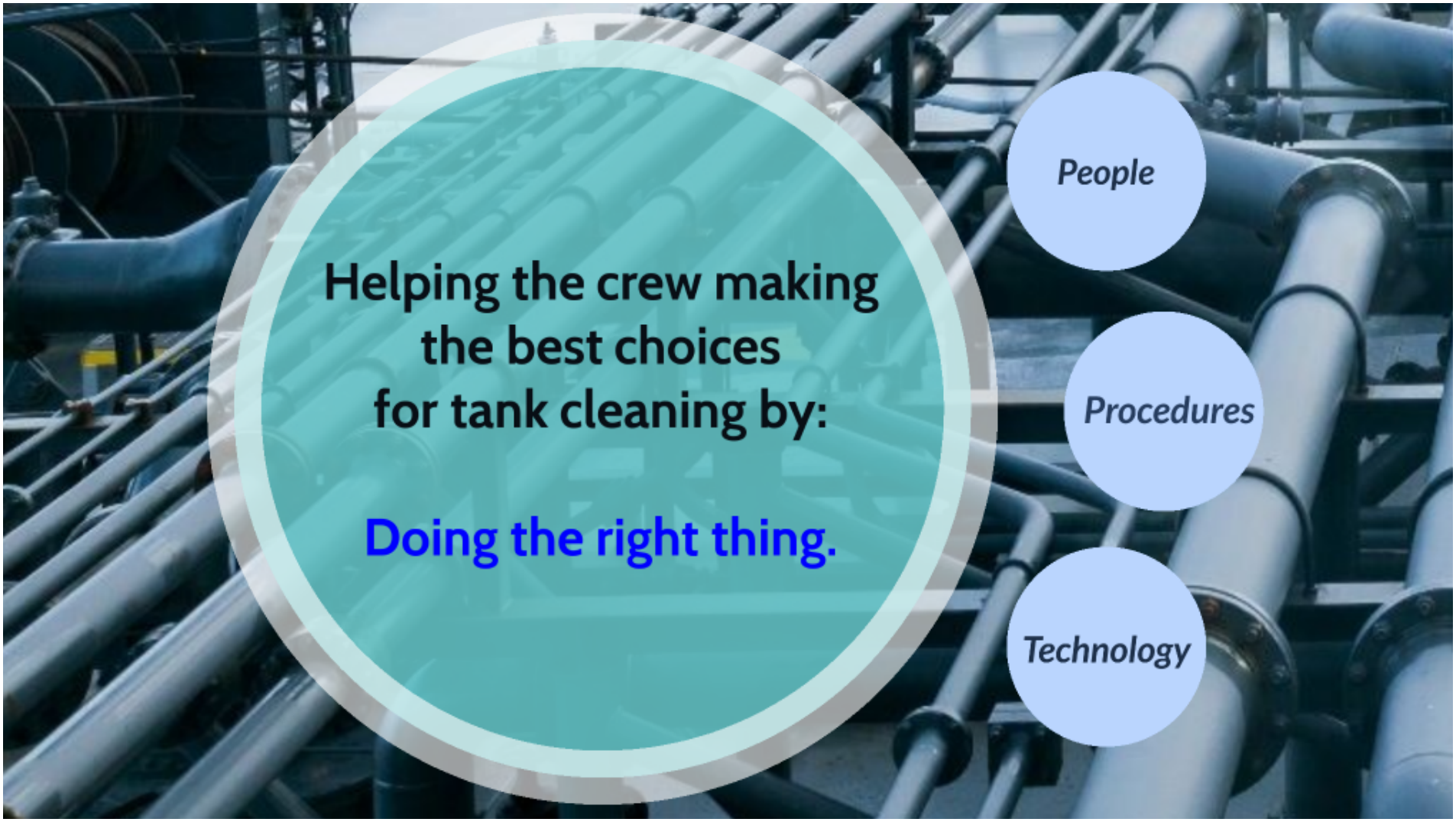

ChemServe
GmbH
Challenge:
Tank
cleaning
The
solution
Try the
Original
Tanker Operator
Conference
16th October 2018
Managing
the Risk


Helping the crew making
the best choices
for tank cleaning by:
Doing the right thing.
People
Procedures
Technology

People involved in the process

Charterer

Operator

Crew

Burden of compliance:

And more to come

Regulations

Industry Guidelines

Charterer Requirements

Company SMS & Requirements

Technologies available

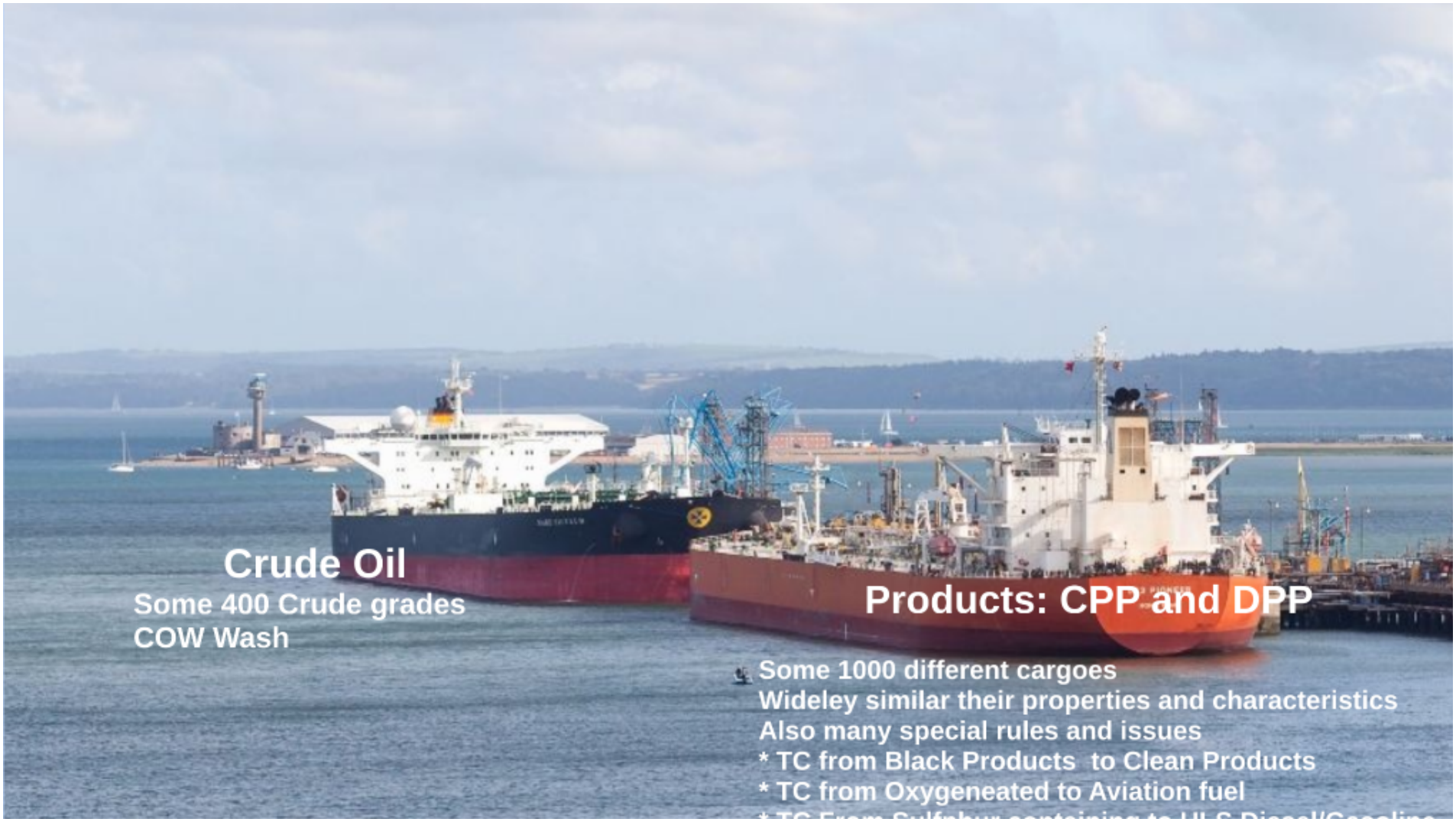
Cleaning Know How

Highly efficient cleaners

Cleaning machines

Risk Assessment Technique


Tank cleaning challenges
Variety of cargoes
Hazards
Compatibility of cargoes
Conflicting goals
Tank Entry
Variety
Hazards
Cargo compatibility
Conflicting Goals
Tank Entry

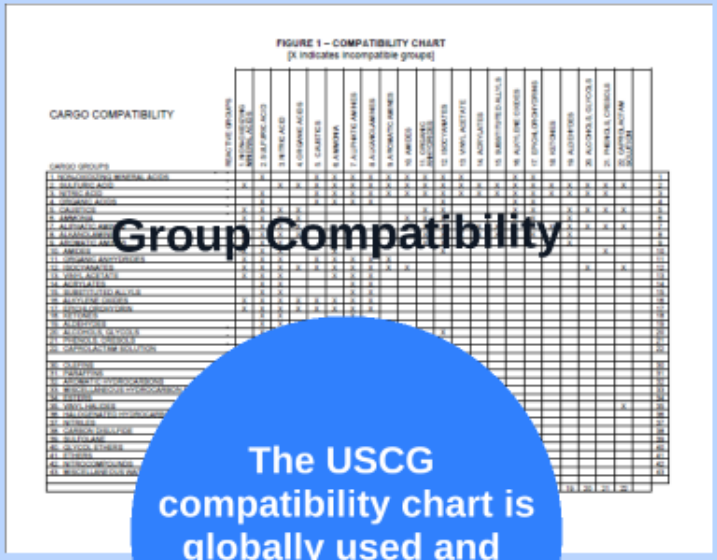

Crude Oil
Some 400 Crude grades
COW Wash
Products: CPP and DPP
Some 1000 different cargoes
Wideley similar their properties and characteristics
Also many special rules and issues
* TC from Black Products to Clean Products
* TC from Oxygeneated to Aviation fuel


Cargo related hazards
Flammable
Toxic
Corrosive
Self reactive
OXIDIZER
5.1
Water Reactive
Reactive with O2
Reactive with other
High Viscosity
Solidifying

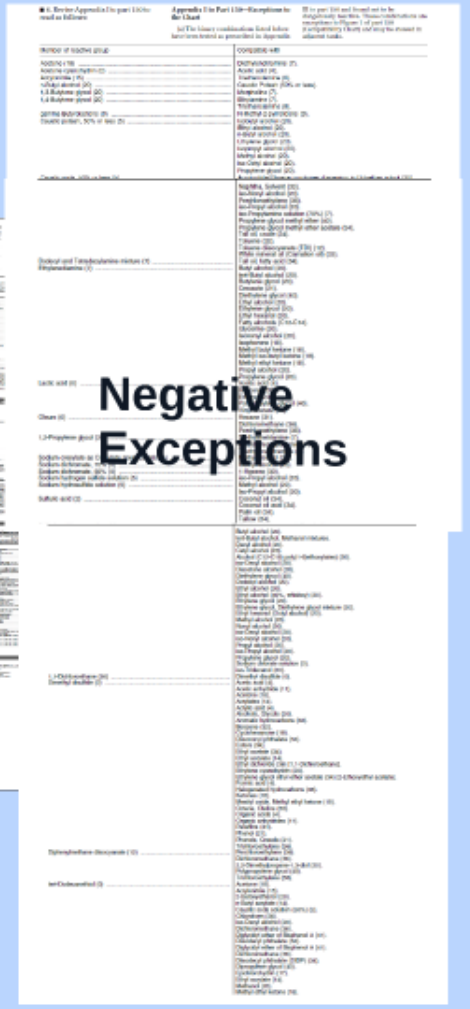

PMS and preventive maintenance
Operational hazards
Training & Competence
Wrong equipment
Defect equipment
Poor maintenance
Defect PPE
Poor planning
Wrong Guidance
Lack of training
Wrong use of PPE
Behavior Safety
Shortcuts
Lack of Intervention
Commercial Pressure


Compatibility of cargoes
Adjacent cargo comparability
Previous (Last) Cargoes
Reactivity
Adjacent cargo compatibility
FOSFA
NIOP
EU
Reactivity

Cargo Compatibility



The USCG compatibility chart is globally used and no IMO equivalent is available



Banned and acceptable cargoes

NIPO - NATIONAL INSTITUTE OF OILSEED PRODUCTS
- NIOP List 1
- NIOP List 2

FOSFA - The Federation of Oils, Seeds and Fats Associations Ltd
- FOSFA accepted
- FOSFA banned

COMMISSION DIRECTIVE 96/3/EC of 26 January 1996
granting a derogation from certain provisions of Council Directive 93/43/EEC on the hygiene of foodstuffs as regards the transport of bulk liquid oils and fats by sea
- EU Accepted

CIQ - China Inspection and Quarantine System
- CIQ accepted
- CIQ banned

And what about Charterer Last Cargo Requirements

Reactivity (tank cleaning hazard)

Cargo reaction by using incompatible cleaning material
(example: water reactive cargoes and water)

