rail carloads of hazardous commodities are originated in the United States and Canada each year. This rail volume is equivalent to over five million annual truck shipments.

This report develops a baseline inventory of rail hazardous commodities that originate in, terminate in, or pass through Region 8. The inventory also includes a set of interregional tables that summarize hazardous rail commodity flows to and from each federal region. These tables were developed from a special version of the waybill database provided by the U.S. DOT. The most important uses of the inventory are in: 1) identifying the general commodities and the magnitudes of hazardous rail commodity flows within the region, 2) describing interregional commercial flows of hazardous materials, and 3) providing commodity flow information for use in general emergency response planning. Appendix E (which can be obtained by authorized state

transportation department personnel) includes a detailed description of business trade area flows and detailed commodity definitions.

The report also includes an evaluation of the usefulness of the waybill sample for hazardous commodity analysis, as well as a background discussion of waybill concepts and data elements. In conclusion, the report recommends a strategy for updating the traffic inventory in future years and recommendations for improvements in future database format. The computer programs written to manipulate the waybill file should be useable in future years, as should the formatting procedures for the tables and appendices.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The movement of hazardous materials (hazmats) and hazardous substances is critical to interstate commerce. In 1986, the Office of Technology Assessment estimated that approximately 500,000 shipments of hazardous materials occurred each day in the United States (OTA, 1986) — an estimate that is still used today (TRB-239, 1993). These hazmat movements raise a wide range of issues and concerns including: route selection and designation; safety enforcement and monitoring of hazmat carriers; and emergency response planning.

Hazmat traffic is especially important to industrial development and commerce in federal Region 8 (which includes the states of CO, MT, ND, SD, UT, and WY) . The agricultural economies of Region 8 depend upon the transport of farm chemicals and fertilizers to producers in rural areas. Moreover, industries and homes depend upon the regular flow of petroleum products, gasoline, and other industrial chemicals.

In spite of the essential nature and potential consequences of hazmat shipments, state transportation departments and communities have limited information at their disposal regarding hazmat commodity flows within and through the region. The Transportation Research Board recently addressed the issue of hazardous materials information for emergency response in special report 239 (1993). In this report, the TRB discussed various aspects of emergency response preparedness including the benefits of better commodity flow data, noting that "predictable commodity movements on railroad tracks and regular truck routes allow carriers and communities to make preparations."[1]

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[1] (TRB-239, 1993, p 145).

Clearly, the identification of major commodity flows, key routes, and general flow characteristics can be very useful in emergency response preparation. Knowledge of origins, destinations, corridors, and commodity volumes and frequencies can help state and local communities target training to particular materials and allocate scarce emergency response resources in a more cost-effective manner. Moreover, commodity origin and destination data are necessary for route analysis and risk assessment.

RESEARCH OBJECTIVES AND OVERVIEW

Considerable information exists regarding the frequency and nature of hazmat accidents and incidents. However, much less is known about the flows of hazmat commodities by rail and truck. Better commodity flow information can enhance emergency response planning and provide important information for safety planning and management systems in state transportation departments.

During the last 25 years, national and regional hazmat flow studies have been periodically conducted. For example, a 1982 study by List and Abkowitz estimated truck-miles of hazmat movements by region. However, this analysis is outdated and the regional definitions used by List and Abkowitz do not conform to the federal regions. In general, such periodic studies are useful but they do not comprise a usable inventory of commodity flow information at the regional level. Moreover, they provide little or no state information.

A long-range research objective of the Mountain Plains Consortium (MPC) is to develop a region-wide highway and railroad hazmat commodity flow database for emergency services planning and route analysis. However, this is a large-scale undertaking that can only be

accomplished over several years. This report represents an initial step in that direction, providing regional-level information about hazmat movements by rail.

Approximately 1.646 million hazmat carloads were originated in the U.S. and Canada in 1993 [Association of American Railroads (AAR), Bureau of Explosives, 1993]. This level is consistent with the average for the 1989-1993 period of approximately 1,587,800 carloads.[2] Approximately one million of these shipments occurred in tank cars. The top 10 hazmat commodities shipped by rail include: LPG and vinyl chloride (flammable gases); sodium hydroxide, sulfuric acid, and phosphoric acid (corrosive materials); anhydrous ammonia (a nonflammable gas); chlorine (a poisonous gas); fuel oil and diesel (combustible liquids); and methyl alcohol (a flammable liquid).[3] Other farm chemicals transported by rail include urea nitrate, superphosphate, and various pesticides.

Many farm chemical shipments are intermodal movements consisting of three stages: (1) a long-distance rail movement into rural areas, (2) trans-loading and storage at central distribution centers, and (3) final delivery by truck. Examination of the rail portion of these movements can serve several purposes. First, hazmat origins and key rail corridors can be identified. Second, transshipment zones can be located from which outbound truck shipments of farm chemicals can be expected to originate. Third, the general magnitude of truck delivery trips can sometimes be inferred from inbound railroad volumes.

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[2] The magnitude of rail hazmat traffic is frequently perceived to be less significant than it really is. For example, a typical load factor for a tank car shipment of hazardous materials is 83 tons (this factor is computed from BN's 1992 QCS report for 28-series commodities). In comparison, a tanker truck operating at 80,000 pounds will typically have a net load of 23 to 25 tons. In essence, one railroad tank car is roughly the equivalent of 3.5 tank truck loads. Therefore, the one million rail tank car shipments cited in the text may be equivalent to 3.5 million highway shipments.

[3] Source: TRB-243, 1993, page 49.

The objectives of this current study are: (1) to develop a baseline inventory of hazmat shipments by rail in Region 8, (2) to illustrate the use of the railroad waybill sample in hazmat flow analysis, and (3) to describe a process for state transportation departments to develop an inventory of rail hazmat shipments on an annual basis.

The remainder of the report is organized as follows. First, major national sources of hazmat traffic data are classified and summarized. This section provides an overview of accident and incident information as well as traffic data. Second, the railroad waybill sample — the primary source of railroad commodity flow information — is described. Third, some background information is presented regarding the classes and definitions of hazardous materials transported by rail. An understanding of these terms is necessary to properly interpret the commodity flow tables and charts. Fourth, Region 8 rail hazmat traffic is analyzed and summarized. Fifth, a process for replicating this study is highlighted and, in conclusion, recommendations for further research and data integration are presented.

OVERVIEW OF HAZMAT DATA SOURCES

A substantial amount of hazmat data already exists at the national level. Tables 1, 2, and 3 summarize many of these hazmat sources[4]. The databases listed in Tables 1-3 are classified according to whether the elements primarily relate to hazmat accidents, incidents, or exposure[5].

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[4] The primary source of the highway elements of these tables is a paper by Hobeika and Kim (1991). However, the authors have added several rail and waterway data elements to the tables and are responsible for their accuracy.

[5] The Federal Railroad Administration also maintains internal accident data not encompassed by the references in Tables 1 or 2.

Table 1. Accident Databases

Database Agency	Type of Database	Hazardous Materials
FARS-Fatal Accident Reporting System (USDOT NHTSA)	All fatal traffic accidents in the United States.	Presence or absence of Hazmat (no indication of whether Hazmat was released)
NASS-National Accident Sampling System (USDOT NHTSA)	Accident sample drawn from 35-50 representative Primary Sampling Units (PSUs)	Presence or absence of Hazmat (no indication of whether Hazmat was released)
FHWA Motor Carrier Accident Reports (USDOT OMC)	Accidents involving vehicles of regulated interstate motor carriers	Presence or absence of Hazmat; Principal type of cargo; Occurrence of Hazmat spillage

Table 2. Incident Databases

Database Agency	Type of Database	Hazardous Materials
Hazardous Materials Incident Reports (RSPA)	Incidents involving unintentional release of Hazmat	Type of Hazmat involved; Quantity released; Type of container and packaging; Nature of packaging failure
AAR/BOE	Railroad tank car hazmat leaks	Railroad tank car hazmat leaks by commodity, by source of leak
EPA Spill Reports	Incidents involving unintentional release of Hazmat	Verbal description of nature of emergency, type of material spilled and volume spilled

Table 3. Exposure Databases

Database Agency	Type of Database	Hazardous Materials
TIUS-Truck Inventory and Use Survey (Bureau of the Census)	Survey of a sample of truck owners in all 50 states	Percentage of time the truck was used to haul Hazmat; Type of Hazmat hauled
CTS-Commodity Transportation Survey (Bureau of the Census & USDOT); changed to *Commodity Flow Survey (CFS)* in 1993	Survey of Transportation modes used by a specific sample of companies to ship specific commodities	Type of commodity shipped
FHWA *Motor Carrier Census* (USDOT/FHWA/OMC)	Census of operations by individual motor carriers	Type of Hazmat carried; Container type used for each USDOT Hazmat class
Association of American Railroads (BOE) Annual Reports	Aggregate information on hazmat transported by rail	Annual hazmat traffic by commodity
U.S. DOT/Surface Transportation Board, *Railroad Waybill Sample*	Stratified random sample of railroad shipments	Type of Hazmat (7-digit STCC); Total cargo weight; Population expansion factor
Waterborne Commerce Statistics	State-to-state commodity movements by water	Type of commodity (5-digit STCC level)

An *incident* involves an unintentional release or spill of a hazardous material or substance. A truck or train accident may result in an incident if the container is breached or otherwise damaged, or if an explosion occurs. However, a rail or truck accident will not necessarily result in an incident. Moreover, incidents may occur in rail yards, terminals or industry locations during loading, unloading or storage.

Exposure refers to the general risk or frequency of accidents. Expected travel and traffic levels are two generalized measures of exposure. In general, the expected frequency of over-the-road highway incidents is a function of the truck accident rate per vehicle mile of travel (VMT), the likelihood of a breach of containment, and the annual VMT in a state, region or corridor.

Similarly, the expected frequency of railroad line-haul accidents is affected by annual freight car miles, ton miles, train miles or other measures of exposure. However, rail accidents frequently occur in switch yards rather than during train movements. Therefore, line-haul variables such as freight car miles only reflect railroad hazmat exposure if yard switches are highly correlated with distance.

Specific data regarding hazmat VMT, rail car miles and accident rates are difficult to obtain. Thus, *overall* accident rates per VMT and freight car mile are frequently used in accident analysis.

The Bureau of Explosives of the AAR publishes some annual rail hazmat traffic statistics. In their *Annual Report of Hazardous Material Transported by Rail*, the AAR summarizes the carloads originated and terminated in each state. Table 4 lists the 1993 AAR statistics for the states located in Region 8.

