HAZARD ANALYSIS

Ford County, Kansas

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March 2011
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Hazard Analysis

1.0 Executive Summary

1.1 Introduction
In the 21st century, threats to people, property and the environment come from diverse hazards and incidents. Chemical spills, accidental releases of hazardous substances, highway accidents, train derailments, and shipping spills are common. A recent study by the Department of Health and Human Services shows the number of fixed-facility and transportation incidents involving hazardous materials increased 53 percent between 1993 and 1998.

Beyond chemical hazards, the potential loss of life, personal injury, economic impact, and property damage resulting from natural hazards is a prime concern for emergency planners. Frequent tornado occurrences, flash flooding in urban and rural areas, damaging hail storms and freezing rain are constant reminders of the enormous impact of severe weather.

The tragic events of Oklahoma City and 9-11 have forced changes in how we approach domestic and international threats to our homeland security. Among other emerging threats are vector-based hazards: biohazards that pose a direct or indirect hazard to people, property and the environment.

A Hazard Analysis is a critical component for planning and responding to hazardous chemical incidents, weather and natural events, civil/societal threats and potential vector diseases and vulnerabilities that impact Ford County. The information provided in the following analysis is based on a “multi-hazard” approach, providing both the factual basis to set priorities for planning and the necessary documentation for supporting future hazard planning, response, and mitigation efforts.

1.2 Synopsis
The Ford County Hazard Analysis was completed over a five-month period, including a visual canvass of the county that logged over 300 miles. The Ford County Office of Emergency Management supplied pertinent data for the analysis. E-Fm Consulting, LLC (hereafter referred to as Consultant) compiled a hazardous materials database from 2007 Tier II reports and aboveground and underground storage tank (AST/UST) data provided by the Kansas Department of Health and Environment (KDHE) in order to evaluate and rank existing chemical storage sites within the County.

Historical records for Ford County indicate natural hazards with the highest risk rating are hail, wildfire, thunderstorm winds, tornados and flash flood. Severe weather associated with high winds, heavy snow, and ice storms also pose a significant risk to the County. Obviously, not much can be done about natural events. Ford County has protocols in place to manage severe weather events and the potential impact of damage ensuing from these events.

Technological hazards impacted by natural events also have the capacity to escalate into cascading hazard events. Section 11.0 of this report provides an overview of cascading hazards associated with natural events. Weather and natural events cannot be controlled, but chemical and technological hazards impacted by natural events and their tendency to escalate into cascading events can be mitigated through the implementation of risk reduction measures in cooperation with facility owners.

Ford State Fishing Lake and Wildlife Area is located in Ford County, approximately three miles north and five miles east of Dodge City. The property consists of 260 acres of uplands, 10 acres of wetlands, and a 45 acre lake. The dam was originally built in 1936. In 1990, the area was donated to the Kansas Department of Wildlife & Parks in order to renovate the lake for fishing. At the same time, Ford County...
assumed management of the area for public use.

Hains Lake is located in Ford County approximately five miles north and eight miles east of Dodge City and is two and one-fourth miles east of US Hwy 283. The area consists of 20 acres of uplands and 35 surface acres of shallow lake. Due to its shallow depth, Hains Lake supplies excellent wetland habitat. However, the lake may go dry during drought periods.

Low lying areas located in close proximity to the Arkansas River, and creeks and tributaries located in the Arkansas River Watershed and Ford State Fishing Lake and Hains Lake Watershed Districts are susceptible to flooding events. A more detailed narrative of the flooding potential associated with rivers and dams is provided in Section 6.0 – Natural Hazards Vulnerability.

Technological hazards consist primarily of potential chemical incidents at fixed facilities and accidents associated with transportation modes. Consistent with the regulations, the first look at chemical hazards is aimed at Extremely Hazardous Substances (EHS) compounds. Six of the Top Ten sites in Ford County have EHS chemicals in inventory, all of which are located within or adjacent to Dodge City.

Technological hazards, as a primary category of concern, have been quantified in this analysis by the use of a Risk Rating Algorithm. The algorithm applies objective values to various risk categories in order to rank each reported chemical. A listing of Ford County’s chemical hazards is available in four different formats using an electronic tool (HzChRT) that is provided separately. Among these reports, the List of Facilities and Chemical Inventory by chemical rank and the List of Facilities with EHS are anticipated to be of greatest use to emergency management.

Vector hazards focuses on the risk of foreign animal disease (FAD). The risk of FAD among domestic and wild animals, along with the potential economic impact this would cause, is a concern in Ford County, as it is with other counties in western Kansas. Local emergency planners need to develop and maintain FAD plans in order to prepare, respond, and recover from a potential disease outbreak. The local FAD plan should also address industrial hygiene procedures for personnel, and quarantine and treatment procedures of animals in the county.

Cascading Hazards in Ford County are closely associated with natural events, fixed chemical storage locations, and transportation systems. The transportation of hazardous chemicals through residential communities and rural areas of Ford County is a priority concern, as well as cascading problems associated with railways and the potential environmental impact of ruptured pipelines. The following fact sheet provides an overview of the county and the various hazards identified during this survey.

### 1.3 Hazard Analysis Fact Sheet

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<tr>
<th>General</th>
<th>County Profile</th>
<th>18 named rivers and streams</th>
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<tr>
<td>County/State</td>
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<td>Ford, KS</td>
<td>Rivers/Waterways</td>
<td>18 named rivers and streams</td>
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<td>County Contact</td>
<td>Land Area (sq. miles)</td>
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<tr>
<td>Mark Shriwise</td>
<td>Seismic Zone</td>
<td>0-No Chance for Severe Ground Shaking</td>
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<td>Contact Title</td>
<td>County Seat</td>
<td>Dodge City</td>
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<td>Director of Planning/Zoning and Env. Health</td>
<td>Average Temp (° Fahrenheit)</td>
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<tr>
<td>Contact Phone</td>
<td>Year Established</td>
<td>Prevailing Winds</td>
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<tr>
<td>(620) 227-4739 x205</td>
<td>1873</td>
<td>N/NW (cold months); S/SW (warm months)</td>
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<td>Dams/Lakes</td>
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<th>County Transportation Systems</th>
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<td>Pipelines (RFPL)</td>
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<td>Railroads (RFRR)</td>
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<td>Waterways (RFWW)</td>
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<td>Total (RFTOTAL)</td>
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Total Risk Factor Ranking: 14th

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<th>Populations / Sites at Risk</th>
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<td>Hospitals</td>
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<td>Commercial Feedlots</td>
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<td>Endangered Species</td>
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Hazard Inventory

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<th>Civil / Societal</th>
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<td># Legal Hazardous Sites</td>
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<td>Number One CBRNE Threat</td>
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## Hazard Inventory

**Vector (Emerging)**
- Foot and Mouth Disease
- BSE
- Anthrax
- Rinderpest
- Swine Fever
- Bio-terrorism
- Insect-transmitted Disease

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<td>Ammonia</td>
<td>Koch Nitrogen Company</td>
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<td>3</td>
<td>Aluminum Phosphide (Phostoxin)</td>
<td>Dodge City Cooperative</td>
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<td>4</td>
<td>Activated Carbon</td>
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<td>Peracetic Acid</td>
<td>National Beef Packing Company</td>
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<td>Cargill Meat Solutions</td>
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<td>Propane</td>
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<td>Hail</td>
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<td>TSTM Wind</td>
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<td>Tornado</td>
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<td>Flash Flood</td>
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Weather event likelihood is based on county specific recorded events across a database timeframe of ~50 years.

*Wildfire event data and likelihood are extrapolated (see Section 5.0) from county specific recorded events across a database timeframe of ~7 years.

**Seismic event (earthquake) likelihood is based on statewide recorded events across a database timeframe of ~110 years.
2.0 Background

2.1 Regulations
Congress' passage of Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA), was the culmination of a series of social and political events that focused attention on the potential for chemical accidents and their impact on people, property, and the environment. Following World War II, the United States experienced a rapid proliferation of new and diverse industries. Attendant to this growth was the development and use of new chemicals. Historically, chemical use has preceded and outstripped complete knowledge of the impacts of chemicals on people, property, and the environment.

Concern about the impact of widespread chemical usage surfaced in the 1960s. In 1962, Rachel Carson published a book entitled Silent Spring, describing the impact of DDT use on the environment. The book is often referred to as a benchmark in the movement to learn about and address the risks of chemical use. During the 1970s and 1980s, a series of environmental laws created programs to address pollution released into the environment including the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act, etc. Regulations began to address the most obvious (i.e., visible) problems, such as water pollution, and steadily moved toward the less obvious effects of chemical usage (e.g., slow-acting carcinogens). As pollution control and cleanup programs were implemented, the focus began to shift toward less visible chemical use issues. The public began to question the safety of operations and materials at industrial facilities. This gradual shift in public attention was galvanized by two industrial accidents at Union Carbide facilities involving chemicals, first in Bhopal, India and then in Institute, West Virginia. These events, together with a growing body of knowledge about chemical use and risks, spurred Congress to enact, and the U.S. Environmental Protection Agency (EPA) to implement, SARA Title III.

A summary of the following regulations can be found in the References Section.
- The Clean Air Act (CAA, as amended)
- The Clean Water Act (CWA)
- Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended
- Pollution Prevention Act (PPA)
- Resource Conservation and Recovery Act (RCRA, as amended)
- Safe Drinking Water Act (SDWA)
- Toxic Substance Control Act, as amended
- Emergency Planning and Community Right-to-Know Act, as amended

2.2 The Hazard Analysis Process
The primary purpose of a “Hazard Analysis” is to identify and prioritize potential hazards within a jurisdiction. A hazard analysis typically includes a vulnerability assessment and risk analysis. By definition, vulnerability is the susceptibility of life, property, and the environment to injury or damage, and risk represents the probability that any situation will cause injury to life or damage to property and the environment. Simple or sophisticated, a Hazards Analysis serves to characterize the nature of the problem posed by hazardous materials and events.

While an individual analysis of all hazards would be most useful, it is not feasible or practical for most jurisdictions given resource and time constraints. The focus of this report includes the following hazard categories:
Natural Hazards
Naturally occurring events such as floods, earthquakes, tornados, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people, property, or the environment.

Technological Hazards
Refers generally to hazardous materials, petroleum, natural gas, synthetic gas, acutely toxic chemicals, and other toxic chemicals at fixed facilities or in transport.

Civil/Societal Hazards
Civil disorder and unrest or the unlawful use of force or violence by a group or individual to intimidate or coerce a government, the civilian population, or a segment thereof, in furtherance of political or social objectives.

Vector Hazards
Vector hazards are limited to infectious Foreign Animal Disease (FAD), biological agents, and/or by-products utilized to create weapons of mass destruction (WMD), which could otherwise require an emergency response.

The information developed in a hazards analysis provides both the factual basis to set priorities for planning and the necessary documentation for supporting hazard planning and response efforts. Effective emergency preparedness requires periodic review and evaluation. Plans should reflect any recent changes in land use, response capabilities, hazardous materials inventories, federal, state, and local laws and ordinances, population change, emergency telephone numbers, and facility locations.

2.3 Compliance Statement
The Hazard Analysis performed for the County was conducted in general compliance with requirements and guidance set forth in the following regulatory documents:

- SARA (Superfund Amendments and Reauthorization Act) Title III/EPCRA (Emergency Planning and Community Right to Know Act) requirements as outlined in sections 302 and 304
- The Kansas Planning Standards -1996, page B-2 and B-3
- Technical Guidance for Hazard Analysis: Emergency Planning for Extremely Hazardous Substances; USEPA, FEMA, USDOT; December 1987

2.4 Utilization and Residual Benefits
The hazard analysis should be used as support for the county local emergency operations plan (LEOP) and may be utilized as a reference to support emergency planning, mitigation, and response initiatives. The hazard analysis is intended to be a dynamic tool and the basis for future planning and decisions necessary to support, produce, and enhance other assessments that are required by regulation. Consequently, as many elements as possible have been supplied in an electronic format to facilitate revisions and updates. Both the "References" and "Resources" sections should be reviewed in conjunction with the narrative report in order to gain a more in-depth understanding of the pertinent issues.

Documentation contained in the hazard analysis can be used to provide support for the following:

- Mitigation plans
- Zoning regulations
- Compliance with Tier II registry requirements
- Monitoring hazardous chemical facilities and sites
- Insurance coverage
- Building sites
- Security
- Evacuation routes
• Management of transportation and utility infrastructures
3.0 Scope of Work

3.1 Authorization
E-Fm Consulting, LLC (Consultant), provided a written proposal to Ford County to conduct an All-Hazards Multi-Jurisdiction Mitigation Plan (including a Hazard Analysis), which was approved by the county by contract and notice to proceed dated July 25, 2008. The All-Hazards Mitigation Plan and Hazard Analysis were funded by an approved grant from the Federal Emergency Management Agency (FEMA), and the State of Kansas, Division of Emergency Management (KDEM).
3.2 Objective
The primary objective of this contract is to complete an analysis of hazards present within the county. The information developed in a hazards analysis provides both the factual basis to set priorities for planning and the necessary documentation for supporting future hazard planning, response, and mitigation efforts.
3.3 Scope Summary
The scope of work can be summarized as the systematic identification of hazards in the county that can be generally classified as natural, technological, civil/societal, and vector. The primary tasks include hazards identification, risk assessment, vulnerability assessment, and document production.

(1) Hazard Identification
This phase of the work includes research and review of natural, technological, civil/societal, and vector hazards. Data is accumulated from a variety of sources to identify county-specific hazards. At the first tier, natural hazards are heavily influenced by weather events and technological hazards typically arise from the release of chemicals at fixed facilities or chemicals in transit. Civil/societal risks are based primarily on potential threat elements identified in the 2003 Homeland Security assessment and suspect targets within the jurisdiction. Vector hazards are limited to infectious FAD, biological agents, and/or by-products utilized to create WMD, which could otherwise require an emergency response. Key data sources include Tier II data, County Engineers, the Kansas Department of Transportation (KDOT) Transportation Study, U.S. EPA, Kansas Geological Survey (KGS), National Climatic Data Center (NCDC) Weather, the Office of Domestic Preparedness (ODP) Assessment, and AST/UST data obtained from the KDHE. This research generates multi-hazard information necessary for the hazard analysis. A drive-through canvassing of the county is conducted with photographs to document specific or unusual elements in the county.

(2) Risk Analysis
This phase includes the collection of Chemical Emergency Preparedness and Prevention Office (CEPPO) chemical risk information, unusual environmental conditions, research and identification of populations and properties potentially impacted by chemical releases, natural hazards, determination of probability and prioritization of risks. The collective information, historical data, and local experience are used to calculate risks and probabilities. Changes in technological information are accounted for during this phase. Relative risk calculations for each hazard category are based on conservative estimates, using worst-case scenarios as outlined in SARA Title III. Site visits are scheduled at select facilities to verify collected data and analyze other unique risk factors that might affect neighboring entities. A cascading hazard matrix, showing potential secondary risks from primary sources, is revised to reflect local conditions.

(3) Vulnerability Analysis
Vulnerability analyzes the impact of hazards on people, property, animals and the environment. This phase of the work includes assessing the vulnerability of the Top Three ranked chemical sites in the county and determining the size, estimated property value, and sensitive populations within the vulnerable zones. Other vulnerability assessments include the impact of hazards on the environment (if applicable), site visits, interviews with local agencies, and obtaining and analyzing state-level information relevant to the hazard analysis. In certain cases, unique approaches may be necessary to analyze vulnerability.

(4) Hazard Analysis Production
Production of the hazard analysis includes developing and constructing tables, maps and graphs, narrative preparation with observations and conclusions, quality control review, and delivery of the final draft. The hazard analysis will be issued as the online tool HzART, which allows the processing of information and future editing of data contained within the hazard analysis. Access to the HzChRT application is available online through HzVAT.
3.4 Assumptions
Discovery of information by E-Fm during field investigations, archival research, and documentation provided by county staff in completing this Hazard Analysis is assumed to be representative and inclusive of the respective county characteristics, hazards, vulnerability, and risks associated with the identified hazardous materials and other related hazards. Information presented by county staff, regulatory agencies and Owner/Operators is presumed to be correct and will be relied upon by E-Fm in completing the analysis unless contrary evidence is discovered. Information contained in the Hazard Analysis is representative of the conditions at the time of the survey and will change over time.
3.5 Confidentiality
We recommend that access to the online version and any hard copies made of the hazard analysis be kept under strict control as they contain very sensitive, detailed and valuable information. The Consultant will not disclose information in this assessment without prior written consent of an authorized county representative, unless subject to a court order requiring such disclosure.
4.0 County Profile

Figure 4.0 (1) Ford County Courthouse

4.1 General Description
Ford County is located in the southwestern part of the State of Kansas, and is bounded on the east by Edwards and Kiowa Counties, on the west by Gray County, on the south by Clark and Meade Counties, and on the north by Hodgeman County.

Dodge City is the county’s largest city and also serves as the county seat. At 1,099 square miles total area and approximately 29.5 people per square mile, Ford County is ranked 29th in population density. With a 2000 population of approximately 32,458, Ford County was the 17th most populated county in the State of Kansas.

Table 4.1 (1) - Ford County Boundaries

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Latitude</th>
<th>Boundary</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
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<td>37.9131</td>
<td>East</td>
<td>-99.5590</td>
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<tr>
<td>South</td>
<td>37.4702</td>
<td>West</td>
<td>-100.2275</td>
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4.2 Geographic Summary

4.2.1 Mapped Cities and Towns

Table 4.2 (1) - Ford County Cities, Towns, & Villages (past and present)

<table>
<thead>
<tr>
<th>Town/City</th>
<th>2000 Population</th>
<th>Zip Code</th>
<th>Year</th>
<th>Elevation</th>
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<tr>
<td>Bellefont</td>
<td></td>
<td></td>
<td></td>
<td>2355</td>
</tr>
<tr>
<td>Bloom</td>
<td></td>
<td>67865</td>
<td>1885</td>
<td>2584</td>
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<tr>
<td>Bucklin</td>
<td>725</td>
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<td>25,176</td>
<td>67801</td>
<td>1872</td>
<td>2550</td>
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<tr>
<td>Ford</td>
<td>314</td>
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<td>1885</td>
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<tr>
<td>Fort Dodge</td>
<td></td>
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<tr>
<td>Howell</td>
<td></td>
<td></td>
<td></td>
<td>2551</td>
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<td>Kingsdown</td>
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<td>67858</td>
<td>1887</td>
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</tr>
<tr>
<td>Sayre</td>
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<tr>
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<td>2527</td>
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<td>South Dodge</td>
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<td></td>
<td></td>
<td>2480</td>
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<tr>
<td>Spearville</td>
<td>716</td>
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<tr>
<td>Wilroads</td>
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<td></td>
<td></td>
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<tr>
<td>Wright</td>
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<td>2539</td>
</tr>
</tbody>
</table>

4.2.2 Land Use in the County

Table 4.2 (2) - (US Applied Remote Sensing Program: LANDSAT Data Interpretation; reference map in Resources Section).

<table>
<thead>
<tr>
<th>Code</th>
<th>Land Cover</th>
<th>% Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Urban Industrial / Commercial</td>
<td>0.38</td>
</tr>
<tr>
<td>12</td>
<td>Urban Residential</td>
<td>0.48</td>
</tr>
<tr>
<td>13</td>
<td>Urban Openland</td>
<td>0.42</td>
</tr>
<tr>
<td>14</td>
<td>Urban Woodland</td>
<td>0.00</td>
</tr>
<tr>
<td>15</td>
<td>Urban Water</td>
<td>0.01</td>
</tr>
<tr>
<td>20</td>
<td>Cropland</td>
<td>66.25</td>
</tr>
<tr>
<td>30</td>
<td>Grassland</td>
<td>22.78</td>
</tr>
<tr>
<td>31</td>
<td>Conservation Reserve Program (CRP) land</td>
<td>9.35</td>
</tr>
<tr>
<td>40</td>
<td>Woodland</td>
<td>0.16</td>
</tr>
<tr>
<td>50</td>
<td>Water</td>
<td>0.13</td>
</tr>
<tr>
<td>60</td>
<td>Other</td>
<td>0.04</td>
</tr>
</tbody>
</table>

The bulk of the land cover in the county (~89%) is comprised of cropland and grassland. The primary water bodies include Ford State Fishing Lake. Urban residential and urban industrial/commercial development comprises roughly 0.86% of the land cover, primarily in and around the cities of Dodge City, Spearville, Bucklin, and Ford. Woodlands are sparse but typically found along streams in narrow
belts. The cottonwood is the most numerous, but hackberry, walnut and cedar are found.

4.2.3 Topography and drainage

Topography
Ford County is situated in the Great Plains physiographic province, much of the county falling within the subdivision known as the Plains Border section (Fenneman, 1930). About 75 percent of the county consists of upland plains and the remainder of stream flood plains and intermediate slopes. South of the Arkansas River the upland plain slopes southeastward from altitudes of about 2,720 feet along the western boundary at a point about 10 miles north of the southwestern corner of the county to about 2,390 feet along the eastern boundary on the upland plains about four miles east of Bucklin. North of Arkansas River the upland plain descends from an altitude of about 2,660 feet along the western boundary at a point about 2 miles north of Arkansas River to about 2,280 feet along the eastern boundary at a point about two miles south of the northeastern corner of the county. The undissected surfaces of the uplands in general are comparatively flat and featureless, but locally the surface is undulating and is characterized by broad gentle swells and shallow depressions.

The Arkansas River valley ranges in width from about two miles along the western border to about four miles along the eastern border, and is 50 to 160 feet deep. The valley is bordered by moderately steep slopes or bluffs on the north side of the river and by a wide zone of sand hills on the south side.

Ford County is located within three major land resource areas (MLRAs) within the Central Great Plains Winter Wheat and Range Region: the Rolling Plains and Breaks MLRA, the Central Rolling Red Plains MLRA, and the Great Bend Sand Plains MLRA. The majority of Ford County is located in the Rolling Plains and Breaks, with the southeastern segment of the county split among the Central Rolling Bed Plains and the Great Bend Sand Plains.

The Rolling Plains and Breaks contains elevations from 500 to 900 meters, increasing from east to west. These dissected plains have broad undulating to rolling ridgetops and hilly to steep valley sides. The valleys generally are narrow, and local relief is in meters to tens of meters.

The Central Rolling Red Plains MLRA's elevation ranges from 500 to 900 meters, increasing gradually from east to west. On these dissected plains, the broad divides are nearly level to gently sloping, but slopes are short and steep in the valleys. In places the valleys are bordered by a rolling to steep irregular dune topography. Local relief is mainly in meters, but a few of the larger valleys are tens of meters or more below the general level of the plain.

The Great Bend Sand Plains MLRA contains elevation from 500 to 800 meters. These undulating to rolling plains have a deep mantle of windblown sand and sandy outwash materials. Local relief is mainly in meters.

The highest elevation in the county, at 2,665 feet above sea level is located at the area known as Sayre, in the southwestern portion of the county. The area known as Bellefont, located in the northeastern portion of the county, is situated at the lowest elevation in the county, at approximately 2,355 feet above sea level.

Drainage - Central United States
The Mississippi River Basin is the major drainage basin of the central United States. The Mississippi River drainage basin is the world's second largest, draining 4.76 million square kilometers (1.83 million square miles), including tributaries from thirty-two U.S. states and two Canadian provinces. The Mississippi River watershed encompasses 40 percent of the contiguous United States. Major tributaries include the Missouri, Ohio, Arkansas–Red–White, and Tennessee Rivers.
The Mississippi River is North America's longest and largest river in terms of discharge, and the fifth largest discharge river worldwide, at an average of 17,330 cubic meters per second (811,530 cubic feet per second). The Mississippi flows 3,763 kilometers (2,333 miles) from Lake Itasca in northern Minnesota to its delta in southern Louisiana.

The Mississippi River Basin is comprised of six smaller river resource basins: the Missouri, Upper Mississippi, Lower Mississippi, Arkansas White-Red, Ohio, and Tennessee River Basins. These six basins are part of the 21 major water collection areas, called Water Resource Areas in the United States. These areas are named for a state, a geographic area, or a river.

**Drainage - Kansas**

The State of Kansas lies within two of these two water resource areas or river basins; the Missouri River Basin and the Arkansas Red-White River Basin. The northern half of Kansas is within the Missouri River Basin, and the southern half of Kansas is within the Arkansas Red-White River Basin. Water from local rivers eventually flows into the Missouri River, and finally into the Mississippi River. Ford County lies within the Missouri River Basin segment of the State.

The Missouri and Arkansas Red-White basins (within Kansas) are further divided into twelve main water collection areas called watersheds or river basins. Each of these twelve basins is named after the river that collects the runoff water.

The Upper Arkansas River Basin covers most of Ford County. The exceptions include the southwest corner, which lies within the Cimarron River Basin, and the southeast corner, which lies within the Lower Arkansas River Basin.

Ford County is drained by Arkansas River which enters the county along the western boundary at a point about two miles northeast of Howell and flows in a southeasterly direction to a point east of Ford, where it turns and flows northeastward, leaving the county near the middle of the eastern boundary. The change in course near Ford is part of a large and unusual bend that the river makes in passing from eastern Ford County northeastward to Great Bend, where it again changes direction and swings southeastward. During the summer months Arkansas River often dwindles to an insignificant stream or disappears almost entirely in its sandy bed with little or no visible flow. At such times the sandy stream bed is threaded by shallow channels. During periods of flood the stream flow is increased in volume, which results in a general overflow of the stream banks and the inundation of the adjacent floodplain. The average gradient of Arkansas River in Ford County is about seven feet to the mile. Of the several tributary streams to Arkansas River, only Mulberry Creek on the south joins the main stream within the county.

North of the river, where the surface slopes to the northeast, the northeastern drainage heads within a mile and a half of Arkansas River in some places. The largest tributary stream north of the river in Ford County is Sawlog Creek, which rises in the northwestern corner of the county, flows eastward along the northern edge of the county, and leaves the county at a point about three and a half miles east of U.S. Highway 283. Sawlog Creek joins Buckner Creek at Hanston in eastern Hodgeman County. Duck Creek, which heads about a mile north of Dodge City, flows northeast and enters Sawlog Creek at a point about two and a half miles west of U.S. Highway 283. Five-mile Creek heads about two miles west of Wright and flows northeast to join Sawlog Creek at a point about a mile east of U.S. Highway 283. Spring Creek heads about two and a half miles northeast of Wright, flows northward and joins Sawlog Creek about two miles east of U.S. Highway 283. A large area southeast of Spearville is drained by Coon Creek and its chief tributary, Cow Creek. Coon Creek heads about three miles southwest of Spearville and roughly parallels Arkansas River, leaving the county at a point about seven miles south of the northeastern corner. With the exception of Duck Creek, which is largely spring fed, most of the tributaries are usually dry.
South of Arkansas River Mulberry Creek is the principal tributary. An area in the southeastern corner of the county in the vicinity of Bucklin is drained by Rattlesnake Creek, which flows northeastward and joins Arkansas River southwest of Alden in Rice County. It is an intermittent stream and is dry most of the year. Crooked Creek enters the southwestern corner of the county at a point, about one and a half miles east of the southwestern corner, makes a broad loop, and swings out of the county at a point on the south county line about one and three quarters miles east of its point of entry. Throughout its course in Ford County Crooked Creek has eroded a channel of sufficient depth to intercept ground water from springs and seeps, with the result that the creek bed seldom is entirely dry, although actual flow may at times be supplanted by scattered pools along the stream bed. The anomalous features of the reversal in the direction of flow of this stream are discussed under a later section.