Cargo reaction in the slop tank by mixing incompatible cargoes

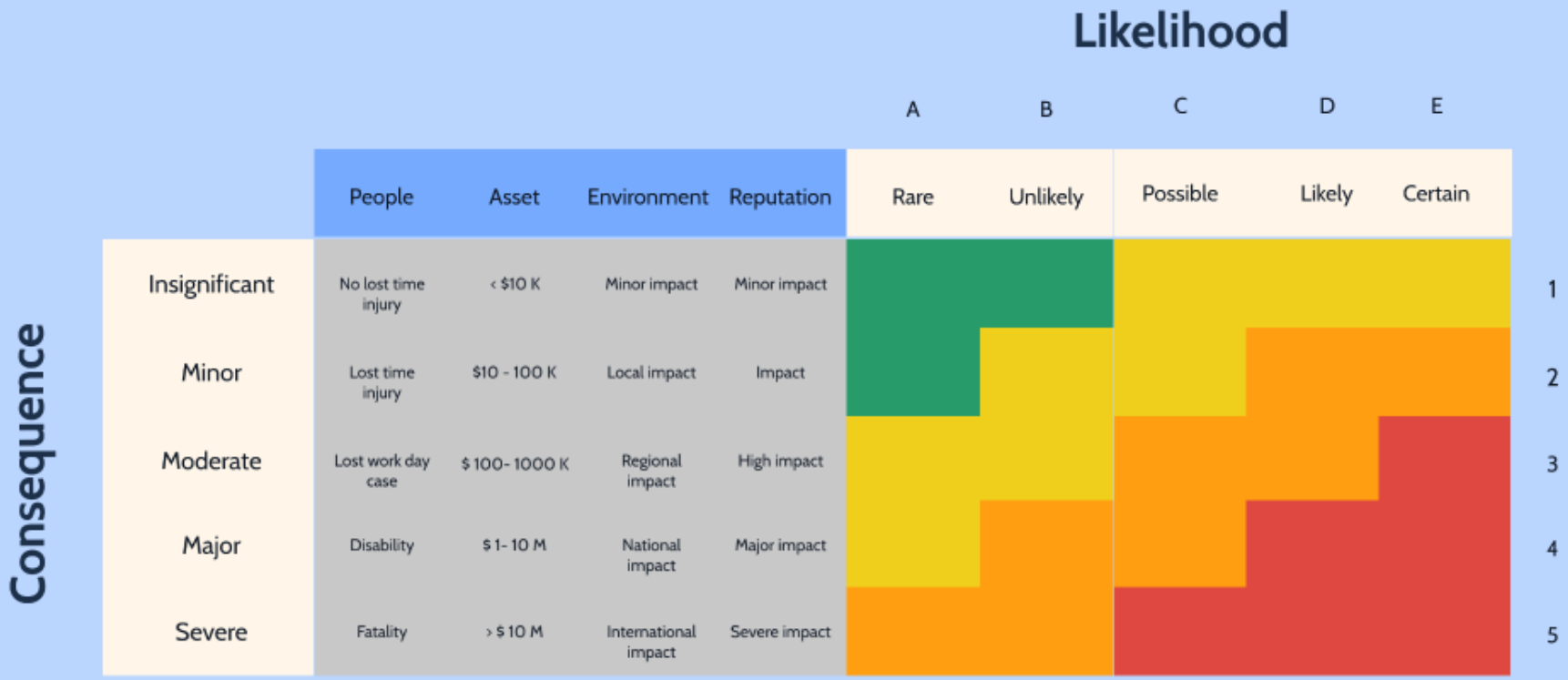
Cargo reaction due to operational error
(example: mixing cargoes in a common stripping line)


Time allowance for tank cleaning
Challenging previous to next cargo
Conflicting Goals
The Commercial Operator
The Operation Department
The Vessels Crew
Maximum efficiency
Time saving
Cost saving
How to achieve all of this by complying with all rules

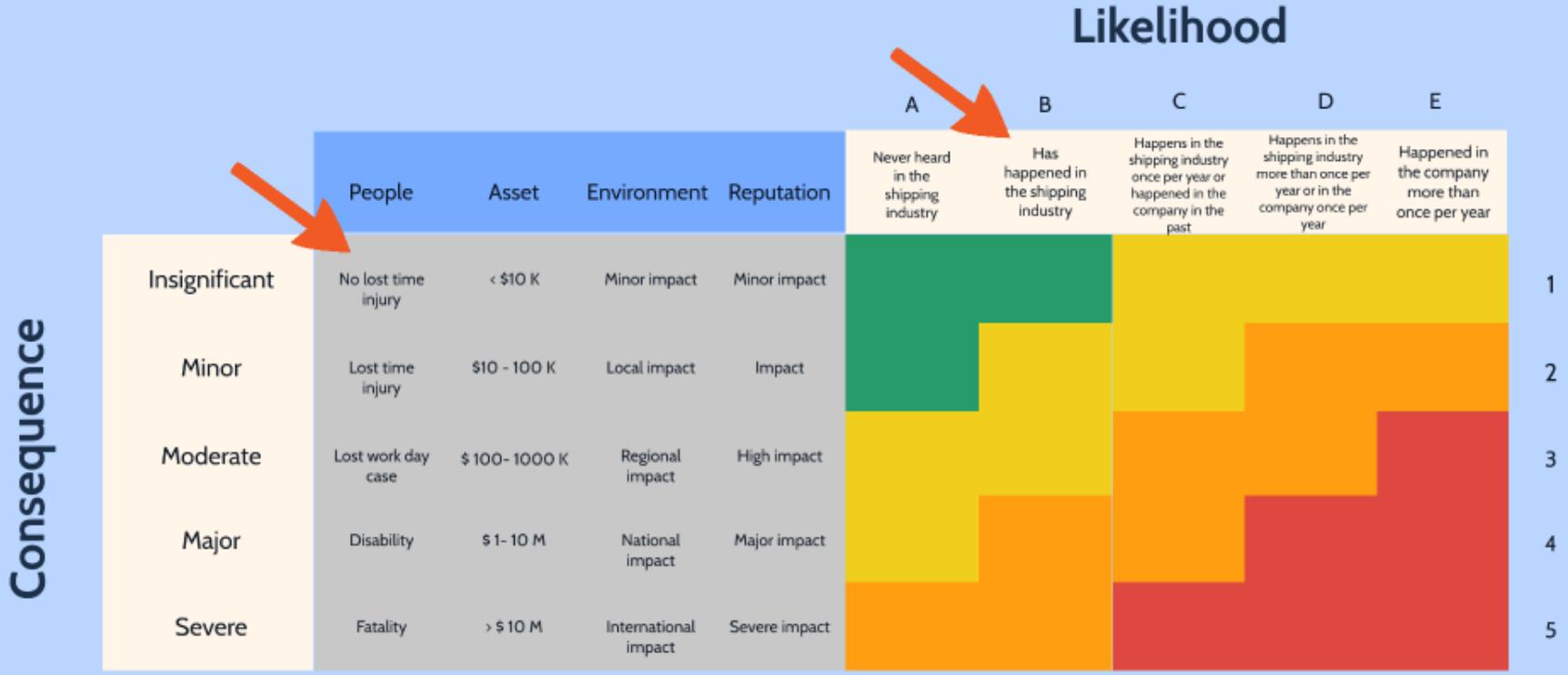

Tank Entry
because of:
Inspection (WWT)
Manual Cleaning
Sweeping / Squeezing
Repair & Maintenance


Managing the Risk
Risk Matrix (Risk Assessment
Tank Cleaning Hazard Register
Management of Change
Risk Matrix
TC Hazard Register
Management of Change

Risk Matrix 5*5



Without clear definitions the Matrix does not work.



