ANNEX K

HAZARDOUS MATERIALS

I. TYPE OF HAZARD

Hazardous Materials

II. DESCRIPTION OF HAZARD

A hazardous material is any substance or material in a quantity or form that may pose a reasonable risk to health, the environment, or property. The category Hazardous Materials includes incidents involving substances such as toxic chemicals, fuels, nuclear wastes and/or products, and other radiological and biological or chemical agents. For the purposes of this hazard analysis section, only accidental or incidental releases of hazardous materials from two different kinds of incidents are addressed: fixed facility incidents and transportation-related accidents. In consideration of recent worldwide and national events, incidents involving terrorism or national attacks, which involve hazardous materials of any type, are addressed in the Terrorism, Attack, and Special Events Considerations annexes of this State Hazard Analysis (Annexes N, O, and Q, respectively).

Generally with a fixed facility, the hazards are pre-identified, and the facility is required by law to prepare a risk management plan done and provide a copy of this plan to the local emergency planning commission (LEPC) and local fire departments. Missouri Tier II forms must also be filed with the Missouri Emergency Response Commission (MERC) at the State Emergency Management Agency (SEMA). For specific site plans, each county LEPC is required by law to maintain a copy of these plans.

The exact location of a hazardous materials accident is not possible to predict. The close proximity of railroads, highways, waterways, and industrial facilities to populated areas, schools, and businesses could put a large number of individuals in danger at any time. In addition, essential service facilities, such as police and fire stations, hospitals, nursing homes, and schools near major transportation routes in the state are also at risk from a potential hazardous materials incident.

Federal Highway Administration statistics indicate that 1 of 10 motor vehicles is engaged in the transport of hazardous materials of some type. The U.S. Army Corps of Engineers also indicates that over 9,000 tons of petroleum products and over 200,000 tons of chemicals and related products are shipped annually by river barge via the Missouri River between Omaha and Kansas City.

Previous estimates have indicated that nationwide, over 4 billion tons of hazardous materials are shipped each year by various transportation modes. Approximately 20 flights each day out of Lambert Airport in St. Louis carry nuclear medicines, and Tri-State Motor Transit Company of Joplin has approximately 25 shipments of high explosives each week.

Missouri is also at risk because of the highway system and geographical location. With Interstate highways such as I-29, I-35, I-44, I-55 and I-70, Missouri offers premium routes for commercial carriers traversing the continental United States. Even arterial highways in Missouri, such as U.S. Highways 71, 13, 63, 54, and 61 are maintained to provide more favorable traveling conditions than in other central states. Also, the locations of nuclear facilities in relation to mines and fuel processing plants result in shipments of radioactive products and wastes across Missouri.

Missouri is at the crossroads for rail and truck transport of nuclear waste to the Yucca Mountain, Nevada, test site. Truck shipments alone will affect 25 different states, 266 counties, and two Indian Reservations. This will be a potentially large waste shipping campaign from as many as 19 nuclear reactors through other corridor states to Nevada.

The railroad systems in Missouri transport voluminous types and amounts of hazardous materials on their 6,351 miles of rails that transverse the state. Though individual cars may be placarded to reveal contents such as hazardous materials, only estimates can be obtained concerning volumes of such materials, because only the interstate traffic is counted or measured. Interstate shipments are accounted for where they originate and terminate.

Increased use and transport of materials across the country has created serious problems for emergency services personnel. Many factors can increase the magnitude of an otherwise simple transportation accident into an incident of potential hazard to high numbers of people. Following are potential factors to be considered:

Over 14,000 different chemicals are estimated as being shipped by the various transportation modes.

Some types of highly toxic chemicals do not require placarding if shipped in quantities of less than 1,000 pounds, even though lesser quantities could devastate a small town.

Only a few emergency response organizations in the larger cities and counties near the more metropolitan areas have had training for handling peacetime radiological problems. With recent federal grants and programs in place to provide funding for training, exercises, and equipment for state Homeland Security Response Teams (HSRT) and local responders the general capabilities of hazardous materials response personnel and teams statewide is expected to improve. Refer to Section N – Terrorism, of this State Hazard Analysis for more information on this topic.

There is a general lack of intelligence reports regarding activity of possible terrorists.

Other scenarios involve nuclear terrorism and faulty re-entry of nuclear-equipped satellites to earth (such as COSMOS 954 in 1978 and SKYLAB in 1980). However, transport of radioactive materials presents the most probable scenario for a radiological incident. The Department of Energy is currently shipping by truck radioactive waste to a repository in the states of Texas and Utah. These trucks cross Missouri through St. Louis and Springfield on Interstate corridors I-270 and I-44.

The federal government has finalized development of long-term repositories for spent fuel and other high-level radioactive wastes, and for transuranics (known as TRU waste), at Yucca Mountain, Nevada, and Carlsbad, New Mexico, respectively. Speculations have suggested that up to 3,600 shipments per year may go to these facilities, depending on several variables.

A large number of hazardous material shipments come from two corporations in Missouri. Tyco/ Mallinckrodt Medical in Maryland Heights (St. Louis County) and Tri-State Motor Transit in Joplin (Jasper County). Tyco/Mallinckrodt Medical is one of the largest manufacturers of radiopharmaceuticals in the world. Tri-State is one of the largest single private carriers of radioactive materials in the world, in addition to transporting all classes of explosive materials and other toxic and hazardous materials.

Missouri is a transportation hub. The Interstate corridors of I-44, I-70 and I-55 are the most commonly used for truck transport. U.S. Highway 36 crosses the northern counties, while U.S. 60 crosses the southern counties. U.S. Highways 71, 13, 65, and 63 are also well-traveled north-south arterial routes.

