

8-9-2010

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

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WARREN COUNTY, KENTUCKY HAZARDOUS MATERIALS COMMODITY FLOW ANALYSIS

FINAL REPORT

August 9, 2010



Prepared by:



**This project was completed by
Western Kentucky University in partnership with Warren County Local
Emergency Planning Committee**

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Acknowledgements

Funding Provided by:

Kentucky Division of Emergency Management

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Chapter 1: Introduction

This report presents the results of a Commodity Flow Analysis of Hazardous Materials for I-65 and the William H. Natcher Parkway conducted by Western Kentucky University in partnership with the Warren County (Kentucky) Local Emergency Planning Committee (LEPC). Kentucky counties within the study area include Warren, Simpson, Edmonson, Butler, Barren, and Hart. Figure 1 shows the sections of I-65 and Natcher Parkway that run through these counties.

The purpose of our report is to give information on patterns of hazardous materials being transported along I-65 and Natcher Parkway as observed from May 24th 2010 to June 18th 2010. A secondary purpose is to summarize incidents involving hazardous materials over the previous ten years (January 2001-2009). Finally, this report assesses survey information collected from fixed facilities that ship and receive hazardous materials in the I-65 and Natcher Parkway corridors.

Commodity flow analysis is necessary in order for the LEPC to prepare for future hazardous material releases that may occur along this section of I-65 and Natcher Parkway. Data collected from this study will aid the emergency planning process for specific hazardous materials that were observed to frequent the study area during the study period.

1.1 Background

The primary goal of a commodity flow study is to identify the transport of specific goods through the transportation system of a specific area. A commodity is defined by the EPA as any physical good moving or any good being transported. In this particular study, hazardous materials are the commodities of interest. Hazardous materials are defined in the following ways:

- US Dept of Transportation: “Any substance or material in any form or quantity which poses an unreasonable risk to safety and health and to property when transported in commerce.” (Transportation)
- US EPA: “Any material, which when discharged into the environment, may be harmful to the public health or welfare of the United States (Agency, 2010).”

As well, according to the EPA, a material is considered hazardous if it displays one or more of the following characteristics (Agency, 2010):

- Ignitability: Can create fires under certain conditions. E.g. fuels which catch fire, and friction-sensitive substances.
- Corrosivity: Is acidic and capable of corroding metal.

- Reactivity: Can create explosions or toxic fumes, gases, or vapors when exposed or mixed with water.
- Toxicity: Is harmful or fatal when ingested, breathed, or absorbed by the skin.

Natcher Parkway & I-65

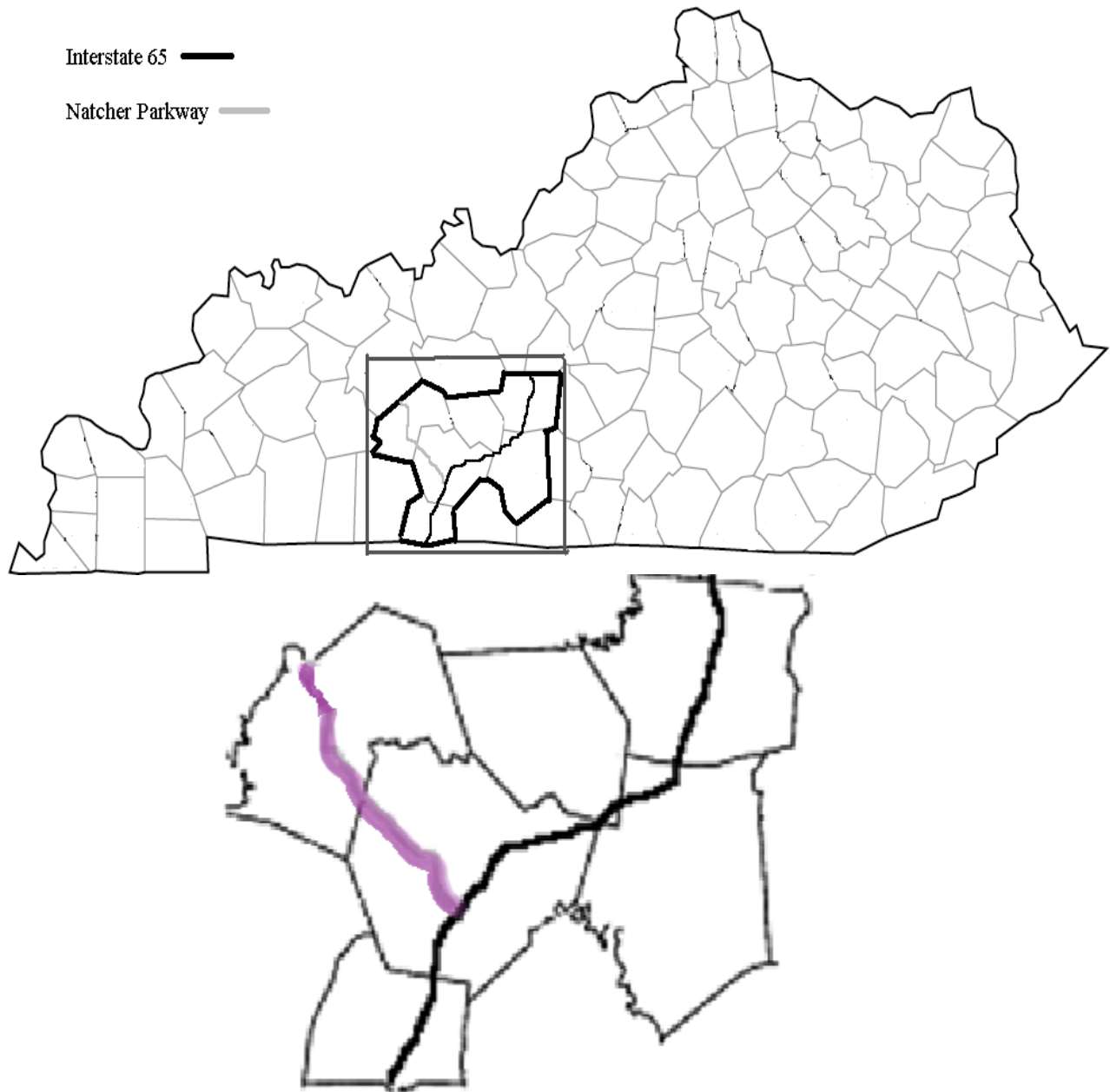


Figure 1.1. Location of I-65 and Natcher Parkway project corridor in Kentucky.

Hazardous material categories include (Transportation):

- Explosive Substances: will release pressure, gas, and heat when exposed to sudden shock, heat, or high pressure. E.g. Explosives, fuel, ammonium nitrate.
- Flammable and Combustible Substances: either liquid or solid, that can be easily ignited. E.g. petroleum substances.
- Toxic Materials (Poisons): can cause injury or death when they enter the bodies of living organisms. Can be classified by chemical nature or toxic action. e.g. heavy metals, cyanides, irritants.
- Oxidizers: supply oxygen to support normally non-flammable materials. e.g. fertilizers (oxides).
- Radioactive Materials: emit harmful rays and particles with their decay. e.g. plutonium, cobalt.
- Etiological Materials: cause disease or infection. e.g. germs which cause rabies, botulism, tetanus.

1.2 I-65 Corridor in Kentucky

I-65 is a part of the Interstate Highway System which runs through the state of Kentucky from north to south for about 137 miles, starting 5 miles south of Franklin, KY, and exiting the state just after passing through Louisville. The main Kentucky cities, which the highway passes through, are Louisville, Elizabethtown, and Bowling Green, which are illustrated in Figure 1.2 on the following page. In Kentucky, the speed limit on this highway is 70 miles per hour. The length of it contains 3 northbound and 4 southbound rest areas, as well as one northbound weigh station (mile 3) and one weigh station which services both directions of traffic flow (mile 89).

This interstate is a key in the transport of many commodities, as it is the main provider of a north-south connection between ports on the Gulf of Mexico and ports on the Great Lakes. The entirety of this highway measures about 887 miles, and begins in Mobile, Alabama and ends in Gary, Indiana, also passing the major cities of Indianapolis, Nashville, Decatur, Birmingham, and Montgomery. The interstate receives large amounts of traffic, including commodity transport traffic, and intersects other very economically important interstates including I-90, I-80, I-74, I-70, I-71, I-64, I-40, I-24, I-565, I-20/I-59 I-85, and I-10.

1.3 William H. Natcher Parkway

The Natcher Parkway is a limited-access freeway, stretching about 70 miles long from I-65 in Bowling Green, Ky. to US 60 bypass in Owensboro. It passes through Warren, Butler, Ohio, and Daviess counties, and the two cities of Bowling Green and Owensboro. The Natcher has junctions with US 31 W, US 68, US 231 (near both Bowling Green and Morgantown), and the Western KY Parkway.

A similar study entitled the I-24 Corridor Commodity Flow Analysis was used as a basis for the current study (Mitchelson and Calhoun, 1998). Study methods adopted from the Mitchelson and Calhoun (1989) study were a placard survey, transportation incidence report, and a fixed facility survey. These were primary sources for data collection used to assess hazardous materials that are being transported by trucks via I-65 and Natcher Parkway. Each of the three primary sources is summarized below. In addition to the methods mentioned above, this study used a railroad transport survey to identify other hazardous materials being transported through the study corridor.

1.4 Data Collection Methods:

ROADWAY PLACARD SURVEY

A monitoring station was set up along I-65 at the Kentucky Scales, which is located two miles inside the Kentucky state line, in order to monitor trucks traveling northbound. Another monitoring station was set up at the Tennessee Scales, located 2 miles outside the Kentucky line, in order to monitor trucks traveling southbound. A monitoring station was also set up along the Natcher Parkway within Basil Griffin Park in Bowling Green. This station served to monitor both the north and south bound lanes of the Natcher Parkway. A final monitoring station was set up on Western Kentucky University's campus to monitor trains moving north and south bound along the railroad system.

From May 24th thru May 28th, monitoring occurred at the Kentucky Scales from 6:00 AM – 2:00 PM and then from 4:00 PM – 12:00 AM. From May 31st thru June 4th monitoring occurred at the Tennessee Scales from 6:00 AM – 10:00 PM. The railroad was monitored between June 8th to June 12th with times being from 8 am-8 pm. The railroad were monitored on June 11th and June 12th between 8 am-2pm due to no railroad traffic in afternoons in the previous three days. The Natcher Park monitoring event occurred on June 14th and June 16th thru June 18th with times being from 7:30 AM – 7:30 PM. This created a total of 256 monitoring hours. $(16 \times 10 = 160 + (12 \times 4) + 48 = 256$.

At each monitoring station at least two observers were in place at all times. During the observation hours the observers recorded the following variables: time of day, date, number of trucks, day of the week, location, number of hazardous materials, the hazardous material being transported, and the state listed on the license plate of each truck.

TRANSPORTATION INCIDENCE REPORT

A complete history from the previous six years (January 2004-June 2010) of transportation incidents involving trucks carrying hazardous material on I-65 or Natcher Parkway was gathered from the Warren County Emergency Management.

FIXED FACILITY SURVEY

The seven page fixed facility survey consisted of 35 response items designed to collect data. General information on the facility, trends in the hazardous materials shipped and received by

the facility, and the frequency of the specific hazardous materials shipped through the facility is the specific data of interest. The years 2005-2009 will be covered in the survey.

RAILWAY PLACARD SURVEY

Rail transport is an important part of commodity flow between regions in the United States. Railroad transportation in the study area moves materials north to south and south to north through the study corridor. A part of the railroad system passes through the city of Bowling Green, KY and very close to Western Kentucky University. In order to observe hazardous materials being transported by rail in the study area a rail commodity flow survey was conducted from June 8th 2010 to June 12th 2010 from the Western Kentucky University campus. Methods consisted of monitoring the railway for twelve hour periods from 8AM to 8PM and recording placards observed on rail cars. The importance of this information is that potential hazardous materials incidents along the rail system in Bowling Green, KY and near Western Kentucky University pose an immediate risk to the community, including the Western Kentucky University community.

1.5 Organization of the Report

The first section of the report provides an introduction to the study, a description of methods, and other pertinent information. A second section of the report provides a detailed summary of the transportation incidence reports along the William Natcher Parkway and I-65. These were incidents involving hazardous materials that were reported to the LEPC. The third section of this report details the results from the placard survey conducted along the I-65, the Natcher Parkway and the railways. A fourth section illustrates the results of the fixed facility survey. Common hazardous materials observed are reviewed in the fifth section, which also describes appropriate responses needed for these materials. Chapter five summarizes the results, and gives some recommendations. Chapter six discusses trends that were noticed on I-65 in 1998 and in comparison to the current study conducted in the summer of 2010. In the appendices, we have included a copy of the survey that was sent to the facilities, a list of placard IDs observed, and a list of the most common roads used by facilities to reach/leave I-65.

Chapter 2: Incident Report Analysis for I-65 from January 2004 to June 2010

Incident analysis indicates the history of accidents that took place in the past, indicates patterns of occurrence, and identifies weaknesses in incident preparedness. Assessment of incidents involving hazardous materials can give emergency responders information regarding hazardous materials types in previous accidents, precautions that are material specific and steps that should be taken in case a similar incident occurs in the future.

Incident report data was obtained from the LEPC database. Information consisted of incidents that had been reported from January 2004-June 2010. We received a total of 71 incident reports where the LEPC had responded. These included cases of accidents on I-65, bomb threats, air release leaks, and oil spills.

2.1 Comparison of Total Incidents from 2004-2010 to Hazmat Incidents from January 2004- June 2010.

The following section compares the total number of incidents that were reported to the LEPC and the hazardous materials incidents that took place from January 2004-June 2010. Table 2.1 provides overview of the total incidents reported to LEPC from 2004-2010. A trend of increasing incidents occurred through 2007 with a decrease to eleven and nine reported in 2009 and 2010, respectively (Figure 2.1). It must be noted that the reporting period for 2010 was from January to June. Based on the rate of incidents thus far in 2010, the 2009 total is expected to be exceeded in 2010.

Year	No of Incidents Reported
2004	2
2005	3
2006	11
2007	19
2008	16
2009	11
*2010	9

* Data from January-June 2010

Table 2.1. Vehicle incidents reported to LEPC, 2004-2010, in the I-65 and Natcher Parkway Corridors in Warren County, KY.

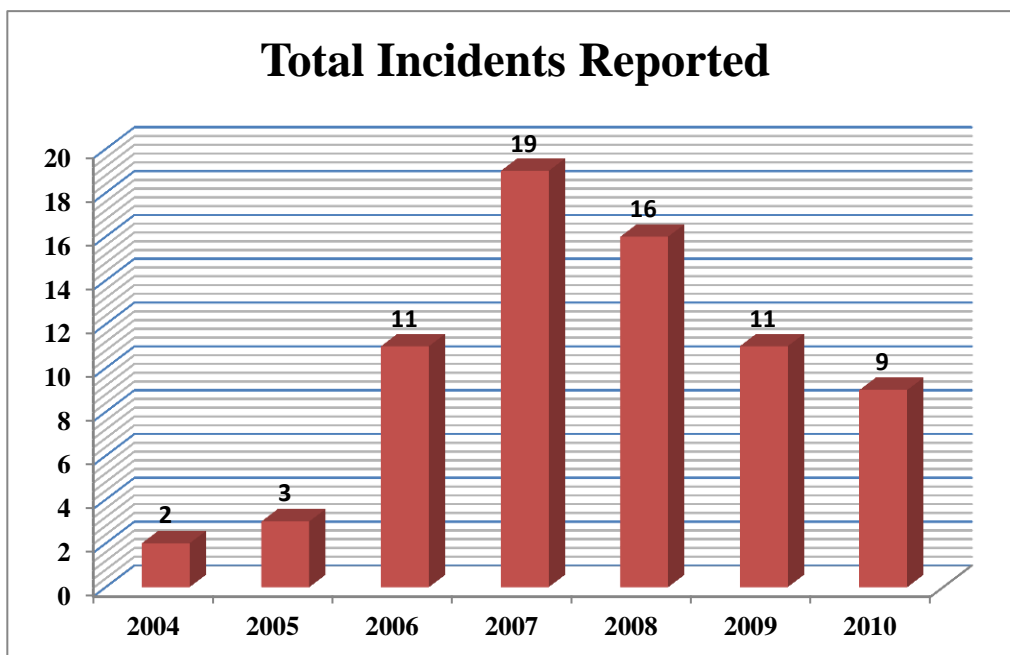


Figure 2.1 Total incidents reported from 2004-2010* (Data from January 2004-June 2010)

To fully assess the risk of hazardous materials, it is essential to identify the most common region or locations of incidents. Figure 2.2 indicates the distribution of incidents by county through the period of 2004-2010. A total of 71 incidents were reported, of this total, 64 incidents were reported to occur in Warren County. Greater than 90% of the reported incidents occurred in Warren County, KY over the past 6 years (2004-June 2010).

The situation and type of emergency determines the emergency response. Several types of emergencies have been recorded in the incident reports from 2004-2010 (Figure 2.3). Spills made up 54 % of all emergency cases reported to LEPC, followed by vehicle accidents. Other emergencies included air release, bomb threats, fires, decontamination etc. A majority of spill cases have been reported on I-65 and William Natcher parkway.

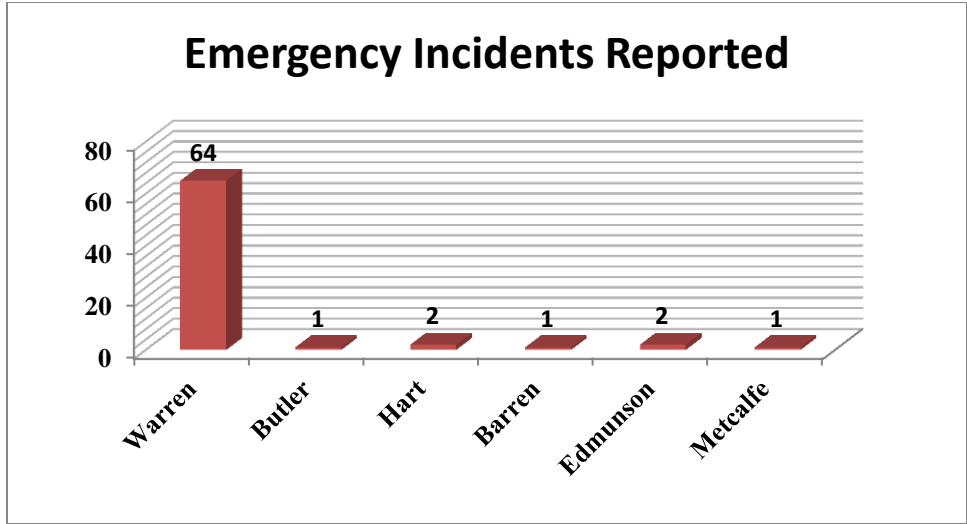


Figure 2.2 Incidents among Different Counties from 2004-2010.

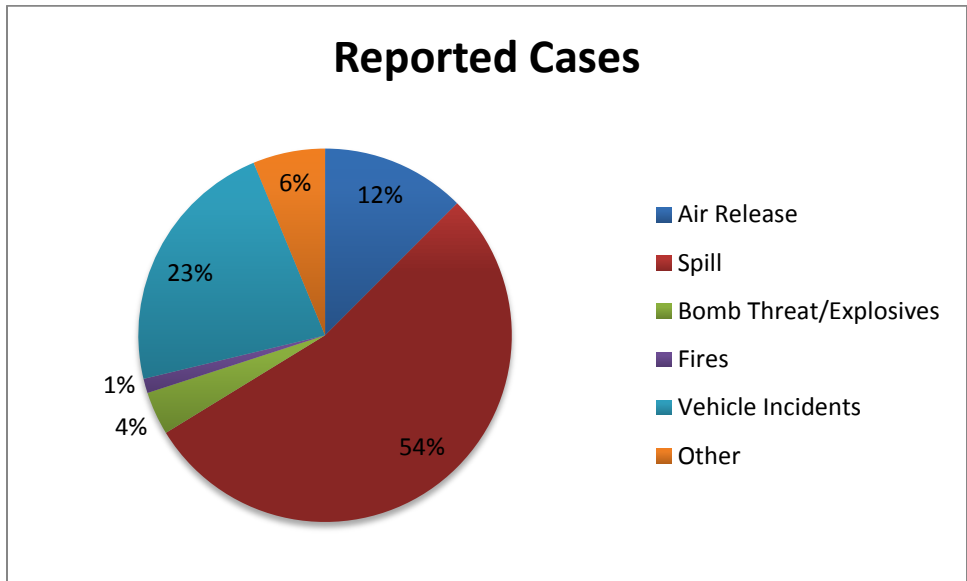


Figure 2.3. Types of emergencies reported as a percentage of the total emergencies, January 2004-June 2010.