As the table shows, over 53,000 carloads of hazmat traffic were originated by rail in federal Region 8 during 1993. Moreover, nearly 70,000 carloads were terminated in the region. (Note: originated and terminated carloads cannot be added since the same car may have originated in CO and terminated in CO). Wyoming originated 19,763 of these carloads, while CO and UT originated 12,330 and 10,572 carloads, respectively. The remaining states originated less than 10,000 hazmat carloads each. CO terminated the most hazmat traffic (22,769 carloads). However, MT and UT also terminated over 16,000 carloads each. Table 4 also shows the incidents [including the leaks and splashes] that occurred in each state.

Table 4. Hazmat Carloads Originated & Terminated by Rail in Region 8, 1993

State	Carloads Originated	Carloads Terminated	Incidents
CO	12,330	22,769	24
MT	5,973	16,284	9
ND	4,269	7,602	2
SD	52	683	0
UT	10,572	16,127	36
WY	19,763	6,122	20
Total	52,959	69,587	91

Source: Bureau of Explosives, AAR. Report BOE 93-1.

Although the AAR data are insightful, they are too aggregate in nature to be of direct use in statewide or emergency response planning. The AAR report does not identify the actual commodities originated and terminated, or the quantity of traffic that passed through the states en route to other destinations. Such bridge or overhead traffic is important to statewide and emergency response planning. In essence, the AAR summary does not provide information regarding exposure to risk or significant commodity characteristics. Fortunately, the waybill sample can shed some light on these questions.

THE RAILROAD WAYBILL SAMPLE

As illustrated in Table 3, the primary traffic or exposure database for railroads is the waybill sample. Two versions of this sample are currently available — the public use and the master. Both versions are highlighted in the following discussion.

Public Use Railroad Waybill Sample

The Public Use Waybill Sample (PWS) is derived from the master sample. As its name implies, the PWS is available to the general public and is included in the *Transportation Data Sampler* published by the Bureau of Transportation Statistics of the U.S. DOT.

The PWS is useful for general commodity analysis. However, it is of limited use in hazmat studies, because key geographic and commodity data are frequently masked or aggregated. Such aggregation limits hazardous commodity identification and route analysis.

In the PWS, commodities are identified by the first five digits of the seven-digit standard transportation commodity code (STCC). Such broad groups can be quite heterogeneous. Some commodities within a five-digit STCC group may be hazardous, while others are not. In order to mark hazmat movements, a "flag" is encoded on the public use record. The flag denotes whether the commodity is hazardous; however, it does not define the nature of the hazardous cargo. The nature of the hazmat can sometimes be inferred from the five-digit STCC; but at other times the five-digit identifier is too general. The following examples illustrate the problem.

Urea Nitrate and Anhydrous Ammonia (AA) are two agricultural chemicals widely transported in Region 8. Many of these shipments move at least part of the way by rail. The four-digit STCC for AA is 2819- *Industrial Inorganic Chemicals, NEC* (not otherwise classified). The five-digit STCC is 28191- *Ammonia or Ammonium Compounds*. Both classifications are too general to understand the hazardous nature of the cargo. AA is a nonflammable compressed gas and a corrosive material. Neither fact could be inferred from the PWS. In the case of Urea Nitrate, the five-digit STCC identifies it as an explosive. However, it

cannot be inferred from the description whether Urea is a Class A or B explosive, a flammable liquid, or a flammable solid. (Urea Nitrate is in fact a flammable solid).

Master Railroad Waybill Sample

Unlike the PWS, the master waybill sample contains the full seven-digit STCC. In addition, the master waybill sample identifies hazardous commodities with a special seven-digit code. STCCs for hazmat movements (other than waste) begin with the number "49." Hazardous waste STCCs begin with the number "48." These hazmat codes allow explicit identification of the class of hazard and provide valuable risk assessment or emergency response information.

The general public does not have access to the master waybill sample. However, each state transportation department can obtain a state sub-sample of the master file from the U.S. DOT. The state sample includes traffic that originates in, terminates in, or passes through a particular state. The following sections of the report presents background information on both the state (master) and the public waybill samples.

Waybill Sample Structure

The sampling frame for the waybill sample is the terminating railroad. All railroads that terminated more than 4,500 revenue carloads of freight during any of the previous three years, or any railroad that terminated more than 5 percent of the traffic in a given state during any of the previous three years, must participate in the waybill sample. Since the sampling frame is the terminating railroad, many short-line railroads that originate traffic and many Canadian origins are reflected in the data.

The sampling unit is the waybill; a document or record that is created each time a shipment is consigned (with the possible exception of contract movements). The waybill is a legal document based on the bill of lading that defines the terms of transportation and specifies a legal weight for billing purposes. The sample record in the waybill file contains much of the pertinent information from the waybill, plus some information that is added by the sampling railroad or by the sampling agency.[6]

Waybill Sampling Methods

Early versions of the waybill sample (e.g. prior to 1981) did not follow the sampling methods used today. In earlier years, a simple random sampling technique was used that did not employ different sampling rates for various shipment sizes. Since only one waybill is typically cut for a given shipment regardless of the number of cars in the consignment, large unit train shipments were under-represented in early samples. Therefore, most waybill time-series analyses are confined to the modern era of waybill sampling: post -1981.

The ICC extensively revised the waybill sampling procedures in 1981 to reflect the frequencies of different carload strata. This process is documented in Wolfe (1986)[7] and Fine and Owen (1981).[8] These changes resulted in a stratified random sampling procedure based on the

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[6] The sampling agency throughout most of the history of the waybill sample has been the ICC. However, the recent elimination of the ICC resulted in the subsequent transfer of functions to USDOT. In future years, it is expected that the Surface Transportation Board or the FRA will oversee the sampling process.

[7] K. Eric Wolfe, Carload Waybill Statistics: A Content Analysis. Journal of Transportation Research Forum. 1986. The extensive ICC revision of the waybill sampling procedures in 1981 is discussed by K. Eric Wolf.

[8] Sidney Fine and Rebecca Owen co-authored Documentation of the ICC Waybill Sample in 1981. This document served as a supplementary reading to the lecture notes.

number of cars per shipment. The sampling strata and corresponding rates are — 1-2 cars (1:40); 3-15 cars (1:12); 16-60 cars (1:4); 61-100 cars (1:3); and more than 100 cars (1:2).

Today, most railroads report data in machine readable input (MRI) format. However, smaller railroads may still use paper waybills and sample by hand. In these cases, the sampling agency provides the railroad with a random number table and a starting number sequence.

The MRI sampling rates adopted by the ICC in 1981 provide good coverage of larger multiple-car and unit train shipments. At least 25 percent of cars are sampled for movements of 16 cars or more. For many unit trains, the sampling rate is 1:2, or 50 percent. Even if a railroad still follows the antiquated hard-copy sampling process, the sampling rate for 26 car shipments is 20 percent.

Geographic and Railroad Identifiers

The master waybill file contains a range of geographic identifiers including the Standard Point Location Code (SPLC) and Freight Station Accounting Code (FSAC).[9] From these codes, the origin and destination station, city, county, and state can be identified. The master waybill file also identifies each railroad involved in the sample movement and its participation in the routing (e.g. origin carrier, terminating carrier, bridge carrier).

Both the master and pubic use waybill data files include a trade area definition—the Business Economic Analysis or *BEA* area—and the freight rate territory, a broad regional definition. BEAs are defined by the U.S. Department of Commerce as

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[9] Both the FSAC and the SPLC can be obtained from the appendix of the Official Railway Guide or from published tariffs. In addition, the American Trucking Association sells an electronic version of the nationwide SPLC tariff.

> ...nodal functional areas delineated to facilitate regional functional analysis. Each area consists of an economic node—a standard metropolitan statistical area (SMSA), or similar area that serves as a center of economic activity—and the surrounding counties that are economically related to the centers.[10]

The United States is demarcated into 183 BEAs.[11] A BEA map of the United States is shown in Appendix A. In addition, the BEAs located within Region 8 are named in a later section of the report.

The masking of BEAs is a second aggregation problem associated with the PWS. If the identification of a BEA could possibly disclose individual shipper or carrier data, then only the freight rate territories are shown.

Sample Traffic and Population Variables

The public use sample contains some important traffic and revenue data including: (1) the number of cars in the shipment, (2) the number of tons in the shipment, (3) the number of trailer and container units in the shipment (for intermodal movements), and (4) the line-haul revenue. The state sample contains the same variables, but also provides an estimated division of revenues for each railroad participating in the movement. These traffic variables are important because they reflect both the magnitude and the commercial value of hazmat shipments.

In addition to sample statistics, both the public use and state waybill samples contain expanded (population) estimates of annual carloads, and tons for each sample movement. In the simplest case, the population values are the sample statistics multiplied by the inverse of the sampling ratio. For example, the carloads and tons for a single-car shipment would be multiplied

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[10] U.S. Department of Commerce. *BEA Economic Areas*. Washington, D.C., 1977.

[11] Additional BEA definitions cover Canadian and Mexican regions.

by 40 to generate annual population estimates for the specific origin-destination commodity flow.

Wolfe (1986) notes that the actual sampling rate may not exactly equal the *theoretical* sampling rate due to a railroad's billing method or interpretation of sampling procedures. However, each railroad also reports the actual stratum population size and stratum sample count. The sampling agency then uses these values to compute an *exact* expansion factor which is used to compute the expanded values on the public sample. Analysts should be aware of possible differences between the exact and theoretical expansion factors when using the state sample or when using the expansion factor as a weight variable.

In general, waybill population estimates are unreliable for a small geographic area (such as a county or branch-line market region). At the substate level, an expanded population estimate may be quite different from the actual annual tonnage, particularly if the traffic consists of sporadic single-car shipments. However, the waybill sample may still be useful in localized analysis. For example, it could be used to look at the types of commodities moving into and out of an area and the general markets. However, local population traffic estimates must be used with caution.

Distance Variables

The shortest distance between two points via a single railroad is frequently referred to as *short-line miles.* The public waybill sample contains the sum of the short-line miles for all carriers in the movement; it is the only distance variable included in the PWS.

The master waybill sample contains additional distance data. The ICC utilizes a rail network model originally developed at Princeton University to route each shipment. The routing algorithm contains impedance factors for various rail lines. The simulated route for a movement may differ from the shortest distance due to link impedance caused by track standards, conditions, traffic densities, etc.

The ICC's network *does not* reflect actual way train routes or consolidation and delivery practices at origin and destination. Thus, while these network distances represent an improvement over naive short-line miles, they may still differ somewhat from the actual route of a given movement. This difference between actual and short-line miles is often called rail *circuity*.

Circuitous routing frequently occurs at origin or destination due to way-train movements against the market. For example, a car headed west may first move east in a way train to a regional yard for classification, and then move west again through the origin city, en route to its ultimate destination. Circuitous routing also may occur in the movement of cars to and from interchange points.