Although there are railroads throughout Missouri, the UP route between St. Louis and Kansas City is the most used for large radioactive material shipments. The switching yards at St. Louis and Kansas City when combined process more of these transcontinental trains than any other yards in the country.

During any radiological emergency, regardless of the cause, local officials and emergency responders will likely require state or federal support in the detection, monitoring, and analysis of radiological data for decision-making.

In 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) of the Centers for Disease Control and Prevention (CDC) began funding selected state health departments to participate in the Hazardous Substances Emergency Events Surveillance (HSEES) system. Missouri was added to this effort in fiscal year 1994 and became the twelfth participating state. The Missouri Department of Health and Senior Services (MDHSS) administers Missouri's HSEES participation. The goal of this surveillance project is to provide data in an effort to reduce injuries and deaths to first responders, employees, and the general public from hazardous substance emergencies.

Beginning in 2002, a newly updated data-collection form, approved by the Office of Management and Budget, went into effect. For each event, information was collected about the event, substance(s) released, victims, injuries, and evacuations.

HSEES defines hazardous substances emergency events as uncontrolled or illegal releases or threatened releases of hazardous substances. Events involving releases of only petroleum are not included. Events are included if (1) the amount of substance released (or that might have been released) needed (or would have needed) to be removed, cleaned up, or neutralized according to federal, state, or local law; or (2) the release of a substance was threatened, but the threat led to an action (for example, evacuation) that could have affected the health of employees, emergency responders, or members of the general public.

Various data sources were used to obtain information about these events. These sources included, but were not limited to, Missouri Department of Natural Resources (DNR), United States Coast Guard, National Response Center (NRC), MDHSS Bioterrorism Surveillance, United States Department of Transportation (DOT) Hazardous Materials Information System (HMIS), Missouri State Highway Patrol (MSHP), private companies and Missouri Press Clipping Bureau (media). Census data were used to estimate the number of residents in the vicinity of the events. All data were computerized using a web-based data entry system provided by ATSDR.

III. HISTORICAL STATISTICS

The MDNR/ALPD Environmental Emergency Response (EER) Section receives most of the environmental emergency response reports in Missouri. All environmental emergencies are to be reported, 24 hours a day, to (573) 634-2436. Approximately 3,500 reports were received by MDNR/EER in fiscal year 2005.

During 2002 and 2003, a total of 824 events were reported to MDHSS. Six (0.73%) of these events were threatened releases, three (0.36%) were both actual and threatened releases. A total of 426 (52%) occurred in fixed facilities. The statistics reported herein are based primarily on the data from these 2002 to 2003 HSEES events and the associated data analysis report published by MDHSS (this report is available on-line at www.dhss.state.mo.us/hsees).

For each fixed-facility event, one or two types of area involved in the release can be selected. Of all 426 fixed-facility events, 409 (96%) had one type of area; 10 (2%), a combination of two area types, and 7

(2%), no type of area reported. Among events with one type of area reported, the main area was classified as follows: 107 (26%) indoor, non-industrial, living (residence), 82 (20%) storage areas above ground (i.e., tank, storage shed, and warehouse), 70 (17%) indoor, non-industrial, non-living and 32 (8%) ancillary processing equipment (Figure K-1). Of the 10 events with two areas, 4 (40%) involved ancillary processing equipments in combination with other types of area. Of the 398 transportation-related events, 361 (91 %) occurred during ground transport (e.g., truck, van, or tractor), and 35 (9%) involved transport by rail (Figure K-2).

Factors contributing to the events consisted of primary and secondary entries and were reported for 804 (98%) events. Of reported factors, 174 (22%) of fixed-facility events and 250 (31 %) of transportation-related events involved human error as the primary factor; 105 (13%) of fixed facility and 72 (9%) of transportation-related events involved equipment failure as the primary factor (Figure K-3).

Of the 818 events involving actual releases, 701 (86%) involved the release of only one substance. Two substances were released in 46 (6%) events, and 71(9%) involved the release of more than two substances. Fixed-facility events were more likely than transportation events to have two or more substances involved in an event (76% vs. 24%). The substances most frequently released were Ammonia, Hydrochloric Acid, Ethyl Ether, and Acetone. These substances were grouped into 16 categories. The categories most commonly involved in fixed-facility events were ammonia (113, 19%), acids (102, 17%), and volatile organic compounds (97, 16%). In transportation-related events, the most common releases were volatile organic compounds (77, 17%), acids (63, 14%), and other inorganic substances (56, 12%).

The number of events by month ranged from 55 (7%) in December to 90 (11 %) in June, with the largest proportions occurring from June-August/Summer. The proportion of events ranged from 123 (15%) to 143 (17%) during weekdays, and from 72 (9%) to 78 (9%) during weekend days. Of all 711 (86%) events for which time of day or time category was reported, 228 (32%) occurred from 6:00 a.m. to 11:59 a.m., 215 (30%) from 12:00 p.m. to 5:59 p.m., 139 (20%) from 6:00 p.m. to 11:59 p.m., and the remainder during the early hours of the day.

A total of 524 victims were involved in 262 events (32% of all events). Of the events with victims, 170 (65%) events involved only one victim, and 55 (21 %) involved two victims. Of all victims, 347 (66%) were injured in fixed-facility events. Fixed-facility events were more likely to have more than one victim per event (67, 26%) than were transportation events (25, 10%).