Various classes of materials have been identified in the incident reports of the LEPC (Figure 2.4). These substances originated from the emergency types shown in Figure 2.3. Figure 2.4 indicates that flammable products like Crude Oil/Fuel/Diesel were the most common substances involved, and spills are a major reason for these. Other substances observed were, Aluminum Dross, Ammonia Leak, Atrazine, Butyl lithium, Chlorine gas leak, dynamite, grenades, lead

batteries, muratic acid, and powdered iron. However, crude oil/diesel, fuel, and gasoline made up the majority, 67%, of all substances reported from emergency incidents.

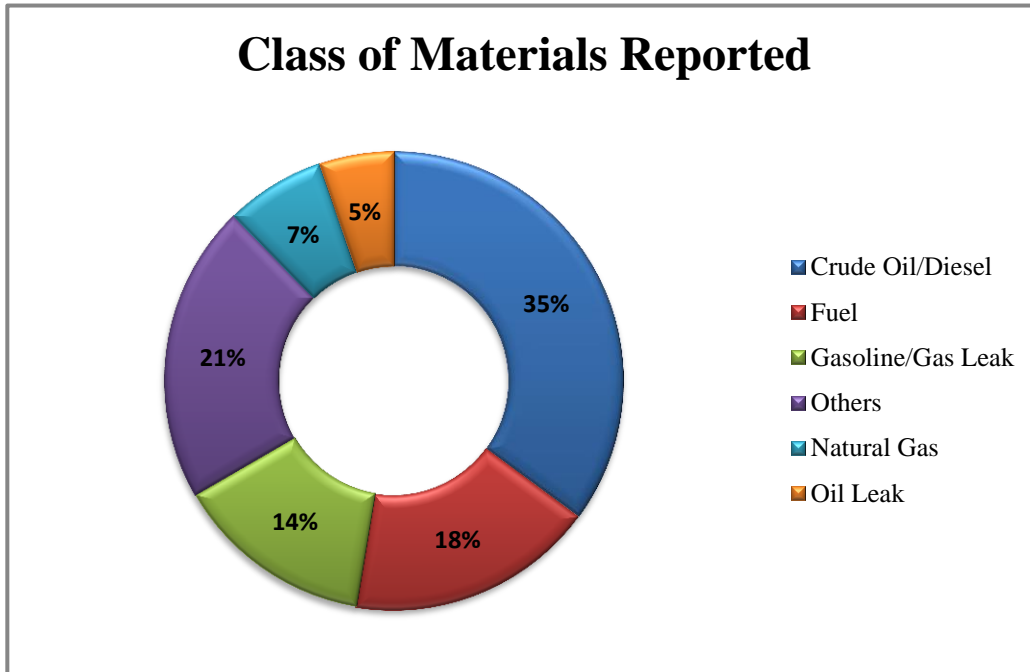


Figure 2.4 Class of Materials reported to LEPS in emergency incidents.

2.2 Hazmat Cases in the I-65 and Natcher Parkway Corridor

Out of the total 71 emergency cases that LEPC responded to, 27 cases involved hazmat incidents that took place on I-65 and the Natcher Parkway. This makes approximately 40% of the 73 total cases reported

Warren County is a populated area that I-65 passes through as it extends south in the direction of Nashville, TN and north towards Louisville, KY. Upon analysis of the incidents on I-65 and Natcher Parkway, and the county involved, 84% of cases reported on I-65 occurred in Warren County, followed by an equal distribution among other counties as shown in the Figure 2.5. Figure 2.6 following chart shows the distribution of incidents on I-65 and Natcher Parkway from January 2004-June 2010.

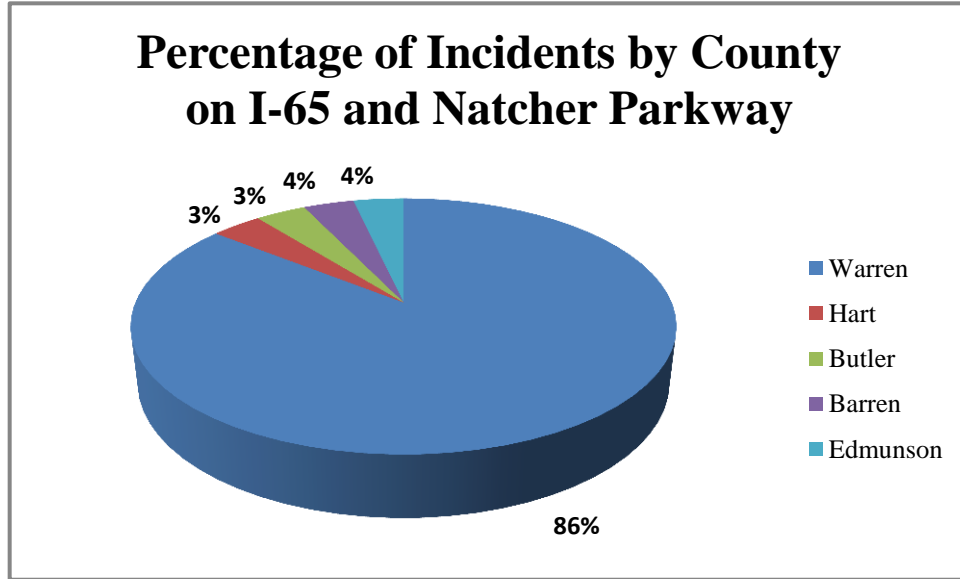


Figure 2.5 Percentage of incidents by county on I-65 and William Natcher.

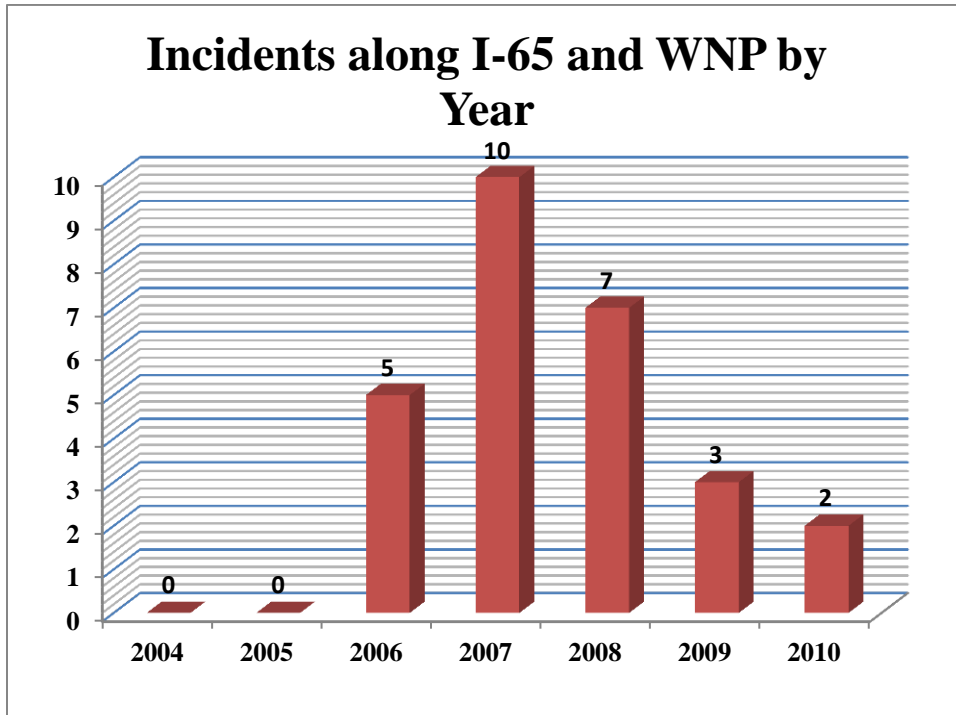


Figure 2.6 No. of incidents on I-65/ WNP (January 2004-June 2010)

The type of accident reported that resulted in a hazmat release was assessed (Figure 2.7). The majority of releases that occurred on I-65 and the Natcher Parkway resulted from spills and vehicle accidents. Based on the amount of substance released, accidents are classified as major and minor. Major incidents are release of more than 100 gallons of hazardous material and minor

is less than 100 gallons. A total of 8 major incidents have been reported on I-65 and Natcher Parkway in the study corridor from January 2004- June 2010.

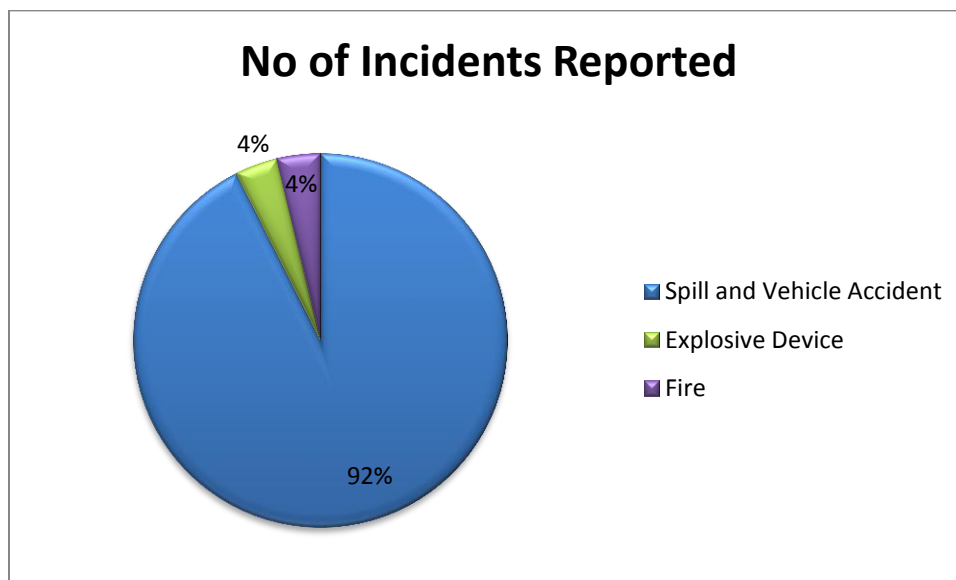


Figure 2.7 Types of Incident on I-65 and William Natcher Parkway

The following chart (Figure 2.8) presents the most common hazardous materials which were released in incidents on I-65 and Natcher Parkway from 2004-2010. Each hazardous material being transported is identified by a unique number that appears on a USDOT hazardous materials transportation placard that should be posted on the front, rear, and sides of the vehicle. As stated by the USDOT, "Title 49 of the United States Code of Federal Regulations (49CFR) also known as the Federal Motor Carriers Safety Regulations (FMCSR) requires the use hazardous materials placards when shipping hazardous materials cargo and dangerous goods in the United States (USDOT, 2010, <http://environmentalchemistry.com/yogi/hazmat/placards/>)." The four digit numbers that appear on the placards, the UN/NA numbers, refer to specific chemicals or groups of chemicals. Diesel, the most common substance reported in incidents from I-65 and the Natcher Parkway, has is UN 1993. Other hazardous materials reported from incidents in the study corridor were gas (UN 1203), Butyl lithium (3394), Adhesives Flammable (1133), Lewisite (2810) and Anhydrous ammonia (1005). As can be seen in Figure 2.9, diesel was easily the most common hazardous material released in incidents reported in the incident reports.

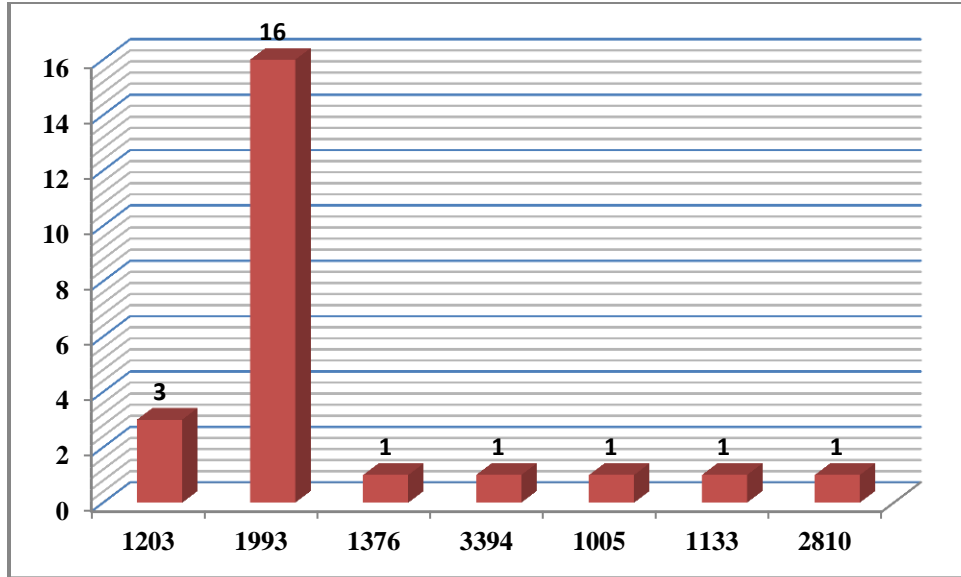


Figure 2.8 Most common hazardous materials reported in incidents from 2004-2010* on I-65 and the Natcher Parkway. (*2010 data reported from January 2010 to June 2010.)

2.3 Sites on I-65/William Natcher Parkway

The distribution of incidents on I-65 and the Natcher Parkway over the last 6 years (2004-2010) are mapped in Figure 2.10. Patterns of incident occurrence can be observed from the map. Incidents are clustered based on locations of exit ramps and other factors. However, incidents have occurred from the southern boundary of Warren County to the northeast corner. This information indicates that emergency response and access for hazard materials incidents should be a major planning and preparation objective.

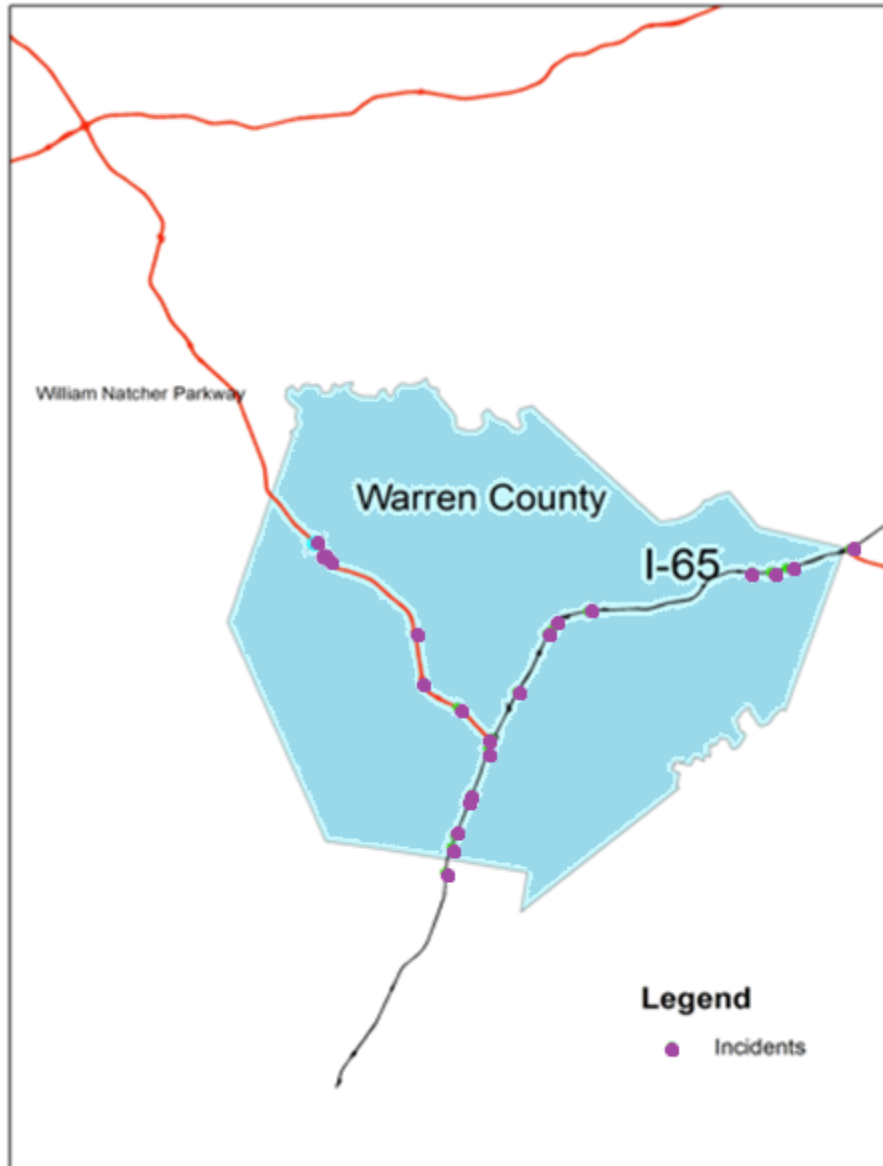


Figure 2.9. Incidents in the I-65 and Natcher Parkway Corridors of Warren County, KY.

2.4 Analysis of Response Guides Based on the Incident History

The United States Department of Transportation published a guidebook which describes action on the part of the responders during the initial phase of a hazardous material incident, “The 2008 Emergency Response Guidebook (Guidebook)” (USDOT, 2008). The 2008 printing is used in this report to highlight the frequency of recommended response guides based on frequency of hazardous materials involved in hazmat incidents within the study corridor from 2004-2010. Please note there are a total of 62 different response guides numbered 111 to 172 in the Guidebook. The appropriate response to accidental release of each hazardous material is assigned a guide number, which is also associated with a brief description of the sorts of dangers

that the material presents and the appropriate actions when accidentally released. By directly relating the five year history of incidents in the study corridor to the Guidebook, a practical utility of the current study is achieved for local emergency planning committee use. Professionals in this field should be able to expand on this usefulness (policy recommendations, training materials) through time.

The Guidebook is the most popular set of standards currently being used by the Emergency Response Community. However, there are other appropriate response standards that also exist in the community. Individuals interested in these other standards should direct inquiries to the LEPC. Readers should be cautioned that although one response might be deemed as “more important” than the others because it is associated with materials more frequently involved in transportation incidents, this does not imply that training and preparedness should focus on one, or just a few, response guides. Training should be inclusive and systematically designed to provide wider knowledge of responses along with frequent review of those response types that are known to be frequently required within the jurisdiction.

Guide No 128 is of great importance as it represents approximately 80% of the appropriate responses that should have had occurred during the past five years (Figure 2.10). Within the I -65 corridor, this type of response, Number 128, would be invoked approximately 3 times a year on an average, if the emergency response teams actually responded by the book. Guide numbers 135 (Spontaneously combustible), 125 (Gases-Corrosive), 153 (Substances- Toxic and or corrosive), and 151 (Substances Toxic –Non Combustible) are other response guides that were used in the incidents on I-65 and Natcher Parkway.

Warren County reported the majority of incidents. It is apparent from this analysis that emergency responders within the study corridor, especially within Warren County, need to be well versed and highly practiced in a number of required response guides e.g.; 128, 135,125,153 and 151.

