SIMA – Spill Impact Mitigation Assessment

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Top Take-Aways

- *SIMA - a new, more descriptive acronym*
- *Ideally part of contingency planning*
- *Requires stakeholder involvement*
- *Is a QUALITATIVE assessment*
- *Is flexible in application - scale and timing*

SIMA Process Issues

- *SIMA is a cornerstone for developing response strategy*

- *Recognized Need for:*
  - *Industry consensus on SIMA process*
  - *Transparency with Stakeholders/Regulators*
  - *Stakeholder/Regulator input/involvement*
  - *Balanced approach (not just for dispersants)*

- *Flexibility is Critical!*
  - *Formal vs informal/expedited SIMAs*
  - *Qualitative vs quantitative*
  - *Many spills won't require SIMA*

Four Stages of SIMA

- *Compile and Evaluate Data*
  - *Define the scenarios*
    - *Event? What spilled? Volume? What happens to it? Where does it go? What does it impact?*
  - *Determine feasible response options*
- ***Predict Outcomes***
  - *No Intervention or Natural Attenuation*
  - *Predict effectiveness and preliminary impact modification potential for feasible response options*
- ***Balance Trade-offs***
  - *Evaluate impact modification potential for response options*
  - *"Sense-check" outputs; Modify assessment as appropriate*
- *Select Best Response Option(s)*
  - *Minimize ecological, socio-economic, cultural impacts*

Predict Outcomes Stage

- *Ideally involves close stakeholder engagement*
- *Determine Appropriate Resource Compartments (RCs)*
  - *Includes environmental, socio-economic, and cultural, as well as "high value"*
  - *Can subdivide, as needed*
- *Predict Relative Spill Impacts to Each RC for "No Intervention" Option*
  - *Establishes "base case" for further evaluations*
  - *None, Low, Medium, High*
- *Assign Numerical Score to Relative Impacts*
  - *1-None, 2-Low, 3-Medium, 4-High, or non-linear*
- *Predict Effectiveness for each Feasible Response Option*
  - *Scenario-specific*
  - *Function of oil type, weathering, sea-state, encounter rate, logistical considerations, etc.*

	No intervention	
	Potential relative impact	
Resource compartments		A
Seabed	None	1
Lower water column	None	1
Upper water coloumn	Low	2
Water suface	Med	3
Air	Med	3
Shorelines		3
Saltmarsh	*High*	*4*
Estuarine mudflats	*High*	*4*
Sandy beaches	*Low*	*2*
High value resources	Low	2
Socio-economic		4
Boat harbour	*Med*	*3*
Water recreation	*High*	*4*
Cultural	None	1

Balance Trade-offs Stage

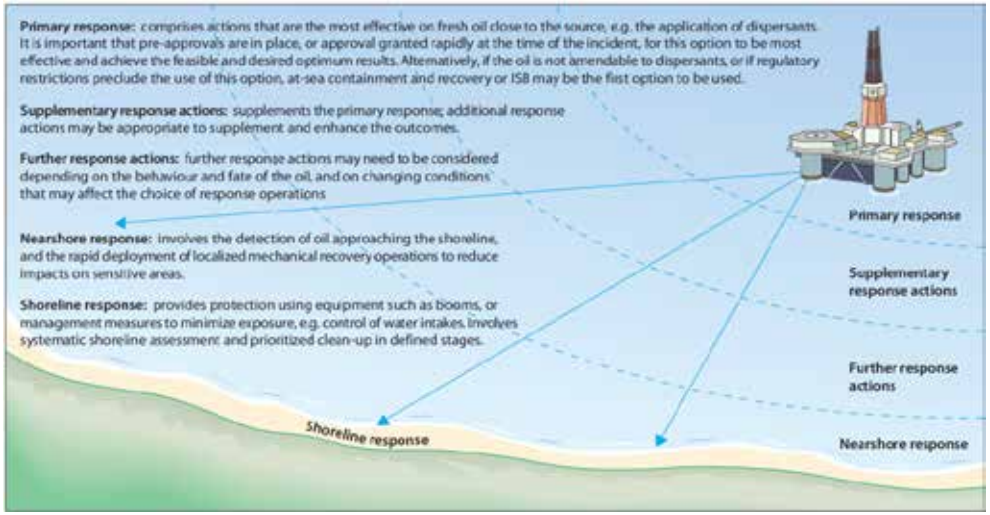
- *Stakeholder engagement crucial*
  - *Can be most contentious element of SIMA*
  - *Strive to keep discussions objective*
- *Establish Impact Modification Factors for each Response Option for each Resource Compartment*
  - *Indicates degree to which "No Intervention" impacts altered by each option*
  - *Assign score (+/- 1 to 3) to each RC*
  - *Total Scores for each Response Option*
- *Review ("sense-check") outcomes*
- *Modify Matrix as appropriate*