Responders (204, 39%) constituted the largest proportion of the population groups injured, followed by employees (147, 28%) of which two are members of a company response team, members of the general public (135, 26%) and students (35, 7%) (Figure K-4). 150 emergency response personnel were injured in fixed-facility events. Of those, 137 (92 %) were police officers, 10 (7%) were career firefighters, and 1 (1 %) was a firefighter that was unspecified. Fifty-six emergency-responder victims were injured in transportation-related events. Of these, most (48, 86%) were police officers. Police officers were more frequently victims in fixed facility-related events than in transportation-events.

Of all reported injuries and symptoms, those most common in fixed-facility events were respiratory (174, 35%), headache (110, 22%), eye irritation (54, 11 %), other (36, 7%), chemical burns (33, 7%) and gastrointestinal system (26, 5%). In transportation-related events, respiratory (98, 50%), headache (40, 20%), trauma (31, 16%) and chemical burns (10, 5%) were reported most frequently. In a large proportion of the instances, trauma might have resulted from a chain of events, such as a motor vehicle accident, leading to the release of a hazardous substance, and not necessarily by the exposure to the substance itself.

The largest proportion of victims (severity/disposition) 250 (48%) were treated and released from a hospital; 182 (35%) had adverse health effects experienced within 24 hours of the event reported by an official, and 8 (2%) died (Figure K-5).

During calendar year 1999-2003, local, state and federal officials reported 9,160 seizures of methamphetamine labs, dumpsites and locations of inactive labs in Missouri – more than any other state in the nation.

Missouri reported a total of 309 HSEES events related to methamphetamine for calendar years 1999-2003. The largest proportion of events occurred in fixed facilities. Each methamphetamine event was categorized into the type of situation such as theft, fixed-lab (private residence, abandoned lab) and mobile lab. There were 203 (66%) fixed labs, 53 (17%) mobile labs and 53 (17%) events in which chemicals were stolen from an agricultural facility (Figure K-6).

In the 254 methamphetamine events involving injuries, respiratory symptoms consistently have been most frequently reported. The number of deaths associated with events continues to suggest the need to evaluate not only the danger posed by methamphetamine substances, but also the circumstances surrounding the events (e.g., insufficient personal protection against adverse health effects). Police officers continue to be the most commonly reported victims of methamphetamine emergency events (Figure K-7).

In summary of all HSEES events between 1994 and 2003, the largest proportion of events occurred in fixed facilities. However, the number of reported transportation-related events is increasing. The increase is partially due to the utilization of the U.S. Department of Transportation's Hazardous Materials Information System as a primary notification source for transportation events. In addition, the total number of events continued to increase over time (Figure K-8). The increase in the number of events may have been due, at least in part, to the expansion of reporting sources.

IV. MEASURE OF PROBABILITY AND SEVERITY

A. Hazardous Materials Transportation Accident

The probability of occurrence is rated as high because of the large volume of hazardous materials being hauled over the highways and railways. This rating means that the probability of occurrence is considered sufficiently high as to assume that an event will occur at least once within any mode of transportation (including water, pipeline, and air) during a 3- year HSEES reporting period.

The severity of the consequences is rated as moderate, but may be either low or high depending on the location of the accident and the time of day. This rating means injuries and/or death are expected only for exposed personnel over extended periods of time or when individual personal health conditions create complications.

B. Hazardous Materials Fixed Facility Accident

The probability of occurrence is rated as moderate. With the new regulations from EPA and OSHA, along with more stringent state laws and employee awareness training, this rating may be

lowered to low or raised to high based on past performance. This rating means the probability of occurrence is possible during the expected lifetime of the facility.

The severity of consequences is rated as moderate but may be either low or high depending on the type and amount of chemical released. This means the chemical is expected to move into the surrounding environment at a concentration sufficient to cause serious injuries and/or death, unless prompt and effective corrective actions are taken. Injuries and/or death would be expected only for personnel exposed over an extended period or when individual personal health conditions create complications.

Note: The severity to the environment will vary in every case depending on the amount, type, and method released to determine the damage to property and the environment. Close coordination between the Missouri Department of Natural Resources, EPA, the local jurisdiction, and the spiller (responsible party) is required to ensure that potential impacts to public health and the environment are adequately addressed.

V. IMPACT OF THE HAZARD

The entire State of Missouri is susceptible to this type of hazard, depending on a number of factors such as the following:

- Type of chemical
- Amount released/spilled
- Method of release
- Location of release
- Time of day
- Weather conditions.

This hazard could have a significant impact on the public health, the environment, or private property.

The impact of this type of disaster will likely be localized to the immediate area surrounding the incident. The initial concern will be for the people, then the environment. If contamination occurs, then the spiller is responsible for the cleanup actions and will work closely with the Missouri Department of Natural Resources, EPA, and the local jurisdiction to ensure that cleanup is done safely and in accordance with federal and state laws.

Local government (county or municipal) is more often directly impacted by radiological incidents than state or federal government. Local responders are generally the first on scene for any incident. Therefore, they have the responsibility for treating any injured victims and transporting them to a hospital for more complete medical care. Also, local first responders have the initial responsibility for controlling exposure of emergency workers and the public to any radioactive materials and to contain the spread of radioactive contamination as much as possible. While cleanup of any actual spill of radioactive materials rests with the shipper (in most cases), local responders may be required to provide site control for several hours until the responsible parties arrive on the scene.

A past survey was completed of Missouri fire departments across the state, asking their perception of their own capabilities to respond to a radiological incident. Of the 433 departments surveyed, only 118 responded. Of those, 21 believed they could adequately handle a radiological incident until proper authorities arrive.

This indicates that pockets of adequate radiological response capabilities are available throughout the state. However, the main transportation corridors have some gaps. It is also clear that more training needs to be encouraged along these corridors. The same consideration must be given to any county located under commercial flyways or where it might be possible for a fallen satellite to leave a contaminated "footprint" (COSMOS 954 left a 200-mile footprint in the Northwest Territory of Canada in 1978).