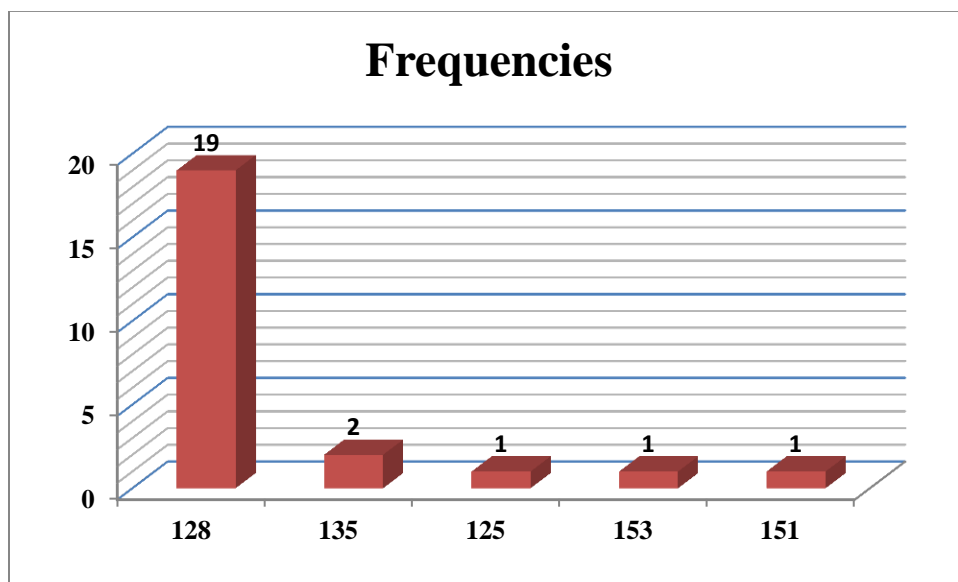


Figure 2.10 Response Guide Frequency required

Chapter 3: Analysis of the I-65 Placard Survey

The placard survey in the I-65 corridor involved 200 hours of observation during the months of May and June 2010. These hours of observations were scheduled in order to note the daily and temporal differences in the transport of hazardous materials through the I-65 corridor. The observations were done in separate shifts by graduate and undergraduate students of the Western Kentucky University, Department Public Health, Environmental Health Science program. All placard survey hours followed pre-decided schedules. These schedules were pre-approved by the LEPC. Schedules were made in a manner so as to discourage repetition of the same students for two consecutive shifts. Also, in cases where repetition could not be avoided, appropriate breaks were provided between the hours of observation. This was done in order to avoid lack of concentration on the part of the students. For every shift, care was taken to schedule two students in order to avoid personal bias.

As mentioned previously, pre-approved schedules were made and observation of the trucks carrying hazardous materials through the I-65 corridor was made. The observation points were set up for monitoring the trucks passing both north and south. The monitoring station northbound trucks on I-65 was located at the Kentucky truck scales, near Franklin KY, located two miles inside the Kentucky state line. The monitoring point for southbound trucks was located at the Tennessee truck scales (near Portland, Tennessee) approximately 1 mile outside the Kentucky state line into Tennessee. An additional monitoring point was set at Basil Griffin Park in Warren County, KY for monitoring the Natcher Parkway. This location was identified and approved by the director of Warren County Parks and Recreation. The Natcher Parkway stretches from I-65 in Bowling Green, KY to US 60 bypass in Owensboro. The monitoring point for the Natcher Parkway was established in order to note the hazmat transport to and from the I-65 corridor toward Bowling Green, KY. This monitoring site for Natcher Parkway was strategic, as it was located before any exits for westbound traffic from I-65 and after all exits for eastbound traffic before I-65.

At each monitoring point, and for each placard observation, the date, day, time, placard ID number, any other number on the placard (class number), and the state on the license plate was noted by the students. As mentioned above, the total number of observation hours were 200, of which the number of observation hours at Kentucky scales, Tennessee scales and Basil Griffin Park were 75 hours, 80 hours and 48 hours, respectively. The only deviation to this schedule was the Kentucky scales, which shut down early on the last day of data collection (due to Memorial Day national holiday) thereby reducing the total hours of data collection at Kentucky scales to 70 hours.

3.1 Aggregate truck frequencies in the I-65 corridor

Since monitoring did not involve a direct count of the total number of trucks on I-65, this data was collected from the Division of Traffic Operations in the Kentucky Transportation Cabinet (KYTC). Monitoring of total trucks numbers and placards in the same survey would have been difficult at the scales, as all trucks do not stop at the scales. During times of high use, noting

placards and counting trucks passing the stations may have hampered accuracy of the placard survey. Therefore, it was decided that student effort would focus on placarded trucks.

It was noted that the total number of vehicles in 2009 on I-65 at mile marker 20 was 41,179 per day of which 39% were commercial trucks (16,060). Therefore, the total number of commercial trucks on I-65 can be calculated as 39% of 41,179 or about 16,060 vehicles (Telephonic conversation with Mr. Shawn Crowe, Division of Traffic Operations, KYTC).

During the study period, the total number of placarded trucks observed that transported hazardous materials through the I-65 corridor, both northbound and southbound, was 1303 (Figure 3.1). Placarded trucks recorded to be carrying hazardous materials on the Natcher Parkway were 312. The average number of trucks observed on both northbound and southbound I-65 per hour was about 9 (8.7) while the average number recorded on the Natcher parkway for both lanes was around 3 (3.25) per hour. (While calculating the average number of placarded trucks per hour for the Natcher Parkway, the observation hours were doubled in order to control for the simultaneous monitoring of both eastbound and westbound lanes). The total number of placarded trucks per day can be extrapolated to be 216 (9x24) for I-65 while the placarded trucks for Natcher Parkway would constitute to be 72 (3x24) per day. When comparing the difference in the average number of hazmat trucks northbound and southbound on I-65, the total number of trucks observed were greater for southbound (684) as compared to the northbound (619). However, the average number of placarded trucks per hour (Figure 3.2) was greater for northbound trucks (8.8) as compared to southbound trucks (8.6). The average for southbound is less because slightly more monitoring hours occurred for this lane direction. Thus, there was only a 2% difference in the average number of placarded trucks passing northbound and southbound per hour. On the Natcher Parkway, out of the total 312 trucks carrying hazmat, 142 trucks were south-eastbound (SE bound) while 170 were north-westbound (NW bound) (Figure 3.1). The average number of trucks observed per hour on Natcher Parkway was 2.9 for SE bound and 3.5 for NW bound. Thus, the difference in the average number of trucks is 20% between the SE bound and NW bound on the Natcher Parkway (Figure 3.2).

TOTAL NUMBER OF HAZMAT TRUCKS ON THE I-65 CORRIDOR AND WILLIAM NATCHER PARKWAY

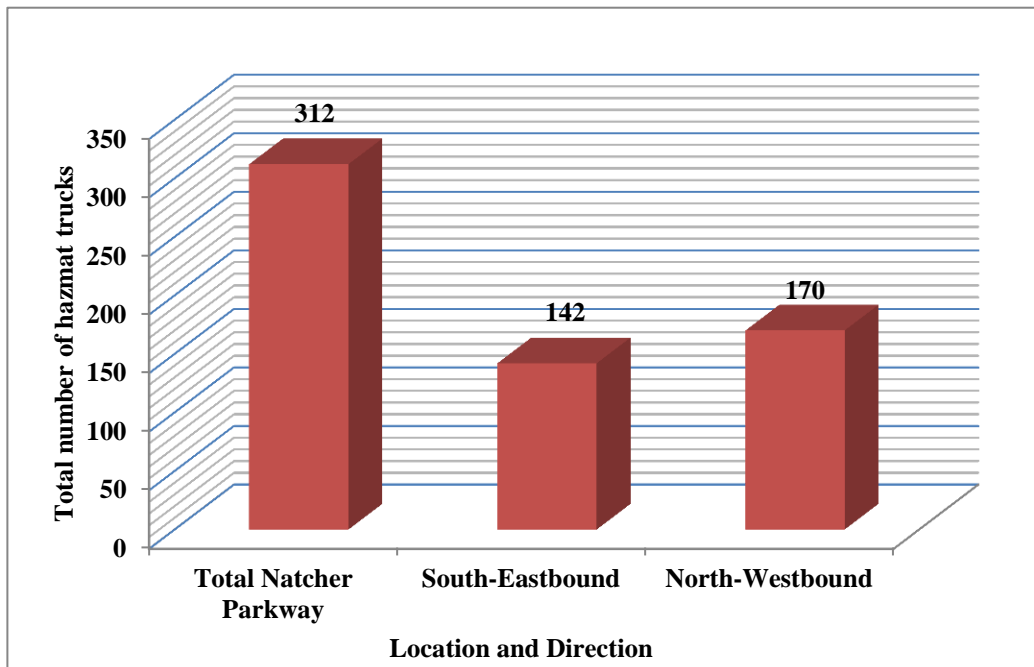
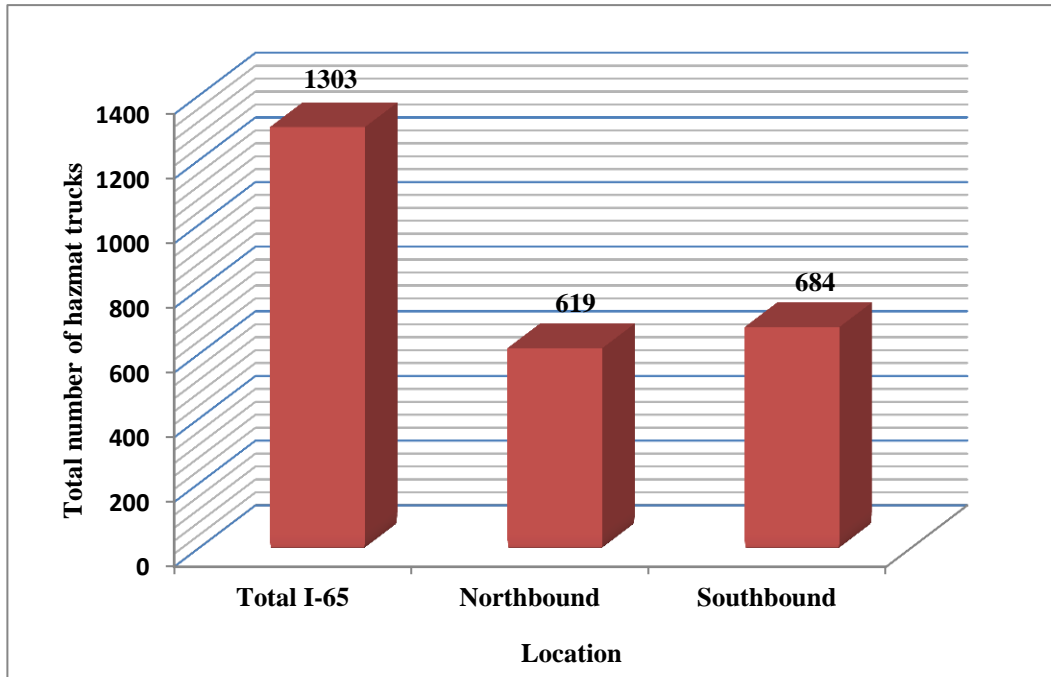


Figure 3.1. Placarded commercial trucks observed on I-65 and the Natcher Parkway.

HAZMAT TRUCK FREQUENCY PER HOUR IN THE I-65 CORRIDOR AND WILLIAM NATCHER PARKWAY

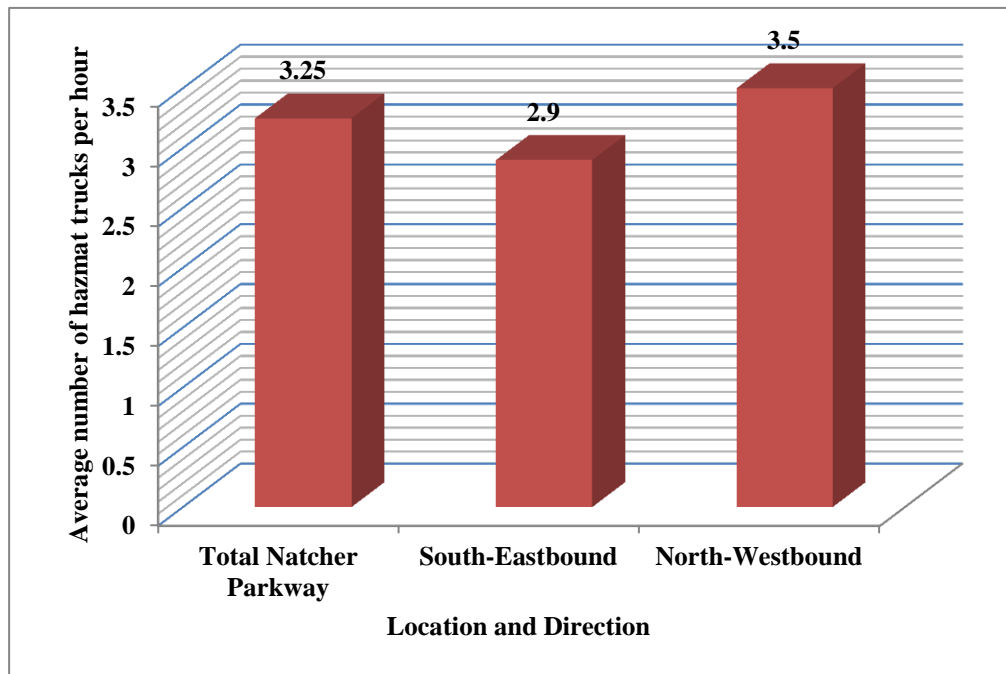
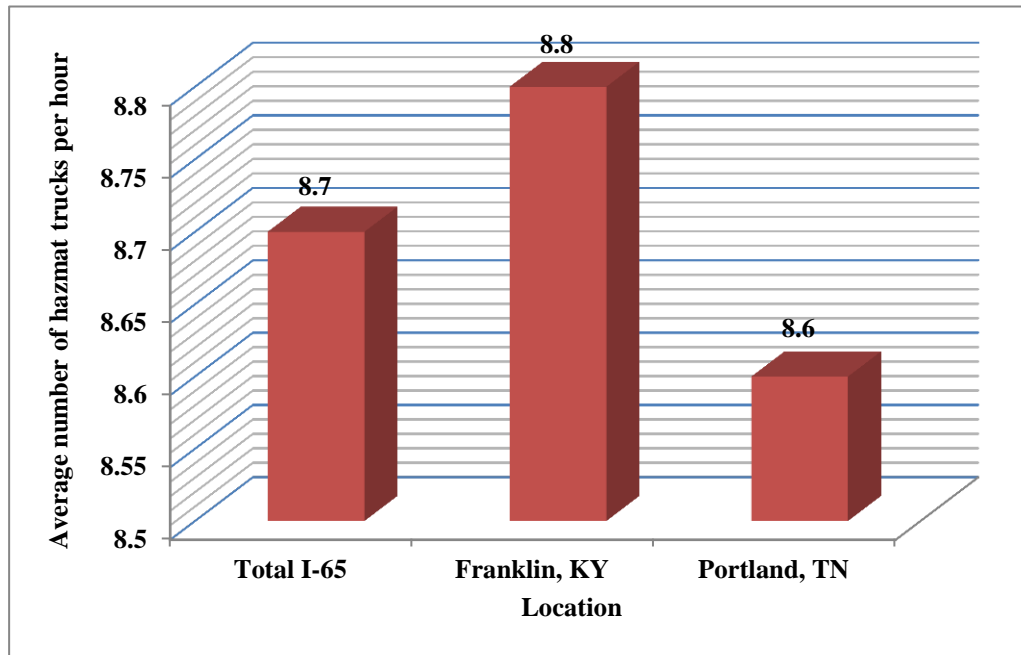


Figure 3.2. Placarded trucks per hour observed on I-65 and Natcher Parkway

3.2 Truck Frequencies by Day of the week

Observation hours at the monitoring points on I-65 were scheduled in a manner as to note the differences in the frequency of hazmat traffic during the various days of the week. Students made observations at the monitoring points near Franklin, KY and Portland, TN during weekdays, whereas the monitoring for Natcher Parkway occurred during the weekend.

Hazmat transportation by commercial trucks demonstrated notable differences across days of the week (Figure 3.3). Total hazmat transport across I-65 peaked on Friday with the average number of trucks being 10.1 per hour. The least rate of hazmat transport was recorded on Monday with an average of 7.0 per hour. Of the other three days, the average was greatest for Wednesday, 9.6 per hour, while the traffic was approximately the same on Tuesday and Thursday, 8.2 and 8.8 per hour, respectively.

Parallel variations were noted for the southbound hazmat transport on I-65. Figure 3.4 shows the number of commercial trucks transporting hazardous materials per hour for each lane for I-65 and the Natcher Parkway. Observations peaked on Friday, with an average of 10.6 vehicles per hour, and the least truck movement was recorded on Monday, with an average of 5.5 vehicles per hour. This low average value could be a result of a national holiday (Memorial Day) weekend, which coincided with this observation day for the southbound truck movements. Among the other observation days for southbound I-65, Tuesday showed the least hazmat truck movement (7.7 per hour) while Wednesdays and Thursdays had approximately the same traffic (9.6 and 9.4 per hour respectively). For the northbound commercial trucks, the trend was different with reference to the day with the highest hazmat transport. For northbound commercial trucks transporting hazmat, the peak was on Wednesday (9.6 per hour) and the least was on Thursday (8.2 per hour). Among the other days, Friday had a higher transport rate (9.3 per hour) as compared to Monday (8.6 per hour) or Tuesday (8.7 per hour).

Similar variations were noted in the hazmat transport across the William Natcher Parkway. If one was to observe the transport of hazmat vehicles in a typical week, the movement was higher during a weekday for both SE bound and NW bound as compared to a weekend. The per hour placarded traffic on the William Natcher parkway was corrected for the simultaneous monitoring of the eastbound and westbound lanes. The total hazmat traffic was highest on Friday (5.5 per hour) and least on Saturday (1.25 per hour). Among the weekdays, the least hazmat traffic was noted on Wednesday (2.35 per hour). The other days of the week showed a consistent flow of hazmat traffic across the Natcher Parkway (3 per hour).

