Nevada Hazardous Commodity Flow Study

Final Report

prepared for

Nevada Department of Transportation

prepared by

Cambridge Systematics, Inc.

NEVADA DOT
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June 30, 2019

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final report

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date

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Executive Summary

The Nevada Department of Transportation (NDOT) contracted Cambridge Systematics (CS) assisted by Silver State Traffic to conduct a Hazardous Commodity Flow Study that documents hazardous material (hazmat) transportation routes and modes in Nevada to help local, regional, State, and Federal officials and first responders better understand the volumes and nature of hazmat movement in the State.

Methodology

The study team employed a three-part approach to documenting hazmat transportation in Nevada. These parts included a (1) priority hazmat identification process; (2) petroleum supply chain analysis; and (3) hazmat roadside surveys at 18 locations around the State. This information will help transportation officials prioritize infrastructure investments and emergency managers prepare for the hazmats carried in the largest volumes and those that pose the greatest hazard to health and safety; it will also help officials position hazmat response resources in locations with the highest risks.

Stakeholder Outreach

The team held meetings and briefings with the groups noted below to facilitate coordination and receive necessary guidance throughout the project.

Nevada State Emergency Response Commission

The Nevada State Emergency Response Commission (SERC) reviewed study progress and provided the information to the Local Emergency Planning Committees (LEPC) and Tribal Nations for review and input.

Nevada State Freight Advisory Committee

The Freight Advisory Committee (FAC), a single advisory committee for all NDOT freight-related studies and actions, received progress reports and opportunities to comment at each quarterly meeting.

Industry Outreach

Since many companies and industries are involved in the transport of hazardous commodities, outreach is a critical component to this project. The study team conducted extensive telephone interviews and multiple in-person meetings with 60 representatives from industrial manufacturers, mines, fuel terminals, and other industries that store hazmat, large shippers/receivers, trucking companies, railroads, pipelines, and chemical companies.

Roadside Hazmat Surveys

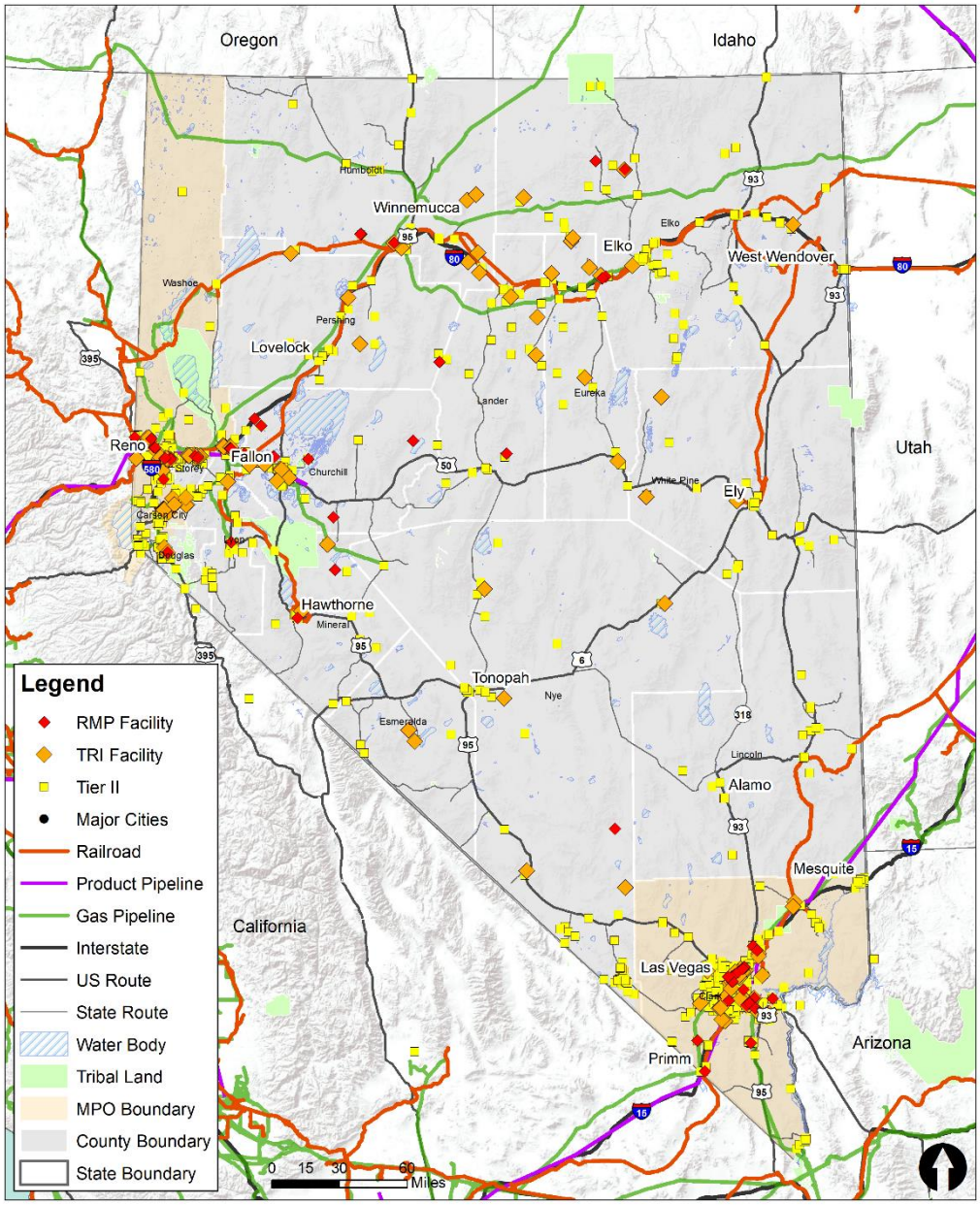
Silver State Traffic, a registered Disadvantaged Business Enterprise (DBE) with NDOT, collected hazmat information by identifying truck volumes, types, and hazmat placards on specific roadways throughout the State.