The Tank Cleaning Hazard Register

The Tank Cleaning Hazard Register is covering the potential risk of Standard (Routine) Tank Cleaning Operations on board oil and chemical tankers and is based on industry data evaluated by **ChemServe.**

NON-Standard (Routine) Operations cannot be covered and therefore might require an individual management of change process.

Risk Mitigation

Determine the ACTUAL risk of a Hazard

The Company to include all relevant Regulations, Guidelines, Company Procedures that will mitigate risk

The Company to include all technical controls which will mitigate the risk

Hazard	Task	Location	Threat	Top Event	Potential consequences	Potential Risk				System Controls in place	Technical Controls in place	Actual Risk			
						P	A	E	R			P	A	E	R
Chemical flammable	Tank cleaning in inerted condition	at any time	Maintenance failure Equipment failure Human error Inadequate PPE Wrong equipment	Loss of primary containment Release of cargo Release of cargo vapour Release of Inert Gas	Injury Permanent Disability Fatality (multiple) Pollution Fire & Explosion Asset damage	B4	B2	B2	B2	TSG-C, IBC Code, MSDS, Miracle, Dr.Verwey´s Company Procedure XX - PPE & PPE Matrix....	Inert Gas System Fixed TC Machines	B1	A2	A2	A1
Chemical flammable	Tank cleaning NOT inerted condition	at any time	Maintenance failure Equipment failure Human error Inadequate PPE Wrong equipment	Loss of primary containment Release of cargo Release of cargo vapour Release of Inert Gas	Injury Permanent Disability Fatality (multiple) Pollution Fire & Explosion Asset damage	B5	B5	B5	B4	TSG-C, IBC Code, MSDS, Miracle, Dr.Verwey´s Company Procedure XX - PPE & PPE Matrix....	Fixed TC machines	C1	C2	A2	A2
Chemical flammable	Gas freeing operation	at any time	loss of primary containment	Loss of primary containment Release of cargo Release of cargo vapour Release of Inert Gas	Injury Permanent Disability Fatality (multiple) Pollution Fire & Explosion Asset damage	B5	B5	B5	B5	TSG-C, IBC Code, MSDS, Miracle, Dr.Verwey´s Company Procedure XX - PPE & PPE Matrix....	Fixed Gas freeing system	C1	C1	C1	C1
Chemical Toxic	Tank cleaning	at any time	Maintenance failure Equipment failure Human error Inadequate PPE Wrong equipment	Loss of primary containment Release of cargo Release of cargo vapour Release of Inert Gas	Injury Chronic disease (cancer) Permanent Disability Fatality Pollution	B4	C1	C1	B4	TSG-C, IBC Code, MSDS, Miracle, Dr.Verwey´s Company Procedure XX - PPE & PPE Matrix....	tba				B2

Actual Risk with controls in place

Can be Provided by ChemServe

To be completed by the SM

Management of Change (TC)

Not all situations can be covered by a risk assessment in order to mitigate the risk.

Therefore a Management of Change might be required in such case
including active office support & assistance.

Consider External resources in case internal know how for a specific case is not sufficient or available.


How can we assist the crew to make the best choices regarding tank cleaning?
Doing the right thing
Training & Reference

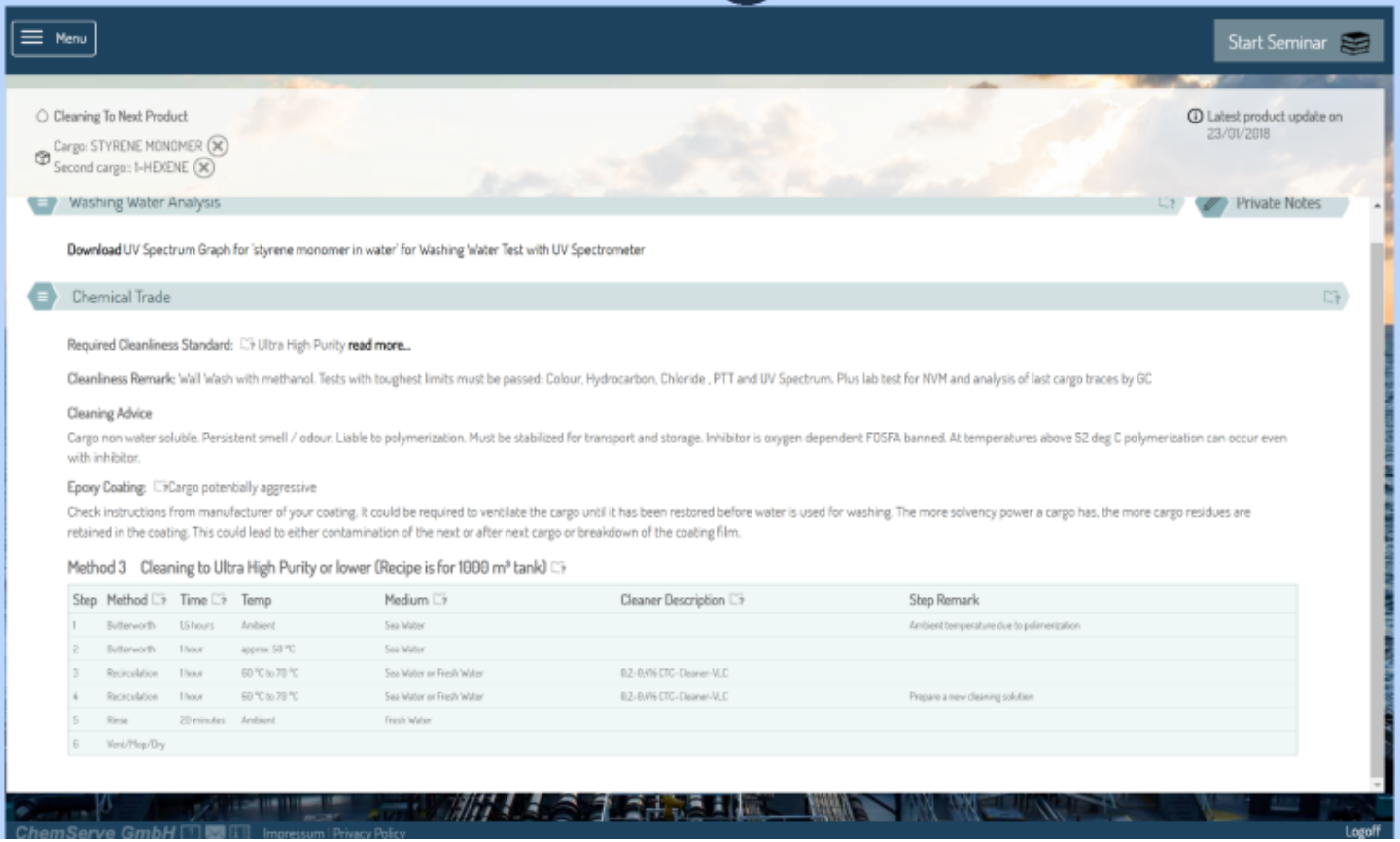
Tank Cleaning Guidance!

Cleaning From - To is not a Miracle:

The MIRACLE Tank Cleaning Database contains guidance for nearly every tank cleaning job -

including regulatory & safety requirements as well as guidance & best practice.