VI. SYNOPSIS

Any disaster or emergency incident could result in additional concerns when it involves of hazardous materials. For example, during the floods of 1993, a large propane tank farm in St. Louis was threatened by rising floodwaters, forcing evacuations of nearby residents in several areas. Another hazardous materials incident related to the 1993 floods involved an on-going ammonia release from the La Roche Industries, Inc., facility near Crystal City, Missouri, caused by power failure and failure of the cooling system on a large ammonia tank, ultimately resulting in off-gassing of ammonia through the tank's pressure relief check valves. The ammonia cloud over the plant led to a declaration of restricted air space in the plant vicinity for several days.

In addition, thousands of chemical containers ranging from household products and 55-gallon drums to 10,000-gallon fuel storage tanks were displaced statewide as a result of the flood damage. A Federal Disaster Declaration was issued, the Federal Response Plan (FRP) was implemented, and the Emergency Support Function (ESF) #10 – Hazardous Materials Annex was activated to support the statewide response to hazardous materials incidents like these and others that resulted from the flooding.

Each emergency event will need to be evaluated on an incident-specific basis, and top priority must be given to the protection of the public, then the environment, and finally property.

VII. MAPS OR OTHER ATTACHMENTS

Tier II Forms are filed and maintained by the Missouri Emergency Response Commission (MERC) at SEMA. Site-specific plans are on file with each county's Local Emergency Planning Commission (LEPC). Transportation and evacuation routes are addressed in each county emergency operations plan.

See Figure H-2 for The Natural Gas Pipeline Map.

The SEMA Homeland Security Response Teams Map, included in Annex N – Terrorism, of this State Hazard Analysis, indicates 28 existing or proposed Homeland Security Response Teams for the State of Missouri. A few of these teams include hazardous materials response teams with enhanced capabilities for response to WMD incidents, including incidents involving nuclear or radiological materials, biological agents, and chemical agents. The SEMA Terrorism Program should be contacted to determine the capabilities of these Homeland Security Response Teams in specific areas.

Attachments to this section include the following: the MO HSEES 2002 to 2003 Data Analysis Report Charts (see Figures K-1 through K-8) and the Missouri Rail Freight Carriers System Map (see Figure K-9).

FIGURE K-1

Fixed-facility events by area type, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003.

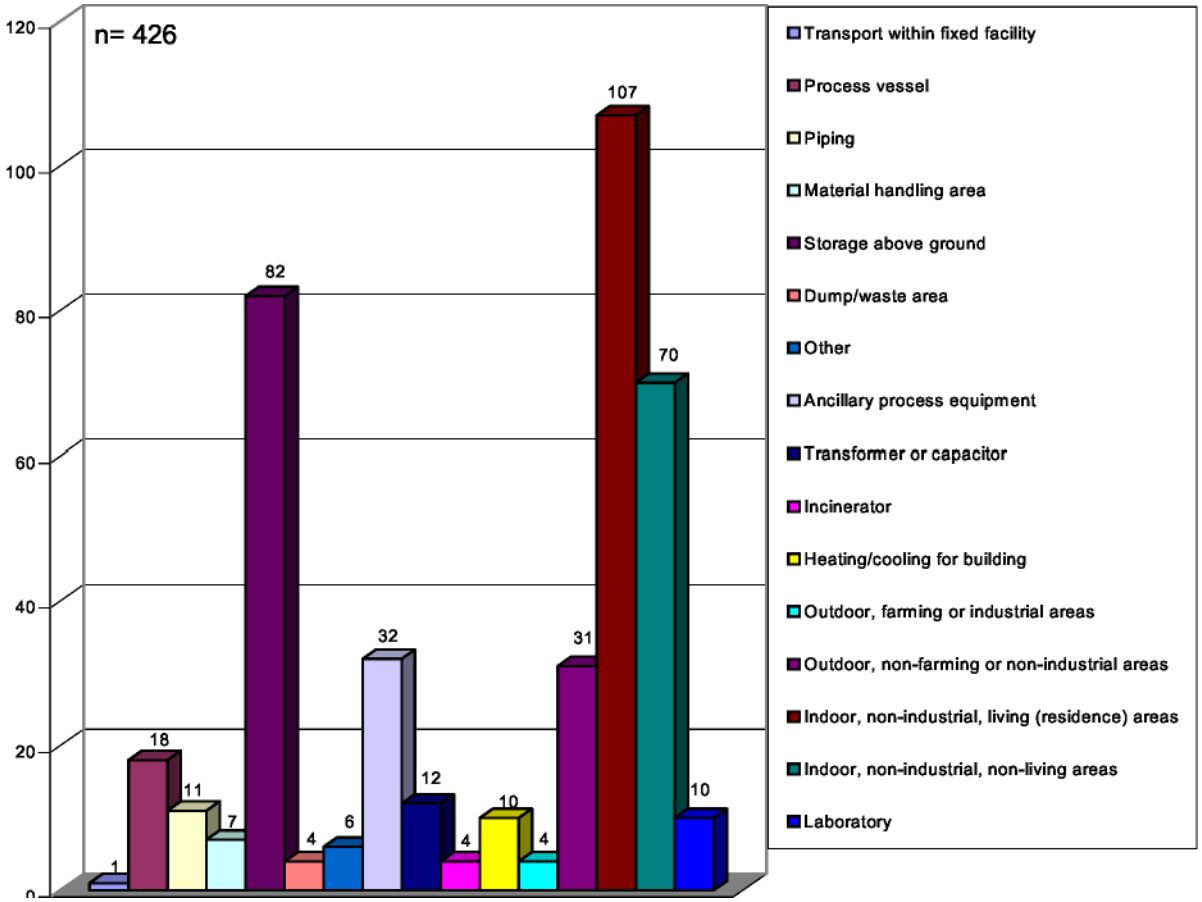


FIGURE K-2

Transportation-related events by mode of transportation, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003