Mulberry Creek heads just to the west in Gray county and enters Ford County at a point about eleven and a half miles north of the southwest corner, flows southeastward to a point about five miles northeast of Bloom, after which it swings northeastward to join Arkansas River about 1 mile east of Ford. This stream is usually dry in its upper reaches and throughout much of its course, but carries a small amount of water the year round in a short stretch above its mouth.

The tributary streams north of the Arkansas River, with the exception of Coon Creek, have cut their channels from 100 to 150 feet below the level of the uplands and in general have narrow flood plains bordered in some places by rather precipitous bluffs. The northern part of the county comprises a deeply dissected area in which encroaching streams such as Sawlog, Duck, and Five-mile creeks are gradually destroying the original plains surface and have cut through the Ogallala formation into the underlying Cretaceous rocks. South of the river the amount of dissection is not as great and tributary streams have not cut their channels into bedrock. Resistant caliche beds, so characteristic of the plains surface north of the river, generally are absent south of the river, and the tributary streams have eroded valleys lacking in precipitous bluffs but with numerous closely-spaced gullies entering from both sides. Mulberry Creek has cut below the plains surface to depths of 80 to 120 feet, but, unlike the streams north of the river, the intermediate slopes on both sides of the valley are gentle. The gullies tributary to Rattlesnake Creek in the southeastern part of the county give rise to a semi-badland type of topography. Near the southwestern corner of the county the plains surface slopes toward the Crooked Creek valley and comprises the northern part of the Meade artesian basin. Within Ford County the channel of Crooked Creek has been incised only to a depth of about 10 feet below its floodplain and has not yet reached base-level.

The U.S. Environmental Protection Agency (EPA) identified six watersheds located in Ford County: Rattlesnake, Arkansas-Dodge City, Crooked, Buckner, Upper Cimmaron-Bluff, and Coon-Pickerel.

### 4.2.4 Rivers, lakes, streams
A number of rivers and streams were identified in Ford County:
- Arkansas River
- Bluff Creek
- Brites Creek
- Coon Creek
- Cow Creek
- Crooked Creek
- Duck Creek
- Elm Creek
- Hargis Creek
- Mulberry Creek
- Rattlesnake Creek
- Saw Log Creek
- Simmons Creek
- South Fork Buckner Creek
- South Fork Duck Creek
- Turkey Creek
- West Kiowa Creek
- White Woman Creek

Ford State Fishing Lake and Wildlife Area is located in Ford County, approximately three miles north and five miles east of Dodge City. The property consists of 260 acres of uplands, 10 acres of wetlands, and a 45 acre lake. The uplands and wetlands are made up of heavily timbered riparian areas along the creek, native grass on the side slopes, and old crop fields on the flatter upland terrain. An old 4-H campus is located on the east side and is presently maintained as a Boy Scout area. The dam was originally built in 1936. In 1990, the area was donated to the Kansas Department of Wildlife & Parks in order to renovate the lake for fishing. At the same time, Ford County assumed management of the area for public use. In 1991-1992, the lake was renovated and stocked with fish after filling.

Hains Lake is located in Ford County approximately 5 miles north and 8 miles east of Dodge City and is two and one quarter miles east of US Hwy 283. The area consists of 20 acres of uplands and 35 surface acres of shallow lake. Due to its shallow depth, Hains Lake supplies excellent wetland habitat. However, the lake may go dry during drought periods. Waterfowl hunting is the primary use of the area. Due to the general lack of water in the area, the lake is stocked when conditions allow to supply basic fishing opportunity. The area is closed to vehicle traffic during waterfowl seasons. Walk-in traffic is welcome for both fishing and hunting during this time. Parking lots are supplied at both entrances when the gates are closed. When gates are open, vehicles must stay on established trails. Camping is allowed on the area, but there are few facilities and no restroom is available. Boats are allowed on the lake, but no ramp is available.

A number of community lakes are present in Dodge City: Lake Charles and Mariah Hills Golf Course Pond. Lake Charles is a one-acre community lake at Dodge City Community College with a maximum depth of 12 feet. Dodge City Community College pumps water to the lake to maintain its water level. Mariah Hills Golf Course Pond is a two-acre community lake with a maximum depth of six feet. The lake is normally full.
4.3 Geologic Summary

4.3.1 Structure
In geologic time, inland seas covered Ford County and Southwest Kansas. The basic underlying geologic foundation gently slopes up to the west and the Rocky Mountains. The official name for the underlying formation is the Hugoton Embayment of the Anadarko Basin.

4.3.2 Underlying strata
Geologic time is divided into Periods. Important periods for the development of Southwest Kansas start with the Mississippian and Pennsylvanian Periods (280-345 millions years ago). These are also known as the Carboniferous Periods. The few reservoirs of oil and natural gas found in Ford County were created from deposits during these Periods. Ford County oil and gas are found deep under the surface: 3,000-5,000 foot wells are the best producers.

The next period is the Permian (230-280 million years ago). Seas covered southwest Kansas during this time. Permian deposits are combinations of limestone, shale, and chert. Salt and gypsum deposits may also be found. Salt deposits over 400 feet thick are located northeast of Ford. A very deep Cedar Hills Sandstone Aquifer is found in the Lower (older) Permian formations (900 feet under Ford County).

No rocks were formed or remain in the county from the next two periods, the Triassic (230-180 million years ago), and Jurassic (135-180 million years ago). Western Kansas was covered by seas during the Cretaceous Period (135-65 million years ago). Formations from this period produced the Dakota Aquifer from ancient river deltas and sandbars.

The two most recent geologic periods are the Tertiary (600,000 to 65 million years ago), and Quaternary (600,000 years ago to current time). The Rocky Mountains were formed during the Tertiary Period about 3.8 million years ago. The Ogallala Aquifer was created by a huge alluvial fan (delta) with deposits from mountain erosion. The Ogallala formation and aquifer cover parts of five states. During the early Quaternary Period the current river and stream channels were established in Western Kansas.

A thrust fault jolted the area during the Tertiary Period. Permian and Cretaceous bedrock in Southeast Ford County were pushed up about 200 feet from the adjacent land. This is known as the Crooked Creek-Fowler Fault. The Ogallala deposits continued after the fault, leveling the surface again. This ancient fault poses almost no risk for earthquakes today. On a scale of earthquake susceptibility for the nation, southwest Kansas ranks lowest.

Continued deposition of Rocky Mountain materials in recent geologic history has raised the bed of the Arkansas River. This caused tributaries to either not feed the river, or made past tributaries change course away from the upper Arkansas. This lack of feeder tributaries is one reason for the surface water shortage in Ford County and along the Arkansas River basin.

4.3.3 Aquifers
Groundwater is the greatest resource in southwest Kansas. Surface streams are intermittent at best. The only reliable water source is underground. Aquifers are subsurface formations, which hold ground water. There are three in Ford County: the Arkansas River alluvial aquifer, immediately adjacent to the river bed; the Ogallala Aquifer which ranges from zero to 240 feet below the surface; and the Dakota Aquifer below the Ogallala. In Ford County, these aquifers are hydraulically interconnected in many places.

Alluvial Aquifer
The Alluvial aquifer is hydrologically the same as the Ogallala in Ford County. The alluvial area is environmentally critical because surface water from the bed can enter the ground water system-surface
water pollution may damage ground water quality. Prior to intense development, the surface streams both recharged and discharged groundwater. The aquifer naturally flowed toward streams. Recent water table declines have reduced the groundwater level so that the streams (when flowing) act only as a recharge now. Groundwater pollution from surface recharge may come from several sources. Agricultural runoff may contain salts, pesticides, and herbicides. Industrial, agricultural production, and municipal runoff are primary sources for nitrates in the groundwater.

Ogallala Aquifer
The Ogallala covers portions of five states in the Great Plains east of the Rocky Mountains. It contains about the same amount of fresh water as Lake Erie. The Ogallala was originally connected to the Rocky Mountains before erosion intervened. The water-bearing rock formations were created during the Tertiary Geologic Period.

Ground water removal from the aquifer has been significantly higher than its recharge. The aquifer is being depleted. As the saturated thickness varies, so does concern about the lowering ground water elevation. As the aquifer was being established, its thickness depended on the depth of materials that could hold water. It was originally 1,000 feet thick in most places.

Erosion over time reduced the thickness of the Ogallala Aquifer. In modern times, wells for agricultural and domestic use have further reduced this resource. Groundwater specialists have established that 1940 is the date intense groundwater use began in the Ogallala. Between 1940 and 1989, the Ford County groundwater level dropped 10 to 25 feet in west, and zero to 10 feet in the north and east. As a percent of available groundwater, Ford County has seen a 10 to 20 percent decline in central Ford County, and a 0 to 10 percent decline to the west. In parts of Grant County, the ground water table has declined over 200 feet and in parts of Finney County the percent decline has been over 50 percent. The percent decline depends on the original thickness of the aquifer.

Dakota Aquifer
The Dakota Aquifer is older and is under the Ogallala in most of southwest Kansas. The Dakota water-holding sandstone was deposited during the Cretaceous Geologic Period. The range of this aquifer is much larger than the Ogallala, covering the western two thirds of Kansas. (Where the Dakota and Ogallala are connected, it is considered one aquifer—the High Plains—for management purposes; where separated by shale deposits the Dakota is a confined and separate aquifer.) Being in the ground longer than Ogallala, the Dakota has dissolved more salts from the bedrock, and is thus contains more salt. The upper levels are younger and have more flow to flush the salts—they are a good source for public and agricultural uses. The deeper into the system one drills, salt becomes a problem.

In Ford County, the Dakota Aquifer is under the Ogallala for most of the county. The Dakota is the available groundwater source for northern and the southwestern corner of Ford County. Of the 1,086 permitted wells in Ford County, 52 are for the “Dakota Aquifer”, where the Dakota is confined or otherwise separated from the Ogallala.

4.3.4 Oil & Gas
Review of the Kansas Geological Survey oil and gas well database indicated in 2007 that 37 wells produced 121,857 barrels of crude oil. For the same year, 23 gas wells produced 200,682 mcf (1000 cubic feet) of natural gas. Reference the Map in the Resources Section for a more detailed description.

4.3.5 Mining
Mining in Ford County consists of 12 sand and gravel companies:
- Broce Construction Company, Inc. (two surface quarries)
- Davis & Sons Sand Sales (one surface quarry)
- Demuth Sand Company (one surface quarry)
Dodge City Sand Company (one pit and two pit or lake dredge operations)
Ford Sand & Gravel Company (two surface quarries and one pit operation)
Gladden Excavating (one surface quarry and one pit operation)
Southwest Sand and Gravel (three surface quarries)
Whitfield Sand & Concrete, Inc. (two pit operations and one pit or lake dredge operation)
Reference the tables in the Resources Section for a more detailed description.

4.3.6 Seismic Activity
Ford County is located in an area of the United States rated for “minor damage” caused by seismic activity. The Uniform Building Code Seismic Zone Map (1997) shows Ford County in Zone 0; therefore little chance of severe ground shaking is present. From a tectonic standpoint, the most important structural feature in Kansas is the Humboldt Fault (Nemaha Anticline), a buried granite mountain range that extends from roughly Omaha, Nebraska, to Oklahoma City. This range was formed about 300 million years ago, and the faults that bound it are still slightly active today, especially the Humboldt fault zone that forms the eastern boundary of the Nemaha Ridge, passing near Wamego, east of Manhattan, and near El Dorado, east of Wichita. About 50 miles (80 km) west of the Nemaha Ridge is the Midcontinent rift, a zone of the earth's continental crust that was ripped apart and filled with oceanic-type crust (basaltic rocks) about 1.1 billion years ago. This zone of rifting extended from central Kansas near Salina, northeast-ward across Nebraska, Iowa, and Minnesota and into the Lake Superior region.
4.4 Historical Summary

Figure 4.4 (1) Crossing the Great American Desert Near Dodge City, Kansas, 1849

The Santa Fe Trail
The Santa Fe Trail was originally an Indian trade route between the Rio Grande and the High Plains. Spanish conquistadors and settlers of Mexico used the route for trade between Mexico and the Missouri River area. Especially after the founding of Santa Fe (New Mexico) in 1610. United States parties made a few trips along the Santa Fe in the early 1800s, such as Zebulon Pike on his 1806 expedition west. And merchants seeking trade. In 1821 William Becknell of Missouri opened the Santa Fe as a commercial route between Mexico and the United States. Mexico had just become a republic. , And lowered tariffs encouraged trade. After the Mexican-American War, the Santa Fe Trail became a military route into the newly acquired territory.
Early Stations/Forts
Way stations and defense forts were established along the Santa Fe for the wagon trains. In Ford County, Fort Mann was established in 1847 and operated for one year. Camp Mackay was established in 1850, and re-named Fort Atkinson in 1851. This was in operation until 1854. There are no remains of these dugout, sod, and log facilities. Both were just west of the present day Dodge City.

Fort Dodge
In 1865 Fort Dodge was established to protect the Santa Fe Trail. It was named for Major General Grenville M. Dodge, then in command of the Missouri Military District. General James H. Ford established the fort. The first buildings were dugouts along the river. Colonel Richard 1. Dodge was a commanding officer at the fort. The two Dodge’s often being confused. Fort Dodge was de-commissioned in 1888, becoming a state soldiers’ home.

Dodge City
The military administration established a “military reservation” five miles around the fort. With the railroad under construction towards the area. George M. Hoover rode five miles from the fort. Unhitched his wagon. And opened up a saloon from the back in June 1872. This was the start of Dodge City. Kansas. For two or three months the place was called Buffalo City. The post office refused to accept that name. As there was already a Buffalo, Kansas. The community then decided to name themselves after the nearby fort.

The Atchison, Topeka, and Santa Fe Railroad was completed through Ford County in 1872. That same year the town site was laid out. But the town was not incorporated until November 2, 1875.

By 1872 there were twenty-two identified stores in Dodge City, a railroad depot, one sod house. And several tents and dugouts. Seven of the businesses were saloons and two stores were conducted out of tents. The primary economy in early Ford County was buffalo hunting along with services for the hunters. By 1874 the vast Kansas herds were decimated. The buffalo hunters moved on to the herds in Texas contrary to the Medicine Lodge Indian Peace Treaty.
The first longhorn cattle drive arrived in Dodge City in 1875. A tick-spread fever caused the Kansas legislature to establish a “quarantine line” to protect the state’s eastern domestic herds. In 1877 the Chisholm Trail to Wichita and Abilene was closed. In 1885 the cattle drives stopped as the quarantine line included the entire state of Kansas. It was during this decade that Dodge City became known as the Cowboy Capital.

Two fires devastated downtown Dodge City in 1885. A severe blizzard that winter nearly marked the end of all area economy. The economy recovered as a typical Kansas farming and cattle raising region.

Figure 4.4 (3) Ford County, 1899

Ford County and Developing Communities
Ford County was authorized in 1867. The Kansas legislature allowed for the creation of western counties if and when a minimum population of 600 was verified. On April 5, 1873 the state acknowledged Ford County, named after the general who laid out Fort Dodge. Until Ford County was authorized, the only civil law and legal support was found in Hays.

Several towns were planned in Ford County that never became chartered. Some were settled to later disappear. Three became incorporated cities and have survived, in addition to Dodge City. One unincorporated village remains a thriving community.

Along the railroad lines, a station was provided to water the steam locomotives and a siding was installed for trains to pass each other on the otherwise single line. These later became ideal locations for farm produce collection, and almost each one had a grain elevator by the 1910s.

The village of Bellefont was platted in July 1885. Promoters believed that it would become a railhead for the Santa Fe Railroad. Instead, the railhead was placed in Dodge City, and Bellefont became a small village with a grain elevator. Oil fields have been explored east and south of the community since 1979.

Bloom developed as a stop on the Fort Dodge-Camp Supply Trail before the Rock Island Railroad. It began in the 1880s and was originally called Bloomberg. Droughts nearly decimated the community in 1893. By 1908 Bloom was again thriving. It has more recently lost most of its population.

Howell developed in the late 1880s, with a population approaching 150 by 1890. This village has all but disappeared except for the grain elevator and county rural fire station.

Nolan started around 1882 as a country store with a post office. It no longer exists.

Sears had little more than a telegraph station and a rural schoolhouse. It no longer exists.
Kingsdown started as a rural village in 1887 along the Rock Island Railroad. It was platted in 1909. A few houses and a grain elevator remain in the community.

Wilroads Gardens was a subdivision from the 1930s. It was platted with very deep lots and included irrigation ditches. Homes were designed towards the street frontage, while the rear areas were intended for self-sustaining agriculture.

Windhorst developed by a group of German Catholics from Cincinnati seeking homestead lands. The Santa Fe Railroad offered ten sections of land for ten dollars an acre, and donated eighty acres for a town site in 1876. The village was settled, but a promised Santa Fe Railroad leg from Offerle was never constructed.

Wright started as a stop for the Stage Coach Line. A hotel was constructed there by 1886. It was originally called Ridgeway. In 1887 a Charter of Incorporation was filed, but Wright never became a Ford County City. Wright is the most populous and most thriving of the Ford County unincorporated villages today.

Bucklin was platted in May 1887. It was designed as a railroad town for the Rock Island Railroad. Ford was Platted in 1885, another stop for the Rock Island Line. Spearville was platted earlier, in May 1873. Spearville was a designated stop for the Santa Fe Railroad. These three became incorporated cities, and are still functional as farming communities and small market areas within the county.

Other communities were planned but never developed. There was much speculation with the developing railroads, and many areas were touted as the next Kansas City. In Ford County, these include Colcord, Corbitt, Concord, and Newkirk. The proposed town of Ryansville was platted and developed in 1885. However, it lost its existence soon after the Rock Island was laid through the City of Ford a little to the south.

The more recent development and steady growth of the Ford County region have been based on wheat, feed grain, cattle, and manufacturing. Dodge City is the principal grain market in southwest Kansas. In recent years, the feeding and fattening of cattle in local feed yards has reached major economic proportions. Manufacturing activities have rapidly grown due to beef processing and agri-business industries.
4.5 Economic Summary

4.5.1 Overview
Following are some facts about the performance of the Ford County economy:

Per Capita Personal Income
In 2006 Ford had a per capita personal income (PCPI) of $26,373. This PCPI ranked 72nd in the state and was 76 percent of the state average, $34,799, and 72 percent of the national average, $36,714. The 2006 PCPI reflected an increase of 4.9 percent from 2005. The 2005-2006 state change was 6.4 percent and the national change was 5.6 percent. In 1996 the PCPI of Ford was $19,422 and ranked 58th in the state. The 1996-2006 average annual growth rate of PCPI was 3.1 percent. The average annual growth rate for the state was 4.3 percent and for the nation was 4.3 percent.

Total Personal Income
In 2006 Ford had a total personal income (TPI) of $869,449,000. This TPI ranked 22nd in the state and accounted for 0.9 percent of the state total. In 1996 the TPI of Ford was $597,227,000 and ranked 18th in the state. The 2006 TPI reflected an increase of 4.6 percent from 2005. The 2005-2006 state change was 6.9 percent and the national change was 6.7 percent. The 1996-2006 average annual growth rate of TPI was 3.8 percent. The average annual growth rate for the state was 4.8 percent and for the nation was 5.4 percent.

Components of Total Personal Income
Total personal income includes net earnings by place of residence; dividends, interest, and rent; and personal current transfer receipts received by the residents of Ford. In 2006 net earnings accounted for 69.7 percent of TPI (compared with 68.8 in 1996); dividends, interest, and rent were 15.3 percent (compared with 17.5 in 1996); and personal current transfer receipts were 15.0 percent (compared with 13.6 in 1996). From 2005 to 2006 net earnings increased 3.2 percent; dividends, interest, and rent increased 9.1 percent; and personal current transfer receipts increased 6.9 percent. From 1996 to 2006 net earnings increased on average 4.0 percent each year; dividends, interest, and rent increased on average 2.4 percent; and personal current transfer receipts increased on average 4.8 percent.

Earnings by Place of Work
Earnings of persons employed in Ford increased from $680,953,000 in 2005 to $704,945,000 in 2006, an increase of 3.5 percent. The 2005-2006 state change was 6.1 percent and the national change was 5.7 percent. The average annual growth rate from the 1996 estimate of $483,693,000 to the 2006 estimate was 3.8 percent. The average annual growth rate for the state was 5.2 percent and for the nation was 5.5 percent.

4.5.2 Agriculture
The 2002 Census of Agriculture indicated 701 farms (down 4 percent from 1997) and 649,460 acres of land (down 4 percent from 1997) were used for agricultural purposes in Ford County.

Ford County ranked 8th in the state for total value of agricultural products sold ($214,658,000).

The primary crops consisted of all wheat for grain (115,219 acres), sorghum for grain (56,536 acres), corn for grain (39,111 acres), forage (27,606 acres), and soybeans (9,723 acres).

Cattle and calve inventory was 182,500 head, ranking Ford County 6th in the state.
4.5.3 Business & Industry
According to the 2000 U.S. Census Bureau, the primary occupation for the employed civilian worker in Ford County was identified as production, transportation, and material moving occupations (26.0%); management, professional, and related occupations (24.5%); sales and office occupations (22.6%); service occupations (14.3%); construction, extraction, and maintenance occupations (10.2%); and farming, fishing, and forestry occupations (2.4%).

Ford County Property was valued at $227,021,000 in 2007. Residential property accounted for 36.78% of the total property valuation, and commercial real estate accounted for 23.34% of the total. Public utilities were identified as making up for 19.52% of the total property valuation, and commercial/industrial machinery accounted for 9.44%. Agricultural land made up 8.07% of the total property valuation, and oil and gas property accounted for 1.52% of the total.

The U.S. Census Bureau identified the employment industries in 2000 as manufacturing (25.0%); educational, health and social services (19.3%); retail trade (11.2%); arts, entertainment, recreation, accommodation and food services (6.4%); construction (5.8%); agriculture, forestry, fishing and hunting, and mining (5.7%); transportation and warehousing, and utilities (5.0%); finance, insurance, real estate, and rental and leasing (4.4%); professional, scientific, management, administrative, and waste management services (4.0%); other services except public administration (4.0%); wholesale trade (3.7%); public administration (3.6%); and information (1.9%).
4.6 Climatic Summary

<table>
<thead>
<tr>
<th>Table 4.6 (1)</th>
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<tbody>
<tr>
<td><strong>Average Daily Temperature (Fahrenheit)</strong></td>
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<tr>
<td>January (Fahrenheit)</td>
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<tr>
<td>High – 42.5</td>
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<tr>
<td>Low - 19.0</td>
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<tr>
<td>July (Fahrenheit)</td>
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<tr>
<td>High – 92.5</td>
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<td>Low - 67.0</td>
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<td><strong>Average Annual Precipitation (inches)</strong></td>
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<td><strong>Average Annual Snowfall (inches)</strong></td>
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<tr>
<td><strong>Prevailing Winds</strong></td>
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<tr>
<td>Warm Months (Late Spring-Summer)South</td>
</tr>
<tr>
<td>Cold Months (Late Autumn-Winter)North</td>
</tr>
</tbody>
</table>
4.7 Demographic Summary

   Economic Data Summary - Ford County, Kansas is not available except online.
   DP-1. Profile of General Demographic Characteristics: 2000 is not available except online.
   DP-3. Profile of Selected Economic Characteristics: 2000 is not available except online.
   DP-4. Profile of Selected Housing Characteristics: 2000 is not available except online.
4.8 County Infrastructure Summary
Ford County has a three-member elected commission and includes the following departments.

**Appointed Positions**
- County Administrator
- Administrative Services
- Appraisal
- Communications
- Planning/Zoning & Environmental Health
- Fire, EMS
- Health Department
- Technology Group
- Community Corrections

**Elected Positions**
- County Attorney
- County Clerk
- Register of Deeds
- Sheriff
- County Treasurer

4.8.1 Power (electric and gas utilities)
(waiting on information regarding electric and gas utilities; request forwarded to Ford County).
4.8.2 Water sources, storage, and treatment

Table 4.8 (1) - List of Water Systems in Ford County

<table>
<thead>
<tr>
<th>Water System Name</th>
<th>Principal County Served</th>
<th>Population Served</th>
<th>Primary Water Source Type</th>
<th>System Status</th>
<th>Water System ID</th>
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<tbody>
<tr>
<td>BUCKLIN, CITY OF</td>
<td>FORD</td>
<td>735</td>
<td>Groundwater</td>
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<td>KS2005711</td>
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<tr>
<td>CARGILL MEAT SOLUTIONS CORP</td>
<td>FORD</td>
<td>2501</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2105716</td>
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<tr>
<td>DODGE CITY, CITY OF</td>
<td>FORD</td>
<td>26101</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2005710</td>
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<tr>
<td>FORD, CITY OF</td>
<td>FORD</td>
<td>330</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2005709</td>
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<tr>
<td>GUNSMOKE TRAVEL PARK</td>
<td>FORD</td>
<td>25</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2105724</td>
</tr>
<tr>
<td>KANSAS SOLDIERS HOME</td>
<td>FORD</td>
<td>420</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2005701</td>
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<td>KDOT BLOOM REST AREA WB 63511</td>
<td>FORD</td>
<td>25</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2105725</td>
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<tr>
<td>NATIONAL BEEF PACKING COMPANY LLC DODGE</td>
<td>FORD</td>
<td>2850</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2105718</td>
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<tr>
<td>SPARE TYME BOWL</td>
<td>FORD</td>
<td>25</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2105715</td>
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<tr>
<td>SPEARVILLE, CITY OF</td>
<td>FORD</td>
<td>872</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2005712</td>
</tr>
<tr>
<td>WILROADS GARDEN SCHOOL</td>
<td>FORD</td>
<td>120</td>
<td>Groundwater</td>
<td>Active</td>
<td>KS2105720</td>
</tr>
</tbody>
</table>

4.8.3 Waste disposal, storage, and treatment

Dodge City currently treats wastewater at the Dodge City Wastewater Treatment Facility at 100 McCaustland Road #1. The facility's permit went into effect on January 1, 2008 and it expires on December 31, 2012. Discharge of wastewater from this treatment facility to surface waters of the State of Kansas is prohibited by this permit.

The Dodge City Wastewater Treatment Facility is composed of the following features:

- Equalization basin
- Primary pump station
- Booster pump station
- Three anaerobic lagoon cells covered, with gas flares ranging in size from 14.2 to 17.5 million gallons (MG)
- Three completed mixed aerated lagoon cells ranging in size from 3.60 MG to 3.97 MG
- Four facultative storage lagoon cells ranging in size from 177 MG to 298 MG
- Two irrigation pump stations
- Center pivot irrigation system
- Total Design Flow = 7.2 million gallons per day (MGD)
- City Design Flow = 4.0 MGD
- Industrial Design Flow = 3.2 MGD

Dodge City is permitted to discharge stormwater from the municipal separate storm sewer system (MS4) into the Upper Arkansas River drainage basin. This permit was effective on October 1, 2004 and expires on September 30, 2009, and authorizes all existing or new stormwater point source discharges to waters of the United States from the MS4 located within the permit area.

