
Environmental Technologies in Maritime Shipping & Transportation: Implementing the New UN Protocols

NSW Seawater Scrubbing

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Introduction

- Currently, more than 50,000 existing and lots of new building ships are in need of low-cost solution to implement MARPOL Annex VI of UN for sulfur emission reduction.
- The maritime shipping industry consumes 300 million tons of 3% sulfur fuel annually. This led to emissions of 6.34 million tons of toxic SO₂ in 2009 ('Ship Design' 2010,China).
- The sulfur emission of the 16 largest ships is equivalent to sulfur emission of all land vehicles (Professor James Corbett, University of Delaware, 2009).
- Three contenders: Low sulfur fuel, Chemicals, Natural Sea Water (NSW)
- CEPT's experience with long-term, large-scale coal-fired plants in Asia, together with small-scale maritime vessels, demonstrate that NSW scrubbing is the most economical and the most green solution.
- Considering overall greenhouse emissions, costs, and efficiency, NSW scrubbing is far superior to switching to low-sulfur fuel.

Pollution of shipping, UN Convention and regulation

IMO ship low sulfur regulation (Exhaust Gas Cleaning Systems as an 'equivalent')

- Already in force:

From January 1, 2010, UN port: sulfur content of fuel ≤ 0.10 %m/m

From August 1, 2012, North American ECA: sulfur content of fuel ≤ 0.10 %m/m

From January 1, 2012, Global: sulfur content of fuel ≤ 3.5 %m/m

- Future:

From January 1, 2015, UN SECA: sulfur content of fuel ≤ 0.10 %m/m

From January 1, 2020, Global: sulfur content of fuel ≤ 0.50 %m/m



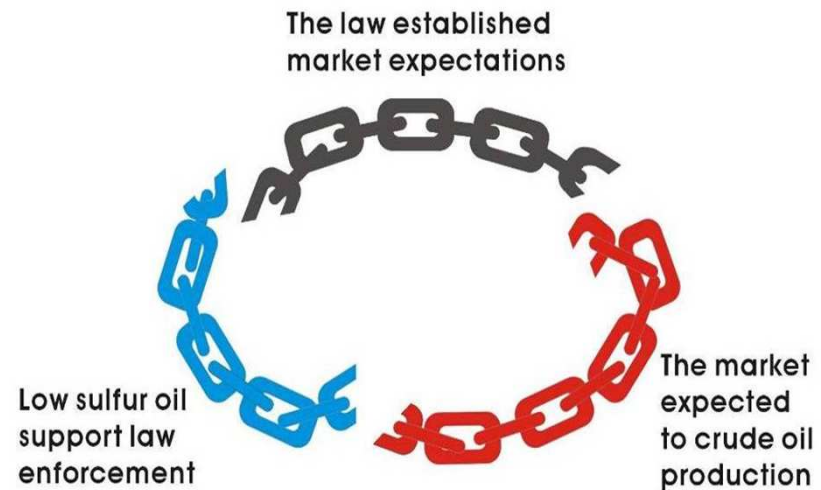
* MARPOL Annex VI, signed by 67 countries

Why Low Sulfur Fuel Regulation Is Hard To Implement?

- **UN expectation:** Low sulfur regulation will raise demand for low sulfur fuel, market demand will stimulate fuel production;
- **Lack of oil:** severe shortage of low sulfur fuel lead to high cost, high cost of fuel caused ship owners to resist implementation, no market developed for low sulfur fuel.

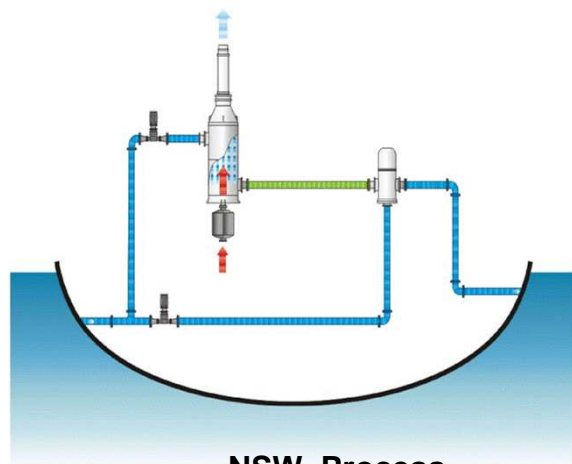
CURRENT STATUS:

- **Refiners don't invest to increase the production of low sulfur oil**
- Organizations still debate how to implement the Convention
- INTERTANKO sued EU to block implementation