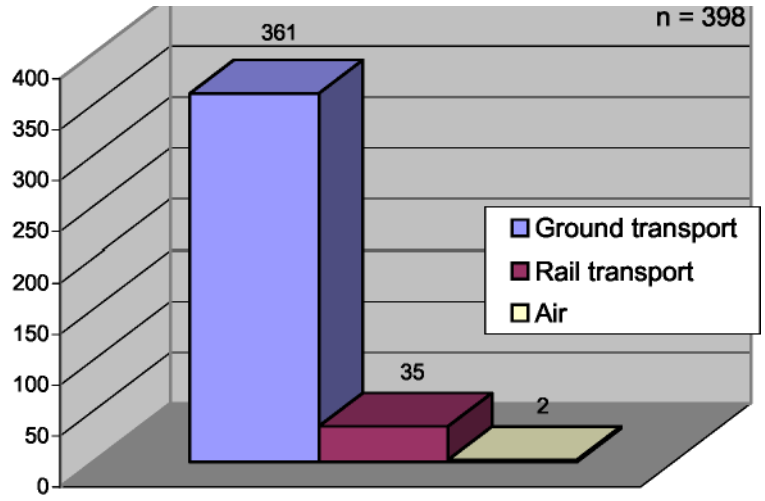


FIGURE K-3

Primary cause of release by event type, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003

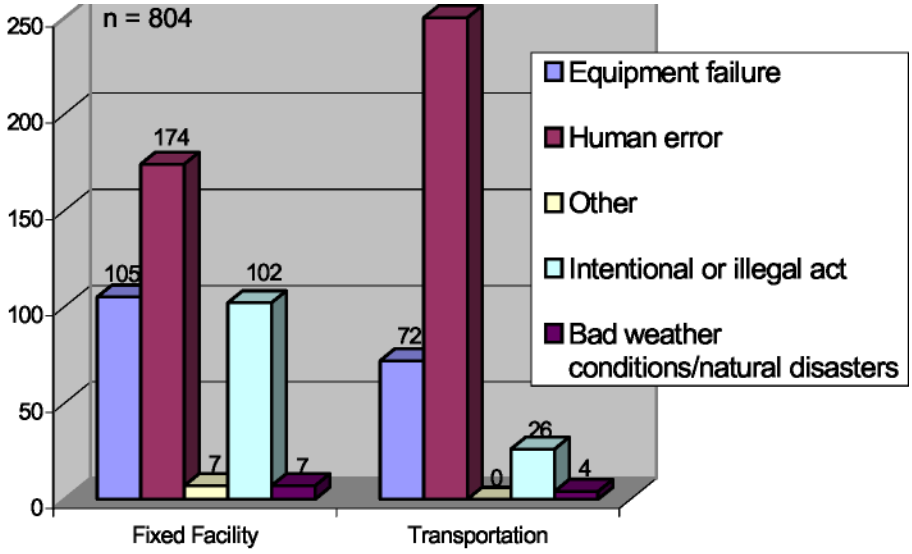


FIGURE K-4

Number of victims by victim category, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003

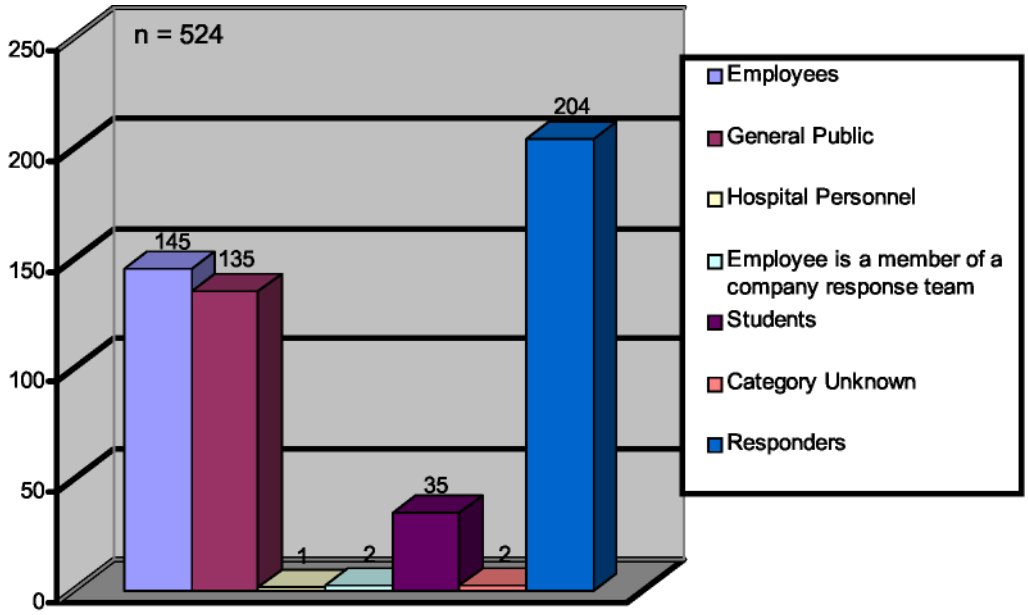


FIGURE K-5

Victims by severity of adverse health effects, Missouri Hazardous Substances Emergency Events Surveillance, 2002-2003

