

Software overview RB-IT

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*Maintenance Innovation
& Risk Based Inspection*



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ROTTERDAMSEWEG 183C | 2629 HD | DELFT | 015 2682588



Today: 2013-04-05

- TANKFARM OVERVIEW
- PRODUCTS LIST
- PIPING OVERVIEW
- PIPING GROUPS
- MANAGEMENT OVERVIEW
- MAINTENANCE PLANNING
- TYPICAL LIST
- BODEMBESCHERMING

TANKFARM OVERVIEW » TANK 539

General details of the tank

TANK DETAILS

Tank name:	TANK 539
Type:	Low pressure tank
Capacity:	6002 m3
Roof type:	Fixed roof
Diameter:	24.00 m
Height:	14.64 m
Max filling height:	14.43 m
Rings:	8
Date of constr.:	1962-01-01
Design code:	API650
Design pressure:	23 mbar
Design vacuum pressure:	5.75 mbar
Tank location:	Tankput 6
Product:	PID product
Operational temperature:	T < 40 °C
Steel type:	Carbon Steel

Tank details

Assessments

- Roof
- Shell
- Floor
- Appurtenances
- Foundation
- Dashboard
- Data Analysis
- F.I.S.
- Bodembescherming

Manage pict's

Manage files

Status and summary of the tank

RBI STATUS

Next onstream inspection:	2009
Next turnaround:	2011
Next extra inspection:	
BoBo-class:	C
Study complete:	100%
Study status:	Technical reviewed
Last updated:	2012-12-18

Set status

OPERATIONAL STATUS

Operational status:	Maintenance
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Activity planning

Set status

Inspection reports and relevant documents

GENERAL PICTURES

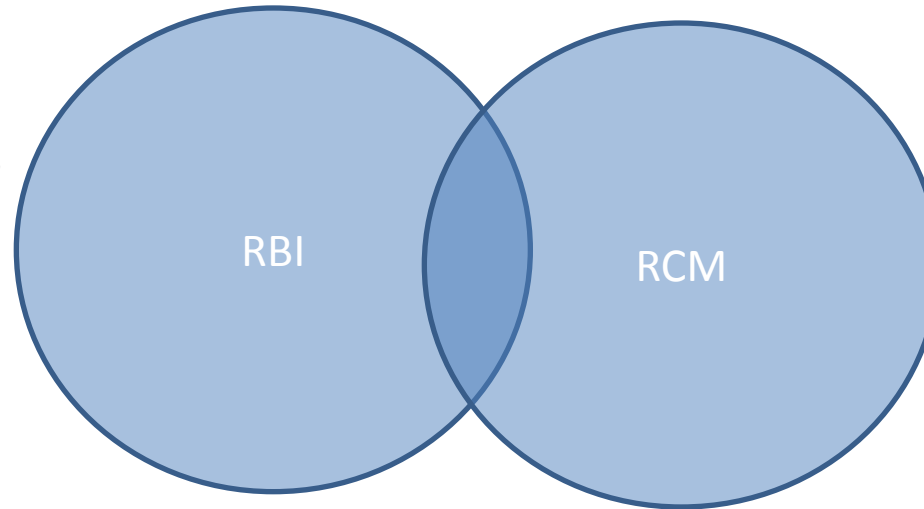
DOCUMENTS

- Reports
- RBI Reviews
- Certificates & records
- Construction drawings

- 2002 MFL onderzoek T539
- 2002 NDO rapportage T539
- 2002 visuele inspectie T539
- 2002 visuele inspectie vervolg T539
- 2007 UT wandnozzles