Data Collection

Hazmat Facility Data

The study team collected data from Federal, State, and local sources to determine the location of hazmat facilities and the distribution methods for hazmats throughout the State. This included geographic information system (GIS) shapefiles, and hazmat facility data from NDOT, the Nevada Department of Environmental Protections (NDEP), the Chemical Accident Prevention Program (CAPP), and the State Fire Marshal's Office (SFMO).

Figure ES.1 Hazmat Facilities Map



Source: EPA, NDEP CAPP, Statewide Fire Marshal's Office, Cambridge Systematics.

Chemical Selection Process

Using the data collected from the CAPP, Toxic Release Inventory (TRI), and Tier II reports, the study team focused on toxic and high-volume flammable chemicals and applied selection criteria to organize the chemicals into a list of priority chemicals for analysis. Tier II reports are required by the EPA for approximately 500,000 hazardous chemicals. Organizations and businesses in the U.S. possessing more than the reportable quantity (RQ) are required to fill out annual Tier II reports. The study team identified 5 selection criteria to "rank" the priority chemicals:

- Isolation Distance.
- Threshold Planning Quantity.
- Lower Flammability Limit.
- Flash Point.

Using the list of hazmats stored at Nevada facilities, the team conducted a hazmat analysis using the criteria above to sort and rank the hazmats in order of impact to health and safety. For each criterion, a cumulative score was established to help with the ranking process. For example, the larger the isolation distances for large spills, the higher the score and therefore the higher the ranking for that chemical. The hazmat analysis provides justification for which companies storing or transporting priority chemicals to contact for determining the transport routing, frequencies, and volumes of priority chemicals.

