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Deepwater Horizon Oil Spill Response
National Institute of Environmental Health Sciences

Gulf of Mexico Research Initiative

Fall Meeting

October 19-21, 2011

Dale P. Sandler, PhD

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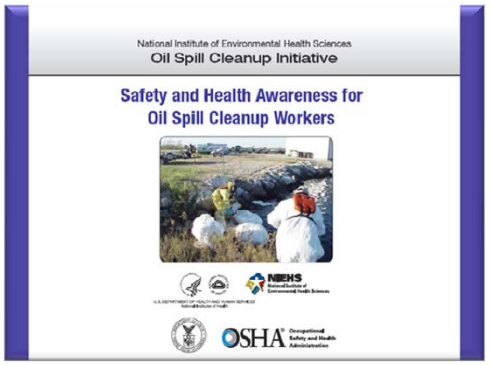
Multi-Program Response

- Worker Education and Training Program
- National Toxicology Program
- Deepwater Horizon Research Consortia
- NIEHS GuLF STUDY



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National Toxicology Program
U.S. Department of Health and Human Services

Research Consortia: Health Impacts and Community Resiliency (U19)

GuLF STUDY
A health study for oil spill clean-up workers and volunteers

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Worker Education and Training Program

Collaboration with OSHA and NIOSH

- Part of Unified Command to assess worker safety issues

Onsite in Gulf within 9 days of explosion

- Oil spill response training tool – ready for use April 29
- Deployed staff, subject matter experts, and grantees for instructor training and worker outreach
- ~150,000 workers and volunteers trained
- Evaluating lessons learned for future training/planning

BP, USCG, OSHA, NIEHS, and NIOSH meet to assess worker protection issues - BP Incident Command Center in Houma, LA , May 3, 2010.

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National Toxicology Program

Mission

- Coordinates toxicology testing within DHHS
- Core Agencies NIEHS, NIOSH, NCTR
- Strengthens science base in toxicology
- Develops and validates improved testing methods
- Provides information about potentially toxic chemicals to health, regulatory, and research agencies, scientific and medical communities and the public

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National Toxicology Program
U.S. Department of Health and Human Services

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NTP Gulf Oil Spill Activities

Information gathering and review

Federal interagency coordination on toxicology research needs

Analysis and chemical characterization of source and weathered oil

Development of toxicology research programs

NTP Analytical Chemistry Goals

Identify and characterize potentially hazardous exposures

- Complementary but not duplicative

Inform toxicology research

- Persistent compounds, changes associated with weathering
- In-depth characterization of metals and PAHs, including alkyl derivatives, and heterocyclic polyaromatics

Support GuLF STUDY exposure reconstruction

- Fill gaps in available information e.g. dermal bioavailability

Develop partnerships with other research efforts

- Support analyses of test media and levels of marker chemicals in animal tissues (e.g. NIOSH dermal and inhalation studies)

NTP Analytical Chemistry Progress

- Acquired samples
  - MC252 source oil collected from the wellhead (BP)
  - Weathered oil and tar balls collected from Louisiana and Alabama beach and marsh areas
  - COREXIT EC9500A
- Source oil testing
  - Metals and sulfur
  - PAHs
    - 16 priority PAHs by EPA 8270
    - C1 and C2 substituted using authentic standards
  - Heterocyclics (Benzothiophenes)
  - Alkanes

NTP Analytical Chemistry Progress (2)

- Environmental sample testing
  - Oiled sand and vegetation
    - PAHs
      - 16 priority PAHs by EPA 8270
      - Expected loss of more volatile compounds (napthalene, acenaphthalene, acenaphthene)
      - Other compounds remain and may be concentrated

- Next Steps
  - Complete analysis of substituted PAHs, heterocyclics, alkanes
  - Develop approaches for quantifying differences between samples and with source oil
  - Targeted analyses of limited volume environmental samples

NTP PAH Toxicology Research Program

High priority long-term research need

- Identify critical data needs to inform cumulative risk assessment of petrogenic and pyrogenic PAHs
- Generate hazard data and relative potency factors for more compounds than included in e.g. EPA IRIS assessment and seafood safety assessments

A broad scope program to provide

- Toxicological characterization of individual chemicals, artificial and real-world complex mixtures
- Assessment of carcinogenicity and other outcomes
- Evaluation of the toxicological importance of routinely measured PAHs relative to other PAHs of environmental relevance

