ADIOS3

Spill Response Effectiveness and Impact for Spill Response Decision-Making

Dagmar Schmidt Etkin, PhD
Environmental Research Consulting

ADIOS3 Workshop
NOAA, Seattle, WA
29 – 29 September 2011

ADIOS3

Goals for ADIOS3

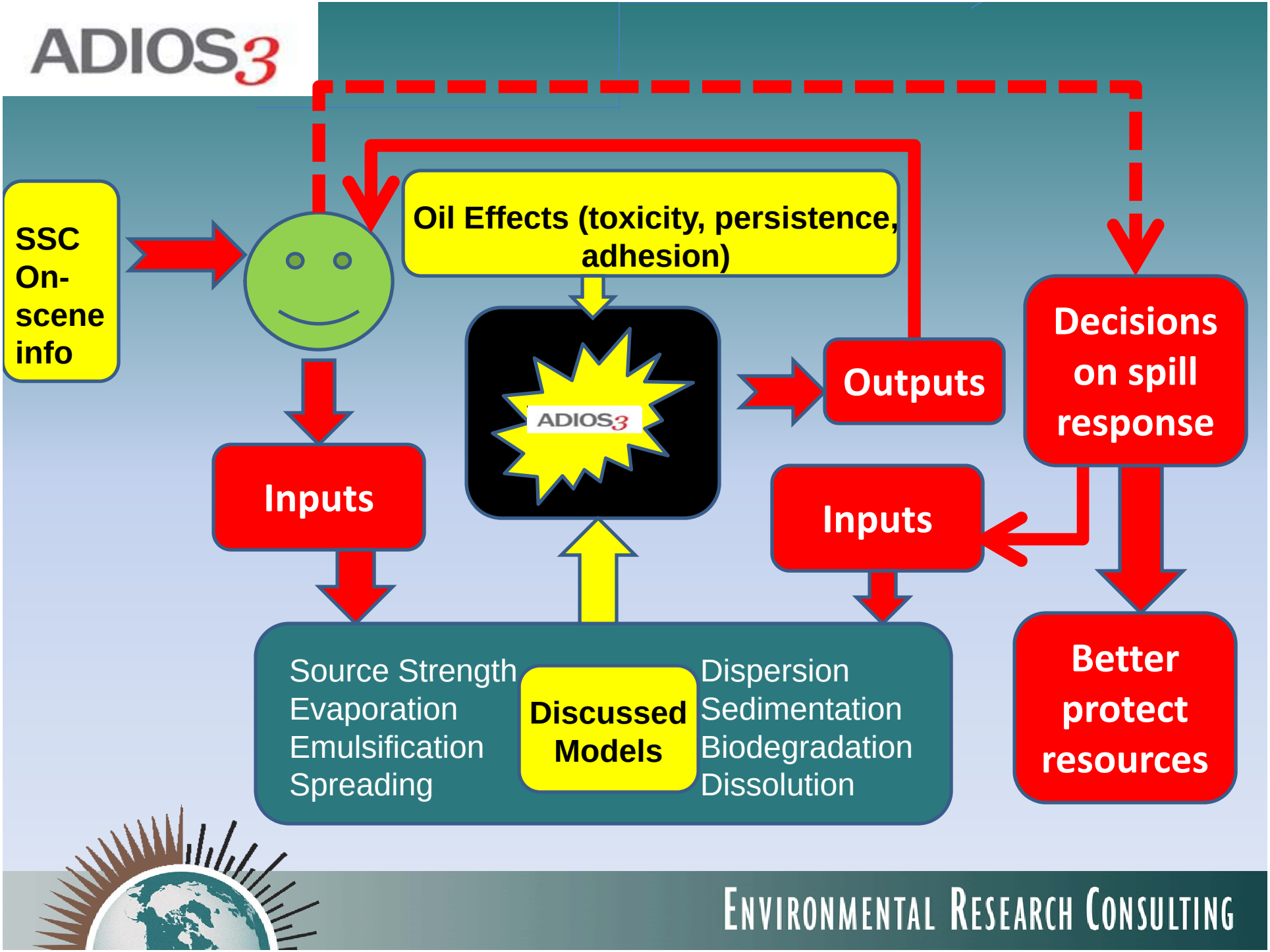
1.) Enhance existing ADIOS2 model by incorporating qualitative evaluation of ***environmental risk factors and develop a response utility benefit/cost metric***

ADIOS 3

2.) Provide a means to **evaluate the complex set of trade-offs and factors that will affect the desired outcome of best protecting the environment and providing net environmental benefit**

ADIOS 3

3.) Provide a tool that will assist response officials/decision-makers to **make better informed decisions regarding response strategy to better protect sensitive environmental resources at risk**


ADIOS3
SSC On-scene info
Oil Effects (toxicity, persistence, adhesion)
ADIOS3
Outputs
Decisions on spill response
Inputs
Inputs
Source Strength
Evaporation
Emulsification
Spreading
Discussed Models
Dispersion
Sedimentation
Biodegradation
Dissolution
Better protect resources
ENVIRONMENTAL RESEARCH CONSULTING

ADIOS 3

Issues of Model "Precision"

Decision-making tools only *assist* in decisions

Based on past experiences with spills and research

May be considerable imprecision in predicting damages in some cases, etc.