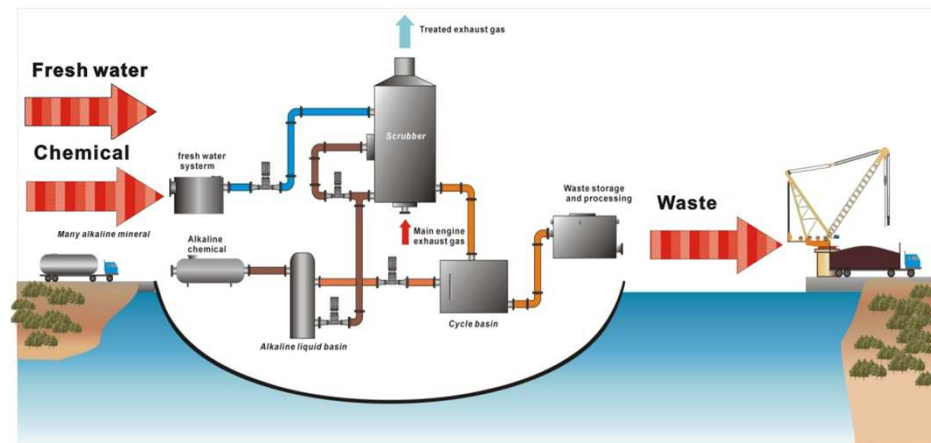


NSW Compared With Chemical Method

NSW		Chemical
No	Fresh Water Consumption	Yes
No	Chemicals	Yes
No	Hazardous Waste need disposal	Yes
No	Additional Storage Space	Yes
No	Port Infrastructure	Yes



NSW Process
Consume Less Resources

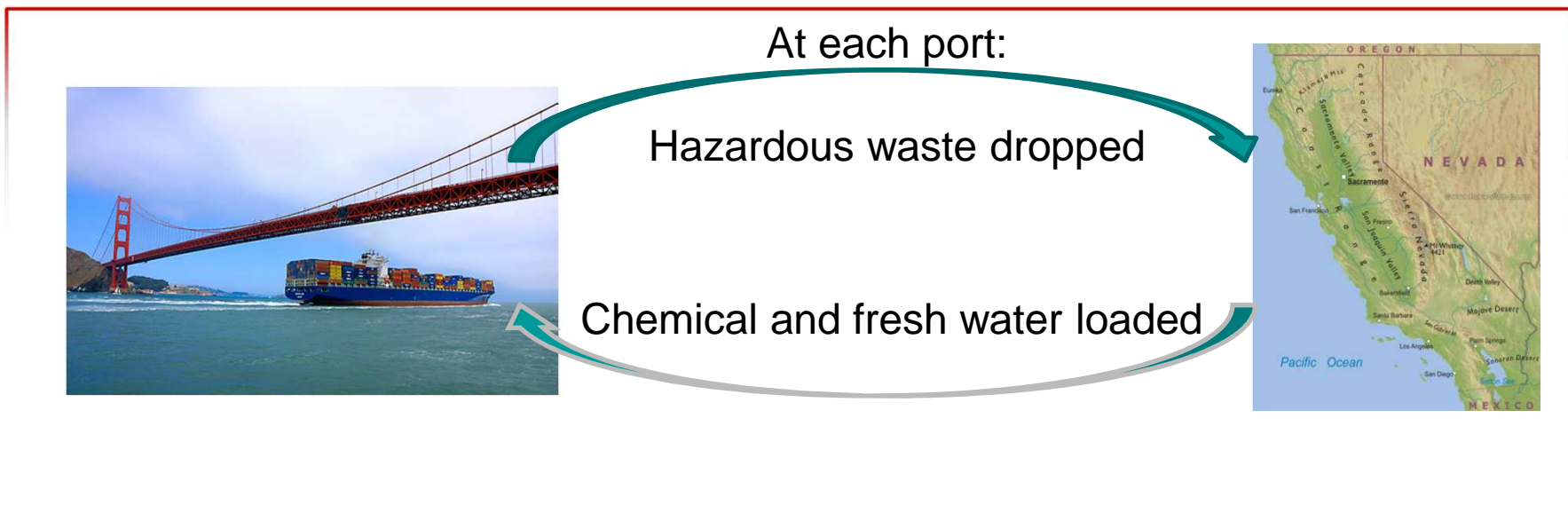


Chemical Process
Consume More Resources

Chemical Process (NaOH + H₂O) Increases Additional Pollution on Land

- Reducing emission by chemical process to comply with UN regulations would require (annually):
 - ~ 40 M tons of chemical solution
 - ~ **170 M tons of fresh water**
 - ~ 210 M tons of waste deposit*

*Calculated data from Lloyd's report



Solution: NSW Seawater Scrubbing (Friendly And Make Good Use Of Natural Resources)

- Large-scale application of NSW seawater scrubbing:

NSW FGD of Shenzhen power plant
6×300MW (1999 ~ 2004)



NSW SYS of Zhangzhou power plant
6×600MW (2000 ~ 2005)



NSW EGC installed on
M/T RUI HE (2011)



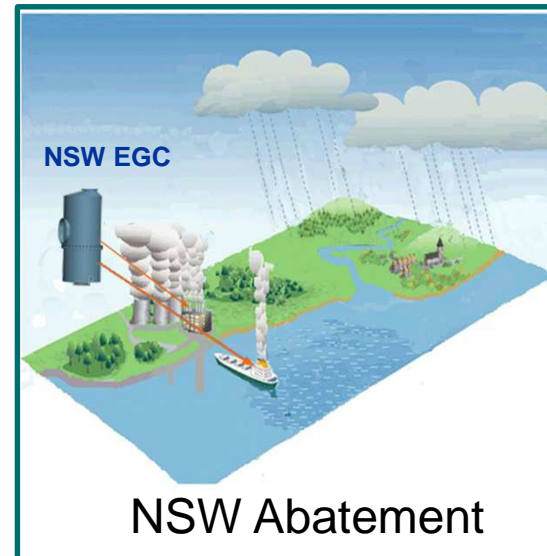
NSW Scrubber (Desulfurization rate up to 99%)

- The amount of emissions reduction of SO₂ by the only 12 coal-fired units above, equivalent to the emissions of more than 230 of 300,000 tons oil tankers.

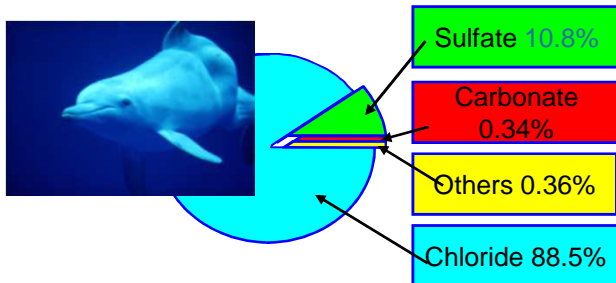
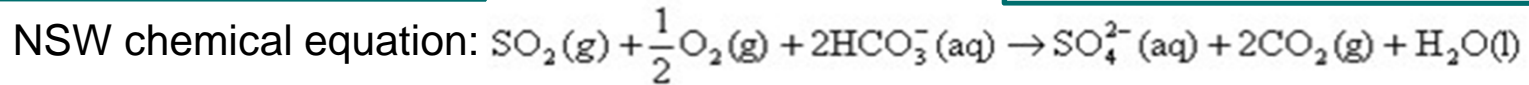
Derived From Nature, Return To Nature, Lowest Cost



SO₂ pollutes atmosphere and land environment, then return to the ocean.



Sulphide is scrubbed by NSW then return to the ocean.



In US, Norway, UK, China, the long-term research and monitoring confirms that:

- 99.94% sulfur of the world in the sea, less than 0.06% in Fossil fuel. Sulphide is not pollution for the sea.
- The wash water is friendly to the sea, which accords with standard of IMO/UN.

Sea Trial of NSW EGC

- From July to Sept. 2011, M/T RUI HE(4999DWT, IMO NO.9485019) sailed with the NSW EGC for about 2,000 hours of sea trial.
- The scrubber combined silencer into one unit using compact design.
- Scrubs 100% of exhausting gas of the main engine with high efficiency.



Sea trial of M/T RUI HE installed with NSW EGC



M/T RUI HE sea trial routes

M.V.: RUI HE
ENGINE: 2MW
GT:3686T DWT:4999T

NSW-EGC INSTALLED: 2011.07.20
SEA TRIAL: 2011.07.20

CEP

Emission And Wash Water Of NSW EGC On M/T RUI HE is in Line With IMO MEPC 184(59).

ITEM		IMO standard	Testing data ⁽³⁾
Emission	Idle SO ₂	≤50 ppm	8 ppm
	SO ₂ /CO ₂	≤4.3 ⁽¹⁾	4.09 ⁽²⁾
Wash water Discharge	Outlet pH	≥6.5	7.0
	Turbidity Average Increment	≤25 NTU	6.34 NTU
	Nitrates Average Increment	≤60mg/l	166µg/l
Testing Conditions	Sulphur content		2.90%
	Exhaust Flow		3,960m ³ /h
	Inlet pH		8.02

(1) As to the SO₂/CO₂ rate of IMO Guideline, 4.3 is equivalent to using 0.1% sulfur content fuel.

(2) Actual measured SO₂/CO₂ rate 4.09 means desulfurization rate of 96.7% (MAX 99.4%).

(3) July – Sept, 2011, Sea Trial, Supervised by CCS

Thanks!

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