Inspection Report
On-stream inspection

Vector Aerospace

Tank No.:	**Tank 33 – ACID WASTE OFF HAUL**
Location:	**Vector Aerospace,** Fareham Road, Gosport, Hampshire, PO13 0AA
Report No:	**187_T33**
Date of Inspection:	**12th May 2022**
Tank Assessor:	**Steve Scott** **API 653 Cert. No.: 43824**

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0	**16th May 2022**	**20**	**In-Service**	**Steve Scott**
Revision	**Date**	**Pages**	**Description**	**Prepared by**

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1 Summary of inspection findings

1.1 Inspection

This section provides a summary of the inspection findings. Finding details are reported in this document under corresponding section.

Location / photographs

The orientation is defined, where referred to, as magnetic North.

Supplementary notes

Tank 33 at Vector Aerospace is a stainless-steel vertical tank supported on an integral plastic bund above a concrete base. Tank 33 stores a chemical, acid waste off haul, used in the refurbishment of aeronautical equipment. Tank 33 was not designed or constructed to any particular standard. The inspection of Tank 33 at Vector Aerospace was however performed as closely as possible to the appropriate guidance. Where some tasks, (as stated under section 3.2.2 `Inspection restrictions'), could not be performed or could only be performed in part in accordance with the standard, in these situations, the inspector will decide on a case-by-case basis, to skip parts of the inspection or to use workarounds to maintain optimum inspection results. In the case of missing information, the use of experience and estimates has been used.

History / Major Alterations

- The date of tank installation in the current position at Vector Aerospace is circa. 2003
- The construction company is not known
- Design code is not known.
- Previous inspection reports are not available.
- No name plate is present on the tank.

General

Bunded area:

- Tank 33 is individually bunded. The tank is eccentrically located in the bund to allow the installation of manway in the bund lid. The bund is constructed of plastic panels welded to form a closed cylinder and lidded to prevent the ingress of rainwater. There is currently no means of emptying the bund. At the time of the inspection, the bund floor was clean and dry. The bund floor welds and shell to floor corner welds could be adequately inspected and there was no evidence of leakage to the tank foundation. The bund floor and corner welds are in good condition. Internal and external shell plates and welded joints are in good visual condition with no signs of failure/leakage. The plastic lid incorporates the bund manway. All sections and welds are in good visual condition with no evidence of leakage. Note that rainwater could be seen to have ponded on the bund lid topside – these penetrations could be a source of rainwater ingress.

- Bund dimensions (approx.): 4.00 m diameter X 2.135 m in height.
- Approximate bund volume = 27 m^3.
- Tank 33 has a maximum capacity of approximately 25 m^3. The bunded area approximately conforms to API requirements to accommodate the volume of the tank plus 10%.
- Bund integrity could be confirmed by leak testing to comply with CIRIA 736.
- The bunded area is in good condition but lacks any means of liquid removal.
- Access into the bund was achieved by using two ladders.
- At the time of this inspection, the bund floor was clean and dry.
- Passage within the bund is reasonable although limited as the tank is located eccentrically within the bund.

Tank Foundation:

- The tank is of shop built vertical design and is supported off the plastic bund floor which is installed above a concrete bund floor. This is considered adequate for the design and for the products being stored.
- Neither the tank nor the integral bund are bolted down to the concrete foundation.
- The concrete foundation pad is somewhat overgrown with weeds, bushes etc. but is in good visual condition showing no sign of settlement, cracking etc.

Level Control/Overfill protection:

- Tank 33 is fitted with a non-return valve or similar device which limits capacity in the tank.

Level Gauging:

- Tank levels are controlled and monitored via PLC in building 97 which indicates percent tank capacity.

Firefighting equipment:

Only the fire extinguishers present at site are evidence of any firefighting equipment associated with the tank.

Venting:

- A 75 mm swan neck free vent is located on the tank roof.
- Calculations ref. API 2000 indicate that tank venting is more than adequate.

Handrails and access ladders:

- There is no permanent access to the tank and integral bund.
- Access to the bund manway and tank shell above the bund lid, was by ladder.
- Access to the tank roof was not possible

Tank Earthing:

- There is no evidence that the tank is earthed but this is not considered necessary.

