

Risk Management Plans and Consequence Modeling

Some RMP Findings



Chemical Emergency Preparedness and Prevention Office
US EPA September 28, 1999

AGENDA

- **RMP Modeling Requirements**
 - ▶ **Worst Case, Alternative Case**
 - ▶ **Toxics, Flammables**
- **Modeling Tools Available**
- **Some Preliminary Results**

RMP Modeling Requirements

- **Worst Case Scenario**
 - ▶ **1 Representing Toxics**
 - ▶ **1 Representing Flammables**
- **Alternative Scenario**
 - ▶ **"More Likely" for Emergency Response**
 - ▶ **1 for each Toxic**
 - ▶ **1 Representative of Flammables**

RMP Modeling Requirements

- **Toxics Worst Case Framework:**
 - ▶ **Largest Vessel / Largest Distance**
 - ▶ **Gases = Vapor Release in 10 minutes**
 - ▶ **Liquids = Instant Spill; Pool Volatilization**
 - ***At Highest Ambient Temperature***
 - ▶ **Include Administrative Control and Passive Mitigation**

RMP Modeling Requirements

- **Toxics Worst Case Framework (cont'd):**
 - ▶ **Determine Release Rate to Air**
 - ▶ **Find Downwind Distance to Set Endpoint:**
 - **F stability, 1.5 m/sec windspeed**
 - **Average Temperature, Humidity**
 - **Rural or Urban Topography**
 - **Conservative Roughness**

RMP Modeling Requirements

- **Flammable Worst Case Scenario:**
 - ▶ **Largest Vessel / Largest Distance**
 - ▶ **Gases = Total Quantity Vapor Release**
 - ▶ **Liquids = Instant Spill; Pool Volatilization for 10 Minutes**
 - ***At Highest Ambient Temperature***

RMP Modeling Requirements

- **Flammable Worst Case (cont'd)**
 - ▶ **Consider Administrative Control and Passive Mitigation**
 - ▶ **Determine Flammable Mass**
 - ▶ **Vapor Cloud Explosion Only**
 - ***to 1 PSI Endpoint***
 - ▶ **If TNT Equivalent Modeling Used:**
 - ***Must use 10% Explosion Yield***

RMP Modeling Requirements

- **Alternative Release Scenario:**
 - ▶ **"More Likely" Event - Beyond Facility Boundary (*unless none exists*)**
 - ▶ **Accident History or 'Typical' Incidents:**
 - **Transfer Hose Rupture**
 - **Overpressurization / Overfilling**
 - **Process Line / Valve Leak**
 - ▶ **Consider PHA scenarios**

RMP Modeling Requirements

- **Alternative Scenario (cont'd)**
 - ▶ **Include Passive and Active Mitigation**
 - ▶ **"Typical" Meteorological Conditions:**
 - **Temperature, Humidity**
 - **D Atmospheric Stability**
 - **3 m/sec Windspeed**
 - ▶ **Other Flammable Events (Pool, Jet Fire)**
 - ▶ **Maximum Flexibility**