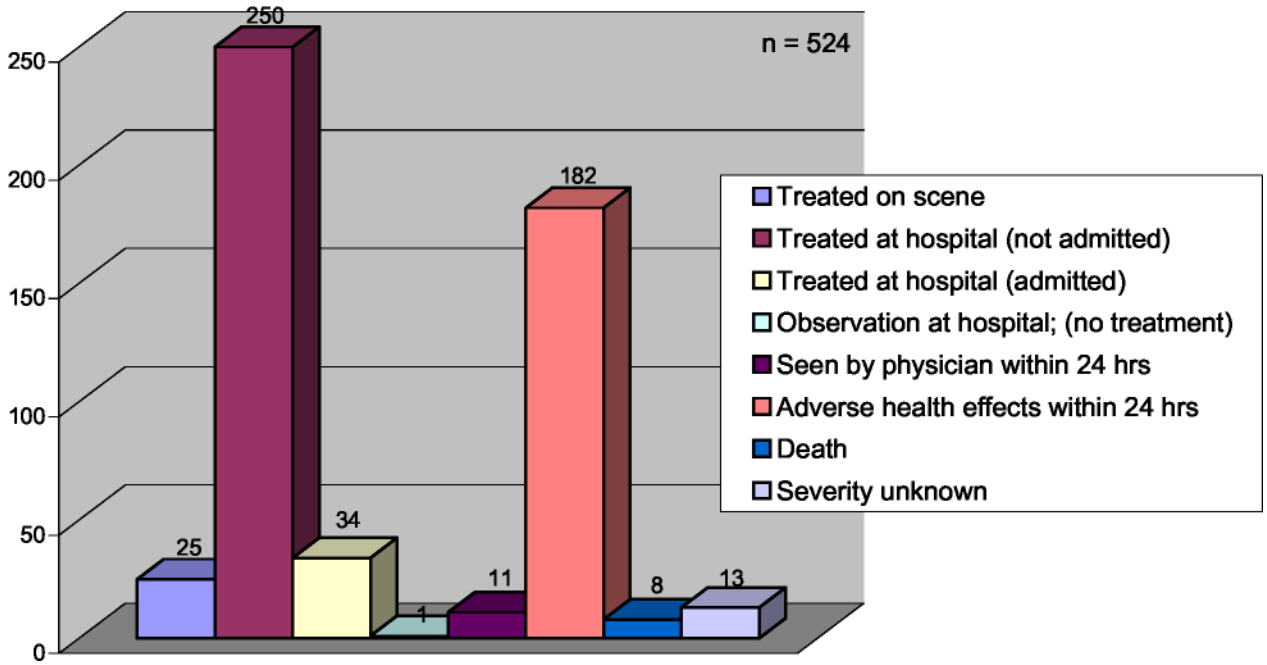
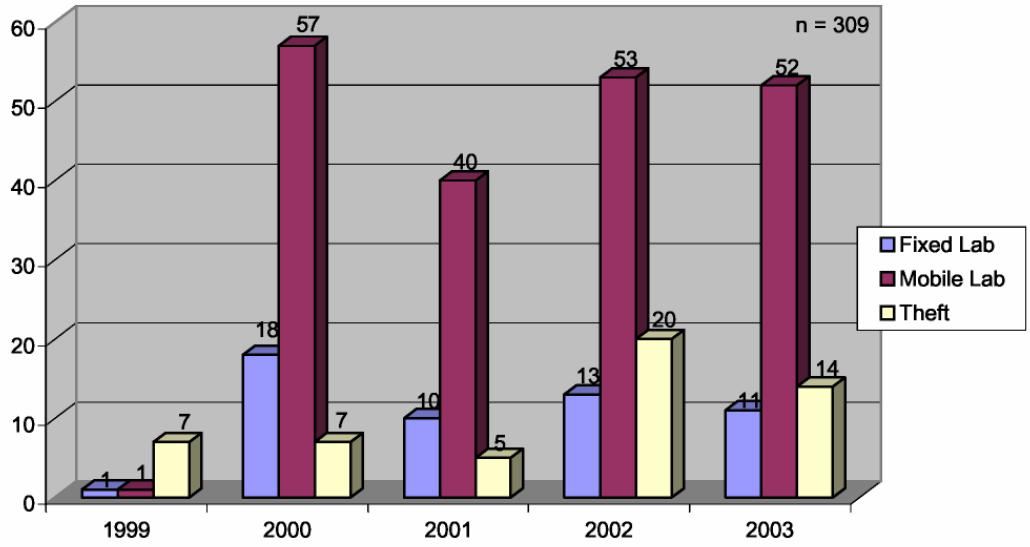


FIGURE K-6

Hazardous Substances Emergency Events Surveillance System
2002—2003 Missouri Summary

Figure 7. - Methamphetamine related-events situation, by year, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003.



A total of 654 substances were involved in all methamphetamine events, of which 2 (.3%) were reported as threatened releases. The substances most frequently released were ammonia, ethyl ether, hydrochloric acid, and methamphetamine chemicals not otherwise specified (NOS) (Table 8).