Impact modification factor	Description
+3	Major mitigation of impact
+2	Moderate mitigation of impact
+1	Minor mitigation of impact
0	No or insignificant alteration of impact
-1	Minor additional impact
-2	Moderate additional impact
-3	Major additional impact

	No intervention		Contain and recover		Surface dispersant		Subsea dispersant	In-situ burning		Shoreline booming	
Resource compartments	Potential relative impact	A	Impact modification factor B1	**Relative impact mitigation score** A x B1	Impact modification factor B2	**Relative impact mitigation score** A x B2	Not feasible	Impact modification factor B4	**Relative impact mitigation score** A x B4	Impact modification factor B5	**Relative impact mitigation score** A x B5
Seabed	None	1	0	**0**	0	**0**		0	**0**	0	**0**
Lower water column	None	1	0	**0**	0	**0**		0	**0**	0	**0**
Upper water coloumn	Low	2	1	**2**	-2	**-4**		0	**0**	0	**0**
Water suface	Med	3	1	**3**	3	**9**		2	**6**	0	**0**
Air	Med	3	1	**3**	2	**6**		-2	**-6**	0	**0**
Shorelines		3	1	**3**	3	**9**		2	**6**	1	**3**
Saltmarsh	*High*	*4*	*1*		*3*			*2*		*1*	
Estuarine mudflats	*High*	*4*	*1*		*3*			*2*		*1*	
Sandy beaches	*Low*	*2*	*1*		*3*			*2*		*2*	
High value resources	Low	2	0	**0**	1	**2**		0	**0**	1	**2**
Socio-economic		4	1	**4**	2	**8**		1	**4**	3	**12**
Boat harbour	*Med*	*3*	*1*		*2*			*1*		*2*	
Water recreation	*High*	*4*	*1*		*2*			*1*		*3*	
Cultural	None	1	0	**0**	2	**2**		1	**1**	1	**1**
		TOTAL		15		32			11		18
		RANKING		**3rd**		**1st**			**4th**		**2nd**

Select Best Options Stage

- *Use Final Total Scores to Objectively Select best Options*
- *Evaluate Optimal Use/Location/Timing of Each Response Option*
- *Develop Response Strategy Incorporating Selected Options and Optimized Utilization*
- *When Planning, ensure capabilities available to implement the strategy*



Marine Terminal Example

Scenario	
Location	Marine terminal within relatively sheltered inlet/estuary
Incident	Discharge hose failure
Oil type	Medium/heavy crude oil (API° 29.3, specific gravity 0.88)
Volume of release	150 m^3
Duration of release	3 minutes
Prevailing conditions	Summer conditions, maximum tidal range is 0.5m giving maximum local currents of 0.2 ms^{-1}
Scenario setting	Spilled oil is predicted to move from the terminal to threaten adjacent shorelines with 1-2 hours. The shorelines and nearshore support both important ecological (saltmarsh and shallow coral) and socio-economic (power station and recreation) features.

Marine Terminal Example

Resource compartments		No intervention: Potential relative impact	Contain and recover: Impact modification factor	Contain and recover: **Relative impact mitigation score**	Surface dispersant: Impact modification factor	Surface dispersant: **Relative impact mitigation score**	Subsea dispersant	In-situ burning	Shoreline booming: Impact modification factor	Shoreline booming: **Relative impact mitigation score**
		A	B1	A x B1	B2	A x B2			B5	A x B5
Seabed	Low	2	2	**4**	-2	**-4**	Not feasible	Not feasible	0	**0**
Lower water column	None	1	0	**0**	0	**0**			0	**0**
Upper water coloumn	Low	2	1	**2**	-2	**-4**			0	**0**
Water suface	Med	3	3	**9**	3	**9**			0	**0**
Air	Low	2	0	**0**	0	**0**			0	**0**
Shorelines		3	2	**6**	1	**3**			1	**3**
Mangrove	*High*	*4*	*2*		*1*				*2*	
Sandy beaches	*Low*	*2*	*2*		*1*				*1*	
Rocky shores	*Med*	*3*	*2*		*1*				*0*	
High value resource										
Coral reef	High	4	2	**8**	-2	**-8**			1	**4**
Socio-economic		4	2	**8**	-1	**-4**			2	**8**
Power station intake	*High*	*4*	*2*		*-1*				*3*	
SCUBA diving	*High*	*4*	*2*		*-1*				*0*	
Cultural	None	1	0	**0**	0	**0**			1	**1**
		TOTAL		37		0				16
		RANKING		**1st**		**3rd**				**2nd**