HAZARDOUS MATERIAL AND HAZARDOUS WASTE DEFINITIONS

In addition to the standard 7-digit Standard Transportation Commodity Code or STCC, each hazardous material or waste is represented by a special 49-series STCC. These codes are listed in the AAR's Standard Transportation Commodity Code Tariff.[12] This tariff contains three

[12] The tariff used for completing this report was Standard Transportation Commodity Code Tariff STCC 6049-U. It was issued December 10, 1992 and was effective January 1, 1993. There are five supplements to the tariff; supplements 3, 4, and 5 contain all changes to the tariff. Supplement five was issued September 10, 1993 and was effective October 1, 1993.

sections. Section 1 contains two parts; Part 1 is an alphabetical listing of hazardous waste STCC descriptions, and Part 2 is a numerical listing of hazardous waste STCC descriptions. Section 2 contains three parts; Part 1 is an alphabetical listing of hazardous materials response codes, Part 2 is a numerical listing of hazardous materials response codes, and Part 3 contains a numerical listing of 49 series codes and a bridge table. Section 3 is an appendix to the tariff listing all hazardous materials other than radio nuclides.

Appendix D of this report condenses the full tariff by listing only those hazmat or hazardous wastes commodities that originate in, terminate in, or potentially pass through Region 8. The bolded entries represent commodities that pass through Region 8; these through shipments are not included in the summaries found in Appendices B and C. The definitions in Appendix D correspond to those stated in the STCC tariff issued December 10, 1992.

DEFINITION OF FEDERAL REGIONS

An obstacle in developing a regional hazmat traffic inventory is defining regions from BEAs. The United States is demarcated into 10 federal regions, which are further divided into Business Economic Analysis Areas (BEAs). Canada is represented by an additional seven BEAs. (Canada is referred to in this study as Region 11).

BEAs are sets of counties. Frequently, a BEA includes counties from more than one state. Thus, when BEAs are aggregated to the level of federal regions, the resulting geographic definitions will not exactly conform to the boundaries of the federal region. However, these geographic regions are close approximations of the federal regions. Table 5 lists the BEAs and states included in each region.

Table 5. BEA Composition of Regions in the United States and Canada

Region	Business Economic Area (BEA)	States
Region 1	1,2,3,4,5,6	ME, VT, MA, RI, CT
Region 2	7,8,9,10,11,12	NY
Region 3	13,14,15,16,17,18,19,20,21,22,23,59,60,61,62,63	PA, MD, DC, VA, WV, DE
Region 4	24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55, 56,57,58	NC, SC, GA, FL, AL, TN, KY
Region 5	64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79, 80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95, 96,97,98,99	OH, MI, IN, IL, WI, MN, IA
Region 6	109,110,111,112,113,114,115,116,117,118, 119,120,121,122,123,124,125,126,127,128, 129,130,131,132,133,134,135,136,137,138,160	AR, MS, LA, TX, OK, NM
Region 7	100,101,102,103,104,105,106,107,108,139, 140,141,142,143,144,145	IA, MO, KS, NE
Region 8	146,147,148,149,150,151,152,153,154,155, 156,157,158,159,165	SD, ND, MT, WY, CO, UT
Region 9	161,162,163,164,174,175,176,177,178,179, 180,181,183	AZ, NV, CA, HI
Region 10	166,167,168,169,170,171,172,173,182	ID, WA, OR, AK
Region 11	185,186,187,188,189,190,191	Canada

REGIONAL HAZMAT TRAFFIC SUMMARY

For purposes of this study, the U.S. DOT provided North Dakota State University with two years of railroad waybill data. This special data base contained all rail hazmat traffic for the years 1990 and 1991. To protect the confidentiality of waybill data, only limited information was included on the special waybill record. Railroads were not identified. Since only BEA-level shipment data were provided, origin or destination states or junction states (where shipments are interchanged between railroads) were not identified.

A computer program was written to manipulate the waybill sample provided by U.S. DOT. An internal assignment table (based on Table 5) was developed to assign BEAs to federal regions. Also, a procedure was written to identify commodities that potentially pass through Region 8 based on the origin and destination BEAs.

Region 8 Traffic Summary

This section of the report (and appendices B and C) uses the special U.S. DOT database to describe rail hazmat commodity flows that pass through, originate in, and terminate in the federal regions. Tables B.1 and B.2 of Appendix B summarize 1990 traffic that originated and terminated in Region 8, respectively. Tables B.3 and B.4 provide analogous information for 1991.

The movements in Appendix B are cross-classified by originating and terminating regions. To summarize a large amount of data, hazmat and hazardous waste categories are represented by a partial STCC (or *hazstcc*). This code contains only the first four digits of the seven-digit hazmat STCC. For example, the first hazardous material referred to in Table B.1 of

Appendix B is identified by the partial STCC code "4901," which includes "Class A Explosives." In 1990, 8,080 tons of Class A Explosives were originated by railroads in Region 8. As Appendix B shows, all of this tonnage was terminated in Region 4.

Overall, the quantity of hazmat and hazardous wastes originating in Region 8 remained relatively constant during the period, decreasing slightly from 3,965,476 tons in 1990 to 3,963,801 tons in 1991. Table 6 lists the four most common hazardous commodities originating in Region 8. In 1990, 87 percent of the hazmat and hazardous waste shipments (in terms of tonnage) were included in these top four groups; while in 1991, the four groups accounted for approximately 79 percent of shipment tons. The remaining hazardous commodity groups are shown in Appendix B.

Table 6. Distribution of Hazardous Commodities Originating in Region 8

Generic Class	Originating in 1990	Originating in 1991
ORM, Group C	33.9%	26.3%
Flammable Liquid	22.3%	17.9%
Flammable Compressed Gas	15.7%	19.2%
Corrosive Material	15.2%	19.5%

The table above was computed from Tables B.1 and B.3 in Appendix B. As Table 6 shows, *Other Regulated Materials (ORM) Group C* was the largest class of hazardous movements during 1990 and 1991, with 33.9 percent and 26.3 percent of tons, respectively. This group (represented by the partial STCC code *4945*), includes substances such as water reactive

pesticides and disposable lithium batteries that pass through Region 8, and substances like sulfur that both originate and terminate in Region 8.

Flammable liquids were the second largest group of commodities shipped during 1990, comprising 22.3 percent of the tonnage originated in Region 8. This category included substances such as benzene, paint, alcoholic beverages, and petroleum oil that pass through Region 8, and substances such as petroleum crude oil that originate or terminate in Region 8.

The remaining major commodity classes were Flammable Compressed Gases and Corrosive Materials, each of which represent over 15 percent of the tons originated in Region 8 during 1990. The 1991 percentages of these same commodities are shown in the third column of Table 6.

The quantities of hazmats and hazardous wastes terminating in Region 8 also remained relatively constant during the period, decreasing approximately 4 percent, from 3,017,832 tons in 1990 to 2,895,864 tons in 1991. Tables B.2 and B.4 of Appendix B contain descriptions of the hazardous commodities terminated in Region 8 during each year. Table 7 shows the major commodity types received and the percentage of the total tons that each group accounted for.

Table 7. Distribution of Hazardous Commodities Terminating in Region 8

Generic Class	Terminating in 1990	Terminating in 1991
Flammable Liquid	27%	22.2%
Non-Flammable Compressed Gas	17.2%	19.3%
Mixed Load	17%	15.4%
Flammable Compressed Gas	11.7%	16.2%

The preceding table was constructed using the values in Tables B.2 and B.4 in Appendix B. As Table 7 shows, the generic class of Flammable Liquids comprised the greatest number of tons terminated in Region 8 during 1990 and 1991 with 27 percent and 22 percent, respectively. Non-Flammable Compressed Gases — such as Compressed Air, Nitrogen or Refrigerant Gases — accounted for 17.2 percent of traffic in 1990 and 19.3 percent in 1991. (Note that the *Mixed Load* category shown in Table 7 is not a shipping name, but rather a term used when a trailer or freight car is carrying more than one commodity in a load.)

More details regarding the hazardous commodities shipped within and through Region 8 can be gleaned from Appendix D. The hazmats and hazardous wastes that pass through Region 8 are designated with a bold font in Appendix D, while those commodities which originate or terminate in Region 8 are shown in normal font. For example, Appendix D shows that within the Class A Explosives group of hazmats (4901), Cartridges for Weapons (4901105) originate or terminate in Region 8, while two other classes of explosives only pass through Region 8: 1) Ammunition, Smoke (4901105) and 2) Ammunition, Toxic (4901164).

As Appendix B shows, the commodities originating in Region 8 are terminated in all 11 regions. The following section of the report provides a distribution of the commodity movements to and from major regions during 1990 and 1991.

Interregional Flow Summary

Tables C.1 and C.2 of Appendix C summarize interregional flows of hazmats and hazardous wastes during 1990 and 1991, respectively. Table 8 summarizes the major origin or supply regions for Region 8 traffic.

Table 8. Destination of Hazardous Commodities Originating in Region 8 (1990)

Terminating Region	% of Tons Originating in Region 8 in 1990
Region 8	27.8%
Region 10	20.9%
Region 5	11.8%

Table 8 lists only the top three terminating regions for commodities originated in Region 8 during 1990. As the table shows, approximately 28 percent of the tons originated in Region 8 also terminated within Region 8. Region 10 received the second highest percentage of tons shipped from Region 8 (21 percent), while Region 5 received approximately 12 percent of the tons originated from Region 8.

As Table 9 shows, the top four regions received over 70 percent of the hazardous materials originating from Region 8 in 1991. More than 25 percent of the commodities originating in Region 8 terminated in Region 10.

Table 9. Destination of Hazardous Commodities Originating in Region 8 (1991)

Terminating Region	% of Tons Originating in Region 8 in 1991
Region 10	25.1%
Region 8	21.7%
Region 4	12%
Region 5	11.8%

As Table 10 shows, the commodities terminated in Region 8 are gathered from 10 of the 11 federal regions. In 1990 and 1991, Region 8 received shipments from every region except for Region 1.

Table 10. Originating Region for Hazardous Commodities Terminating in Region 8 (1990)

Originating Region	% of Hazardous Material Terminating in Region 8 in 1990
Region 8	36.6%
Region 6	14.3%
Region 5	11.9%

As Table 10 shows, almost 63 percent of the hazardous commodities terminating in Region 8 during 1990 were originated in Regions 5, 6 and 8, with the largest percentage (36.6 percent) originated from within Region 8 itself.

