OIL SPILL RESPONSE THAILAND 2019 IN-SITU BURNING (ISB) OPERATIONS AND EQUIPMENT

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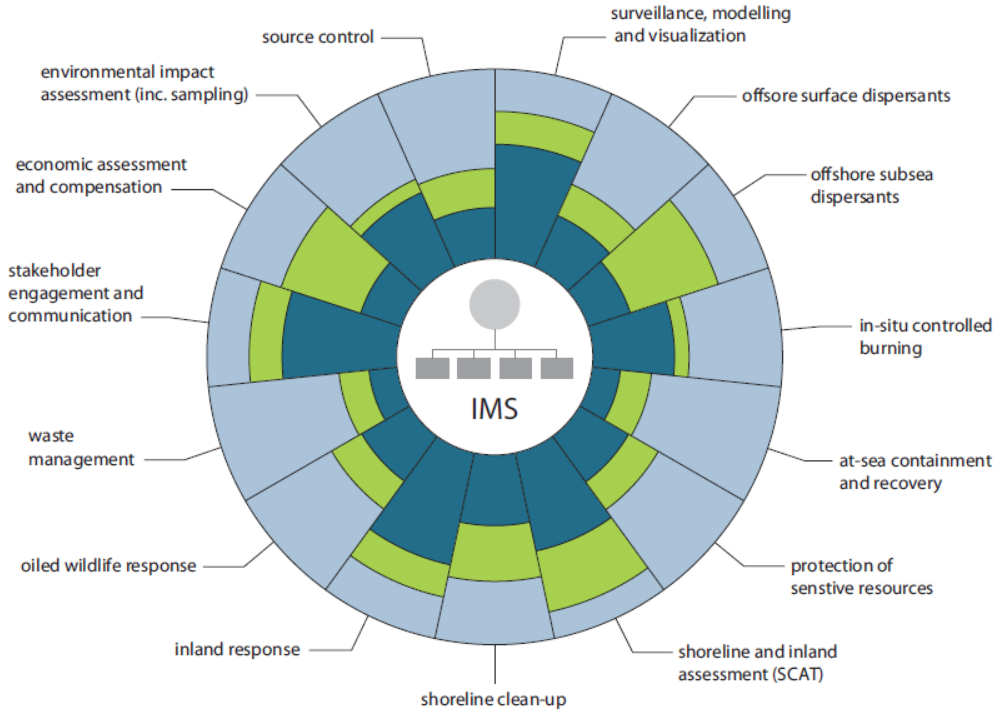
Oil Spill Response