Preliminary research plan for public review in development

DWH Research Consortia

RFA issued October 29, 2010; Awarded June 2010

- RFA-ES-11-006: Deepwater Horizon Disaster Research Consortia: Health Impacts and Community Resiliency (U19)
- To address themes identified during IOM workshop

Partial funding with BP gift to NIH; Support from many other agencies within NIH

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Deepwater Horizon Disaster Research Consortia: Health Impacts and Community Resiliency

Purpose

- Support one or more community-based participatory research consortia
  - Address health issues of concern to residents
  - Develop community-based strategies to improve preparedness and response and minimize health effects in this and future disasters

Outcomes

- Understand the effects of multiple stressors on human health
- Establish evidence base needed to inform recovery and develop strategies to promote health and wellbeing

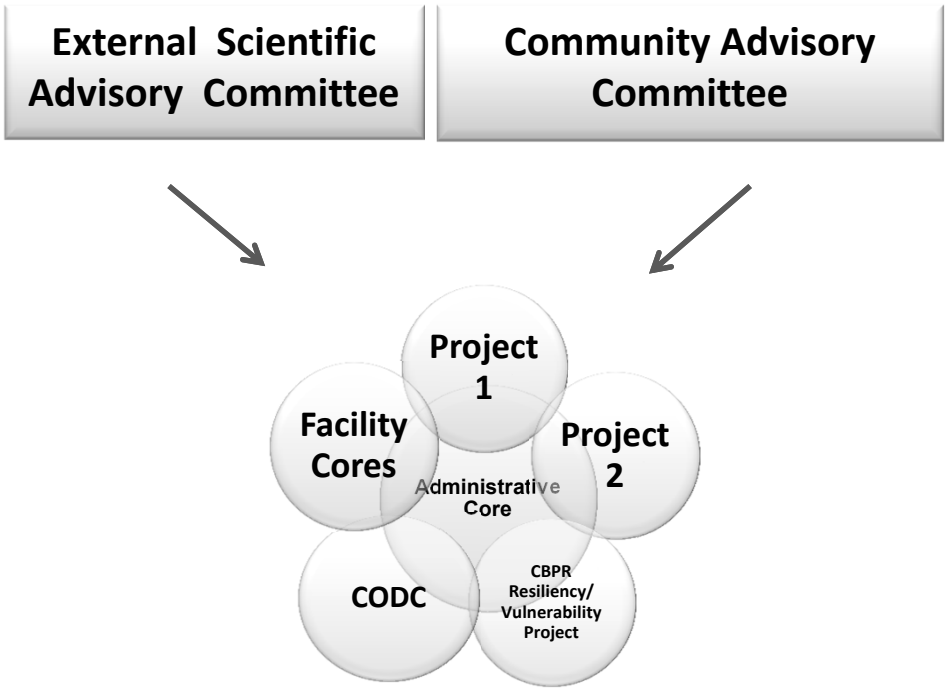
General Approach For U19 Consortia

Multiple projects directed toward common objective

Community-based participatory model

- Community organizations with academic partners
  - Shared planning, implementing and communicating research
- Research activities responsive to the needs of local communities

Focus is on the general population



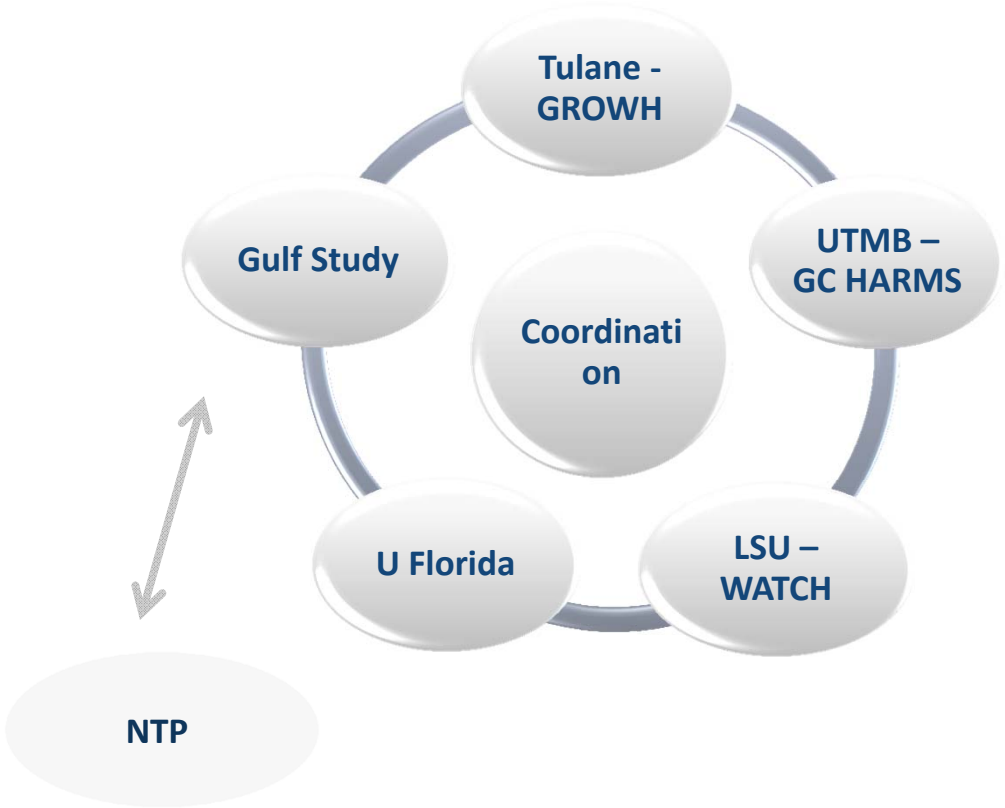
Consortium Members
(academic and community representatives)