TOTAL HAZMAT FREQUENCIES ON I-65 CORRIDOR AND NATCHER PARKWAY BY DAY OF THE WEEK

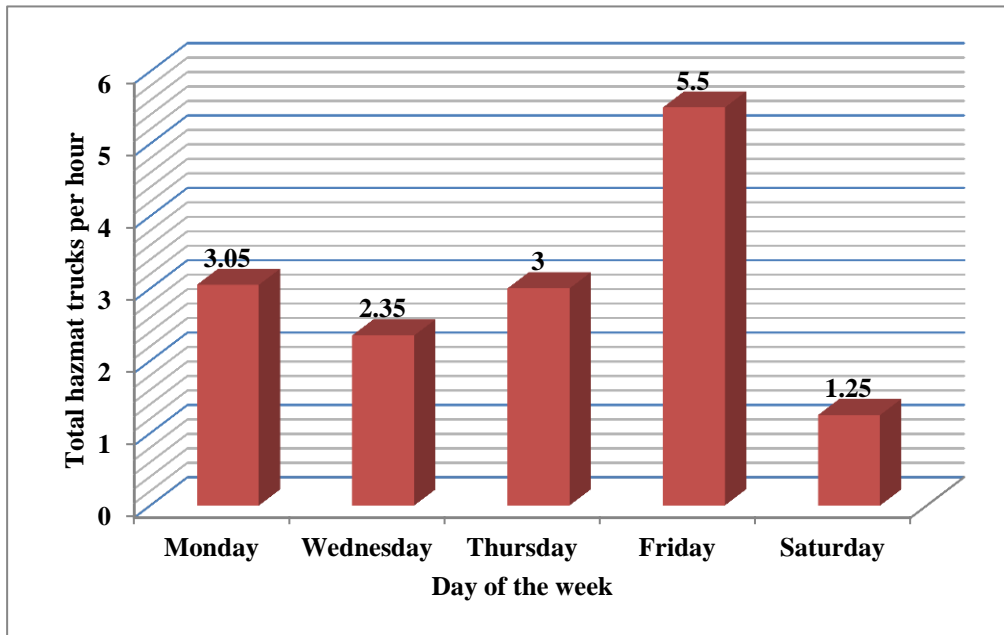
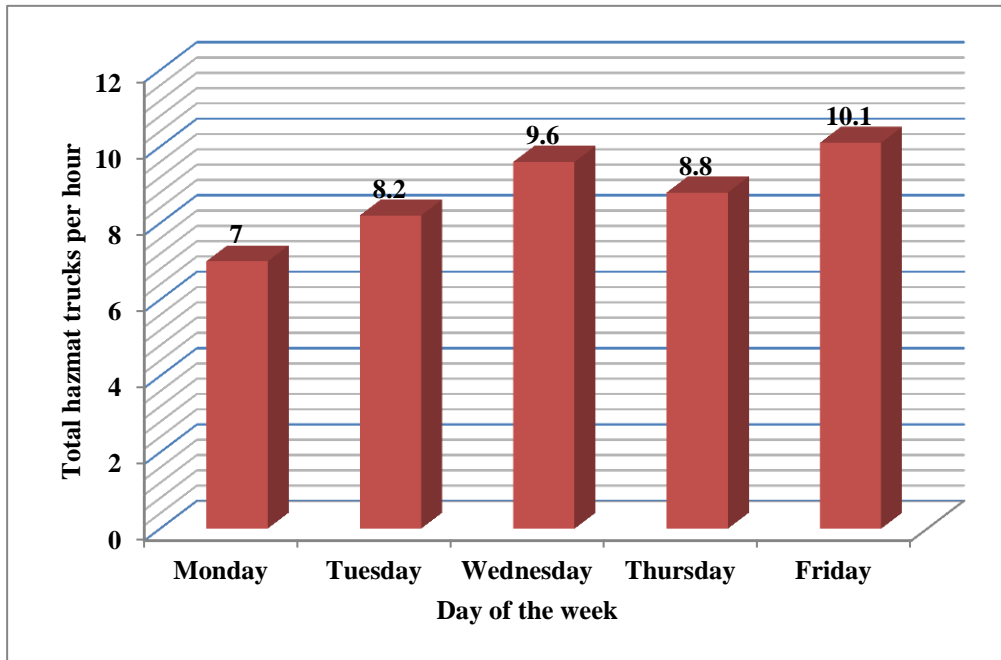


Figure 3.3. Placarded Trucks observed on I-65 and Natcher Parkway by day of the week

HAZMAT FREQUENCIES ACCORDING TO DIRECTION ON I-65 CORRIDOR AND WILLIAM NATCHER PARKWAY

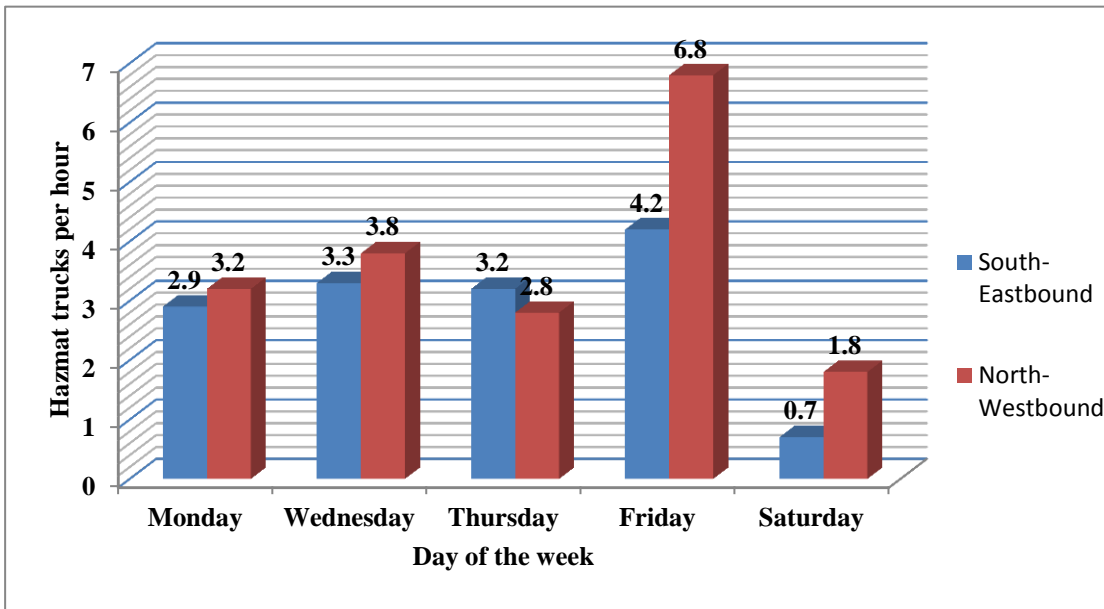
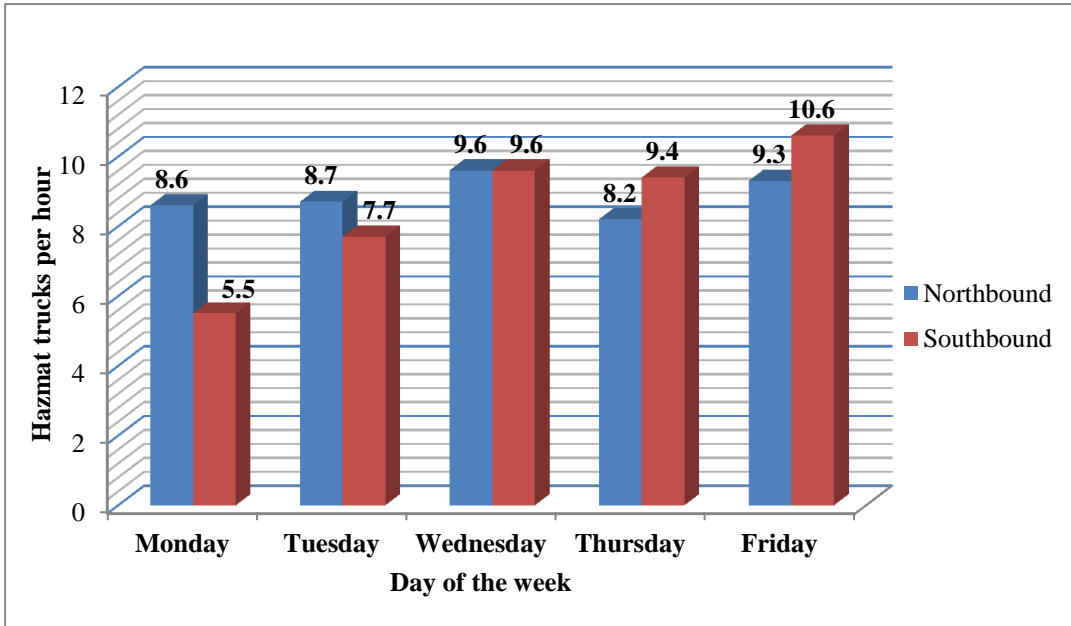


Figure 3.4. Placarded trucks observed on the lanes of I-65 and Natcher Parkway by day of the week

Parallel variations were noted in hazmat traffic for Natcher Parkway during the weekend and weekday, when the SE bound and NW bound lanes were considered separately (Figure 3.4). For the SE bound lane, the average traffic during Saturday was 0.7 per hour and the peak during the weekday was recorded on Friday (4.2 per hour). The least hazmat traffic during the weekday was noted on Monday (2.9 per hour) for the SE bound lane. Other days showed a consistent movement of 3.3 hazmat vehicles per hour. Similarly, for the NW bound lanes, the least traffic movement was noted on Saturday (1.8 per hour) while the maximum transport was recorded on Friday (6.8 per hour). During the week, the least hazmat transport for a weekday was noted on Thursday (2.8 per hour). Other days showed a consistent traffic of approximately 3.6 hazmat vehicles per hour. Thus, the traffic suggests that a greater number of hazardous materials are transported towards the cities of Bowling Green and Owensboro during the weekdays than on weekends. Considering that hazmat incidents may parallel the rate of transportation, greater preparedness must be in place for incidents on the weekdays as compared to the weekends.

3.3 Truck frequencies by time of Day

Variations in the frequency of hazmat transport were determined with reference to time of day. The time of day is important in order to correlate hazmat movement with the expected times of traffic congestion. In this manner, risk profiles for hazardous materials transport can be projected by time of day.

In order to analyze the hourly frequency of hazmat transport, the monitoring hours at each observation point was divided into 4 periods. Due to the fact that the hours chosen for monitoring were different for the northbound and southbound lanes of I-65, the divisions of observation hours varied by lane.

For convenience, the different periods considered for the northbound lanes (Franklin, KY) were:

- Period 1 (Morning): 7 am to 10 am
- Period 2 (Midday): 10 am to 2 pm
- Period 3 (Evening): 4 pm to 8 pm
- Period 4 (Night): 8 pm to 12 am

For the southbound scales (Portland, TN), the different periods were divided as:

- Period 1 (Morning): 6 am to 10 am
- Period 2 (Midday): 10 am to 2 pm
- Period 3 (Evening): 2 pm to 6 pm
- Period 4 (Night): 6 pm to 10 pm

Even though the time of the day was divided in a different manner for the northbound and southbound lanes of I-65, the hourly frequency for each period showed the same trend. As shown in Figure 3.5, the maximum frequency of hazmat trucks were observed during the midday for both north and south bound lanes (12.2 per hour for Franklin, KY and 9.5 per hour for Portland, TN). For the northbound lanes, the frequency was higher during the morning hours (9.3 per hour) and was diminished towards evening (6.9 per hour) and night (6.5 per hour). However, for the southbound lane, the hourly frequency was approximately equal for both morning and evening

HAZMAT TRANSPORT FOR NORTH AND SOUTHBOUND LANES IN THE I-65 CORRIDOR BY TIME OF DAY

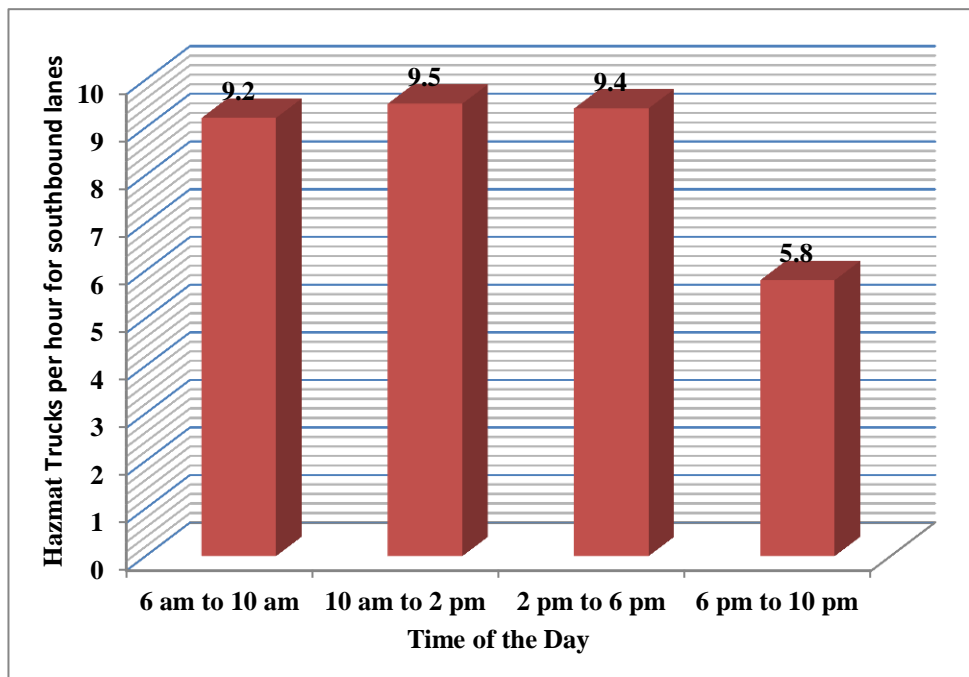
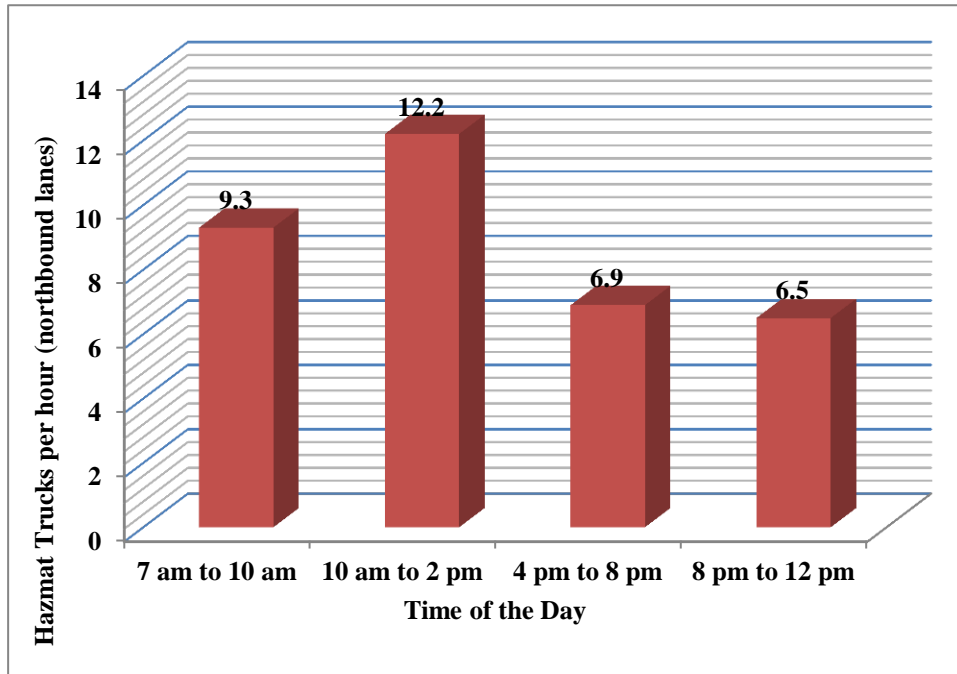


Figure 3.5. Placarded trucks observed on I-65 by time of the Day

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

hours (9.3 per hour), while hazmat transport showed a drastic reduction in the night (5.8 per hour).

For Natcher Parkway the time of the day was divided in a slightly different manner, as shown below. These periods represented the same temporal distributions of a day, as compared to I-65 observations. The time distribution was as follows:

Period 1 (Morning): 8 am to 11 am

Peirod2 (Midday): 11 am to 2 pm

Period 3 (Evening): 2 pm to 5 pm

Period 4 (Early Night): 5 pm to 8 pm

Different trends were observed for the SE bound and NW bound lanes of Natcher Parkway according to the hourly frequency of hazmat transport (Figure 3.6). For the SE bound lanes, the maximum transport was noted during the evening (4.4 per hour) while the peak for the NW bound lanes was noted during the morning (4.7 per hour). However, for the NW bound lanes, the frequency noted during the evening was also high (4.1 per hour) whereas the rest of the day showed a dip in the transport (3.7 per hour during the midday and the lowest of 1.3 during the night). For the SE bound lanes, the frequency was approximately equal for the morning and midday hours (3.3 per hour) and the minimum was noted during the night (1.2 per hour).

HAZMAT TRANSPORT FOR SOUTHEAST BOUND AND NORTHWESTBOUND LANES FOR WILLIAM NATCHER PARKWAY BY TIME OF DAY

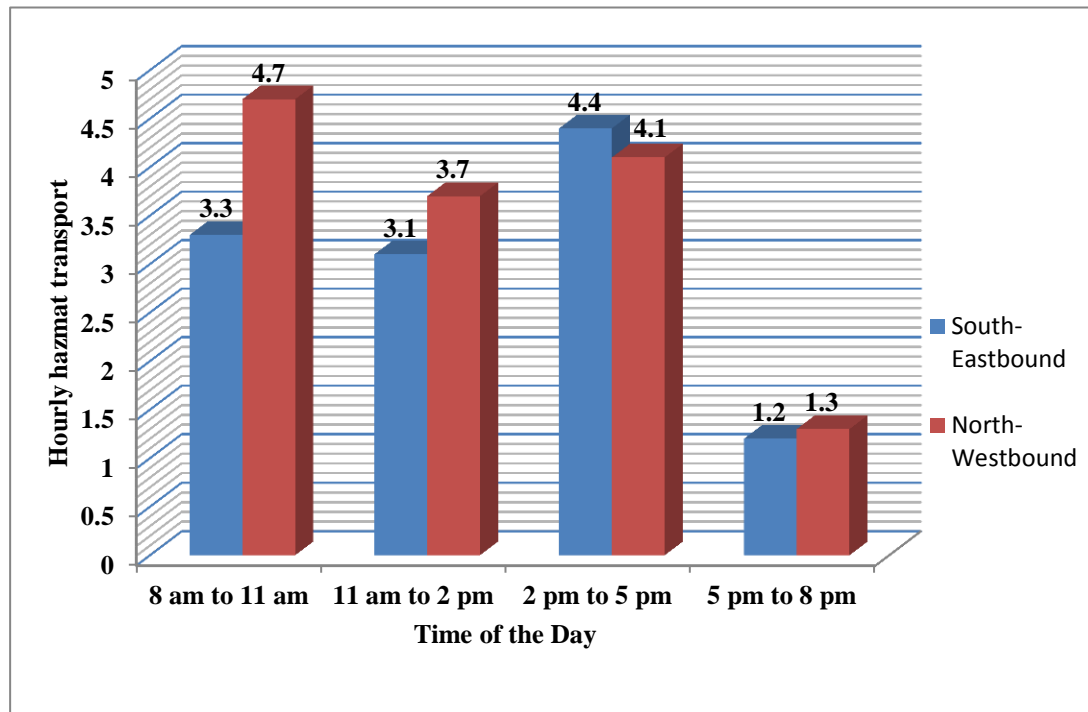


Figure 3.6 Placarded trucks on Natcher Parkway by time of the Day

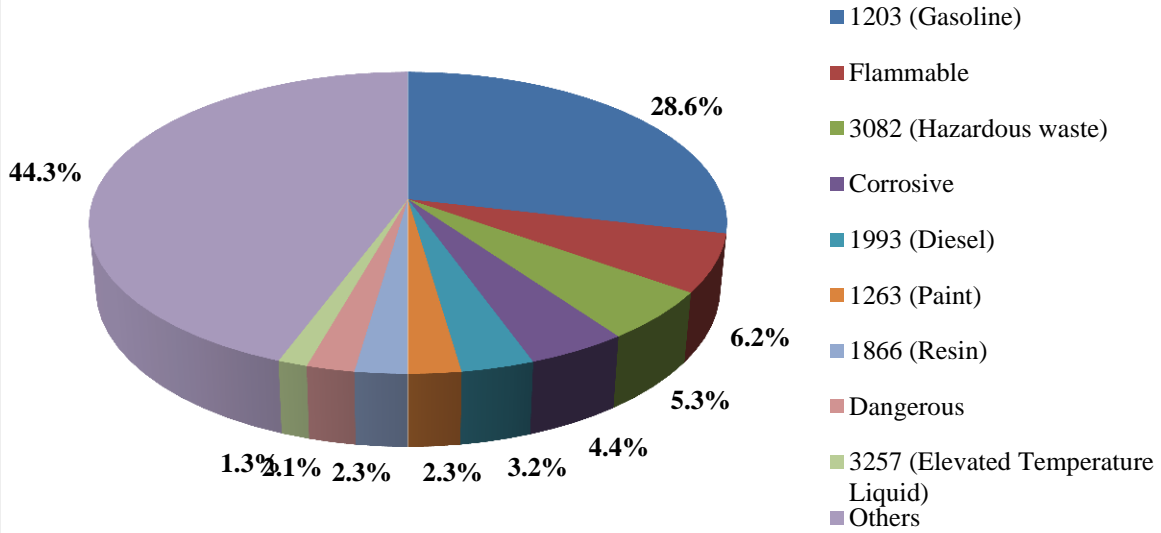
3.4 Composition of Hazardous Materials Being Transported

Analysis of placard data was used to assess materials being transported along the northbound I-65. Based on Figure 3.7, Petrol/ Gasoline (ID no. 1203) was the most frequently transported hazmat with a frequency of 28.6% of the total hazardous materials observed for commercial trucks. Other frequently observed materials included Flammable, Hazardous waste (ID No: 3082), Corrosive, Combustible Liquid (ID no: 1993) and so on. Figure 3.7 shows the top 10 hazardous materials transported along with the top 10 materials transported in the “Others” category.