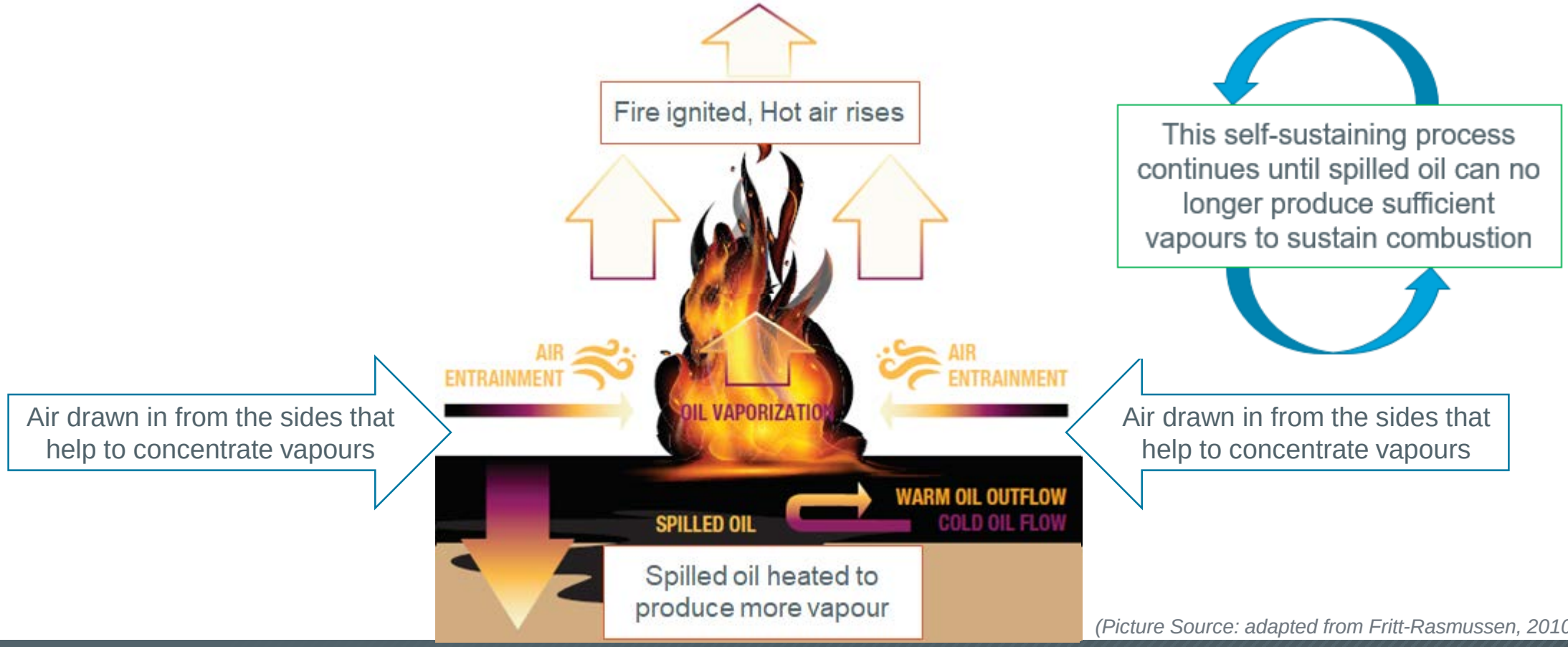
ISB

- ASTM (American Society for Testing and Materials) International (2014) defines Controlled ISB as “burning when the combustion can be started and stopped by human intervention.”
- Compliments other clean-up techniques and has proven to be a valuable addition to the response toolbox.



How ISB on Water Works

- Burning of hydrocarbon vapours that evaporate from oil slick and not the oil itself.



(Picture Source: adapted from Fritt-Rasmussen, 2010)

Oil Spill Response

CONSIDERATIONS FOR CONTROLLED ISB OPERATIONS

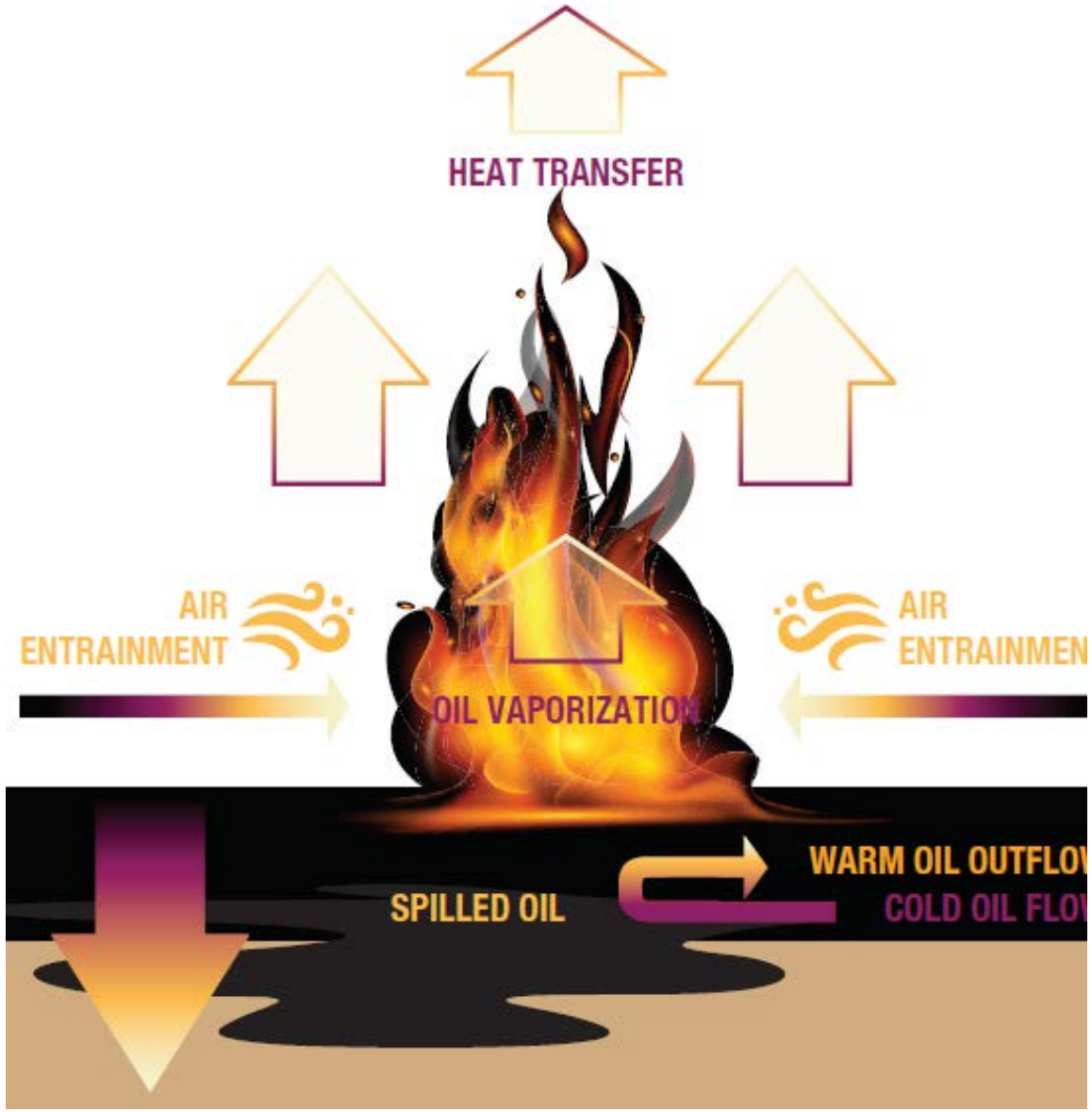
Will the oil burn?