Funded Consortia

University	Principal Investigator	Title
Louisiana State University 1 U19 ES020680-01	Trapido, Edward	The Women And [Their] Children's Gulf Health Consortium (WATCH)
Tulane University 1 U19 ES020677-01	Lichtveld, Maureen	Trans-disciplinary Research Consortium for Gulf Resilience on Women's Health
University of Florida 1 U19 ES020683-01	Morris, John G	Health Impact of Deepwater Horizon Spill in Eastern Gulf Coast Communities
UTMB – Galveston 1 U19 ES020676-01	Elferink, Cornelis	Gulf Coast Health Alliance: Health Risks Related to Macondo Spill (GC-HARMS)

Gulf Academic-Community Consortium Network

- NIH Cooperative Agreement – allows substantial Federal scientific or programmatic involvement to coordinate and/or guide activities



Steering Committee:

- PI from each consortium
- Community member from each consortium
- PI of GuLF study
- NIH staff

Potential Coordination Activities

- Community responsive data sharing plans
- Joint intervention/prevention dissemination plans
- Common data collection & data management
- Coordinated data analysis
- Coordinated communication strategies
- Standardization of protocols
  - Coordination of participant contacts
  - Reducing burden on study participants
- Sharing
  - Metrics for exposure
  - Biospecimens
  - Exposure data

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The Women and (their) Children's Health Study (WATCH Study)

Edward J. Trapido, LSUHSC School of Public Health

- Enroll a cohort of ~3,200 women and 1,400 children from seven coastal Parishes in southeast LA
  - Mid- and long-term effects on physical, behavioral, social, and economic well-being of women and children
- Study Domains
  - Environmental – exposure to oil and dispersants, other exposures
  - Social – predisposing personal factors, resilience, community characteristics, social capital
  - Nutritional – seafood consumption, sources of food, food preparation
  - Behavioral - behavioral and psychological dysfunction, factors that modify or buffer oil-spill related harm