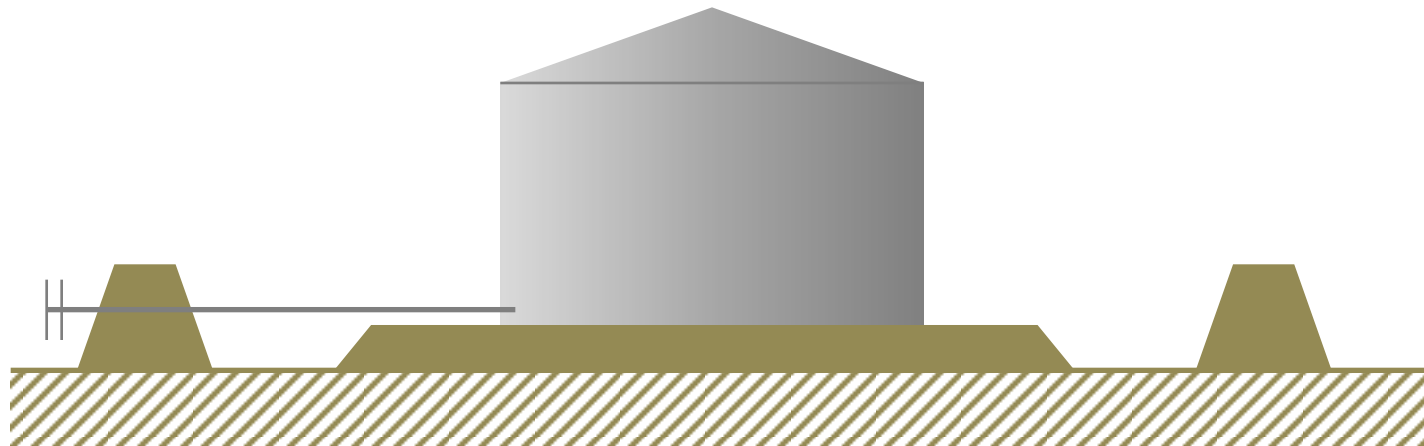
Structural integrity

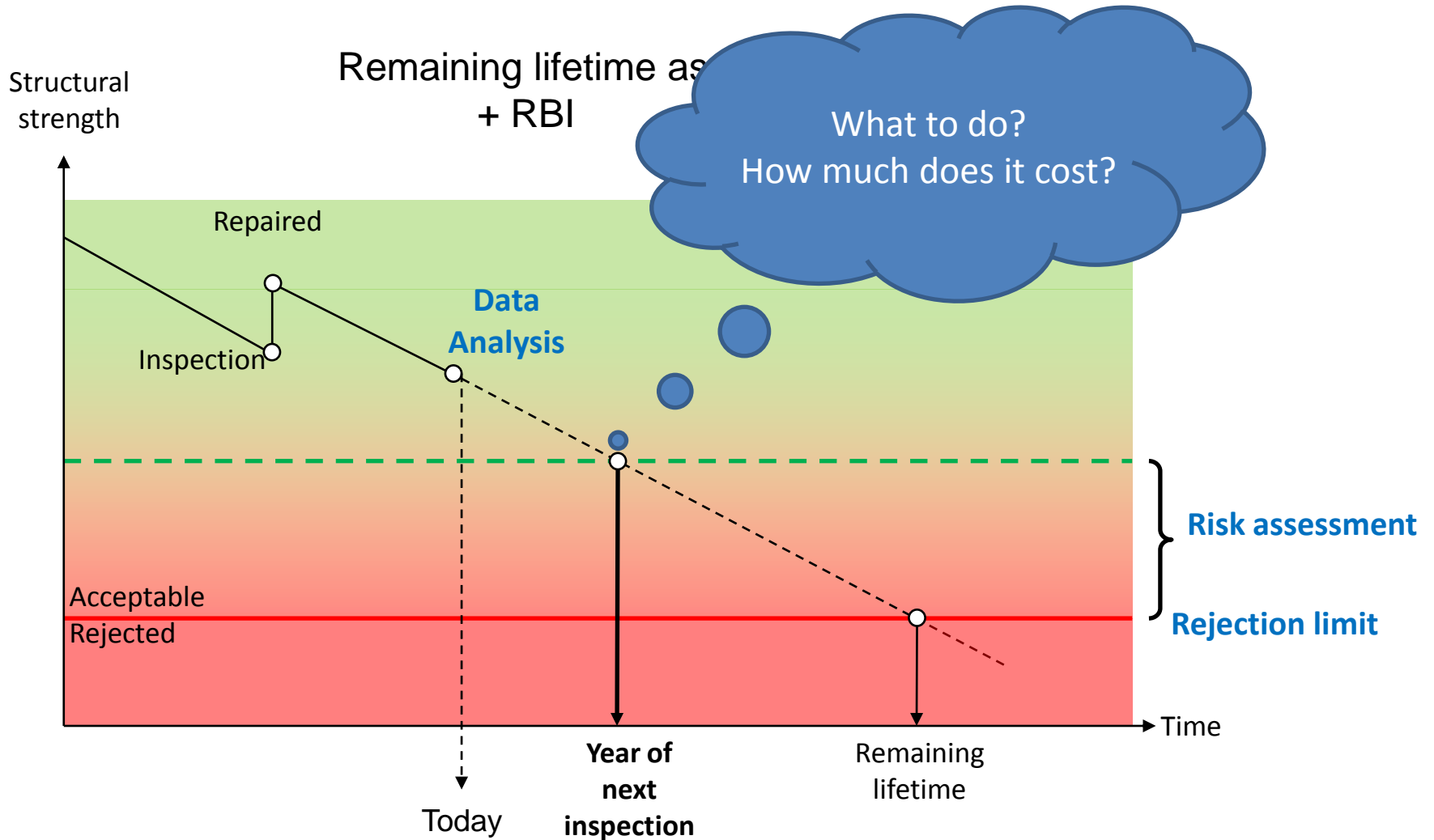
- Membrane plates
- Roof support-structure
- Nozzles
- Foundation
- Roofplates
- Etc