Anchor bolts:

- The tank and bund are not bolted to the concrete bund floor.

Tank Shell - GENERAL

- The tank shell is 316 stainless-steel over two shell courses each with a single vertical weld.
- There is a 150 mm ST-steel skirt, welded around the shell immediately above the point at which the bund lid connects with the tank shell – this to deflect rain away from this joint.
- Ultrasonic thickness measurements were recorded where access allowed.
- See UT and DVI data in Appendix 1.

Tank Bottom

- The tank is in – service, no access to the internal tank bottom.
- The tank bottom to lower shell connection is close formed with no external projection.
- The tank bottom is located directly on top of the plastic bund floor.

Tank Shell above the bund lid – EXTERNAL

- The tank shell above the bund lid was observed from ground level with binoculars, and, where accessible, from a ladder – painted blue - some evidence of fungal growth.
- See UT and DVI data in Appendix 1.

Tank Shell below the bund lid - EXTERNAL

- The tank shell below the bund lid was accessed by entry into the bunded area.
- The lower tank shell was subjected to DVI enhanced by hand-held LED lighting and magnifying glass.
- The lower tank shell below the bund lid is not painted.
- As the tank is located eccentrically within the bund, there was limited access to approximately 15% of the circumference diametrically opposite the manway position.
- See UT and DVI data in Appendix 1.

Integral bund shell – EXTERNAL

- The tank bund external shell is plastic in self-coloured dark grey. There are horizontal and vertical welds on the external tank bund shell, all are well made with no evidence of separation/leakage.

Integral bund shell – INTERNAL

- The tank bund shell is plastic in self-coloured black. There are horizontal and vertical welds on the internal tank bund shell, all are well made with no evidence of separation/leakage.
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Integral Bund Floor

- The tank bund floor is self-coloured black plastic and extends approximately 15 mm beyond the diameter of the tank bund shell, creating an external bottom projection.
- The tank bund shell is connected internally and externally to the tank bottom with a corner weld.

Integral bund Lid

- The integral bund is covered with a self-coloured dark grey plastic lid.
- The lid is sectional with sections being connected by gasket and bolts to eliminate rainwater ingress.
- A manway is placed in the bund lid extending to 80 mm in width and allowing access into the bund. The manway lid simply sits on top of the manway penetration and is not bolted.
- All external and internal welds in the bund lid are sound and well made.

Tank Roof

- The tank roof was not accessible for inspection.

Venting

- The roof mounted 75 mm swan-neck free vent complies with API 2000 venting requirements.

1.2 Repair requirements and recommendations

Integrity related actions:

None

Non-integrity related actions:

1. Consider installing a simple valved outlet in the lower bund shell to allow draining (after analysis) of any rainwater.
2. Clearly identify the tank with Tank No, Duty and Volume.
3. Remove the vegetation from the concrete foundation and in particular the growth emanating from under the bund floor.
4. Review the firefighting system by engaging a competent authority experienced in storage tank farm fire safety and protection.

Tank 33 is considered Suitable for Continued Service.

Next Inspection – Out of Service 2027

– at which time the tank internal shell and tank bottom should be inspected by UT and DVI in addition to re-inspection of the elements inspected herein.

NOTE: The single tank manway located in the tank roof will make man-entry into the tank very difficult and potentially dangerous. It is recommended that solutions to this dilemma are investigated as soon as possible.

2 Introduction

2.1 General

This report records the results of the API 653 off-stream tank inspection survey carried out by Bro Nant International for Vector Aerospace on their Tank 33 at Gosport commencing 12th May 2022.

The tank has been inspected by BNI Survey Engineer(s) by means of a Detailed Visual Inspection (DVI) in combination with the appropriate NDT equipment. This DVI includes inspection of the tank exterior and interior (where specified) as required for an EEMUA compliance check. Evidence of leakage, shell distortion, signs of settlement, and condition of appurtenances has been documented by the authorized API 653 inspector for follow-up action as deemed necessary.

