Presentation 3 – Jeffrey Kirkpatrick

Exposure to Smoke from the Kuwait Oil Well Fires

Presentation to
Research Advisory Committee on Gulf War Veterans' Illnesses

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Deployment Occupational and Environmental Health Surveillance – Kuwait Oil Well Fires

- To Comply with Public Law 102-190 (Troop Registry from exposure to oil well fires in Operation Desert Storm), CHPPM (formerly AEHA) Used Geographic Information System Technologies to Develop the Troop Exposure Assessment Model (TEAM)
- Collaborative Effort with National Oceanic and Atmospheric Administration (NOAA), National Center for Atmospheric Research (NCAR), Arabian Gulf Program Office (AGPO)
- Briefing will Provide Overview Summary of Dispersion Modeling Efforts for the Kuwait Oil Well Fires

1991 Oil Fires Sampling Locations
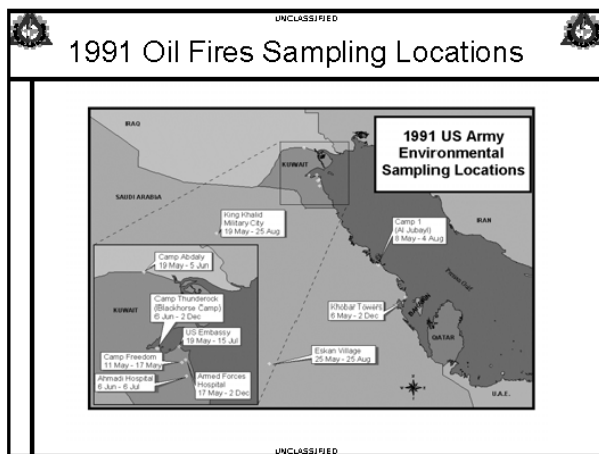
Modeled Exposure Data

- Expands Oil Fires Assessment of:

  - **Time** (from May-Dec '91 to Feb-Nov '91)

  - **Location** (from 10 Specific Sites to Entire KTO)

  - **Population** (from Subset of Exposed Population to Entire Oil Fires Exposed Population)

  - **Sources** (Separates oil fire sources from industrial, vehicular and natural sources)

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Modeled Oil Fires Data

- NOAA/Air Resources Laboratory Modeling (Feb – Oct 1991)
- NCAR Satellite Imagery (274 images)
- NOAA / AGPO Oil Fires Extinguishment Chronology
- Pollutant Emission Factors / Oil Compositions
- Troop Exposure Factors
- Toxicity Data
- Army Center for Unit Records Research (CURR) Troop Unit Location Data (~697,000 personnel, 9,000 units, 850,000 unit locations)
- Sample and aircraft transect flight data

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Oil Well Fires Emissions Modeling

- Dispersion Modeling: NOAA ARL
  - HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory) Model
- Source Term Refinements
  - 24 Hour Unit Emission Concentration – Breathing Zone
  - Extinguishment Chronology
  - Smoke Lofting Feedback
- 15 Km Grid Spacing for Gulf War Theater (over 40,000 points)
- Meteorological Data:
  - National Weather Service; Medium Range Forecast Model
  - European Center for Medium Range Weather Forecasting (ECMWF)
- Air Concentrations Validated – Ground and Aircraft Measurements of SO_2 and Soot