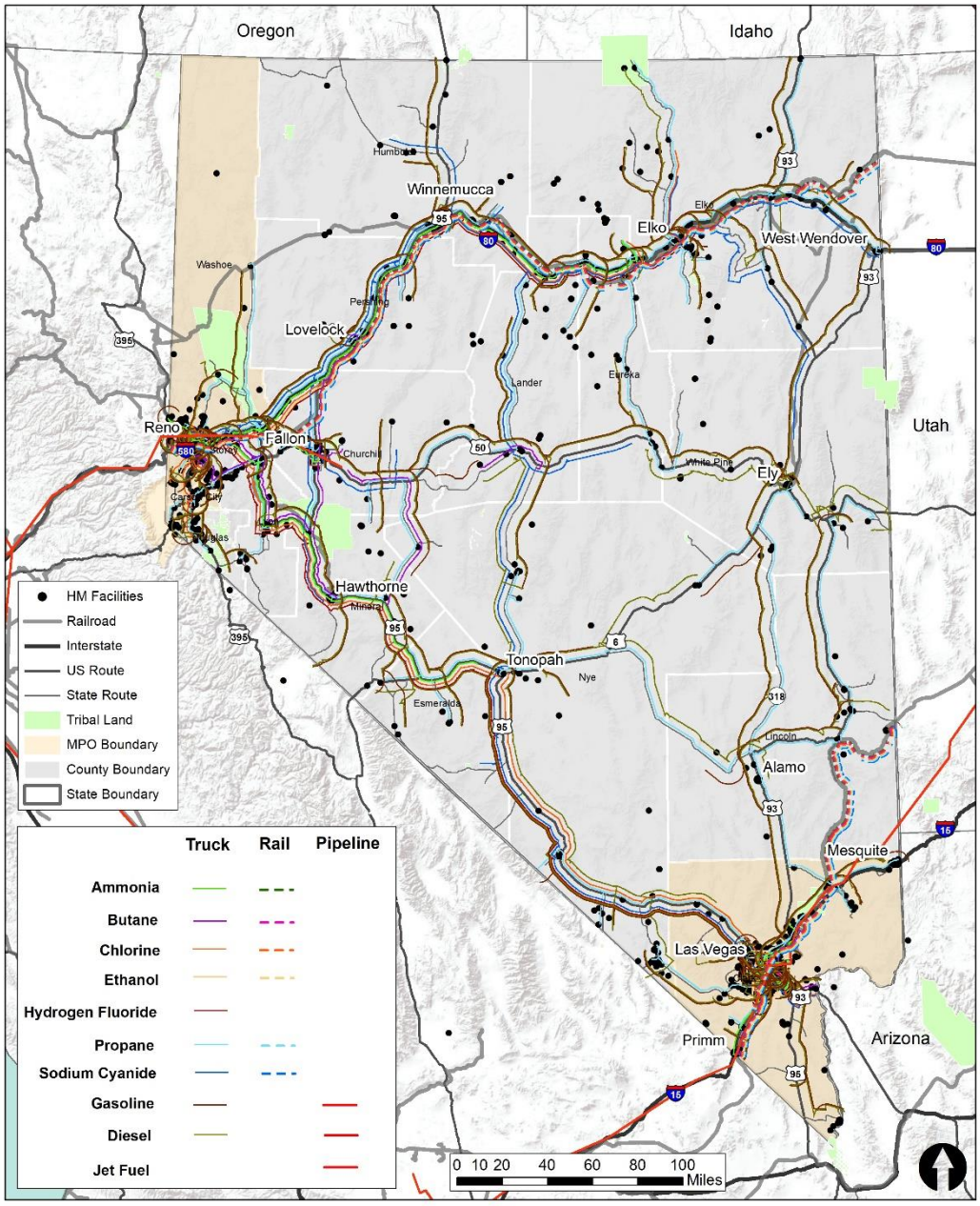
Table ES.1 Priority Chemicals for Study

#	Chemical Name	Score	Chemical Uses	Facilities	EHS
1	Anhydrous Ammonia	4	Refrigerant, fertilizer	18	Yes
2	Butane	5	Fuel and blending	6	No
3	Chlorine	7	Water treatment	6	Yes
4	Ethanol	3	Biofuel	5	No
5	Hydrogen Fluoride	4	Manufacturing	8	Yes
6	Nitrogen Dioxide	6	Catalyst, oxidizing agent	3	Yes
7	Potassium Cyanide	4	Mining and electroplating	2	Yes
8	Propane	5	Fuel and heating	7	No
9	Sodium Cyanide	4	Mining operations	18	Yes
10	Titanium Tetrachloride	4	Titanium, whitening	4	Yes

Once the priority chemicals were selected, the information provided a baseline to determine which industries store the priority chemicals in the State. From this list of priority chemical industries, the study team conducted outreach calls and interviews to collect additional hazmat transportation information, including origin-destination, frequency, volume, and mode of transport. Some interviews were conducted in person, most interviews were conducted by conference calls between October 2018 and March 2019.