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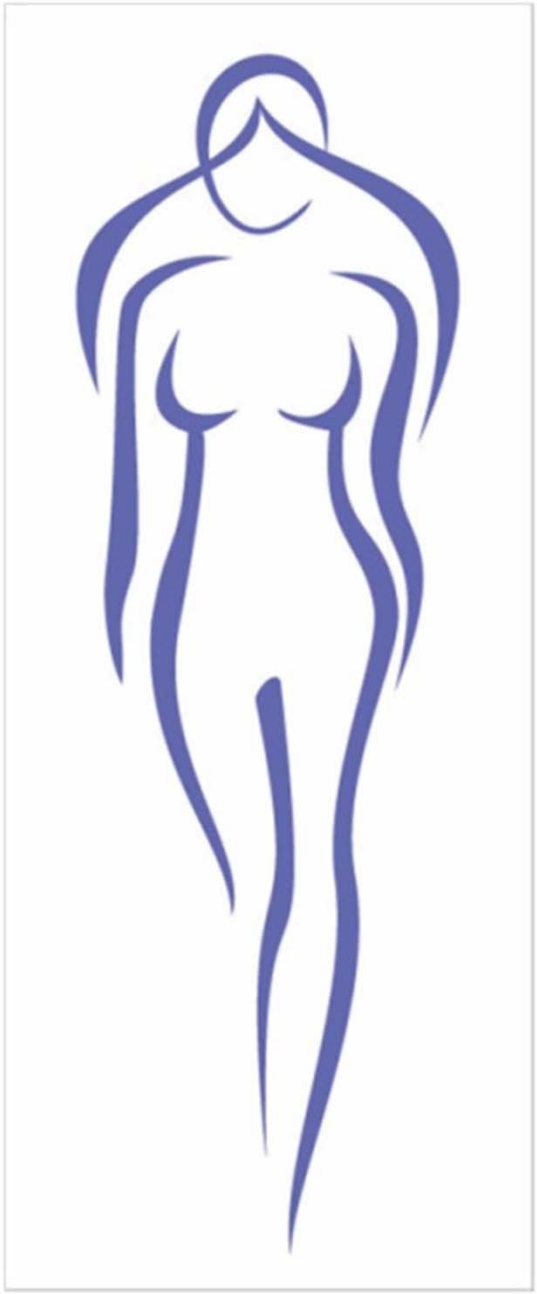

Trans-disciplinary Research Consortium for Gulf Resilience on Women's Health *(GROWH)*

Research. Community. **Education.** Resiliency.

Tulane University
SCHOOL OF PUBLIC HEALTH AND TROPICAL MEDICINE

Overarching Goal

To strengthen health security and resilience of **vulnerable pregnant women** and **women of reproductive age** living in Deepwater Horizon disaster-affected parishes of Louisiana.

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Impact of Deepwater Horizon Oil Spill in Eastern Gulf Coast Communities

J. Glenn Morris, Jr., MD, MPH
University of Florida

Objectives

- To monitor the psychological impact on individuals and families across time, and identify predictors of favorable adjustment after environmental disasters
- To conduct a community-based assessment of social vulnerability and resilience
- To evaluate possible sources of ongoing hydrocarbon exposure, such as seafood
- To maintain dialog with the community, and provide key findings to the community, to assist in the recovery process.

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GC-HARMS

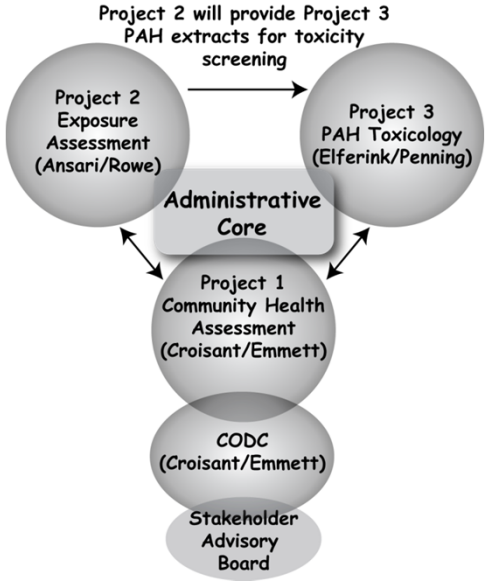
Gulf Coast Health Alliance: health Risks related to the Macondo Spill (GC-HARMS)

University of Texas Medical Branch, Cornelis Elferink, Sharon Croisant

Community-based Participatory Research Partnership between Gulf fishing communities and a consortium of academic institutions

Objectives –

- Assess PAH contamination of Gulf seafood consumed and sold by subsistence fishing communities
- Evaluate current exposures in the human population
- Predict future exposure risks
- Evaluate the toxicity of selected alkylated and oxygenated PAH, and PAH extracts from seafood using validated cell-based assay system
- Elucidate the metabolism of the petrogenic PAH
- Personalized biomarker approach to identify increases in disease risk and psychosocial stress.