BUT – **decisions *are* being made on-scene at every spill already** based on many other factors (politics, guesswork, misinformation, public pressure) that have *absolutely no scientific basis*

ADIOS 3

ERC's Task

Develop algorithm series to provide relative measures of environmental impact risk based on response strategy

Data from ADIOS oil behavior and fate

User Input:
Environmental factors
Sensitive resources in trajectory
Sensitive resources in water column
Potential spill response measures

Relative environmental impact risk

ENVIRONMENTAL RESEARCH CONSULTING

ADIOS 3

User Interface Inputs

1.) **Sensitive marine environmental resources** within immediate vicinity of spill or potential trajectory

- Coral reefs
- Fisheries
- Marine sanctuaries
- Seabird populations
- Endangered or threatened species

ADIOS 3

User Interface Inputs

2**.) Proximity of marine resources** to spill source and/or spill slick and trajectory

- Coral reefs
- Fisheries
- Marine sanctuaries
- Seabird populations
- Endangered or threatened species

ADIOS 3

User Interface Inputs

3.) **Sensitive shoreline and nearshore resources** in spill vicinity or slick trajectory vicinity:

- Mangroves
- Wetlands
- Mudflats
- Shore bird populations
- Endangered or threatened species

ADIOS 3

User Interface Inputs

4.) **Sensitive shoreline and nearshore resources** in spill vicinity or slick trajectory vicinity:

- Mangroves
- Wetlands
- Mudflats
- Shore bird populations
- Endangered or threatened species

ADIOS 3

User Interface Inputs

5.) **On-water spill response strategy** options:

- Mechanical containment and recovery
- Dispersant application
- In situ burning
- Combination of responses
- No response (monitoring only)

ADIOS 3

Important Relationships

Response effectiveness depends on:

- Oil type and fate over time
- Prevailing conditions (winds, currents, temperatures)
- Timing of response (logistics, distance to shore)
- Response strategy (mechanical, dispersant, ISB, etc.)
- Skill of operators (training) and resources available

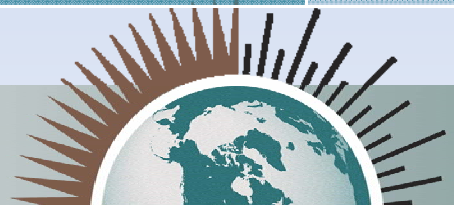
Choice of response should depend on:

- Sensitive resources at risk and tradeoffs
- Spill location
- Prevailing conditions
- Availability of equipment, personnel (and timing)

ADIOS 3

Response Tradeoffs Highly Simplified

Response Strategy	Likely Effectiveness	Benefit	Drawback
Mechanical	5 – 20% Depends on timing, oil type, logistics	Little environmental impact	Expensive Labor-intensive Not very effective
Dispersants	50 – 90+% Depends on timing, oil type/thickness, weather	May keep oil off shoreline and nearshore; effective	May affect fish and water column
In-Situ Burning	80 – 95+% Depends on timing, oil type/thickness	May keep oil off shoreline and nearshore; effective	Air pollution issues
No Response	Natural recovery may	No environmental damage from response	Oil may affect shoreline, nearshore



ADIOS 3

Proposed Approach

Data from ADIOS:

- Amount of oil
- Oil properties (toxicity, persistence, adhesion, etc.)
- Fate (% water column, % onshore, % surface) – over time

Estimate **relative environmental impact** (score 0 to 100?):

- Oil alone (or "no response")
- With dispersants (varying effectiveness)
- With mechanical recovery (varying effectiveness)
- With in situ burning (varying effectiveness)

[Taking into account potential impacts of response]