Mapping priority chemicals involves a combination of techniques previously described in this report. The Statewide Hazmat Facilities Map served as a starting point for chemical transport destinations. Industry outreach and supply chain analysis techniques helped to determine chemical supply sources from in-State and out-of-State refineries, distributors, and manufacturers. Interviews with stakeholders and industry contacts helped to determine hazmat demand, transport frequencies, and volumes. Using the results of the priority chemicals, the CS Team added the three petroleum flows from the Petroleum Supply Chain Analysis to create a "composite" map of 10 hazmat routes. The resulting Hazmat Composite Map in Figure ES.2 depicts 10 flows across Nevada highways, railroads and pipeline by route but not volume.

Figure ES.2 Statewide Hazmat Composite Map



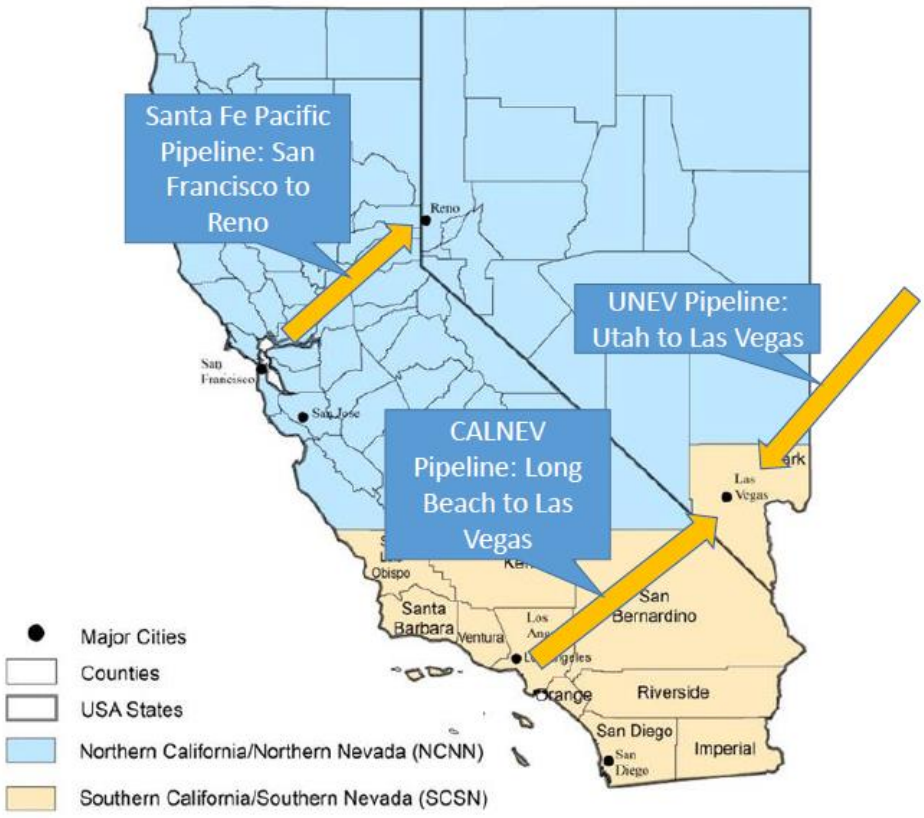
Source: SFMO, CAPP, UP, Kinder Morgan, Holly Energy, Nevada Industries, Cambridge Systematics.

Petroleum Supply Chain Analysis

To supplement the priority hazmat analysis, the study team also conducted a petroleum supply chain analysis. Refined petroleum products represent 86.4 percent of all hazmat shipments transported in the United States, including the required transportation fuels for automobiles, trucks, trains, and airplanes throughout Nevada. Though the volume of petroleum products on the roads is greater than any other hazmat, emergency responders have experience with handling petroleum-related incidents. The primary fuels evaluated in this effort included gasoline, diesel, and aviation fuel.