Table 11. Originating Region for Hazardous Commodities Terminating in Region 8 (1991)

Originating Region	% of Hazardous Material Terminating in Region 8 in 1991
Region 8	29.7%
Region 11	15.5%
Region 6	14.2%
Region 5	11.4%

Table 11 shows that almost 71 percent of the hazardous commodities terminated in Region 8 in 1991 came from Regions 8, 11, 6, 5. As in 1990, Region 8 originated the highest

percentage of terminated traffic. The remaining distributions for other regions for 1990 and 1991 are shown in Tables B.2 and B.4 of Appendix B.

Emergency Response Planning Data

The analysis presented in Appendices B and C summarizes a vast amount of flow data at the four-digit hazstcc level. However, it also is possible to compile information at more detailed commodity and geographic levels. Such analyses are usually relevant at the state or local level for purposes of emergency response planning (where more detailed commodity information is critical to understanding the hazardous nature of the cargo). However, greater safeguards are needed to protect the confidentiality of waybill data when used for local planning purposes.

State transportation department employees or other authorized state personnel can use waybill data, summarized at the seven-digit hazstcc and substate geographic levels, for internal departmental or planning purposes. However, public dissemination of product class or BEA-level data may unnecessarily disclose business information that railroads or shippers prefer to keep private. Consequently, the Surface Transportation Board places several restrictions on the release of waybill data, as exemplified in this agreement with the state of North Dakota.

> For purposes of releasing waybill data, members of state and local emergency planning committees are considered state employees. However, you [*state transportation department personnel*] should release to these committees only the hazardous material waybill data pertaining to: number of carloads, tons, type of equipment used, and the generic class or category of hazardous material passing over the rail lines in the communities under study.

As part of this project, we have summarized the 1991 interregional flows at the seven-digit hazstcc and BEA levels. These flows are contained in a separate appendix (not included in this report) referred to as Appendix E. Appendix E will be supplied to U.S. DOT personnel or

state departments of transportation upon request for internal or "in-house" use. With Appendix E, state transportation and emergency response planners can use the BEA definitions and map presented in Appendix A, in conjunction with the hazmat STCC decoder shown in Appendix D, to examine the types of hazmat commodities or hazardous wastes moving by rail. However, as previously noted, such localized estimates of population carloads and tons are less reliable than regional or statewide estimates, given the relatively small geographic areas represented by the BEAs. Qualified persons requesting Appendix E must also comply with the disclosure provisions noted above.

CONCLUSION

The primary objective of this project was to develop an initial rail inventory of hazardous commodities moving within or through Region 8 and to define a process for monitoring rail hazardous commodities on an on-going basis. A major outcome of the project is a baseline inventory of hazardous rail traffic for Region 8. The most important uses of the inventory are: 1) to identify the general commodities and the magnitudes of hazardous rail commodity flows, 2) to describe the interregional commercial flows of hazardous materials, and 3) to provide commodity flow information for use in general emergency response planning. Appendix E (which can be obtained by authorized state transportation department personnel) includes a detailed description of BEA-to-BEA flows and detailed commodity definitions. Since the commodity inventory is reflective of traffic characteristics during the early 1990s, it should be updated periodically.

A second outcome of the project is a process for the updating the inventory. The computer programs written to manipulate the waybill file should be useable in future years, as should the formatting procedures for the tables and appendices. However, several lessons were learned during this initial effort. Some additional data available from the U.S. DOT could facilitate processing and compilation of data. First, the junction or interchange states could be included on in the waybill record. These items will allow an easier and more precise identification of traffic that passes through (but does not originate or terminate in) Region 8. Second, the origin and termination states could be included in the data base (in addition to the BEAs). State identification would allow easier definition of federal regions.

Individual state transportation departments have substantial latitude in developing internal hazmat reports. Thus, considerable variations on the reports presented in appendices B and C are possible for individual states.

In closing, in appears that the railroad waybill sample is a good source of information for monitoring rail hazmat flows and identifying hazardous commodities at a statewide or BEA level. Further research should focus on integrating the waybill sample with state Geographic Information Systems (GIS). If such integration is successful, then state transportation and emergency response planners could use GIS software to pinpoint the commodities moving over actual routes and through specific communities. However, at such localized levels, the estimated tonnages and annual carloads will have less reliability than statewide or BEA-level estimates. Thus, the primary use of waybill data in local emergency response planning appears to be identifying the commodity classes moving through an area instead of estimating the relative magnitudes of the commodity flows.

GLOSSARY

Combustible Liquid - Any liquid that does not meet the definition of any other classification and has a flash point at or above 100 degrees F (37.8 degrees C) and below 200 degrees F (93.3 degrees C).

Corrosive Material - A liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or in the case of leakage from its package, a liquid that has a severe corrosion rate on steel. A severe corrosion rate is one exceeding 0.250 inch per year on steel at a test temperature of 130 degrees F.

Flammable Liquid - Any liquid having a flash point below 100 degree F (37.8 degrees C).

Flammable Solid - Any solid material, other than one classified as an explosive, which, under conditions normally incident to transportation, is liable to cause fires through friction, retained heat from manufacturing or processing, or which could be ignited readily and when ignited burns so vigorously and persistently as to create a serious transportation hazard. Included in this class are spontaneously combustible and water reactive materials.

Hazard - The severity of harm relative to a commodity itself occurring from unwanted exposure to the commodity.

Hazardous Materials - A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated.

Hazardous Substance - A material, including its mixtures and solutions that is listed in the Appendix to the Hazardous Materials Table, Part 172.101, when offered for transportation in one package, or in one transport vehicle is not packaged, and when the quantity of the material therein equals or exceeds the reportable quantity (RQ); and, when in a mixture or solution, is in a concentration by weight which equals or exceeds the concentration corresponding to the RQ of the material, as shown in the Table under Par. (3) of the Hazardous Substance definition shown in Part 171.8.

Hazardous Waste - Any material that is subject to the hazardous waste manifesting requirements of the EPA specifies in 40 CFR Part 262.

ORM - Other regulated material.

ORM-A - material which has an anesthetic, irritating, noxious, toxic, or other similar property and can cause extreme annoyance or discomfort to passengers and crew in the event of leakage during transportation.

ORM-E - A material that is not included in any other hazard class but is a hazardous waste or hazardous substance.

Oxidizer or Oxidizing Material - A substance such as a chlorate, permanganate, inorganic peroxide, or a nitrate that yields oxygen readily to stimulate the combustion of organic matter.

Poison B - Those substances, liquid or solid, other than class A poisons (gases) or irritating materials, which are know to be so toxic to man as to afford a hazard to health during transportation; or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man because they fall within one of the following categories when tested on laboratory animals: oral toxicity, toxicity on inhalation, toxicity by skin absorption, or poison-inhalation hazard liquid-special requirements.

Technical Name - Means a recognized chemical name currently used in scientific and technical handbooks, journals, and texts. Generic descriptions are authorized for use as technical names provided they readily identify the general chemical group.

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Appendix A

Business Economic Analysis (BEA) Trade Areas

1. List of BEA Codes and Trade Area Descriptions

2. BEA Map

BEA Code	BEA Description
1	BANGOR, ME
2	PORTLAND-LEWISTON, ME
3	BURLINGTON, VT
4	BOSTON, MA
5	PROVIDENCE-WARWICK-PAWTUCKET, RI
6	HARTFORD-NEW HAVEN-SPRINGFIELD, CT-MA
7	ALBANY-SCHENECTADY-TROY, NY
8	SYRACUSE-UTICA, NY
9	ROCHESTER, NY
10	BUFFALO, NY
11	BINGHAMTON-ELMIRA, NY
12	NEW YORK, NY
13	SCRANTON-WILKES-BARRE, PA
14	WILLIAMSPORT, PA
15	ERIE, PA
16	PITTSBURGH, PA
17	HARRISBURG-YORK-LANCASTER, PA
18	PHILADELPHIA, PA
19	BALTIMORE, MD
20	WASHINGTON, DC
21	ROANOKE-LYNCHBURG, VA
22	RICHMOND, VA
23	NORFOLK-VA. BEACH-NEWPORT NEWS, VA
24	ROCKY MNT-WILSON-GREENVILLE, NC
25	WILMINGTON, NC
26	FAYETTEVILLE, NC
27	RALEIGH-DURHAM, NC
28	GREENSBORO-WINSTON-SALEM-HIGHPNT, NC
29	CHARLOTTE, NC
30	ASHEVILLE, NC
31	GREENVILLE-SPARTANBURG, SC
32	COLUMBIA, SC
33	FLORENCE, SC
34	CHARLESTON-N. CHARLESTON, SC
35	AUGUSTA, GA
36	ATLANTA, GA
37	COLUMBUS, GA
38	MACON, GA
39	SAVANNAH, GA
40	ALBANY, GA

BEA Code	BEA Description
41	JACKSONVILLE, FL
42	ORLANDO-MELBOURNE-DAYTONA BEACH, FL
43	MIAMI-FORT LAUDERDALE, FL
44	TAMPA-ST. PETERSBURG, FL
45	TALLAHASSEE, FL
46	PENSACOLA-PANAMA CITY, FL
47	MOBILE, AL
48	MONTGOMERY, AL
49	BIRMINGHAM, AL
50	HUNTSVILLE-FLORENCE, AL
51	CHATTANOOGA, TN
52	JOHNSON CITY-KINGSPORT-BRISTOL, TN-VA
53	KNOXVILLE, TN
54	NASHVILLE, TN
55	MEMPHIS, TN
56	PADUCAH, KY
57	LOUISVILLE, KY
58	LEXINGTON, KY
59	HUNTINGTON, WV
60	CHARLESTON, WV
61	MORGANTOWN-FAIRMONT, WV
62	PARKERSBURG, WV
63	WHEELING-STEUBENVIL-WIERTON, WV-OH
64	YOUNGSTOWN-WARREN, OH
65	CLEVELAND, OH
66	COLUMBUS, OH
67	CINCINNATI, OH
68	DAYTON, OH
69	LIMA, OH
70	TOLEDO, OH
71	DETROIT, MI
72	SAGINAW-BAY CITY, MI
73	GRAND RAPIDS, MI
74	LANSING-KALAMAZOO, MI
75	SOUTH BEND, IN
76	FORT WAYNE, IN
77	KOKOMO-MARION, IN
78	ANDERSON-MUNCIE, IN
79	INDIANAPOLIS, IN
80	EVANSVILLE, IN
81	TERRE HAUTE, IN
82	LAFAYETTE, IN