- If thick enough and sufficient vapours are present.

Oil Type	Minimum Thickness
Fresh crude oil	2-3 mm
Diesel and weathered crude oil	3-5 mm
Emulsified and heavy fuel oil	5-10 mm

(Source: American Petroleum Institute 2015a)

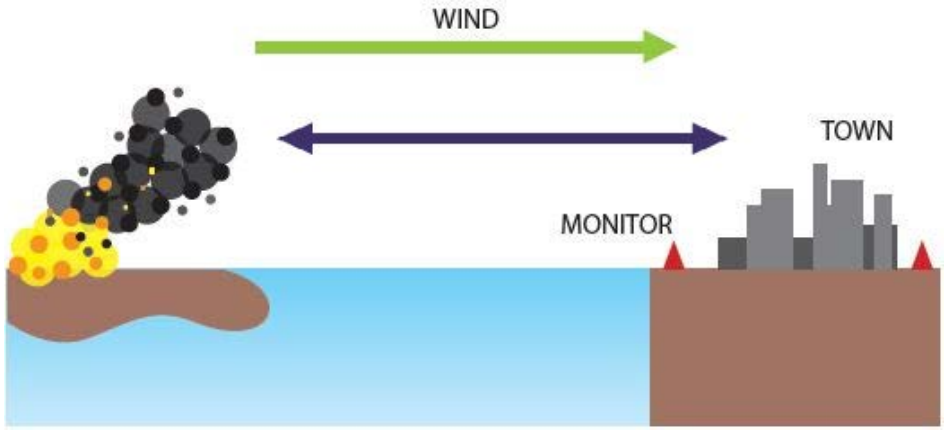
- Test burn is recommended



(Picture Source: adapted from Fritt-Rasmussen, 2010)

Planning

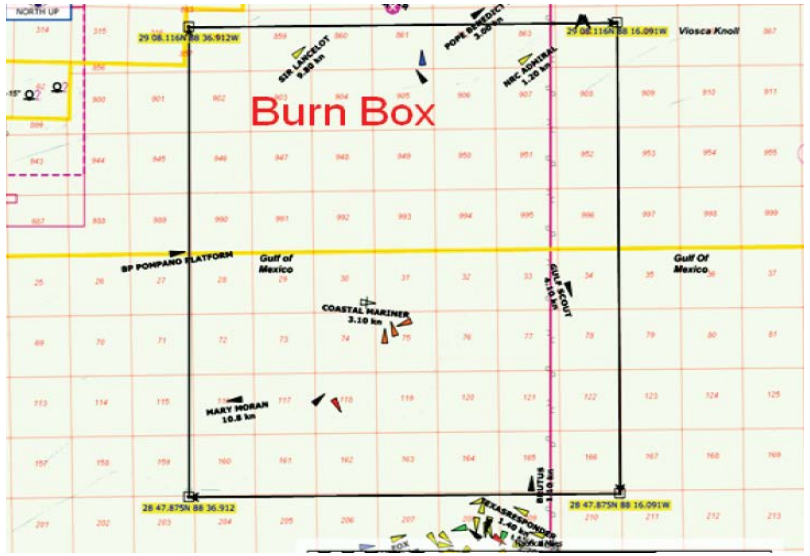
- Is the location suitable for burning?
  - Distance from populated areas and other activities? (e.g. fish farm, dispersant, C&R)
  - Direction and distance of smoke plume trajectory?
- A burn should be greater than 1 km from any residence and 4 km from multiple residences that is downwind of a smoke plume.