The City of Spearville is permitted to treat wastewater at the Spearville Wastewater Treatment Facility approximately one miles south-southeast of the city limits. The facility utilizes a four cell wastewater stabilization lagoon system. The total surface area of the four cells is 11.6 acres. The design flow is 66,000 gallons per day (gpd), and it is designed for a population equivalent (P.E.) of 720. The facility's permit was effective on May 1, 2007, and it expires on April 30, 2012. Discharge of wastewater from this treatment facility to surface waters of the State of Kansas is prohibited.

The City of Bucklin is permitted to treat wastewater at the Bucklin Wastewater Treatment Facility located approximately 0.5 miles southeast of Bucklin. The facility utilizes a lift station and a three cell wastewater stabilization lagoon system. The total surface area of the three lagoons is 9.6 acres. The design flow is 115,000 gpd, and it's designed for a P.E. of 1,000 at 115 gpcd. Its permit was effective on July 1, 2007, and it expires on June 30, 2012. Effluent from the plant is received by Rattlesnake Creek via West Fork Rattlesnake Creek in the Lower Arkansas River Basin.

The City of Ford is permitted to treat wastewater at the Ford Wastewater Treatment Facility located outside the Ford city limits on the northeast side. The facility utilizes a three cell wastewater stabilization lagoon system. The total surface area of the three cells is 2.26 acres. The design flow is 31,680 gpd, and it is designed for a P.E. of 317 at 100 gallons per capita per day (gpcd). The facility utilizes an irrigation pump station and agricultural irrigation of the effluent. Its permit was effective on February 1, 2008, and it expires on February 28, 2012. Discharge of wastewater from this treatment facility to surface waters of the State of Kansas is prohibited by this permit.

The Kansas Soldiers Home in Fort Dodge is permitted to treat wastewater at the Kansas Soldiers Home Wastewater Treatment Plant located at 714 Sheridan, Unit 128. The plant utilizes a two cell wastewater stabilization lagoon system (with irrigation). The total surface area is 2.88 acres. It's designed for a P.E. of 500 with design flow of 50,000 gallons per day (gpd). The rated flow is 25,300 gpd, and its rated P.E. is 253 at 100 gallons per capita daily (gpcd). The plant's permit was effective July 1, 2007, and it expires on June 30, 2012. Discharge of wastewater from this treatment facility to surface waters of the State of Kansas is prohibited.

The Wright Improvement District is permitted to treat wastewater at the Wright Improvement District Wastewater Treatment Plant approximately 0.25 miles east of the unincorporated area of Wright. The facility utilizes a three cell wastewater stabilization lagoon system. The total surface area of the three lagoons is 2.38 acres. It's designed for a P.E. of 200, and its rated flow is 20,800 gpd. The facility's permit was effective on August 1, 2007, and it expires on July 31, 2012. Discharge of wastewater from this treatment facility to surface waters of the State of Kansas is prohibited.

The Wilroad Gardens Improvement District is permitted to treat wastewater at the Wilroads Gardens Wastewater Treatment Facility located at 11602 East Main Road, Dodge City. The facility utilizes a three cell wastewater stabilization lagoon system. The total surface area of the three lagoons is 5.5 acres. It's
designed for a P.E. of 500, and its rated flow is 49,500 gpd. The facility's permit was effective on June 1, 2007, and it expires on May 31, 2012. Discharge of wastewater from this treatment facility to surface waters of the State of Kansas is prohibited.

Industrial wastewater treatment is located throughout Ford County:

- APAC-Kansas / Shears (Plant #923) treats wastewater for the facility's paving mixtures and blocks operations
- Cargill Meat Solutions treats wastewater for its meat packing operations
- J.A.G. Construction's plant at 109 Road treats wastewater for its ready-mix concrete operations
- Kansas Bi-Products treats wastewater for its dog and cat food operations
- Koch Nitrogen Company treats wastewater for its nitrogen fertilizer operations
- Mid-Kansas Electric - Fort Dodge treats wastewater for its electrical services
- Sem Materials treats wastewater for its asphalt felt and coatings operations

### 4.8.4 Solid Waste

By state statute, KSA 65-3405 requires the development of county solid waste management plans, annual reviews of these plans, and public hearing of the plans along with the future goals of solid waste management in the county at least every five years. The Ford County’s Solid Waste Management Plan (SWMP) was formally established on March 13, 1995 by county resolution 95-2006, project number 52935107E. The primary solid waste landfill is located at the Ford County Landfill, 10349 110 Road. On March 4, 1996, the Santa Fe Trails Solid Waste Authority was formed with Edwards, Hodgeman, Pawnee, and Stafford Counties. The landfill's five year plan update has been approved; the landfill's vertical expansion is pending approval; and the county is currently working on a Phase 3 pit.

Rural areas throughout Ford County, as well as Edwards, Hodgeman, Pawnee, and Stafford Counties transfer solid waste to the Ford County Landfill.

The former Ford County Landfill at 10972 113 Road is pending approval for closure.

The Dodge City Construction and Debris (C&D) landfill is located south of Minneola and Agnes Streets on the south side of Dodge City.

### 4.8.5 Communication

Internet Service Providers

- Cox Communications
- Hubris Communications
- Rural Link Internet Service
- Starr Computer Solutions
- United Wireless Communications

*(waiting on information regarding communications; request forwarded to Ford County).*
5.0 Methodology

5.1 Introduction
A hazards analysis is a critical component of planning for handling releases of hazardous materials as well as preparing for other hazardous events and situations arising from technological, natural, civil/societal, and vector hazards. A comprehensive hazard analysis should address three primary considerations: hazard, risk, and vulnerability. These terms are defined as follows:

**Hazard**
Any situation that has the potential for causing injury to life, or damage to property and the environment.

**Risk**
The probability that injury to life, or damage to property or the environment will occur. Risk can simply be expressed as: Severity X Likelihood = Risk

**Vulnerability**
The susceptibility of life, property, and the environment to injury or damage if a hazard manifests its potential.
5.2 Hazard Identification
As previously indicated, the process of performing a hazard analysis begins with the identification of hazards in the county. Chemical hazards form the basis for compliance with SARA Title III requirements. The scope of this report has been expanded to include other items that have the potential to create a hazardous event. The objective is to identify and categorize situations and forces that pose the most serious threats to the community in terms of injury to life and damage to property and the environment.

The identification of hazards includes an interview with the County Emergency Management Coordinator and other county representatives in both the public and private sectors. Existing County plans and data are collected and reviewed to identify potential sites with hazardous materials. The County provides hard copies of past and current Tier II submittals, and directed the consultant to maps and resource documents used for Emergency Operations Planning.

The consultant completed a physical canvassing of the county via public roads. Primary roads were followed for visual surveys and secondary roads were traversed as necessary to insure a visual sighting of physical landmarks from a least two vantage points. In some cases, unpaved gravel or dirt roads were traveled in order to accomplish a more thorough cross hatching coverage pattern of the county. Generally, 300 - 500 miles of roadway are driven in the County during the hazard analysis.

The consultant visually identified potential hazards including storage tanks, stored chemicals, process equipment, commercial livestock and agro-business sites, railroad spurs, and similar locations. Coupled with the consultants experience and knowledge of the particular type of site, a decision was made to photograph it and log it into a list of potential sites.

Following the field survey, a search of existing records was performed to collect data for the hazard assessment. This included examining EPA data, EPCRA data, Tier II filings, Kansas data, DOT filings, and other state and federal databases that might contain information to identify hazards. The combination of Tier II filings and field observations form the primary basis for the identification of hazards in this report.
5.3 Location, Classification & Prioritization of Hazards

Locations for facilities reporting hazardous chemicals are listed in Tier II databases. Specific locations of dynamic hazards, such as atmospheric, geologic, civil and vector-based hazards are typically variable and hard to predict. They are manifested only with the occurrence of a hazardous event. The identity and location of most stationary hazards is a matter of public record. The types of hazards that are referred to in the SARA Title III regulations and EPCRA are those that, in the case of an incident, pose a threat to people, property and public infrastructure, commercial livestock, flora and fauna, and the economy. Hazards are prioritized based on their relative risk rating. Risk ratings for hazardous chemicals and weather events are calculated in the Risk Assessment section of this document.

It has become generally accepted practice to use the following four primary classifications for identifying hazards:

(1) **Natural Hazards**
Hazardous events caused by extreme atmospheric, geologic, or other naturally occurring conditions. Generally, new natural hazards will emerge over time as climate conditions change. Staff should review the data supplied in this analysis each year to determine if there have been significant changes. Any new data should be analyzed and incorporated into the LEOP.

(2) **Technological**
Hazards arising from chemical releases and accidents. Technological hazards are further delineated into two sub-classes: Transportation and Stationary. Technological hazards generally involve hazardous chemicals or substances in one form or another.

(3) **Civil/Societal**
Hazardous events emanating from acts of war, criminal action, malicious mischief, or terrorism. Civil and Societal hazards can develop immediately, or over an extended period. This category includes terrorism and as such carries a certain amount of subjectivity in identifying potential hazards. This subjectivity also points out the problems related to discrimination and profiling since this category relates to people more than any other.

(4) **Vector**
Hazardous events arising from bio-terrorism, disease, bacteria, insects, and other animals (including agro-movement) that present a direct or indirect hazard to humans, their food supply, and the economy. When addressing hazards that originate from bio-terrorism, disease, bacteria, insects, and other animals, it is normally addressed from the viewpoint of their origin and how they would propagate through an area. Consequently, the identification of a hazard in this category is more likely to be “after the fact” and addressed primarily as a potential.
5.4 Risk Assessment

The goal of Risk Analysis is to formulate an assessment of the probability of occurrence for a hazardous event in tandem with its anticipated severity. Probability or likelihood of occurrence is expressed in terms of events over time. Occurrence probability is determined from actual historical data when available. Otherwise, it may be described in relative terms (low, medium, and high). Severity is expressed in relative terms of damage, injury, and overall residual impact resulting from the event. Severity is determined from utilizing established rating systems (i.e. National Fire Protection Association [NFPA] Material Factors, Fujita Scale, Mercalli/Richter Scale, etc.) or may be derived from subjective criteria based on justifiable assumptions. Worst-case scenarios can be assumed. Elaborate quantitative release probabilities are generally not required. Risk analysis should focus on creating reasonable estimates based on the best available data.

Primary components:

(1) Probability that a release will occur and any unusual environmental conditions, such as flood plain areas, seismic activity, or potential for simultaneous occurrence of emergency incidents (i.e. flooding or fire hazards associated with the release of hazardous materials).

(2) Classification of potential harm to the humans (acute, delayed, chronic) and identification of high-risk groups.

(3) Classification of potential harm and damage to commercial livestock (when applicable).

(4) Classification of potential damage to property (temporary, repairable, permanent).

(5) Classification of potential damage to the environment (recoverable, permanent).
5.5 Chemical Risk Rating Procedure

Hazardous chemicals identified in the hazard analysis must be prioritized according to degree of hazard or relative danger to the public to establish a reasonable assessment of risk associated with the hazard. Material Factor is a recognized industry standard utilized as a starting value in the computation of risk analysis values. The Material Factor is “a measure of the intrinsic rate of potential energy release from fire or explosion produced by combustion or chemical reaction”. It provides a means for classifying the inherent nature and associated risk of a chemical or compound in terms of combustion, explosion, and reactivity. Material Factor is derived from NFPA hazard ratings (NF and NR) expressing flammability and reactivity (or instability) relative ratings. Table 5.5 (1), Material Factor Determination Guide (as published in Dow’s Fire & Explosion Index Hazard Classification Guide), is used to derive Material Factors for a particular chemical or compound given the basic NF and NR values.

The product of Material Factor, Severity Rating, and Health Hazard (NH) is calculated to determine a Severity Index. The Likelihood of Occurrence (probability of a hazardous chemical release or incident) is determined from historical data or a qualified estimate from local emergency response or industry experience. A value for Risk may then be calculated from the product of Likelihood of Occurrence and Severity Index. A summary of the calculations are provided in the following:

5.5.1 Material Factor (MF)

Using the identity of the chemical or compound, most Material Factors can be read from charts provided in Dow’s F & E Index Hazard Classification Guide or by using values from the NFPA Hazard Ratings:

- Dow’s F & E Index Hazard Classification Guide
- NFPA 49
- NFPA 325M
- NFPA 704

a) If the chemical or compound is not listed in any of these sources, Material Factor is determined through utilization of Table 5.5 (1), Material Factor Determination Guide (as published in Dow’s Fire & Explosion Index Hazard Classification Guide). NFPA hazard ratings (NF and NR) are obtained from a Material Safety Data Sheet (MSDS) of the chemical or compound. Plotting NF and NR on Table 5.5. (1), the value denoted at the intersection of the appropriate NR column and NF row is the Material Factor for that chemical or compound.

b) Based on the NFPA hazard ratings for NF and NR, Material Factors are valued within an upper and lower limit ranging from one to forty:

<table>
<thead>
<tr>
<th>Material Factor Range Table</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>( N_F = 0 )</td>
</tr>
<tr>
<td>( N_R = 0 )</td>
</tr>
<tr>
<td>( N_R = 1 )</td>
</tr>
<tr>
<td>( N_R = 2 )</td>
</tr>
<tr>
<td>( N_R = 3 )</td>
</tr>
<tr>
<td>( N_R = 4 )</td>
</tr>
</tbody>
</table>

Table 5.5 (1), Material Factor Determination Guide (as published in Dow’s Fire & Explosion Index
Hazard Classification Guide provides specific material factors for various phases of hazardous chemicals or substances based on temperature, pressure, and density:
- Liquids and Gases
- Combustible Solids

5.5.2 Severity Rating

a) Formula
The Severity Rating (Sr) is a calculated value based on numerical ratings determined for four primary chemical attributes, a proximity score related to the chemical storage location, and a correction factor to establish an appropriate range of categories. Severity Rating is calculated via the following equation:

\[
\text{Severity Rating (Sr)} = \left(\frac{\text{PR} + \text{TR} + \text{MR} + \text{CTR}}{\text{Proximity Score}}\right)
\]

where:
- PR = Pressure Rating
- TR = Temperature Rating
- MR = Maximum Amount Rating (stored chemical volume/weight)
- CTR = Container Type Rating

b) Chemical Attribute Ratings
The primary chemical attributes are taken directly from Tier II submittals that further define the target chemical in terms of actual storage conditions and quantity in storage. Chemical storage conditions include information on pressure, temperature, and container type. These attributes have been set up in tables and assigned scores based on assessment of relative severity. For calculation purposes, values for PR, TR, MR, and CTR are selected based on the correlating information provided by the Tier II registrant for the target chemical.

<table>
<thead>
<tr>
<th>Pressure Rating Table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pressure Code</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>
### Temperature Rating Table

<table>
<thead>
<tr>
<th>Temperature Code</th>
<th>Temperature Code Description</th>
<th>T Rating (TR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Ambient pressure</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Greater than ambient temperature</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Less than ambient temperature</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>Cryogenic conditions</td>
<td>3</td>
</tr>
</tbody>
</table>

### Container Type Rating Table

<table>
<thead>
<tr>
<th>Container Type Code</th>
<th>Container Type Code Description</th>
<th>CT Rating (CTR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Above Ground Tank</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>Below Ground Tank</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>Tank Inside Building</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>Steel Drum</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>Plastic or Non-Metallic Drum</td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>Can</td>
<td>1</td>
</tr>
<tr>
<td>G</td>
<td>Carboy</td>
<td>2</td>
</tr>
<tr>
<td>H</td>
<td>Silo</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>Fiber Drum</td>
<td>1</td>
</tr>
<tr>
<td>J</td>
<td>Bag</td>
<td>2</td>
</tr>
<tr>
<td>K</td>
<td>Box</td>
<td>1</td>
</tr>
<tr>
<td>L</td>
<td>Cylinder</td>
<td>1</td>
</tr>
<tr>
<td>M</td>
<td>Glass Bottles or Jugs</td>
<td>2</td>
</tr>
<tr>
<td>N</td>
<td>Plastic Bottles or Jugs</td>
<td>1</td>
</tr>
<tr>
<td>O</td>
<td>Tote Bin</td>
<td>1</td>
</tr>
<tr>
<td>P</td>
<td>Tank Wagon</td>
<td>2</td>
</tr>
<tr>
<td>Q</td>
<td>Rail Car</td>
<td>1</td>
</tr>
<tr>
<td>R</td>
<td>Other</td>
<td>1</td>
</tr>
</tbody>
</table>
c) Proximity Rating
The location or proximity of a hazardous chemical or substance in relation to people, property, environment, or other hazards is a factor in determining severity. A proximity-rating table was created to define the relative severity of a hazardous chemical in relation to its location to surrounding entities. A proximity score is selected from the following table based on applicable criteria. The proximity score, in the form of a numerical rating, is utilized as a component in the Severity Rating equation. Letter identifiers are used in the Risk Rating database to correlate with their respective proximity score.

<table>
<thead>
<tr>
<th>Proximity Rating</th>
<th>Proximity Description</th>
<th>Proximity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Extraordinary Risk Area-A facility or group of facilities whose specific location(s) poses an extraordinary risk.</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Within or adjacent to a populated area, a densely developed area, an environmentally sensitive area, or a commercial livestock operation.</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Not adjacent to but within one (1) mile of a populated area, a densely developed area, an environmentally sensitive area, or a commercial livestock operation.</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>All Other Sites (typically includes rural areas)</td>
<td>1</td>
</tr>
</tbody>
</table>

The potential for fatalities and injury to people and commercial livestock, as well as damage and harm to property, environment, business, and public relations must be considered when selecting a Proximity...
5.5.3 Health Hazard Factor (NH)
Most chemicals have designated NFPA ratings for health hazard, flammability, reactivity, and unusual or critical characteristics. These ratings are represented in a four-quadrant diamond symbol with each specific quadrant reserved for a particular hazardous characteristic (color) and relative hazard rating (number). Hazard ratings range from a baseline of zero to an upper limit of four. A rating of zero indicates that the material essentially poses no hazard; while a rating of four signifies extreme danger and warrants high precaution. The NFPA hazard diamond is summarized in clockwise fashion as follows:

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Quadrant Color</th>
<th>Location</th>
<th>Rating Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Hazard ( (N_h) )</td>
<td>Blue</td>
<td>Left</td>
<td>0 - 4</td>
</tr>
<tr>
<td>Flammability ( (N_f) )</td>
<td>Red</td>
<td>Upper</td>
<td>0 - 4</td>
</tr>
<tr>
<td>Reactivity ( (N_r) )</td>
<td>Yellow</td>
<td>Right</td>
<td>0 - 4</td>
</tr>
<tr>
<td>Unusual Hazards &amp; Special Precautions</td>
<td>White</td>
<td>Bottom</td>
<td>Symbols</td>
</tr>
</tbody>
</table>

A (NH) factor, the health hazard rating, is represented in the blue quadrant of the NFPA Hazard Diamond. The numerical value associated with the NFPA health quadrant describes the relative hazard or threat to health. Health hazard ratings for the chemical in question may be selected from an MSDS or other references previously listed in the Material Factor section of this document. The (NH) factor is the final variable required in the calculation of Severity Index.

5.5.4 Severity Index
Severity Index is a relative estimate of the danger, acute impact, or chronic residual effect associated with or occurring as a result of exposure to a hazardous chemical or substance. Severity Index is employed in
the quantification of risk and is determined via the following equation:

\[ \text{Severity Index (Si)} = (\text{Material Factor}) \times (\text{Severity Rating}) \times (\text{Health Hazard Rating}) \]

Or

\[ \text{Severity Index (Si)} = (\text{MF}) \times (\text{Sr}) \times (\text{NH}) \]

Example: Where \( \text{MF} = 40; \text{Sr} = 5; \text{NH} = 4 \)

\[ \text{(Si)} = 40 \times 5 \times 4 = 800 \]

5.5.5 Likelihood of Occurrence (Li)
Likelihood of Occurrence can be defined as the actual or expected frequency for a hazardous event to occur. The frequency of occurrence of hazardous events is obtained through historical data documenting hazardous material spills or releases or through a best estimate derived by local emergency responders or industry experience. An objective assessment of this information will be made to determine the best available data for risk calculations. Likelihood of Occurrence will be measured in units of events/year. In cases where local or regional data is unavailable, national averages for occurrence frequencies will be used.

The Likelihood factor for prioritizing SARA Title III chemicals, in E-Fm’s chemical risk-ranking algorithm, is based on reported spills from EPA’s National Response Center (NRC), the Kansas Corporation Commission (KCC), and the Kansas Department of Health and Environment’s (KDHE) spill reporting systems.

These data are reviewed for reporting duplications, ownership changes (as readily available), and matched to Tier II reporters in the target county. The normalized data is then utilized to calculate a value to be used as the default County Likelihood for all chemical storage facilities in the county.

\[ \text{Li} = \frac{\text{TRS}}{(\text{RS} \times \text{AY})} \]

Where:
- \( \text{Li} = \text{County Likelihood} \)
- \( \text{TRS} = \text{Total number of reported spills reported in the county} \)
- \( \text{RS} = \text{Total number of chemical storage facilities reporting spills in the county} \)
- \( \text{AY} = \text{Average years of reporting period for the county} \)

The County Likelihood provides a base factor for Tier II chemical facilities with no attributed spills. The calculated risk factor is utilized for Chemical Reporters with reported spills. The process of evaluating spill records over time provides additional support for individual evaluation of each chemical storage facility.

5.5.6 Risk Rating
As published in Hazard Identification and Risk Assessment, a reasonable determination of risk may be obtained through the combined calculation of a measure of severity of a hazardous chemical or substance and the likelihood of occurrence for a particular hazardous event. Risk Rating can then be defined in the following equation:
Risk Ratings are calculated for individual hazardous chemicals and are presented in selected report formats to assess relative hazard magnitude. The Risk Rating Algorithm, a comprehensive, empirical depiction of the chemical risk rating process, is provided in schematic format at the end of this section.

### 5.5.7 Procedure Explanation

The top ten ranked chemicals and the top three ranks sites are evaluated in Section 7.0 of this analysis. As planners assess these findings, they should remember that several assumptions were made in order to prepare relative risk ratings. Worst case conditions were always used as a default unless otherwise noted. For example, it is assumed that liquids and/or gases will be completely released from their containers when a hazardous event occurs. Since temperature, topography, prevailing winds, and other parameters for each chemical release or incident vary, an impact zone is assumed to be a one-mile radius from the point of origin. Some chemical incidents, however, may have a greater zone of impact than a one-mile radius.

### 5.5.8 SARA Title III Chemicals

The Consolidated List of Chemicals was compiled by the EPA to assist industry, state and local emergency planning and response personnel in readily identifying hazardous substances subject to the reporting requirements under Sections 302, 304, and 313 of SARA Title III – EPCRA. The EPA has the authority to add or delete the chemicals regulated under each section of EPCRA, and to adjust the threshold planning quantity (TPQ) and reportable quantity (RQ). It is the responsibility of Owner/Operators to be aware of any changes that EPA makes to chemical lists. These changes are printed in the Federal Register.

The list provided in this report should be used as a reference tool, not as a definitive source of compliance information. Compliance information for EPCRA is published in 40 Code of Federal Regulations (CFR) Parts 302, 355, and 372. Compliance information for CAA Section 112(r) is published in 40 CFR Part 68. For updated versions please refer to EPA’s website at www.epa.gov/ceppo.

The EHS list includes the following information on each chemical listed, if available:

- Chemical Name
- CAS Number - Chemical Abstract Service Registry
- RQ - Reportable quantity as defined by CERCLA and Section 304 of EPCRA
- TPQ - Threshold planning quantities for EHS

The TPQ and RQ are measured in pounds for the hazardous substances covered.

The chemicals are referenced under three federal statutory provisions as follows:

- Section 302 Extremely Hazardous Substances, the presence of which, in sufficient quantities, requires certain emergency planning activities. Releases of these substances are also subject to reporting under Section 304 of EPCRA. The final rule was published on April 22, 1987 (40 CFR Parts 300 and 355). Listed here are the TPQ and the RQ for the 360 chemicals.

- CERCLA Hazardous Substances, releases of which are subject to reporting under the Comprehensive Environmental Response, Compensation and Liability Act of 1980. Such releases are also subject to reporting under Section 304 of EPCRA, and
Section 313 Toxic Chemicals, emissions or releases, both routine and accidental, are to be reported beginning July 1, 1988, and annually thereafter.

The “List of Lists” is found in the References Section of this report.

Many hazardous chemicals and substances stored at facilities and sites are subject to Tier II registration. Hazardous chemicals and substances also fall into two classifications and are defined as follows:

§ Extremely Hazardous Substances: A list of chemicals identified by the EPA based on toxicity, listed under SARA Title III specifically in Appendices A & B of 40 CFR 355, Emergency Planning and Notification.

§ Hazardous Substances (as defined in “Technical Guidance for Hazards Analysis”; 12/87): Substances designated as hazardous under CERCLA (Superfund). CERCLA includes substances listed under the Clean Water Act, the Clean Air Act, RCRA, and TSCA Section 7.

5.5.9 Risk Rating Algorithm

As the algorithm for risk rating was developed, the impact of various factors was considered. The subjectivity inherent in estimating vulnerability was also considered, which influenced the addition of storage conditions, quantity, and proximity into the equation. Incorporating these factors into risk allows a straightforward look at vulnerability. Subsequently, an assessment of vulnerability becomes a simple process of establishing and examining the potential impact radius associated with the highest-ranked listings. This accomplishes the goals set out in both the NRT-1 and the Technical Guidance for Hazards Analysis (Green Book), which is to prioritize and allocate resources to those hazards with highest priority.

Figure 5.5 (12)
5.6 Natural Events Risk Rating Procedure
The availability of detailed, consistent, and reliable data allows the calculation of relative risk values for natural events. A standardized set of data is routinely tracked by the NCDC for an established inventory of individual natural hazard types. The standard data categories record information regarding the impact or strength of the particular natural event and include the following:
- Magnitude (in terms of Fujita Scale, hail diameter, or wind speed)
- Deaths
- Injuries
- Property damage
- Crop damage
This information provides the basis for establishing severity ratings and an additive severity index. The rate of occurrence is established from the data record time interval and the number of events recorded. These primary factors of severity and likelihood of occurrence provide the basis for calculating risks for natural events.

5.6.1 Severity Rating
Severity Rating tables were established for each of the standard data categories tracked by the NCDC and assigned a lower limit of 0.5 and an upper limit of 5.0. From these tables, Severity Indexes were derived for each of the possible natural events. The Severity Ratings are identified as follows:
- Magnitude Sr (M)
- Death Sr (D)
- Injury Sr (I)
- Property damage Sr (Pd)
- Crop damage Sr (Cd)
The Severity Index (Si) for a particular event is calculated as the sum of the five individual Severity Ratings (Sr).

\[
\text{Severity Index (Si)} = (\text{Magnitude Sr} + \text{Death Sr} + \text{Injury Sr} + \text{Property Damage Sr} + \text{Crop Damage Sr})
\]
Or more simply stated:
\[
\text{Severity Index (Si)} = (M + D + I + Pd + Cd)
\]

5.6.2 Likelihood of Occurrence
The data record time interval is determined from the difference between the beginning and ending dates of the record inventory. The total number of individual events can be extracted from the inventory of data. Given this information, Likelihood of Occurrence (in units of events/year) for a particular natural event is calculated as the quotient of the number of events as the numerator and data record time interval as the denominator.

\[
\text{Likelihood of Occurrence (L)} = \frac{\text{Number of Events}}{\text{data time interval (yrs)}}
\]
5.6.3 Risk Rating
As published in Hazard Identification and Risk Assessment by Geoff Wells (copyright 1996), a
reasonable determination of risk may be obtained through the combined calculation of a measure of
severity of a hazard and the likelihood of occurrence for a particular hazardous event. Risk Rating can
then be defined in the following equation:

\[
\text{Risk Rating (RR)} = \text{Severity Index (Si)} \times \text{Likelihood of Occurrence (Li)}
\]

Risk Ratings were calculated for individual weather events and are presented in Section 6.0 – Natural
Hazards Vulnerability.
5.7 Kansas Wildfire Risk Rating
The State Fire Marshal’s Office has required counties to formally report wildfires since 1997. A summary of the database, by county, was provided to E-Fm for use in developing a severity and risk rating for this event. Relatively little historical data was available making a comparative analysis to other events difficult. It was necessary to develop an events/time baseline for comparison of wildfire to other reported hazardous events. To obtain the desired results, the consultant normalized existing data to more closely resemble reporting patterns found in the NCDC database, and expand the time element of the wildfire reporting data. Our target was to predict data for the time period 1951 to 2002.