Functional integrity

- Pumps
- Valves
- Seal
- Mixers
- Overflow alarm
- Etc







Today: 2013-04-05

TANKFARM OVERVIEW » TANK 539

TANKFARM OVERVIEW » TANK 539 » DATA ANALYSIS

- » TANKFARM OVERVIEW
- » PRODUCTS LIST
- » PIPING OVERVIEW
- » PIPING-GROUPS
- » MANAGEMENT OVERVIEW
- » MAINTENANCE PLAN
- » TYPICAL LIST
- » BODEMBESCHERMING
- » CLIENT ADMINISTRATION
- » HELP
- » LOG OUT

Inspection Date	Ring								Membrane		Annular	
	1	2	3	4	5	6	7	8	Gen.	Pit.	Gen.	Pit.
2002-08-01										5.0		6.4
2002-07-01	13.5	12.2	10.3	8.4	5.6	5.4	5.3	5.6	7.0	3.5	8.4	5.4
1996-07-01										5.0		6.4
1996-03-31									7.0	3.0	8.4	4.4
1991-04-19											8.2	6.2
1986-08-05	13.3	11.7	11.2	9.2	6.9	6.2	7.3	6.3	7.8	5.8	9.0	7.0
1981-07-08	14.5	13.1	11.2	10.0	7.4	6.3	6.4	6.1				
1975-05-15	14.2	12.3	10.2	9.1	7.1	6.0	6.0	5.9	7.3		9.9	
1962-01-01	14.0	12.7	10.5	9.5	7.0	6.0	6.0	6.0	8.0	8.0	9.5	9.5
CR EEMUA	0.010	0.010	0.057	0.050	0.082	0.050	0.126	0.044	0.010	0.010	0.010	0.010
CR LS fit	0.017	0.015	0.010	0.025	0.034	0.013	0.010	0.010	0.022	0.100	0.038	0.097
CR user	0.017	0.015	0.010	0.025	0.034	0.013	0.126	0.010	0.022	0.250	0.038	0.250

- Roof
- Shell
- Floor
- Appurtenances
- Foundation
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- Bodembescherming
- Manage pict's
- Manage files

Next extra inspection:
 BoBo-class: C
 Study complete: 100%
 Study status: Technical reviewed
 Last updated: 2012-12-18

[Set status](#)