BEA Code	BEA Description
83	CHICAGO, IL
84	CHAMPAIGN-URBANA, IL
85	SPRINGFIELD-DECATUR, IL
86	QUINCY, IL
87	PEORIA, IL
88	ROCKFORD, IL
89	MILWAUKEE, WI
90	MADISON, WI
91	LA CROSSE, WI
92	EAU CLAIRE, WI
93	WAUSAU, WI
94	APLETON-GREEN BAY-OSHKOSH, WI
95	DULUTH, MN
96	MINNEAPOLIS-ST. PAUL, MN
97	ROCHESTER, MN
98	DUBUQUE, IA
99	DAVENPORT-ROCK ISLAND-MOLINE, IA-IL
100	CEDAR RAPIDS, IA
101	WATERLOO, IA
102	FORT DODGE, IA
103	SIOUX CITY, IA
104	DES MOINES, IA
105	KANSAS CITY, MO
106	COLUMBIA, OH
107	ST. LOUIS, MO
108	SPRINGFIELD, MO
109	FAYETTEVILLE, AR
110	FORT SMITH, AR
111	LITTLE ROCK-N. LITTLE ROCK, AR
112	JACKSON, MS
113	NEW ORLEANS, LA
114	BATON ROUGE, LA
115	LAFAYETTE, LA
116	LAKE CHARLES, LA
117	SHREVEPORT, LA
118	MONROE, LA
119	TEXARKANA, TX
120	TYLER-LONGVIEW, TX
121	BEAUMONT-PORT AUTHUR, TX
122	HOUSTON, TX
123	AUSTIN, TX
124	WACO-KILLEEN-TEMPLE, TX
125	DALLAS-FORT WORTH, TX
126	WICHITA FALLS, TX
127	ABILENE, TX

BEA Code	BEA Description
128	SAN ANGELO, TX
129	SAN ANTONIO, TX
130	CORPUS CHRISTI, TX
131	BROWNSVILLE-MCALLAN-HAR., TX
132	ODESSA-MIDLAND, TX
133	EL PASO, TX
134	LUBBOCK, TX
135	AMARILLO, TX
136	LAWTON, OK
137	OKLAHOMA CITY, OK
138	TULSA, OK
139	WICHITA, KS
140	SALINA, KS
141	TOPEKA, KS
142	LINCOLN, NE
143	OMAHA, NE
144	GRAND ISLAND, NE
145	SCOTTS BLUFF, NE
146	RAPID CITY, SD
147	SIOUX FALLS, SD
148	ABERDEEN, SD
149	FARGO-MOORHEAD, ND-MN
150	GRAND FORKS, ND
151	BISMARCK, ND
152	MINOT, ND
153	GREAT FALLS, MT
154	MISSOULA, MT
155	BILLINGS, MT
156	CHEYENNE-CASPER, WY
157	DENVER, CO
158	COLORADO SPRINGS-PUEBLO, CO
159	GRAND JUNCTION, CO
160	ALBUQUERQUE, NM
161	TUCSON, AZ
162	PHOENIX, AZ
163	LAS VEGAS, NV
164	RENO, NV
165	SALT LAKE CITY-OGDEN, UT
166	POCATELLO-IDAHO FALLS, ID
167	BOISE CITY, ID
168	SPOKANE, WA
169	RICHLAND, WA
170	YAKIMA, WA
171	SEATTLE, WA

BEA Code	BEA Description
172	PORTLAND, OR
173	EUGENE, OR
174	REDDING, CA
175	EUREKA, CA
176	SAN FRAN.-OAKLAND-SAN JOSE, CA
177	SACRAMENTO, CA
178	STOCKTON-MODESTO, CA
179	FRESNO-BAKERSFIELD, CA
180	LOS ANGELES, CA
181	SAN DIEGO, CA
182	ANCHORAGE, AK
183	HONOLULU, HI
184	NEWFOUNDLAND
185	MARITIMES
186	QUEBEC
187	ONTARIO
188	MANITOBA
189	SASKATCHEWAN
190	ALBERTA
191	BRITISH COLUMBIA
192	PUERTO RICO
193	OTHER NORTHEAST
194	OTHER SOUTHERN
195	OTHER WESTERN
196	OTHER SOUTHWESTERN
197	OTHER MOUNTAIN-PACIFIC

APPENDIX B

ESTIMATED RAILROAD HAZARDOUS COMMODITY FLOWS FOR FEDERAL REGION VIII

Table B.1 Traffic Originating in Region VIII (1990)

HAZARDOUS MATERIAL SHIPMENTS ORIGINATING IN REGION 8

Tonnage Classified by Hazstcc and Terminating Region

Partial HAZSTCC	Descriptive Name	REGION 1	REGION 2	REGION 3	REGION 4	REGION 5	REGION 6	REGION 7	REGION 8	REGION 9	REGION 10	REGION 11	Total	Percentages
4827	Waste Radioactive, Low Activity								1,800				1,800	0.05%
4836	Waste Corrosive Material						3,320						3,320	0.08%
4860	Waste ORM, Group E							1,600		23,900			25,500	0.64%
4875	Waste Stream ORM					7,840			3,960				11,800	0.30%
4901	Class A Explosive				8,080								8,080	0.20%
4902	Class B Explosive								7,200	1,440			8,640	0.22%
4903	Class C Explosive									1,160			1,160	0.03%
4904	NonFlammable Compressed Gas								61,200	3,600	9,760		74,560	1.88%
4905	Flammable Compressed Gas				960	175,000	41,200	71,400	190,840	122,840	19,960		622,200	15.69%
4908	Flammable Liquid							6,640	236,440	6,920			250,000	6.30%
4909	Flammable Liquid				3,800	130,840	31,000	26,760	96,400		49,840		338,640	8.54%
4910	Flammable Liquid										3,760		3,760	0.09%
4915	Flammable Liquid					23,960	57,600	10,400	134,640	3,400	62,508		292,508	7.38%
4916	Flammable Solid					23,520							23,520	0.59%
4918	Oxidizing Material						3,920		11,920	67,920	11,880		95,640	2.41%
4930	Corrosive Material				12,280		12,000	188,840	96,900	112,244	95,840	23,800	541,904	13.67%
4932	Corrosive Material					17,860							17,860	0.45%
4935	Corrosive Material						11,800		3,920	23,640			39,360	0.99%
4936	Corrosive Material		4,040										4,040	0.10%
4941	ORM, Group A											3,800	3,800	0.10%
4945	ORM, Group C			43,080	367,252	15,640	217,476	11,760	170,584		516,732		1,342,524	33.86%
4950	Mixed Load	880	440			72,160	800	10,160	70,100	27,320	40,760		221,740	5.59%
4961	ORM, Group E								3,000				3,000	0.08%
4963	ORM, Group E								14,120		16,000		30,120	0.76%
Total		880	4,480	43,080	392,372	466,820	379,116	327,560	1,103,024	394,384	827,040	27,600	3,965,476	100.00%
Percentage in each Region		0.02%	0.11%	1.09%	9.89%	11.77%	9.56%	8.26%	27.82%	9.95%	20.86%	0.70%		

TABLE B.2 Traffic Terminating in Region VIII (1990)

HAZARDOUS MATERIAL SHIPMENTS TERMINATING IN REGION 8

Tonnage Classified by Hazstcc and Originating Region

Partial HAZSTCC	Descriptive Name	REGION 2	REGION 3	REGION 4	REGION 5	REGION 6	REGION 7	REGION 8	REGION 9	REGION 10	REGION 11	Total	Percentages
4827	Waste Radioactive, Low Activity							1,800				1,800	0.06%
4860	Waste ORM, Group E						920		10,320			11,240	0.37%
4861	Waste ORM, Group E	3,880	7,040		15,520		1,120					27,560	0.91%
4875	Waste Stream ORM							3,960				3,960	0.13%
4901	Class A Explosive					2,748			2,916			5,664	0.19%
4902	Class B Explosive							7,200				7,200	0.24%
4903	Class C Explosive						7,152			1,440		8,592	0.28%
4904	NonFlammable Compressed Gas					149,556	105,520	61,200	3,240	24,400	174,400	518,316	17.18%
4905	Flammable Compressed Gas				2,880	7,400	9,840	190,840		20,400	121,980	353,340	11.71%
4908	Flammable Liquid					188,400		236,440				424,840	14.08%
4909	Flammable Liquid				3,800	16,120	52,120	96,400			15,360	183,800	6.09%
4910	Flammable Liquid								25,400			25,400	0.84%
4915	Flammable Liquid				22,720		3,040	134,640			20,000	180,400	5.98%
4916	Flammable Solid			920						58,560		59,480	1.97%
4918	Oxidizing Material					21,600	11,720	11,920	12,000	7,880	36,520	101,640	3.37%
4921	Poisons B, Organic				960							960	0.03%
4923	Poisons B, Inorgamic			7,920		800						8,720	0.29%
4930	Corrosive Material			6,220	4,000	7,880	6,880	96,900	34,796	15,760		172,436	5.71%
4935	Corrosive Material				7,920	15,560	19,800	3,920	11,600	70,960		129,760	4.30%
4941	ORM, Group A					920				1,800		2,720	0.09%
4945	ORM, Group C							170,584				170,584	5.65%
4950	Mixed Load	680	520	5,280	283,840	6,720	87,080	70,100	31,440	26,240		511,900	16.96%
4960	ORM, Group E	22,240	3,560	10,200	17,400	12,240			1,400	9,400		76,440	2.53%
4961	ORM, Group E							3,000				3,000	0.10%
4963	ORM, Group E							14,120				14,120	0.47%
4966	ORM, Group E										13,960	13,960	0.46%
Total		26,800	11,120	30,540	359,040	429,944	305,192	1,103,024	133,112	236,840	382,220	3,017,832	100.00%
Percentage in each Region		0.89%	0.37%	1.01%	11.90%	14.25%	10.11%	36.55%	4.41%	7.85%	12.67%		

TABLE B.3 Traffic Originating in Region VIII (1991)