The Consultant compiled a state-wide database from the NCDC weather events database. This data was then sorted by year and analyzed utilizing exponential smoothing of the data. This is an accepted methodology to produce a smoothed Time Series. Comparatively, in single moving averages the past observations are weighted equally, exponential smoothing assigns exponentially decreasing weights as the observations get older. In other words, recent observations are given relatively more weight in forecasting than the older observations. Based on the review of weather data the assumption that wildfire reporting would follow a similar pattern was adopted.

In the case of moving averages, the weights assigned to the observations are the same and are equal to 1/N. In exponential smoothing, however, there are one or more smoothing parameters to be determined (or estimated) and these choices determine the weights assigned to the observations. For this analysis, 0.25 was used as the damping factor to eliminate unwanted cyclic and irregular variations. The result was a representative curve which could be used to predict past reporting of wildfire data.

The seven years of county data was averaged and used as the maximum value on the curve. The exponential curve was applied using this maximum value and individual yearly data were produced. This process provided a longer reporting period which effectively lowered the overall likelihood value and placed the risk rating for wildfires in a more usable range.
5.8 Seismic Risk Rating
Advances in technology, coupled with numerous federal, state and local research institutions have increased our awareness and understanding of seismic events through monitoring and tracking seismic activity across the country. There are two generally accepted methods for measuring the strength of a seismic event. The Richter scale is the most common method used by seismologists to quantify the “magnitude” of an earthquake. The modified Mercalli Scale (MMI) provides a semi-quantitative method for expressing earthquake “intensity” and is based on the type and amount of damage caused by the earthquake and the observations of people within the area where the activity is felt. By comparative conversion of the Richter and Mercalli measurements, in conjunction with past-recorded events and the seismic zone rating map of the United States, it possible to develop relative probability of occurrence for seismic events in tandem with its anticipated severity.

An objective assessment of this information will be made to determine the best available data for risk calculation. Likelihood of Occurrence will be measured in units of events/year. In cases where local or regional data is unavailable, national averages for occurrence frequencies will be used. Risk ratings for other hazards may be based on the availability of historical frequency data and a subjective assessment of predicted severity.
5.9. Summary of Risk Ratings
Risk ratings are calculated and prioritized for technological hazards within the hazardous chemicals sub-classification and for natural hazards in the atmospheric sub-classification. Historical occurrence data was available for both types of hazard categories in sufficient detail and from known, reputable sources tasked with compiling this information on a continuous basis. Atmospheric data was obtained from the NCDC weather event database. Hazardous chemical spill data were obtained from the KDHE spill database, the National Response Center (NRC) and the Kansas Corporation Commission (KCC).

Generally, risk ratings associated with natural hazards change slowly over time and the source of changes can be documented. The risks associated with civil or vector based hazards are more dynamic. It is not feasible to calculate a risk rating for these categories that would have any useful content for the county. Defining risk as it relates to civil and vector based hazards is in its infancy at the federal level. Because of the events of September 11, 2001, analysis of the risk in these categories has started at the appropriate agencies. Guidelines for these categories will likely evolve over the coming years and county staff should follow this development.

Compared with other hazard categories, remediation of technological hazards represents the greatest opportunity to mitigate the overall risk in the county. The emergency management staff should utilize the reports in this analysis to prioritize mitigation efforts. The variables that influence risk ratings can be used as the basis for discussion with each facility manager to determine potential changes in quantities, storage conditions, container types, etc. in an effort to lower the site rating. Specific mitigation strategies determined at the local level typically lead to the most productive changes.

A hazard analysis is based on best available information that provides a benchmark for the county, as it exists today. Risk values for the Top 10 ranked facilities and EHS sites can be used on a comparative basis as an objective measure for progress in lowering the overall county risk. Risk Ratings for hazardous chemicals are provided via the HzChRT computer application. The following four reports are available through the HzChRT application:
   a) Facility Owners by Risk Rating
   b) Facility Owners by Alpha Listing
   c) Top Ten Rated Sites
   d) EHS Sites by Risk Rating
5.10. Vulnerability Assessment

Vulnerability can simply be described as the potential damage, injury, and impact on people, property, and the environment. In order to ascertain damage potential, some assumptions must be made. Vulnerability assessments include the zone of impact, sizes and types of affected populations, private and public property damage, and the potential impact on the environment.

Time and resource constraints make it virtually impossible for local planners to calculate and prepare a detailed vulnerability assessment for each potential hazard every year. In addition, the hazards, quantities, conditions, etc. tend to be dynamic over any given time period and efforts to produce detailed vulnerability assessments will only be a snap shot in time. Even when using similar assessment models, risk assessors may obtain different results when measuring vulnerability for the exact same site or condition. Vulnerability is an estimate of impact for a set of assumed circumstances.

A more useful approach in a hazard analysis is the prioritization process, which allows local personnel to focus their efforts on priority sites. Both NRT-1 and the Technical Guidance for Hazard Analysis (the Green Book) point out that resources should be “focused on those situations that pose the greatest risk” in the case of an incident.
6.0 Natural Hazards Vulnerability

6.1 General Description and Definition
A widely accepted definition characterizes natural hazards as "those elements of the physical environment, harmful to man and caused by forces extraneous to him" (Burton, 1978). More specifically, in this document the term "natural hazard" refers to atmospheric, hydrologic, geologic, and wildfire phenomena that, because of their location, severity, and frequency have the potential to adversely affect people, property and the environment. The qualifier "natural" eliminates such exclusively manmade phenomena as war, pollution, chemical contamination, and hazards to people such as infectious disease (not necessarily related to the physical environment), which are discussed separately in this analysis.

Notwithstanding the term "natural", a natural hazard must have an element of human involvement. A physical event, such as a volcanic eruption, that does not affect human beings is a "natural phenomenon" but not a natural hazard. A natural phenomenon that occurs in a populated area is a hazardous event. A hazardous event that causes unacceptably large numbers of fatalities and/or overwhelming property damage is a “natural disaster”. In areas where there are no people, natural phenomena are not defined as hazards and do not produce natural disasters. This definition is thus at odds with the perception of natural hazards as unavoidable havoc wreaked by the unrestrained forces of nature. It shifts the burden of cause from purely natural processes to the concurrent presence of human activities and natural events.

Natural phenomena are unpreventable events in nature that may expose the county’s people, property, and the environment. Most areas within the county are vulnerable to natural hazards, so it is vital that planners, researchers, and decision-makers have access to available information as the county continues to develop. Understanding when, where, why, and how natural hazards occur is the first step in minimizing its impact on our lives. The challenge to communities is to halt or reverse the trend of rising impacts. Experience suggests that sufficient knowledge already exists, if properly applied, to substantially reduce both human and property losses from natural disasters. Adequate planning and mitigation efforts can minimize damage from natural hazards.

The purpose of this section of the analysis is to identify the most prevalent natural phenomena that occur in the county, and evaluate the historic impact of natural hazards and disasters.

6.2 Natural Hazard Data and Tables
The following Damage Events Table identifies the risk rating for each natural occurrence over a specified period. Supporting severity tables and a review of seismic activities in Kansas follows the Damage Events Table.

Hazard Analysis
Table 6.2 (1) Natural Damage Events

<table>
<thead>
<tr>
<th>Event</th>
<th># Events</th>
<th>Likelihood (Li)</th>
<th>Severity Index (Avg)</th>
<th>Severity Index (Avg)</th>
<th>Severity Index (Avg)</th>
<th>Severity Index (Avg)</th>
<th>Severity Index (Avg)</th>
<th>Severity Rating</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency of Occurrence (Events/Year)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hail</td>
<td>590</td>
<td>10.536</td>
<td>2</td>
<td>0.5</td>
<td>0.5</td>
<td>2</td>
<td>0.5</td>
<td>5.5</td>
<td>57.95</td>
</tr>
<tr>
<td><em>Wildfires</em></td>
<td>496.74</td>
<td>48.143</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0</td>
<td>0.5</td>
<td>2</td>
<td>19.11</td>
</tr>
<tr>
<td>TSTM Wind</td>
<td>250</td>
<td>4.464</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>3.5</td>
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<tr>
<td>Tornado</td>
<td>61</td>
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<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
<td>0.5</td>
<td>3.5</td>
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</tr>
<tr>
<td>Flash Flood</td>
<td>15</td>
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<td>5</td>
<td>0.5</td>
<td>0.5</td>
<td>3</td>
<td>0.5</td>
<td>9.5</td>
<td>2.54</td>
</tr>
<tr>
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<td>31</td>
<td>0.554</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2.21</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>23</td>
<td>0.411</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
<td>1</td>
<td>0.5</td>
<td>5</td>
<td>2.05</td>
</tr>
<tr>
<td>Heavy Snow</td>
<td>18</td>
<td>0.321</td>
<td>4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>6</td>
<td>1.93</td>
</tr>
<tr>
<td>Flood</td>
<td>8</td>
<td>0.143</td>
<td>4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>1</td>
<td>6.5</td>
<td>0.93</td>
</tr>
<tr>
<td>Heavy Rain</td>
<td>16</td>
<td>0.286</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>2.5</td>
<td>0.71</td>
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<tr>
<td><strong>Earthquake</strong></td>
<td>25</td>
<td>0.227</td>
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<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>3</td>
<td>0.68</td>
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<tr>
<td>Ice Storm</td>
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<td>0.071</td>
<td>4</td>
<td>0.5</td>
<td>0.5</td>
<td>2</td>
<td>0.5</td>
<td>7.5</td>
<td>0.54</td>
</tr>
<tr>
<td>Drought</td>
<td>3</td>
<td>0.054</td>
<td>4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>4</td>
<td>9.5</td>
<td>0.51</td>
</tr>
<tr>
<td>Blizzard</td>
<td>3</td>
<td>0.054</td>
<td>4</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>6</td>
<td>0.32</td>
</tr>
<tr>
<td>Extreme Windchill</td>
<td>2</td>
<td>0.036</td>
<td>3</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>5</td>
<td>0.18</td>
</tr>
<tr>
<td>Excessive Heat</td>
<td>2</td>
<td>0.036</td>
<td>2</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>4</td>
<td>0.14</td>
</tr>
<tr>
<td>Lightning</td>
<td>1</td>
<td>0.018</td>
<td>2</td>
<td>0.5</td>
<td>0.5</td>
<td>2</td>
<td>0.5</td>
<td>5.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Urban Flood</td>
<td>1</td>
<td>0.018</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>3</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Weather event likelihood is based on county specific recorded events across a database timeframe of ~50 years.

*Wildfire event data and likelihood are extrapolated (see Section 5.0) from county specific recorded events across a database timeframe of ~7 years.

**Seismic event (earthquake) likelihood is based on statewide recorded events across a database timeframe of ~110 years.

The following tables detail the severity indices necessary to perform the calculation of a severity rating for natural events.

Figure 6.2 (1) provides a comprehensive listing of Severity Index Magnitude Ratings for Natural Events. The primary categories of weather, seismic, and wildfire events are represented. Each event has been assigned a severity index for magnitude based on the probable impact of the event. Gradational rating systems were employed to allow a more precise determination of magnitude. Where possible, gradational rating systems were developed from widely accepted rating systems currently in use. Gradational rating systems have been established for the following natural events: hail, wind, seismic, and wildfire. Magnitudes for hail events were developed from an assessment of the NCDC severe weather event database and are based on hailstone diameter. Magnitudes for tornado and high wind events are drawn directly from the Fujita Scale and are based on wind speed ranges. Magnitudes for seismic events were
assigned relative to the Modified Mercali Index rating system which establishes earthquake magnitudes relative to damage thresholds. Magnitudes for wildfire events were generated through an assessment of the State Fire Marshall Office database and are based on financial loss in terms of appraised value per acre burned.
<table>
<thead>
<tr>
<th>Weather Event</th>
<th>Criteria</th>
<th>Assigned Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.5 1 2 3 4 5</td>
</tr>
<tr>
<td>Blizzard</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Dense Fog</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Drought</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Dry Microburst</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Dust Storm</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Earthquake (MMI) VI</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Earthquake (MMI) VII</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Earthquake (MMI) IX</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Earthquake (MMI) XI</td>
<td>X</td>
<td>5</td>
</tr>
<tr>
<td>Excessive Heat</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Extreme Cold</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Extreme Windchill</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Flash Flood</td>
<td>X</td>
<td>5</td>
</tr>
<tr>
<td>Flood</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Fog</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Freeze</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Funnel Cloud</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Glaze</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Hail &lt;0.75 in dia</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Hail &gt;0.75 - 1.0 in dia</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Hail &gt;1.0 - 1.25 in dia</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Hail &gt;1.25 - 1.5 in dia</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Hail &gt;1.5 - 2.0 in dia</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Hail &gt;2.0 in dia</td>
<td>X</td>
<td>5</td>
</tr>
<tr>
<td>Heavy Rain</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Heavy Snow</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>High Wind(s); Tstm Wind(s); Thunderstorm Wind(s); 40-72 mph / 33-62 knots</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>High Wind(s); Tstm Wind(s); Thunderstorm Wind(s); 73-112 mph / 63-97 knots</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>High Wind(s); Tstm Wind(s); Thunderstorm Wind(s); 113-157 mph / 98-136 knots</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Ice Storm</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Lightning</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>River Flood</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Sleet</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Small Stream Flood</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Snow</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Street Flood</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Tornado (Fo)</td>
<td>40-72 mph / 35-62 knots</td>
<td>X</td>
</tr>
<tr>
<td>Tornado (F1)</td>
<td>73-112 mph / 63-97 knots</td>
<td>X</td>
</tr>
<tr>
<td>Tornado (F2)</td>
<td>113-157 mph /98-136 knots</td>
<td>X</td>
</tr>
<tr>
<td>Tornado (F3)</td>
<td>158-226 mph /137-179 knots</td>
<td>X</td>
</tr>
<tr>
<td>Tornado (F4)</td>
<td>207-260 mph /180-226 knots</td>
<td>X</td>
</tr>
<tr>
<td>Tornado (F5)</td>
<td>261-318 mph /227-276 knots</td>
<td>X</td>
</tr>
<tr>
<td>Urban Flood</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Urban/Small Stream Flood</td>
<td>X</td>
<td>0.5</td>
</tr>
<tr>
<td>Wild/forest fire</td>
<td>1,000</td>
<td>X</td>
</tr>
<tr>
<td>Wild/forest fire &gt; 1,000 - 2,000</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Wild/forest fire &gt; 2,000 - 3,000</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Wild/forest fire &gt; 3,000 - 4,000</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Wild/forest fire &gt; 4,000 - 5,000</td>
<td>X</td>
<td>4</td>
</tr>
<tr>
<td>Wild/forest fire &gt; 5,000</td>
<td>X</td>
<td>5</td>
</tr>
<tr>
<td>Winter Storm</td>
<td>X</td>
<td>2</td>
</tr>
</tbody>
</table>
Figure 6.2 (2) provides a breakdown of the severity indices for population and assets. The primary categories utilized are Death (D), Injury (I), Property Damage (Pd), and Crop Damage (Cd). All of these categories are common parameters to natural events and are typically captured when recording and reporting natural event data. Death and injury indices are measured in terms of population impacted. Property and crop damage indices are measured in terms of financial loss (dollars). The gradational rating system for population and assets severity indices was established through evaluation of severity categories published in the Geoff Wells text, Hazard Identification and Risk Assessment (1996).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>0.5</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death (D)</td>
<td>0</td>
<td>1</td>
<td>&gt;1 - 5</td>
<td>&gt;5 - 10</td>
<td>&gt;10 - 50</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Injury (I)</td>
<td>1</td>
<td>&gt;1 - 10</td>
<td>&gt;10 - 50</td>
<td>&gt;50 - 100</td>
<td>&gt;100 - 500</td>
<td>&gt;500</td>
</tr>
<tr>
<td>Property Damage (Pd)</td>
<td>&lt;10K</td>
<td>&gt;10K - 100K</td>
<td>&gt;100K - 1M</td>
<td>&gt;1M - 10M</td>
<td>&gt;10M - 100M</td>
<td>&gt;10M</td>
</tr>
<tr>
<td>Crop Damage (Cd)</td>
<td>&lt;10K</td>
<td>&gt;10K - 100K</td>
<td>&gt;100K - 1M</td>
<td>&gt;1M - 10M</td>
<td>&gt;10M - 100M</td>
<td>&gt;100M</td>
</tr>
</tbody>
</table>

Table 6.2 (2) provides historical NOAA weather data utilized in this analysis.

Table 6.2 (2) - County Weather Data is not available except online.

6.3 Geologic Data

6.3.1 Earthquakes in Kansas

Most Kansas residents have never felt so much as a tremor, but at least 25 earthquakes rumbled through the state prior to 1977 (Fig. 6.3 (1)) and more than 100 were measured between 1977 and 1989 (Fig. 6.3 (2)). Most of these were microearthquakes, which are defined as earthquakes that are too small to feel. The largest recorded Kansas earthquake hit the Manhattan area in 1867. It toppled chimneys and cracked foundations and was felt as far away as Dubuque, Iowa.

More than 25 earthquakes with epicenters in the borders of Kansas have been felt during the past 133 years, beginning with the earthquake of April 24, 1867 near Wamego, Kansas. This earthquake magnitude was 5.1 and is the largest earthquake known to have occurred in Kansas. This earthquake cracked walls in Manhattan, caused areas of the Kansas River valley sands to liquefy south of Wamego, and caused minor damage in Wamego, Junction City, Lawrence, and Kansas City. The shaking was felt as far away as Indiana, Kentucky, and Arkansas.

An earthquake of magnitude 4.7 occurred on January 7, 1906. This earthquake was centered in the Manhattan area with smaller aftershocks continuing until late January.

In 1929, a series of four earthquakes with magnitudes between 3.2 and 4.2 occurred in the area surrounding Manhattan between September and December.

Before 1867, earthquakes generally went unreported because there were few newspapers or other ways to record the occurrence and effects of earthquakes. Earthquakes that occurred before seismic instruments became common are described by the Modified Mercalli Intensity scale (MMI). The MMI scale describes the earthquake effects felt by people and structures, and reports from various locations can help seismologists to determine the approximate epicenters and magnitudes of past earthquakes.

Since the 1960’s, earthquake epicenters and magnitudes have been recorded on sensitive seismic instruments, including microseismic earthquakes that cannot be felt and have no noticeable effect at the surface. Detailed microseismic studies using very sensitive equipment have been performed by the Kansas Geological Survey and partially funded by the U.S. Army Corps of Engineers. These studies have shown...
that very small earthquakes occur routinely in Kansas. The majority of these very small earthquakes are related to the Nemaha Ridge/Humboldt fault zone, and other deep fault zones that show very little or no evidence of faults at the surface.

While it is clear that the potential for significant earthquakes is present in east-central Kansas, this activity is typically of limited size and frequency. However, in the case of critical structures such as a major dam and reservoir, there is reason for caution given the potential for damage even with a low probability earthquake.

Figure 6.3 (1) - Historical earthquakes in Kansas, prior to 1977.

Figure 6.3 (2) - Microearthquakes recorded by the Kansas Geological Survey between August 1977 and August 1989 are size-coded by local magnitude. The largest event had a magnitude of 4.0 and the smallest had a magnitude of 0.8 on the Richter Scale.
Some Kansas earthquakes are associated with the Nemaha Ridge, a buried granite mountain range that extends from roughly Omaha, Nebraska, to Oklahoma City. This mountain range was formed about 300 million years ago, and the faults that bound it are still slightly active today, especially the Humboldt fault zone that forms the eastern boundary of the Nemaha Ridge, passing near Wamego, east of Manhattan, and near El Dorado, east of Wichita. About 50 miles (80 km) west of the Nemaha Ridge is the Midcontinent rift, a zone of the earth's continental crust that was ripped apart and filled with oceanic-type crust (basaltic rocks) about 1.1 billion years ago. This zone of rifting extended from central Kansas near Salina, northeast-ward across Nebraska, Iowa, and Minnesota and into the Lake Superior region. For unknown reasons the rifting stopped after only spreading about 30 to 50 miles (50-80 km); if it had not stopped, eastern and western Kansas would likely be on different continents today.

Figure 6.3 (3) - Major regional tectonic features that are apparently related to earthquake activity. Nemaha County is the locality where the Nemaha Ridge was discovered by drilling in the early 1900's (Kansas Geological Survey, 1989, Bulletin 226).
To better understand these earthquakes in Kansas, seismologists at the Kansas Geological Survey monitored seismic activity throughout the state from 1977 to 1989. Information from this research will help to refine building codes and design dams and power plants. The data also will be used to refine and update the seismic-risk map. Even though the risk of a major earthquake in Kansas is slight, it is important to understand the risk, so structures can be built to withstand any earthquakes that may occur.

### 6.3.2 Recording Kansas Earthquakes

The Kansas Geological Survey maintained a seismograph network to study Kansas earthquakes from December 1977 to June 1989. The network could pick up ground movements 1000 times smaller than the thickness of a human hair. The recording stations could even detect artillery firings at Fort Riley from 30 miles (50 km) away and also registered large earthquakes from locations as distant as Japan and South America. During 12 years of recording, more than 200 small earthquakes in Kansas and Nebraska were registered (Fig. 6.3 (2)). The largest of these measured about magnitude 4.0 on the Richter Scale, and the smallest was magnitude 0.8. Seismograms from an earthquake that occurred southeast of Seneca, Kansas, on January 27, 1978, are shown in Figure 6.3 (4). The record of the earthquake appears as a broad black area. These recordings are from stations at Milford Reservoir, Hiawatha, and Tuttle Creek Reservoir, Kansas. The Tuttle Creek recording also shows some smaller blackened areas caused by artillery explosions at Fort Riley.
Figure 6.3 (4) - Seismograms from January 27, 1978 earthquake that occurred southeast of Seneca, Kansas.

In Kansas, earthquakes occur along the Humboldt fault zone or the Nemaha Ridge in a zone extending from Omaha to Oklahoma City. In the late 1980's, several small earthquakes also occurred northeast of Hays and in Palco, about 30 miles (50 km) northwest of Hays. These earthquakes occurred along faults associated with the Central Kansas Uplift. Many of these tremors had magnitudes of about 2 on the Richter scale, although the largest one at Palco was a magnitude 4.0 earthquake that did minor damage.

The earthquake activity observed in Kansas between 1977 and 1989 is consistent with the number and location of earthquakes experienced between 1867 and 1976. Kansas will continue to have occasional, unpredictable, small-to-moderate earthquakes. By combining historical earthquake data with that obtained between 1977 and 1989, seismologists estimate that a magnitude 6.0 earthquake may occur in Kansas about every 2000 years.
This map indicates the potential for damage that could occur resulting from a major earthquake in the United States. The awareness of earthquake hazards for your area should be taken seriously. Just because an earthquake hasn't occurred doesn't mean it won't happen!
<table>
<thead>
<tr>
<th>Richter Magnitude</th>
<th>Modified Mercali Intensity</th>
<th>Type of Damage and Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 3.4</td>
<td>I</td>
<td>Recorded only by seismographs</td>
</tr>
<tr>
<td>3.5 - 4.2</td>
<td>II and III</td>
<td>Felt by some persons that are indoors</td>
</tr>
<tr>
<td>4.3 - 4.8</td>
<td>IV</td>
<td>Felt by many persons; windows rattle</td>
</tr>
<tr>
<td>4.9 - 5.4</td>
<td>V</td>
<td>Felt by everyone; dishes break; doors swing</td>
</tr>
<tr>
<td>5.5 - 6.1</td>
<td>VI and VII</td>
<td>Slight building damage; plaster cracks; bricks fall</td>
</tr>
<tr>
<td>6.2 - 6.9</td>
<td>VIII and IX</td>
<td>Much building damage; chimneys fall; houses move on foundations</td>
</tr>
<tr>
<td>7.0 - 7.3</td>
<td>X</td>
<td>Serious damage; bridges twisted, walls fracture; many masonry buildings collapse</td>
</tr>
<tr>
<td>7.4 - 7.9</td>
<td>XI</td>
<td>Great damage; most buildings collapse</td>
</tr>
<tr>
<td>&gt; 8.0</td>
<td>XII</td>
<td>Total damage, waves seen on ground surface, objects thrown in the air</td>
</tr>
</tbody>
</table>
Table 6.3 (2)

Kansas Earthquakes Recorded from 1867 to 1977

<table>
<thead>
<tr>
<th>Year</th>
<th>Magnitude</th>
<th>Magnitude &gt;= 5</th>
</tr>
</thead>
<tbody>
<tr>
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<td>7</td>
<td>7</td>
</tr>
<tr>
<td>1875</td>
<td>5</td>
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<td>1881</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>1902</td>
<td>2</td>
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</tr>
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<td>1904</td>
<td>4</td>
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<td>1906</td>
<td>4</td>
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<td>1919</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1919</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1926</td>
<td>Magnitude not Reported</td>
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</tr>
<tr>
<td>1927</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1927</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>1928</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1929</td>
<td>5</td>
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</tr>
<tr>
<td>1929</td>
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<td>1931</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>1932</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1933</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>1942</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>1948</td>
<td>4</td>
<td></td>
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<td>1956</td>
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<td>1961</td>
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**Total Events:** 25

<table>
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<tr>
<th>Total Events &gt; 5 MMI</th>
<th>Historical Record/Years</th>
<th>Average Magnitude (All Events)</th>
<th>Average of Magnitude (&gt;= 5)</th>
<th>Frequency of Occurrence (All Events)</th>
<th>Frequency of Occurrence (&gt;= 5)</th>
<th>Likelihood of Occurrence 5.7M or greater (1800 years) (Source - USACE)</th>
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<tr>
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<td>15</td>
<td>110</td>
<td>4.7917</td>
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<thead>
<tr>
<th>MMI</th>
<th>Number of Events</th>
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<td>I</td>
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<td>V</td>
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<tr>
<td>VIII</td>
<td>0</td>
</tr>
<tr>
<td>IX</td>
<td>0</td>
</tr>
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</table>

**Total Events** 24

Total is one less than above due to no magnitude in 1926
6.4 Dams and Lakes

All Federal reservoirs in Kansas are designed, owned and operated by either the U.S. Army Corp of Engineers (Corps) or the Bureau of Reclamation (Bureau).