OPERATIONAL STATUS

Operational status: Maintenance

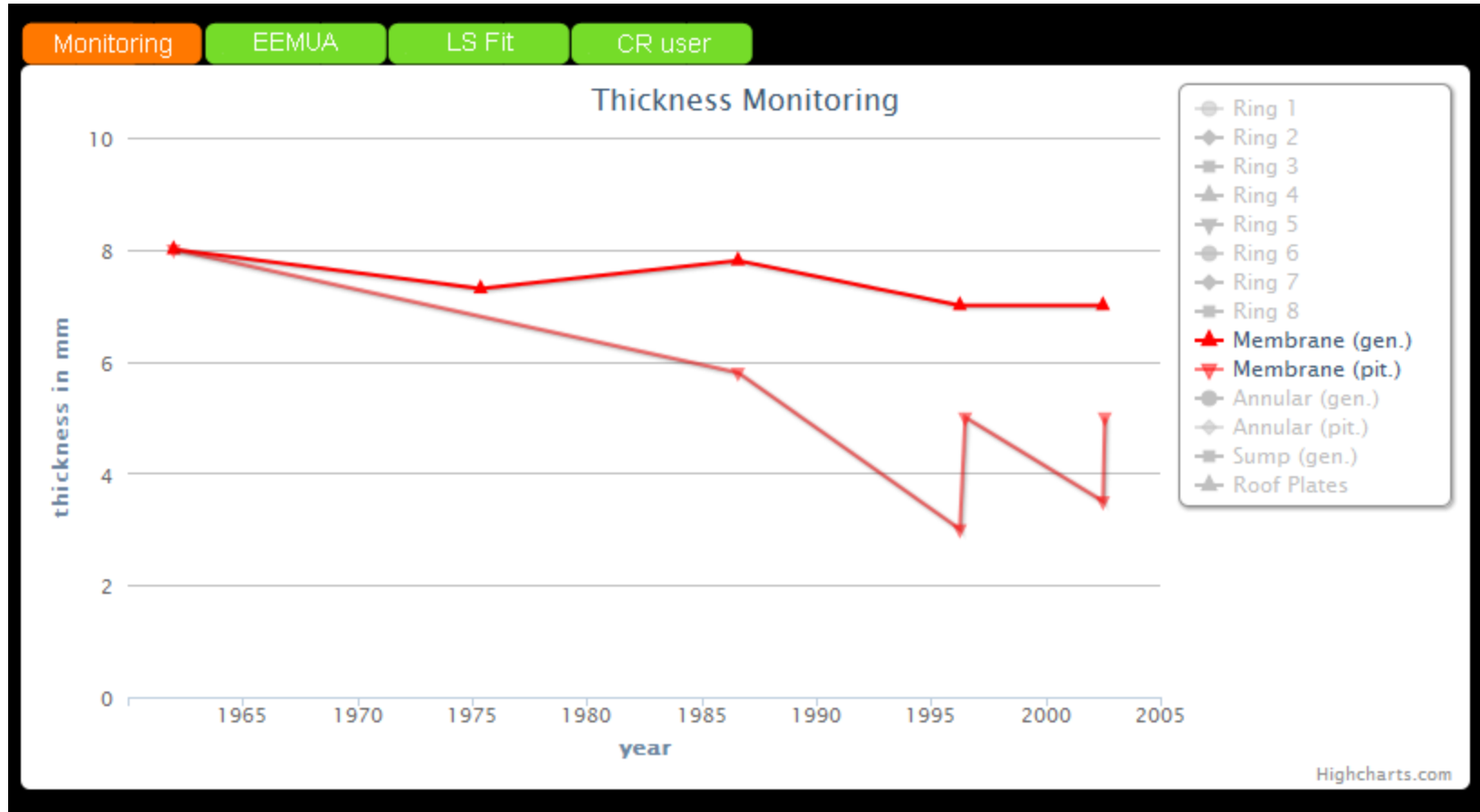
- [Activity planning](#) [Set status](#)

- [Reports](#) [RBI Reviews](#) [Certificates & records](#) [Construction drawings](#)

- » 2002 MFL onderzoek T539
- » 2002 NDO rapportage T539
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- » 2007 UT wandnozzles



Data Analysis on multiple degradation mechanisms (below: thinning & pitting)



