



# **OK-EFRA: An ArcGIS Web Application for EHS Flow and Risk Assessment on Oklahoma Roadways**

Manjunath Kamath, Scott Frazier, Diana Rodriguez Coca  
Timman Nyamagoudar, and Felipe Carreno Urquijo  
Oklahoma State University  
Stillwater, OK 74078

OKSCAUG 2023



## Agenda

- Project Description
- OK-EFRA Web Application Demo
  - OK-EFRA County Summary Sheets
- Project Website



# OK-EFRA Project Team

- OSU Faculty
  - Dr. Manjunath Kamath, IEM
  - Dr. R. Scott Frazier, BAE
  - Dr. Diana Rodriguez Coca, FPSET
- OSU Students
  - Mr. Timman Nyamagoudar (Graduate - IEM)
  - Mr. Luis Felipe Carreno Urquijo (Graduate - FPSET)
- ODEMHS
  - Mr. Curtis Driscoll
  - Mr. Zakary Legarda
  - Ms. Bonnie McKelvey (retired)
- DEQ
  - Mr. Matthew Wormus
  - Mr. Tom Bergman (retired)



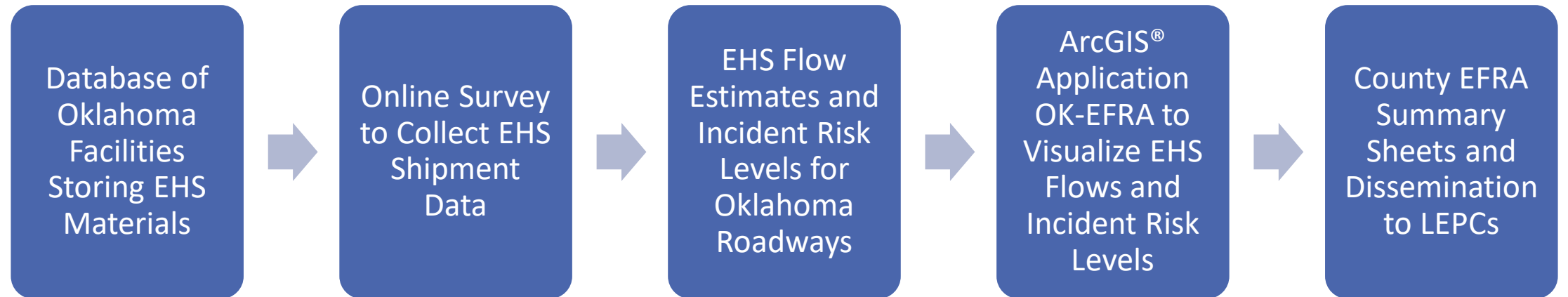


## OK-EFRA Project Overview

- Information about materials considered as being extremely hazardous substances (EHSs) passing through county roadways and their associated incident risk levels would be valuable input to the state's Local Emergency Planning Commissions (LEPCs) in their preparation for possible emergencies
- A novel feature of our approach was the collection of shipment data using a targeted, online survey of facilities in Oklahoma, which store extremely hazardous substances (EHSs)
- Shipment data from these facilities such as frequency, amount, and origin/destination locations was used to estimate HazMat flows on Oklahoma roadways



# OK-EFRA Methodology





# OK-EFRA Results

## *EHS Flows on Oklahoma Roadways*

An ArcGIS application (OK-EFRA) was developed to inform LEPCs, first responders, and other local bodies in Oklahoma counties as to what EHS may be transported on county roads and highways.



## *EHS Incident Risks on Oklahoma Roadways*

Models to assess EHS incident, health, flammability, and instability risks were developed and risk levels were displayed as heat maps in the ArcGIS application (OK-EFRA) to serve as input to the emergency preparedness planning activities.



## *County EFRA Summary Sheets*

Each sheet presents a summary of the main findings related to EHS flow and incident risk assessment for a Oklahoma county.



# OK-EFRA Web Application Demo





# OK-EFRA County Summary Sheets





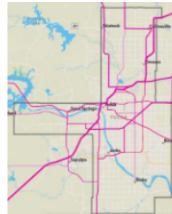
## OK-EFRA (EHS Flow and Risk Assessment) Tulsa County EFRA Summary Sheet

The purpose of this data sheet is to inform LEPCs, first responders, and other local bodies in a county as to what extremely hazardous substances (EHS) may be transported on local roads. This information is expected to assist county personnel in their emergency preparedness planning activities. The EHS shipment data was collected through an online survey of facilities in the state that store EHS on-site and send or receive such EHS materials on a regular basis. The online survey used data on facilities and their EHS storage collected by Oklahoma Department of Environmental Quality in 2018. The survey data may not include all EHS transported in a county.