This inspection report should be read in conjunction with API 653, API 575 and EEMUA 159, particularly if the reader is not familiar with these Standards and the terms used therein, as some of the terms used are specific to these Standards. We have exercised and applied API 653 and EEMUA 159 in good faith and present all details in accordance with these Standards.
Note that API 653 should not be interpreted as approving, recommending, or endorsing any specific design or limiting the methods of inspection, repair, alteration, or reconstruction. Deviations from this standard will only be applied when considered absolutely necessary. All deviations will conform to one of the standards as identified in section 1.2 of this report and only after consultation with the Customer. In all cases, the technical integrity of the tank under consideration will be safeguarded.

Evaluation for structural integrity of areas that do not meet the Standard is considered on a case-by-case basis and is dependent upon the available information. Where information not available, assumptions will be made on the basis of experience. Where necessary, our engineers will recognize and report whether a more dedicated (tank construction) engineering judgment is required. Additionally, we are receptive to any request from the Customer to reprocess the tank data in accordance with their differing interpretation of the API 653 standard.

3.1 Tank Details

The following is a brief summary of the tank details. Other parameters are included in this document where relevant.

General			
Tank number		33	
Tank type		Vertical	
Design standard		Not known	
Construction date		c. 2003	
Manufacturer			
Nameplate present	[y/n]	No	
As built drawing available	[y/n]	Yes	
Tank Dimensions			
Diameter		2.82 m	
Height		4.00 m	
Volume		25 m^3	*Approx..*
Maximum filling height		95%	
Tank Shell, Bottom and Roof			
Material		316 – ST Steel	
Construction		Shop Built	*Two course – single vertical weld*
Insulated	[y/n]	No	
Internal coated	[y/n]	Not known	
External coated	[y/n]	Yes	*Blue paint above the bund lid.*
Tank Bund Dimensions			
Diameter		4.00 m	
Height		2.135 m	
Volume		27 m^3	*In compliance (TVol + 10%)*
Tank Bund Shell, Bottom and Lid			
Material		PPV/GRP	
Construction		Welded panels	*Horizontal and vertical welds.*
Lining	[y/n]	No	
Foundation			
Type		Concrete slab	
Foundation height		150 mm	Above ground level
Tank supports		None	*Direct onto concrete base*
Operational			
Product stored		ACID WASTE OFF HAUL	
Relative Density at 15°C		1.05 to 1.43	
Storage temperature		-10 - +25°C	*Ambient*
Inflow rate		30 m^3 / hr.	*Maximum – diaphragm pump*
Outflow rate		30 m^3 / hr.	*Maximum – diaphragm pump*

3.2 Survey Details

The inspection involved the following BNI personnel:

Name	NDO/Technique	Certification
Steve Scott	API 653	43824
Andrew Kitchener	Standby	

The inspection has been carried out in line with:

1. "Procedure for the Off-Stream Inspection of Vertical Above Ground Storage Tanks in accordance with **EEMUA 159** requirements.
2. **API 653,** edition 4 "Tank inspection, Repair, Alteration and Reconstruction"
3. **Silverwing** Procedure for Wall Thickness Measurements of Steel Plates by Ultrasound Testing.

3.2.1 Inspection Condition

- At no time were there hazardous vapors or gasses present in the vicinity of the tank or the bunded area.

3.2.2 Inspection Restrictions

- The tank roof has no safe access. DVI of the tank roof was not possible.

4 Inspection Results

4.1 Results and required Actions

The following is a summary of the inspection results together with our recommendations. The recommendations are based upon API 653.

Condition Code

0. Not Applicable
1. Very poor — Immediate repair/replacement/maintenance required
2. Poor — Repair/replacement/maintenance required in the next 1 to 3 years.
3. Follow up required — Attention, monitoring, control is required.
4. Good — Slight degradation, no action required.
5. Very good — Excellent condition, similar to "as built" situation. No degradation found.