HAZARDOUS MATERIAL SHIPMENTS ORIGINATING IN REGION 8

Tonnage Classified by Hazstcc and Terminating Region

Partial HAZSTCC	Descriptive Name	REGION 1	REGION 2	REGION 3	REGION 4	REGION 5	REGION 6	REGION 7	REGION 8	REGION 9	REGION 10	REGION 11	Total	Percentages
4810	Waste Flammable Liquids, Misc.						9,600						9,600	0.24%
4836	Waste Corrosive Material						7,200						7,200	0.18%
4860	Waste ORM, Group E							1,040					1,040	0.03%
4861	Waste ORM, Group E							3,800					3,800	0.10%
4875	Waste Stream ORM					3,867			6,920				10,787	0.27%
4901	Class A Explosive				34,420					14,260			48,680	1.23%
4902	Class B Explosive								11,760	14,880			26,640	0.67%
4903	Class C Explosive								5,100				5,100	0.13%
4904	NonFlammable Compressed Gas						3,280	6,800	74,980	12,760	12,560		110,380	2.78%
4905	Flammable Compressed Gas					196,920	55,086	41,560	283,172	153,688	30,880		761,306	19.21%
4908	Flammable Liquid								131,040	6,120			137,160	3.46%
4909	Flammable Liquid		27,040		23,160	99,080	153,160	4,440	89,396	5,640	27,160		429,076	10.82%
4910	Flammable Liquid							600	36,580	1,800			38,980	0.98%
4915	Flammable Liquid				3,748			3,520	45,720	12,640	38,564		104,192	2.63%
4916	Flammable Solid					15,440							15,440	0.39%
4917	Flammable Solid									600			600	0.02%
4918	Oxidizing Material						3,920		24,300	41,080			69,300	1.75%
4919	Organic Peroxides									400	3,880		4,280	0.11%
4923	Poisons B, Organic									17,000			17,000	0.43%
4930	Corrosive Material					7,880	7,960	141,360	83,840	108,520	237,520	24,240	611,320	15.42%
4931	Corrosive Material								600				600	0.02%
4935	Corrosive Material				3,960	76,860	12,000		13,260	28,400	15,720		150,200	3.79%
4936	Corrosive Material					80			9,600	880			10,560	0.27%
4941	ORM, Group A						140,112	27,360					167,472	4.23%
4945	ORM, Group C			35,320	409,948	23,128	3,800			4,640	565,612		1,042,448	26.30%
4950	Mixed Load	1,760	2,200			43,360		18,920	14,600		52,520		133,360	3.36%
4963	ORM, Group E						3,640			3,920	10,120		17,680	0.45%
4966	ORM, Group E								29,600				29,600	0.75%
Total		1,760	29,240	35,320	475,236	466,615	399,758	249,400	860,468	427,228	994,536	24,240	3,963,801	100.00%
Percentages in Each Region		0.04%	0.74%	0.89%	11.99%	11.77%	10.09%	6.29%	21.71%	10.78%	25.09%	0.61%		

TABLE B.4 Traffic Terminating in Region VIII (1991)

HAZARDOUS MATERIAL SHIPMENTS TERMINATING IN REGION 8

Tonnage Classified by Hazstcc and Originating Region

Partial HAZSTCC	Descriptive Name	REGION 2	REGION 3	REGION 4	REGION 5	REGION 6	REGION 7	REGION 8	REGION 9	REGION 10	REGION 11	Total	Percentages
4810	Waste Flammable Liquids, Misc.								1,400			1,400	0.05%
4836	Waste Corrosive Material				3,800							3,800	0.13%
4841	Waste ORM, Group A								600			600	0.02%
4860	Waste ORM, Group E	3,600		640			7,200			3,720		15,160	0.52%
4861	Waste ORM, Group E		3,600			1,520				3,720		8,840	0.31%
4875	Waste Stream ORM							6,920				6,920	0.24%
4901	Class A Explosive								33,892			33,892	1.17%
4902	Class B Explosives			5,688				11,760	16,800			34,248	1.18%
4903	Class C Explosive				800			5,100				5,900	0.20%
4904	NonFlammable Compressed Gas					126,380	137,664	74,980	800	55,920	163,440	559,184	19.31%
4905	Flammable Compressed Gas						29,000	283,172	20,240	8,880	128,720	470,012	16.23%
4907	Flammable Liquid				640							640	0.02%
4908	Flammable Liquid					134,040		131,040		3,640		268,720	9.28%
4909	Flammable Liquid					36,060	76,480	89,396			3,840	205,776	7.11%
4910	Flammable Liquid					5,920	320	36,580	17,000	6,452		66,272	2.29%
4915	Flammable Liquid				3,680	3,800		45,720	2,000		45,480	100,680	3.48%
4916	Flammable Solid	1,560		4,800		3,000				50,772		60,132	2.08%
4918	Oxidizing Material					16,240	16,000	24,300	11,800	10,160	69,560	148,060	5.11%
4920	Poisons A									7,200		7,200	0.25%
4921	Poisons B, Organic				840	4,480						5,320	0.18%
4923	Poisons B, Inorgamic			2,640							3,560	6,200	0.21%
4927	Radioactive Material, Low Act.				520							520	0.02%
4930	Corrosive Material				3,840	11,720	7,960	83,840		42,388		149,748	5.17%
4931	Corrosive Material							600				600	0.02%
4932	Corrosive Material				4,000							4,000	0.14%
4935	Corrosive Material				15,920	19,280		13,260	3,920	36,880		89,260	3.08%
4936	Corrosive Material						1,720	9,600				11,320	0.39%
4941	ORM, Group A					800	1,600			360		2,760	0.10%
4950	Mixed Load			6,240	281,440	9,200	78,680	14,600	32,760	21,560		444,480	15.35%
4960	ORM, Group E	4,800	51,600		10,120	39,800	3,400		1,400			111,120	3.84%
4963	ORM, Group E			880	3,640						34,468	38,988	1.35%
4966	ORM, Group E							29,600		4,512		34,112	1.18%
Total		9,960	55,200	20,888	329,240	412,240	360,024	860,468	142,612	256,164	449,068	2,895,864	100.00%
Percentages in Each Region		0.34%	1.91%	0.72%	11.37%	14.24%	12.43%	29.71%	4.92%	8.85%	15.51%		

APPENDIX C

TABLE C.1 Inter-regional Flows of Hazmat and Hazardous wastes (1990)

TOTAL TONS OF COMMODITIES SHIPPED [thousand tons]													
FROM/TO	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Region 10	Region 11	Totals	Percentage
Region 1	533	43	3	0	103	10	2	0	24	2	0	719	0.90%
Region 2	1,106	540	643	295	749	211	44	0	90	18	16	3,712	4.63%
Region 3	189	572	1,315	778	940	293	122	4	86	21	15	4,335	5.41%
Region 4	19	142	748	6,978	1,314	972	532	17	192	51	7	10,973	13.70%
Region 5	208	479	1,447	1,579	2,960	970	734	219	702	389	120	9,807	12.24%
Region 6	85	437	1,878	8,606	2,619	13,880	1,084	265	2,169	218	35	31,275	39.04%
Region 7	8	81	358	471	831	641	837	26	505	55	2	3,816	4.76%
Region 8	0	0	15	193	243	182	155	533	292	226	28	1,866	2.33%
Region 9	32	61	36	289	296	436	271	142	2,443	862	0	4,867	6.08%
Region 10	0	11	10	52	188	118	189	127	595	909	19	2,218	2.77%
Region 11	415	464	701	991	2,031	383	227	353	171	748	33	6,516	8.13%
Totals	2,595	2,830	7,154	20,231	12,276	18,095	4,195	1,685	7,269	3,499	275	80,104	100.00%
Percentage	3.24%	3.53%	8.93%	25.26%	15.33%	22.59%	5.24%	2.10%	9.07%	4.37%	0.34%		

TABLE C.2 Inter-regional Flows of Hazmat and Hazardous Wastes (1991)

TOTAL TONS OF COMMODITIES SHIPPED [thousand tons]													
FROM/TO	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9	Region 10	Region 11	Totals	Percentage
Region 1	527	8	0	3	90	8	2	0	21	0	0	658	0.80%
Region 2	1,569	731	673	217	811	168	20	2	72	1	22	4,285	5.21%
Region 3	120	462	1,172	756	938	405	124	0	126	27	23	4,154	5.05%
Region 4	28	155	640	6,336	1,369	1,109	604	8	256	35	3	10,543	12.82%
Region 5	264	512	1,771	1,554	2,948	1,000	657	223	911	386	124	10,350	12.59%
Region 6	111	446	1,639	8,500	2,558	14,290	1,066	248	2,236	172	52	31,319	38.09%
Region 7	8	47	404	384	693	818	738	293	532	72	3	3,991	4.85%
Region 8	0	27	16	169	235	317	83	437	387	190	24	1,885	2.29%
Region 9	19	50	43	494	349	447	2,787	113	1,928	1,017	0	7,248	8.81%
Region 10	4	28	16	52	164	179	273	124	669	854	20	2,382	2.90%
Region 11	388	507	797	152	1,960	406	20	396	158	582	49	5,415	6.58%
Totals	3,039	2,972	7,170	18,618	12,116	19,146	6,373	1,843	7,297	3,335	321	82,229	100.00%
Percentage	3.70%	3.61%	8.72%	22.64%	14.73%	23.28%	7.75%	2.24%	8.87%	4.06%	0.39%		

Appendix D

Standard Transportation Commodity Code Definitions

48 Waste hazardous materials or waste hazardous substances
- 4810 Waste flammable liquids, miscellaneous
  - **48101 Flammable liquids, miscellaneous**
    - 18 Flammable liquid, n.o.s.**
    - **19 Flammable liquid, n.o.s.**
    - 85 Flammable liquid, n.o.s.
  - 48102 Flammable liquids, miscellaneous
    - 51 Paint related material
    - **65 Paint related material**
  - 48105 Flammable liquids, miscellaneous
    - 60 Flammable liquid, n.o.s.
- **4815 Waste combustible liquids**
  - **48151 Combustible liquids**
    - **85 Combustible liquid, n.o.s.**
- **4817 Waste flammable solid**
  - **48173 Flammable solids, miscellaneous**
    - **32 Flammable solid, n.o.s.**
    - **35 Flammable solid, n.o.s.**
- **4823 Waste poisons B, inorganic**
  - **48233 Poisons B, inorganic**
    - **60 Flue dust, poisonous**
- **4825 Waste etiologic agents**
  - **48259 Etiologic agents**
    - **50 Infectious substances, humans, n.o.s.**
- 4827 Waste radioactive materials, low activity
  - 48272 Radioactive materials
    - 79 LSA, n.o.s.
- **4830 Waste corrosive materials**
  - **48302 Corrosive materials, acidic**
    - **21 Corrosive liquid, n.o.s.**
- 4836 Waste corrosive materials
  - 48365 Corrosive materials, miscellaneous compounds
    - **36 Corrosive liquid, n.o.s.**
    - 38 Corrosive liquid, n.o.s.
    - 45 Corrosive solid, n.o.s.
- 4841 Waste other regulated materials, group A***
  - 48411 Other regulated materials, group A
    - 32 Dichloromethane or methylene chloride
- 4860 Waste other regulated materials, group E
  - 48601 Other regulated materials, group E
    - **05** Hazardous waste, liquid, n.o.s.

** n.o.s. or NOS within the definition means "not otherwise specified."

*** Other regulated materials is often referred to as ORM. In this example, the material would be referred to as Waste ORM-A, where A refers to the group name.