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	No intervention		Contain and recover		Surface dispersant		Subsea dispersant	In-situ burning	Shoreline booming	
	Potential relative impact		Impact modification factor	Relative impact mitigation score	Impact modification factor	Relative impact mitigation score			Impact modification factor	Relative impact mitigation score
Resource compartments		A	B1	A x B1	B2	A x B2			B5	A x B5
Seabed	Low	2	2	**4**	-2	**-4**	Not feasible	Not feasible	0	**0**
Lower water column	None	1	0	**0**	0	**0**			0	**0**
Upper water coloumn	Low	2	1	**2**	-2	**-4**			0	**0**
Water suface	Med	3	3	**9**	3	**9**			0	**0**
Air	Low	2	0	**0**	0	**0**			0	**0**
Shorelines		3	2	**6**	1	**3**			1	**3**
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SCUBA diving	*High*	*4*	*2*		*-1*				*0*	
Cultural	None	1	0	**0**	0	**0**			1	**1**
		TOTAL		37		0				16
		RANKING		**1st**		**3rd**				**2nd**

Selecting best options

The matrix indicates that contain and recover provides the highest mitigation potential. Sheltered sea conditions and summer weather are favourable to on-water recovery and the relatively heavy oil would have reduced spreading. Recovery and storage systems would need to take into account the viscous nature of the oil. Response capability would need to be available for rapid mobilization and deployment i.e. close to the terminal.

Shoreline booming brings specific benefit to the power station intake and would be focused on its protection. Consideration would be given to storing suitable boom and installing permanent anchor points at the facility. Surface dispersant is not a viable option, due to reduced effectiveness on heavier oil, plus the shallow waters limiting dilution - leading to poor likelihood of net impact mitigation.

Shoreline Oiling Example

Scenario	
Location	Sand beach
Incident	Stranded oil
Oil type	Medium crude oil
Volume of release	30 m^3 extending over 1 km of beach
Duration of release	Calm seas, good access to the beach
Prevailing conditions	Fresh oil has stranded along the beach in a band up to 5m width and up to 1 cm thickness. The beach is used as a turtle nesting and seal haul out. There is a hotel and public recreation area at one end of the beach and a backshore petrified forest.
Scenario setting	For this specific location a set of feasible cleanup techniques is considered. The SIMA matrix has been adapted to compare these techniques, taking into account both their impacts (e.g. through physical disturbance or mixing oil into sediment) and ability to remove oil and thereby promote recovery. Due to this shoreline segment representing a small geographic area, relative impacts to key individual resources of concern were assessed, rather than the resource compartments used in the previous examples.

Shoreline Oiling Example

Resource compartments	No intervention		Manual removal		Debris removal		Flooding (deluge)		Sorbents		Mechanical removal	
	Potential relative impact		Impact modification factor	**Relative impact mitigation score**	Impact mitigation factor	**Relative impact mitigation score**	Impact modification factor	**Relative impact mitigation score**	Impact modification factor	**Relative impact mitigation score**	Impact modification factor	**Relative impact mitigation score**
		A	B1	A x B1	B2	A x B2	B3	A x B3	B4	A x B4	B5	A x B5
Invertebrates	Low	2	1	**2**	0	**0**	1	**2**	0	**0**	-2	**-4**
Sea turtles	High	4	2	**8**	1	**4**	2	**8**	1	**4**	-3	**-12**
Shore birds	Med	3	2	**6**	2	**6**	1	**3**	1	**3**	1	**3**
Seal haulout	Med	3	2	**6**	1	**3**	1	**3**	1	**3**	1	**3**
Recreation	Med	3	3	**9**	2	**6**	2	**6**	1	**3**	2	**6**
Petrified forest	Low	2	1	**2**	0	**0**	0	**0**	0	**0**	-2	**-4**
		TOTAL		33		19		22		13		-8
		RANKING		**1st**		**3rd**		**2nd**		**4th**		**5th**

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Resource compartments		A	B1	A x B1	B2	A x B2	B3	A x B3	B4	A x B4	B5	A x B5
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Shore birds	Med	3	2	**6**	2	**6**	1	**3**	1	**3**	1	**3**
Seal haulout	Med	3	2	**6**	1	**3**	1	**3**	1	**3**	1	**3**
Recreation	Med	3	3	**9**	2	**6**	2	**6**	1	**3**	2	**6**
Petrified forest	Low	2	1	**2**	0	**0**	0	**0**	0	**0**	-2	**-4**
		TOTAL		33		19		22		13		-8
		RANKING		**1st**		**3rd**		**2nd**		**4th**		**5th**

Selecting best options

The matrix indicates that manual removal provides the highest mitigation and would be adopted as the primary cleanup technique. Both debris removal and flooding (deluge) would also be considered; the former reducing and minimizing waste and the latter targeting heaviest oil deposits. Use of sorbents would be limited due to disposal issues and mechanical removal would avoided, as it exacerbates the overall impacts and would require access through the backshore petrified forest.

Once the bulk oil removal has taken place, the matrix may be revisited to assess the continued validity of the techniques and mitigation potential for lower oiling conditions.

Top Take-Aways

- *SIMA - a new, more descriptive acronym*
- *Ideally part of contingency planning*
- *Requires stakeholder involvement*
- *Is a QUALITATIVE assessment*
- *Is a flexible in application - scale and timing*

energy API

THANK YOU!!