TOXICOLOGY RESEARCH PRIORITIES FOR GULF OF MEXICO OIL SPILL

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Toxicological impact: scope

- Comprehensive effects on entire Gulf of Mexico biological system
  - Organisms from bacterial and phytoplankton to humans
  - Deep water to surface and on shore
  - Interactive effects on organisms in the food web
  - Physical effects in the marine environment on biology

Toxicological impact: complexity

- Magnitude of release
  - Volume not precisely defined
  - Locations exist in 3 dimensions which are not well described
  - Changing rapidly due to biodegradation and dispersal
- Chemical complexity
  - Light sweet crude – rapid loss of light fractions
  - Use of dispersants
  - Different composition than in previous large spills

Toxicological impact: complexity II

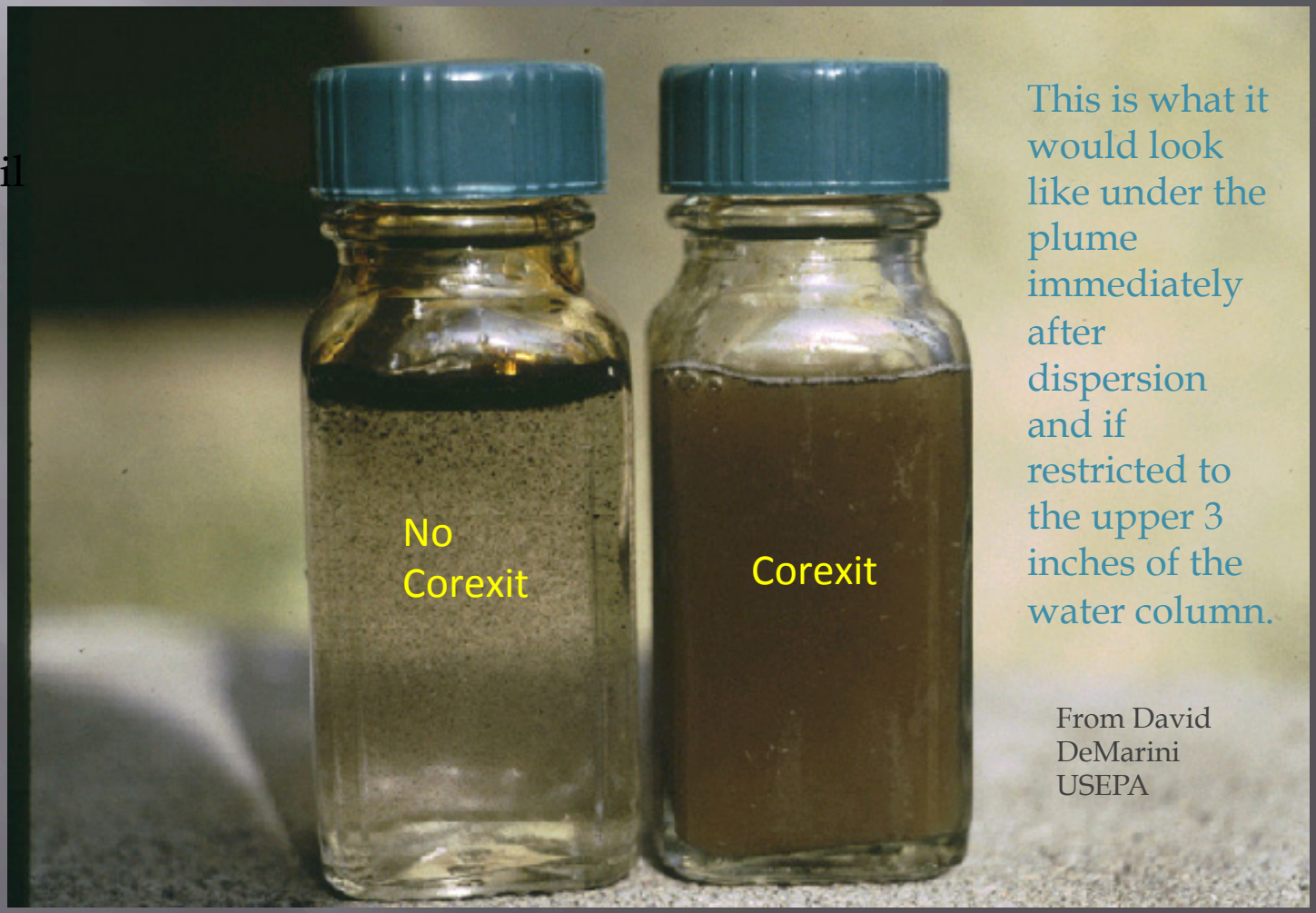
- Complex mixtures
- Effect of Dispersants on toxicity
  - Increased bioavailability of emulsified oil
  - Dispersant toxicity
  - Accelerated degradation
- Other contaminants from well
  - Natural gas
  - Process water
    - Contains heavy metals (?)