07 Hazardous waste, solid, n.o.s.
31 Hazardous waste, solid or liquid, n.o.s.
50 Hazardous waste, solid or liquid, n.o.s.
48606 Other regulated materials, group E
46 Hazardous waste, liquid, n.o.s.
4861 Waste other regulated materials, group E
48611 Other regulated materials, group E
70 Hazardous substance, solid, n.o.s.
76 Hazardous substance, solid, n.o.s.
78 Hazardous substance, solid, n.o.s.
79 Hazardous substance, solid, n.o.s.
4875 Waste stream other regulated
48755 Other regulated materials, group E
01 Hazardous waste, liquid or solid, n.o.s.
68 Hazardous waste, liquid or solid, n.o.s.
71 **Hazardous waste, liquid or solid, n.o.s.**
48756 Other regulated materials, group E
25 Hazardous waste, liquid or solid, n.o.s.
49 Hazardous Materials or hazardous substances
4901 Class a explosives
49011 Class a explosive, ammunition
05 Cartridges for weapons
25 Ammunition, smoke
64 Ammunition, toxic
49012 Class a explosives, military devices other than ammunition
22 Bombs
23 Bombs
30 Charges, depth
35 Mines
40 Warheads, rocket
44 Warheads, rocket
71 Projectiles
49013 Class a explosives, commercial devices
50 Rocket motors
49015 Class a explosives, high explosives
02 Substances, explosive, n.o.s.
10 Picric acid or trinitrophenol
52 Explosives, blasting, type c
4902 Class b explosives
49021 Class b explosives, ammunition
40 Rocket with inert head
49024 Class b explosives, propellant explosives, solid
20 Charges, propelling, for cannon
23 Charges, propelling, for cannon
25 Charges, propelling, for cannon
49025 Class b explosives, explosive devices
30 Rocket motor
4903 Class c explosives
49031 Class c explosives, ammunition
70 Cartridges for weapons or small arms other than blank
49033 Class c explosives, explosive devices, detonating
05 Cartridges, power device

62 Detonators

49034 Class c explosives, explosive devices, non-detonating

80 Cartridges, power device

49035 Class c explosives, fireworks, toy or novelty devices

20 Fireworks

25 Fireworks

36 Fireworks

40 Toy propellant device

60 Articles, explosive, n.o.s.

49036 Class c explosives, signaling devices

10 Hand signal device

20 Signal cartridge

30 Signals, smoke

4904 Nonflammable Compressed Gases

49042 Nonflammable compressed gases, corrosive

10 Anhydrous ammonia

49043 Nonflammable compressed gases, oxidizing

50 Oxygen, compressed

80 Oxygen, compressed

49045 Nonflammable compressed gases

01 Air, compressed

03 Argon, refrigerated liquid

09 Carbon dioxide, refrigerated liquid

15 Compressed or liquefied gas, n.o.s.

16 Dichlorodiflouromethane

20 Chlorodifluoromethane

35 Carbon dioxide

36 Refrigerant gases, n.o.s.

46 Hexaflouropropylene

52 Clhorodifluoromethane

63 Neon, compressed

65 Nitrogen, compressed

66 Nitrogen, refrigerated liquid

69 Nitrogen, compressed

75 Sulfur hexafluoride

49048 Nonflammable compressed gases, miscellaneous

20 Fire Extinguisher

25 Accumulator, pressurized, pneumatic

27 Accumulator, pressurized pneumatic

67 Refrigerating machines

4905 Flammable compress gases

49054 Flammable compressed gases, poisonous

10 Hydrogen sulfide

49055 Flammable compressed gases, corrosive

10 Dimethylamine, anhydrous

30 Methylamine, anhydrous

49057 Flammable compressed gases

01 Acetylene, dissolved

02 Butane or butane mixtures

06 Butane or butane mixtures

07 Liquefied petroleum gas

10 Compressed gas, flammable, n.o.s.

16 Difluoroethane
25 **Dimethyl ether**
26 Lighter refills or lighter
27 Dispersant gas, n.o.s.
28 Engine starting fluid
29 Refrigerant or dispersant gases, n.o.s.
47 Isobutane or isobutane mixtures
48 Isobutylene
50 Isobutane or isobutane mixtures
52 Petroleum gas, liquefied
80 Petroleum gases, liquefied, n.o.s.
81 Propane
82 Vinyl chloride, inhibited

4906 Flammable Liquids
49064 Flammable liquids, polymerizable and poisonous
20 Acrylonitrile, inhibited

4907 Flammable Liquids
49072 Flammable liquids, polymerizable
15 Ethyl acrylate, inhibited
19 Dicyclopentadiene
50 Methyl methacrylate monomer, inhibited
55 Flammable liquid, n.o.s.
65 Styrene monomer, inhibited
70 Vinyl acetate, inhibited
49074 Flammable liquids, poisonous
19 Flammable liquids, poisonous, n.o.s.
20 NA
49076 Flammable liquids, corrosive, acidic
90 Solium methylate, solutions in alcohols
49078 Flammable liquids, corrosive, basic
15 Diethylamine
40 Monomethylamine, aqueous solution
77 Triethylamine

4908 Flammable liquids
49081 Flammable liquids, flash point below 20F
05 Acetone
10 Benzene
25 Carbon bisulfide
34 Flammable liquids, n.o.s.
62 Flammable liquids, n.o.s.
76 Gasoline
83 Hexane
49082 Flammable liquids, flash point below 20F
24 Methyl tert-butyl ether
85 Tetrahydrofuran
90 Tetrahytdofuran

4909 Flammable Liquids
49091 Flammable liquids
17 Butanols
20 Flammable liquids, n.o.s.
23 Ethyl or ethanol solutions
28 Butyl acetate

41 Denatured alcohol
46 Ethanol or ethanol solutions
51 Denatured alcohol
55 Dioxane
59 Ethanol or ethanol solutions
60 Ethyl acetate
76 Flammable liquids, n.o.s.
79 Picolines

49092 Flammable liquids
03 Fluorobenzene
05 Isopropanol or isopropyl alcohol
07 Isobutyl acetate
15 Fuel, aviation, turbine engine
25 2-Methyl-2-butene
30 Methyl alcohol or methanol
43 Methyl ethyl ketone
55 Dichloropropene

49093 Flammable liquids
05 Toluene
50 Xylene

4910 Flammable Liquids

49101 Flammable liquids, miscellaneous
01 Paint
02 Alcoholic beverages
04 Alcoholic beverage
09 Adhesives
20 Adhesives
30 Flammable liquids, n.o.s.
33 Coal tar distillate
35 Coal tar distillate
42 Coating solution
47 Compound, cleaning, liquid
50 Paint related material
53 Paint related material
59 Driers, varnish or paint, liquid
65 Petroleum crude oil
76 Paint
81 Extract, liquid, flavoring
85 Flamable liquids, n.o.s.

49102 Flammable liquids, miscellaneous
05 Ink
25 Alcoholic beverage
30 Paint
33 Paint related material
36 Flammable liquids, n.o.s.
39 Naphtha
42 Petroleum distillates, n.o.s.
45 Petroleum oil
50 Paint related material
51 Paint
52 Paint
54 Paint

57 Naphtha
58 Naphtha
59 Naphtha
64 Petroleum distillates, n.o.s.
65 Paint related material
80 Resin solution
82 Resin solution

49103 Flammable liquids, miscellaneous
09 Alcoholic beverage
34 Flammable liquids, n.o.s.
49 Flammable liquids, n.o.s.

49104 Flammable liquids, miscellaneous
44 Flammable liquids, n.o.s.

49105 Flammable liquids, miscellaneous
01 Alcohols, n.o.s.
04 Adhesive
35 Flammable liquid, n.o.s.
60 Flammable liquid, n.o.s.

4912 Combustible liquids

49122 Combustible liquids, polymerizable
75 Vinyl toluene, inhibited

4913 Combustible liquids

49131 Combustible liquids
11 Aldehydes, n.o.s.
28 Alcohols, n.o.s.
29 Alcohol, n.o.s.
74 Picolines
78 Allyl glycidyl ether
79 Cyclohexanone

4915 Combustible liquids

49151 Combustible liquids
02 Alcoholic beverages
10 Fuel oil or gas oil
11 Fuel oil or gas oil
12 Fuel oil, no. 1,2,3,4,5 (or) 6
13 Fuel oil or gas oil
17 Fuel oil, no. 2
20 Fuel oil, no. 6
31 Flammable liquids, n.o.s.
33 Coal tar distillate
39 Coal tar distillate
47 Compound, cleaning, liquid
65 Petroleum crude oil
67 Fuel, aviation, turbine engine
70 Pine oil
73 Flammable liquids, n.o.s.
85 Flammable liquids, n.o.s.
97 Flammable liquid, n.o.s.

49152 Combustible liquids
45 Petroleum oil
56 Petroleum distillates n.o.s.
59 Naphtha

60 Asphalt,cut back or tars, liquid
63 Flammable liquids, n.o.s.
82 Flammable liquids, n.o.s.
87 Petroleum distillates, n.o.s.
88 Dicyclopentadiene

49153 Combustible liquids
02 Flammable liquids, n.o.s.
20 Asphalt, cut back or tars, liquid
44 Flammable liquids, n.o.s.

49154 Combustible liquids
15 Windshield washer cleaning or anifreeze, comcentrated or premixed

49155 Combustible liquids
25 Flammable liquids, n.o.s.
35 Flammable liquids, n.o.s.

4916 Flammable Solids

49161 Flammable solids, pyroforic, poisonous
41 Phosphorus, white (or) yellow, under water

49164 Flammable solids, water reactive
08 Calcium carbide
47 Silicon-calcium
56 Sodium
75 Substances which in contact with water emit flammable gases, n.o.s.