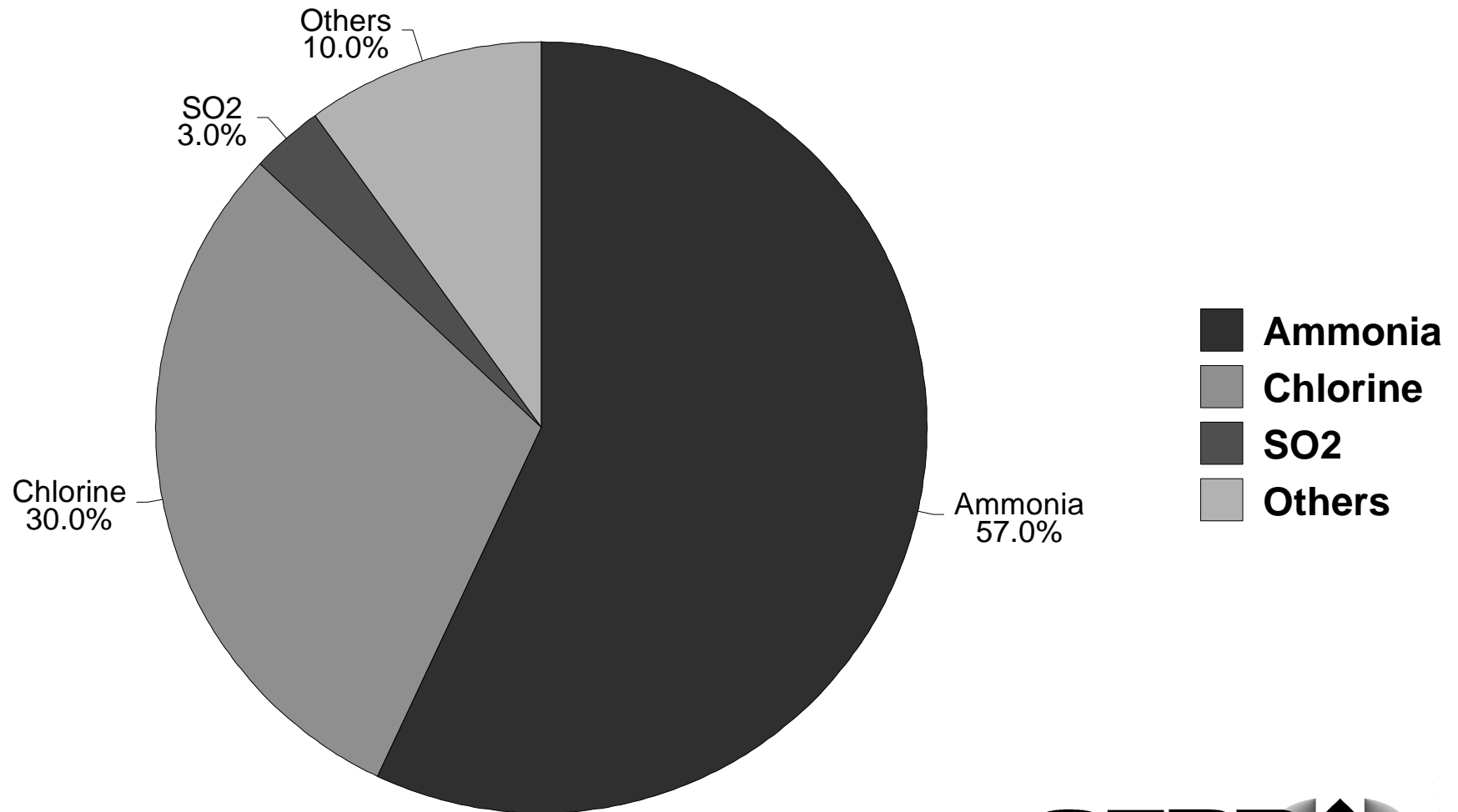
RMP Modeling Tools

- **Use Any Public or Proprietary Model:**
 - ▶ *Apply Appropriately*
 - ▶ *Share Details Upon Request*
- **EPA Tools (*free!*)**
 - ▶ **OCA Guide and Lookup Tables**
 - ▶ **RMP*Comp Calculator**
 - ▶ **ALOHA (*and others*)**
 - ▶ **Industry-Specific Guides, Models:**
 - **Propane, Ammonia, Chlorine**

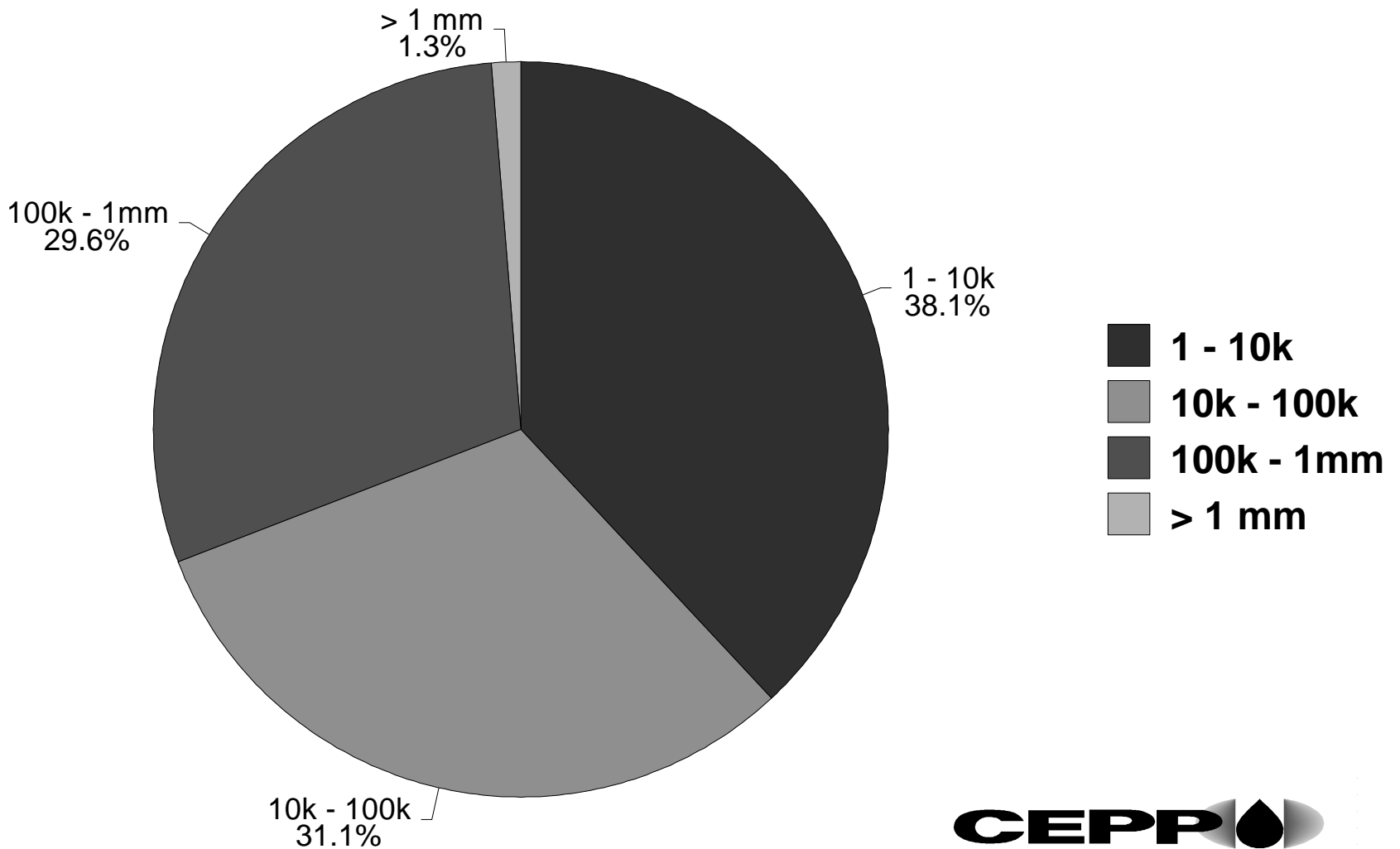
Some RMP Results

- **Total # RMPs = 14,449**
- **Toxic Worst Cases = 13,537**
 - ▶ **56 of 76 (74%) Listed Substances**
- **Flammable Worst Cases = 3,110**
 - ▶ **42 of 63 (67%) Listed Substances**
- **Toxic Alternative Cases = 15,608**
 - ▶ **64 of 76 (84%) Listed Substances**
- **Flammable Alternatives = 2,457**
 - ▶ **45 of 63 (71%) Listed Substances**