SAFETY	Condition Code	Action Required	Comments/Recommendations
Tank isolation	4	No	Tank is on-line.
Safe entry	4	No	Adequate ladder access to the integral tank bund internals.
Roof access	1	Yes	Roof access will be required during the proposed out of service inspection.
Falling object hazards	4	No	
Access structure	0	No	There is no permanent access.
GENERAL	**Condition Code**	**Action Required**	**Comments/Recommendations**
Bunded area	2	Yes	Consider the installation of a drain valve in the bund shell. Bund integrity could be tested in-line with CIRIA 736.
Access structure	0	No	There is no permanent access structure.
Valves/Flanges	0	No	None noted
Instruments and electrical	3	Yes	Instrumentation will require maintenance according to manufacturer's recommendations
Firefighting equipment	3	Yes	Fire-fighting system requires review by a competent authority.
Overfill/Level alarms	4	No	Maintain and test regularly.
Venting	4	No	Venting capacity conforms to API 2000

FOUNDATION	Condition Code	Action Required	Comments/Recommendations
Foundation condition	4	No	Simple concrete base
Housekeeping	2	Yes	Remove vegetation from foundation and in and around tanks.
Tank 33	**Condition Code**	**Action Required**	**Comments/Recommendations**
Shell above Bund Lid EXTERNAL	4	No	External Shell in good condition – some evidence of moss growth etc.
Shell below Bund Lid EXTERNAL	4	No	External Shell in good clean condition.
Bottom	4	No	Tank bottom appears to be in good condition.
Roof	0		No access
Welds	0		Vertical and horizontal welds well made.
Liquid Load	4	No	Tank can continue to operate at maximum filling height
T33 Integral Bund	**Condition Code**	**Action Required**	**Comments/Recommendations**
Bund Shell exterior condition	4	No	External Shell in good condition – some evidence of moss growth etc
Bund Shell interior condition	4	No	Internal Shell in good condition
Bund Floor	4	No	Good condition - no evidence of leakage.
Bund Lid	4	No	Rainwater could enter the bund – from penetrations in the bund lid.
Appurtenances	2	Yes	There is currently no way to easily drain the bund of rainwater – fit a drain valve.
Anchor bolts	0	N/A	None present

4.2 Photographs Safety

Photograph 1: Tank is on stream with no permanent access.

Photograph 2: Manway is in the bund lid. Temporary ladder access.

4.3 Photographs General

Photograph 3: Tank foundation is cast concrete slab construction.

Photograph 4: Tank bund is installed directly on top of the foundation.

Photograph 5: Internal bund is clean and dry.

4.4 Photographs Foundation

Photograph 6: The tank is installed directly above the plastic bund floor, above a concrete base.

Photograph 7: Significant vegetation in and around tank bunds.

4.5 Photographs EXTERNAL Tank Shell above Bund

Photograph 8: The tank shell above the bund is in good condition – painted blue..

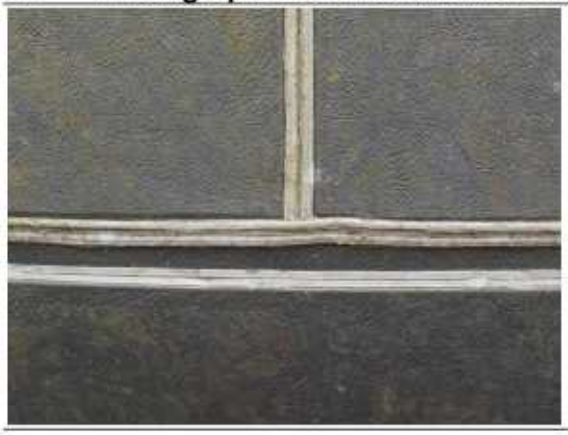
Photograph 9; Mild-steel rain-deflector skirt above bund lid.

4.6 Photographs EXTERNAL Tank Shell below bund

Photograph 10: The external shell below the bund is in good condition and unpainted.

Photograph 11: single horizontal and vertical weld over two courses.

4.7 Photographs Tank Bund Shell - EXTERNAL



Photograph 12: External bund is in good condition. Welds all good.

4.8 Photographs Tank Bund Shell- INTERNAL

Photograph 13: The internal tank bund shell is in good condition with all welds well made.