State of Kansas Reservoir Listings

There are 17 Corps reservoirs and 7 Bureau reservoirs in the State. The reservoirs include the following water impoundments:

- Big Hill, located 4-1/2 miles east of Cherryvale in Montgomery County; constructed in 1981
- Cedar Bluff, located 13-miles south of I-70 Ogallah interchange in Ellis County; constructed in 1954
- Cheney, located 25-miles west of Wichita, in Reno, Sedgwick, and Kingman Counties; constructed in 1964
- Clinton, located 5-miles west of Lawrence in Douglas County; constructed in 1977
- Council Grove, located 1-mile northwest of Council Grove in Morris County; constructed in 1964
- El Dorado, is located 3-miles east of El Dorado in Butler County; constructed in 1981
- Elk City, located 5-miles northwest of Independence in Montgomery County; constructed in 1966
- Fall River, located 4-miles north of Fall River in Greenwood County; constructed in 1949
- Hillsdale, located in Paola in Miami County; constructed in 1982
- John Redmond, located 1-mile west of New Strawn in Coffey County; constructed in 1964
- Kanopolis, located south of Kanapolis in Ellsworth County; constructed in 1948
- Keith Sebelius, located 3-miles southwest of Norton in Norton county; constructed in 1964
- Kirwin, located 4-miles west and 1-mile south of Kirwin in Phillips County; constructed in 1955
- Lovewell, located 4-miles east, 9-miles north and 4-miles east of Mankato in Jewell County; constructed in 1957
- Marion, located just north of US 56 between Marion and Hillsboro in Marion County; constructed in 1968
- Melvern, located 2-miles west of Melvern in Osage County; constructed in 1972
- Milford, located 5-miles north of Junction City spans three counties: Clay, Dickenson, and Geary; constructed in 1967
- Perry, located 2-miles north of Perry in Jefferson County; constructed in 1969
- Pomona, located 1-mile northeast of Vassar in Osage County; constructed in 1963
- Toronto, located primarily in Woodson County; constructed in 1960
- Tuttle Creek, located 6-miles north of Manhattan in Riley County; constructed in 1962
- Waconda, located 2-miles east of Downs in Mitchell County; constructed in 1967
- Webster, located 8-miles west of Stockton in Rooks County; constructed in 1956
- Wilson, located in Russell County approximately 7.5 miles west of Sylvan Grove; constructed in 1964

In Kansas, Federal reservoirs are created by building an earthen dam across a river causing water to back up and create storage. The height of the dam, type of spillway, size and shape of the reservoir pool, amount of precipitation, rate of evaporation, and the size and characteristics of the watershed are among the physical characteristics that determine the volume of water that may be stored, and the potential water supply yield from this storage. Past and current land use in the watershed will also play a major role in long term water quality of each reservoir. Although often referred to as lakes, reservoirs are not natural occurrences in the Kansas landscape. Natural lakes are formed through geologic processes, such as glacial melting or scouring. Reservoirs are artificially created by transforming part of a flowing water body into a still water body.

National statistics show that overtopping due to inadequate spillway design, debris blockage of spillways, or settlement of the dam crest account for 34% of all dam failures. Foundation defects, including settlement and slope instability, account for 30% of all failures. Piping and seepage cause 20% of national failures.
dam failures. This includes internal erosion caused by seepage, seepage and erosion along hydraulic structures, leakage through animal burrows, and cracks in the dam. The remaining 16% of failures are caused by other means.

Loss of life and damage to structures, roads, utilities and crops may occur as a result of dam failures. These losses, either individually or combined with other factors, can create significant negative economic impact for long-term periods of time. These effects would certainly accompany the failure of one of the major dams in Kansas.

6.4.1 County Dams and Lakes Info

Federal Reservoirs Within Ford County
No Federal reservoirs were identified in Ford County.

Federal Reservoirs Outside Ford County
No Federal reservoirs were identified outside Ford County that would significantly impact the county.

Regulation of Dams in the State of Kansas
Dams in Kansas can be owned by State and local governments, or privately owned. 
NOTE: Federal dams and reservoirs do not fall under the jurisdiction of the state and are not subject to state inspection or regulation.

The Dam Safety Program is part of the broader Water Structures Program of the Kansas Department of Agriculture, Division of Water Resources. The Kansas Stream Obstructions Act (K.S.A. 82a-301 through 305a) gives the Chief Engineer, Kansas Department of Agriculture – Division of Water Resources the exclusive authority to regulate the construction, operation and maintenance of dams in Kansas. The written consent or permit of the Chief Engineer is required to construct a dam or make changes in any dam which meets the regulatory criteria.

The Chief Engineer has the power and duty to inspect any dam. The Chief may issue orders requiring correction of deficiencies or removal of the dam. An annual inspection of all dams found to be unsafe is required until the deficiency is corrected or the dam is removed.

Where a dam condition is so dangerous as to pose an immediate safety threat, the Chief Engineer has the responsibility to immediately employ any remedial means considered necessary. The Chief Engineer continues in full charge and control of any such dam until it is considered safe or the emergency prompting the remedial action has ceased.

Three dam hazard classifications have been established as described in K.A.R. 5-40-9. These classes are:

- Hazard Class A (low) – dams located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or county, township and private roads.
- Hazard Class B (significant) – dams located in predominately rural or agricultural areas where failure may endanger few lives, damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities.
- Hazard Class C (high) – dams located in areas where failure may cause extensive loss of life, serious damage to homes, industrial and commercial facilities, important public utilities, main highways or railroads.

The referenced hazard classes are solely impact-based. It is important to note that a high hazard dam is not necessarily unsafe. An individual dam’s hazard classification is based upon the potential consequences of dam failure and does not reflect the physical condition of the dam. Post-construction development in the area is evaluated for potential to flood due to failure of the dam (breach inundation zone), and may result in the dam’s reclassification to a higher hazard class than was originally assigned (Reference: Kansas Water Plan, Small Dam Safety and Rehabilitation, Policy Section, approved by the Kansas Water Authority November 18, 2005).
There are separate Emergency Action Plan requirements for owners of Hazard Class B and Hazard Class C dams under Kansas regulation. Hazard Class B dam owners are required to provide a notification plan as follows: dam location and description, name, address and telephone number of the person responsible to notify local authorities of an emergency, a map or written description of the area that can be inundated by type of breach, a list of persons who should be notified in case of emergency, and contact information for those persons responsible for the operation and maintenance of the dam. This information is to be provided to the Kansas Water Office - Chief Engineer.


The hazard classifications do not use a calculation of “likelihood” since the inspections do not include an evaluation of “worthiness” or probability of failure. Also, there are no reported dam failures in Ford County, which precludes the calculation of an overall county likelihood. Since likelihood data is not available for potential dam failure, the county has elected to rely on the State classifications to prioritize, and to plan for, High Hazard Class C dams only for this analysis.

**State and Private Dams Within Ford County**
The Kansas Division of Water Resources identified 43 dams within Ford County that are regulated by the Kansas Department of Agriculture, Water Resources Department. The dams are inspected and classified based on the summary criteria outlined above. As of the writing of this analysis 29 of the referenced dam structures have not been classified (rated) by the Department of Water Resources. A list of these dams is provided as a link in this section.

NOTE: Low lying areas located in close proximity to the Arkansas River, and the numerous creeks and tributaries located within the Ford County Watersheds, are susceptible to localized flooding events.

**State/Private Dams Outside Ford County**
A review of regulated dams in surrounding counties did not suggest any major impact on Ford County in the event of local dam failures.

**High Hazard Dams Within Ford County**
The Kansas Department of Water Resources did not identify any dams in Ford County as High Hazard Class C structures.

Excel File Link to Ford County Dams is not available except online.
7.0 Technological Hazards Vulnerability

7.1 General Description and Definition
The types of hazards that are referred to in the SARA Title III regulations and EPCRA are those that, in the case of an incident, pose a threat to geography, people, property and public infrastructure, commercial livestock, flora and fauna, and economy. It has become generally accepted practice to use four primary classifications for identifying those hazards. The focus of this section deals specifically with technological hazards within Ford County.

7.2 Relative vs. Absolute Ranking
Any ranking or prioritization of risk must be quantitative in nature. Numbers alone, however, do not prevent people from arguing about a potential hazard or its acceptability, but it does require these arguments to be related to quantitative values and subjected to scrutiny. This discussion leads to a better understanding of the system and its potential weaknesses and enables the identification of improvements and significant ability to predict and plan. Using relative indicators as opposed to absolute values eliminates many questions which are used to attack absolute values. Inherently, absolute values invite the question of “how much better or how much worse.” Relative indicators do not suffer as much from those types of questions since the indicators have been placed in a relative position of 1 to 100.

The importance of choosing relative indicators versus absolute values cannot be over emphasized. Geoff Wells summarizes this concept in his 1996 book, Hazard Identification and Risk Assessment. He notes that absolute values, used in quantifying any form of risk, are easily subjected to uncertainty and error because the data can always be said to be incomplete, inappropriate, or incorrectly manipulated. Whereas relative values are less sensitive to error or questioning since the inherent uncertainties tend to cancel each other out when evaluating the change in risk from scenario to scenario. Using the relative position of events as the value as opposed to absolute values provides this advantage. It is therefore possible to estimate risk with considerable accuracy through the on-going modification of a system.

7.3 Risk Rating Tool
Defining, categorizing, or prioritizing chemical vulnerability can be a formidable task involving complex evaluations that are based on specific site information not readily accessible to local emergency management. Additionally, the evaluation may be very subjective and time-consuming depending on the approach taken to evaluate risk. E-Fm Consulting has developed an objective approach for evaluating the risk and vulnerability of fixed chemical storage facilities utilizing accepted industry standards and practices. E-Fm’s risk rating is based on worst-case scenarios using a relative risk-ranking approach. A detailed description of the process is provided in the Methodology section of this report (Section 5.0).

As the algorithm for risk rating was developed, the impact of various factors was considered. The subjectivity inherent in estimating vulnerability was also considered, which influenced the addition of storage conditions, quantity, proximity, and Likelihood of Occurrence (LI) into the equation.

Likelihood of Occurrence is defined as the actual or expected frequency of a hazardous event. The likelihood of hazardous incidents at fixed facilities is derived from historical data reported to various government agencies who document hazardous material incidents, spills, and releases. Spill/incident data for Kansas counties comes from the Kansas Department of Health and Environment (KDHE), the Kansas Corporation Commission (KCC), and the National Response Center (NRC), through the USEPA. An objective assessment of the spill/incident data is used to project the future frequency or likelihood of occurrence.

Incorporating these factors into risk allows a straightforward look at vulnerability. Subsequently, an
assessment of vulnerability becomes a simple process of establishing and examining the potential impact radius associated with the highest-ranked listings. This accomplishes the goals set out in both the NRT-1 and the Technical Guidance for Hazards Analysis (Green Book), which is to prioritize and allocate resources to those hazards with highest priority.

E-Fm’s Hazardous Chemical Risk Rating Tool (HzChRT) is designed to work with any Microsoft windows-based platform. The risk-rating tool is essentially a SQL database containing the most recent Tier II and AST/UST data provided by the county, including the analysis and vulnerability ranking of each reporting entity. The tool is designed with capabilities that allow local emergency management staff to add, update, delete and/or modify chemical data reported for the county on an ongoing basis. Data within the risk-rating tool (HzChRT) contains sensitive information regarding public and private industry and is assumed to be confidential. For this reason, HzChRT data is provided separately from the Hazard Analysis.

Four standard reports are available with the HzChRT reporting tool. The first report lists the Top Ten chemicals in numerical order, including the facility name, address, description of the chemical, and storage location. This report is useful because it provides a brief summary of the top ranked chemicals within the county. The second report lists extremely hazardous substances (EHS) in rank order with their respective facility names, addresses, CAS numbers, chemical description, and storage locations. The focus of this report is to identify extremely hazardous chemicals stored at facilities and locations that pose significant risks to people. The third report provides a listing of chemical risks ranked from the highest to the lowest rating, with their respective facility names, addresses, etc. This report can be used to set priorities for risk management, mitigation plans, and other planning initiatives. The fourth report provides an alpha listing of facilities in the county, with their chemical inventories. This report format allows local emergency planners and responders a quick reference to the number, type, and ranking of hazardous materials at each reporting facility.

7.4 Top Ten Chemicals
After review of the Top Ten chemicals, it was noted that eight (8) of the Top Ten chemicals in Ford County were located at Koch Nitrogen Company. In addition, 13 occurrences of the of the Top Ten chemicals identified in the county were EHS chemicals.
Table 7.4 (1) Top Ten Ranked Chemicals

<table>
<thead>
<tr>
<th>Rank Order</th>
<th>Company</th>
<th>Chemical</th>
<th>Risk Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Koch Nitrogen Company</td>
<td>Ammonia</td>
<td>17845</td>
</tr>
<tr>
<td>2</td>
<td>Koch Nitrogen Company</td>
<td>Ammonia</td>
<td>17845</td>
</tr>
<tr>
<td>3</td>
<td>Koch Nitrogen Company</td>
<td>Ammonia</td>
<td>16358</td>
</tr>
<tr>
<td>4</td>
<td>Koch Nitrogen Company</td>
<td>Activated Carbon</td>
<td>3812</td>
</tr>
<tr>
<td>5</td>
<td>Koch Nitrogen Company</td>
<td>Activated Carbon</td>
<td>3346</td>
</tr>
<tr>
<td>6</td>
<td>Koch Nitrogen Company</td>
<td>Activated Carbon</td>
<td>2974</td>
</tr>
<tr>
<td>7</td>
<td>Koch Nitrogen Company</td>
<td>Sulfuric Acid</td>
<td>2965</td>
</tr>
<tr>
<td>8</td>
<td>National Beef Packing Company</td>
<td>Peracetic Acid</td>
<td>2965</td>
</tr>
<tr>
<td>9</td>
<td>Aquila Incorporated</td>
<td>Sulfuric Acid</td>
<td>2668</td>
</tr>
<tr>
<td>10</td>
<td>Cargill Meat Solutions</td>
<td>Sulfuric Acid</td>
<td>2668</td>
</tr>
<tr>
<td>11</td>
<td>Dodge City Cooperative</td>
<td>Propane</td>
<td>2668</td>
</tr>
<tr>
<td>12</td>
<td>RSA Microtech</td>
<td>Zinc Chloride</td>
<td>2668</td>
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<td>13</td>
<td>Jon Erhart</td>
<td>Methyl Parathion</td>
<td>2594</td>
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<td>14</td>
<td>Cargill Meat Solutions</td>
<td>Peracetic Acid</td>
<td>2471</td>
</tr>
<tr>
<td>15</td>
<td>Cargill Meat Solutions</td>
<td>Peracetic Acid</td>
<td>2471</td>
</tr>
</tbody>
</table>

Tier II chemical listings and AST/UST data provided by Ford County emergency management is for the 2007 reporting period. It is important to note that although city/county/state facilities may not be required to submit Tier II information for materials stored on-site, the county EM may initiate measures to collect chemical information for these entities for inclusion in their chemical hazard inventory. The highest risk-ranked chemicals identified in Ford County were three storage locations of the EHS chemical ammonia (CAS #7664-41-7), located at Koch Nitrogen Company northeast of Dodge City. Additional Top Ten chemicals identified at Koch Nitrogen Company include an additional storage location of ammonia (CAS #7664-41-7), the second highest risk-ranked chemical in the county. Three storage locations of activated carbon (CAS #7440-44-0) are stored at Koch Nitrogen Company, and account for the forth, fifth, and sixth highest risk-ranked chemicals in the county. One storage location of sulfuric acid (CAS #7664-93-9) was tied for the seventh highest risk-ranked chemical in Ford County. A complete listing of the submitted chemicals attributed to the Koch Nitrogen Company is included in the HzChRT program within this Hazard Analysis.

Aluminum phosphide (Phostoxin) was identified as the third highest risk-ranked chemicals in Ford County, stored at the Dodge City Cooperative Feed Department. Additional Top Ten chemicals identified at the Dodge City Cooperative's main complex in Dodge City was one storage location of propane (CAS #74-98-6), tied for the eighth highest risk-ranked chemical in Ford County.

Two storage locations of peracetic acid (CAS #79-21-0) were identified as being tied for the seventh highest risk-ranked chemical in the county, both located at National Beef Packing Company.

One storage location of sulfuric acid was identified as tied for the eighth highest risk-ranked chemical,
located at an Aquila communications building. At the Aquila facility, the sulfuric acid is contained within batteries utilized to power communication equipment. The amount of sulfuric acid reported on the Tier II forms typically includes the weight of the battery cores, the acid, and the battery cases.

Sulfuric acid was identified as tied for the eighth highest risk-ranked chemical in the county, located at Cargill Meat Solutions. Additional Top Ten chemicals attributed to Cargill Meat Solutions include two storage locations of peracetic acid, tied for the tenth highest risk-ranked chemicals in the county.

Two storage locations of zinc chloride were identified as tied for the eighth highest risk-ranked chemical in the county, both located at RSA Microtech in separate warehouses.

Methyl parathion was identified as the ninth highest risk-ranked chemical in Ford County, located at the Dodge City Regional Airport, attributed to Erhart Aerial Spraying.

A complete listing of the submitted chemicals located in Ford County is included in the HzChRT program within this Hazard Analysis. The Ford County Top Ten listing illustrates the importance of maintaining accurate chemical reporting and tracking for all reportable spills and incidents at chemical facilities.

### 7.5 Top Three Ranked Sites

The Top Three vulnerable sites in the County were identified based on the relative risk rating of hazardous materials stored at their facilities.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Facility</th>
<th>Location</th>
<th>Latitude / Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Koch Dodge City Nitrogen Plant</td>
<td>11559 E US Hwy 50, northeast of Dodge City</td>
<td>37.7782 / -99.9306</td>
</tr>
<tr>
<td>2</td>
<td>Dodge City Cooperative - Feed Department</td>
<td>708 W Trail St, Dodge City</td>
<td>37.7520 / -100.0249</td>
</tr>
<tr>
<td>3</td>
<td>National Beef Packing Company - Slaughter Division</td>
<td>2000 E Trail St, Dodge City</td>
<td>37.7482 / -99.9856</td>
</tr>
</tbody>
</table>

For these locations, the following items are of key importance to the county:

- size of the vulnerable zone
- number of people in the zone
- sensitive populations in the zone
- essential services in the zone

These key items detailed in the Vulnerability Zone Tables are also depicted in Zone of Impact Maps, which show the radius of the areas potentially affected by an event at the top three locations.

For the chemicals identified, the suggested initial evacuation radii published in the North American Emergency Response Handbook (USDOT) can be used without modification as the baseline parameter. The primary radius of impact would be 0.5 miles and the secondary radius for consideration would be 1.0 mile. The 0.5 and 1.0 mile radius should not be considered “safe” limits for all hazards. Safe limits should be established on an individual basis after consideration of the conditions, material type, characteristics, and potential for cascading events. Rather, these baseline limits establish a reasonable method to evaluate potential impact on people, property, and the environment. The baseline distances should be used as the most probable situations and vulnerability should be measured from this baseline. The ability to determine the probability of cascade events is very limited due to the significant influence from circumstances experienced at the time of the initial event.
#1 - Koch Dodge City Nitrogen Plant
The Koch Dodge City Nitrogen Plant is located at 11559 E. Highway 50, northeast of Dodge City. This facility was identified as storing four locations of the EHS chemical ammonia, the highest and second highest risk-ranked chemical identified in Ford County. Additional Top 10 chemicals attributed to Koch Nitrogen Plant include three storage locations of activated carbon and one storage location of the EHS chemical sulfuric acid. A complete listing of submitted chemicals for Koch Nitrogen Company is included in the HzChRT program within this Hazard Analysis.

This facility is located approximately four miles east of Dodge City and approximately two miles west of the unincorporated area of Wright. The most vulnerable area in relation to the facilities appears to be within the 0.5 mile radius of the site, which includes Koch's large industrial complex. The residential population plus the employee population within the 0.5 mile radius is estimated to be 51 people. The 1.0 mile radius area from this site includes additional rural areas. The residential population plus the employee population within the 1.0 mile radius is estimated to be 63 people.

Based on the physical characteristics of ammonia, the most likely event appears to be the possible release of ammonia into the atmosphere, and could impact the employees at the facility, as well as the nearby commercial and residential developments. The prevailing winds in the area of the facility are primarily from the south in the summer and from the north in the winter. In the event of a release of ammonia from the facility, it is expected that the significant impact area would be within the 0.5 mile radius, with a lower likelihood of impacting the population within the 1.0 mile radius.

Although the storage of the identified chemicals at the facility is a significant concern in regards to areas near Dodge City and Wright, an additional risk associated with the facility to Ford County is the transportation via truck of hazardous materials to and from this facility, increasing the possibility of vehicular incidents involving hazardous materials along the traffic routes of the county. The facility also utilizes rail traffic for delivery of hazardous materials to the site, increasing the possibility of rail incidents involving hazardous materials in transit.

#2 - Dodge City Cooperative - Feed Department
The Feed Department of Dodge City Cooperative is located at 708 West Trail Street, on the south-central side of Dodge City. This facility was identified as storing the EHS chemical aluminum phosphide (Phostoxin), the third highest risk-ranked chemical identified in Ford County. Additional Top 10 chemicals attributed to Dodge City Cooperative include additional storage areas of sulfuric acid, as well as sodium bisulfite and the EHS chemical anhydrous ammonia. A complete listing of submitted chemicals for Dodge City Cooperative is included in the HzChRT program within this Hazard Analysis.

This facility is located in a mixed-usage area of residential and commercial developments. The most vulnerable area in relation to the facilities appears to be within the 0.5 mile radius of the site, which includes populated areas of Dodge City. The population within the 0.5 mile radius is estimated to be approximately 1,557 people. The 1.0 mile radius area from this site includes additional populated areas of Dodge City. The population within the 1.0 mile radius is estimated to be 6,228 people.

Based on the physical characteristics of aluminum phosphide, the most likely event appears to be the possible release of aluminum phosphide into the atmosphere, and could impact the employees at the facility, as well as the nearby commercial and residential developments. The prevailing winds in the area of the facility are primarily from the south in the summer and from the north in the winter. In the event of a release of aluminum phosphide from the facility, it is expected that the significant impact area would be within the 0.5 mile radius, with a lower likelihood of impacting the population within the 1.0 mile radius.
Although the storage of the identified chemicals at the facility is a significant concern in regards to Dodge City, an additional risk associated with the facility to Ford County is the transportation via truck of hazardous materials to and from this facility, increasing the possibility of vehicular incidents involving hazardous materials along the traffic routes of the county. The facility also utilizes rail traffic for delivery of hazardous materials to the site, increasing the possibility of rail incidents involving hazardous materials in transit.

#3 - National Beef Packing Company
The National Beef Packing Company is located at 2000 East Trail Street, on the southeast side of Dodge City. This facility was identified as storing two locations of the EHS chemical peracetic acid, the seventh highest risk-ranked chemical identified in Ford County. No additional Top 10 chemicals were attributed to National Beef Packing Company. A complete listing of submitted chemicals for National Beef Packing Company is included in the HzChRT program within this Hazard Analysis.

This facility is located in a mixed-usage area of residential and commercial developments to the north and east and rural areas to the south and west. The most vulnerable area in relation to the facilities appears to be within the 0.5 mile radius of the site, which includes populated areas of Dodge City's southeast side. The residential population (1,158) plus the employee population (3,000) within the 0.5 mile radius is estimated to be approximately 4,158 people. The 1.0 mile radius area from this site includes additional populated areas of Dodge City as well as additional rural areas. The residential population (4,171) plus the employee population (3,000) within the 1.0 mile radius is estimated to be 7,171 people.

Based on the physical characteristics of peracetic acid, the most likely event appears to be the possible release of peracetic acid into the atmosphere or introduction into a groundwater source, and could impact the employees at the facility, as well as the nearby commercial and residential developments. The prevailing winds in the area of the facility are primarily from the south in the summer and from the north in the winter. In the event of a release of sulfuric acid from the facility, it is expected that the significant impact area would be within the 0.5 mile radius, with a lower likelihood of impacting the population within the 1.0 mile radius.

Although the storage of the identified chemicals at the facility is a significant concern in regards to Dodge City, an additional risk associated with the facility to Ford County is the transportation via truck of hazardous materials to and from this facility, increasing the possibility of vehicular incidents involving hazardous materials along the traffic routes of the county. The facility also utilizes rail traffic for delivery of hazardous materials to the site, increasing the possibility of rail incidents involving hazardous materials in transit.

Risk and Vulnerability of the Top Three Sites
Emergency managers should expect sites and conditions to change over time. Mitigation efforts must anticipate this variability and account for the possibility of shifting conditions in the future. The risk rating process and vulnerability assessment should be viewed as a cyclical/repetitive function that is constantly changing, similar to the routine maintenance of equipment or periodic review of processes and procedures in an operational environment. Risk and vulnerability assessments are dynamic issues that require due diligence in maintaining continuous review and assessment of current conditions. The following two tables provide a detailed look at the vulnerability information relative to the Top Three sites:
# Tables - Vulnerability Zones

## Table 7.5 (2) - 0.5 Mile Radius

<table>
<thead>
<tr>
<th>Facility</th>
<th>Population within Zone</th>
<th>Senior Citizens</th>
<th>Students</th>
<th>Employees at Facility</th>
<th>Spanish Only Population</th>
<th>Tangible Assessed Value</th>
<th>Essential Facilities within Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koch Nitrogen Plant</td>
<td>+/- 4 (+/- 0.012% of county)</td>
<td>+/- 1</td>
<td>+/- 0</td>
<td>47</td>
<td>+/- 2</td>
<td>$66,847 (+/- 0.03% of county)</td>
<td>Utilities, Support Services, Localized Services, Water Supply, County Public Works, Communication Systems, Auto and Rail Transportation</td>
</tr>
<tr>
<td>Dodge City Cooperative - Feed Department</td>
<td>+/- 1,557 (+/- 4.80% of county)</td>
<td>+/- 172</td>
<td>+/- 430</td>
<td>125</td>
<td>+/- 587</td>
<td>$7.6MM (+/- 3.4% of county)</td>
<td>Fire and Ambulance, Law Enforcement, City Administrative, Utilities, Support Services, Localized Services, Water Supply, Communication Systems, Auto and Rail Transportation, City and County Public Works, Localized Commercial Businesses</td>
</tr>
<tr>
<td>National Beef Packing Company</td>
<td>+/- 1,557 (+/- 4.80% of county)</td>
<td>+/- 172</td>
<td>+/- 430</td>
<td>3,000</td>
<td>+/- 587</td>
<td>$7.6MM (+/- 3.4% of county)</td>
<td>Utilities, Support Services, Localized Services, Water Supply, Communication Systems, Auto and Rail Transportation, City and County Public Works, Localized Commercial Businesses</td>
</tr>
</tbody>
</table>

County Tangible Assessed Value is +/- $223.35MM (million)

## Table 7.5 (3) - 1 Mile Radius

<table>
<thead>
<tr>
<th>Facility</th>
<th>Population within Zone</th>
<th>Senior Citizens</th>
<th>Students</th>
<th>Employees at Facility</th>
<th>Spanish Only Population</th>
<th>Tangible Assessed Value</th>
<th>Essential Facilities within Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koch Nitrogen Plant</td>
<td>+/- 16 (+/- 0.05% of county)</td>
<td>+/- 2</td>
<td>+/- 0</td>
<td>47</td>
<td>+/- 6</td>
<td>$267,300 (+/- 0.12% of county)</td>
<td>Utilities, Support Services, Localized Services, Water Supply, County Public Works, Communication Systems, Auto and Rail Transportation, Localized Commercial Businesses</td>
</tr>
<tr>
<td>Dodge City Cooperative - Feed Department</td>
<td>+/- 6,228 (+/- 19.19% of county)</td>
<td>+/- 685</td>
<td>+/- 1,719</td>
<td>125</td>
<td>+/- 2,347</td>
<td>$30.45MM (+/- 13.6% of county)</td>
<td>Fire and Ambulance, Law Enforcement, City Administrative, Utilities, Support Services, Localized Services, Water Supply, Communication Systems, Auto and Rail Transportation, City and County Public Works, Localized Commercial Businesses</td>
</tr>
<tr>
<td>National Beef Packing Company</td>
<td>+/- 4,171 (+/- 12.85% of county)</td>
<td>+/- 457</td>
<td>+/- 1,149</td>
<td>3,000</td>
<td>+/- 1,569</td>
<td>$20.45MM (+/- 9.15% of county)</td>
<td>Utilities, Support Services, Localized Services, Water Supply, Communication Systems, Auto and Rail Transportation, City and County Public Works, Localized Commercial Businesses</td>
</tr>
</tbody>
</table>

County Tangible Assessed Value is +/- $223.35MM (million)
If an event occurs at any of these sites in the county, it would likely be within the 0.5-mile radius with a low to medium probability to escalate to a 1.0-mile radius. The sites are located primarily in populated areas of Ford County, and the estimated populations that may be impacted by an incident at any of the sites are based on the populations of Dodge City and rural areas. An event at any of the sites also has the potential of impacting vehicular and/or railway traffic as well. In the event of an incident at the facilities, emergency responders and essential services should be located in close proximity to the referenced sites. The population(s) affected in the zones may vary dependent upon event magnitude, location, and time of occurrence. Any one of these potential events could lead to a cascading hazard (see Cascading Hazard Matrix in Section 11.0 and the Resources Section).