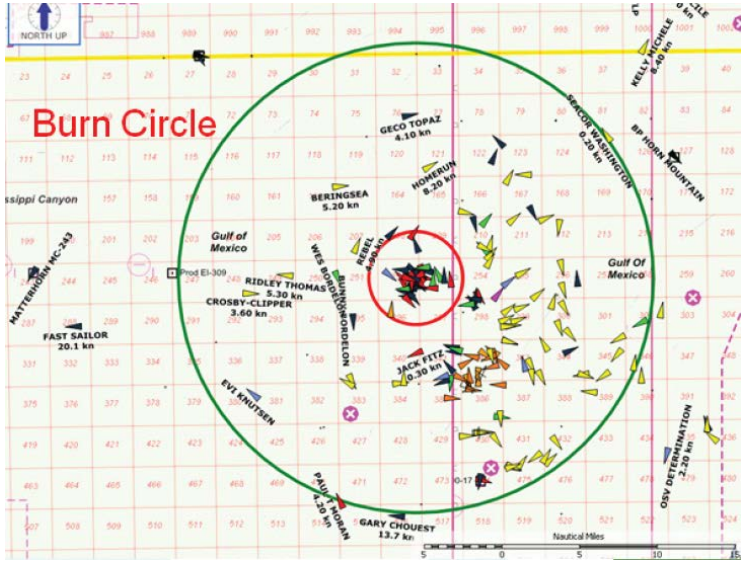


(Picture Source: OSRL Offshore In-Situ Burn Operations Field Guide)

Planning

- Designate controlled ISB area(s).
- ISB areas can be pre-approved as part of the contingency planning.
- Burn Plan – Health and Safety, map, resources, communications (internal and external), pre/during/post actions, etc.





(Picture Source: OSRL Offshore In-Situ Burn Operations Field Guide)

Environment Factors

- Wind
  - In general wind speed less than 18 knots.
  - However less than 10 knots are preferred for fire control.
  - Concentration of vapours can become difficult to maintain at high wind speed.
- Rain can lower the efficiency of a burn due to the cooling effect of water droplets.
- High sea states can cause boom failures during towing operations.

(Source: IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil)

Resources Availability

(Picture Source: Nere Mabile - The Coming of Age of Controlled In-Situ Burning)

- Controlled ISB equipment
- Vessels
  - Command Vessel
  - Boom Towing Vessel
  - Support Vessel
- Ignition Device
- Aerial Support – Surveillance and Ignition
- Trained Personnel – Responders, Vessel Crew, Pilot

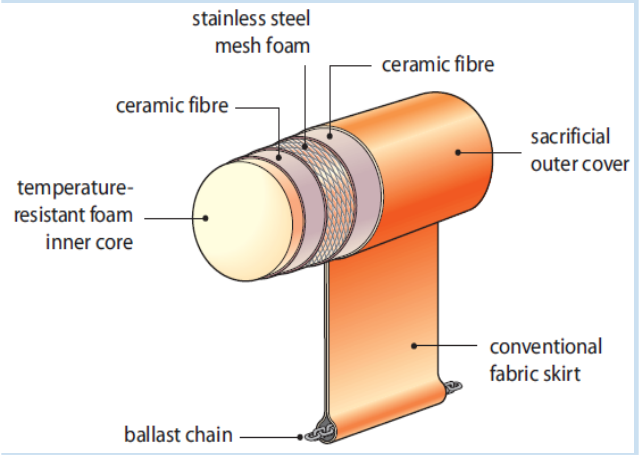
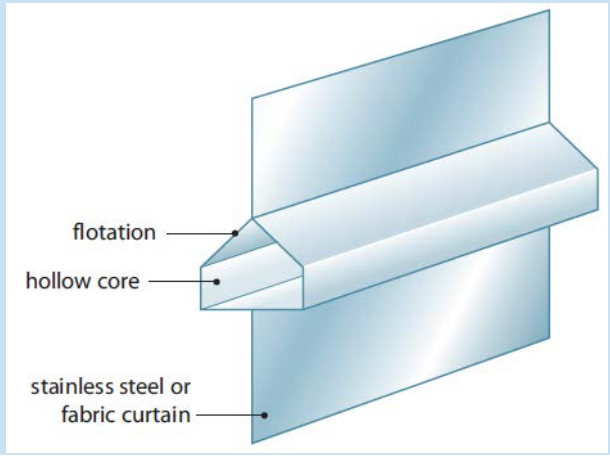
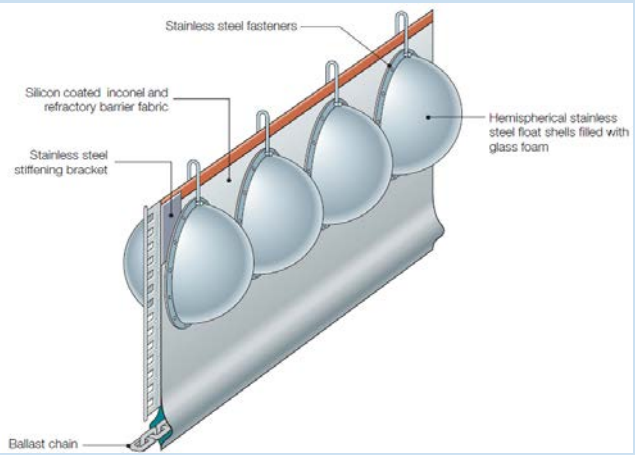
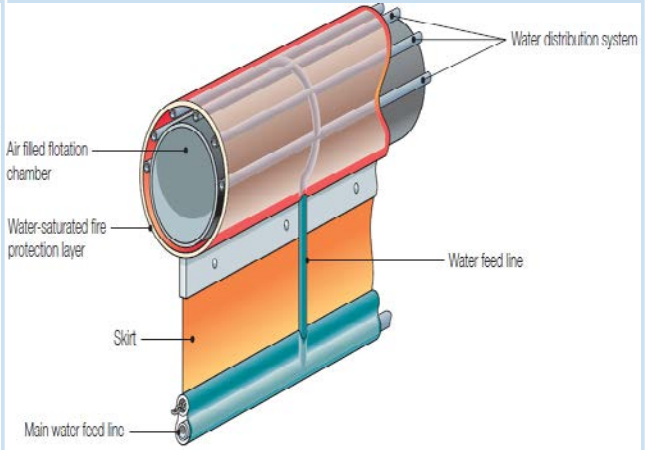
Oil Spill Response

