Appendix A

Presentation 1 – Jack Heller

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Readiness thru Health

Overview of the Assessment of U.S. Forces Exposure to Oil Well Fire Emissions in the Persian Gulf in 1991

25 October 2004

Jack M. Heller, Ph.D.
Director Health Risk Management

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Oil Well Fire Health Risk Assessment

- Identify Contaminants Produced by Fires
- What Concentrations of Contaminants are at Troop Receptor Points?
- What are the Health Risks (Cancer and Non-cancer) from Exposure to Various Contaminants?
- Conduct "Classic" USEPA Superfund HRA

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Health Risk Assessment Methodology

- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

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Exposure (Intake) Assessment

- Inhalation
- Dermal Contact
- Incidental Ingestion
- Reasonable Maximum Exposure

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Toxicity Assessment

- Slope Factor - Carcinogenic Risk
- Reference Dose - Non-carcinogenic Risk
  - Chronic and Sub-chronic
- Weight of Evidence

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Risk Characterization

- Carcinogenic Risk = Intake X Slope Factor
  - USEPA Acceptable Range (1E-04 to 1E-06)
- Non-Carcinogenic Risk = Intake / Reference Dose (Hazard Quotient)
  - USEPA Acceptable Level (1)
  - Segregate Chemicals by Mechanism of Action / Target Organ
- Total Risk
  - Additive for Chemicals and Pathways

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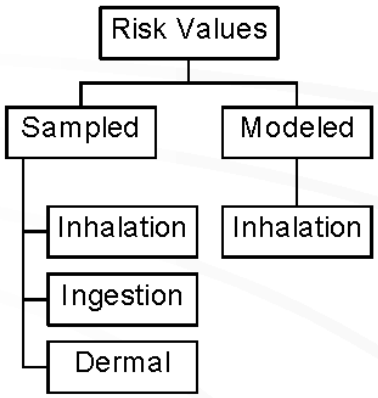
Risk Values Composition



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Human Health Risks

- Predicted Outcomes (population based)
- End Points
  - Cancer
  - Non-cancer
- Verification
  - Biologic Surveillance Initiative (BSI)