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GuLF STUDY

A health study for oil spill clean-up workers and volunteers

Chronicle / Kurt Rogers

Dale Sandler, Richard Kwok, Lawrence Engel, Aubrey Miller
National Institute of Environmental Health Sciences, NIH
Research Triangle Park, NC

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Setting and Timeframe

April 20, 2010 - Deepwater Horizon drilling rig exploded in Gulf of Mexico

June – NIH announces support for study; IOM meets to identify research needs

July – temporary cap; 185m gallons of oil released

September – relief well completed; IOM review of GuLF STUDY

February 2011 – final clearances, study launched

- First interview March 28
- First home visit May 12

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Background and Goal

Of the 40 major supertanker spills in past 50 years, only 8 studied for health effects

- Limited long-term follow-up

Our goal – to carry out prospective study

- Characterize exposures
- Multiple health endpoints, biomarkers
- Account for other environmental and occupational exposures, confounders
- Long-term follow-up for chronic or late effects

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Design Implications of "Late" Start

Emphasis on long-term effects

Exposure characterization more difficult

- No relevant biological samples
- Worker recall of experience diminishes with time

Workforce difficult to locate

- Young, unemployed, mobile, prepaid cell phones

Key players gone; lack of institutional memory

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Objectives of GuLF STUDY

Assess health effects associated with oil spill clean-up following Deepwater Horizon disaster - April 20, 2010

Investigate biomarkers of adverse biological effects

Create a resource for future collaborative research

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Health Outcomes of Interest

Based on

- Research on previous spills
- Studies of groups with exposure to compounds in oil, dispersants, heat, or disaster-related stress

Include

- Physiologic/biologic effects from oil
- Effects due to disaster-related stress

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Eligible Cohort

Workers & potential workers ≥ 21 yrs

- Worked at least 1 day in oil-spill clean-up or support
- Completed training but not hired

Combine lists from multiple sources

- Oil industry, contractors, locals, federal workers
- Final tally ~150,000

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Not a Typical Worker Cohort

- Multiple contractors and subcontractors
- Not a healthy worker population
- Not a controlled work environment
- Variability by contractor in how tasks performed, use of PPE
- Little or no pre-spill health data
- No individual exposure data
- Variable employee/employer records

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Potential Participants

NIOSH roster

Petroleum Education Council (PEC) training list

- 65% not on NOISH roster
- Some groups pre-trained or exempt

Other BP contractor lists

- TRG Badge data
  - Other workers; worksite location
- Vessels of Opportunity

Federal partners

- Coast Guard, National Guard, Fish & Wildlife
- Other lists

Characteristics of Potential Participants*

Characteristic	Percent
Age < 30	27.9
Male	79.9
Black	36.7

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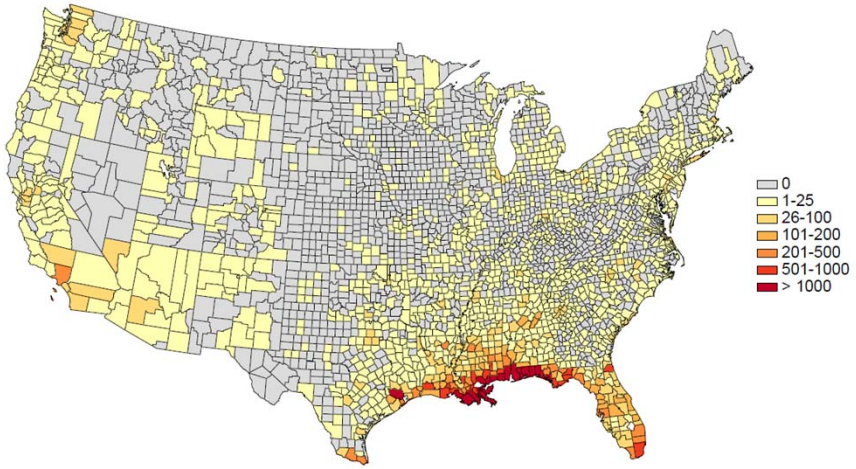
* NIOSH Roster

County/Parish of Residence – Oil Spill Workers*

State	Percent
Alabama	21.3
Florida	25.3
Louisiana	26.6
Mississippi	16.5
Other	10.3



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N=113,258; w/contact information, lists to date