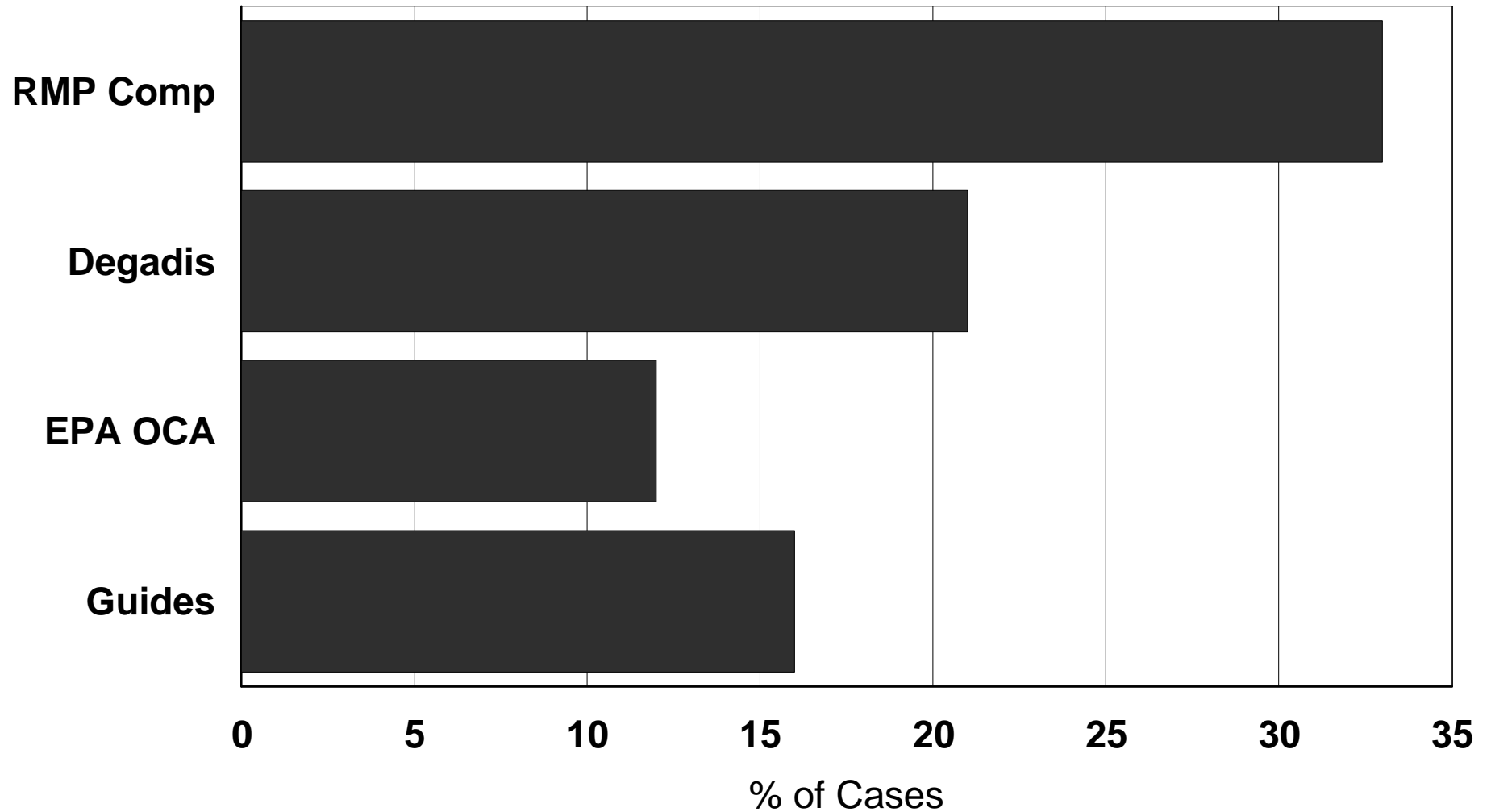
Toxics Worst Case



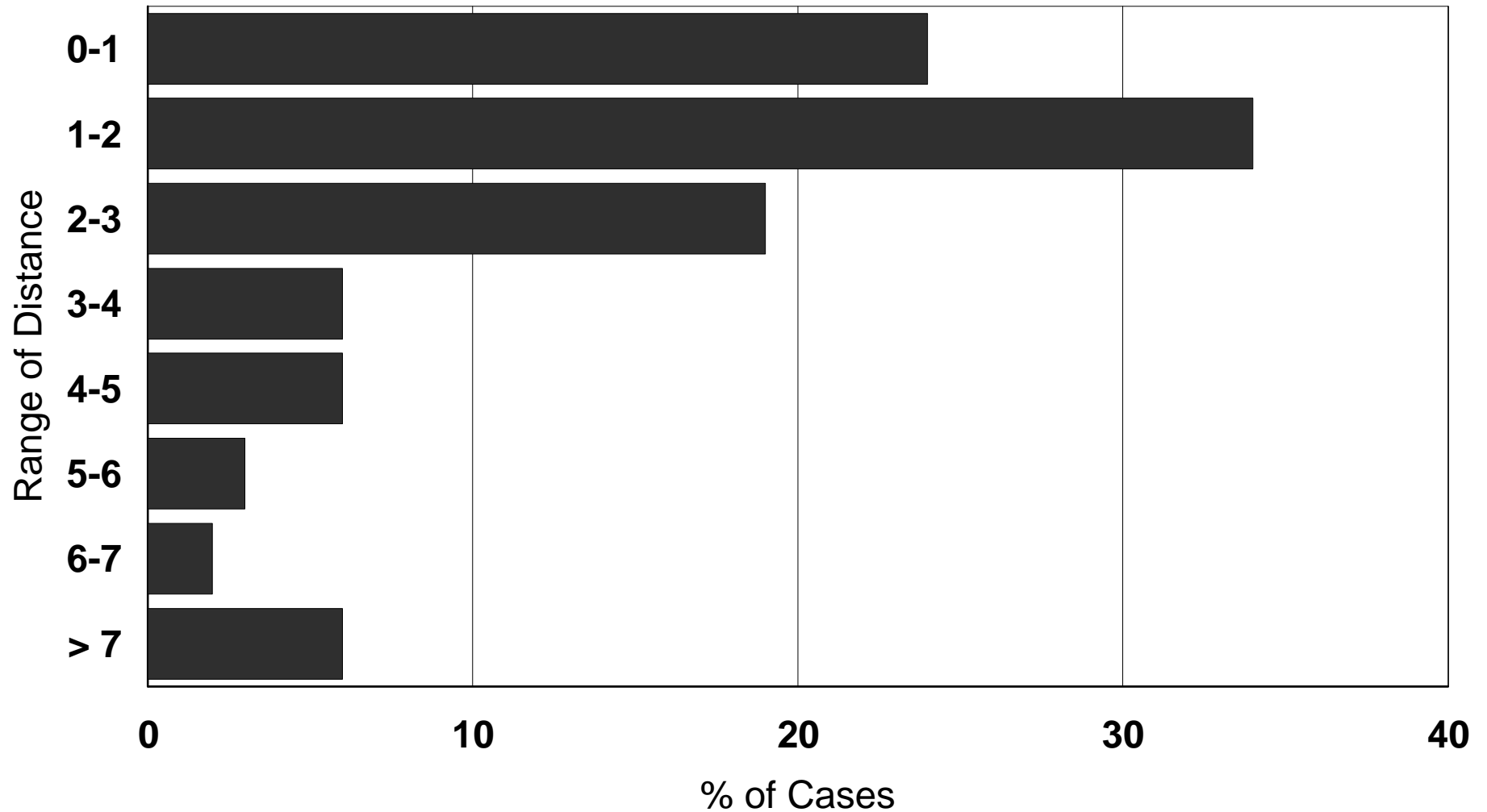
Toxics Worst Case - Quantity