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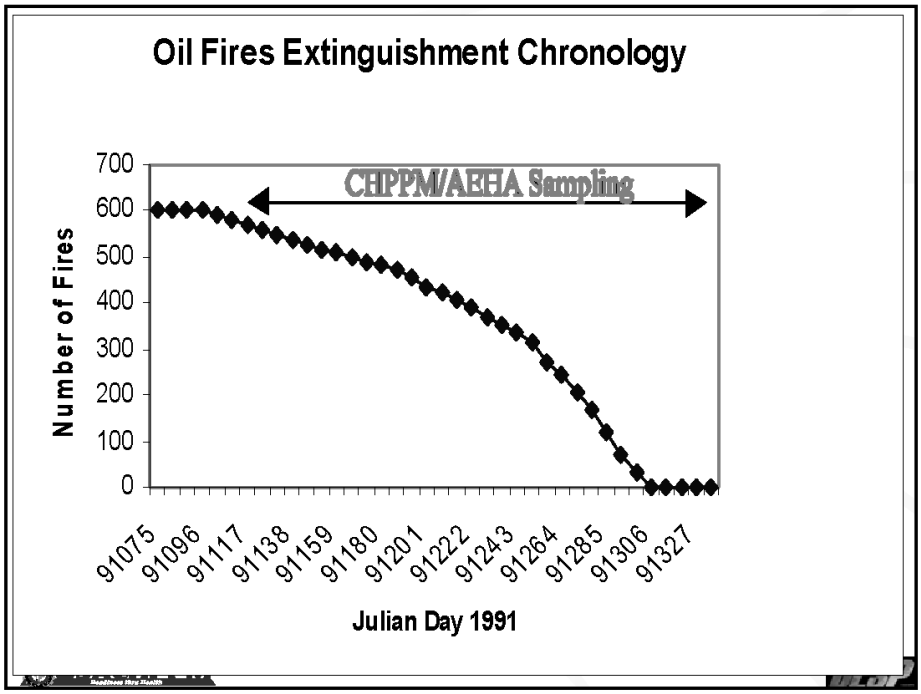
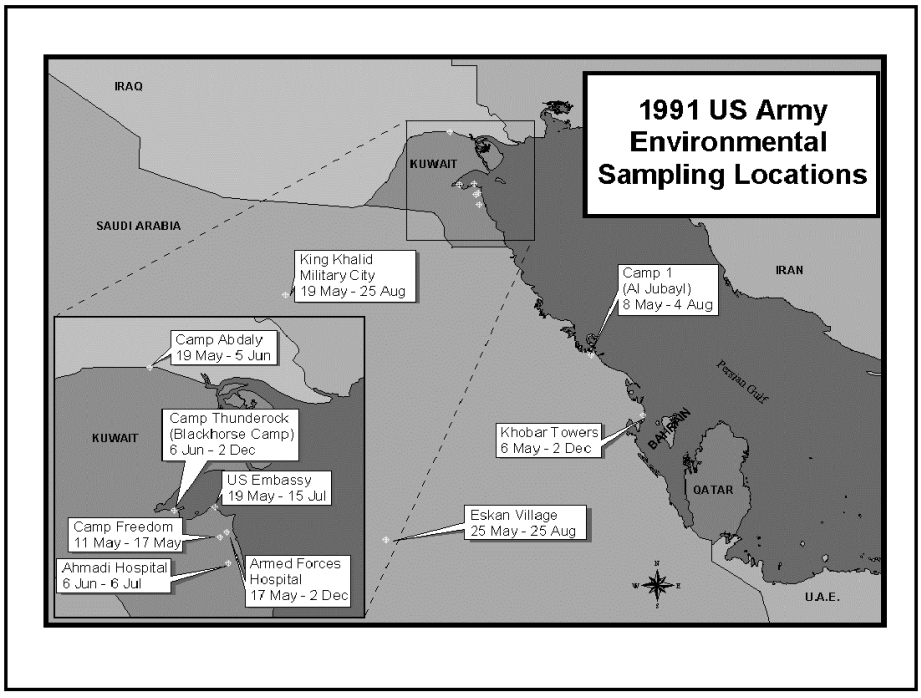

Oil Fires Extinguishment Chronology
CHPPM/AEHA Sampling
Number of Fires
700
600
500
400
300
200
100
0
91075
91096
91117
91138
91159
91180
91201
91222
91243
91264
91285
91306
91327
Julian Day 1991


1991 US Army Environmental Sampling Locations
IRAQ
KUWAIT
SAUDI ARABIA
IRAN
King Khalid Military City 19 May - 25 Aug
Camp 1 (Al Jubayl) 8 May - 4 Aug
Camp Abdaly 19 May - 5 Jun
Camp Thunderock (Blackhorse Camp) 6 Jun - 2 Dec
US Embassy 19 May - 15 Jul
Camp Freedom 11 May - 17 May
Ahmadi Hospital 6 Jun - 6 Jul
Armed Forces Hospital 17 May - 2 Dec
Khobar Towers 6 May - 2 Dec
Eskan Village 25 May - 25 Aug
BAHRAIN
QATAR
U.A.E.

Environmental Samples Collected

- Ambient Air: 4,019
- Surface Soil: 200
- Industrial Hygiene: 600
- Radiological (air): 200

(gross alpha and beta-gamma)

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Ambient Air Samples Collected

ANALYTE	NUMBER COLLECTED
Poly Aromatic Hydrocarbons	437
Volatiles	803
Acid Gas	487
NOX	86
SOX	90
OZONE	92
Mercury	191
Metals	803
TSP	224
PM10	591
Radiological	215
TOTAL	4019

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Sampled Pollutants of Concern