### EHS Flow on County Roads

**EHS Flow**  
Amount(Pounds/Year)

- 43,800,001 - 100,000,000
- 11,350,001 - 43,800,000
- 2,800,001 - 11,350,000
- 750,001 - 2,800,000
- less than 750,000



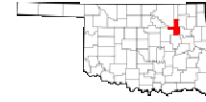
### EHS Transported on County Roads

EHS	Stored/Passing Through	Annual Amount (pounds)	Shipments per year	Shipments Frequency	Container
Ammonia	Stored/Passing Through	88,529,600	434	Daily, Weekly, Monthly, Quarterly, Yearly	Cylinder, Tanker
Chlorine	Stored/Passing Through	97,827,800	101	Weekly, Biweekly, Monthly, Bimonthly, Quarterly, Yearly	Drum, Cylinder, Tanker
Hydrochloric Acid	Stored/Passing Through	8,298,300	45	Biweekly, Monthly, Bimonthly, Yearly	Drum, Railcar, Tanker, Tote
Nitric Acid	Stored/Passing Through	125,800	23	Monthly, Bimonthly, Quarterly, Yearly	Drum, Tanker, IBC
Phosphoric Acid	Stored/Passing Through	13,500	4	Quarterly	Tote
Sodium Cyanide	Stored/Passing Through	1,200	12	Monthly	Can
Sulfuric Acid	Stored/Passing Through	13,912,600	95	Weekly, Biweekly, Monthly, Quarterly, Yearly	Drum, Tanker, IBC, Can, Tote
Sulphur Dioxide	Stored/Passing Through	40,100	7	Bimonthly, Yearly	Cylinder

\*Approximated to the nearest hundred

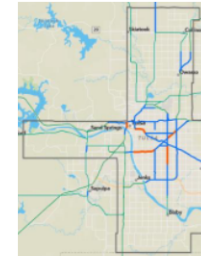
The above information is based on survey data collected in 2018 and may not include all EHS transported in the county. In addition, the following EHS are also stored within the county: Phosphorus

## OK-EFRA (EHS Flow and Risk Assessment) Tulsa County EFRA Summary Sheet

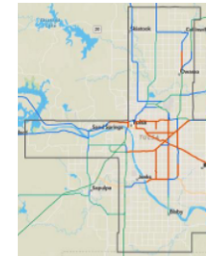


An assessment of EHS incident risk for roadways was done using a model that incorporated three risk factors: incident probability, shipment frequency, and impact (i.e., population density). The NFPA 704 categories were incorporated into the risk model to establish Flammability, Health, and Instability/Reactivity risks related to EHS incidents on county roadways.

### EHS Incident Risk



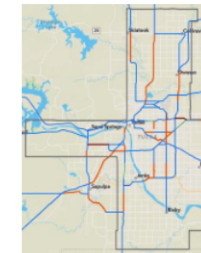
### Flammability Risk



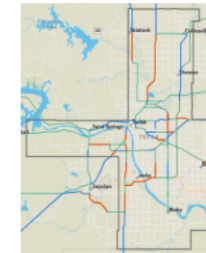
#### Risk Maps Legend

Low  
Moderate  
High  
Very High

### Health Risk



### Instability/Reactivity Risk



### Contact Us



**Mr. Zakary Legarda**  
GIS Analyst  
Oklahoma Department of  
Emergency Management and  
Homeland Security  
[helpdesk@oem.ok.gov](mailto:helpdesk@oem.ok.gov)



**Prof. Manjunath Kamath**  
Industrial Engineering and  
Management  
Oklahoma State University  
[ocm.osu@okstate.edu](mailto:ocm.osu@okstate.edu)



**Mr. Matthew Wormus**  
Environmental Programs Specialist  
Oklahoma Department of  
Environmental Quality  
[Matthew.Wormus@deq.ok.gov](mailto:Matthew.Wormus@deq.ok.gov)

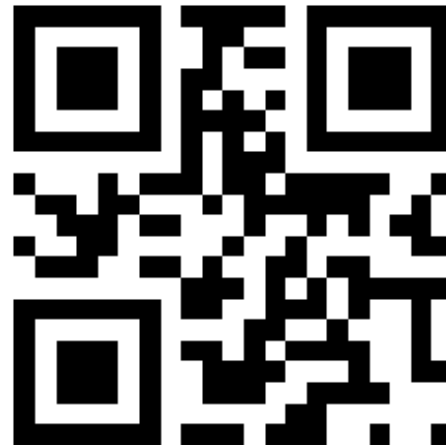
The information presented above was derived from the results of a research effort funded by the Oklahoma Department of Emergency Management and Homeland Security and conducted by a research team at Oklahoma State University, Stillwater, OK with technical guidance and expertise provided by the Oklahoma Department of Environmental Quality.



# OK-EFRA Project Website

*URL: [okehs.org](http://okehs.org)*

*Website Name: OK-EFRA Project (EHS Flow and Risk Assessment on Oklahoma Roadways)*





Questions?