TANKFARM OVERVIEW » TANK B37 » APPURTENANCES

NOZZLES

Location	Nr	Name	Diameter	Schedule	Nominal thickness	Edit nozzle	Inspections
Shell	N1	Spare	4.00	80	8.56	EDIT	VIEW
Shell	N2	Hoge zuig	8.00	80	12.70	EDIT	VIEW
Shell	N3	Lage Zuig	4.00	80	8.56	EDIT	VIEW
Shell	N4	Wateraftap	2.00	80	5.54	EDIT	VIEW
Shell	N5	Mangat noord	24.00	(special)	11.00	EDIT	VIEW
Shell	N6	Mangat zuid	24.00	(special)	11.00	EDIT	VIEW
Roof	N1	Mangat 1	24.00	(special)	6.00	EDIT	VIEW
Roof	N2	Meetpoort 1	4.00	40	6.02	EDIT	VIEW
Roof	N3	Meetpoort 2	4.00	40	6.02	EDIT	VIEW
Roof	N4	Mangat 2	24.00	(special)	6.00	EDIT	VIEW
Roof	N5	Meetpoort 3	4.00	40	6.02	EDIT	VIEW
Roof	N6	Nivesumeter	20.00	40	15.07	EDIT	VIEW
Roof	N7	Meetpoort 4	4.00	40	6.02	EDIT	VIEW
Roof	N8	Meetpoort 5	4.00	40	6.02	EDIT	VIEW
Internal	N1	Hoge zuig	4.00	40	6.02	EDIT	VIEW
Internal	N2	Vul + diffusor	10.00	40	9.27	EDIT	VIEW
Internal	N3	Lage zuig naar sump	4.00	40	6.02	EDIT	VIEW
Internal	N4	Wateraftap naar sump	2.00	40	3.91	EDIT	VIEW
External	N1	Tankeiding vanaf broekstuk	10.00	40	9.27	EDIT	VIEW

[Data Analysis](#)
[Nozzle picture](#)
[Nozzle report](#)

Add a new nozzle: Name:

Remove an existing nozzle: Name:

[Add nozzle](#) [Remove](#)

TANKFARM OVERVIEW » TANK 503 » FOUNDATION

TANK PAD DETAILS:

Inspection date:
 Height of tank pad: 650.00 mm
 Height of sump above ground: 200.00 mm
 Tank pad finish type: Clinker bricks
 Tank pad finish condition: Present and in good condition
 Condensation bin: Not present
 Tank position relative to tank pad: Top position
 Tank pad rain protection type: MTE
 Tank pad rain protection condition: Present and in good shape
 Tank pad foil: Not present
 Tank pad leak detection: Not present
 Tank pad oil sand: Present and qualified
 Effectiveness of drainage: Slope of tank pad shoulder allows for adequate drainage

Effectiveness of drainage

Height

Tank position relative to tank pad

Topposition (ideal)
 Light settlement
 Settlement equal to tank pad shoulder
 Heavy settlement (floor lower than tank pad shoulder)

[Edit details](#)

SETTLEMENT

Settlement has been checked and is within tolerance limits. [Save](#)

PLANAR TILT

Inspection Date	North	East	South	West	OK/NOK	Edit Data	Delete Data
2012-10-17	4.00	0.00	-5.00	-31.00	OK	EDIT	DELETE
1986-05-01	0.00	0.00	0.00	0.00	OK	EDIT	DELETE

[Add inspection](#)

The program can assess planar tilt, edge settlement, differential settlement, sagging, out-of-roundness, etc etc.



TANKFARM OVERVIEW » TANK 539 » Fitness for Service

Today: 2013-04-0

- » TANKFARM OV
- » PRODUCTS LE
- » PIPING OVERV
- » PIPING GROU
- » MANAGEMENT
- » MAINTENANCE
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- » BODENBESCH
- » CLIENT ADMIN
- » HELP
- » LOG OUT

ROOF

Rejection Limit Roofplates mm Apply control measure 1

FLOOR

Young's modulus N/mm²

Material Yield Strength N/mm²

Rejection Limit General mm

Rejection Limit pitting mm

RE-CALCULATE

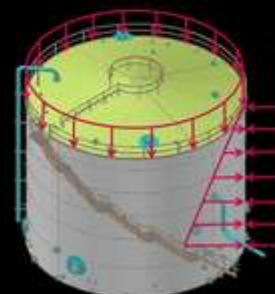
Tank diameter: 24.00 m
 Design pressure: 23.00 mbar
 Design vacuum pressure: 5.75 mbar
 Design windspeed: 33.47 m/s
 Relative density product: 1.00
 Joint efficiency factor: 0.85
 Tank height: 14.64 m
 Max. filling height: 14.43 m
 Operational temperature: T < 40 °C
 Steel type: Carbon Steel