Users may consult other documents referenced in this report to investigate the options for more detailed vulnerability studies. If a detailed site-specific vulnerability assessment is completed, it is recommended that this be treated as a stand-alone document. The assessment results should be carefully applied in changing the risk rating or vulnerability rating for a particular site. Vulnerability is a subjective process that is influenced by wind speed and direction, temperature, time of day, population, quantity of material released and other critical variables. Consequently, a specific assessment for vulnerability must be treated as a snapshot in time. It is recommended that the risk rating system provided in this analysis be used as the primary source for prioritizing the overall county risk and for future vulnerability assessments.

Zones of Impact Maps (corridors and radii) - The HzMAP icon below is a link to your live GIS based map which will show the county’s Top Three Sites with Zone of Impact radius areas. The map uses a live link to MS Virtual Earth at close to the highest resolution available for the county. The first time used, it may take up to 2 minutes to load, but should be faster after that. The toolbar at the top left of the map will allow you to zoom, zoom with a rectangle, re-center, and go back to full view.

7.6 Other Technological Vulnerabilities

Although city/county/state facilities may not be required to submit Tier II information for materials stored on-site, the county EM may initiate measures to collect chemical information for these entities for inclusion in their chemical hazard inventory.

7.7 Transportation Summary

7.7.1 Highways

a. Federal

U.S. Highway 50 trends east-west and is joined with U.S. Highway 56 crosses Ford County's eastern boundary. It passes through the incorporated area of Spearville and the unincorporated areas of Bellefont and Wright and splits from U.S. Highway 56 northeast of Dodge City. U.S. 50 traverses across Dodge City's north side and joins U.S. Highway 400 west of Dodge City. U.S. Highway 50/400 passes through the unincorporated area of Howell, and it crosses Ford County's western boundary. The total mileage of U.S. 50, including combined highway mileage, is 38.46 miles within Ford County.

U.S. Highway 54 trends northeast-southwest across Ford County’s southeast side, passing through the incorporated areas of Bucklin and the unincorporated areas of Kingsdown and Bloom. U.S. 54 crosses Ford County’s eastern and southern boundaries. The total mileage of U.S. Highway 54 is 22.22 miles within Ford County.

U.S. Highway 56 trends northeast-southwest across Ford County. It is combined with U.S. 283 in Dodge City, and it is combined with U.S. 50 in the northeast quarter of Ford County. This roadway passes through the incorporated areas Spearville and Dodge City and the unincorporated areas of Bellefont and Wright. U.S. Highway 56 crosses Ford County's western and eastern boundaries. The total mileage of U.S. Highway 56, including combined highway mileage, is 41.22 miles within Ford County.
U.S. Highway 283 trends north-south, and crosses both the north and south county boundaries. One-half mile west of Wright, U.S. Highway 283 joins U.S Highway 50/56, bypasses Dodge City on the east side, and extends from Dodge City to the southern county boundary. The total mileage of U.S. 283 within Ford County is 35.41 miles including combined highways.

U.S. Highway 400 crosses Ford County trending northwest-southeast. The roadway is joined with Kansas Highway 154 across the county's southeast side, passing through the incorporated area of Dodge City, Ford and Fort Dodge. The highway is joined with U.S. 50 west of Dodge City, passing through unincorporated area of Howell. The total mileage of U.S. Highway 400, including combined highway mileage, is 38.41 miles within Ford County.

The total federal roadway mileage within Ford County is 139.13 miles.

b. State
Kansas Highway 34 trends north-south, spanning 5.91 miles from Ford County's southern boundary to the incorporated area of Bucklin. Highway 34 trends northwest-southeast, spanning 3.61 miles from Bucklin to the intersection of U.S. Highway 400/Kansas Highway 154. The total mileage of Kansas Highway 34 is 9.53 miles.

Kansas Highway 94 trends north-south, spanning 3.9 miles from Ford County's southern county boundary to the unincorporated area of Kingdown.

Kansas Highway 154 is joined with U.S. Highway 400 in Ford County, trending northwest-southeast, and it passes through the incorporated areas of Ford and Fort Dodge. The total mileage of Kansas Highway 154 is 27.68 miles within Ford County.

The total mileage of state roadways within Ford County is 41.11 miles.

c. Other
Numerous other secondary paved and unpaved roads crisscross the county. Hazardous chemical, agricultural, and petroleum industry transporters use these routes on a periodic basis. Total mileage for non-federal and non-state roads in Ford County is 1,696.42 miles.

The total mileage for federal, state, and county roads combined for Ford County is 1,876.66 miles.

7.7.2 Railroad
Amtrack and Burlington Northern Santa Fe (BNSF) Railways service the areas of Bellefont, Spearville, Wright, and Dodge City, and Howell. The railway roughly parallels U.S. Highway 50/56 east of Dodge City and U.S. Highway 50/400 west of Dodge City.

Union Pacific and BNSF Railroads service the areas of Bucklin, Kingsdown, and Bloom on the southern side of Ford County. The railway roughly parallels U.S. Highway 54.

Cimarron Valley Railroad trends northeast-southwest connecting Dodge City to stations within neighboring Gray County.

Boothill and Western (BH&W) Railway spans from Dodge City to the unincorporated area of Wilroads, but the Wilroads station has been abandoned.

7.7.3 Airports
The Dodge City Regional Airport, located on the east side of Dodge City, is a public airport with four good-condition asphalt-covered runways. Runway 14 and runway 32 are 6,899 feet long and 100 feet
wide. Runway 2 and runway 20 are 4,649 feet long and 100 feet wide. There are 33 airplanes based at
the airport, 27 of which are single-engine, and six are multi-engine. Over the 12-month period ending
January 31, 2008 the airport averaged 64 aircraft operations per day, 51% of which were local general
aviation, 26% were transient general aviation, 16% were commercial, and 6% were air taxi.

Wilroads Garden Airport, located one mile southeast of Dodge City, is a privately-owned,
open-to-the-public airport with two poor-condition turf-covered runways (2,630 ft. x 60 ft.). The runways
are not actively maintained. Five airplanes are based at the airport, one being single-engine and four are
ultralights. Over the 12-month period ending July 15, 2006 approximately 200 aircraft operations took
place, all of which were local general aviation.

Bucklin Airport, located one mile southwest of Bucklin, is a privately-owned, open-to-the-public airport
with two fair-condition turf runways (2,560 ft. x 150 ft.). One single-engine airplane is based at the
airport. Over a 12-month period ending June 14, 2006 the airport averaged 29 aircraft operations per week,
80% of which were local general aviation and 20% were transient general aviation.

Three private airstrips were identified in Ford County:
- Knoeber Landing Strip: Latitude 37.83778; Longitude -99.74361; one-half mile southeast of
  Spearville
- Shehan Airpark: Latitude 37.77444; Longitude -99.83056; three miles east of Wright
- Shelor Airport: Latitude 37.47778; Longitude -99.97778; three miles northeast of Minneola

Crop-dusting service based in Ford County is active. When crop-dusting is performed in the county, a
private crop-dusting service receives chemicals from the Ford County Noxious Weeds Department or
from the agricultural cooperatives located in the county.

7.7.4 Pipelines
The National Pipeline Mapping System provides data for comprehensive cartographic reference for
pipeline sources. Eight natural gas pipeline operators are present in Ford County:
- ANR Pipeline Company operates 15.0 miles of pipeline
- Colorado Interstate Gas Company operates 25.5 miles of pipeline
- Natural Gas Pipeline Company of America (KMI) operates 91.2 miles of pipeline
- Northern Natural Gas Company operates 95.3 miles of pipeline
- Panhandle Eastern Pipeline Company operates 110.5 miles of pipeline
- Kansas Gas Service operates 73.4 miles of pipeline
- Aquila Networks operates 5.5 miles of pipeline
- Southern Star Central Gas Pipeline, Inc. operates 70.1 miles of pipeline

Oneok NGL Pipeline LP, the only operator of highly volatile liquid pipeline within Ford County, operates
34.27 miles of hazardous liquid pipeline.

The KDOT Hazardous Materials Study - Project Final Report assigned a pipeline risk factor of 0.01 to
Ford County, which is well below the Statewide Mean Risk Factor of 0.05.

The pipelines range in size from 3” to 20” in diameter. Reference the county pipelines map included in the
Resources Section for a more detailed description.

7.7.5 Other Modes
Information regarding vulnerability and risk in relation to other modes of transportation is provided in the
following sub-section: An Overview of the Kansas Hazardous Materials Transportation Risk and
Vulnerability Assessment Project Final Report.
7.8 Environment

Environment (at risk natural areas)

Portions of the Upper Arkansas River drainage basin and the Cimarron River drainage basin are designated as sensitive groundwater areas in Ford County. As such, these areas may be considered vulnerable and susceptible to environmental impact.

The areas designated as Sensitive Groundwater Areas in Ford County are depicted in the Resources Section, Maps.

Two large playa lakes are located in the county: Stein and Herron. Stein is 117 acres and is located at longitude 99°48'29.95" W; latitude 37°50'50.01" N. Herron is 700 acres and is located at longitude 99°45'39.28" W, latitude 37°47'33.85". Both are run by the Kansas Department of Wildlife and Parks.

Several pipeline systems carrying natural gas, liquid petroleum gas, and crude oil pass through Ford County's watershed areas. Pipeline incidents within select areas of the county have the potential for impacting drinking water supplies, sensitive groundwater areas, and the environment.

KDHE-identified contamination sites and storage/treatment/disposal sites are provided in the Resources Section. In Ford County, three sites are designated as CERCLA sites, commonly known as Superfund sites: (1) Dodge City Army Airfield (AAF), (2) Pratt (EX) Precision BOM RAN #1, and (3) Wright Ground Water Contamination.

7.9 An Overview of the Kansas Hazardous Materials Transportation Risk and Vulnerability Assessment Project Final Report

Target: Ford County, Kansas

Introduction

In the early half of the 1990's, the University of Kansas Transportation Center was commissioned by the Kansas Division of Emergency Management (KDEM) and the Kansas Department of the Adjutant General to undertake an investigation into the transport of hazardous materials in the State of Kansas. A Hazardous Materials Transportation Risk and Vulnerability Assessment Tool was developed to assimilate data compiled from research in multiple transportation modes and potential sources and carriers of hazardous materials into an empirical calculation of risk and vulnerability. A Project Final Report detailing this process was issued in 1995. Risk and vulnerability data in the form of Risk Factors, Vulnerability Factors, and Risk Index were tabulated for all 105 Kansas Counties. Additionally, some general conclusions were offered in regard to the Risk and Vulnerability Assessment Tool and the transportation and hazardous materials source categories. Charts, tables, and interpretations presented in this Overview were derived from an analysis of data, assumptions, and findings documented in the Project Final Report.

Risk and Vulnerability Assessment Process

Risk Factor

The Project Final Report defines risk as the probability of occurrence of a hazardous event. As it relates to this study, Risk Factor was formulated on the probability or likelihood of occurrence of an accident involving the presence of hazardous materials. Risk Factor was determined for six transportation modes or sources for hazardous materials:

- Highways (RFHW)
- Railroads (RFRR)
- Pipelines (RFPL)
- Waterways (RFWW)
- Airports (RFAP)
- Fixed Facilities (RFFF)

Generally, Risk Factor was calculated as a product of the following parameters:
- Accident Rate
- Spill Probability
- Hazardous Material Carriers (%)
- Number of Carriers
- Length of Route
- Adjustment Factor for the level of risk of hazardous material (chemical ranking)
- Adjustment for the quantity of material (Adjustment factor for the weight)
- Safety Response Factor
- Percent of material spilled on ground (Ground / Spill Ratio)

Individually, Risk Factor equations were developed and employed for the six carrier/source categories. Total Risk Factor is calculated as the sum of the six individual Risk Factor categories.

Vulnerability Factor
As stated in the Project Final Report, vulnerability is the measure of the likelihood of injury, damage, or loss due to exposure, insufficient procedures, and response. Vulnerability, in essence, is a measure of the potential consequences arising from a hazardous event. Vulnerability Factor was determined based on five primary categories:
- Population Density
- Land Use
- Environment
- Special Facilities
- Water Treatment Plants

The Vulnerability Factor for Special Facilities was further subdivided into four additional categories:
- Nursing Homes
- Schools
- Prisons
- Stadiums

The sum of the individual vulnerability factors for these targets gives the overall Vulnerability Factor for Special Facilities.
- Vulnerability Factor equations were established for each of the eight individual categories.
- Total Vulnerability Factor for each county is calculated as the sum of the eight individual Vulnerability Factor categories.

Risk Index
The determination of Risk Index is supported by two primary components:
- Risk Factor
- Vulnerability Factor

Risk Index is the product of Risk Factor and Vulnerability Factor. Risk Indexes are calculated for all 105 Kansas Counties. As emphasized in the Project Final Report, Risk Index values calculated in this study are considered to be a measure of relative risk as opposed to absolute risk. As stand alone factors, the risk index information does not offer guidance for local decisions. However, the risk index values do provide a useful mechanism for assessing relative risk in similar categories across a regional subset of counties or from a statewide perspective.

Conclusions, Facts, and Assumptions

Risk Factor

Highways
Commodity flow studies for Kansas are limited or non-existent. Therefore, data about the type of materials carried are unknown. (Per KDOT source, a hazardous materials commodity flow study has not been performed in Kansas to date.)

- 62% of the hazardous materials transported in the US in 1992-93 were moved on highways.
- Average U.S. and State highway accident rate is estimated at 2.74 x 10^-6 per truck mile.
- Average Interstate highway accident rate is estimated at 1.23 x 10^-6 per truck mile.
- Highway spill probability is estimated at 20%.
- Highway truck volume transporting hazardous materials is estimated at 4%.
- Ground to spill ratio is estimated at 3.5%.

Railroads
- Hazardous materials account for 5.4% of the overall U.S. rail tonnage.
- One of every three trains is estimated to carry hazardous materials.
- National average main track accident rate is estimated at 3 x 10^-6 per train mile. Assuming a 20% damage rate in a train accident, the per car mile accident rate is estimated at 6 x 10^-7.
- Railway main line spill probability is estimated at 15%.
- Rail yard accident rate is estimated at 3 x 10^-6 per car mile.
- Rail yard spill probability is estimated at 15%.
- Ground to spill ratio is estimated at 3.5%.
- Rolling stock cars are loaded to 60% of storage capacity leaving a balance of 40% void capacity.
- Average weight of a rolling stock car (at 60% loaded capacity) is assumed to be 67 tons.

Pipelines
- U.S. pipelines primarily transport petroleum liquids (crude oil, gasoline, natural gas liquids) and energy gases (natural gas and liquefied petroleum gas (LPG)).
- Materials transported via pipeline less frequently include ethane, ethylene, anhydrous ammonia, and various other chemicals.
- Kansas pipelines primarily carry liquid ammonia, crude oil, LPG, helium, and gasoline.
- Quantities of material transported by Kansas pipelines were not available at the time of the study.
- The average diameter of pipelines operating in Kansas is 6 inches.

Waterways
- Significant amounts of hazardous materials are transported on U.S. coastal and inland waterways via barges or other marine vessels.
- In extreme northeast Kansas, hazardous materials are shipped along a 94-mile segment of the Missouri River, the state’s only navigable inland waterway. Wyandotte, Leavenworth, Doniphan, and Atchison counties are bordered by the Missouri River along this stretch.

Airports
- Transportation of hazardous materials via air is generally limited to small quantities and containers.
- The application of crop dusting operations spraying pesticides and other agricultural related chemical applications is included in this category.
- At the time of the report, relatively few accidents involving air transportation of hazardous materials had been documented.
- Accidents tend to occur at and in close proximity to airports.

Fixed Facilities
- 1994 Spill Data Base (KDEM Spill & Response Report, 1994) was provided by KDEM.
- 1992 Fixed Facilities Data Base (KDHE Tier II reporting under Section 312 of Title III EPCRA) was provided by the KDHE.
- The Project Final Report indicated that essentially no data (common field) exists to correlate the two databases.
Wyandotte County registered the highest total risk factor while Elk County registered the lowest total risk factor.

<table>
<thead>
<tr>
<th>Transportation Mode</th>
<th>Mean Risk Factor</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Facilities</td>
<td>3.69</td>
<td>1 (High)</td>
</tr>
<tr>
<td>Highways</td>
<td>2.39</td>
<td>2</td>
</tr>
<tr>
<td>Railroads</td>
<td>1.35</td>
<td>3</td>
</tr>
<tr>
<td>Airways</td>
<td>0.05</td>
<td>4</td>
</tr>
<tr>
<td>Pipelines</td>
<td>0.05</td>
<td>5</td>
</tr>
<tr>
<td>Waterways</td>
<td>0.03</td>
<td>6 (Low)</td>
</tr>
</tbody>
</table>

Table 7.9 (1) - Transportation Mode Hazard Data Summary is not available except online.

Vulnerability Factor
- Human life is designated as the main priority in assessing vulnerability. Population Density and Special Facilities are assigned increased weighting in the calculation of Total Vulnerability Factor.
- Water treatment plants are a critical link in preserving viable living conditions and are also assigned increased weighting in the calculation of Total Vulnerability Factor.
The most populated counties in Kansas are the most vulnerable.

The overall Vulnerability Factor for land use considered four different usage classifications: Residential, commercial, agricultural, and other. The “other” category included open lands, forests, prairies, and unpopulated, underdeveloped areas. Residential property is given the highest rating, as its inherent population density would render it most vulnerable.

Vulnerability Factor for environment is calculated based solely on the area of surface water in each county.

Special Facilities are extremely vulnerable to hazardous materials accidents.

Sedgwick County has the highest total vulnerability factor while Anderson, Morris, and Ottawa Counties tied for the lowest total vulnerability factor.
Table 7.9 (3) Ford County, Kansas Vulnerability Factor Summary

<table>
<thead>
<tr>
<th>Vulnerable Target</th>
<th>County Vulnerability Factor</th>
<th>Statewide Mean Vulnerability Factor</th>
<th>Statewide Upper Vulnerability Factor</th>
<th>Statewide Lower Vulnerability Factor</th>
<th>County Ranking (105 Total Counties)</th>
<th>County Ranking Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population Density (VFPD)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.31</td>
<td>0</td>
<td>26th</td>
<td>Tied with 12 other counties</td>
</tr>
<tr>
<td>Environment (VFEN)</td>
<td>0.03</td>
<td>0.03</td>
<td>0.09</td>
<td>0</td>
<td>26th</td>
<td>Tied with 36 other counties</td>
</tr>
<tr>
<td>Land Use (VFUL)</td>
<td>0.09</td>
<td>0.05</td>
<td>0.09</td>
<td>0.01</td>
<td>1st</td>
<td>Tied with 3 other counties</td>
</tr>
<tr>
<td>Hospitals (VFHO)</td>
<td>0.01</td>
<td>0</td>
<td>0.08</td>
<td>0</td>
<td>7th</td>
<td>Tied with 13 other counties</td>
</tr>
<tr>
<td>Schools (VFSH)</td>
<td>0.01</td>
<td>0</td>
<td>0.07</td>
<td>0</td>
<td>5th</td>
<td>Tied with 15 other counties</td>
</tr>
<tr>
<td>Nursing Homes (VFNH)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.08</td>
<td>0</td>
<td>13th</td>
<td>Tied with 37 other counties</td>
</tr>
<tr>
<td>Stadiums (VFST)</td>
<td>0.00</td>
<td>0</td>
<td>0.02</td>
<td>0</td>
<td>3rd</td>
<td>Tied with 102 other counties</td>
</tr>
<tr>
<td>Prisons (VFPR)</td>
<td>0.00</td>
<td>0</td>
<td>0.05</td>
<td>0</td>
<td>9th</td>
<td>Tied with 96 other counties</td>
</tr>
<tr>
<td>Water Treatment (VFWT)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.2</td>
<td>0</td>
<td>17th</td>
<td>Tied with 23 other counties</td>
</tr>
<tr>
<td>Total (VFTOTAL)</td>
<td>0.15</td>
<td>0.12</td>
<td>0.37</td>
<td>0.01</td>
<td>13th</td>
<td>Tied with two other counties</td>
</tr>
</tbody>
</table>

Risk Index

- Wyandotte County registered the highest risk index and Elk County has the lowest risk index.
- Overall, risk index is greater in the eastern and southeastern portions of Kansas than in the western section of the state. This is primarily due to the presence of large industries in the eastern half of the state as well as a greater number of major transportation corridors and overall population density.
- Counties in the western half of Kansas register the majority of the lower end risk indexes.

Table 7.9 (4) Ford County, Kansas Risk Index Summary

<table>
<thead>
<tr>
<th>County Risk Index</th>
<th>Statewide Mean Risk Index</th>
<th>Statewide Upper Risk Index</th>
<th>Statewide Lower Risk Index</th>
<th>County Ranking (105 Total Counties)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.68</td>
<td>1.5</td>
<td>67.35</td>
<td>.01</td>
<td>12th</td>
</tr>
</tbody>
</table>

General

A KDOT source indicated that funding for a commodity flow study is being pursued. However, the study would likely be limited to major transportation routes and population centers.

Implementation of a limited, short term commodity flow study on a community or county wide basis would likely reveal only information relative to that particular time increment or “snapshot in time”. General, long-term trends would be difficult to extrapolate from the limited inventory of data that this type of study could provide. Commodity flow rates based on a short-term study could vary substantially from actual values based on the high probability of underestimation and overestimation.

A significant problem identified by the project team during research for the Project Final Report involved format inconsistencies in data collection and data recording procedures used to populate the two primary data bases reviewed during the investigation (1994 Spill Data Base (KDEM Spill & Response Report,
1994) and 1992 Fixed Facilities Data Base (KDHE Tier II reporting under Section 312 of Title III EPCRA)). As previously indicated, no common data (field) was available to correlate the two databases.

In-consistent or non-standardized data entry creates a major obstacle in correlating target information to geographic information systems (GIS) databases.

The application of an interface for GIS data is beneficial, if not critical, to the overall utility of a commodity flow study.

7.10 Charts and Comparisons

Total Risk Factor Comparison: Ford County and Top 10 Counties
Graphical representation of the relationship between the ten highest risk factor counties and the target county: Ford County, Kansas.

Total Risk Factors are plotted for each county (identified by county abbreviation) and are prioritized according to rank of risk factor in relation to the 105 counties in Kansas. Additionally, statewide baseline, upper, and lower control limit Total Risk Factor values are also plotted. Ford County had the 14th highest Total Risk Factor (11.39) out of 105 counties, significantly higher than the statewide mean value.

- Mean Total Risk Factor (average value of all counties) = 7.32
- High Total Risk Factor (high value of all counties) = 61.76
- Low Total Risk Factor (low value of all counties) = 0.69

Figure 7.10 (1)

Total Risk Factor Comparison: Ford County and Perimeter Counties
Graphical representation of the Total Risk Factor relationship between the perimeter counties and the target county: Ford County, Kansas.

Perimeter counties were selected based on the criteria of sharing a common border or being in relatively...
close proximity with the target county. Total Risk Factors are plotted for each county (identified by county abbreviation) and prioritized alphabetically. Additionally, statewide baseline, upper, and lower control limit Total Risk Factor values are also plotted. Along with Ford County, seven perimeter counties were assessed, and Ford County had the 2nd highest Total Risk Factor (11.39) of the perimeter counties.

- Mean Total Risk Factor (average value of perimeter counties) = 2.81
- High Total Risk Factor (high value of perimeter counties) = 14.43
- Low Total Risk Factor (low value of perimeter counties) = 1.52

**Figure 7.10 (2)**

**Total Vulnerability Factor Comparison: Ford County and Top 10 Counties**

Graphical representation of the relationship between the ten highest vulnerability factor counties and the target county: Ford County, Kansas.

Total Vulnerability Factors are plotted for each county (identified by county abbreviation) and are prioritized according to rank of vulnerability factor in relation to the 105 counties in Kansas. Additionally, statewide baseline, upper, and lower control limit Total Vulnerability Factor values are also plotted. Ford County had the 13th highest (0.15) Total Vulnerability Factor out of 105 counties, which is slightly above the statewide mean value.

- Mean Total Vulnerability Factor (average value of all counties) = 0.12
- High Total Vulnerability Factor (high value of all counties) = 0.57
- Low Total Vulnerability Factor (low value of all counties) = 0.06
Total Vulnerability Factor Comparison: Ford County and Perimeter Counties

Graphical representation of the Total Vulnerability Factor relationship between the perimeter counties and the target county: Ford County, Kansas.

Perimeter counties were selected based on the criteria of sharing a common border or being in relatively close proximity with the target county. Total Vulnerability Factors are plotted for each county (identified by county abbreviation) and prioritized alphabetically. Additionally, statewide baseline, upper, and lower control limit Total Vulnerability Factor values are also plotted. Along with Ford County, seven perimeter counties were assessed, and Ford County had the 2nd highest (0.15) Total Vulnerability Factor, which is significantly higher than the perimeter county mean value.

- Mean Total Vulnerability Factor (average value of perimeter counties) = 0.11
- High Total Vulnerability Factor (high value of perimeter counties) = 0.17
- Low Total Vulnerability Factor (low value of perimeter counties) = 0.08
**Risk Index Comparison: Ford County and Top 10 Counties**

Graphical representation of the relationship between the ten highest risk index counties and the target county: Ford County, Kansas.