Tank Cleaning From - To



Including Intertanko Cleanliness Standards

- Visually Clean
- Water White
- High Purity
- Ultra High Purity

These standards have now been implemented into the recipes of the MIRACLE tank cleaning guide

Cleaning to Intertanko Standards - Next cargo TBN

Cleaning from	STYRENE MONOMER	Cleaning to	
		Req. Standard	

Cleaning to Water White or lower Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater	no cleaner required	Temperature due to removal of smell
3	Rinse	20 mins	ambient	Fresh Water		
4	Vent/Mop/Dry					

Cleaning to High Purity Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater		
3	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	
4	Rinse	20 mins	ambient	Fresh Water		
5	Vent/Mop/Dry					

Cleaning to Ultra High Purity Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater		
3	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	
4	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	Prepare a new cleaning solution
4	Rinse	20 mins	ambient	Fresh Water		
5	Vent/Mop/Dry					

Cleaning to Intertanko Standards - Next cargo TBN

All available cleaning standards for this cargo are displayed because next cargo not yet known

Cleaning from	STYRENE MONOMER	Cleaning to	
		Req. Standard	

Cleaning to Water White or lower Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater	no cleaner required	Temperature due to removal of smell
3	Rinse	20 mins	ambient	Fresh Water		
4	Vent/Mop/Dry					

Cleaning to High Purity Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater		
3	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	
4	Rinse	20 mins	ambient	Fresh Water		
5	Vent/Mop/Dry					

Cleaning to Ultra High Purity Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater		
3	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	
4	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	Prepare a new cleaning solution
4	Rinse	20 mins	ambient	Fresh Water		
5	Vent/Mop/Dry					

Cleaning to Intertanko Standards - Next cargo - Visually Clean Standard

Cleaning from	STYRENE MONOMER	Cleaning to	Diesel Oil
		Req. Standard	Visually Clean

Cleaning to Water White or lower Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater	no cleaner required	Temperature due to removal of smell
3	Rinse	20 mins	ambient	Fresh Water		
4	Vent/Mop/Dry					

Cleaning to Intertanko Standards - Next cargo - Visually Clean Standard

Cleaning from	STYRENE MONOMER

Cleaning to	Diesel Oil
Req. Standard	Visually Clean

Cleaning to Water White or lower Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater	no cleaner required	Temperature due to removal of smell
3	Rinse	20 mins	ambient	Fresh Water		
4	Vent/Mop/Dry					

Cleaning to Intertanko Standards - Next cargo - Ultra High Purity

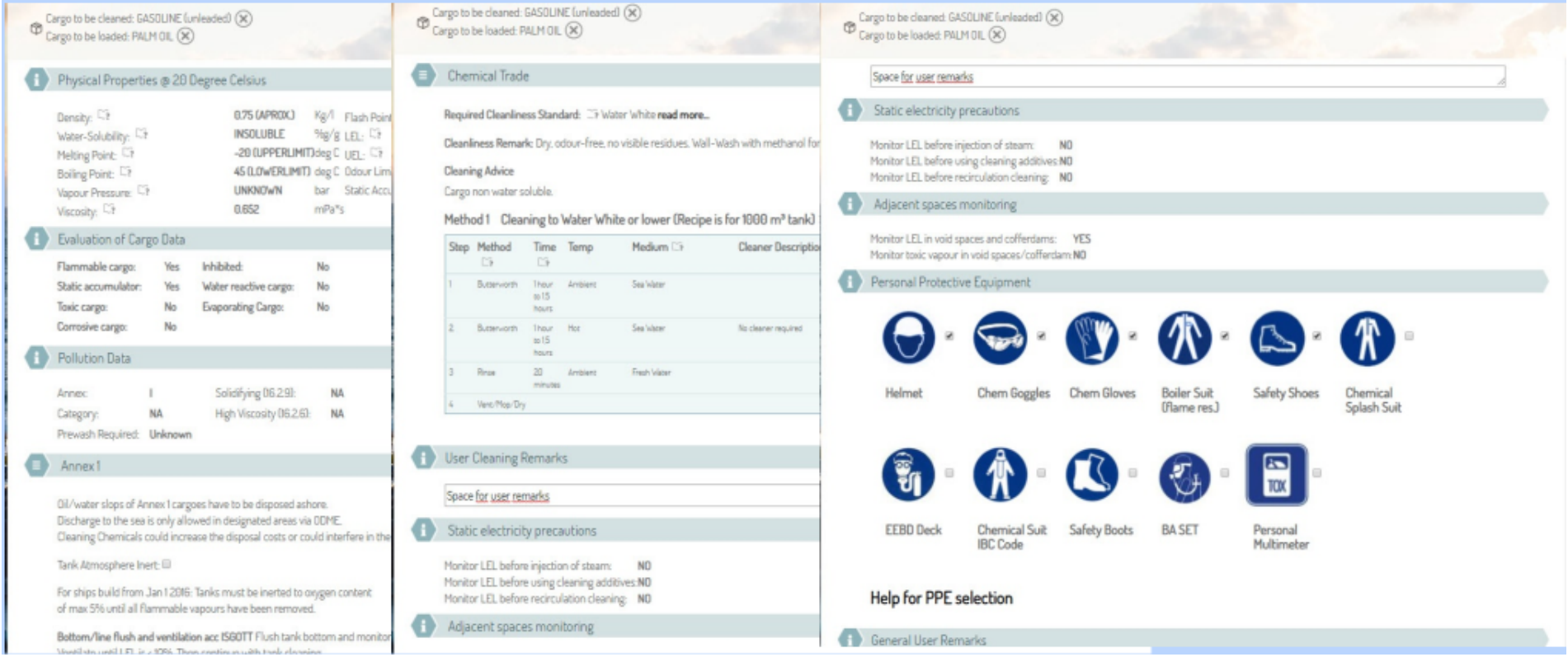
Cleaning from	STYRENE MONOMER	Cleaning to	1-HEXENE
		Req. Standard	Ultra High Purity

Cleaning to Ultra High Purity Standard

Step	Method	Time	Temp	Medium	Cleaner Descr.	Step Remark
1	Butterworth	1.5 hrs	ambient	Seawater		Ambient temperature due to polimerization
2	Butterworth	1.0- 1.5 hrs	50°C	Seawater		
3	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	
4	Recirculation	1.0 hrs	60-70 °C	Seawater or Freshwater	0,2-0,4% CTC-Cleaner-VLC	Prepare a new cleaning solution
4	Rinse	20 mins	ambient	Fresh Water		
5	Vent/Mop/Dry					

Tank Cleaning Plan

Best help is: providing the relevant information and data at the right time - Example of a tank cleaning plan:

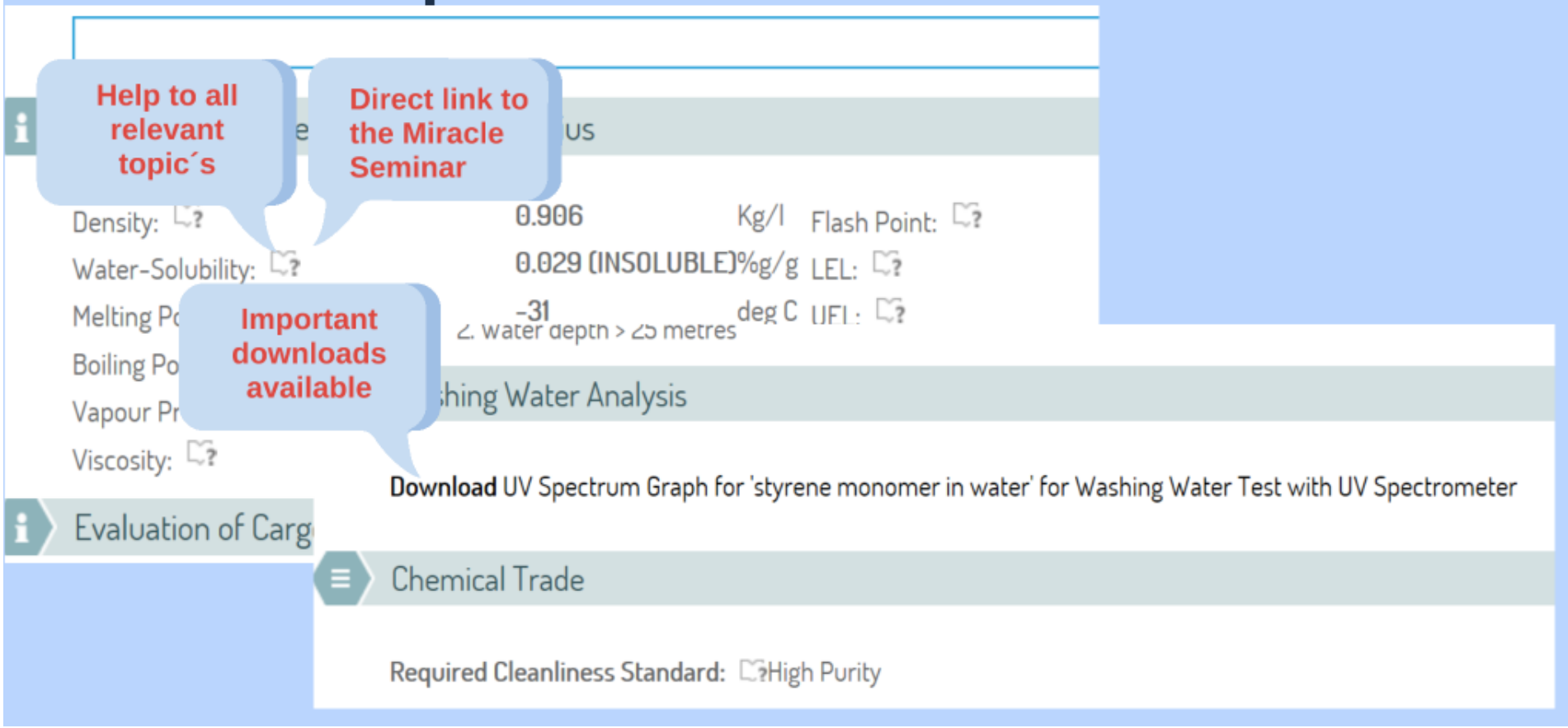


MIRACLE easy Compatibility Chart

SODIUMHYDROXIDE SOLUTION 50%	
compatible to	incompatible to
Cargoes	Cargoes
Acrylonitrile/Styrene copolymer dispersion in Polyether polyol (20)	1, 4-Butylene glycol (20)
Alcohol (C12-C16) poly(1-6)ethoxylates (20)	Groups
Bio-fuel blends of Gasoline and Ethyl alcohol (>25% but <99% by volume) (20)	UNASSIGNED CARGOES (0)
Butyl alcohol (20)	NON-OXIDIZING MINERAL ACIDS (1)
Cetyl alcohol (20)	SULPHURIC ACID (2)
Decyl alcohol (20)	NITRIC ACID (3)
Diacetone alcohol (20)	ORGANIC ACIDS (4)
Diethylene glycol (40)	ORGANIC ANHYDRIDES (11)
Dodecyl alcohol (20)	ISOCYANATES (12)
Ethyl alcohol (20)	ALKYLENE OXIDES (16)
Ethyl hexanol (Octyl alcohol) (20)	EPICHLOROHYDRIN (17)
Ethylene glycol (20)	ALDEHYDES (19)
iso-Butyl alcohol (20)	ALCOHOLS AND GLYCOLS (20)
iso-Propyl alcohol (20)	PHENOLS AND CRESOLS (21)
iso-Tridecanol (20)	CAPROPLACTAM SOLUTION (22)
Methyl alcohol (20)	

PROPYLENEOXIDE	
compatible to	incompatible to
Groups	Groups
AROMATIC AMINES (9)	UNASSIGNED CARGOES (0)
AMIDES (10)	NON-OXIDIZING MINERAL ACIDS (1)
ORGANIC ANHYDRIDES (11)	SULPHURIC ACID (2)
ISOCYANATES (12)	NITRIC ACID (3)
VINYL ACETATE (13)	ORGANIC ACIDS (4)
ACRYLATES (14)	CAUSTICS (5)
SUBSTITUTED ALLYLS (15)	AMMONIA (6)
ALKYLENE OXIDES (16)	ALIPHATIC AMINES (7)
EPICHLOROHYDRIN (17)	ALKONOLAMINES (8)
KETONES (18)	
ALDEHYDES (19)	
ALCOHOLS AND GLYCOLS (20)	
PHENOLS AND CRESOLS (21)	
CAPROPLACTAM SOLUTION (22)	
OLEFINS (30)	
PARAFFINS (31)	