Nevada relies on neighboring States for its petroleum supply; Southern California and Utah refineries supply Southern Nevada and Northern California refineries supply Northern Nevada.

Figure ES.3 PADD 5 Regional Markets in California/Nevada, with SCSN Counties



Source: Cambridge Systematics. Energy Information Administration's PADD 5 Transportation Fuels Markets Study, 2015.

From California and Utah Refineries to Nevada Petroleum Terminals

In Southern California, the CALNEV pipeline transports gasoline, jet fuel, and diesel fuel from Colton Terminal to Kinder Morgan's Las Vegas Terminal, which is adjacent to Nellis Air Force Base in Southern Nevada. From Utah, the UNEV pipeline transports petroleum products into Las Vegas from Woods Cross, Utah to Holly Energy's Terminal at Apex Industrial Park. In Northern California, Kinder Morgan's Santa Fe

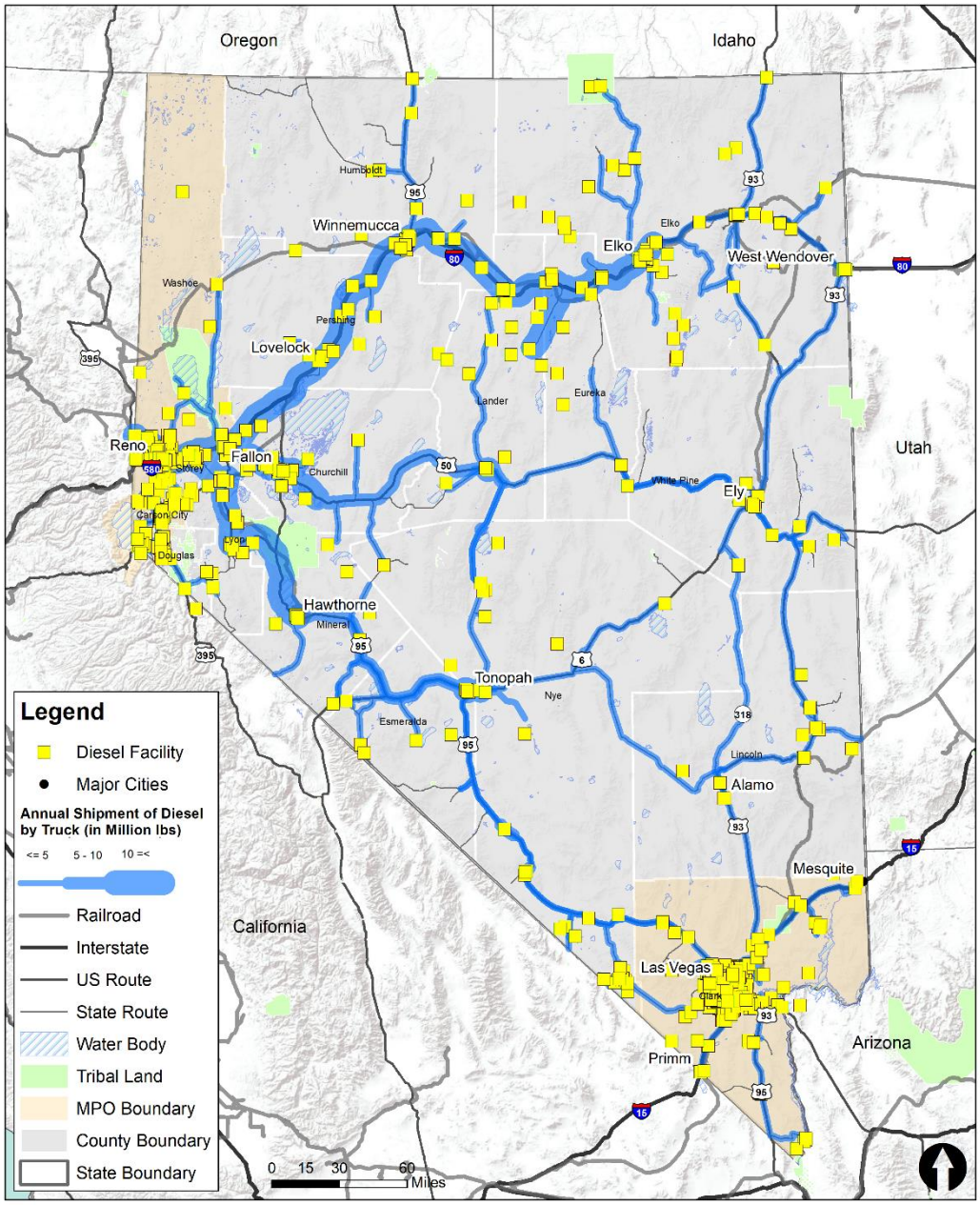
Pacific Pipeline (SFPP) North Line transports gasoline, jet fuel, and diesel fuel from Concord Station to the Sparks Terminal in Northern Nevada.