Table 8. - The 10 most frequent substances involved in methamphetamine events, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003

Number	Standardized Substance Name	Frequency
1.	Ammonia	163
2.	Ethyl Ether	103
3.	Hydrochloric Acid	76
4.	Methamphetamine Chemicals NOS*	56
5.	Acetone	43
6.	Phosphorus	42
7.	Acid NOS*	36
8.	Iodine	30
9.	Solvent NOS*	21
10.	Sulfuric Acid	15
	Total	**585**

FIGURE K-7

Number of methamphetamine-related victims by victim category, Missouri Hazardous Substances Emergency Events Surveillance, 1999-2003

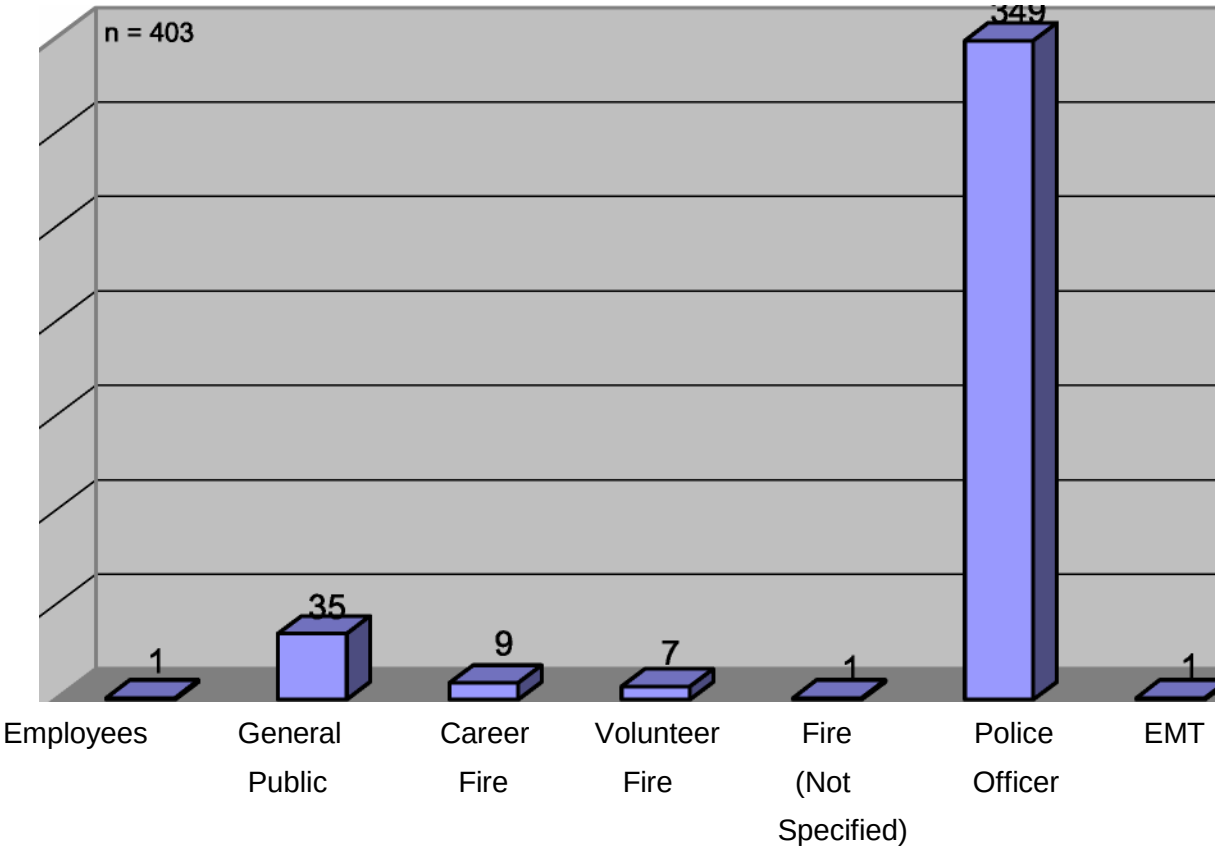


FIGURE K-8

Cumulative data by year, Missouri Hazardous Substances Emergency Events Surveillance, 1994-2003