Risk Indexes are plotted for each county (identified by county abbreviation) and are prioritized according to rank of risk index in relation to the 105 counties in Kansas. Additionally, statewide baseline, upper, and lower control limit Risk Index values are also plotted. Ford County had the 12th highest (1.68) Risk Index out of 105 counties, and it is above the statewide mean value.

- Mean Risk Index (average value of all counties) = 1.50
- High Risk index (high value of all counties) = 34.13
- Low Risk Index (low value of all counties) = 0.05
Risk Index Comparison: Ford County and Perimeter Counties

Graphical representation of the Risk Index relationship between the perimeter counties and the target county: Ford County, Kansas.

Perimeter counties were selected based on the criteria of sharing a common border or being in relatively close proximity with the target county. Risk Indexes are plotted for each county (identified by county abbreviation) and prioritized alphabetically. Additionally, statewide baseline, upper, and lower control limit Risk Index values are also plotted. Along with Ford County, seven perimeter counties were assessed, and Ford County had the 2nd highest (1.68) Risk Index, which is significantly higher than the perimeter county mean value.

- Mean Risk Index (average value of perimeter counties) = 0.84
- High Risk Index (high value of perimeter counties) = 2.47
- Low Risk Index (low value of perimeter counties) = 0.24
Figure 7.10 (6)

Risk Index Comparison
Ford County and Perimeter Counties

- (Ri)
- Mean
- High
- Low

County

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8.0 Civil / Societal Hazard Vulnerability

8.1 General Description and Definition
Civil Unrest/Disorder is a condition in society when people engage in several forms of disorder such as protest marches, sit-ins, riots, sabotage and other criminal activity. The underlying causes of civil disorder include general discontent among people, economic conditions, high unemployment and political scandal. When people turn to violence in response to political turmoil, government suppression, or perceived criminal activity by some organization or group, the resulting aggression is rarely well focused. The effects of civil unrest range from the shattered storefront of a downtown business following a racially charged court decision to the bombing of an American corporation's satellite office in Columbia.

The United States has a long history of civil disorders and civil unrest. Unlike other large-scale emergencies that unite communities, civil disorders tend to be divisive. Since the 1960’s, this division has been primarily along racial lines. These types of disorders have been classified as "communal" riots because they are direct conflicts between two or more ethnic groups. We have also seen "commodity riots" which stress the economic and political distribution of power among groups. Congressional Commissions in the 1960’s attempted to categorize civil disorders based on crowd size, the length of the violence, its intensity, and the level of force needed to restore order. With this information they established rankings of major, serious, and minor.

The last decade has also seen increased rioting and looting across the nation in response to community sports teams winning championships. Multiple Championships won by the Chicago Bulls in the early 1990’s instigated riots each year. The 1991 Championship was followed by 100 arrests. The 1992 Championship (occurring approximately one month after the Rodney King verdict) was followed by 1,000 arrests, hundreds of injuries (including 95 injured police officers), and many burned and looted buildings. These were not the first riots of this type, however. In 1990, seven people were killed in Detroit after the Pistons won the Championship and one person was killed in 1984 after the Tigers won the World Series.

8.2 Terrorism
Domestic Terrorism is the unlawful use, or threatened use, of force or violence by a group or individual based and operating entirely within the United States or Puerto Rico, and whose acts are directed at elements of the U.S. Government or its population, in the furtherance of political or social goals.

National Terrorism is the unlawful use of force or violence committed by a group or individual who has some connection to a foreign power or whose activities transcend national boundaries against persons or property, to intimidate or coerce a government, the civilian population, or a segment thereof, in furtherance of political or social objectives.

Terrorism trends have shifted from well organized, localized groups supported by state sponsors to loosely organized, international networks of terrorists bent on dismembering organizations, churches, cities, and nations. The terrorists of today are not under any one person or nation’s control and governance, but are associated with various local, national and international communities, religions, cults, and political affiliations.

Recent terrorist acts include the 1988 bombing of Pan Am Flight 103 over Lockerbie, Scotland, the 1993 bombing of the World Trade Center in New York City, the 1995 bombing of the Federal office building in Oklahoma City, and the 1996 bombing at the Atlanta Olympics. In 1995, a militia group committed a series of domestic terrorist acts and bank robberies in Spokane, Washington to bring attention to their cause and finance their militia activities.
8.3 The Nature of Riots

A riot may be defined as an unlawful assembly (several people who intend to unite for confrontation) that has developed to a stage of violence. Blacks Law Dictionary defines riot as a “public disturbance involving (1) an act or acts of violence by one or more persons part of an assemblage of three or more persons, which act or acts shall constitute a clear and present danger of, or shall result in, damage to property of any other person or to the person of any other individual, or (2) a threat of threats of the commission of an act or act of violence…would constitute a clear and present danger of, or would result in, damage or injury to the property of any other person or to the person of any other individual” (Black 1990).

In general, riots are formed in several distinct stages. The first stage occurs when a group of people is moved to commit acts of civil disorder. In the second stage, other individuals with no interest in the issue join the action to take advantage of an opportunity to loot and destroy property. The third stage occurs when organized youth gangs join the disturbance and take it to their communities. Actions can range from looting to ambush and sniper attacks directed against police and fire personnel. At times, youth gangs will design diversionary tactics such as fires to distract police from the intended target(s). Given these distinct stages in the development of a riot, police and fire agencies must be prepared to respond quickly, with adequate equipment, tactical plans, and sufficient personnel to control potential civil unrest (FEMA/USFA, FA-142, 1994).

Since the end of the Cold War, and further integration of the United States into the global market, the country’s role in the world as a leader in economics, defense, and social trends compels the current administration to address national security issues including foreign and domestic terrorism. The federal government has realized the importance of planning at the state and local levels because local emergency responders are typically the first to respond to terrorist incidents.

In 2001, the World Trade center buildings in New York City were destroyed by terrorists creating a major change in government policy and the creation of the Homeland Security Department. As part of this reorganization, the ODP was placed under the jurisdiction of the Homeland Security Department. In 1999, the ODP developed and conducted the State Homeland Security Assessment and Strategy to identify potential Threats, Vulnerabilities, Capabilities, and Needs, specific to domestic and/or international terrorism at the local level of government. The Needs Assessment segment of the program identified current and projected Organizational, Planning, Equipment, Training and Exercise needs at the local (county) level to prepare, respond, and recover from an incident involving weapons of mass destruction (WMD).

8.4 Civil/Societal Vulnerability Summary

In the future, Ford County could be vulnerable to civil unrest and terrorist activities because several casinos are in the planning stages and other potential targets are present. However, the county is fortunate when compared to other potential high profile “target” areas in the country. With business and economics (education & healthcare, service, and manufacturing) that span throughout this region, it is easy to see how Ford County could be a potential target for terrorists. Threats to the commercial livestock industry are a major concern in the State of Kansas, and this problem is a concern for Ford County. The disruption of food production and distribution affects all areas of Kansas and beyond.

Kansas as a whole does not have an extensive history of civil disorder other than wartime periods. History indicates civil violence is typically focused on property rather than people, but this pattern may change. The County Emergency Coordinator reported that civil unrest and/or terrorist type activities have not been an issue in Ford County over the past 10 years.
8.5 Homeland Security Assessment
In the winter of 2003, the ODP assessment was updated. Pertinent data from this assessment is summarized as follows:

(1) Facilities and Infrastructure
Potential terrorist targets in Ford County were assigned ratings as part of the ODP vulnerability assessment based on several factors including accessibility to the target, level of visibility, criticality of target, potential threat hazard (presence of WMD materials), and population capacity. There are facilities and businesses in Ford County that if attacked would have negative repercussions for the county, state and region (See table 8E (1)). The ratings of potential targets are not presented in this analysis due to the sensitive nature of this subject.

(2) Hazard Rating: Probability and Impact
The ODP Assessment for Ford County was completed by the following participating agencies:

- City Police
- Sheriff
- County Public Works
- City Public Works
- City Fire Department
- County Fire Department
- Communications
- Health Care
- EMS

Two Potential Threat Elements (PTE’s) were identified within Ford County. A PTE is “any group or individual in which there are allegations or information indicating a possibility of the unlawful use of force or violence, specifically the utilization of a WMD against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of a specific motivation or goal, possibly political or social in nature.” The coordinated effort to identify PTE’s in the county has helped form the basis for planning, responding, and recovering from potential WMD threats. Additionally, this knowledge has provided law enforcement with the ability to plan, monitor, and develop contingencies in the event of an emergency. Known threats are currently under surveillance through a coordinated effort between local, county, state and federal law enforcement officials.
Table 8.5 (1)-Potential Targets in Ford County

<table>
<thead>
<tr>
<th>#</th>
<th>Potential Target</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Ford County Government Center</td>
</tr>
<tr>
<td>2</td>
<td>Ford County Courthouse</td>
</tr>
<tr>
<td>3</td>
<td>Aquila</td>
</tr>
<tr>
<td>4</td>
<td>Dodge City Cooperative Elevator #3</td>
</tr>
<tr>
<td>5</td>
<td>Excel Corp</td>
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<tr>
<td>6</td>
<td>Koch Nitrogen</td>
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<tr>
<td>7</td>
<td>National Beef</td>
</tr>
<tr>
<td>8</td>
<td>Western Plains Medical Complex</td>
</tr>
<tr>
<td>9</td>
<td>Feeder I</td>
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<tr>
<td>10</td>
<td>Feeder II</td>
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<td>11</td>
<td>Feeder III</td>
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<td>12</td>
<td>Feeder IV</td>
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<td>13</td>
<td>Feeder V</td>
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<tr>
<td>14</td>
<td>Auction I</td>
</tr>
<tr>
<td>15</td>
<td>Auction II</td>
</tr>
<tr>
<td>16</td>
<td>Elevator I</td>
</tr>
<tr>
<td>17</td>
<td>Elevator II</td>
</tr>
</tbody>
</table>

(3) Risk Rating

Two PTE's were identified in Ford County during the 2003 ODP Assessment. The number of PTE’s in Ford County is very low compared with other counties in the State with large population centers. Each PTE was rated based on five indicators; (1) existence, (2) violent history, (3) intentions, (4) WMD capability, and (5) targeting. The maximum threat rating for each PTE is defined by a rating scale based on 1 (lowest) to 10 (highest). The threat level for the both identified PTE's were rated at one (1), indicating Ford County has a relatively low threat and potential risk of civil unrest and/or terrorist activities. Among the chemical, biological, radioactive, nuclear, or explosive (CBRNE) threats to Ford County, no one type was indicated as the number one threat in the local law enforcement’s ODP assessment report for Ford County.

Table 8.5.(2) - Summary of County ODP Assessment

| Number of Potential Threat Elements (PTEs) | 2 |
| Number of Legal Hazardous Sites           | 18 |
| Potential Targets                         | 17 |
| Number One CBRNE Threat                   | None Identified |
9.0 Vector Hazard Vulnerability

9.1 General Description and Definition
Vector-based hazards have become an "emerging" threat to the state and its citizens. Insects, infectious diseases, and naturally occurring biological agents can pose a direct or indirect hazard to humans, livestock, and the state's economy.

Numerous definitions for “vector” have been proposed, and vary with the nature and focus of the specific discipline of research such as epidemiology, public health, mathematics, and most recently – Emergency Management. This section will focus primarily on Emergency Management’s role with infectious Foreign Animal Disease (FAD), biological agents, and/or by-products utilized to create WMD, which could otherwise require an emergency response.

Other forms of disease and biological/chemical agents are causes for concern. However, authority and response to these potential health issues resides with agencies and disciplines such as the Food and Drug Administration (FDA), Center for Disease Control (CDC), and Public Health Departments, and therefore will only be mentioned in this section. Emergency Management roles and responsibilities will likely change with time requiring refinement and expansion of response for this discipline.

9.2 Agricultural and Ecological
Potential threats to U.S. agriculture and livestock can arise from a variety of pathogens and causative agents. Terrorist attacks against agricultural assets might be tempting, due to the perceived relative ease of attack, the plausible deniability toward accusations, and the limited number of plant seed varieties in use. Highly infectious naturally-occurring plant and animal pathogens exist outside the U.S. borders, and some agents are readily transported, inadvertently or intentionally, with little risk of detection.

Nature has already shown how easy it might be for a sophisticated, technically informed state, group, or individual to attack crops and livestock by introducing a new parasite, predator, or disease. There are a host of “rusts” and “smuts” that can attack grain crops, as evidenced by past naturally-occurring events in the U.S.

The list of threats to livestock is substantial. They include, but are not limited to, foreign animal animal disease (FAD), which include diseases such as foot and mouth disease (FMD), vesicular stomatitis, Bovine spongiform encephalopathy (BSE), rinderpest, gibberella, African swine fever, highly pathogenic avian influenza, Rift Valley fever, lumpy skin disease, blue tongue, sheep and goat pox, swine vesicular disease, contagious bovine pleuropneumonia, Newcastle disease, African horse sickness, and classical swine fever.

9.3 Foreign Animal Disease (FAD)
Animal health officials define an exotic or FAD as an important transmissible livestock or poultry disease believed to be absent from the United States and its territories, and capable of generating potential significant health or economic impact.

FMD, anthrax, BSE, rinderpest, and swine fever are potential ways to attack livestock.

The following are brief explanations of some of the major animal diseases.

1. Foot and Mouth Disease
Although FMD is not a true “vector” disease, it is highly transmissible, and of great concern for the agricultural communities in the U.S. The State of Kansas considers foot and mouth disease to be the
number one foreign animal disease threat to the state. The disease is highly contagious and may spread over great distances with movement of infected or contaminated animals, products, objects, and people. A good example was the recent outbreak of the disease in Europe that caused widespread concern over the safety of the continent's meat supply, and the fear of possible infection of humans. Federal, State and Local officials, including the emergency services community are developing plans and procedures for handling incidents involving foreign animal diseases and similar vector-based threats.

FMD is persistent and difficult disease to control in cattle, domestic sheep and swine. It also affects other cloven-hoofed mammals including wild sheep, goats, deer and pigs. Should an outbreak occur anywhere in the United States, routine livestock movements could rapidly spread the disease to all sections of the country making early detection, combined with immediate eradication of affected animals, crucial for controlling the disease. Left unchecked, the economic impact of FMD could reach billions of dollars in the first year. Deer and other wildlife populations would likely become infected and would be a source for re-infection of livestock. The virus does not infect horses, mules, and burros. People can be infected through skin wounds or the oral mucosa by handling diseased stock, the virus in the laboratory, or by drinking infected milk, but not by eating meat from infected animals. The human infection is temporary and mild. FMD is not considered a public health problem, but people can spread the disease to animals.

Animals such as rodents and birds may also transmit the virus mechanically. These animals do not become infected with the virus, but experimental studies have shown that the virus can survive for a short time on their bodies (up to 91 hours on the feathers of live birds). Experimental studies also demonstrate that the virus could pass unaltered through bird digestive systems. These findings suggest that these animals may facilitate the spread of the virus for a short time and distance from an outbreak.

Domestic animals, wildlife, people, or materials that bring the virus into physical contact with susceptible animals can spread FMD. This can occur when susceptible animals drink from a common source of contaminated water, when animals carrying the virus are introduced into susceptible herds, when susceptible animals are exposed to materials such as hay or other feedstuffs contaminated with the virus, when people wearing contaminated clothes or footwear or using contaminated equipment (including vehicles) pass the virus to susceptible animals, and when raw or improperly cooked garbage containing infected meat or animal products are fed to susceptible animals.

For the above mentioned reasons, animal transportation becomes a critical aspect for transmission of the disease. It is important to note the three main transportation issues in the county: (1) livestock is routinely transported into the county from other counties or states; (2) transported out of the county to other counties or states; and (3) many times livestock is just traveling through the county bound for other destinations. Any or all of these scenarios can import or export the spread of FMD with great speed. For this reason, it is important for emergency management to plan for this type of event, whether caused by man or nature.

2. Anthrax
Anthrax is an acute infectious disease caused by the spore-forming bacterium Bacillus anthracis. Anthrax most commonly occurs in wild and domestic lower vertebrates (cattle, sheep, goats, camels, antelopes, and other herbivores), but it can also occur in humans when they are exposed to infected animals or tissue from infected animals.

Anthrax infection can occur in three forms: cutaneous (skin), inhalation, and gastrointestinal. B. anthracis spores can live in the soil for many years, and humans can become infected with anthrax by handling products from infected animals or by inhaling anthrax spores from contaminated animal products. Anthrax can also be spread by eating undercooked meat from infected animals. It is rare to find infected
animals in the United States.

Direct person-to-person spread of anthrax is extremely unlikely to occur. Communicability is not a concern in managing or visiting with patients with inhalational anthrax.

3. BSE

BSE, unfortunately labeled "mad cow disease," is a chronic, afebrile, degenerative disease affecting the central nervous system (CNS) of cattle.

Bovine spongiform encephalopathy belongs to the family of diseases known as the transmissible spongiform encephalopathies (TSE's). These diseases are caused by a transmissible agent that is yet to be fully characterized. They share the following common characteristics: a prolonged incubation period of months or years; a progressive debilitating neurological illness that is always fatal; when examined by electron microscopy, detergent-treated extracts of brain tissue from animals or humans affected by these diseases reveal the presence of scrapie-associated fibrils (SAF’s); pathological changes appear to be confined to the CNS and include vacuolation and astrocytosis; the transmissible agent elicits no detectable specific immune response in the host.

Specific types of TSE's include scrapie, which affects sheep and goats; transmissible mink encephalopathy; feline spongiform encephalopathy; chronic wasting disease of deer and elk; and five rare diseases in humans: kuru, Creutzfeldt-Jakob disease (CJD), Gerstmann-Sträussler-Scheinker syndrome, fatal familial insomnia (FFI), and new variant Creutzfeldt-Jakob disease (nvCJD).

4. Rinderpest

Rinderpest (RP) is a contagious viral disease of cattle, domestic buffalo, and some species of wildlife. It is characterized by fever, oral erosions, diarrhea, lymphoid necrosis, and high mortality.

Rinderpest virus (RPV) is a single-stranded RNA virus in the family Paramyxoviridae, genus Morbillivirus. It is immunologically related to canine distemper virus, human measles virus, peste des petits ruminants virus, and marine mammal morbillviruses. There is only one serotype of rinderpest virus, but field strains vary widely in virulence, ease of transmission, and host affinity.

5. Swine Fever

Hog cholera (HC) is a highly contagious viral disease of swine that occurs in an acute, a subacute, a chronic, or a persistent form. In the acute form, the disease is characterized by high fever, severe depression, multiple superficial and internal hemorrhages, and high morbidity and mortality. In the chronic form, the signs of depression, anorexia, and fever are less severe than in the acute form, and recovery is occasionally seen in mature animals. Transplacental infection with viral strains of low virulence often results in persistently infected piglets, which constitute a major cause of virus dissemination to noninfected farms.

9.4 Insect-borne Diseases in Kansas

Traditionally in medicine, a vector is “an organism that does not cause disease itself but which spreads infection by conveying pathogens from one host to another”. Species of mosquito, for example, serve as vectors for the disease-causing West Nile Virus; which insects may ingest by feeding from an infected bird and regurgitate into a human, infecting him or her. This sense of "biological vector" is the primary one in epidemiology and in common speech.

Vector-borne diseases that have been diagnosed in Kansas include St. Louis Encephalitis, Western Equine Encephalitis, Colorado Tick Fever, Rocky Mountain Spotted Fever, Lyme Disease, Tularemia, Rabies, and Plague.
As long as vectors are present in the state, the potential for recurring disease exists. A number of factors influence this potential including historical occurrence, time of year, vector habitat availability and incident of human exposure. The following summary of vector hazards identifies some of these health issues that exist in Kansas.

**West Nile Virus**
West Nile Virus (WNV) is one of several mosquito-borne viruses in the United States that can infect people. The virus exists in nature primarily through a transmission cycle involving mosquitoes and birds. Mosquitoes become infected with WNV when they feed on infected birds.

Mosquitoes that acquire the virus from infected birds transmit West Nile. While humans and horses may be infected by the virus, there is no documentation that infected horses can spread the virus to uninfected horses or other animals. It is believed that migrating birds may play a role in spreading the disease. Mosquito-borne diseases, like West Nile Virus, are not new to Kansas. Kansas's climate and prolific mosquito population make the state conducive to a number of mosquito-borne diseases (Eastern Equine Encephalitis, Yellow Fever, West Nile Virus, etc., have already been identified in the state).

**St. Louis Encephalitis**
St. Louis encephalitis is contracted by the bite of a mosquito (primarily the Culex species) that becomes infected with St. Louis encephalitis virus (a flavivirus antigenically related to Japanese encephalitis virus). Feeding on birds infected with the St. Louis encephalitis virus infects mosquitoes. Infected mosquitoes then transmit the St. Louis encephalitis virus to humans and animals during the feeding process. The St. Louis encephalitis virus grows both in the infected mosquito and the infected bird, but does not make either one sick.

**Tularemia**
Tularemia is caused by the gram-negative coccobacillus Francisella tularensis. Known also as "rabbit fever" and "deer fly fever," tularemia was first described in the United States in 1911 and has been reported from all states except Hawaii. Tularemia was removed from the list of nationally notifiable diseases in 1994, but increased concern about potential use of F. tularensis as a biological weapon led to its reinstatement in 2000.

In the United States, most persons with tularemia acquire the infection from arthropod bites, particularly tick bites, or from contact with infected mammals, particularly rabbits. Outbreaks of tularemia in the United States have been associated with muskrat handling, tick bites, deerfly bites, and lawn mowing or cutting brush. Sporadic cases in the United States have been associated with contaminated drinking water and various laboratory exposures. Outbreaks of pneumonic tularemia, particularly in low-incidence areas, should prompt consideration of bioterrorism.

**Lyme Disease**
The Lone Star tick, the American dog tick, the brown dog tick, and the blacklegged tick or deer tick frequent Oklahoma and Kansas. Most ticks are capable of transmitting a variety of diseases, including Rocky Mountain Spotted Fever, Colorado Tick Fever, Lyme Disease, and even Tularemia.

Lyme disease, which is characterized by a skin rash, headache and fever, is not fatal. From 20 to 30 cases per year are reported in Doniphan. The majority of cases occur in the eastern one-third of the state. Exposure is exclusively through the bites of certain tick species in or within a mile or so of wooded streambeds or lakeshores. Early diagnosis is difficult and seldom certain, but early treatment is crucial to full recovery. Warmer temperatures could increase the incidence of Lyme disease and other tick-borne diseases in Kansas, because populations of ticks, and their rodent hosts, could increase under warmer temperatures and increased vegetation.

**Rocky Mountain Spotted Fever**
Rocky Mountain spotted fever (RMSF) is the most common rickettsial infection and the second most
commonly reported tick-borne disease in the United States.

The causative agent is Rickettsia rickettsii, a member of the spotted fever groups of rickettsial infections. RMSF was first described in the late 1800s in the Bitterroot Valley of Idaho. For several decades, it was thought to be limited to the Rocky Mountain area; however, it now has a higher documented prevalence in the eastern United States.

RMSF has been reported in almost every state in the continental United States, with an average annual incidence of approximately 3 per one million populations. States reporting the highest rate of disease are Oklahoma, North Carolina, Arkansas, Missouri, and Kansas. The term Rocky Mountain spotted fever is a misnomer because it is relatively rare in the Rocky Mountain States. Most cases (90%) occur between the months of April and September, the time of the year when ticks have maximal activity and people participate in outdoor recreational activities.

**Colorado Tick Fever**

Colorado Tick Fever is also called mountain tick fever; mountain fever; and American mountain fever. Colorado tick fever is an acute viral infection transmitted by the bite of the tick Dermacentor Andersoni. This disease is limited to the western US and is most prevalent from March to September, with the highest numbers of infections occurring in May and June.

Symptoms start about 3 to 6 days after the tick bite. Symptoms of fever continue for 3 days, stop, then recur 1 to 3 days later for another few days. Risk factors are recent outdoor activity and recent tick bite. The incidence is high in Colorado, where up to 15% of regular campers show past exposure (based on antibodies). It is much less common in the rest of the US.

**9.5 Biological Weapons Threats**

The CDC published a Special Issue report titled Potential Biological Weapons Threats in the Emerging Infectious Diseases Digest, Volume 5, July-August, 1999, written by Mark G. Kortepeter and Gerald W. Parker, U.S. Army Medical Research Institute of Infectious Diseases, Fort Detrick, Maryland, USA. The following text is excerpted from this report.

**Excerpts**

The use of biological weapons has occurred sporadically for centuries, culminating in sophisticated research and testing programs run by several countries. Biological weapons proliferation is a serious problem that is increasing the probability of a serious bioterrorism incident... Of the seven countries listed by the U.S. Department of State as sponsoring international terrorism, at least five are suspected to have biological warfare programs. There is no evidence at this time, however, that any state has provided biological weapons expertise to a terrorist organization.

A wide range of groups or individuals might use biological agents as instruments of terror. At the most dangerous end of the spectrum are large organizations that are well-funded and possibly state-supported. They would be expected to cause the greatest harm, because of their access to scientific expertise, biological agents, and most importantly, dissemination technology, including the capability to produce refined dry agent, deliverable in milled particles of the proper size for aerosol dissemination... On this end of the spectrum, the list of biological agents available to cause mass casualties is small and would probably include one of the classic biological agents. The probability of occurrence is low; however, the consequences of a possible successful attack are serious.

Smaller, less sophisticated organizations may or may not have the intent to kill but may use biological pathogens to further their specific goals... Rather than having a sophisticated research program, these organizations could use biological pathogens that are readily available.
The third type is smaller groups or individuals who may have very limited targets (e.g., individuals or buildings) and are using biological pathogens in murder plots or to threaten havoc. The recent anthrax hoaxes are examples of this. Many biological agents could be used in such instances and the likelihood of their occurrence is high, but the public health consequences would be low.

Modern biological weapons offer many potential advantages to terrorist groups. They employ living agents or toxins produced by natural or synthetic agents to kill or injure humans, domestic animals, and crops. There are a wide range of agents with many different effects and they offer a wide range of ways to attack citizens, crops, and livestock. These types of weapons also create massive psychological and physiological consequences.

Such weapons fall into five main medical categories: bacterial agents (anthrax, plague, brucellosis, and typhoid fever); rickettsial agents (typhus, Rocky Mountain spotted fever, and Q fever); viral agents (smallpox, influenza, yellow fever, encephalitis, dengue fever, chikungunya, Rift Valley fever, and hemorrhagic fevers like Ebola, Marburg, and Lassa); toxins (botulism, staphylococcus enterotoxin, shigella toxin, and aflatoxin); and fungal (coccidiodomyocosis).

The CDC categorizes these biological agents into three main categories according to lethality (A, B, and C). Category A are high priority agents because the organisms can be easily disseminated or transmitted person-to-person; cause high mortality, with potential for major public health impact; might cause public panic and social disruption; and require special action for health preparedness. Category B agents include biological weapons that are moderately easy to disseminate, cause moderate morbidity and low mortality, and require specific enhancements of CDC’s diagnostic capabilities. Category C agents include emerging pathogens that could be engineered for mass dissemination in the future because of their availability, ease of production or dissemination and potential for high morbidity and mortality and major health impact.