Volatile Organic Compounds		
Benzene	Toluene	m-Xylene
o-Xylene	p-Xylene	Propylbenzene
Ethylbenzene	Heptane	
Polycyclic Aromatic Hydrocarbons		
Acenaphthene	Acenaphthylene	Anthracene
Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(e)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene
Biphenyl	Chrysene	Carbazole
Dibenzo(ah)anthracene	Dibenzofuran	2,6-dimethylnapthalene
Fluoranthene	Fluorene	Ideno(1,2,3-cd)pyrene
1-methylnapthalene	2-methylnapthalene	Naphthalene
Phenanthrene	Pyrene	
Acid Gases		
Acetic	Formic	Hydrochloric
Nitric	Sulfuric	
Criteria Pollutant Gases		
Nitrogen Dioxide/Nitrogen Oxide	Ozone	Sulfur Dioxide
Particulates, Metals, Inorganics		
Particulate Matter <10um	Total Suspended Particulate	Aluminum
Arsenic	Beryllium	Calcium
Cadmium	Chromium(3)	Chromium(6)
Iron	Mercury	Magnesium
Sodium	Nickel	Lead
Vanadium	Zinc	Sulfates
Nitrates	Chlorides	

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Sampled Data – Volatile Organics

Camp	Contaminant Average (ug/m^3)		
Name	Benzene	Toluene	Xylene
Khobar	4.25	12.80	11.10
Doha	3.35	22.80	2.22
AF Hosp	2.65	19.30	1.70

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Sampled Data - Particulates

	Average	Maximum	Maximum
Camp Name	PM10 Conc (ug/m3)	PM10 Conc (ug/m3)	TSP Conc (ug/m3)
Khobar	186	1354	1148
Doha	194	1208	N/A

Majority – Sand based particulates
Silica and Calcium

Minimal – Carbon/Soot

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Sampled Data – PM_{10}/Metals

Camp Name	Average Conc (ug/m3) Vanadium		Average Conc (ug/m3) Lead	
Doha	0.018		0.19	
	June	Nov	June	Nov
	0.023	0.0074	0.13	0.26
Khobar	0.277		0.37	
	June	Nov	June	Nov
	0.072	0.005	0.42	0.29

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Personal Sampling

ANALYTE	NUMBER COLLECTED
Poly Aromatic Hydrocarbons	229
Dust	28
Coal Tar Pitch Volatiles	208
Volatiles	196
Acids	27
SO_X/NO_X	40
TOTAL	785

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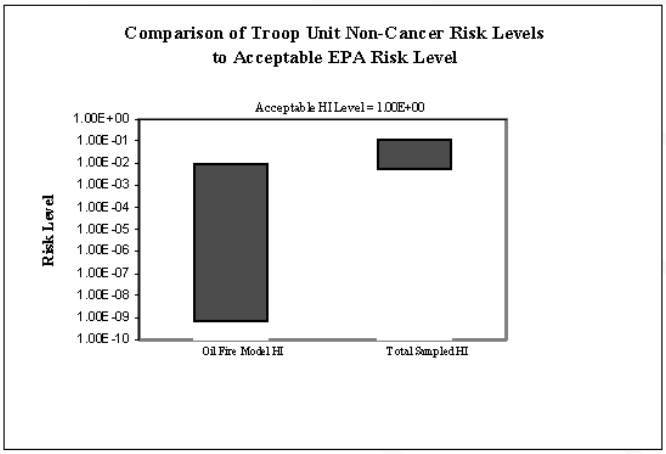
Soil Sampling

- Sampling sites co-located with air sampling sites
- Sample Collection
  - Surface Composites
  - Random
  - Multiple Collections
- Contaminants of Concern
  - Polycyclic Aromatic Hydrocarbons
  - Metals

Results / Summary

- Incremental vs. Absolute (Total) Risk
  - Incremental = Oil Fires
  - Absolute = Oil Fires + Industrial + Vehicular + Natural