Southbound I-65 observations of hazmat transport were similar to northbound (Figure 3.8). The most frequent hazmat transported was Petrol/ Gasoline (ID No: 1203) with the frequency being 38.7 % of the total hazardous materials transported southbound. The other most frequently observed hazardous materials, in terms of percentages, were Flammable, Corrosive, Hazardous Waste (ID No: 3082), Combustible Liquid (ID No: 1993), and Dangerous materials.

Some differences were noted when the transport of hazardous materials were analyzed for the William Natcher Parkway. For the SE bound transport, the most common hazmat was Petrol/Gasoline (ID No: 1203) with the frequency being 40.8% of the total hazardous materials transport eastbound. The other hazardous materials in order of their decreasing frequency included Flammable, Molten Aluminum (ID No: 9260), Paint (ID No: 1263), and Combustible Liquid (ID No: 1993). For the NW bound transport, the same trend was noticed. The most frequently transported material was Petrol/ Gasoline (ID No: 1203), the transport being 48.2% of the total westbound hazardous materials. The other hazardous materials in order of their frequency were Corrosive, Flammable, Molten Aluminum (ID No: 9260), and Propane (ID No: 1075). Figure 3.9 gives the percentages of the top 10 frequently transported hazardous materials both SE bound and NW bound on the William Natcher Parkway.

Top 10 Hazardous Materials Transported Along the Northbound I-65 Corridor



Percentage of Top 10 Hazardous Materials in the Others Category

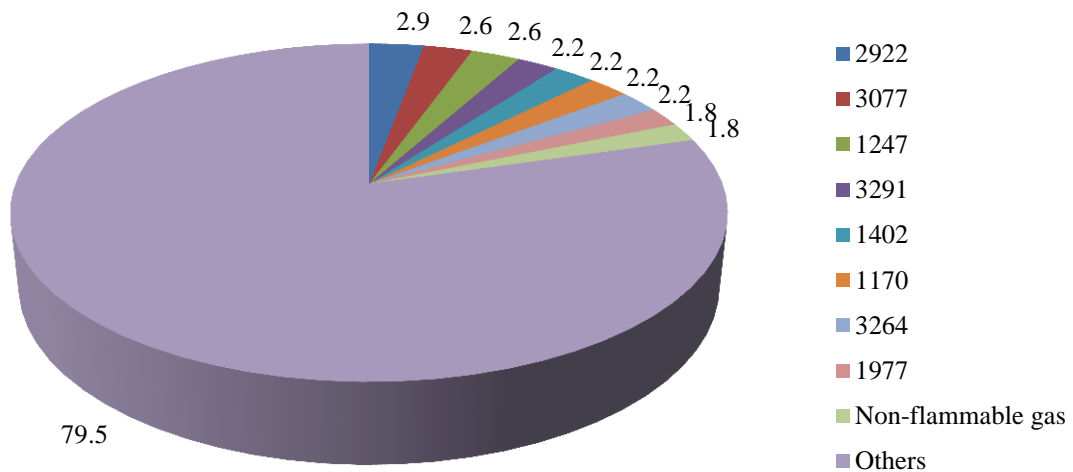
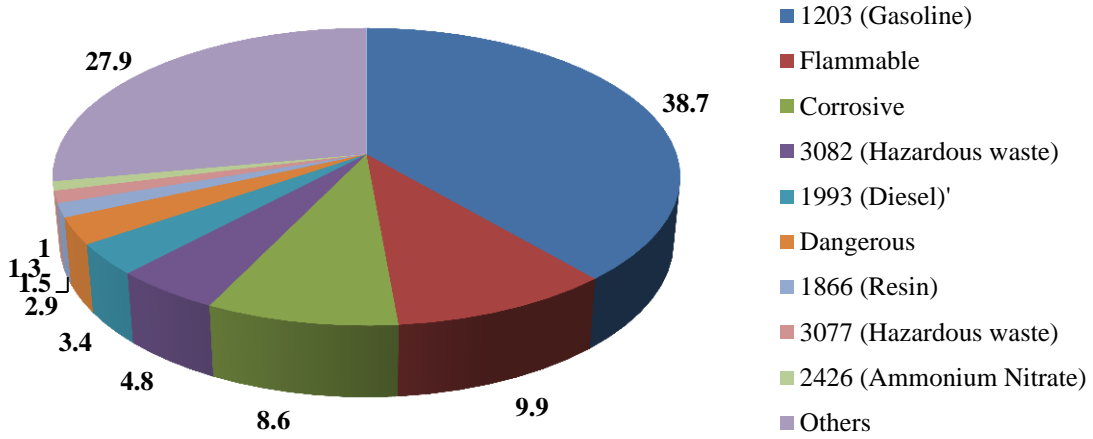


Figure 3.7 Most common hazardous materials observed on the Northbound I-65 Corridor

Percentage of Top 10 Hazardous Materials Transported Along the Southbound I-65 Corridor



Percentage of Hazardous Materials in the Others Category

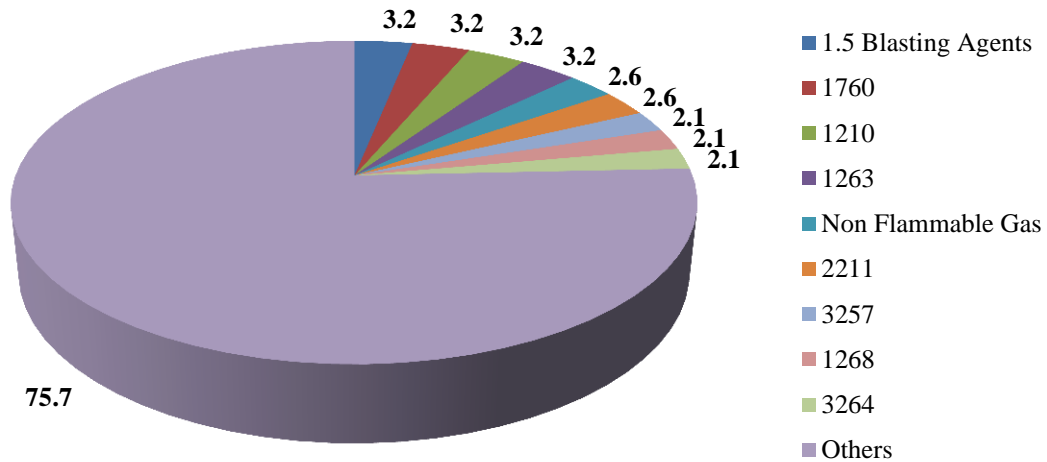
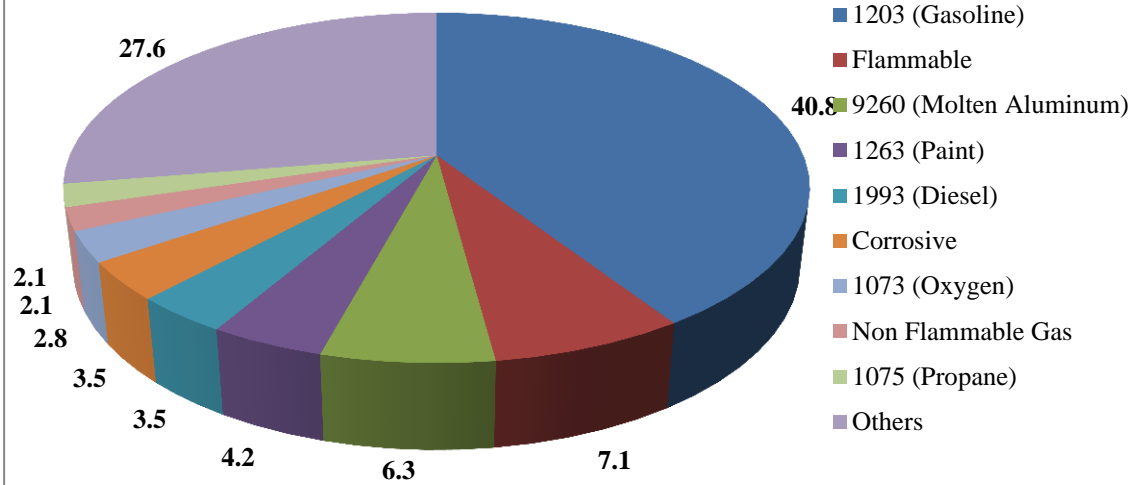


Figure 3.8 Most common hazardous materials observed on the Southbound I-65 Corridor

Percentage of Top 10 Hazardous Materials Transported along the South-Eastbound Natcher Parkway



Percentage of Top 10 Hazardous Materials Transported Along the North-Westbound Natcher Parkway

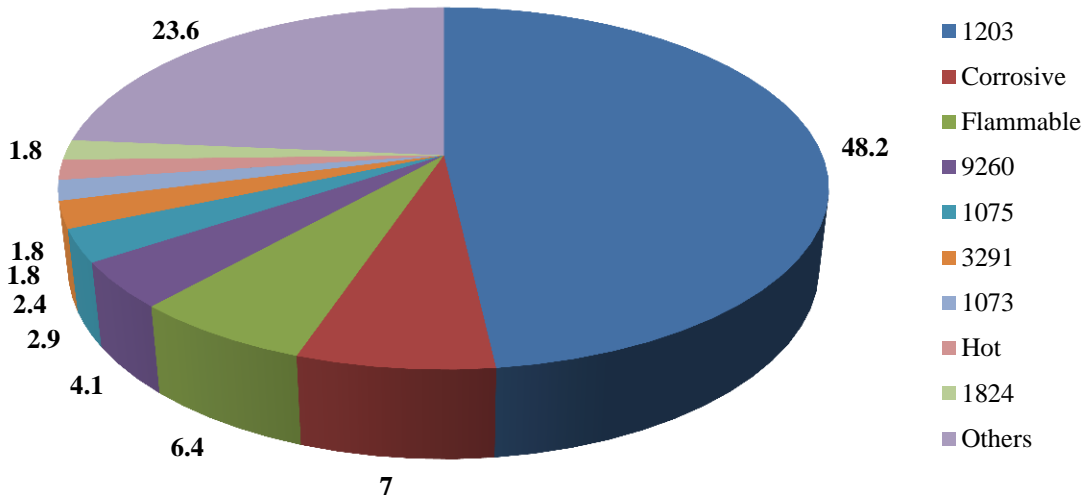


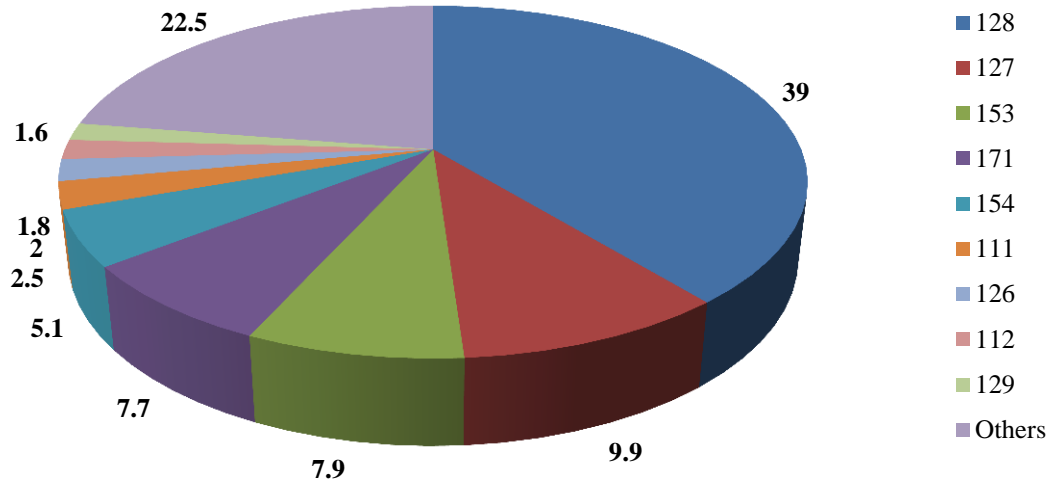
Figure 3.9 Most Common Hazardous Materials observed on the Natcher Parkway

3.5 Recommended Responses to the Frequently Transported Hazardous Materials

According to the frequency of recurring hazardous materials in the I-65 corridor, a recommendation is made based on the most frequently recurring guide number. This guide number in the Emergency Response Guide will help in preparing for hazmat incidents and training the emergency response team.

As per the frequencies, the most frequent guide no. in the Northbound corridor is 128 (Flammable Liquids, Water Immiscible) comprising almost 39% of the total hazardous materials transported. The other most frequent guide nos. include 127 (Flammable Liquids, Water Miscible), 153 (Substances- Toxic and/or Corrosive, Combustible), 171 (Substances- Low to Moderate Hazard) and 154 Substances- Toxic and/or Corrosive, Non Combustible). Similarly in the southbound corridor, similar trend was noted. The most frequent guide nos. were the same as noted in the northbound corridor, though there were some subtle differences. The guide no. 128 had a frequency of 44.6%. Thus, this exhibits an exaggerated need for development of emergency response for the flammable liquids. Please refer Figure 3.10 for further information.

Top 10 Recommended Emergency Responses according to Percentage of Guide Nos. along the Northbound I-65 Corridor



Top 10 Recommended Emergency Responses according to Percentage of Guide Nos. in the Southbound I-65 Corridor

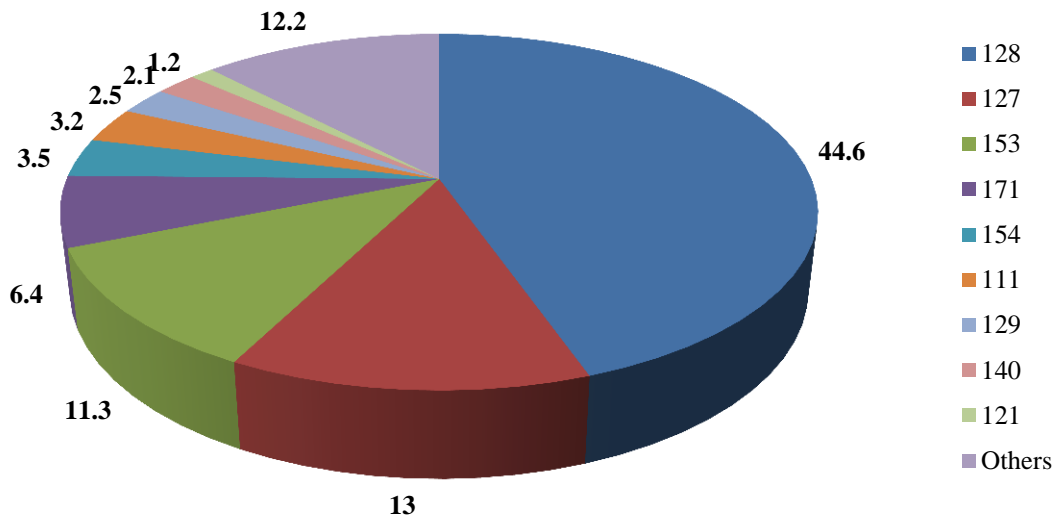


Figure 3.10 Recommended Emergency Responses on I-65 Corridor

3.6 Analysis of the hazardous material transport by railroad:

The transport of hazardous materials was also monitored for the railroads since they serve as one of the most important routes of influx of commodities. The railroads were monitored for a total of 48 hours over a five day period. The monitoring was done on four weekdays (12 hours each on Tuesday, Wednesday and Thursday and a 6-hours shift on Friday) and Saturday (6-hours shift). This gives a widespread distribution of the toxic materials transport. It should be noted that even though there were not a large number of trains passing through the city of Bowling Green, the number of toxic materials are proportionately larger since one train may transport multiple hazardous materials. The toxic material transport was monitored according to their direction (Northbound or Southbound).

The total number of trains that passed through Bowling Green was 29 of which 13 were Southbound while 16 were Northbound. Of these 29 trains, 13 trains did not carry any placards, and hence it can be assumed that they did not transport any toxic materials. So, the remaining 16 trains transported hazardous materials. Thus, the frequency of transport of placarded trains was 1 in 3 hours. When the direction of the placarded trains was compared, it was noted that out of 16 trains, only 7 were southbound while 9 were northbound. So, the directional trend is the same for hazardous materials as it was for the total number of trains. So, the ratio of northbound trains to southbound trains was the same for total number of trains and placarded trains, approximately 1.28.

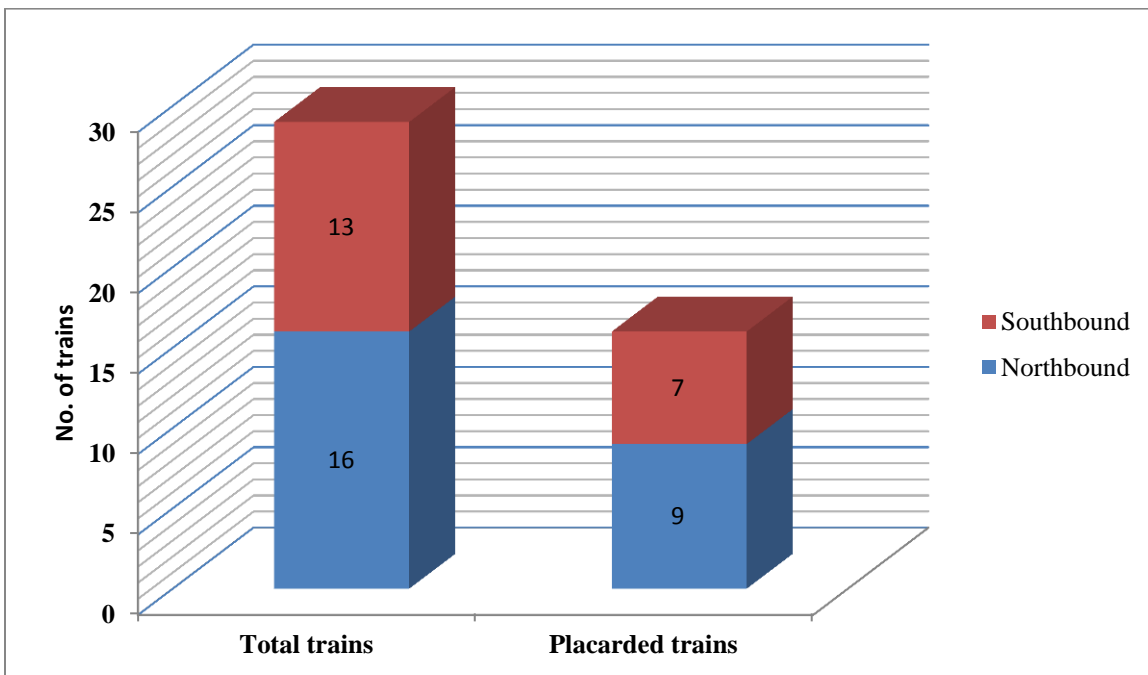


Figure 3.11 Total numbers of trains and placarded trains with reference to their directions

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

Out of the 16 trains, a total of 56 placards were identified. Of these hazardous materials, the most common 10 hazardous materials were identified. The most frequently transported hazardous material included Gasoline (ID no: 1203) followed by Caustic soda (ID No: 1824), Propane (ID No: 1075), Sulfuric Acid (ID No: 1830) and then Hazardous waste (ID No: 3082).