EQUIPMENT FOR CONTROLLED ISB OPERATIONS

Fire-Resistant Containment Booms (Fire Boom)

- Generally designed to withstand heat and to survive multiple burns.
- Towing operations is similar to conventional containment boom
- Standard test by ASTM to assess fire-resistant booms durability is a minimum five-hour test

(Source: IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil, OSRL Offshore In-Situ Burn Operations Field Guide)

Thermally Resistant	Stainless Steel		Water-Cooled System
			
• Layers of temperature resistant material • Sacrificial outer cover	• Stainless steel floats	• Stainless steel hemispheres flotation chambers	• Water pumps system with a protective jacket
			
• Considerably bulky • Generally stored in containers, racks, open trays	• Considerably bulky • Generally stored in container	• Considerably bulky • Generally stored in containers, racks, open trays	• Reel-mounted system

(Source: IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil, OSRL Offshore In-Situ Burn Operations Field Guide)

Thermally Resistant	Stainless Steel		Water-Cooled System
			

• Rigid type
  • Less effective wave-following characteristics than inflatable
  • Rapid deployment time
	• Rigid type
	  • Less effective wave-following characteristics than inflatable
	  • Towed in apex to withstand the greatest heat
		• Fence Boom type
		  • Less effective wave-following characteristics than inflatable
		  • Rapid deployment time
			• Inflatable type
			  • Good following characteristics than inflatable

• Rapid deployment time	• Rapid deployment time	• Rapid deployment time	• Hydraulic powered • Requires support ancillaries (hydraulic power pack, water pumps, air blower)
• Requires little training	• Requires little training	• Requires little training	• Requires training to operate support ancillaries

(Source: IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil, OSRL Offshore In-Situ Burn Operations Field Guide)

(Picture Source: Nere J. Mabile 2010 Fire Boom Performance Evaluation)

Fire Boom Performance Evaluation

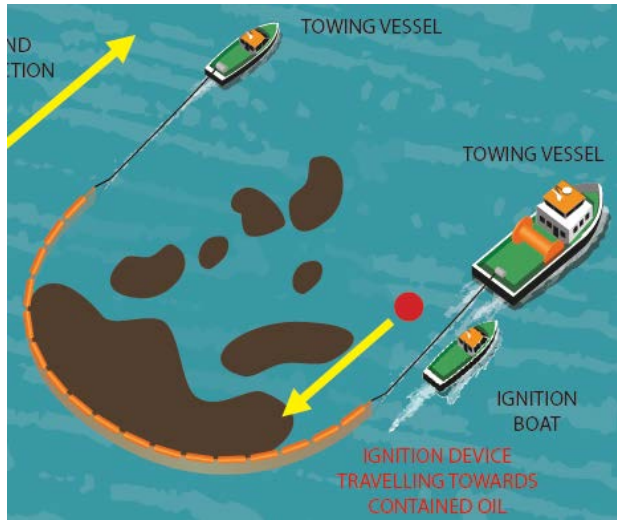
- 411 ISB operations were recorded during 2010 Deepwater Horizon oil spill