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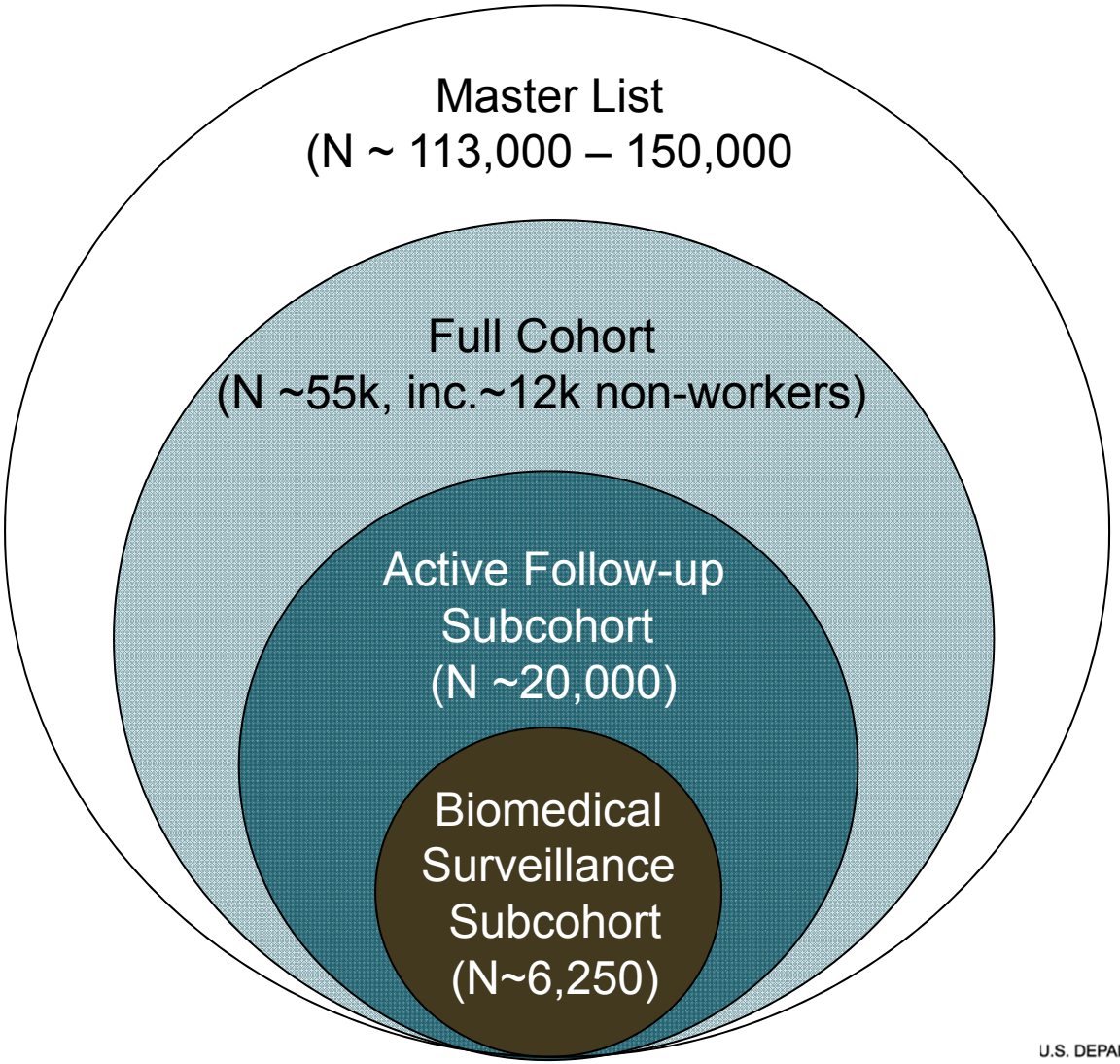
Study Design



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Study Design- Enrolled Cohort

Screen 86,000 (stratified random sample)

- Enroll cohort of ~55,000
  - Telephone interview ~ 30-60 min
    - Exclude ineligibles
    - Characterize clean-up activities
    - Collect data on lifestyle, health, other exposures
  - Follow via record linkage

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Study Design – Active Subcohort

Stratified random sample (~20,000)

- Represent all clean-up related tasks; full range of exposures
- Maximize communities close to spill
- Residents of LA, MS, AL, FL, *east TX* (unless highly exposed)

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Study Design – Baseline Data Collection

Home visit

- Additional questionnaire (30-60 minutes)
- Biologic and environmental samples
- Height, weight, blood pressure
- Pulmonary function (FEV_1, FVC)

Follow-up via biennial questionnaires

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Study Design – Biomedical Subcohort

Biomedical Surveillance Subcohort (n~5,000)

- Potential subcohort flagged (n=6,250)
  - Louisiana, Alabama; proximity to Gulf
  - Exposure potential
- Laboratory tests done at baseline (e.g. CBC)
- Future home or clinic visits
  - Additional biological and environmental samples
  - Comprehensive assessment of neurologic and respiratory function, immunologic response
  - Evaluate persistence and late effects