Released (Pounds)



Toxics Worst Case Model



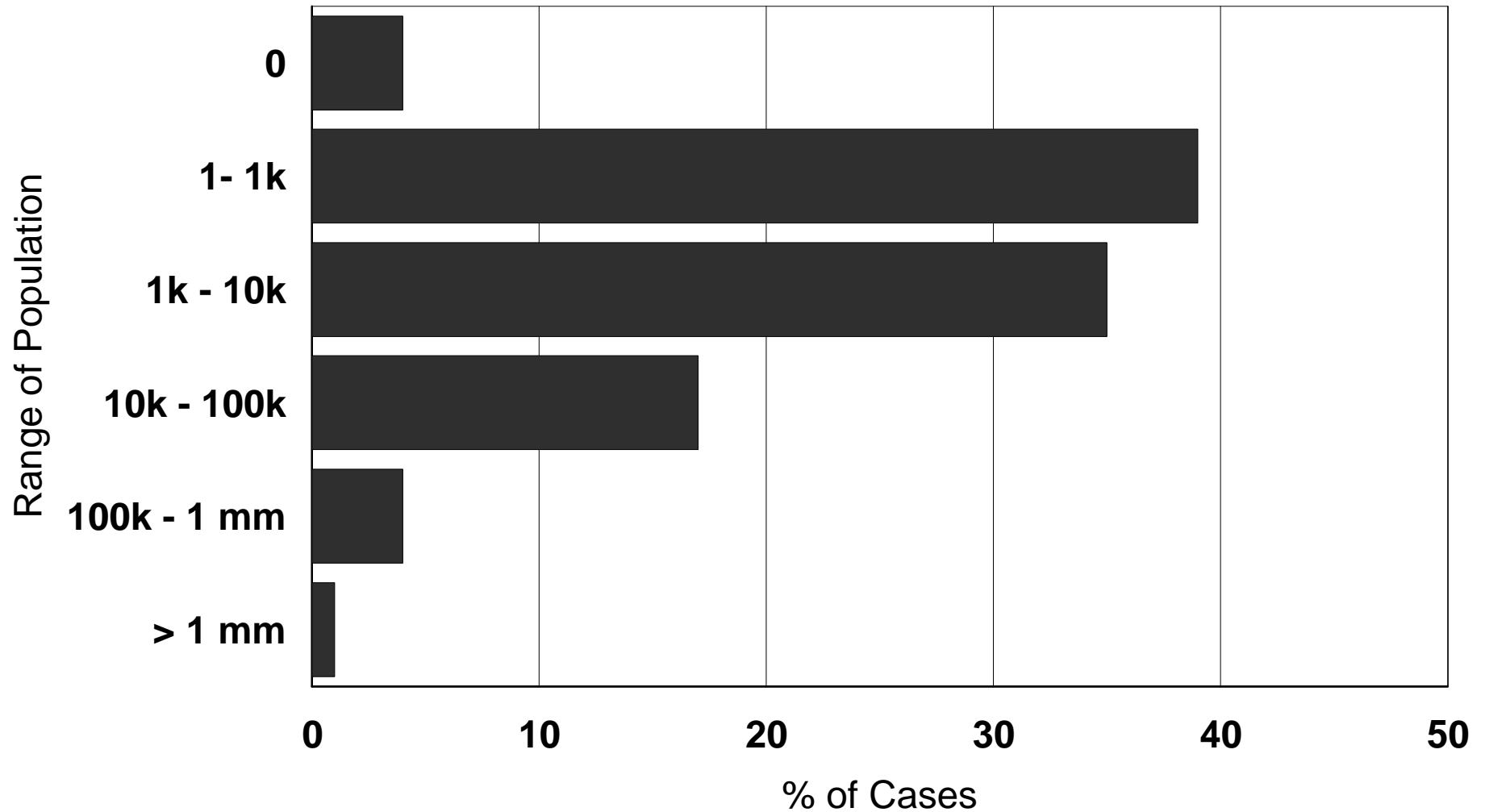
Toxics Worst Case Endpoint Distance (mi)