Petroleum Distribution by Truck

Petroleum products are transported from storage facilities to retail petroleum facilities throughout the State. The team used the Nevada Statewide Hazmat Database to identify refined petroleum facilities by type and develop estimates for refined petroleum distribution across the State. Applying a 250-mile radius around Las Vegas for petroleum distribution, the study team used a shortest path algorithm to determine likely routing options, with the assumption that truck drivers will primarily stay on Interstates and U.S. highways as much as possible.

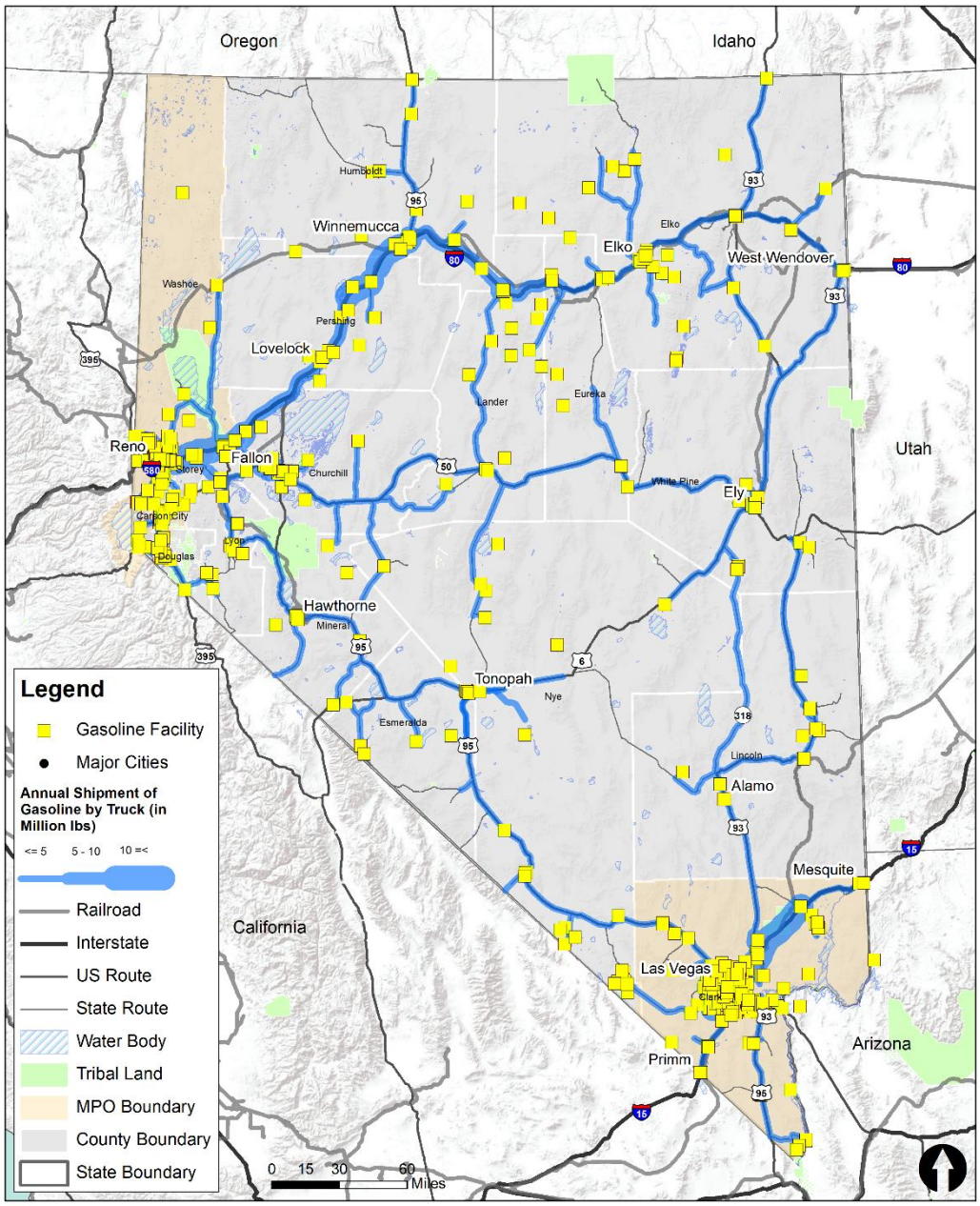
The petroleum distribution maps below demonstrate that the volume of diesel on the roadways is greatest in Northern Nevada, while Southern Nevada is dominated by gasoline. These results are consistent with the large urban population around Las Vegas in the south and the increased prevalence of industrial facilities and mining operations in Northern Nevada. Figure ES.4 and Figure ES.4 illustrate the likely distribution of diesel and gasoline by truck in Nevada.