- Roof**
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SHELL

	T _{min} Liquid Load ¹	T _{min} Wind Load ²	T _{min} Roof Load ³	½ ABT	Rejection Limit [mm]
Ring 1	10.57	13.16	13.07	7.00	13.16
Ring 2	9.23	11.90	11.82	6.35	11.90
Ring 3	7.89	10.10	10.05	5.25	10.10
Ring 4	6.54	7.90	7.78	4.75	7.90
Ring 5	5.20	4.92	4.75	3.50	5.20
Ring 6	3.86	5.14	5.08	3.00	5.14
Ring 7	2.51	2.78	2.15	3.00	3.00
Ring 8	1.17	5.40	5.35	3.00	5.40

- 1) Independent rejection calculation per ring.
- 2) Combined rejection calculation for entire shell.
- 3) Combined rejection calculation for entire shell.



- Manage pics
- Manage files

Complete Hoop stress, wind & vacuum load, Roof load analysis

Activity planning Set status



TANKFARM OVERVIEW » TANK 539 » DETAILS ROOF

UPDATE ROOF DETAILS

PoF Analysis

Probability Factor

ξ	Rating
≥ 3.00	H
2.50 - 3.00	M
2.15 - 2.50	L
< 2.15	N

$\xi = 2.14$
 ξ Rating = N

Consequence Factor

χ	Rating
≥ 3.00	H
2.50 - 3.00	M
2.00 - 2.50	L
< 2.00	N

$\chi = 3.00$
 χ Rating = H

Risk assessment matrix

Probability	Consequence				
	H	L	H	E	E
H	L	H	E	E	E
M	L	M	H	E	E
L	N	L	M	H	H
N	N	N	L	M	* M *

Risk factor

Risk factor	K-factor
N	0.9
L	0.8
M	0.7
H	0.6
E	0.5

Confidence Rating:
0

K-factor:
0.7

Adjusted K-factor:
0.7

	Allowed Thickness	As Built Thickness	Thickness Last Insp.	Corrosion Rate	Thickness Allowance	Remaining Lifetime
	$t_{min acc.}$ [mm]	t_{nom} [mm]	t_{last} [mm]	CR [mm/yr]	TA [mm]	RLT [yr]
Roof Plates	3.81	4.75	5.60	0.010	1.79	50.00

Confidence Assessment

NDT method used:

TANKFARM OVERVIEW » TANK 539 » DASHBOARD » CONCLUSIONS & RECOMMENDATIONS

CONCLUSIONS & RECOMMENDATIONS

2012-12-18

EDIT

RBI Report

Study notes

Conclusion

Tank is in onderhoud. Nadat alle inspectie- en onderhoudsgegevens zijn ontvangen en verwerkt wordt de RBI analyse herzien.

Floor

Aangezien de terp te laag is, de sump onder het maaiveld ligt en de tank inwaterend is gerapporteerd is bij deze tank significante kans op aantasting van de onderzijde van de bodem. Dit is tijdens een MFL onderzoek in 2002 echter ge aangetoond. Desondanks is het aan te bevelen dit verhoogde risico te mitigeren tijdens het volgende groo t terp te renoveren. Deze situatie is in acht genomen in het bepalen van een verantwoord operatie termijn gestelde jaar in onderhoud moeten worden gebracht.

Deze tank heeft een zogenaamde C status volgens de NRB richtlijn. Conform deze richtlijn is derhalve ee tank binnen een bepaald termijn naar een A status te brengen. Derhalve is tijdens het groot onderhoud i de tank gevijzeld dient te worden, de terp gerenoveerd, een HDPE folie geïnstaleerd en de onderzijde ge

Shell

Tijdens de eerstvolgend groot onderhoud dient de lokale afname bovenaan ring 3, noordoost (8.2mm) b eventueel L-criterium worden toegepast. (30-06-2012: dit is uitgevoerd). Tijdens volgend onstream insp onderzocht te worden middels een crawler. Tevens dient de 5e ring onderzocht te worden naar lokale af hier een L-criterium toegepast kan worden.

Roof

Geen opmerkingen. Tijdens volgende onstream inspectie opnieuw manuele UT metingen uitvoeren.