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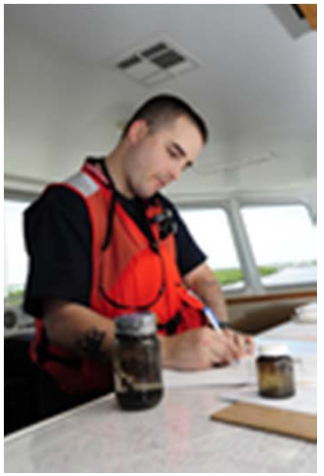
Exposure Assessment Goal

Develop exposure estimates for each study subject for each agent for all routes of exposure using *exposure scenarios*

Exposure Data Sources

- ***Study questionnaires***
- Measurement data (specific jobs/tasks/locations)
  - BP, Federal agencies, other
- Environmental monitoring data
- Other BP and Federal records
- NIOSH Hazard Evaluations
- Public Websites
- Site visits and interviews/focus groups
- Photographs



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Exposure Scenarios

Groups of workers having the same general exposure profile for the agent being estimated

- Similar activities, tasks, materials and processes
- Other potentially important components
  - Area (hot zone, source, offshore, near shore, land)
  - Vessel
  - Geographic location (LA, MI, AL, FL)
  - Time (month)

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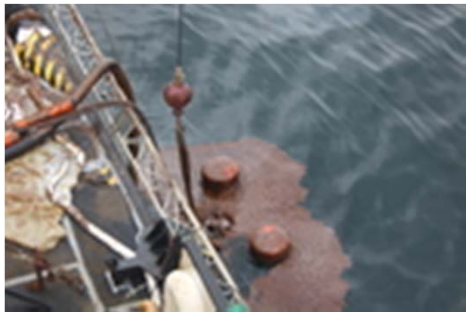
Hazards of Interest

Fresh and weathered oil

- VOCs, THCs, BTEX, PAHs, hydrogen sulfide, nickel, vanadium, aluminum, cadmium, lead

Burning oil

- Dioxins, particulate matter



Dispersants

- 2-BE, PG, Other surfactants

Insecticides and sunscreen

Heat and noise stress

Exposure Reconstruction

Use existing measurement data to estimate exposures for specific tasks, considering time and location

- Estimate exposures when measurements <LOD, LOQ
- Determine whether some agents can be markers for other agents

Develop inhalation, dermal and ingestion exposure estimates

Modifying Factors

Chemical and physical properties of agent

- Weathering of oil

Types of contact, part of body and extent of contamination

Frequency of exposure

Protective equipment

Hand-to-mouth/face contact

Other personal factors

- Long work hours, heat, sunscreen, insect repellent, exposure during off hours

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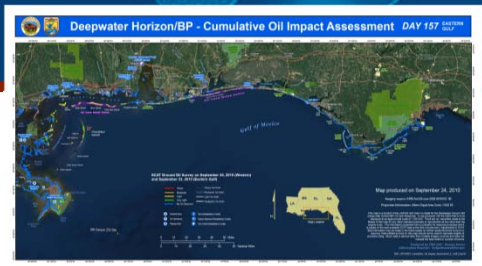

Exposure Reconstruction

Mathematical models - unmeasured exposure scenarios

- Chemical and physical properties of agents
- Monte Carlo simulations to estimate uncertainty
- Bayesian statistics to use information from other situations
- Air dispersion models link to longitude and latitude data

Job Exposure Matrix (JEM)

- Link exposure estimates to scenarios to estimate exposure levels to study subjects
- Modify JEM values by exposure-specific individual information (e.g. dates, days and hours, dermal exposure)

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Enrollment Progress – 10/4/11

30,688 phone numbers “released”

- ~ 46% flagged for tracing; 9% no contact

4,183 contacted and eligible

- 3,390 (81%) completed phone interview

2,224 eligible for Active Subcohort

- Residence in Gulf states; “Exposure” based sampling
- 1,497* agreed to home visit (67.3%); 645 home visits completed to date
  - Of those assigned to HVA, 20% “unable to contact”
  - Of those finalized, 21% refused

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*doesn’t include those recently added back in

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Sample Collection

- >99% compliance with clinical measures
  - 95.7% for PFT due to exclusion
- 90% with more than one blood tube
  - Protocol mandated exclusions
  - Other challenges
  - 6% of samples problematic (not cold, leaking, hemolyzed, clotted)
- 98% with urine sample
- 77% toenail collection
  - Added mail back option
- 16% hair sample
- 98% dust wipe and GPS; 73.7% vacuum sample