Non-Cancer Comparison



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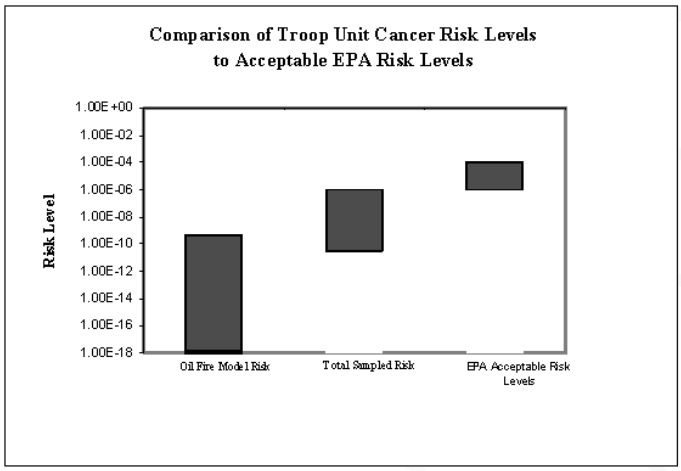
Excess Cancer Comparison



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Radiological Sampling -1991

- Gross α, and β Measurements
- Assessment of Air Samples (217 filters)
- Gross α as a screen for DU
- Background Samples from KKMC and Riyadh
- Assessment of Camp Doha Filters Post Fire
- Levels Lower than for Fuel Oil Combustion in U.S. to Produce Electricity

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Biological Surveillance Initiative

- Pre, During, and Post Deployment Surveillance (11th ACR)
  - Questionnaires
  - Blood and Urine Metals
  - Blood VOCs
  - PAH-DNA Adducts

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External Peer Review

- USEPA
- HHS
- NOAA/ARL
- NIEHS
- ATSDR
- NSF
- DVA
- CDC&P
- NIST
- NRC
- DOD

Exposure Studies

- Cowan DN, Lange JL, Heller J, Kirkpatrick J, DeBakey S. A case control study of asthma among U.S. Army Gulf War veterans and modeled exposure to oil well fire smoke. Mil Med 2002 Sep; 167(9): 777-82
- Smith TC, Heller JM, Hooper TI, Gackstetter GD, Gray GC. Are Gulf War veterans experiencing illness due to exposure to smoke from Kuwait oil well fires? Examination of Department of Defense hospitalization data. Am J Epidemiol 2002 May 15; 155(10): 908-17
- Lange JL, Schwartz DA, Doebbeling BN, Heller JM, Thorne PS. Exposures to the Kuwait oil fires and their association with asthma and bronchitis among gulf war veterans. Environ Health Perspect 2002 Nov; 110(11): 1141-1146

Collaborative Efforts

- Epidemiological studies with VA and other researchers
- Gulf War veterans' ALS (Lou Gehrig's Disease) Study
- Harvard/Temple Univ. Study of Kuwaiti Citizens
- Johns Hopkins Univ. Study of Saudi Citizens
- Boston Environmental Hazards Center

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Support to Gulf War Investigations

- Public Laws
  PL 102-190 (SEC. 734; Troop Registry from exposure to oil well fires in Operation Desert Storm)
  PL 102-585 (SEC. 702; Scientific research using Troop Health Registry)
- Troop Exposure Assessment Model (TEAM)
  - Integrate GIS technology

- Questions?
- Dr. Jack M. Heller, Director, Health Risk Management, 410.436.5244

Hazard Quotient Meaning

- HQ > 1.0
  - If a population were exposed to the contaminant(s) under the conditions assumed in the exposure assessment, then some members may develop adverse health effects (more likely in the most susceptible members). As the frequency / magnitude of exposures exceeding the RfD/RfC increase, the probability (and severity) of adverse effects in the population increases.
- Risk Affected by Severity of Toxicity End Point

Excess Cancer Meaning

- Cancer Risk = 3E-05
  - If one hundred thousand people were exposed to the contaminant(s) under the conditions assumed in the exposure assessment, then there may be as many as three additional cases of cancer (in addition to the number expected from the background/historical rate) during the course of a lifetime.
- Affected by Class of Carcinogen

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