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THE NATIONAL BOARD OF BOILER AND PRESSURE VESSEL INSPECTORS

NATIONAL BOARD SUBGROUP FRP

MINUTES

Meeting of April 25th, 2016
Tampa, FL

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The National Board of Boiler & Pressure Vessel Inspectors
1055 Crupper Avenue
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1. **Call to Order**

The meeting was called to order at 2:55pm local time by Chair Bernie Shelley.

2. **Introduction of Members and Visitors**

Members and visitors introduced themselves. An attendance sheet was passed to the group. (Attachment Page 1)

3. **Announcements**

Mr. Shelley announced Brad Besserman the new secretary of the subgroup.

4. **Adoption of the Agenda**

The agenda was adopted by a unanimous vote of the subgroup.

5. **Approval of the Minutes of October 2015 Meeting**

Minutes from the previous meeting were shown on the screen, but several members expressed that the minutes were the wrong version. The correct version was shown on the screen, and approved by a unanimous vote of the subgroup.

6. **Action Item Reports**

Item Number: NB11-1901	**NBIC Location: Part 1**	**Attachment Pages 2-6**
General Description: Add guidance for the safe installation of high pressure composite pressure vessels operating in close proximity to the public **Subgroup:** FRP **Task Group:** None assigned **Meeting Action:** Project manager Dale Keeler was not present for the meeting, so no progress was reported. Francis Brown and Dale Keeler will work on this item and present a proposal at the next meeting of the subgroup.		

Item Number: NB15-2202	**NBIC Location: Part 1**	**Attachment Pages 7-9**
General Description: Add checklist for the safe installation of high pressure composite pressure vessels operating in close proximity to the public **Subgroup:** FRP **Task Group:** None assigned **Meeting Action:** Project manager Dale Keeler was not present for the meeting, so no progress was reported. Francis Brown and Dale Keeler will work on this item and present a proposal at the next meeting of the subgroup.		

Item Number: NB16-1401	NBIC Location: Part 2, S10	No Attachment

General Description: Revise and update Supplement 10 on Inspection of CRPVs

Subgroup: FRP

Task Group: None assigned

Meeting Action: It was reported that there had been no progress on this item. Project manager Norm Newhouse will work on this item and present a proposal at the next meeting of the subgroup.

Item Number: NB16-1402	NBIC Location: Part 3	No Attachment

General Description: Life extension for high pressure vessels above 20 years

Subgroup: FRP

Task Group: None assigned

Meeting Action: Project manager Mike Gorman recapped a presentation regarding this item that he gave at the last meeting. The presentation will be sent to the subgroup for review and comment prior to the next meeting of the subgroup.

Item Number: NB16-1403	NBIC Location: Part 3, S4	No Attachment

General Description: Add information on repair of high pressure vessels

Subgroup: FRP

Task Group: None assigned

Meeting Action: It was reported that there has been no progress on this item since the last meeting. The subgroup discussed the feasibility of repair of high pressure composite vessels. Mr. Newhouse was added to task group. Mr. Newhouse or project manager Neel Sirosh will work on this item and present a proposal at the next meeting of the subgroup.

7. **Future Meetings**

October 2016 – Las Vegas, NV
April 2017 – Puerto Rico

8. Adjournment

Chair Bernie Shelley adjourned the meeting at 3:51pm local time.

Respectfully submitted,

Brad Besserman
NBIC Secretary

NBIC SG FRP - Attendance for Meeting of 4/25/2016			
Name	**Company**	**Phone**	**Signature**
Bernard Shelley	Chemours	(302) 999-2593	
Brad Besserman	National Board	(614) 431-3236	
Francis Brown	Consultant	(740) 862-8901	
Juan Bustillos	Bustillos & Associates	(979) 266-9238	
Terry Cowley	FRP Consulting, LLC	(832) 443-3591	
Rick Crawford	L&M Fiberglass	(519) 336-1660	
Doug Eisberg	Avista Technologies	(760) 744-0536	
Michael Gorman	Digital Wave Corp.	(303) 790-7559	
David Hodgkinson	Composite Vessels	(613) 345-4921	
Dale Keeler	Dow Chemical	(979) 238-5650	
Deb McCauley	Chemours	(302) 999-2526	
Norman Newhouse	Lincoln Composites	(402) 470-5035	
Adrian Pollock	Mistras Group	(609) 716-4006	
Jess Richter	~~Thorpe Plant Services~~	(870) 391-9200	SENTINEL CONSULTING, LLC
Neel Sirosh	LightSail Energy	(510) 644-8225	
TOM CHEN	CHEMOURS	302-773-2453	
RAUL RODRIGUEZ	PROTEC	760 599 4800	RAUL.RODRIGUEZ@PROTEC-ARISAWA.COM
Eduardo DeAr	VFS plastic	+529999450928	eduardo@vfs.mx
Allen Beckwith	Thorpe Plant Servic	870 391 4787	allen.beckwith@thorpepme.com
Patrick Murray	ASME	518 8260447	MurrayP@Asme.org

NB11-1901

S3.0 Installation of High Pressure Composite Pressure Vessels
At the time of vessel installation, the current edition of all documents referenced herein shall apply.