Figure ES.4 Statewide Diesel Fuel Distribution by Truck



Source: SFMO, Kinder Morgan, Cambridge Systematics.

Figure ES.5 Statewide Gasoline Fuel Distribution by Truck



Source: SFMO, Kinder Morgan, Cambridge Systematics.

Hazardous Materials Classification

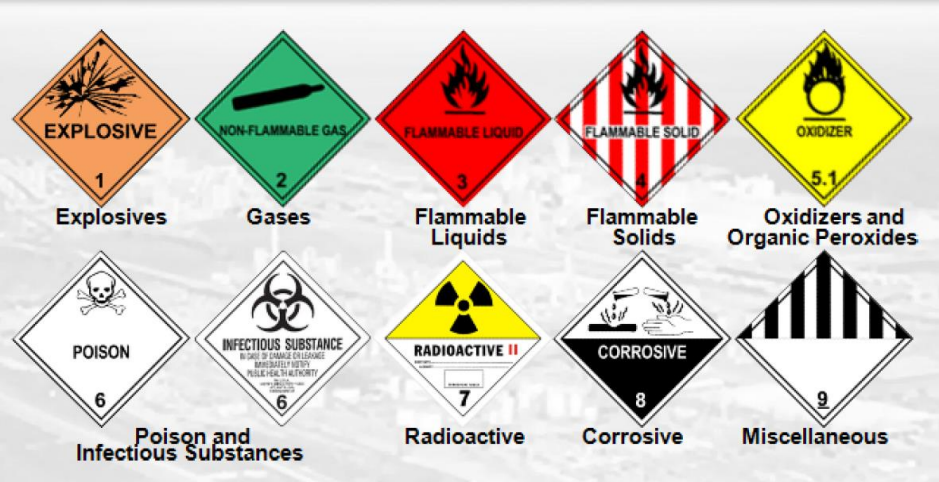
Hazmats are classified according to the risks that they pose. The U.S. Department of Transportation (U.S. DOT) established nine hazmat classifications in order to provide consistency across all agencies that regulate commercial shipping. There are multiple sources for identifying the defined hazards of a material, including shipping papers, safety data sheets (SDS), container labels, and markings. Hazmat placards or labels found on packaging reference the U.S. DOT hazard class of the material. Some classes include multiple hazards denoted by the division number.