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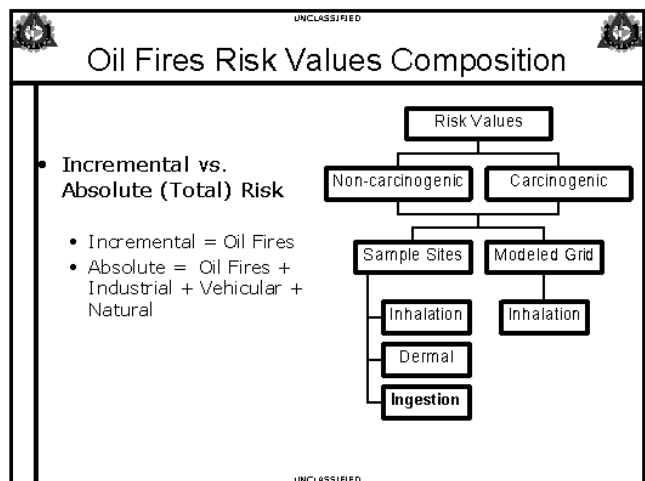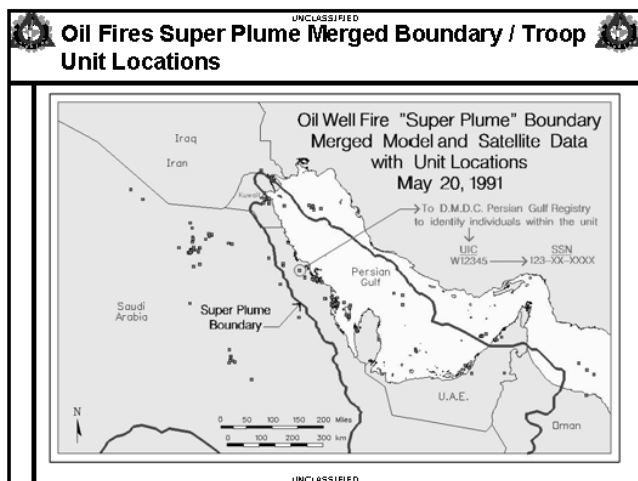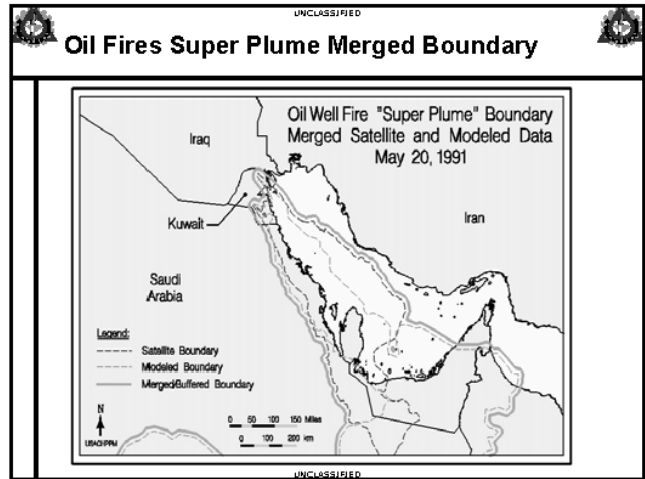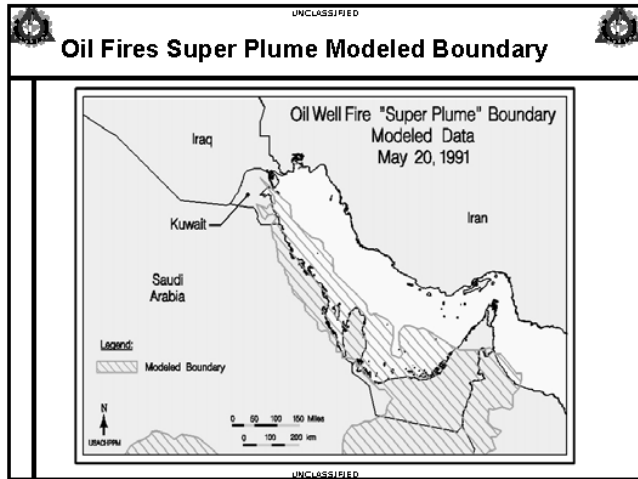
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Modeled Pollutants of Concern

Volatile Organic Compounds		
Benzene	Toluene	m-Xylene
o-Xylene	p-Xylene	Propylbenzene
Ethylbenzene		
Polycyclic Aromatic Hydrocarbons		
Naphthalene		
Particulates, Metals, Inorganics		
Total Suspended Particulate	Iron	Nickel
Vanadium		

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Oil Fires Super Plume Satellite Boundary

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Oil Fires Super Plume Modeled Boundary

Oil Fires Super Plume Merged Boundary

Oil Fires Super Plume Merged Boundary / Troop Unit Locations

Oil Fires Risk Values Composition

Slide 1: Concentration, Exposure, Risk Values

Slide 2: Oil Fires Particulate Matter Modeling

Modeled Oil Well Fire TSP Concentrations and Study Subject Locations February 25, 1991

Oil Fires Publications

- Jeffrey S. Kirkpatrick, Brian W. Higgins, David B. Martin, "Ambient Air Pollutant Trends in Kuwait and Saudi Arabia Observed from 5 May Through 15 September 1991", 85th Annual Meeting and Exhibition of the Air and Waste Management Association, 1992.
- Draxler, Roland R, McQueen, Jeffrey T., and Stunder, Barbara J.B.; "An Evaluation of Air Pollutant Exposures Due to the 1991 Kuwait Oil Fires,' National oceanic and Atmospheric Administration, Air Resources Laboratory, August 1993.
- McQueen, J.T. and R.R. Draxler, 1994. Evaluation of model back trajectories of the Kuwait oil fires smoke plume using digital satellite data. Atmospheric Environment, 28, 2159-2174.
- David Cowan, Jeff Lange, Jack Heller, Jeff Kirkpatrick, Jackie Howard, Chris Weir, and Warren Wortman, "Asthma and Oil Fires Smoke Among Persian Gulf War Veterans", American Public Health Association, 1998.
- Roland R. Draxler, Dale A. Gillette, Jeffrey S. Kirkpatrick, and Jack M. Heller, "Estimating PM_{10} Air Concentrations from Dust Storms in Iraq, Kuwait, and Saudi Arabia", Atmospheric Environment, 35(2001): 4315-4330.

Oil Fires Modeling Summary

- CHPPM TEAM Solution Meets Intent of Public Laws for Exposure to the 1991 Kuwait Oil Well Fires
- TEAM is Used to Support Numerous Oil Fires Exposure Studies / Assessments with Government and Non-Government Agencies
- Periodic Updates are Made on the System
- Experience Gained from this Effort Has Been Applied to Other / Current Deployment Surveillance Efforts

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USACHPPM Contact Information

- Questions?

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