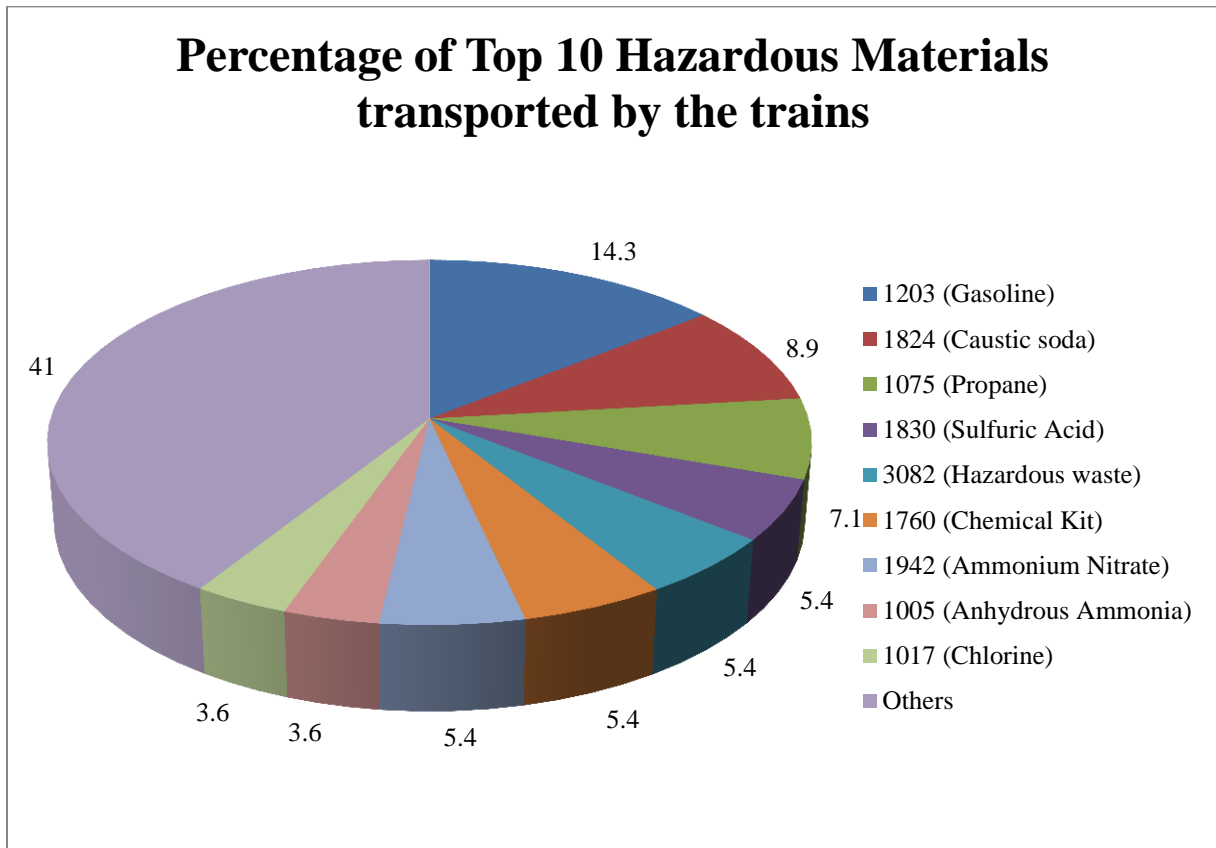


Figure 3.12 Most common hazardous materials transported by railroads

The Guide numbers of the toxic materials were then analyzed in order to conclude the emergency responses that would be most frequently needed in order to deal with incidents in case they occur proportionately to the frequency of transport of hazardous materials. So, this will highlight the importance of the type of response that would be most frequently needed.

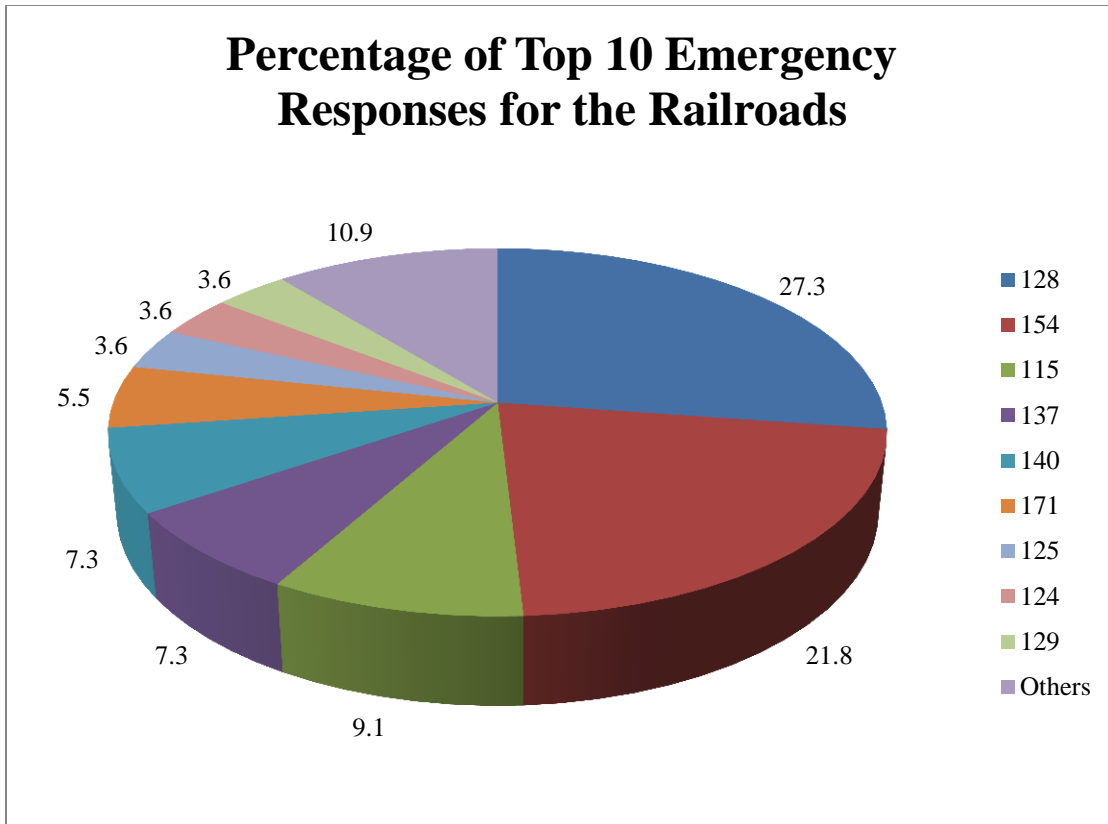


Figure 3.13 Most common recommended emergency responses near railroads

Chapter 4: Fixed Facilities along the I-65 Corridor and William Natcher Parkway

There are approximately 50 fixed facilities within the six counties of the study corridor in South Central Kentucky. The Kentucky Emergency Response Commission monitors these facilities because they store large amounts of hazardous materials, and in some cases in excess of the threshold planning capacity of one or more of the EPA's "Extremely Hazardous Materials" (Agency, 2010). In order to maintain inventories of these materials, fixed facilities such as manufacturing plants, regional terminals and distributors, municipal water plants, and retail operations that serve agriculture, receive shipments into and, in some cases, send hazardous materials outbound. Proper plans for anticipating the timing and placement of transportation incidents involving hazardous materials should be based upon the knowledge of fixed facilities uses of trucking, although other modes of transportation such as rail and barge may be used.

In order to investigate the use of local roads, highways, and streets in moving hazardous materials to and from fixed facilities in the study corridor, voluntary questionnaires were mailed to environmental health and safety managers at these facilities during May 2010. The questionnaire was designed to document the origins and destinations of hazmats interacting with fixed facilities within the corridor. Information requested in the questionnaire included:

- Frequency of Hazmat shipments
- Routine of hazmat shipments
- Total quantities of hazardous materials
- Origins/Destinations of shipments
- Timing of Hazmat shipments
- Composition of Hazmat shipments
- Recent trends

A total of 40 usable questionnaires were returned to LEPC. Questionnaires were assessed to portray the types of hazmat transport taking place at the local scale. Inspection of the questionnaire returns indicated a wide variety of firms in terms of size and function, which adds further support to the assumption of a representative sample.

4.1 Fixed facilities and hazardous materials

There are many industrial facilities, large and small, located in the study area and around I-65 and Natcher Parkway, which use these roadways for transportation of materials. Most of them ship and receive hazardous materials. It is essential to know the type of hazardous material transported as well as their regular periods of shipment. This knowledge will elucidate the most common substances transported, their origins and destinations, as well as trend of transportation over the last five years. LEPC is in need of fixed facility information to plan for necessary steps they should take for the most common hazardous materials transported. An important part of this survey was to assess if the facilities transport hazardous materials on legal holidays as well

as based on climatic conditions. Facilities which responded that they do not carry hazardous materials have been discarded from the results.

4.2 Fixed Facility Locations

Survey questions regarding the location of facilities based on city, state and county were provided to local industry and fixed facilities. This data was used to assess hazardous materials transport in and out of the Warren County area. Out of the 40 facilities that responded, all facilities were based in Kentucky, and some had corporate offices in other states. Kentucky cities where fixed facilities are located is presented in Figure 4.1. Most facilities were located in Bowling Green followed by Glasgow, Franklin, Horse cave, and other cities. Facilities were also asked to reply regarding the counties in which they were located (Figure 4.2). Survey results indicate that Warren County is a major hub of industrial facilities.

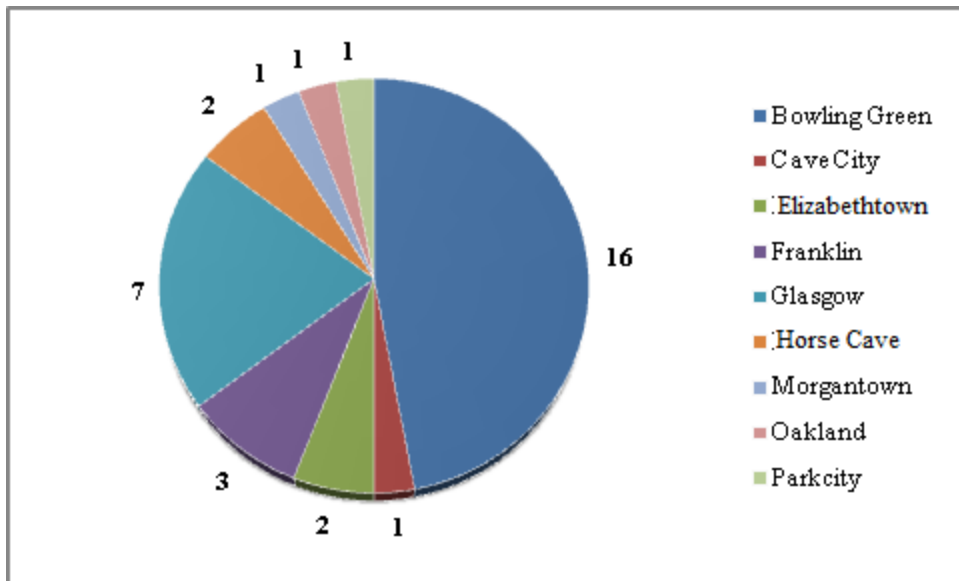


Figure 4.1- No of facilities in different Cities of Kentucky

The facilities were asked about the most common mode of *transportation* of materials through their facilities. All the facilities reported using trucks as a major source of transporting their materials. None of the facilities reported using railroad, as means of transportation. The survey consisted of questions requiring the facilities to give information about the five year history of the number of placarded trucks that leave or come to their facilities. They are also asked to give the routes they use for their movement, and to get to I-65, as this can be vital information to trace accidents or leaks.

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

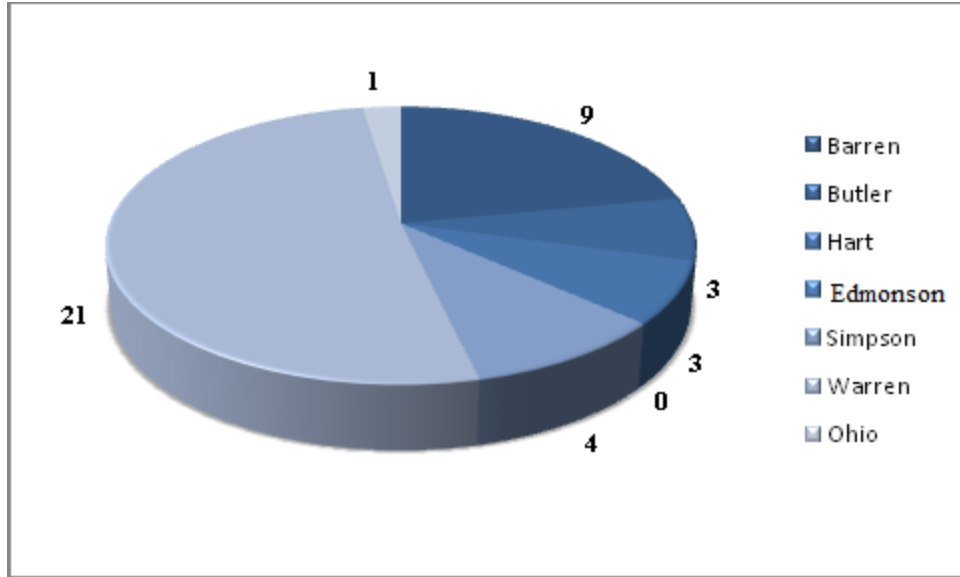


Figure 4.2- Distribution of facilities based on counties.

One of the questions in the survey asked the facilities to give information regarding the number of placarded trucks that entered and left their facilities in the five-year period of 2005-2009. Table 4.1 gives an overview of the movement of trucks for shipping and receiving. In both cases, shipping and receiving has not increased over this period for fixed facilities. In fact, numbers of placarded trucks received and shipped decreased in 2009. The cause for this decrease may be directly correlated to the down turn in the economy that has been experienced. Figure 4.3 shows that trucks received is approximately 3:1 as compared to the number shipped. When we compare the tonnage of materials shipped or received over the past five years, we observe the following trend shown in Figure 4.3.

Year	No of Trucks received	No of trucks shipped
2005	2740	798
2006	2931	804
2007	2878	731
2008	2973	1074
2009	2700	771

Table 4.1- No of Placarded Trucks-Shipped and Received from 2005-2009

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

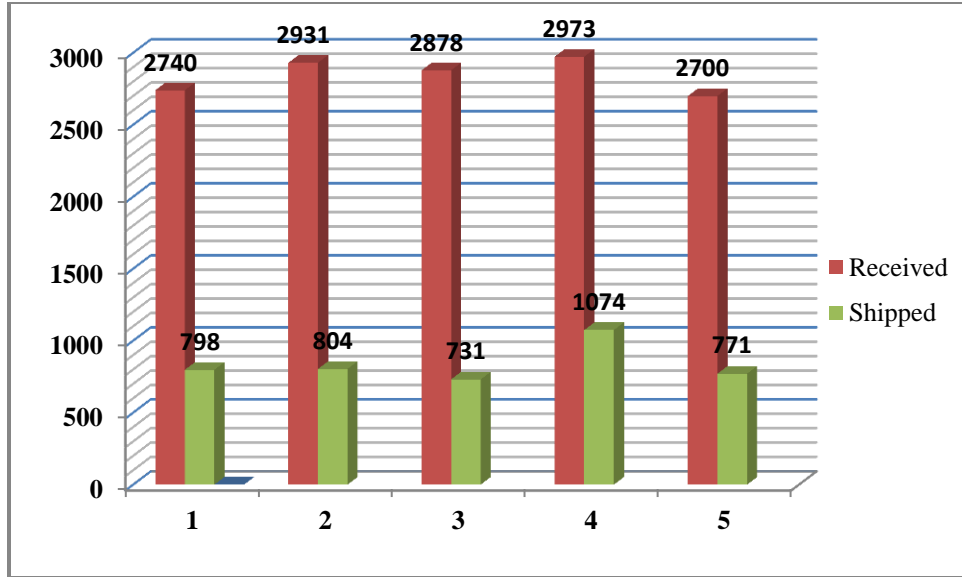


Figure 4.3- Distribution of Placarded trucks based on Shipping/Receiving

Hazardous materials shipment decreased from 89,598 tons per year (2,968 tons per year per facility) to 81,594 (2205 tons per year per facility) from 2005 to 2009 (Figure 4.4). Again, this reduction in tonnage mirrors the economic downturn that the United States and the region has experienced. At the level of individual facilities there are few systemic patterns of hazmat truck movements detected through analysis of these survey results. First very few facilities receive or send hazardous materials outside the normal M-F work week. Secondly, the most common time of transportation of hazardous materials is from 6 am - 4 pm.

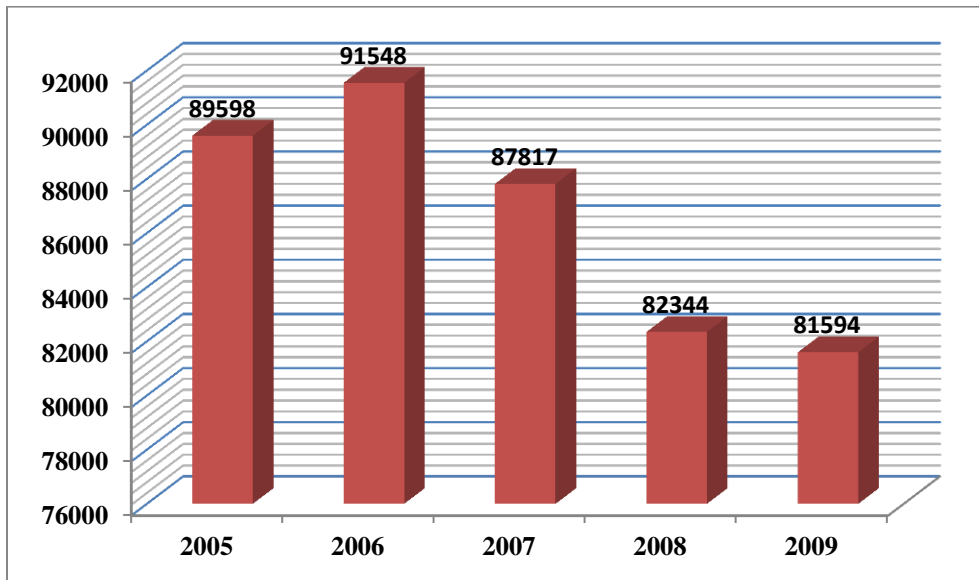


Figure 4.4- Tonnage of materials shipped from 2005-2010

4.3 Time and Space Pattern for shipments out of the facilities

Facilities were asked to report on days of shipment. Two facilities reported Saturday and Sunday as routine days of shipment. Thirteen of the facilities reported that they had no routine period of shipment. Basically, shipment was based on their requirements. Table 4.2 shows the facilities that reported that they did not have a routine of shipment of materials out of the facilities. A list of days and the number of facilities that ship on each day is show in Table 4.3. As evidenced from the data, shipments primarily occur Monday through Friday (Figure 4.5).

Table. 4.2. Facilities with no routine days of shipment.