49167 Flammable solids
07 Flammable solids, n.o.s.
55 Flammable solids, corrosive, n.o.s.

4917 Flammable Solids

49173 Flammable solids, miscellaneous
32 Flammable solids, n.o.s.
56 Matches, safety
69 Smokeless powder for small arms

49174 Flammable solids, miscellaneous
15 Flammable solids, n.o.s.

4918 Oxidizing Materials

49182 Oxidizers, poisonous, corrosive
06 Chloric acid solution

49183 Oxidizing materials, thermally unstable, inorganic
10 Ammonium nitrate fertilizer
11 Ammonium nitrate
20 Ammonium perchlorate
35 Hydrogen peroxide stabilized or aqueous solution

49184 Oxidizing materials, thermally unstable, organic
45 Trichloro-s-triazinetrione
48 Trichloroisocyanuric acid, dry, oxidizer

49185 Oxidizing materials, corrosive
10 Chromium trioxide, anydrous

49187 Oxidizing materials
05 Ammonuim nitrate mixed fertilizer
10 Barium perchlorate
15 Calcium hypochlorite mixture or dry
23 Sodium chlorate

33 Oxidizing substances, liquid, n.o.s.
35 Permanganate inorganic, n.o.s.
37 Potassium nitrate
47 Sodium nitrate
54 Strontium nitrate
65 Sodium chlorate solutions
75 Hydrogen peroxide aqueous solution

4919 Organic peroxides
49191 Organic peroxides
78 Methyl ethyl ketone peroxide
49192 Organic peroxides
43 2,4-Dichlorobenzoyl peroxide

4920 Poisons a
49205 Poisons a
23 Chlorine

4921 Poisons b, organic
49210 Poisons b, organic, flammable
15 Poisonous liquids, flammable, n.o.s.
32 Motor fuel antiknock
49212 Poisons b, corrosive, organic
20 Phenol, solid
49214 Poisons b, organic
29 Substituted nitrophenol pesticides, solid, toxic, n.o.s.
45 Motor fuel antiknock mixtures
61 Organophosphorus pesticidesl, liquid, n.o.s.
64 Organophosphorus pesticides, solid, n.o.s.
75 Poisonous liquids, n.o.s.
76 Poisonous solids, n.o.s.
49215 Poisons b, organic
57 Cocodylic acid
79 Hexamethylene-diisocyanate
49216 Poisons b
27 Carbamate pesticides, solid, toxic, n.o.s.
56 Organophosphorus pesticide, liquid, toxic, n.o.s.
74 **Organophosphorus pesticide, liquid, toxic, n.o.s.**

4923 Poisons b, inorganic
49231 Poisons b, inorganic, corrosive
06 Arsenic acid solution
15 Arsenic trioxide
49232 Poisons b, inorganic
23 Calcium cyanide
27 Sodium cyanide solution
28 Sodium cyanide
49233 Poisons b, inorganic

4925 Irritating Materials And Etiologic Agents
49252 Irritating materials
40 Ammunition tear producing, non-explosive
49259 Etiologic agents
99 Infectious substances, affecting humans, n.o.s.

4927 Radioactive materials, low activity
49271 Radioactive material, nuclear fuel
45 Radioactive material, low specific activity, n.o.s.

49273 Radioactive materials, ores
37 Radioactive material, low specific activity, n.o.s.
4929 Radioactive materials, low spicific activity, nec
49299 Radioactive materials, nec
50 Radioactive material, special form, n.o.
63 Radioactive material, n.o.s
4930 Corrosive materials
49300 Corrosive materials, acidic, poisonous
22 Hydoflouric acid solution
24 Hydogen flouride anhydrous
26 Hydroflousilicic acid
40 Sulfuric acid or sulphuric acid
42 Sulfuric acid or sulphuric acid, spent
49302 Corrosive materials, acidic
04 Chlorosulfonic acid
16 Battery fluid,acid
17 Battery fluid, acid, with battery
21 Corrosive liquids, n.o.s
28 Hydrochloric acid solution
29 Hydrochloric acid mixture, corrosive material
30 Hydrochloric acid solution, inhibited corrosive materia
32 Hydrobromic acid solutions
47 Phosphoric acid
48 Phosphoric acid
4931 Corrosive Materials
49313 Corrosive materials, organic acids
03 Acetic acid, glacial or acetic acid solution
49314 Corrosive materials, acidic
04 Corrosive liquids, n.o.s.
08 Alkyl sulphonic acid
17 Cresol corrosive material
26 Dodecybenzenesulfonic acid
47 Propionic acid or solution
70 Trichloroacetic acid, solid
49317 Corrosive materials, acidic
25 Benzoyl chloride
57 Corrosive liquids, n.o.s.
4932 Corrosive materials
49323 Corrosive materials, acidic
15 Corrosive liquids, n.o.s.
29 Corrosive liquids, n.o.s.
42 Ferric chloride solution
55 Sodium hydrogen fluoride
70 Silicon tetrachloride
77 Sodium hydrogen sulfate solution
78 Hypochlorite solutions
85 Titanium tetrachloride
4933 Corrosive materials
49333 Corrosive materials, organic salts and esters
19 Dimethyl thiophosphoryl chloride
4934 Corrosive materials
49342 Corrosive materials, acidic

23 Phthalic anhydride

4935 Corrosive materials

49352 Corrosive materials, basic

01 Alkyldimethylamines, n.o.s.
06 Sodium hydroxide solution
20 Caustic alkali, liquids, n.o.s.
23 Caustic alkali, liquids, n.o.s.
25 Potassium hydroxide, solid
28
30 Potassium hydroxide solution
34 Ammonium hydroxide solutions
35 Sodium hydroxide, solid
40 Sodium hydroxide solution
45 Sodium hydroxide solution
48 Corrosive liquid, n.o.s.
68 Sodium hydrosulfide, solution
73 Sodium hydroxide solution

49356 Corrosive materials, basic

01 Alkylamines, n.o.s.
17 N,N-diethylethylene diamine
28 Eethylenediamine
40 Hexamethylenediamine, solid
65 Ethanolamine or ethanolamine solutions or monoethanolamine or monoethanolamine solution
71 Corrosive liquids, n.o.s.

4936 Corrosive materials

49365 Corrosive materials, miscellaneous compounds

07 Battery, electric storage, wet, filled with acid, with automobile corrosive material
15 Compounds, cleaning, liquid
16 Compounds, cleaning, liquid
20 Compounds, cleaning, liquid
23 Batteries, wet, nonspillable, electric storage
30 Corrosive liquids, n.o.s
32 Corrosive liquids, n.o.s.
39 Corrosive liquids, n.o.s.
40 Corrosive liquids, n.o.s.
45 corrosive solids, n.o.s.
50 Corrosive liquids, n.o.s.
55 Dyes n.o.s. or dye intermediated, n.o.s.
56 Battery, wet, filled with acid
61 Disinfenctant, corrosive liquids, n.o.s.
66 Battery, wet, filled with acid
69 Battery, electric storage, wet, filled with acid, with automobile
76 Corrosive liquids, n.o.s.
77 Corrosive liquids, n.o.s.
78 Corrosive liquids, flammable, n.o.s.
80 Corrosive liquids, n.o.s.
86 Paint or paint related material
88 Paint or paint related material
94 Corrosive liquid, n.o.s.

95 **Corrosive liquid, n.o.s.**

4940 Other regulated materials group a

49403 Other regulated materials, group a

16 Ammonium hydroxide or aqua ammonia solutions

20 Carbon tetrachloride

28 ORM-A n.o.s.

45 Ferrosilicon

55 Tetrachloroethylene or perchloroethylene

90 ORM-A n.o.c.

4941 Other regulated materials group a

49411 Other regulated materials group a

06 Acetylene tetrabromide

23 Chlorpyrifos

24 Chlorpyrifos

25 Chlorpyrifos

26 2,4-Dichlorophenoxyacetic acid

27 Dichlorobenzene, ortho, liquid

28 Dichlorobenzene, para, solid

32 Dichloromethane or methylene chloride

42 Diazinon

48 ORM-A, n.o.s.

61 Maleic anhydride

71 Trichloroethylene

76 t1,1,1-richloroethane or methyl chloroform

4944 Other regulated materials group b

49441 Other regulated materials, broup b

85 Zirconium sulfate

90 ORM-B, n.o.s.

4945 Other regulated materials, group c

49453 Other regulated materials, group c

48 Pesticides, water reactive

56 Sulphur or sulfur, solid, or sulfur flower or flowers of sulfur

49457 Other regulated materials, group c

30 Lithium batteries, for disposal

70 Sulfur or sulphur, molten

4950 Mixed Loads

49501 Mixed Loads (not a proper shipping name) to be used only when trailer or freight car containes one or more hazardous commodity shipment in the load.

10 Fak-hazardous materials

30 Fak-hazardous materials

40 Fak-hazardous materials

50 Fak-hazardous materials

55 Fak-hazardous materials

70 Fak-hazardous materials

4960 Other regulated materials group e

49601 Other regulated materials group e

31 Environmentally hazardous substances, liquid, n.o.s.

33 Environmentally hazardous substances, liquid, n.o.s.

4961 Other regulated materials group e

49611 Other regulated materials group e

53 Environmentally hazardous substances, liquid, n.o.s.

4962 Other regulated materials group e

49621 Other regulated materials group e
20 Environmentally hazardous substances, liquid, n.o.s.
49623 Other regulated materials group e
10 Environmentally hazardous substances, solid, n.o.s.
4963 Other regulated materials group e
49633 Other regulated materials group e
30 Environmentally hazardous substances, liquid, n.o.s.
38 Environmentally hazardous substances, liquid, n.o.s.
40 Environmentally hazardous substances, liquid, n.o.
41 Environmentally hazardous substances, solid, n.o.s.
67 Environmentally hazardous substances, solid, n.o.s.
76 Environmentally hazardous substances, solid, n.o.s.
95 Environmentally hazardous substances, solid, n.o.s.
96 Environmentally hazardous substances, liquid, n.o.s.
49637 Other regulated materials group e
33 Environmentally hazardous substances, liquid, n.o.s.
49638 Other regulated materials group e
18 Environmentally hazardous substances, liquid, n.o.s.
23 Environmentally hazardous substances, liquid, n.o.s.
32 Environmentally hazardous substances, liquid, n.o.s.
36 Environmentally hazardous substances, liquid, n.o.s.
4966 Other regulated materials group e
49663 Other regulated materials group e
16 Environmentally hazardous substances, liquid, n.o.s.
27 Environmentally hazardous substances, liquid, n.o.s.
29 Environmentally hazardous substances, liquid, n.o.s.
49669 Other regulated materials group e
87 Environmentally hazardous substances, liquid, n.o.s.
94 Environmentally hazardous substances, liquid, n.o.s.

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16. Abstract

This report develops a baseline inventory of rail hazardous commodities that originate in, terminate in, or pass through Region 8. The inventory also includes a set of interregional tables that summarize hazardous rail commodity flows to and from each federal region. These tables were developed from a special version of the waybill database provided by the U.S. DOT. The most important uses of the inventory are in: 1) identifying the general commodities and the magnitudes of hazardous rail commodity flows within the region, 2) describing interregional commercial flows of hazardous materials, and 3) providing commodity flow information for use in general emergency response planning.

The report also includes an evaluation of the usefulness of the waybill sample for hazardous commodity analysis, as well as a background discussion of waybill concepts and data elements. In conclusion, the report recommends a strategy for updating the traffic inventory in future years and recommendations for improvements in future database format.

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