S3.1 Scope
This supplement provides requirements for the installation of high pressure composite pressure vessels (HPCPV). This supplement is applicable to pressure vessels with the MAWP not exceeding 15,000 psi, and is applicable to the following classes of vessels:
a) Metallic vessel with a Fiber Reinforced Plastic (FRP) hoop wrap over the shell part of the vessel (both load sharing).
b) Metallic vessel with a full FRP wrap (both load sharing)
c) FRP vessel with a non load sharing metallic liner
d) FRP vessel with a non load sharing non metallic liner

S3.2 Supports
Design of supports, foundations, and settings shall consider the dead loads, live loads, wind, and seismic loads. Vibration, and thermal expansion shall also be considered. The design of supports, foundations, and settings shall be in accordance with ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*. The importance factors used in calculating the seismic and wind loads shall be the highest value specified for any category in ASCE/SEI 7.

S3.3 Clearances
The pressure vessel installation shall allow sufficient clearance for normal operation, maintenance, and inspection. Stacking of pressure vessels is permitted. The minimum clear space between pressure vessels shall be 1 ft. vertical and 2 ft. horizontal. Vessel nameplates shall be visible after installation for inspection.

The location of vessels containing flammable fluids shall comply with NFPA [2, Table 7.3.2.3.1.2(a)] *Minimum Distance From Outdoor (GH_2) Systems to Exposures (U.S.Units).* The vessel owner shall document the vessel pressure and pipe diameters used as a basis for compliance with NFPA 2 location requirements.

S3.4 Piping Loads
Piping loads on vessel nozzles shall be determined by a formal flexibility analysis per ASME B31.12: paragraph IP-6.1.5(b). The

piping loads shall not exceed the maximum nozzle loads defined by the vessel manufacturer.

S3.5 Mechanical Connections

Mechanical connections shall comply with pressure vessel manufacturer's instructions. Mechanical connections shall comply with applicable codes. Connections to threaded nozzles shall have primary and secondary seals. The seal design shall include a method of detecting a leak in the primary seal. Seal functionality shall be demonstrated at the initial pressurization of the vessel.

S3.6 Pressure Indicating Devices

Each pressure vessel shall be equipped with a pressure gage mounted on the vessel. The dial range shall be from 0 psi to not less than 1.25 times the vessel MAWP. The pressure gage shall have an opening not to exceed 0.055in (1.4mm) (No. 54 drill size) at the inlet connection. In addition, vessel pressure shall be monitored by a suitable remote pressure indicating device with alarm having an indicating range of 0 psi to not less than 1.25 times the vessel MAWP.

S3.7 Pressure Relief Devices

Each pressure vessel shall be protected by pressure relief devices per the following requirements.

a) Pressure relief devices shall be suitable for the intended service.

b) Pressure relief devices are to be manufactured in accordance with a national or international standard and certified for capacity (or resistance to flow for rupture disk devices) by the National Board.

c) Dead weight or weighted lever pressure relief valves are prohibited.

d) Pressure relief valves shall not be fitted with lifting devices.

e) The pressure relief device shall be installed directly on the pressure vessel with no isolation valves between the vessel and the pressure relief device except:

1) when these isolation valves are so constructed or positively controlled below the minimum required capacity, that closing the maximum number of valves at one time will not reduce the pressure relieving capacity, or

2)upon specific acceptance of the Jurisdiction. An isolation valve between vessel and its pressure relief device may be provided for vessel inspection and repair only. The isolation valve shall be arranged so it can be locked or sealed open.

f) The discharge from pressure relief device(s) shall be directed upward so as to prevent any impingement of escaping fluid upon the vessel, adjacent vessels, adjacent structures, or personnel. Gaseous discharge must be to outdoors, not under any structure or roof that might permit formation of a "cloud". The pressure relief device(s) discharge piping shall be designed so that it cannot become plugged by animals, rain water, or other materials.

g) The pressure relief device(s) shall be set at a pressure not exceeding the MAWP of the vessel.

h) The pressure relief device(s) shall have sufficient capacity to ensure the pressure vessel does not exceed the MAWP as specified in the original code of construction.

i) The owner shall document the basis for selection of the pressure relief device(s) used, including capacity.

j) The owner shall have such analysis available for review by the jurisdiction.

k) Pressure relief devices and discharge piping shall be supported so that reaction forces are not transmitted to the vessel.

l) Heat detection system: a heat activated system shall be provided so that vessel contents will be vented per f) (above), if any part of the vessel is exposed to a temperature higher than 185 °F.

m) Positive methods shall be incorporated to prevent overfilling of the vessel.