1.	Dana Corporation
2.	Arvin Meritor
3.	Bondix Spicor
4.	KYTC
5.	Five star 4409(Newcomb oil co., LLC)
6.	Five Star 2215 (Newcomb Oil Co. LLC)
7.	Schwan's Food company
8.	JL French Corp.
9.	Texas Gas Transmission
10	Fruit of the Loom Dist. Center
11.	Speedway Super American LLC
12.	Qwest Communications

Table 4.3 Distribution of facilities shipping based on day of week

Day	No of Facilities shipping on that day
Monday	13
Tuesday	15
Wednesday	15
Thursday	15
Friday	15
Saturday	2
Sunday	2

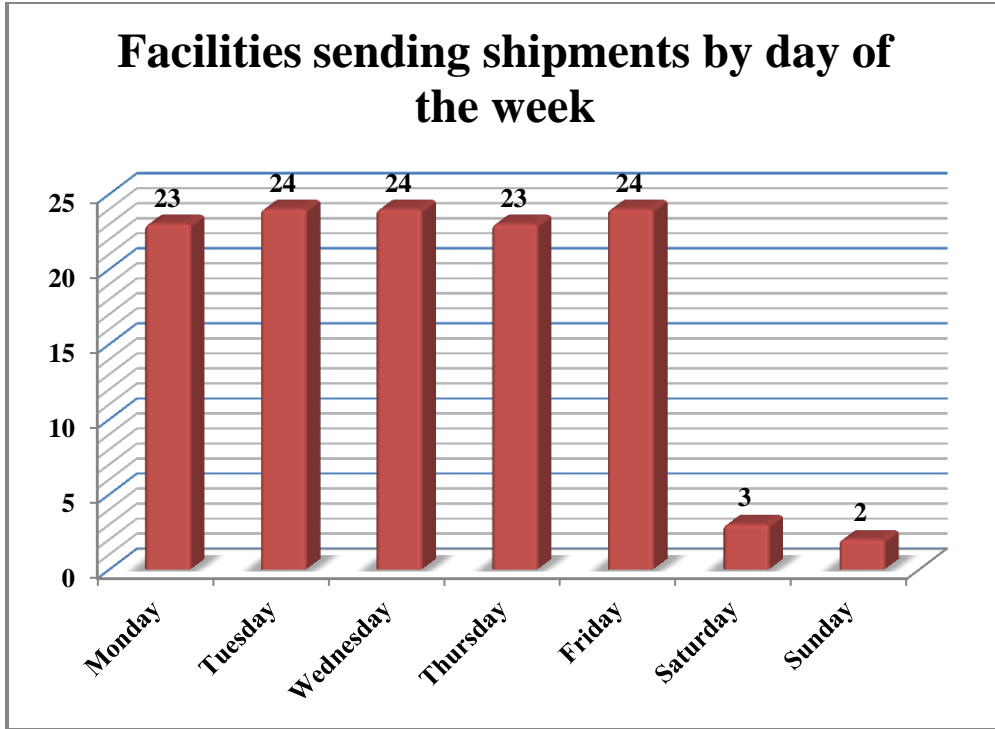


Figure 4.5 – Figure showing distribution of facilities shipping based on days of week

Fixed facilities were also asked to give information on the most common shipment times. Results are shown in Table 4.4 and Figure 4.6. The most common time of day of shipments was during normal working hours, between 6 am – 4 pm. It is also important to note that many of the facilities reported no routine times of shipment. Very few facilities ship after 4pm.

Time of Day	No of Facilities shipping at that time
6 am-9 am	4
9 am -12 pm	7
12 pm-4pm	6
4pm-6pm	1
6pm-12 am	0
12am-6am	4
No Routine	19

Table 4.4. Time of day wise distribution of facilities shipping

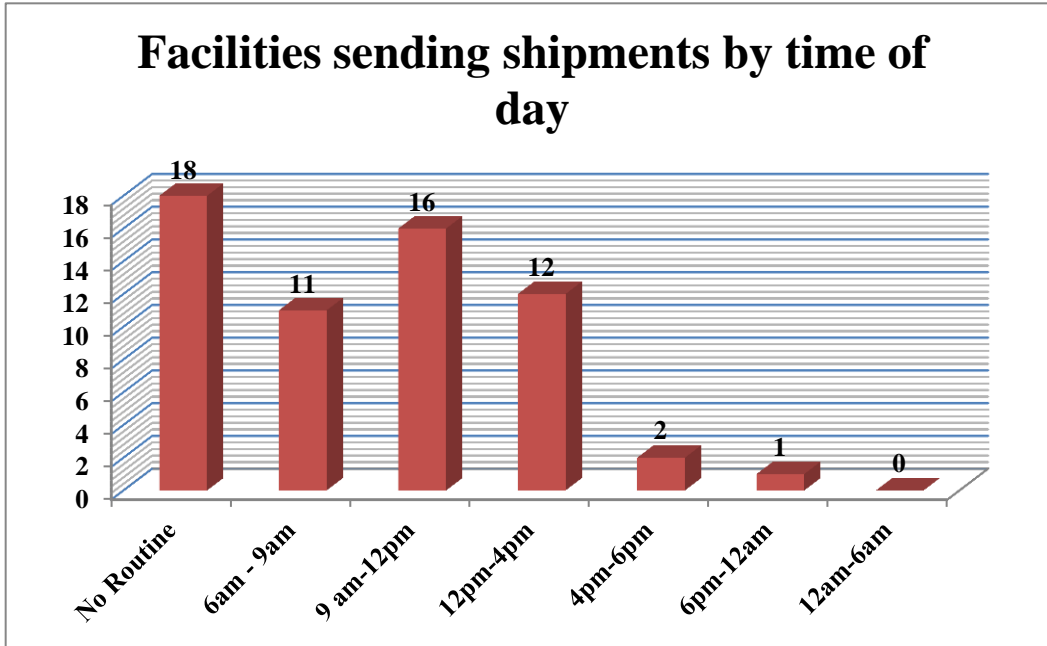


Figure 4.6- Time of day of shipping from facilities

4.4 Space and time pattern for receiving into the facilities

Information reported by facilities was analyzed to determine time patterns associated with receiving. Table 4.5 and Figure 4.7 gives information about the days of the week during which the facilities receive shipments. Eleven (11) of the facilities reported that they had no routine days for receiving shipments. However, it is clear that work days are when shipments are normally received. Very few facilities received shipments on weekends.

Day	No of Facilities shipping on that day
Monday	23
Tuesday	24
Wednesday	24
Thursday	23
Friday	24
Saturday	3
Sunday	2

Table 4.5- Distribution of facilities receiving materials based on days of week

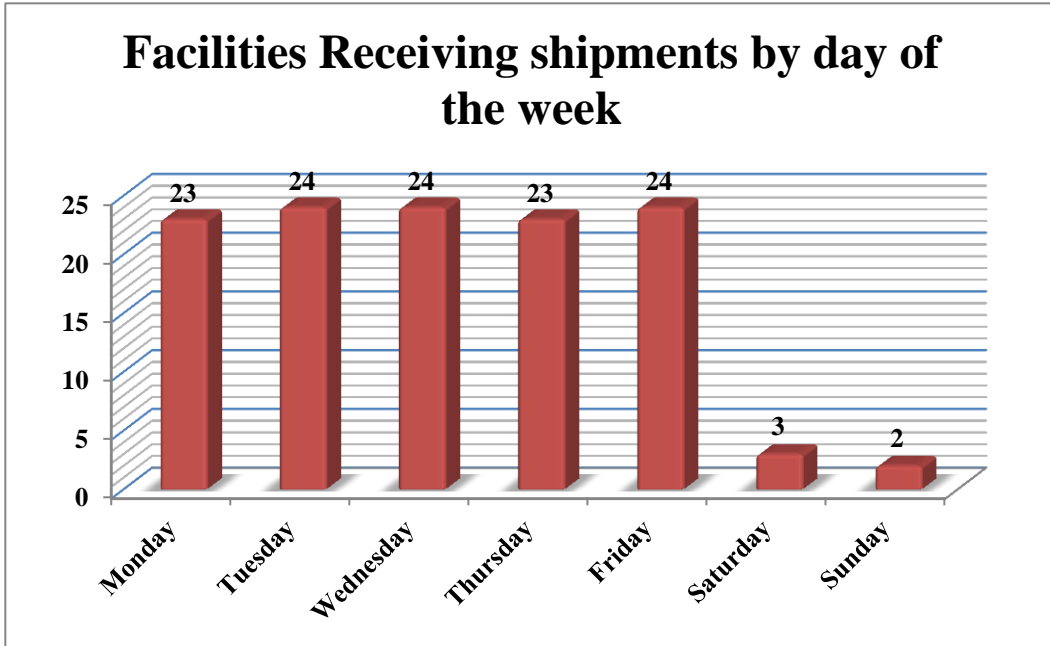


Figure 4.7- Distribution of facilities receiving materials based on days of week

Analysis of times when shipments are received indicates that most occur between 6 am – 4 pm, standard work hours. Figure 4.9 shows the distribution based on the surveys. The facilities were asked if they received or shipped hazardous materials on legal holidays. Eight out of 40 facilities, which make up 20% of all the facilities, ship or receive hazardous materials on legal holidays. This may be a cause of concern as with low traffic, trucks can drive at higher rates of speed, thus increasing the chances of incidents.

Table 4.6. Time shipment of receiving reported by facilities.

Time of Day	No of Facilities shipping at that time
6 am-9 am	11
9 am -12 pm	16
12 pm-4pm	12
4pm-6pm	2
6pm-12 am	1
12am-6am	0
No Routine	18

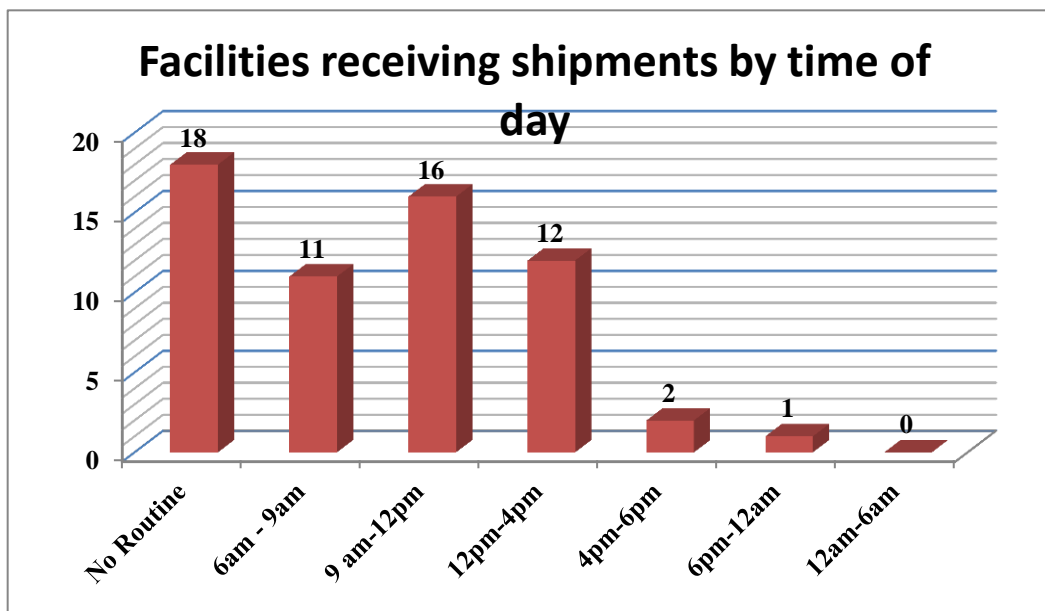


Figure 4.8- Figure showing time of receiving of shipments into facilities

4.5 Material Data Analysis

The questionnaire was designed to elicit information about five most frequently shipped hazardous materials to and from fixed facilities, within the study corridor. The 40 respondents listed a total of 42 hazardous materials that were transported during the five year period from January 2005 through December 2009. The survey had questions regarding the most common cities and states the materials are received from or shipped to, as well as the season of the year.

Out of the 42 hazardous materials listed, diesel and other flammable substances, LPG and Gasoline formed approximately 29% of the composition of hazardous materials reported by the fixed facilities (Figure 4.9). Other materials that were shipped or received included lead and lead batteries, chlorine, and Pliogrip 7400. Other substances which were shipped in smaller quantities together formed the 51% of the total of hazardous materials. The other category, which makes up 51 % of the remaining hazardous materials, consisted of the substances having the following Placard numbers: 1830 , 1263, 2211, 1824, 1805, 1993, 1079, 1005, 1268, 3268, 1823, 2735, 1139, 1267, 3077, 1977, 2211, 3268, 100, 1307, 1760, 1066, 1866, 3214, 1993, 2187, 2357, 1206, 1223, 3082,2693 and 2491.

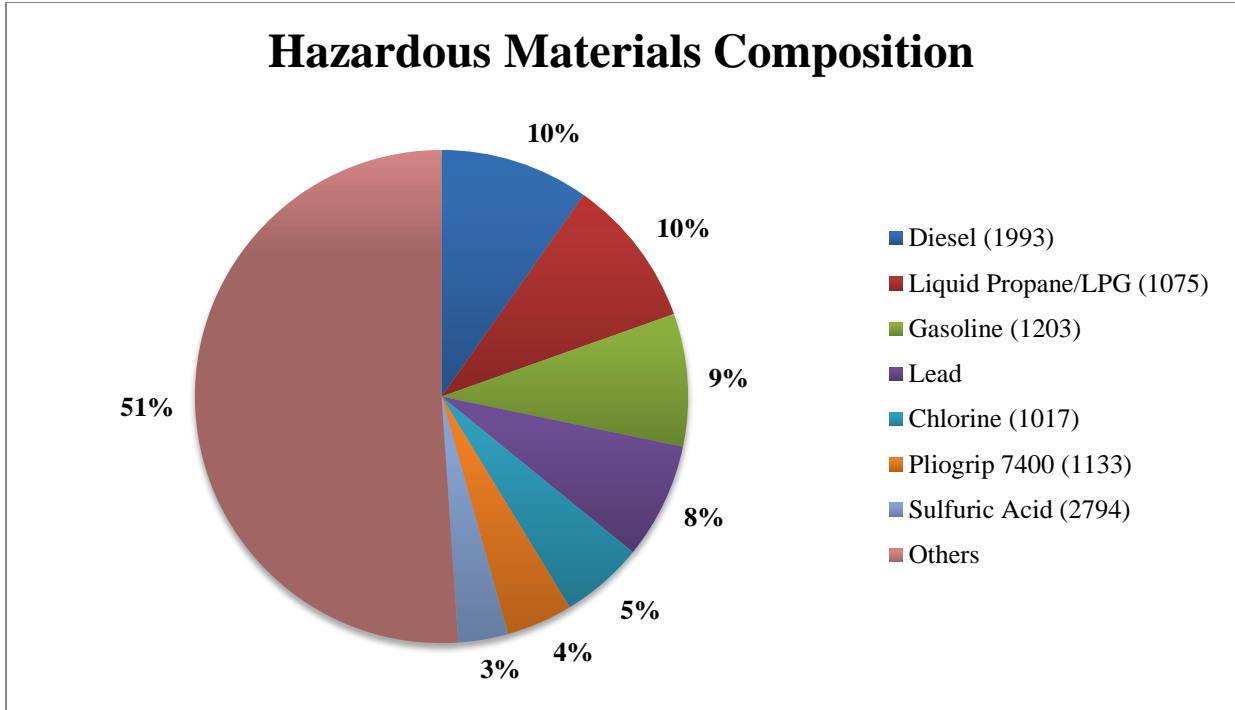


Figure 4.9- Hazardous Material most commonly shipped/Received

The survey also asked the facilities to fill out information about the origin city and state of materials received. This information provides guidance on the routes that commercial trucks may take to the fixed facilities, As such, this will add in emergency preparedness. Figure 4.10 shows that Kentucky is the major state hazardous materials origin in the I-65 corridor of the study area, Kentucky is followed by Tennessee, Illinois, Indiana and others. Other states include Alabama, Georgia, Arizona, California, Iowa, Michigan, NC, SC, Utah, West Virginia, and Wisconsin.

Nashville is the most common city of origin of hazardous materials into the study corridor (Figure 4.11). Bowling Green was the second most common city, followed by Louisville, Morgantown, Owensboro and others. Survey results show that local transport is a primary source of materials. Table 4.7 gives an overview of the different states and cities from which commodity flow originates in the study corridor. A map of states that fixed facilities received shipments from is shown in Figure 4.12.

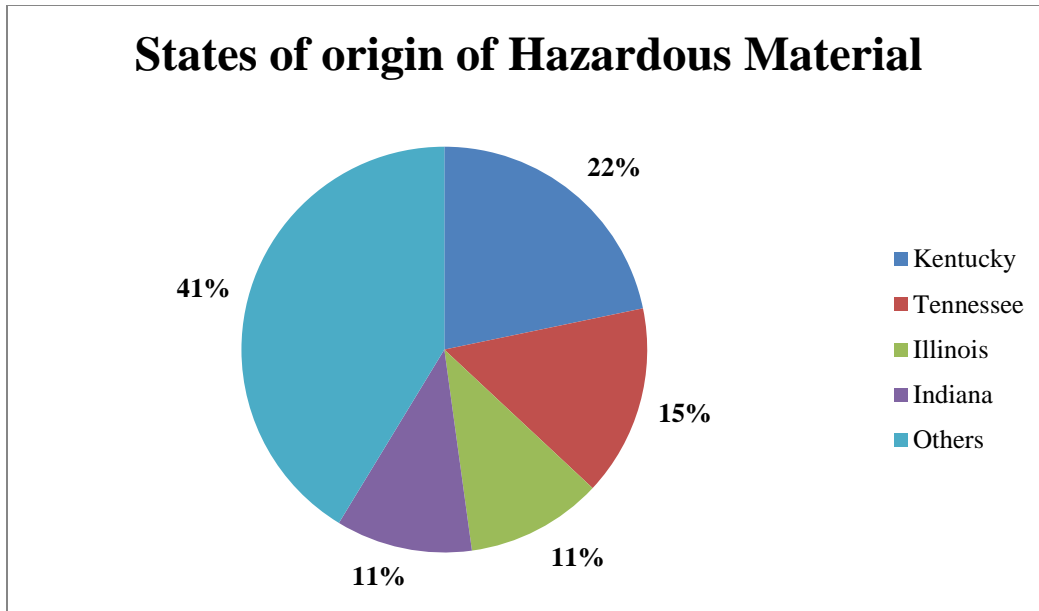


Figure 4.10- States of Origins of Hazardous materials shipment

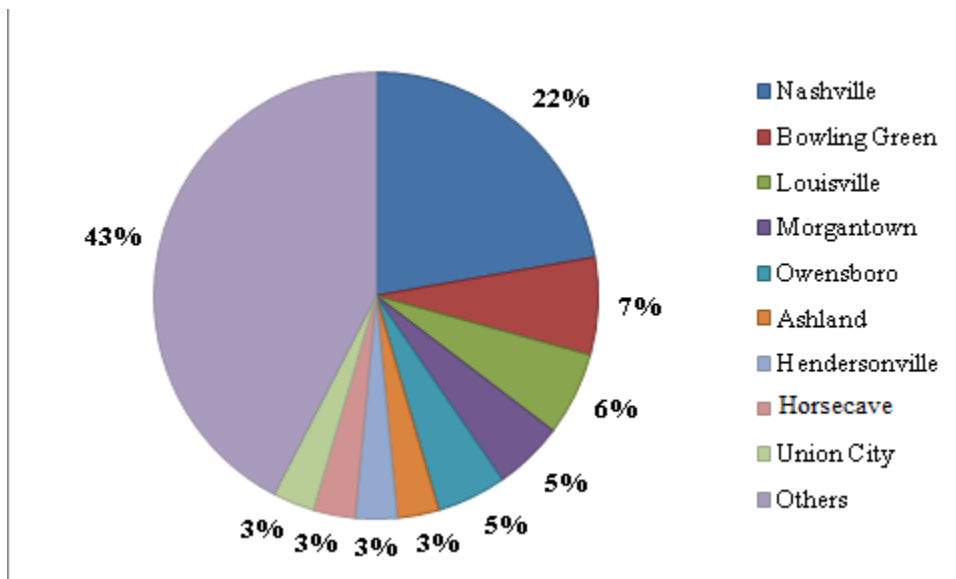


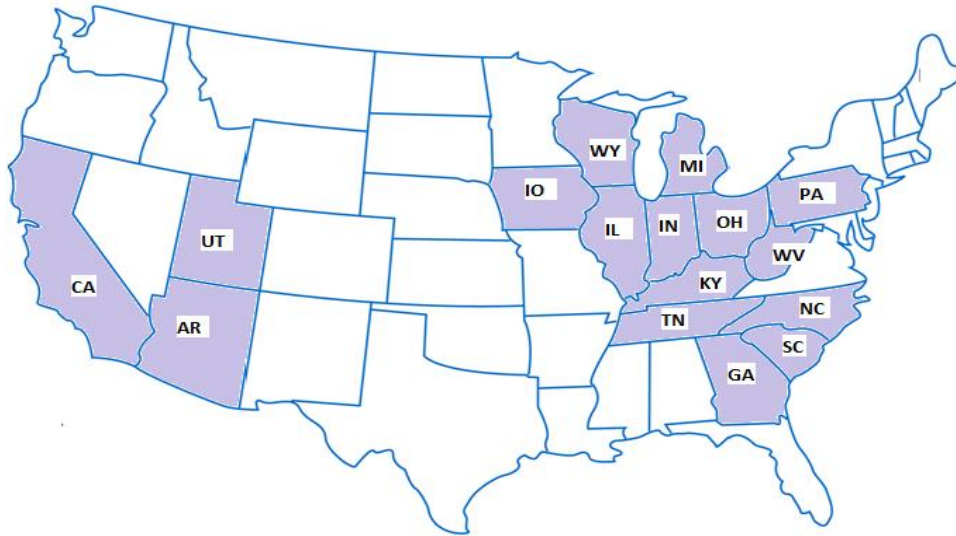
Figure 4.11- Most common cities of origin of Hazardous materials

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

State	Cities
Alabama	Birmingham
Georgia	Benton, Blytheville
Arizona	Troy, Allatta, Cheroche
California	Adelanto
Illinois	Joliet, Carpentersville, Channanoh, Chicago, Riverdale
Indiana	Princeton, Beach groove, Cottage groove, Indianapolis, Oklahoma City
Iowa	Elridge
Kentucky	Bowling Green, Louisville, Morgantown, Owensboro, HorseCave, Elizabeth town, Franklin, Glasgow, Hendersonville, Somerset
Michigan	Romulus
North Carolina	Charlotte, Roxboro
Ohio	Ashland, Maumee, Holland
South Carolina	Russellville
Tennessee	Nashville, Hendersonville, Union City, Cleveland, Kingsport, Lafayette,
Utah	Ogden
West Virginia	Weirbon
Wisconsin	Columbus, Saukville

Table 4.7- States and Cities of Origin for commodity flow on I-65, Warren County, KY.