**Category A**
- variola major (smallpox)
- Bacillus anthracis (anthrax)
- Yersinia pestis (plague)
- Clostridium botulinum toxin (botulism)
- Francisella tularensis (tularaemia)
- Filoviruses (Ebola / marbola hemorrhagic fever)
- Arenaviruses (lassa, Junin, and related diseases)

**Category B**
- Coxiella burnetti (Q Fever)
- Brucella species (brucellosis)
- Burkholderia mallei (glanders)
- Alphaviruses (Venezuelan encephalomyelitis, eastern/western equine encephalomyelitis)
- Ricin toxin from Ricinus communis (castor beans)
- Epsilon toxin of Clostridium perfringens
- Staphylococcus enterotoxin B

**Category C**
- Nipah virus
- Hanta viruses
- Tick-borne hemorrhagic fever viruses
- Tick-borne encephalitis viruses
- Yellow fever
Multi-drug resistant tuberculosis

It should be noted that none of these lists include biological weapons directed at livestock or food groups, or the use of “eco-weapons” such as introducing new strains of agricultural disease or new plants, animals, and insects that could exploit vulnerabilities in the ecological balance of the U.S.

As stated earlier in this Section, vector disease and/or biological/chemical weapons created from variants of the agents mentioned in this report are important to understand, but are not the primary responsibility of emergency management as first responder. Authority and response to these potential health issues resides with agencies and disciplines such as the FDA, CDC, and Public Health Departments, where emergency management may serve in a coordination role, but would not be directly responsible for response and recovery.

9.6 Summary of Vector Hazards

There is a growing body of expert and official opinion, especially in the United States, that the threat of non-state violence involving WMD is becoming one of the most serious security challenges of the modern era.

Federal and state officials understand local-level resources will be the first to respond to any emergency situation and have acknowledged the fact that local planning and preparation, even if resources are exhausted quickly, will play a major role in mitigating an attack or outbreak of an animal disease. Research suggests the best approach is to broaden the prevention, response and recovery spectrum for emergency operations planning to include all hazards, with the understanding that limited resources and funding at the local level will require quick evaluation of an event in order to efficiently respond to the emergency and to obtain state and federal assistance in a timely fashion.

Local Emergency Response

It is important to note that state, federal and local agencies are working diligently to address the risks associated with the nation’s agriculture industry. County emergency management coordinators are being urged to pursue countywide FAD planning activities to help identify their county’s assets, liabilities and available resources. These pre-planning activities will help to solidify a coordinated response when dealing with a FAD event.

Emergency Management’s role, when dealing with a FAD event, will continue to evolve as local, state, and federal agencies unveil more specific information regarding preparedness, response, recovery, and mitigation expectations.

The role of emergency management will continue to be fine tuned for prevention, response, and recovery activities involving a FAD event to provide the resource support needed to effectively and efficiently deal with the disease onset and lifespan. A comprehensive FAD Annex should be developed to ensure the safety of personnel (industrial hygiene), property (public and private) and infrastructure (natural and economic resources) are protected.

The Local Emergency Operations Plan and the emergency manager’s role in implementing the LEOP will be critical in responding to, supporting, and coordinating the supply and demands associated with a disaster event.
10.0 Special Populations and Sites

10.1 General Description and Definition
The hazard analysis identifies what is susceptible to damage should a hazardous incident occur. The extent of damage to persons, property, and the environment is influenced in part by the sizes and types of sensitive/special needs populations and sites that are present within the jurisdiction. Some special populations and/or sites within Ford County could include hospitals, schools, disabled care facilities, senior care facilities, youth care facilities, commercial livestock operations, endangered species, wetlands, and historic sites.

10.2 Special Needs Human Populations
Special needs populations are defined as groups whose needs may not be fully addressed by traditional service providers or who feel they may not comfortably or safely access and use the standard resources offered in disaster preparedness, response, relief, and recovery. Local emergency operations planning for special needs populations has become a "hot button" issue in the past few years. As such, the county should remain active in identifying special population groups.

In the event of a hazardous incident, special human populations (hospitals, schools, disabled care facilities, senior care facilities, youth care facilities, prisons, etc.) that may lie within the vulnerable radius of an event may be subject to increased risk due to proximity. A combination of these factors could pose significant limitations when planning response actions in a hazardous event.

Additionally, facilities serving special human populations may be subject to additional operational stress when needed for emergency response support, or when marshaled as a contingency resource. The projected impact of a hazardous incident on special human populations is addressed for specific cases in Section 7.0-Technological Hazards Vulnerability. A directory of facilities, identified during the Hazard Analysis process, serving special human populations is provided in the Resources Section - Contingency Resources.

Local emergency management should coordinate and work with the public and private sectors to ensure each facility has planned for protective actions for their specific special needs groups, and include contingencies for assistance in the time of emergency or disaster.

10.3 Commercial Livestock Operations
According to the Kansas Department of Agriculture (KDA) and the USDA, approximately 178,800 head of cattle were located in Ford County on January 1, 2008, ranking the county 6th in the state for livestock inventory. Cattle and calve inventory value on January 1, 2008 was estimated to be $155,560,000, ranking Ford County 6th in the state. Swine, sheep, and poultry inventory numbers were not available from the KDA/USDA.

The Kansas Livestock Association (KLA) identified three member-feedlots located in the county: Boot Hill Feeders, Inc., Ford County Feed Yard, Inc., and Wilroads Feed Yard. Ford County is located within Region D of the KLA's statewide organization of livestock feeding operations. KLA Region D has a documented feedlot capacity for 439,400 head of cattle at 18 member feedlots.

Stock-raising in Ford County is also done on privately-owned farms and ranches. Review of the KDHE Confined Animal Feeding Operations (CAFO) database in 2008 indicated that there was a licensing potential of 208,998 head of cattle, swine, and dairy livestock in Ford County.

Review of the U.S. Environmental Protection Agency (USEPA) database regarding discharge permits to
local waters (National Pollutant Discharge Elimination System {NPDES}) identified 19 beef cattle feedlots, one dairy farm, one meat packing plant, and two truck washes in possession of NPDES permits in Ford County.

Based on the livestock operations conducted in the county, Ford County could face an increased vulnerability to livestock disease and agro-movement issues due to the large numbers of livestock present and transported through the county. In effect, the presence of feeding operations and livestock become the source of a hazard as well as an area of vulnerability. Livestock are routinely transported on Ford County roadways from producers to feedlots to packing plants.

Vulnerability of commercial livestock is a critical issue faced by Ford County, the State of Kansas and the country. The impact of an affected feedlot has monetary significance but the long-term impact of disposal is a growing issue in the regulatory community. Identification and diligent monitoring of feeding operations, as well as routine interaction with Kansas Livestock Commission officials to develop mitigation and response plans, may serve to lessen the vulnerability presented by this hazard.

The Ford County KDHE CAFO Table is included in the Resources Section.

10.4 Flora and Fauna (endangered species)
Statewide, Kansas has 16 listings in the U.S. Fish and Wildlife Service’s Threatened and Endangered Species System. The listings include 13 animals and 3 plants. Kansas Wildlife and Parks lists the following threatened and endangered species known or likely to occur in Ford County, Kansas.

<table>
<thead>
<tr>
<th>Species</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Burying Beetle</td>
<td>Threatened</td>
</tr>
<tr>
<td>Bald Eagle</td>
<td>Threatened</td>
</tr>
<tr>
<td>Eastern Spotted Skunk</td>
<td>Threatened</td>
</tr>
<tr>
<td>Least Tern</td>
<td>Endangered</td>
</tr>
<tr>
<td>Longnose Snake</td>
<td>Threatened</td>
</tr>
<tr>
<td>Peregrine Falcon</td>
<td>Endangered</td>
</tr>
<tr>
<td>Piping Plover</td>
<td>Threatened</td>
</tr>
<tr>
<td>Snowy Plover</td>
<td>Threatened</td>
</tr>
<tr>
<td>Whooping Crane</td>
<td>Endangered</td>
</tr>
</tbody>
</table>

10.5 Wetlands and Sensitive Groundwater Areas
Portions of the Upper Arkansas River drainage basin and the Cimarron River drainage basin are designated as sensitive groundwater areas in Ford County. As such, these areas may be considered vulnerable and susceptible to environmental impact.

The areas designated as Sensitive Groundwater Areas in Ford County are depicted in the Resources Section, Maps.

Two large playa lakes are located in the county: Stein and Herron. Stein is 117 acres and is located at longitude 99°48'29.95" W; latitude 37°50'50.01" N. Herron is 700 acres and is located at longitude 99°45'39.28" W, latitude 37°47'33.85". Both are run by the Kansas Department of Wildlife and Parks.
10.6 Historic Sites
A listing of historic sites within Ford County is provided below, and also included in the Resources Section.

Link to Historic Sites Excel file is not available except online.
11.0 Cascading Hazards

11.1 General Description & Definition
The concept of “cascading hazards” relates to the propensity of a primary or source hazard to spawn or generate additional hazards, better known as cascading hazards. On the first cascade level, primary hazards can bring about secondary hazards. Subsequently, secondary hazards may escalate into tertiary hazards and so forth. The extent of cascading hazards is potentially limitless.

11.2 Cascading Hazards Matrix
The Cascading Hazards Matrix is a table depicting the interrelationship between primary/source hazards and secondary cascade hazards. The table lists the four major classifications of hazards, their sub-classifications, and the corresponding individual hazards. The classifications are presented both vertically and horizontally to form the guiding axis of the array. Potential primary/source hazards are listed vertically. Potential secondary cascade hazards are listed horizontally. Secondary cascade hazards are identified in the matrix table by a letter abbreviation and color corresponding to the primary hazard classification.

Additional hazards arising from a secondary cascade hazard are entirely possible. They are identified by locating the corresponding secondary cascade hazard in the primary/source hazard column and then reading across horizontally. Cascading hazards for tertiary levels are determined in similar fashion.

11.3 Cascade Expectancy
The matrix data is summarized at the end of the Hazards Matrix and is identified as the Cascade Expectancy. This table provides the total potential events (number) by classification. Additionally, the data is presented as a percent of the total number of potential hazards and cascading events that could occur in the county.

Cascade Expectancy is a quantitative summary (by primary hazard classifications) of the secondary cascade hazards anticipated to spawn from a primary source hazard classification. It provides a relative assessment of the volume of secondary cascade hazards.

The Cascading Hazards Matrix is not available except online.
12.0 Observations

12.1 Introduction
The hazard analysis should be used as the support for the county LEOP and may be utilized as a reference to support emergency planning, mitigation, and response initiatives. The analysis is intended to be a dynamic tool and the basis for future planning and decisions necessary to support, produce, and enhance other assessments that are required by regulation. The “Resources Section” in this Hazard Analysis should be reviewed in conjunction with the narrative report in order to gain a more in-depth understanding of the pertinent issues.

Documentation contained in the hazard analysis can be used to provide support for the following:
- Mitigation plans
- Zoning regulations
- Compliance with Tier II registry requirements
- Monitoring hazardous chemical facilities and sites
- Insurance coverage
- Building sites
- Security
- Evacuation routes
- Management of transportation and utility infrastructures

12.2 Plan Maintenance
Observations and recommendations provided in the following tables for “all hazards” planning reflect present conditions and circumstances. Risk Ratings and Vulnerability Assessments should be updated on a periodic basis, similar to the routine maintenance of equipment or periodic review of processes and procedures in an operational environment. Some risk assessment factors, such as the Tier II data, must be updated on an annual basis. Other risk assessment factors, such as natural events data, may be updated on a less frequent basis.

12.3 Follow-up
Some of the entries listed in the table are provided for follow-up purposes. Some of the follow-up sites are included because there appears to be a lack of Tier II information from one reporting year to the next. Other sites observed during the fieldwork may have gaps or anomalies that could not be readily reconciled during the assessment period. In some cases, the consultant encountered data failure or the absence of credible information. Additional issues have been identified that in the opinion of the consultant, could influence the vulnerability and risk of a facility, or the overall approach to hazard management.

County emergency planners should attempt to satisfy any discrepancies or gaps in the information associated with these entries over the next year and determine their operational status, hazardous material inventories, and other characteristics that influence risk and vulnerability ratings. Follow up calls, research, and site visits can be used to satisfy any concerns and expectations. Any significant findings discovered during the follow up process should be included in the hazard analysis for future reference.

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Location</th>
<th>Comment / Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spills Database List Facilities</td>
<td>Throughout Ford County</td>
<td>The following facilities were identified on the historical KDHE/KCC/NRC combined spills list, but there were no records for these facilities for the 2007 Tier II or AST/UST reporting period. We recommend that follow-up research be conducted to determine if these facilities are...</td>
</tr>
<tr>
<td></td>
<td>City / County / State Facilities</td>
<td>Throughout Ford County</td>
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<td>2</td>
<td>It was noted during the Tier II and AST/UST data entry that there were three submitters for city/county/state facilities located in the county: City of Dodge City, Ford County, and KDOT Construction/Maintenance. Although city/county/state facilities may not be required to submit Tier II information for materials stored on-site, the county EM may initiate measures to collect chemical information for these entities for inclusion in their chemical hazard inventory.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>E-Fm observed numerous facilities during the county drive-through that were not included in the Tier II reporting or UST/AST databases. Recommend follow-up to determine whether non-submitting Owner/Operators located throughout the county have sufficient quantities of chemicals that require Tier II or UST/AST database reporting. If necessary, the KDHE can assist the County EM with notifying Owner/Operators regarding reporting requirements. Observed facilities included: AIRGAS GAS, WELDING AND SAFETY PRODUCTS • BNSF RAILROAD • CASE IMPLEMENT • CHESTERLINE FEEDS • CRUSTBUSTER/SPEED KING INC. • CURTIS MACHINE COMPANY • DODGE CITY CONCRETE • DODGE CITY CONSTRUCTION AND DEBRIS (C&amp;D) LANDFILL • EAST KANSAS CHEMICAL • JOHN DEERE BCI - BUCKLIN • JOHN DEERE MURPHY TRACTOR IMPLEMENT • KLENKY OIL • MIDWEST MIXER SERVICE •</td>
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<tr>
<td></td>
<td>4</td>
<td>Under-Reported Facilities</td>
<td>Throughout Ford County</td>
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<td>------------------------</td>
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<td></td>
<td>There were several instances noted in which Tier II and UST/AST information appears to be under-reported for the county. An example is an agricultural cooperative which reports fuel stored on-site, but not the pesticides/fertilizers and anhydrous ammonia that appeared to be stored on-site. Recommend follow-up research with reporting facilities to ensure that all chemicals required to be reported are included on the Tier II or AST/UST database reporting.</td>
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</table>

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<thead>
<tr>
<th></th>
<th>5</th>
<th>Commercial Feed Lots and Farms</th>
<th>Throughout Ford County</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>There were few Tier II or UST/AST records submitted for feed lots that are present in the county. Recommend follow-up research to determine whether these facilities that are located in the county have sufficient quantities of materials that require reporting.</td>
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<table>
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<tr>
<th></th>
<th>6</th>
<th>Chlorine Storage</th>
<th>Throughout Ford County</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Although most of Ford County water supply is treated with chlorine, limited chemical information was submitted for the chlorine utilized for potable water pretreatment in the county. Based on the nature of chlorine, a release of this chemical could potentially affect a significant population within Ford County. We recommend that the county emergency management department request the chlorine storage and utilization information for inclusion on the hazardous chemical inventory list.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>7</th>
<th>Quarries</th>
<th>Throughout Ford County</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Information obtained through the Kansas Geological Survey (KGS) indicate that sand and gravel quarries are in operation in Ford County. There were few Tier II or AST/UST information provided for the active quarries in Ford County. In addition, although quarry facilities may not be required to submit Tier II data for explosives stored on-site, the county EM should initiate measures to collect explosive information for these facilities through the State Fire Marshal's office for inclusion in their chemical hazard inventory.</td>
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<thead>
<tr>
<th></th>
<th>8</th>
<th>Agricultural Cooperatives</th>
<th>Throughout Ford County</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The active agricultural cooperatives located in Ford County were found to be, for the most part, in close proximity to populated areas within the county. A large-scale incident at the facilities would have a significant impact on the residential populations within Ford County. We recommend that the county emergency management department maintain contact with the county's agricultural cooperatives regarding the chemicals stored at the facilities, and consider the inclusion of the cooperatives as a component of the EOP response team.</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>9</th>
<th>Pesticides / Herbicides / Insecticides</th>
<th>Throughout Ford County</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recommend follow-up research to determine whether or not landscaping companies, pest treatment companies, etc. have sufficient quantities of chemicals that require Tier II reporting.</td>
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</tbody>
</table>

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<thead>
<tr>
<th></th>
<th>10</th>
<th>Oil Leases / Storage</th>
<th>Throughout Ford County</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Though a number of oil-well sites and tank batteries were observed in the county, Tier II and UST/AST provided for this analysis do not appear to fully represent all county oil field operations. Recommend that the EM follow-up with oil producers operating in the county to ensure full compliance with Tier II and UST/AST reporting requirements for oil leases.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Topic</td>
<td>Location</td>
<td>Details</td>
</tr>
<tr>
<td>---</td>
<td>------------------------</td>
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<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11</td>
<td>Telecommunications</td>
<td>Throughout Ford County</td>
<td>E-Fm observed numerous telecommunications towers located throughout the county, many of which had associated outbuildings present. These sites typically store the EHS chemical sulfuric acid in the batteries utilized to power the equipment. We recommend follow-up research to determine whether or not non-reporting sites have sufficient quantities of chemicals that require Tier II reporting or fuel tanks that require UST/AST database reporting.</td>
</tr>
<tr>
<td>12</td>
<td>Contingency Resources</td>
<td>Throughout Ford County</td>
<td>E-Fm was unable to fully identify all necessary information for several of the Contingency Resource sections that provide information necessary for supporting the communities of Ford County. We recommend that the EM Coordinator complete the necessary information and include them under the Contingency Resources heading in the Resources Section of this Hazard Analysis.</td>
</tr>
<tr>
<td>13</td>
<td>Flood Control</td>
<td>Throughout Ford County</td>
<td>Recommend that the EM maintain contact with Watershed Districts for current information regarding flood control activities for rural areas.</td>
</tr>
<tr>
<td>14</td>
<td>Pipeline Incidents</td>
<td>Throughout Ford County</td>
<td>Conduct follow-up research with pipeline owner/operators and obtain emergency operations plans for potential pipeline incidents.</td>
</tr>
</tbody>
</table>
### 12.4 Observations

#### General

The continued support and maintenance of dedicated emergency management services, staff, and county knowledgeable supervisory personnel are critical to the ability of the county to provide timely and effective response to emergency events.

Examination of the Cascading Hazards Matrix reveals the following observations:

- In general, technological hazards appear to be the most prevalent type of secondary cascade hazard, mainly emanating from instances of natural and technological hazards as primary/source hazards.
- Natural hazards appear to generate the most secondary cascade hazard possibilities, followed closely by technological hazards.
- Technological, civil/societal, and vector based hazards all appear to have a greater likelihood of secondary cascade hazards arising from their own respective hazard classifications.

#### Administrative

Utilizing the support of the LEPC, EM staff should require all submitters of Tier II and UST/AST report forms to provide all required information specified on the reporting template, including accurate CAS numbers, corresponding chemical names, and storage conditions.

Update Tier II and UST/AST data files with new annual submittals.

Review the state (KDHE & KCC) and federal (NRC) spill event databases on an annual basis to maintain an accurate and comprehensive listing of spills/incidents for determining likelihood values. If necessary, contact E-Fm for assistance in recalculating likelihood values based on additional records.

Review contingency resource inventory and directories for any additions or deletions. Ensure that all information is current to account for changes in personnel, addresses, capability, telephone numbers, email addresses, (etc.).

Review the cascading hazard matrix on an annual basis and update as needed.

Document the completion of the system-wide hazard analysis review process on a revision log to accompany the actual hazard analysis documentation.

In order to facilitate future database extraction and consistency, data entered into HzChRT should not include commas or periods. Commas and periods are a common data file delimiter. As an example, “Xyz Co., Inc.” should be entered as simply “Xyz Co Inc”.

#### Mitigation Efforts

Utilize the Risk Rating system to identify and prioritize targets for mitigation.

Use Vulnerability Tables and Maps as a basis for recommendations for zoning and mitigation plans.

Maintain contact with Watershed Districts for current information regarding flood control activities for rural areas.

#### LEOP

Update the County Local Emergency Operations Plan utilizing the Hazard Analysis information.

Review county-wide transportation system for changes and update plan accordingly.

Establish plans and procedures for continuously updating hazard, risk, and vulnerability data.

Facilitate interaction with community businesses and foster an environment of cooperation in managing and mitigating hazards for the overall public welfare.

Maintain contact with pipeline owner/operators and obtain updated emergency operations plans for potential pipeline incidents.

#### Natural Hazards

Review updated weather historical data from NCDC and updated wildfire historical data from State Fire Marshal on an annual basis. If necessary, contact E-Fm for assistance in recalculating likelihoods and risk-ratings for weather and wildfire data.

#### Technological Hazards

Increased focus on the reduction of hazardous chemical spill event frequencies (through increased awareness, training, and oversight) could lead to significant decreases in risk ratings for facilities and owner-operators in the county.

Request all governmental departments (city, county, state) and public/private educational institutions in the county to provide Tier II and UST/AST inventory reporting data or chemical inventory for their respective operations and/or storage sites (includes fuel storage).

Conduct routine driving surveys of the county as well as periodic inspections of facilities storing or using hazardous chemicals.

Perform a facility visit at the Top 3 rated sites to review and confirm site conditions. Update maps and tables with appropriate changes (new construction, etc.).
demolition, population changes, transportation modifications, etc.)

- Conduct annual interviews with owners of the Top 10 sites or an annual on-site walk-through of the Top 10 sites, or other sites where there is insufficient information to complete hazard planning.

- Review HzChrt Chemicals in Inventory report to identify owner/operators with incomplete information (i.e. CAS number, chemical name, storage conditions and volume, facility name, location, etc.). Obtain missing information from owner/operators and enter into HzChrt. CAS number, storage conditions, and volume must be known to complete the risk rating calculation.

- Utilize HzChrt Risk Rating reports to assess compliance of county owner/operators with Tier II and UST/AST registrant requirements.

- Maintain an up-to-date Tier II and UST/AST registrant database utilizing the HzChrt application.

- Review HzChrt chemical risk rating lists for changes in proximity which could impact the prioritization of target sites. Update proximity ratings as necessary to reflect current conditions. Update prioritization of target sites to reflect current conditions.

### Civil Hazards

To further develop a preparedness strategy for the county and the cities within its boundaries, it is suggested that the county develop a comprehensive needs assessment for the county based on the initial findings from the ODP assessment.

### Vector Hazards

A comprehensive FAD Annex should be developed to address personnel safety (industrial hygiene), property (public and private) and infrastructure (natural and economic resources).

- Monitor the on-going work at Kansas State and the Livestock Commission regarding agro-movement issues.

- State health and veterinary officials are monitoring for West Nile Virus. Enhanced surveillance for viral and equine encephalitis is being conducted throughout the state. Active surveillance for arboviruses in wild birds is also being performed. The County should remain current on any developing requirements for reporting information in cooperation with Public Health.
References
1.0 References

References is not available except online.
SARA Title III - List of Lists is not available except online.
Transportation Study Tables is not available except online.
Regulations Overview is not available except online.
Article on Lead-Acid Battery Hazards is not available except online.
2.0 Acronyms

Select to View Acronyms is not available except online.
3.0 Glossary

Select to View Glossary is not available except online.
Resources
1.0 Contingency Resources

Table 14a - Emergency Responders
   Excel File Link - Ford County Contingency Resources is not available except online.

Table 14b - Schools
   Excel File Link - Ford County Schools is not available except online.

Table 14c - Adult Health Care
   Excel File Link - Ford County Adult Health Care Facilities is not available except online.

Table 14d - Lumber Yards
   Excel File Link - Ford County Lumber Yards is not available except online.

Table 14e - Refrigerated Storage

Table 14f - Broadcast Stations
   2008 Kansas Association of Broadcasters is not available except online.
2.0 State Maps and Tables

KS Aquifers is not available except online.
KS Avg Precip is not available except online.
KS Average Annual Snowfall is not available except online.
KS CERCLA & National Priority List is not available except online.
KS Color Coded Elevations is not available except online.
KS County Square Mile Areas is not available except online.
KS Environmental Risk TSDS & Contaminated Sites is not available except online.
KS Geologic is not available except online.
KS Geologic Generalized is not available except online.
KS Identified Sites 2007 is not available except online.
KS Oil & Gas Fields is not available except online.
KS Oil & Gas Wells is not available except online.
KS Physiographic is not available except online.
KS Pipelines is not available except online.
KS Railroads is not available except online.
KS Structural & Seismic Geologic is not available except online.
KS Sensitive Groundwater is not available except online.
Federal Reservoirs in Kansas is not available except online.
Kansas Watershed Basins is not available except online.
Kansas Watershed Projects is not available except online.
3.0 County Maps and Tables

- Ford County CERCLIS Sites is not available except online.
- Ford County NPDES Water Discharge Permits is not available except online.
- Ford County Color Elevation is not available except online.
- Ford County Geologic Map is not available except online.
- Ford County Industrial Minerals is not available except online.
- Ford County KDOT General Highway is not available except online.
- Ford County Land Cover is not available except online.
- Ford County Confined Animal Feeding Operations (CAFO) is not available except online.
- Livestock Feeders - Region D is not available except online.
- Ford County Oil & Gas Production - KGS is not available except online.
- Ford County Pipelines is not available except online.
- Ford County Townships is not available except online.
- Ford County Traffic Count is not available except online.
- Ford County Watersheds is not available except online.
4.0 Historic Sites

Link to Excel file for Historic Sites is not available except online.
5.0 Photos

Cargill Meat Solutions, Dodge City is not available except online.
Sunflower Electric, 11453 Fort Dodge Road is not available except online.
Winter Feed Yard is not available except online.
APAC/Shears asphalt plant, south of US-283/Trail Street intersection, outside of Dodge City is not available except online.
Chlorine storage, City of Dodge City Well #11 is not available except online.
Back side of Dodge City Cooperative elevators, Dodge City is not available except online.
Front side of Dodge City Cooperative elevators, Dodge City, view north is not available except online.
Western Plains Regional Medical Complex, 3001 Avenue A, northeast side of Dodge City is not available except online.
Tanker truck carrying fertilizer, 6th Avenue and US Highway 50 is not available except online.
Dodge City roadside overlook of large feed yards, northeast of Dodge City is not available except online.
Offerle Cooperative, Bellefont is not available except online.
Wind Farm, northeast of Spearville, north of US-56 Highway is not available except online.
Anhydrous ammonia storage tanks and grain elevators, Right Cooperative, Spearville is not available except online.
Right Cooperative in Wright is not available except online.
Hi Plains Feed is not available except online.
Koch Nitrogen Plant, view south from US-56 Highway is not available except online.
Dodge City Cooperative, City of Ford is not available except online.
Dodge City Cooperative, City of Ford is not available except online.
Offerle Cooperative, Bucklin is not available except online.
Southwestern Bell facility, Bucklin is not available except online.
Dodge City Cooperative, Kingsdown is not available except online.
East Kansas Chemical, Kingsdown is not available except online.
Minneola Cooperative grain elevators, Bloom is not available except online.
Minneola Cooperative chemical storage tanks, Bloom is not available except online.
Dodge City Wastewater Treatment facility lagoon is not available except online.
Wilroads Right Cooperative is not available except online.
Dodge City Cooperative, Howell is not available except online.
Ford County State Lake is not available except online.
Hains Lake is not available except online.