What Does Chemically Dispersed Oil Look Like?

[www.orr.noaa.gov/public/erd/chemistry-data/dispersanttoxicity/]

3 ml Fresh South Louisiana Crude Oil in 30 ml salt water (100,000 ppm)

Shaken and let stand for 10 min



This is what it would look like under the plume immediately after dispersion and if restricted to the upper 3 inches of the water column.

From David DeMarini USEPA

Toxicological impact: social - economic

- Toxic effects drive indirect social and economic impacts
- Direct exposure to oil
- Indirect exposures through air and food web
- Impacts on business and employment
- Social stresses
- Legal issues

Areas for collaborative toxicology-related research

- Four broad areas
  - Oil/dispersant composition, concentration, physical make-up and location
  - Biological effects on Gulf biota
  - Monitoring and surveillance of human populations exposed directly or indirectly
  - Investigation of cumulative risks associated with oil spill

Research: oil/dispersant

- Need clear description of composition, concentration, physical characteristics and location of oil
  - Because it was deep and offshore the light fractions were not a major problem except for offshore workers
  - Environmental exposure pathways: biota and humans
  - Potential mechanisms and toxic effects

Ecosystem biological effects

- Oil and dispersant effects on ecosystem
- Effects on biological productivity
- Food web effects
- Mechanistic effects
- Surveillance for potential direct or indirect effects on human health

Human health surveillance

- Monitor cleanup workers for exposures and their effects (NIEHS – RFA)
  - Needs to be longitudinal for late effects and persistent chemicals
  - PAH exposures may be immunosuppressive – alert for infection outbreaks
- Monitor health status of general community
  - Food chain exposures
  - Other indirect effects
- Catch problems early so effects can be mitigated
  - Don't repeat mistakes of 9/11

Cumulative risk assessment

- Cumulative risk assessment deals with effects of mixtures
- Includes not only chemical exposures but other physical, psychosocial, and economic stressors
- EPA focus
  - Multiple indicators
  - Environmental justice issues
  - EJSEAT - http://www.epa.gov/ncer/events/calendar/2010/mar17/presentations/andrew_schulman.pdf
- Psychosocial and economic stress appear to be major in this event
- How do direct and indirect exposures interact with them?

NIEHS Announcement

- http://grants.nih.gov/grants/guide/notice-files/NOT-ES-10-012.html
- The National Institute of Environmental Health Sciences, in partnership with several NIH Institutes/Centers/Offices, intend to promote a new initiative by publishing a Request for Applications (RFA) to solicit applications to examine the impacts of the Deepwater Horizon Disaster on health and quality of life of the general population residing in the Gulf Coast Region. In addition to the potential for exposure to oil and chemical mixtures, dispersants, etc., residents in the Gulf region are experiencing economic hardship, job loss, resettlements and other forms of psychological distress which may all impact health and quality of life

Overall research goals

- Comprehensive understanding of effects of spill
- Secondary and tertiary prevention of human health effects
- Minimize impacts on ecosystem
- Provide evidence to appropriately compensate for harm
- Set appropriate policies for future to prevent recurrence and plan effective responses