S3.8 Assessment of Installation

a) Isolation valve(s) shall be installed directly on each vessel so as to isolate the vessel from the system, but not between the vessel and the pressure relief device except as noted in 3.7, e), above.

b) Vessels shall **not** be buried.

c) Vessels may be installed in a vault subject to a hazard analysis, verified by the AI, or jurisdiction, to include as a minimum the following:

1) ventilation
2) inlet and outlet openings
3) access to vessels
4) clearances
5) intrusion of ground water
6) designed for cover loads
7) explosion control
8) ignition sources

9) noncombustible construction
10) remote monitoring for leaks, smoke, and fire
11) remote controlled isolation valves
12) other safety requirements

d) Fire and heat detection/suppression provisions shall comply with local jurisdictional requirements, and as a minimum include relief scenarios in the event of a fire or impending overpressure from heat sources.

e) Installation locations shall provide the following:
1)Guard posts shall be provided to protect the vessels from vehicular damage per NFPA [2:4.14.1]. Protection from wind, seismic events, and other miscellaneous impacts shall be provided.
2)Supports and barriers shall be constructed of non-combustible materials.
3)Vessels shall be protected from degradation due to direct sunlight.
4)Access to vessels shall be limited to authorized personnel.
5)Any fence surrounding the vessels shall be provided with a minimum of two gates. The gates shall open outward, and shall be capable of being opened from the inside without a key.
6) Access for initial and periodic visual inspection and NDE of vessels, supports, piping, pressure gages or devices, relief devices and related piping, and other associated equipment.
7) Completed installations shall be validated by the local jurisdiction or an Authorized Inspection Agency as addressing all of the above and jurisdictional requirements prior to first use. This verification shall include an itemized check list identifying all applicable areas with initial and date of the authorized inspection personnel. This verification shall be posted in a conspicuous location near the vessel and on file with the local jurisdiction. Certificates shall be updated as required by mandated subsequent inspections.

8) Piping installation shall comply with ASME B31.3 *Process Piping*.
Piping installation for gaseous hydrogen shall comply with ASME B31.12 *Hydrogen Piping and Pipelines* or NFPA [2:7.1.15].

9) The installation area shall have placards posted per NFPA [2:7.3.1.2.5].

10) The vessels shall be electrically bonded and grounded per NFPA [55:10.2.6].

S3.9 Ladders and runways

A minimum of two exits shall be provided for each walkway or enclosed space. The distance from any point on the walkway to the nearest exit shall not exceed 75 ft.

S3.10 See Supplement ? for an installation assessment checklist.

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High Pressure Vessel Installation Checklist (draft 4)

Preface: This checklist is a guide to be used in preparation of formal installation inspection documents in conjunction with regulatory authorities.

1. Construction Code Compliance
    a. Manufacturers data plate (record all information)
    b. ASME Code with appropriate designator for the type of Construction
    c. Capacity (when indicated on nameplate in water volume)
    d. Manufactured date, expiration date, or/service life
2. Condition of tank – paint, signs
    a. Condition of all painted surfaces
    b. Visible damage per inspection guidelines ~ (scratches, gouges, impact, etc.)
    c. Flammable warning signs
    d. No smoking, welding, or open flame signs
    e. Exterior protective barrier condition
3. Foundations / Supports per the jurisdiction building code
    a. fire protection
    b. painted metallic parts
    c. anchoring / securing of supports
    d. is support frame condition acceptable
    e. are tanks installed on a firm foundation
4. Tank Connections / Fittings
    a. Connections equipped with required correctly rated valves, (shut off valves, relief device, excess flow valve)

5. **NB15-2202**

a. Remote operated emergency shut off or isolation valves
b. protected from damage

c. leak free

6. Gauges
   a. Dedicated pressure gauge for each tank.
   b. Gauges in good condition, display ~ 1.25 x operating pressure
   c. remote and local indicating gauges function
7. Pressure Relief Device(s)
   a. information legible
   b. isolation valve between PRD and tank
   c. pressure relief device is properly certified (ASME/NB)
   d. discharge unobstructed
   e. properly capped/protected to prevent entry of foreign material or objects
   f. weep holes to drain moisture
   g. free of corrosion
   h. routine inspection and test documents (date and results)
8. Fence / Security
   a. Area properly secured
   b. Limited / restricted access provided
   c. Camouflaged
   d. Properly protected from errant vehicle damage
   e. Protection from vandalism (rifle shot, etc)
9. location and spacing of tanks
   a. proper tank spacing to allow inspection

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b. proper tank spacing to allow for maintenance or replacement
c. stacking does not exceed allowable limits

10. presence of combustible materials
area is free from combustible materials

11. vault installed tanks
a. non combustible construction
b. at least two points of access (entrance and egress)
c. secured against unauthorized entry
d. adequate ventilation
e. fire suppression
f. adequate access for inspection, maintenance, and replacement
g. Confined space signs (vault installation)

12. Shading
shade to prevent solar heating