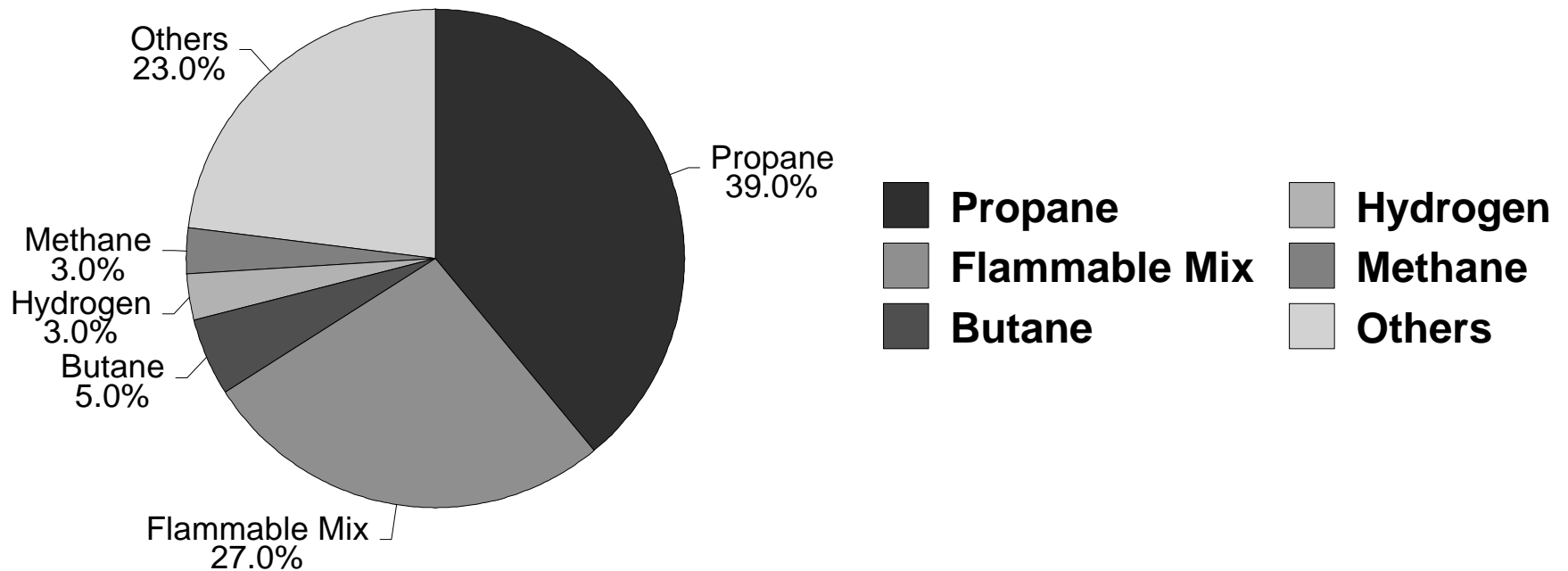
Toxics Worst Case Scenario

- **Release Duration = 10 min (90%)**
 - ▶ **5% > 60 min**
- **Windspeed = 1.5 m/sec (99%)**
 - ▶ **0.1 to 321!**
- **Topography = Urban (66%)**
- **Stability = F (99%)**
- **Passive Mitigation ~ 40%**
 - ▶ **Dikes 9%, Enclosures 18%**