Figure 4.12. States of origin of Hazardous Materials



Facilities provided the most common seasons of the year during which they transport hazardous materials (Figure 4.13). For the facilities that responded, 55% reported that they had no particular season for transportation of hazardous materials. Basically, the supply period is

based upon demand for their produced materials. The distribution of supply was equivalent throughout the year, with a slightly increased rate from October to December

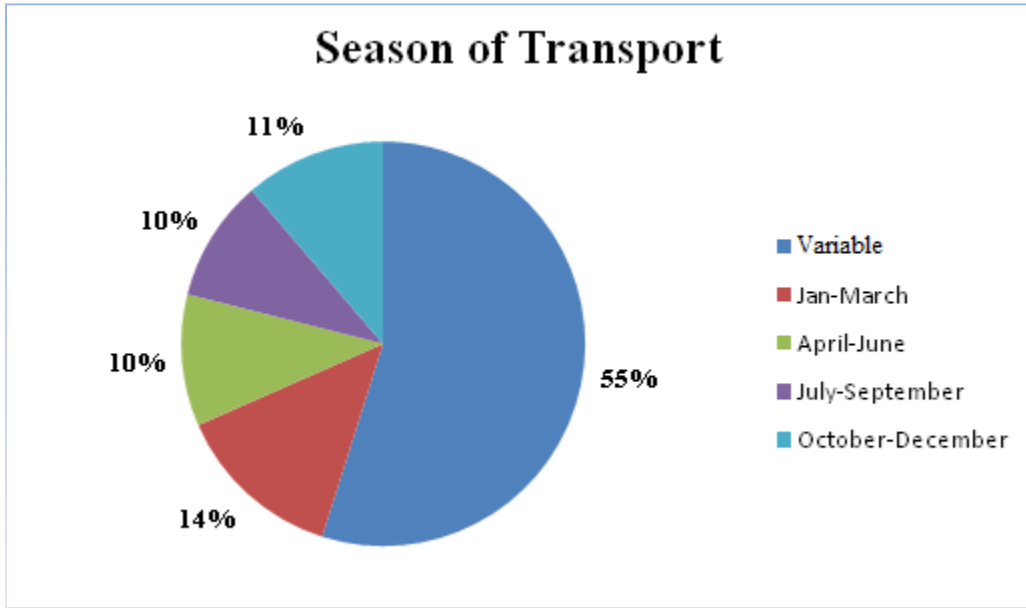


Figure 4.13- Seasons of shipments on I-65

Chapter 5: Most Common Hazardous Materials Transported through the I-65 corridor: Discussion

The following points regarding the most common hazardous materials are provided in a bulleted list for ease of review. Below, placard numbers are provided to improve the ease of “Guidebook” use.

- The Placard Ids of the first five most commonly reported hazardous materials transported through the I-65 study corridor were 1203, Flammable, 3082, Corrosive and 1993.
- The following table (Table shows the most common Placard numbers with their respective guide numbers used from the Emergency response guidebook:

Table 5.1- Placard numbers for the most commonly received commodities.

<i>Placard No.</i>	<i>Respective Guide No.</i>
1203	128
Flammable	127
3082	171
Corrosive	153
1993	128

- Placard Id 1203 is used for materials like Gasohol, Gasoline, Motor Spirit and Petrol, while Id 3082 is used for the materials that are environmentally hazardous Liquid materials, Hazardous waste materials and other regulated liquid substances. The Placard Id 1993 is used for Combustible Liquids, Compound cleaning liquids, Compound tree or week cleaning liquids, Diesel fluids, Flammable Liquids, Fuel Oil, Medicines, and

materials used in Refrigerating machine. Apart from these the common toxic materials transported through this route included Flammable and Corrosive hazardous materials.

- Now we shall discuss the immediate response in case of emergency, for the materials using the common Placard Id numbers and the respective PPE (Personal Protective Equipment / Response) required.

Reported Emergency Response from the “Guidebook”:

1. Materials with Placard Id. 1203: Gasohol, Gasoline, Motor Spirit and Petrol.

- **Emergency Response:** These are usually the non- Polar or Water Immiscible liquids. According to the Emergency Response Guidebook, in case of small fire involving these materials, dry chemical or Co2 is suggested to be used. Water spray, fog or regular foam can be used in case of large fires. In case of massive fire involving large Tanks or Trailer Loads, it is suggested to fight the fire from maximum distance or use unmanned hose holders; and if this is not possible, withdraw from area letting the fire burn. Withdraw immediately in case of a rising sound or discoloration of tank. It is advised to always stay away from the Tanks engulfed in fire. In case of Spill or Leak, first step is to eliminate all ignition sources (eg. No Smoking). Do not step or walk on the spilled material, and if possible stop the leak without leak. A vapor suppressing foam may be used to reduce the vapors. In case of the large spills, it is suggested to dike far ahead of liquid spill for later disposal.
 - **PPE required:** Positive Pressure Self-contained breathing apparatus (SCBA)
- 2. Flammable Materials:** These are the Polar or water miscible liquids. But the emergency Response and PPE required for this section of materials is same as mentioned above.
- 3. Materials with Placard Id. 3082:** This involves the materials that are environmentally hazardous Liquid materials, Hazardous waste materials and other regulated liquid substances. These are the low to moderate hazard materials.
- **Emergency Response and PPE:** Emergency Response in case of a Fire is same as mentioned in the section 1 with Placard 1203. In case of Spill or Leak involving these materials, apart from the response mentioned in section 1, it is advised to prevent dust cloud and avoid inhalation of asbestos dust. In case of a Small Dry spill, it is advised to

use a clean shovel to place the material into clean, dry container and cover loosely and move containers from the spill area. In case of a Small spill, take up the material with the sand or other non-combustible absorbent material and place into containers for later disposal. In case of Large spill, cover the powder spill with plastic sheet or tarp to minimize the spreading. It is also advised to try and avoid entry into waterways, sewers, basements or confined areas. A Self-contained breathing apparatus (SCBA) is advised as a PPE.

4. **Corrosive Materials:** These are also Combustible Materials.
- **Emergency Response:** The emergency response for these materials is same as mentioned in the 1 above. In addition to that, it is advised to not get water inside the containers. Elimination of the ignition sources is highly recommended.
- **PPE:** Apart from the commonly used SCBA, it is advised to wear chemical protective clothing that is specifically recommended by the manufacturer.
5. **Materials with Placard Id. 1993:** It involves Combustible Liquids, Compound cleaning liquids, Compound tree or week cleaning liquids, Diesel fluids, Flammable Liquids, Fuel Oil, Medicines, and materials used in Refrigerating machine. Since the placard Id, for the materials under this section also refers to the Guide No. 128, the Emergency response and PPE required remains the same as mentioned in Section 1.

Chapter 6: Summary

Hazardous materials are an important part of contemporary American society. As with other commodities, hazardous materials are produced, transported, stored, used and discarded. A threat to environment and human health is posed by hazardous materials that are released due to highway, railway, and other incidents. Incidents with hazardous materials can take place at any time, from their production to their disposition. This study clarifies the quantities and types of hazardous materials that are transported on highways in the Warren County area of Kentucky. Likewise, information is provided on the timing of transport, which is critical for emergency preparedness by LEPC.

It is essential to educate communities, both large and small, about the care to be taken with hazardous materials. Hence, it is important to initiate construction of a knowledge base that concerns types of hazardous materials being transported into, out of, and through a respective jurisdiction. In addition to their relative frequency, the timing and routing of hazardous materials increases emergency response. The Emergency Response Planning committee must be predicated on an adequate portrayal of these elements of hazmat movements. The adequacy of emergency response organizational schemes, equipment inventories and purchases, and personal training can only be assessed in the light of this type of information.

This report creates an accurate starting point, and begins the development of the necessary knowledge of transportation of hazardous materials through the I-65 and Natcher Parkway corridors. Communicating this information to emergency responders will generate an initial line of incident response before such an event occurs. A greater issue is that I-65 passes through six (6) Kentucky counties in the study corridor. Coordination of emergency response will be critical to adequately protect human health and environment from the potential impacts of the hazardous materials documented. It is hopeful that results and recommendations of this report will be a useful guide in preparing emergency responders.

This study provides focus on highway and railroad transportation. The empirical results that are summarized below are based on the following:

- A seven year hazmat incident history from 2004-June 2010 which was reported to the Warren County Local emergency Planning commission.
- A fixed facility survey sent out to all the facilities in Warren county and the surrounding region.
- Commodity flow data were collected by placard surveys on I-65, Natcher Parkway and at the railroad crossing near Western Kentucky University's campus. Monitoring was conducted by Western Kentucky University students from the Department of Public Health, Environmental Health Science program. Student work was supervised by Dr. Vijay Golla and Dr. Ritchie Taylor of Western Kentucky University and by Mr. Bob Myatt with the LEPC.

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

The following section summarizes the results obtained in chapters 2, 3, 4 and 5 and gives recommendations which can be used as a guidance tool for emergency preparedness:

Result 1:

During the period of January 2004 - June 2010 a total of 71 incidents were reported to the Warren County Local Emergency Planning Commission. Out of the total of 71 incidents, 27 occurred in the I-65 and Natcher Parkway study corridor. A great variation is found in the number of incidents reported during the data period, with greater incidents being reported in 2007. USDOT placard ID number 1993 was the most common hazardous material involved in incidents, with a total of 16 incidents. Current data for 2010 indicates a greater rate of incidents than in 2009, with only incident data available through June 2010. Hazmat transport reported by fixed facilities, both shipping and receiving, indicates that transport volume follows economic activity.

Recommendation 1.1:

The emergency response committee should index general economic activity as a predictor of commodity transport. Data shows that transport volume corresponds to the number of incidents. Periods of recovery after a sustained economic lull may be particularly dangerous periods in the study corridor.

Recommendation 1.2:

LEPC should inform local emergency responders as to the most detected placard ID numbers in surveys, incidents, and from other data sources. This would ensure that responders are prepared for hazardous materials incidents that are likely to occur. Also, LEPC planning should take all hazardous materials observed in to account in planning.

Result 2:

Highest incidents were reported in the Warren County area during the year of 2007. Warren county includes the city of Bowling Green and Western Kentucky University.

Recommendation 2:

It is very important for emergency responders in the Warren County area to be prepared for multiple incidents. Additionally, emergency response should be overly prepared in order to safeguard a large group of population from hazmat incident effects. Past data indicates that incidents will continue to occur in the Warren County study corridor.

Result 3:

Majority of incidents include spill and vehicular accidents along the I-65 and Natcher Parkway corridor.

Recommendation 3:

It is important to update the drivers about the current rules and regulations and safety norms. Strict rules should be implemented for speed control in this corridor, especially in the Bowling Green area. Log books should be thoroughly checked to make sure the drivers do not overwork,

and speed limits for trucks should be restricted to 60 mph. Also trucks overtaking on highways should be fined. A system of automated signage may improve safety.

Result 4:

Diesel, placard ID 1993, is the most common hazardous material released hazmat incidents. The Response guide that should be used for this substance is 128.

Recommendation 4:

It is important for Local Emergency responders to be properly trained for response Guide no 128. They should be updated with any changes that are made to this guide. Annual training for emergency responders should include a refresher on application of response guide 128 under various scenarios.

Result 5:

The overall frequency of hazardous material demonstrated an increase in the southbound transport. This shows that a greater amount of hazardous materials pass through the state of Kentucky even if the destination for the hazardous materials are southern states.

Recommendation 5:

This warrants an increased need for the emergency responders to be vigilant around the southbound I-65 corridor since it is a popular route for hazardous materials. Additional emergency crossover points should be provided along I-65 that allows emergency vehicles increased access for incidents.

Result 6:

The frequency of hazardous materials was recorded to be highest on Friday as compared to any other day of the week. Also, it was noted that the traffic lull with regards to the hazardous material was highest from 10 am to 2 pm. Fixed facility data indicate that Monday through Friday are the busiest days for transport, and 6 am – 4 pm is when the majority of shipping and receiving occurs.

Recommendation 6:

It is extremely important for the emergency responders to be familiar with the peak days and times with reference to the transportation of hazardous materials. This will ensure better alertness and preparedness in case an incident occurs during these time periods. Extra emergency responders should be on call during the aforementioned peak timing in order to ensure efficient response. One potential problem in areas with volunteer emergency responders is that these responders are usually working other jobs during these peak times for hazardous materials transport. A system needs to be devised to improve incident response in these areas.

Result 7:

Warren County, Kentucky Hazardous Materials Commodity Flow Analysis

The most common hazardous material that was transported across the I-65 corridor was placard ID 1203 which was petrol. This demonstrates the increased transportation of motor fuels between states.

Recommendation 7:

This explains the increased need of developing emergency response for these fuel related products in case of an incident. It is also important to train the emergency responders with reference to these motor fuels. Annual training should be established for incidents involving ID 1203.

Result 8:

The Natcher Parkway shows slight deviation in the pattern of peak duration of hazardous material transport. The peak time for transport is 8 am to 11 am, which is the morning rush hour. However, the day of peak transport of placarded trucks is Friday (the same as on the I-65 corridor).

Recommendation 8:

This diverts attention to the most important period of hazardous material transport on the Natcher Parkway. Since, it is the morning rush hour, any incident during this period will affect the commuters' health. So, it should be the most vigilant work period for the emergency responders. Correspondence of hazard transport and high traffic volume constitutes a worst case scenario. A public health risk assessment should be conducted for the most hazardous materials.

Result 9:

The overall transport of hazardous materials on the Natcher Parkway suggests that a greater number of placarded trucks travel on the westbound lane as compared to the eastbound lane. Thus, a greater number of hazardous materials are brought into the cities of Bowling Green and Owensboro from Exit 20 on I-65 highway.

Recommendation 9:

This depicts the importance of greater traffic vigil at exit 20 and Natcher Parkway since any incident occurring there would not only affect the commuters but would also affect the residential areas nearby. Public health risk assessments should be conducted to assess worst case scenarios and develop adequate training for emergency responders.

Result 10:

The hazardous material that was transported most commonly on Natcher Parkway was motor fuels (Placard No: 1203). This is the same as the most common material transported on the I-65 corridor.

Recommendation 10:

This emphasizes the increased need for training the emergency responders with reference to any incident involving motor fuels. It is extremely important to include the emergency response to guide no. 128 while developing any training programs for the officials. Worst case conditions for motor fuels should be assessed and adequate training scenarios provided.

Result 11: The numbers of trains with placarded train cars were 16 out of a total number of 29 trains. Of these 16 trains transporting hazardous materials 9 were northbound while 7 were southbound.

Recommendation 11: Train transport results in an existing threat within Bowling Green city limits. Also, hazardous materials are being transported very near to Western Kentucky University. Due to the high concentration of people on this campus, response and training scenarios need to be developed in the case of a train incident. These scenarios would aid emergency response in the region. LEPC should partner with Western Kentucky University's campus community to improve incident response.

Result 12:

The hazardous material that is transported in abundance via the trains is motor fuel, which is gasoline (ID No: 1203). Also, the proportion of guide no. 128 in the total transported hazardous materials is the highest.

Recommendation 12:

This emphasizes the aforementioned point that the response guide no 128 has to be included in the training of every personnel. It may also be important to educate not only the emergency responders but also the state troopers with reference to this guide no. since it will be beneficial and may help in public safety.

Result 13:

From chapter 4, Fixed Facilities, it is clear that the greatest numbers of facilities are located in the city of Bowling Green. It is the third largest city of Kentucky.

Recommendation 13:

It is very important for Local responders in the city of Bowling Green to be trained to deal with any kind of hazmat incidents. Proper training equipments and PPE should be kept in place. Each responder should review the hazmats that have been observed in this report and be trained to respond to each one. Additionally, scenarios with multiple hazmats should be practiced.

Result 14: The amount of hazardous materials received is thrice the amount shipped. It means that inflow of traffic is large, as compared to outflow.

Recommendation 14: Additional planning should be developed for incident response on roads most commonly used for receiving and shipping materials. Responders should have information that maps out most commonly used routes, areas of high human health and environmental risk, and methods that must be used.

Result 15: Transportation of the majority of hazardous materials takes place during weekdays, and between working hours of 6 am -4 pm. This corresponds to the morning and evening rush hours of public traffic. Additionally, this corresponds to school bus transport.

Recommendation 15: Facilities should be requested to change their hours of shipments to mid day, early morning or early evening. This will limit the risk to the public during traffic rush hour.

Result 16: On reviewing the data, it is clear that Kentucky is the most common state of origin of hazardous materials, but based on cities, Nashville tops the chart of most common city of origin/destination of hazardous materials.

Recommendation 16: From this, we can conclude that the part of I-65 corridor between the city of Nashville, and cities of Bowling Green and Elizabethtown should be considered important, and emergency response stations should be established at regular intervals along this corridor.

Result 17: On tracing the incidents along I-65, a majority of incidents occurred between the 10 mile marker-30 mile marker on I-65.

Recommendation 17: This gives us an idea of the most common stretch of road involved in traffic incidents. Extra crossover lanes, additional lanes or ramps should be constructed especially for the emergency vehicles to approach this stretch of road. Automated signage should be posted along this corridor warning of incidents and potential hazard

Result 18: This survey indicates the heaviest traffic periods are between the hours of 8:00 AM and 4:00 PM. Any incident in the survey area is covered primarily by volunteer fire departments and volunteer hazmat teams. The number of personnel available during these times may be limited by the fact that most of these volunteers are at work during these same periods of time.

Recommendation 18: Better communication with the fire department, local government and the employers may lead to a more lenient practice of allowing trained hazmat personnel to leave the workplace and respond to serious hazmat accidents.

Chapter 7: Comparison of Commodity Flows on I-65 (1998) and I-65 (2010)

Table 6.1 shows that traffic flow of hazardous materials has increased by approximately 55% over the past 12 years. Placard ID 1203 is transported on a greater scale on I-65, as compared to 1998. However due to limited information we cannot comment on the incidents reported on I-65 in 2010. (make sure to see Bob’s comments on this).

Table 6.1 Summary of the Comparison of Commodity Flows on I-65 (1998 – as per the I-24 Commodity Flow Analysis) and I-65 (2010).

Characteristics	I-65 (1998)	I-65 (2010)
Traffic Hazmats/hr Peak Hazmat Day Peak Hazmat Hours Max. Hazmat Direction Max. Hazmat Region	5.61 Wednesday 10- 4 pm South South	8.7 Friday 10 am to 2 pm South South
Hazmat Composition Placard 1203 (% of hazmats) Max. Response Guide (%)	21 128 (33%)	38.7 128 (44.6%)

Chapter 8: References

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