Burn #	Burn Date	Hydro-Fire Est. Min Volume (Barrels)	Hydro-Fire Est. Max Volume (Barrels)	Pyro-Boom Est. Min Volume (Barrels)	Pyro-Boom Est. Max Volume (Barrels)	AMI / 3M Est. Min Volume (Barrels)	AMI / 3M Est. Max Volume (Barrels)	Oil Stop Est. Min Volume (Barrels)	Oil Stop Est. Max Volume (Barrels)	Kepner Est. Min Volume (Barrels)	Kepner Est. Max Volume (Barrels)
397	7/16/2010	11	15								
398	7/16/2010	1	1								
399	7/16/2010	16	23								
400	7/16/2010					63	89				
401	7/16/2010			0	0						
402	7/16/2010			0	0						
403	7/16/2010	82	115								
404	7/16/2010	55	78								
405	7/16/2010			0	0						
406	7/16/2010	13	18								
407	7/16/2010			8	12						
408	7/16/2010					50	70				
409	7/17/2010			0	0						
410	7/19/2010	106	148								
411	7/19/2010			0	0						
Total		101932	139661	16088	22745	103591	144890	34	84	422	591
Systems Deployed		27	27	13	13	37	37	3	3	2	2
Barrels/ System		3,775	5,173	1,238	1,750	2,800	3,916	11	28	211	296

	Water-Cooled System	Thermally Resistant	Stainless Steel	Thermally Resistant	
Factors	**Hydro-Fireboom**	**American Marine / 3M**	**Pyroboom**	**Oil Stop**	**Kepner**
No. of Systems Used	27	37	13	3	2
Longest Continuous Burn	11 hrs 48 min.	11 hrs 21 min.	3 hours 13 min	27 min.	43 min.
Average Max/Min Barrels Burned per System	5,173/ 3,775	3,916/ 2,800	1,750/ 1,238	28/ 11	296/ 211

(Source: Nere J. Mabile 2010 Fire Boom Performance Evaluation)

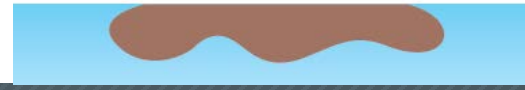
Ignition Device



- Floating hand-held igniter
  - Easily deployed from small vessel
  - Component parts widely available (Marine flare, diesel fuel, gelling agent)

- Heli-torch
  - Underslung from a helicopter
  - Storage drum containing gelled fuel, a pump assembly, and electronically-fired propane jets

(Picture source: IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil, OSRL Offshore In-Situ Burn Operations Field Guide)



Particulate Monitor

- Capable of detecting small particulates emitted by the burn (ten microns/ 0.01mm n diameter or smaller)

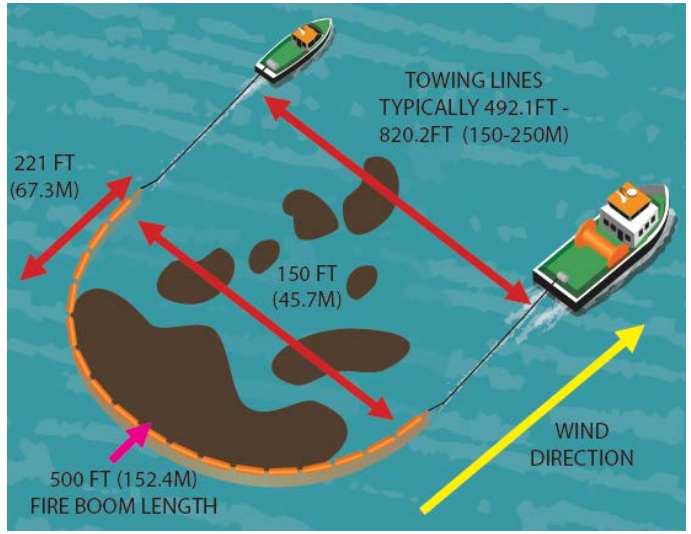
Oil Spill Response

OPERATIONAL ASPECTS OF CONTROLLED ISB OPERATIONS

Contain the Oil

- Towing operations is similar to conventional containment boom.
- Towing in the direction of the wind reduces the heat stress on the boom.
- This may cause smoke plume to move towards the vessels.