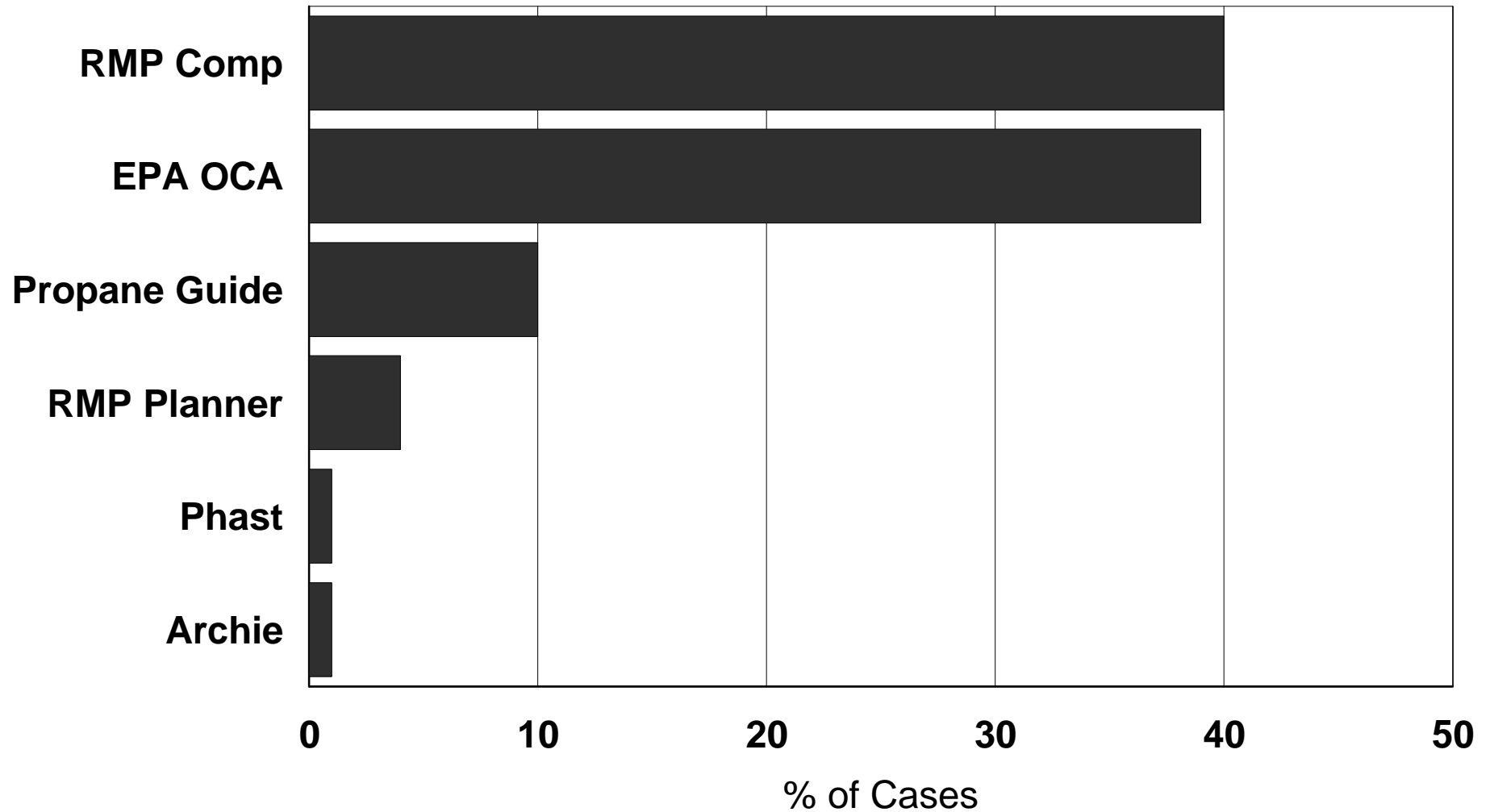
Toxics Worst Case Population



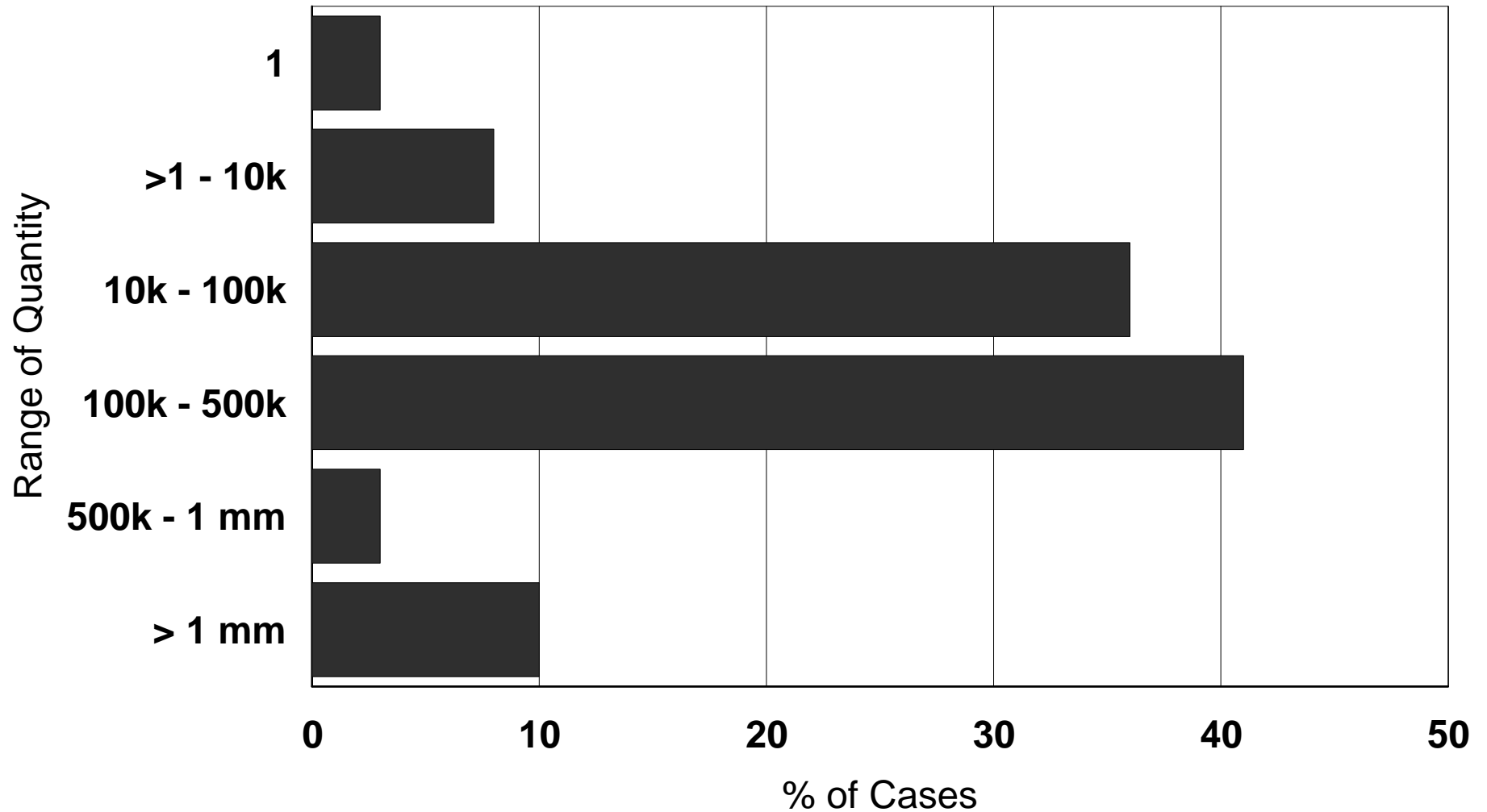
Flammable Worst Case - Chemicals



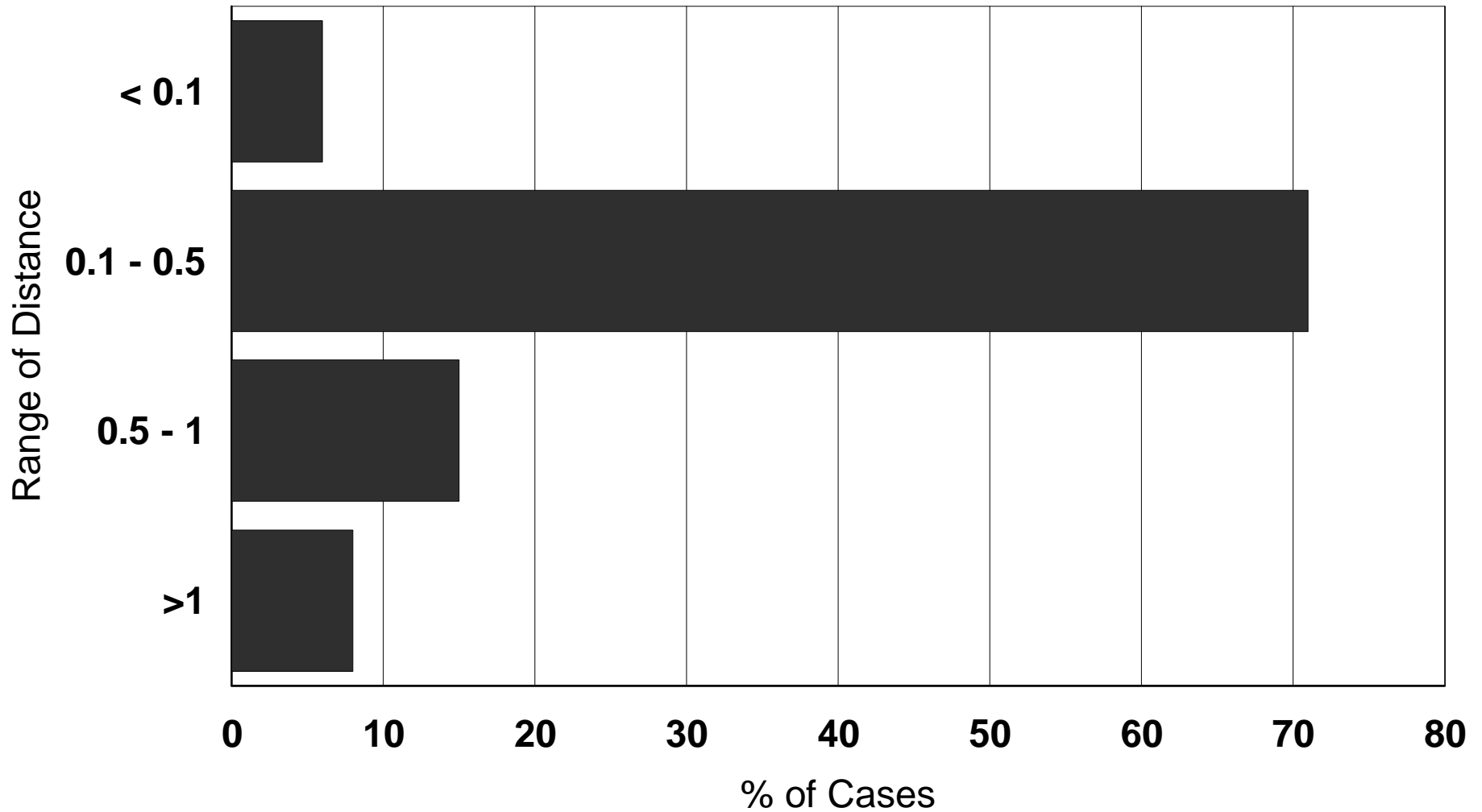
Flammable Worst Case - Model



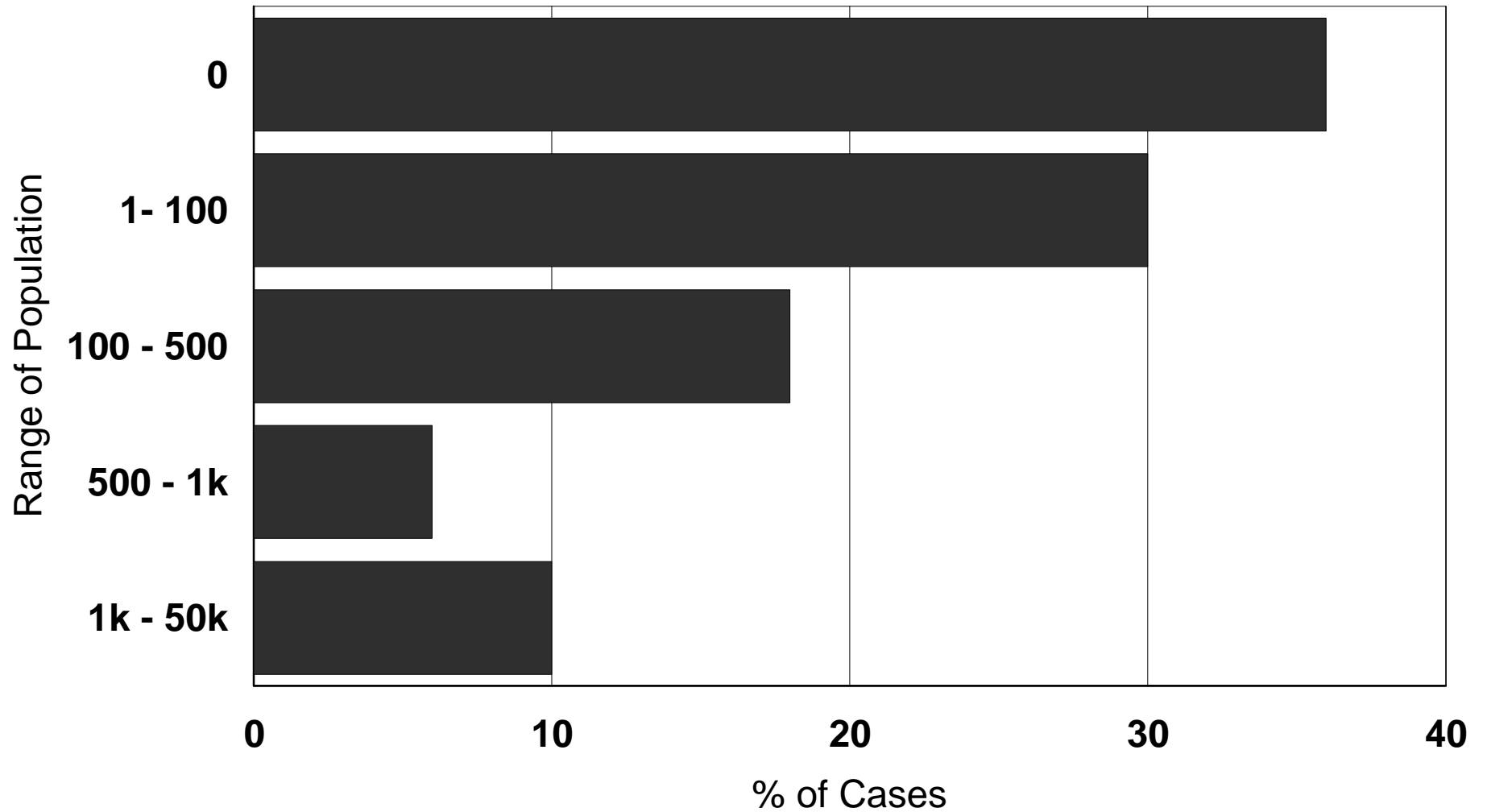
Flammable Worst Case - Quantity Released (pounds)



Flammable Worst Case - Distance to Endpoint (mi)



Flammable Worst Case - Population



Alternative Case

- **Quantity Released (pounds):**
 - ▶ **Toxics = 0 - 5.3 mm 2,000 median**
 - ▶ **Flammables = 1 - 49 mm 10k median**
- **Endpoint Distance (miles):**
 - ▶ **Toxics = 0.01 to 78 0.24 median**
 - ▶ **Flammables = 0.01 - 175 0.1 median**
- **Other Parameters:**
 - ▶ **Toxics = D stability (89%), Urban (66%)**
 - ▶ **Flammables = VCE (68%), VCF (18%) Pool Fire (4%)**

The End

- **More to do....Stay Tuned!**
- **Check Web www.epa.gov/ceppo**

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