MIRACLE quick reference



For the Commercial Department, the Operation Department and the Crew

Pollution Prevention

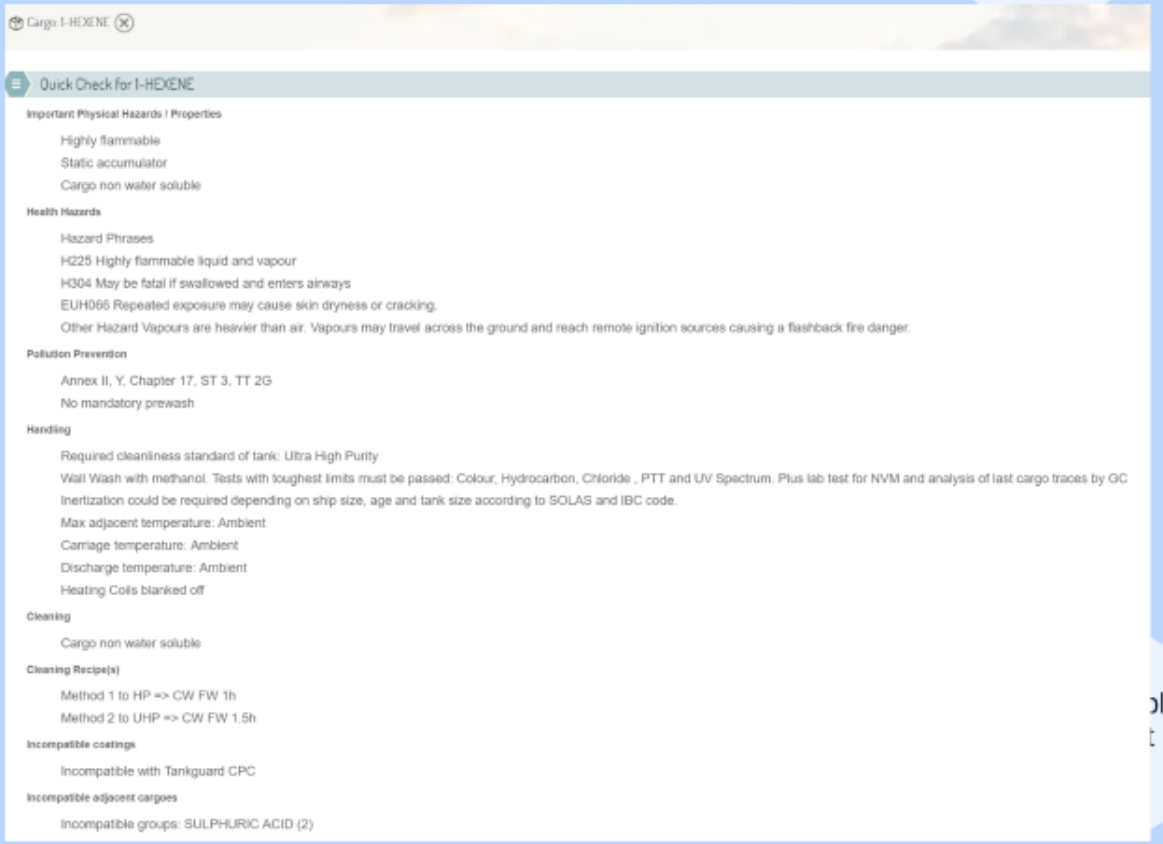
Handling

Cleaning

Incompatible coatings

Incompatible adjacent cargoes

The Quick Check



Cargo: 1-HEXENE

Quick Check for 1-HEXENE

Important Physical Hazards / Properties

- Highly flammable
- Static accumulator
- Cargo non water soluble

Health Hazards

- Hazard Phrases
- H225 Highly flammable liquid and vapour
- H304 May be fatal if swallowed and enters airways
- EUH066 Repeated exposure may cause skin dryness or cracking.
- Other Hazard Vapours are heavier than air. Vapours may travel across the ground and reach remote ignition sources causing a flashback fire danger.

Pollution Prevention

- Annex II, Y, Chapter 17, ST 3, TT 2G
- No mandatory prewash

Handling

- Required cleanliness standard of tank: Ultra High Purity
- Wall Wash with methanol. Tests with toughest limits must be passed: Colour, Hydrocarbon, Chloride , PTT and UV Spectrum. Plus lab test for NVM and analysis of last cargo traces by GC
- Inertization could be required depending on ship size, age and tank size according to SOLAS and IBC code.
- Max adjacent temperature: Ambient
- Carriage temperature: Ambient
- Discharge temperature: Ambient
- Heating Coils blanked off

Cleaning

- Cargo non water soluble

Cleaning Recipe(s)

- Method 1 to HP => CW FW 1h
- Method 2 to UHP => CW FW 1.5h

Incompatible coatings

- Incompatible with Tankguard CPC

Incompatible adjacent cargoes

- Incompatible groups: SULPHURIC ACID (2)

Important Physical Hazards

Health Hazards

Pollution Prevention

Handling

Cleaning

Incompatible coatings

References embedded in Miracle

Regulations

Industry Guidelines

Charterer Guidelines

Company Guidelines

The Miracle Seminar

A powerful system for all involved:

- A kind of Wikipedia about tank cleaning
- A comprehensive collection of themes, tables and videos
- Explains technology

- **A great training tool for office members & the crew on board**
- **A comprehensive reference tool for experienced people**

Cleaning Seminar

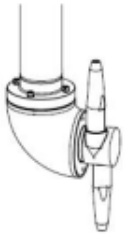
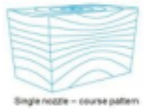
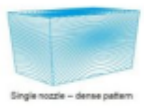
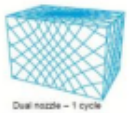
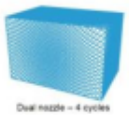
A tank cleaning wiki

Cleaning Seminar

A tank cleaning wiki

- Physical Properties
- Prod. Characteristics
- Cleaning Machines
  - **Single nozzle**
  - Dual nozzle
  - Comparison
  - Time conversion
- Pumps, Pipes & Hardware
- Methods
- Tank Cleaning Plan
- Trade pattern

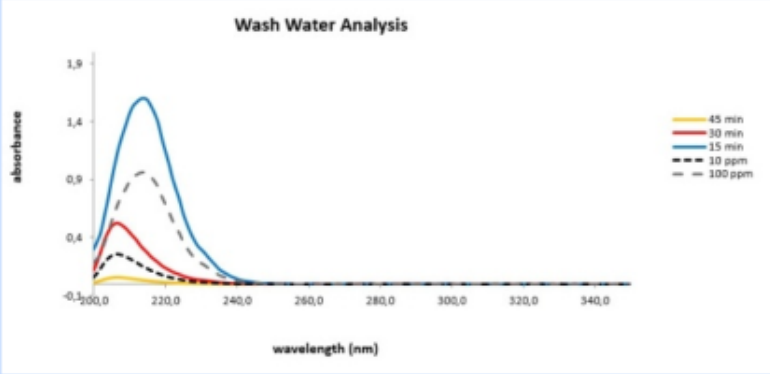
Cleaning Process

	Single	Dual
Picture		
Number of nozzles (Hits)	1 (one hit always)	2 (two hits always)
Speed	Slower coverage of tank	Faster coverage of tank
Impact	High impact long throw length	Lower impact
Operation	Programmable	Variable cleaning time
Cleaning pattern	Helical  	Criss-Cross  
Temperature	Only cleaned section hot	Keeps entire tank hot
Consumption (water and cleaner)	Higher	Lower


Cleaning Seminar
A tank cleaning
A great training tool for office members, the crew on board
and a great reference tool for experienced people
Tank Material
Manual

Example: Washing Water Analysis

Analysis of samples from the washing water with UV Spectrometer in regular intervals



Cleaning step can be finished after 45 min. No cargo is removed anymore.

If this is a water soluble cargo it means the tank is clean.

If this a non water soluble cargo it means continuation will not improve anything. It could mean go to next step.