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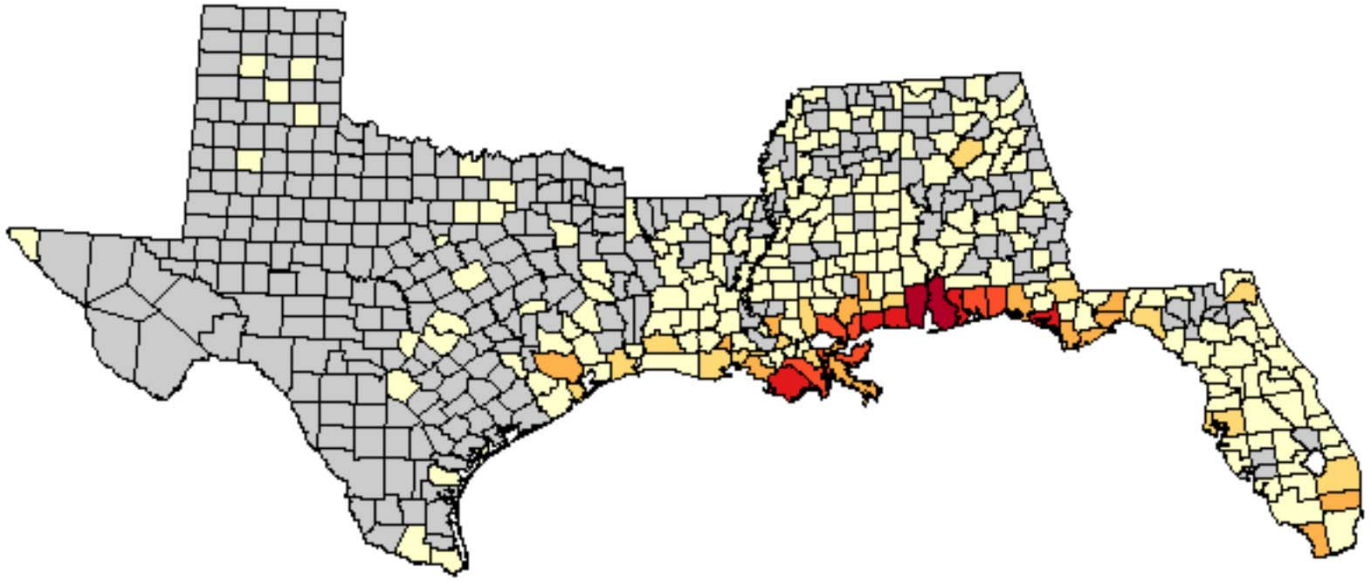
County/Parish of Residence - Gulf States Enrolled Cohort



None 1-10 11-20 21-50 51-100 101-200 > 200

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Cohort Characteristics* (%)

Characteristics	Overall (3,390)	Active (645)
Age < 30 yrs	19.1	16.5
Age > 45 yrs	46.4	46.7
Female	19.5	20.6
Non-White	34.5	37.8
Hispanic	3.9	3.9
Education < HS	16.7	18.3
Annual HH Income <$20k	27.4	34.0

**As of 10/4/11*

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Cohort Characteristics* (%)

Characteristic	Overall (3,390)	Active (645)
Fair/Poor Health	16.1	21.9
Obese (BMI > 30)	33.8	35.3
Current Smoker	33.8	42.1
Depression^	10.4	13.8
Hypertension^	21.6	22.6
Asthma^	11.8	11.8

**Baseline characteristics as of 10/4/11*
^Ever diagnosed before oil spill

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Exposure Potential – worked ≥ 1 day*

	Oil		Dispersant	
Exposure	Number	%	Number	%
Unknown	122	5.3	0	0.0
Unexposed	0	0.0	1599	69.7
Low	655	28.6	560	24.4
Medium	437	19.1	17	0.7
Medium-High	236	10.3	71	3.1
High	843	36.8	46	2.0
Total	2293	100.0	2293	100

**Based on telephone responses to questions about jobs and tasks and external information on exposure likelihood; to facilitate sampling decisions for Active Subcohort*

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Ongoing Challenges

- Reconstructing exposures and assigning exposure metrics
- Tracing workers
- Managing community expectations
- Political and legal climate
- Dispelling misinformation
- "Gulf Oil Syndrome"
  - Sick people who had exposures, advocacy groups, media
- Unmet health care needs

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www.nihgulfstudy.org

www.niehs.nih.gov

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