Table ES.2 Hazardous Material Classes

Class	Description
Class 1	Explosives
Class 2	Gases
Class 3	Flammable and Combustible Liquids[1]
Class 4	Flammable Solids
Class 5	Oxidizing Substances, Organic Peroxides
Class 6	Poisonous (Toxic) Materials and Infectious Substances
Class 7	Radioactive Materials
Class 8	Corrosive Materials
Class 9	Miscellaneous Hazardous Materials

[1] Includes materials whose flash point is not more than 141°F.

Figure ES.6 Hazmat Classification Placards



Source: U.S. DOT, et al. Emergency Response Guidebook, 2016.

In Nevada, the study team identified hazmat flows for 5 of the 9 hazard classifications. Not all hazmat classifications were identified as part of the chemical selection process and not all hazmat classes were identified during the Hazmat Roadside Surveys conducted at 18 locations around the State. Radioactive materials were not part of the study scope of work. Table ES.3 illustrates the 5 hazmat classifications identified as part of this study.

Table ES.3 Nevada Hazardous Commodity Flow Study Classifications

Class	Description	Study Hazardous Materials
Class 2	Gases	Butane, Chlorine, Propane, Ammonia, Nitrogen Dioxide
Class 3	Flammable and Combustible Liquids	Gasoline, Diesel, Jet Fuel, Ethanol
Class 5	Oxidizing Substances, Organic Peroxides	Chlorine

Class	Description	Study Hazardous Materials
Class 6	Poisonous (Toxic) Materials and Infectious Substances	Potassium Cyanide, Sodium Cyanide, Titanium Tetrachloride
Class 8	Corrosive Materials	Hydrogen Fluoride, Chlorine, Hydrofluoric Acid, Titanium Tetrachloride

Source: Industry interviews, Cambridge Systematics.

Conclusion

Hazmats are essential to Nevada's industries that manufacture chemicals, protect public water, and sewer systems, fuel transportation services and mine precious minerals. Because of Nevada's location between National east-west freight flows, approximately one third of U.S. hazmats pass through the State.[1] Nearly all of Nevada's refined petroleum is transported from California and Utah by pipeline and distributed to mining operations and retail petroleum facilities by truck; this includes gasoline, diesel, and jet fuel. Nevada industries use more diesel than gasoline, which is the opposite of most States, and likely the result of the extensive mining operations in Northern Nevada counties.

Nevada's top hazmats of concern are similar to those in other States, including the truck and rail transportation of anhydrous ammonia, butane, chlorine, ethanol, and propane. However, Nevada specializes in mining precious minerals and specialty manufacturing facilities, resulting in the transportation of sodium cyanide and potassium cyanide, which is not typically used in significant volumes in other States. Several large-scale green energy utilities use butane and propane to transfer energy using specialty turbines. Butane is also used to increase octane levels in gasoline mixtures. Most of the ethanol transported through the State by rail is destined for West Coast ports for export, and only 10 percent of ethanol is used in Nevada for biofuel blending purposes. However, Nevada and California are using proportionately higher volumes of ethanol than other states, and this is the reason for increasing amounts of E85 in retail gas stations.

Air cargo transportation of hazmats represents a small fraction of all air cargo, estimated by several air cargo carriers as less than one percent. Air cargo hazmat shipments are restricted by regulation that limits the types and amounts of hazmat that may be shipped. Dry ice and lithium batteries are shipped by air, but are not the only hazmats shipped by air. Medical aerosols, small amounts of radioactive materials, and high value epoxies can be shipped by air.

By identifying top hazmat volumes, routes, and frequencies, transportation officials will have more information on which transportation facilities transport high volumes of hazmats. This will help officials prioritize transportation infrastructure investments for highway, rail, and pipeline facilities, first responders train for chemicals and fuels likely to be transported in their counties, and emergency managers locate hazmat response assets and resources in appropriate locations. At the local level, LEPCs will be able to use this information to conduct training and exercise programs that match up with the likely hazards in their jurisdictions.

[1] ICF International, John A. Volpe National Transportation Systems Center (U.S.) "Guidance for Conducting Hazardous Materials Flow Surveys." Cambridge: U.S. Department of Transportation, 1995.