ADIOS 3

Comparison between Spill Response Strategies in Space and Time

Relative effectiveness given oil type, conditions, location

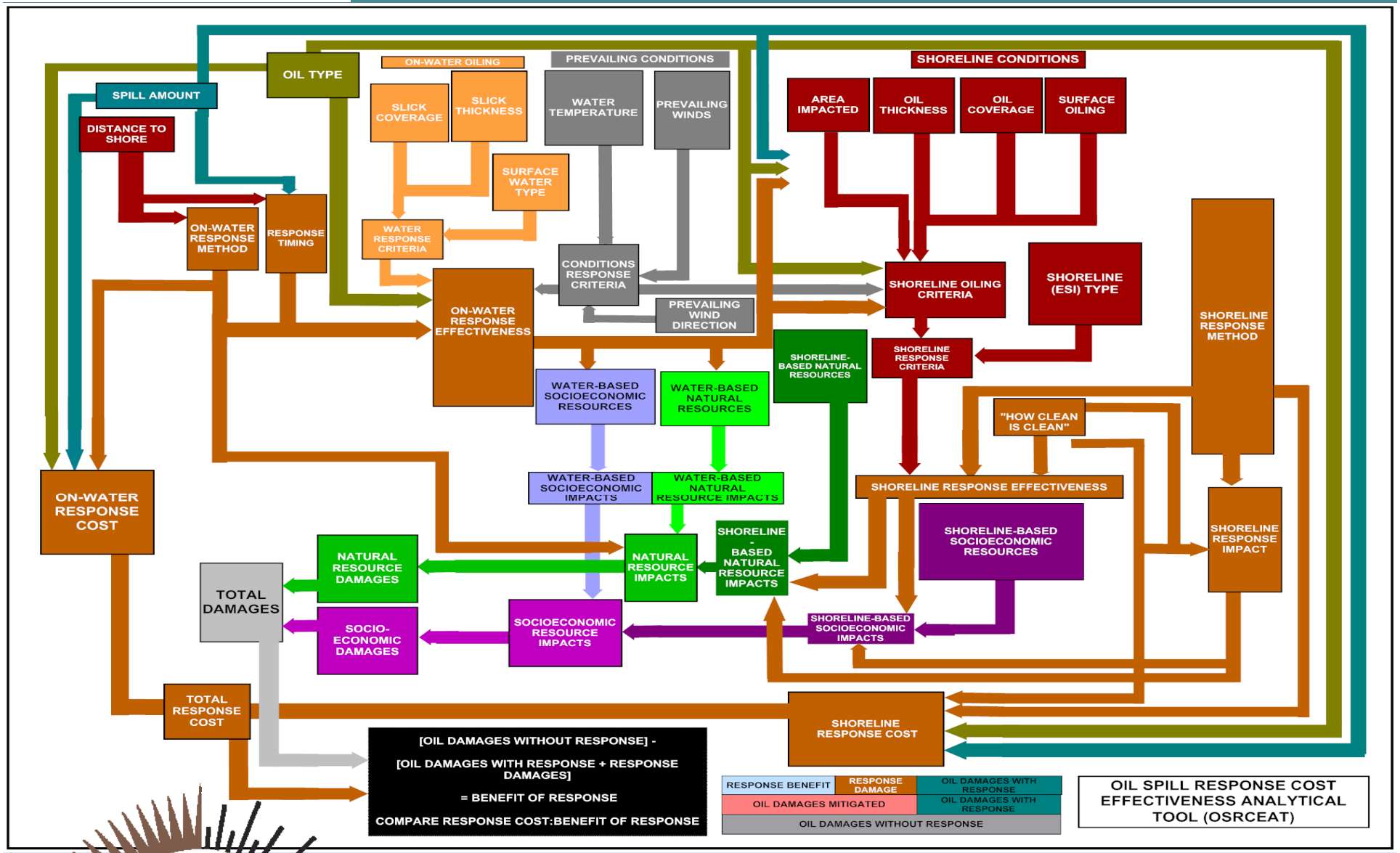
Potential impacts of spill response

Potential benefits of spill response

Tradeoffs between benefits and impacts to different sensitive resources clearly outlined

→ Aid in decision-making for response strategy

ADIOS3



ENVIRONMENTAL RESEARCH CONSULTING

ADIOS 3

Data Needed (Over Time and Space?)

Response	Effectiveness Estimate	Impact Prediction	Benefit Prediction
Mechanical	Surface thick; spread Sea state; currents Timing/logistics Emulsification	Presence of sensitive shoreline and nearshore resources	Presence of sensitive water column resources
Dispersant	Surface thickness Spread Oil type/weathering Timing/logistics Emulsification	Presence of sensitive water column resources	Presence of sensitive shoreline and nearshore resources
In Situ Burn	Surface thickness Timing/logistics Oil type/weathering Emulsification	Proximity to populated areas Wind direction	Presence of sensitive shoreline and nearshore resources

ADIOS 3

Important Considerations for Evaluating the Benefits of Response

How does the timing (delay) in response affect the fate and impacts of the oil?

- Response effectiveness (spread, weathering)
- Shoreline/nearshore impact

How does the effectiveness of the response affect the fate and impacts of the oil?

- Shoreline/nearshore impact
- Impact of undispersed/burned/removed oil

ADIOS3

Proposed Goals for ADIOS3 Outputs

ADIOS3 algorithms calculate the **potential effectiveness** of response (over space and time) – dispersants, ISB, mechanical removal

Provide data on oil behavior **over time** for the purpose of calculating spill response effectiveness and benefit/impact

Provide data on oil behavior **over space** for the purpose of calculating spill response effectiveness and benefit/impact