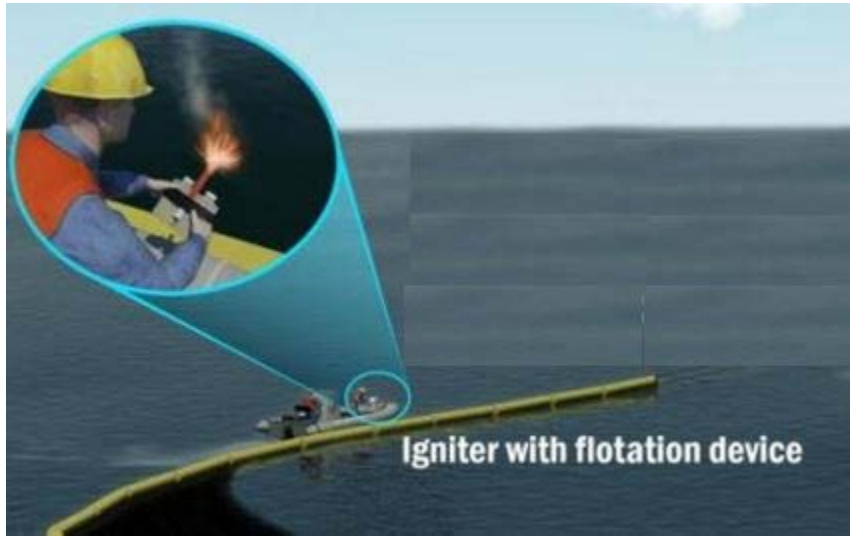
In Direction of Wind



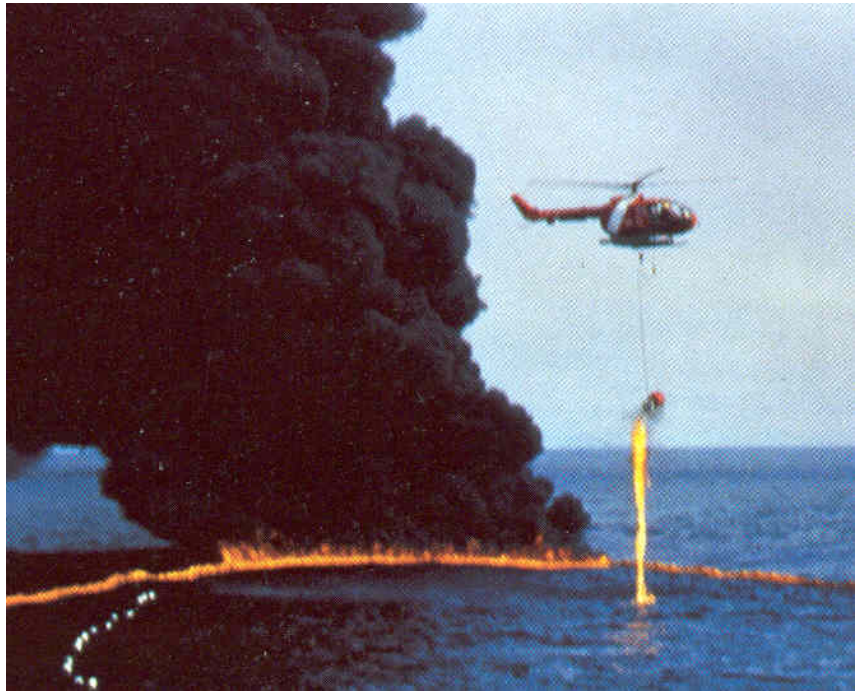
Against Wind

Igniting

- Floating hand-held igniter
  - Deployed at a safe distance between the device and the towing vessels