4.9 Photographs Bund Floor

Photograph 14: The tank bund bottom is clean and dry. Welds all well made.

Photograph 15: Bund floor to shell internal corner weld in good condition

4.10 Photographs Bund Lid

Photograph 15: Bund lid below steel rainwater deflector skirt.

5 Abbreviations & References

5.1 Abbreviations

DVI	Detailed Visual Inspection
H	Height
LDS	Leakage Detection System
LID	Last Inspection Date
N/A	Not applicable
NDT	Non Destructive Testing
SMYS	Specified Minimum Yield Strength
UT	Ultrasonic Testing
MT	Magnetic Particle Inspection
PT	Liquid Penetrant Inspection
W	Width
WT	Wall Thickness

5.2 References

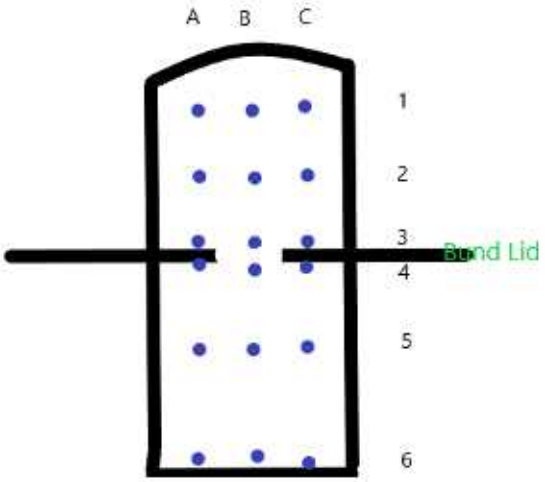
The latest editions of the following standards were used during the inspection and for the preparation of this report:

4. **EEMUA 159,**" Inspection of Vertical Above Ground Storage Tanks".
5. **EN14015**, "The European Standard EN 14015, "Specification for the design and manufacture of site built, vertical, cylindrical, flat-bottomed, above ground, welded, steel tanks for the storage of liquids at ambient *temperature and above"*
6. **EN 13018**, "Non-destructive testing – Visual testing – general principles".
7. **EN 13927**, "Non-destructive testing – Visual testing – Equipment".
8. **EN 9934**, "Non-destructive testing – magnetic particle testing – parts 1 to 3".
9. **BS2654**, "British Standard Specification for: "Manufacture of vertical steel welded
   non-refrigerated storage tanks with butt-welded shells for the petroleum industry".
10. **API 650**, "Welded Steel Tanks for Oil Storage".
11. **API 653**, "Tank Inspection, Repair, Alteration and Reconstruction".
12. **API RP 575**, "Inspection of Atmospheric and Low-Pressure Storage Tanks".
13. **API RP 652**, "Lining of Aboveground Petroleum Storage Tank Bottoms".
14. **API 2015**, "Safe Entry and Cleaning of Petroleum Storage Tanks".
15. **API 2000**, "Venting Atmospheric and Low-Pressure Storage Tanks".

Appendix A: Inspection Measurements and Observational DVI Results

Tank 33 UT and DVI

1. Ultrasonic thickness testing was performed on the tank shell above and below the bund lid, where access allowed.



T33 UT measurements (mm)

	1	2	3	4	5	6
A	4.1	3.9	4	3.9	4	4
B	4	3.9	4	4.1	4	4
C	3.9	4.1	3.9	4	4.1	3.9

Average Tank Shell thickness – 4 mm 316 Stainless Steel

2. All of the accessible surfaces of Tank 33 bund were inspected by DVI enhanced with hand-held lighting, magnifying glass etc.

The recommendations of Health and Safety Guidance Note PM 86 were followed.
The following potential defects were investigated:

- bulges;
- discolouration.
- crazing;
- crack-like defects.

- leaning/loss of verticality;
- local wetting of external surfaces;
- erosion/corrosion of supporting structures and plinths.

The following areas were of particular interest: -

- Area where the tank shell and tank base meet;
- Branch and manway attachments; and
- Supporting structures of piping and valves.

None of the defects listed above were noted by DVI.