Nozzles

Tijdens de volgende offstream inspectie speciale aandacht voor het inwendige leidingwerk nabij sump (l Rekening houden met vervanging van beide. Voor wat betreft integriteit is dit verder niet belang, aangee in de tank bevind en dus geen lekkage kan opleveren. Derhalve levert dit geen afkeur op. Tijdens volge alle nozzles nameten middels manuele UT.

Settlement

ACTIVITY PLANNING

Next Turnaround: 2011

Activity	
Algemeen: Tank In- en uit bedrijf nemen	
Algemeen: Watertest	
Bodem: Bodemzakking	
Bodem: Bottom ripples	
Bodem: Conserveren Onderkant	
Bodem: Cornerweld A-hoogte meting	
Bodem: Floorscan	
Bodem: Hoekverdraaiing (EEMUA grid)	
Bodem: Manual UT (5 metingen/plaat)	
Bodem: Pitting Oplassen	
Bodem: Stralen zonder Spiraal tot 55m diameter	
Bodem: Voids onder tankvloer	
Cleaning Categorie 1 tot 7500 kuub	
Dak: HD foto's dakspanten	
Dak: Manual UT (EEMUA grid)	
Dak: Schilderwerk bijwerken	
Nozzles: Manual UT	
Piping: Manual UT	
Tank: Annular Projection	
Tank: Visueel Inwendige Inspectie	
Tank: Visueel Uitwendige Inspectie	
Tankterp: HDPE folie + aanbrengen	
Tankterp: Renoveren	
Tankterp: Schouder Klinkers Geheel Vernieuwen	
Tankterp: Steenslagring Aanbrengen	
Wand: Crawler UT	
Wand: Pitting Oplassen	
Wand: Schilderwerk bijwerken	

Blue = inspection
Red = maintenance
Green = cleaning

Edit

Analysis Conclusion & recomm

NOZZLES	External	16.30	0.6	10
	Internal	0.00	1.0	0
SETTLEMENT		Status: OK		

Note 1: Final applied risk factor is adjusted with a confidence rati guidelines.

Note 2: Risk rating and remaining lifetime are two separate para have a low risk and still be rejected.

Today: 2013-04-05

MAINTENANCE PLANNING

The maintenance planning shows a summary of costs for the terminal for the next 20 years. Note: costs are exclusive downtime costs. Select a year for detailed costs or select a tank for detailed activities.

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Year	Costs in €
2013	4.091.122
2014	2.080.870
2015	2.028.114
2016	2.139.420
2017	1.415.007
2018	1.139.852
2019	1.272.955
2020	2.316.026
2021	889.617
2022	1.328.543
2023	206.225
2024	848.392
2025	323.525
2026	291.760
2027	472.901
2028	204.711
2029	88.226
2030	31.333
2031	16.466
2032	1.397
2033	200
2034	250
2035	500
2036	1.000

2014	
tank/pipe	costs in €
TANK 504	1.975
TANK 517	3.467
TANK 540	1.975
TANK 541	19.798
TANK 543	1.320
TANK 566	105.810
TANK 569	157.355
TANK 574	1.975
TANK 578	1.975
TANK 582	1.975
TANK 584	331.152
TANK 599	106.628
TANK 605	131.418
TANK 614	1.397
TANK 616	161.612
TANK 617	1.922
TANK 627	67.348

TANK 541	
activity	costs in €
Algemeen: Tank In- en uit bedrijf nemen	3.000
Bodem: Bodemzakking	700
Bodem: Bottom ripples	250
Bodem: Cornerweld A-hoogte meting	250
Bodem: Floorscan	3.500
Bodem: Hoekverdraaiing (EEMUA grid)	700
Bodem: Manual UT (5 metingen/plaast)	1.000
Bodem: Pitting Oplassen	2.000
Bodem: Stralen met Spiraal tot 55m diameter	1.531
Bodem: Voids onder tankvloer	250
Cleaning Categorie 1 tot 7500 kuub	400
Dak: Manual UT (EEMUA grid)	275
Dak: Uitwendige Inspectie (drijvend dak)	450
(EEMUA grid)	1.397
Tank: Visueel Inwendige Inspectie	600

- Activity report
- Inspection report
- Activity planning

Per year an Activity Report can be printed in PDF. This can also be uploaded to CMMS systems



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