WWA advantages

- Substantial energy savings are possible because excessive hot washes can be avoided
- Less tank rejections and less contamination of cargoes
- Reduces hazards because less tank entries required

UV Graphs available for many cargoes in MIRACLE

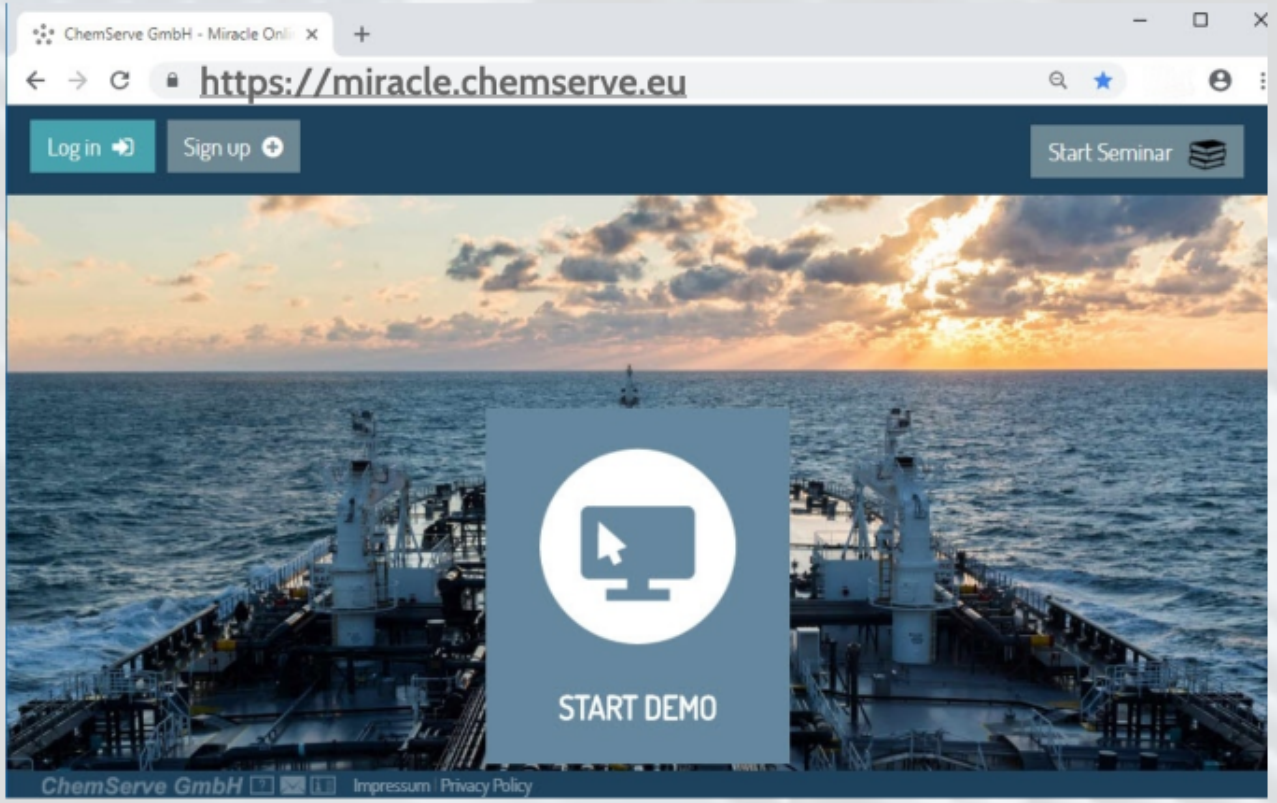
MIRACLE Tank Cleaning Database

Decades of Tank Cleaning Experience, Continues Improvement, Latest Innovation included

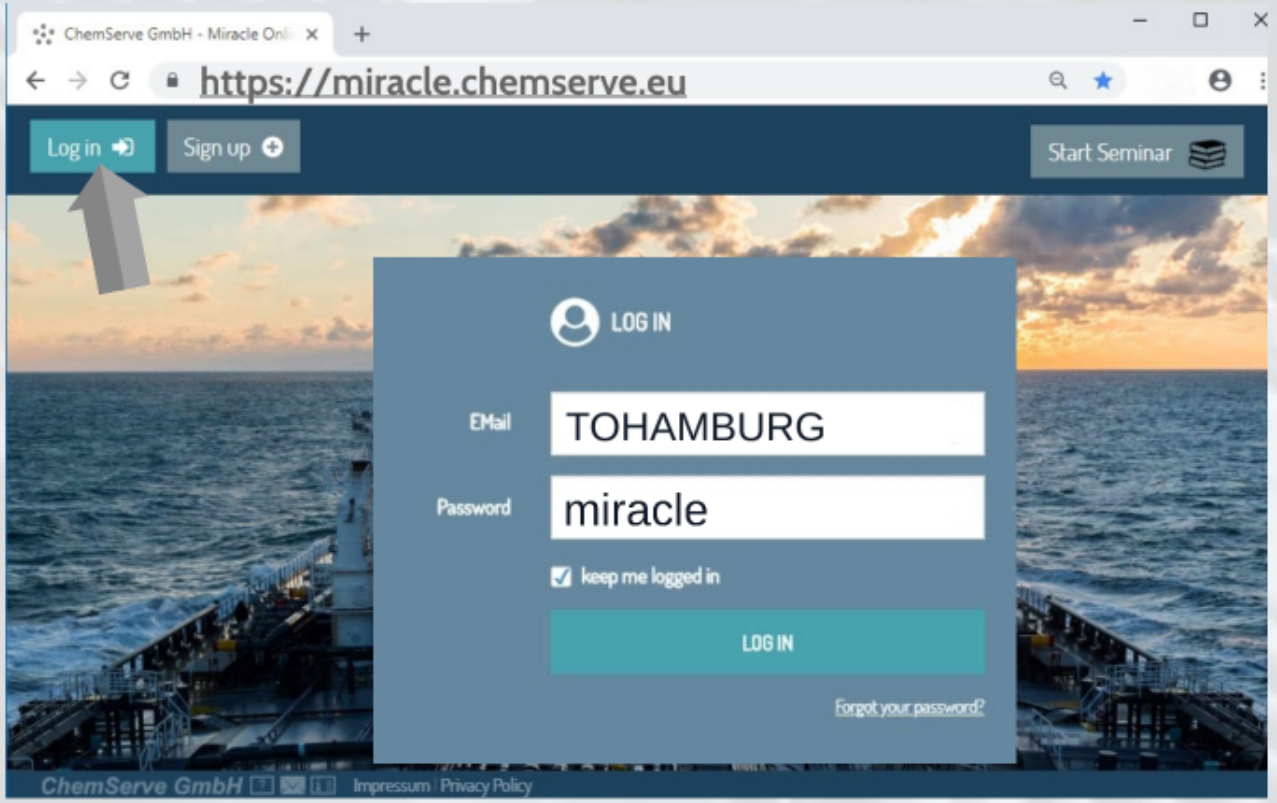
Any Question?
Please contact us!

ChemServe GmbH: Phone: +49 4135 808630 Fax: +49 4135 808631
info@chemserve-marine.com OR axelkahl@chemserve-marine.com
https://www.chemserve-marine.com

Your free Trial valid until October 31



Your free Trial valid until October 31




Thank You
ChemServe
MIRACLE