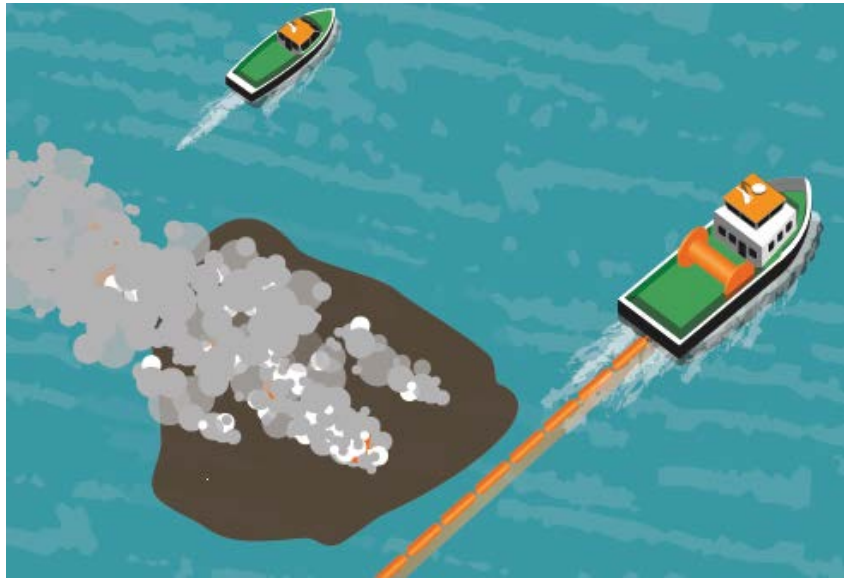


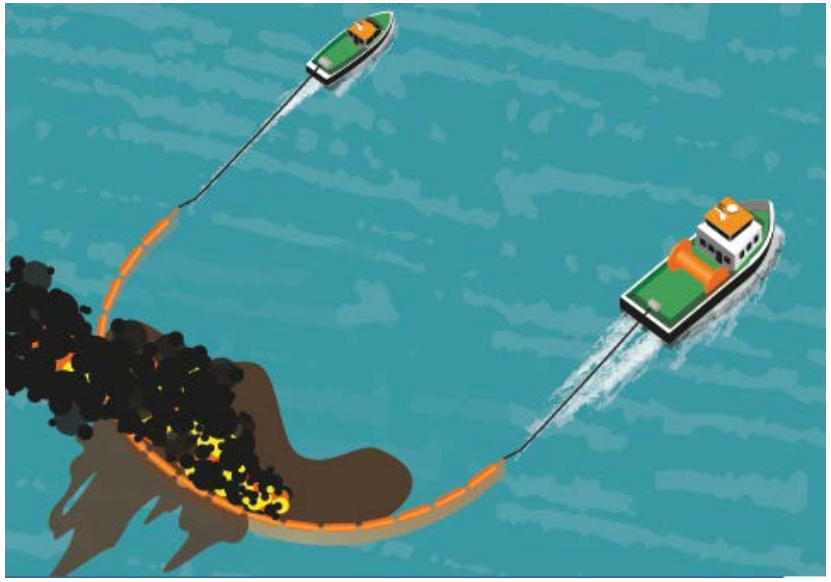
- Heli-torch
  - Operated at an approximate altitude of 25-75 feet/ 8-23m



Extinguish the Burn

- Command or another vessel to extinguish using appropriate firefighting equipment.
- Reduce the oil layer thickness
  1. Release one of the towing lines
  2. Increase both towing vessels speed (3-4 knots)





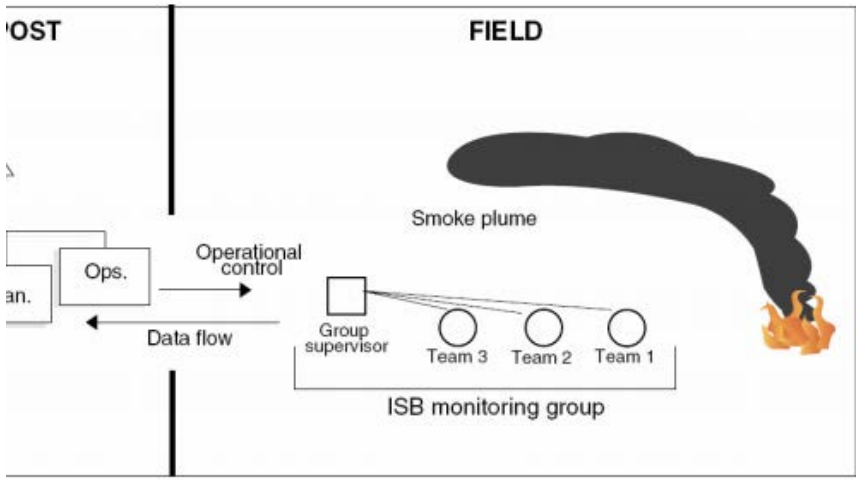
Burn Residue and Unburned Oil

- Normally heavy, viscous and similar of heavily weathered oil.
- May sink rather than float.
- Can be mechanically recovered or pumped.
- Another option is to re-ignite the residue or burn it along with newly collected oil.

(Source: IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil)

Air Monitoring

- The Special Monitoring of Applied Response Technologies (SMART) provide guideline for ISB operations.
- Air monitoring is generally required as a condition of regulatory approval for ISB.



Preparedness

- Decision makers must be prepared to quickly determine the best response countermeasures for an oil spill incident.
- ISB is one of several response options that can be analysed and compared in SIMA.

(Source: IPIECA Good Practice Guide - Guidelines on implementing spill impact mitigation assessment (SIMA))

Advantages	Disadvantages
• Rapid removal of oil • Minimal equipment requirement • High efficiency rates • Reduced volume of oily waste for disposal • Can be used on almost any habitat and on most oils	• Black smoke plume (aesthetics and emissions concerns) • Risk of fire spreading or loss of fire control • Residue may need to be recovered

Oil Spill Response

REFERENCES

National Oceanic and Atmospheric Administration (NOAA) - In Situ Burning

IPIECA Good Practice Guide - Controlled in-situ burning of spilled oil

IPIECA Good Practice Guide - Guidelines for the selection

Oil Spill Prevention and Response - Response Library_In-Situ Burning

Nere J. Mabile - Fire Boom Performance Evaluation

Nere J. Mabile - The Coming of Age of Controlled In-Situ Burning

IPIECA Good Practice - Guidelines on implementing spill impact mitigation assessment (SIMA)

OSRL Offshore In-Situ Burn Operations Field Guide