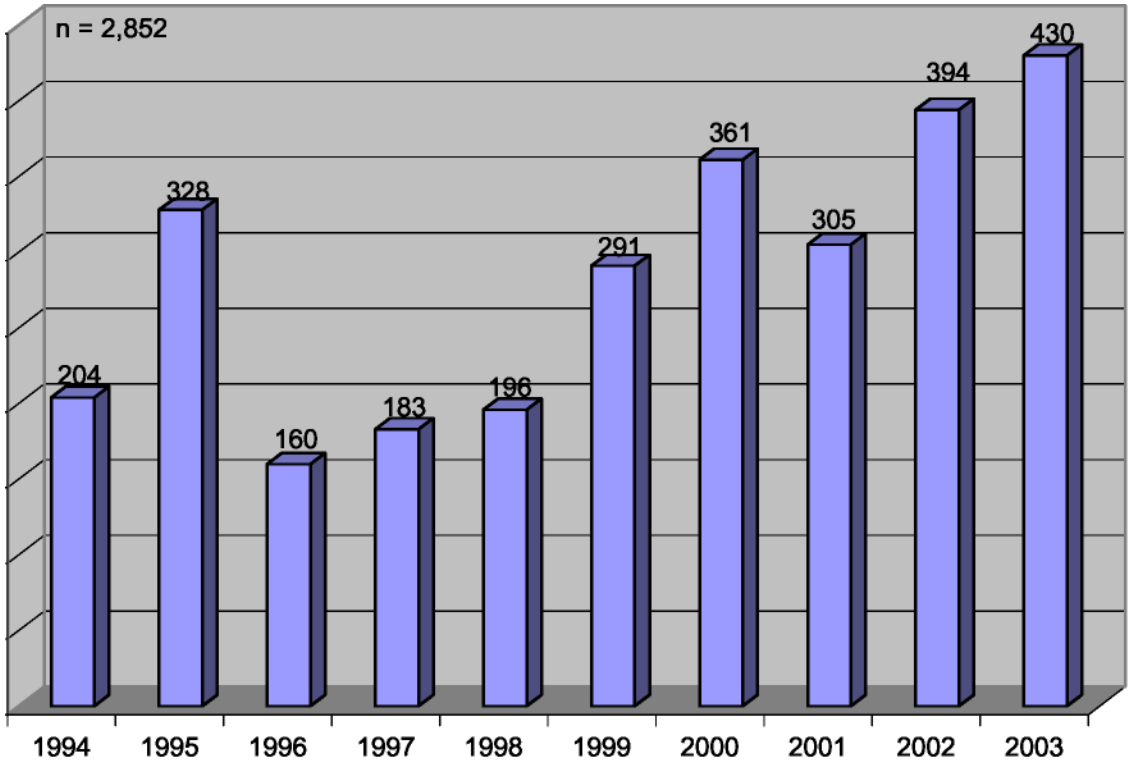
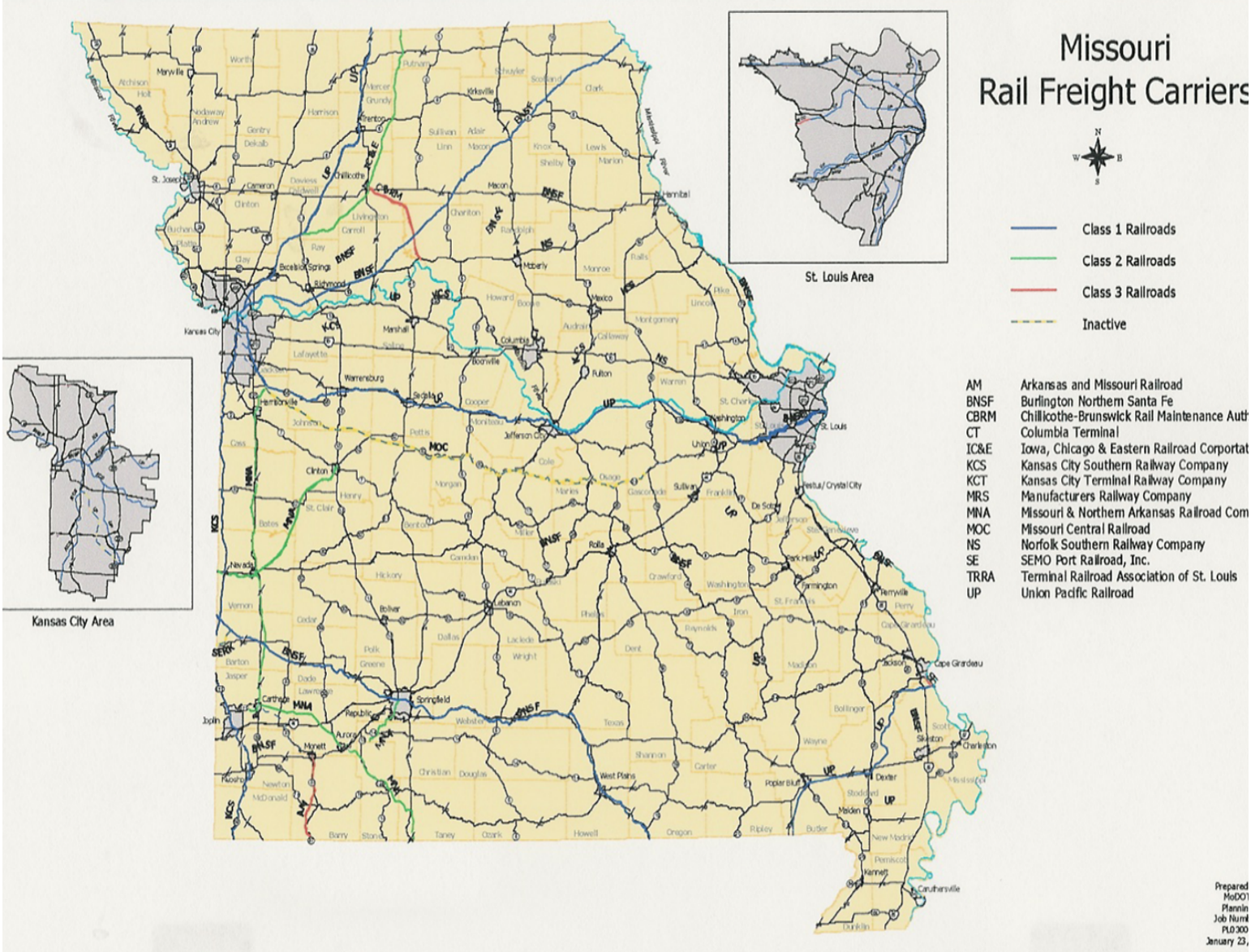


FIGURE K-9



VIII. BIBLIOGRAPHY

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MDHSS. 2002. "Hazardous Substances Emergency Events Surveillance (HSEES) Program, Methamphetamine Events Analysis Report, 1999-2001, available electronically through the MDHSS homepage at www.dhss.state.mo.us/hsees.

Other past and present statistics were obtained from the following sources:

MDHSS HSEES Reports, the State of Missouri Emergency Management Agency (SEMA), the Federal Highway Administration, United States Department of Energy, Center for Disease Control/Agency for Toxic Substances and Disease Registry (ATSDR), Missouri Department of Natural Resources and the Missouri Environmental Emergency Response Tracking System (MEERTS), Missouri State Highway Patrol, and the Missouri Department of Transportation.

Figures and illustrations were adapted primarily from: MDHSS HSEES Reports, 2002 – 2003.