Future Editions of API RP 2A

2014 BSEE Domestic and International Standards Workshop

January 28 – 29, 2014

Future Editions of API RP 2A

- API RP 2A-WSD 22nd Edition -

  Based on OTC 23558, “Insights into Using the 22nd Edition of API 2A” by K. A. Digre and F. J. Zwerneman

- API RP 2A-LRFD 2nd Edition (tentative title)

  Modified adoption of ISO 19902, “Fixed Steel Offshore Structures”

RP 2A 22nd - API TG 13

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API RP 2A-WSD 22nd Edition

Background

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Clarification

Summary

Background

- API Standards are scheduled to be reviewed and revised, reaffirmed, or withdrawn at least every five years
- Incorporate content from API Bulletins 2INT-MET, 2INT-DG, 2INT-EX
- Accommodate development of API RP 2SIM, 2MET, 2EQ, 2GEO, 2MOP
- Needed technical revisions
- Editorial cleaning

Background (cont'd)

- Formed Task Group in October 2007
- Decided RP 2A would not follow the organization of ISO 19902
- Moved MET content to 2MET, 2EQ, … while retaining information required for structural design
- Followed "API Document Formatting and Style Manual"
- International System (SI) as primary units / U.S. Customary as secondary units

API RP 2A-WSD 22nd Edition

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Organization

1. Introduction, Purpose and Scope (new)
2. References (new)
3. Definitions and Acronyms (new)
4. Planning (21st Section 1)
5. Design Criteria and Procedures (21st Section 2)
6. Structural Steel Design (21st Section 3)
7. Strength of Tubular Joints (21st Section 4)
8. Fatigue (21st Section 5)
9. Foundation Design (21st Section 6)
10. Other Structural Components and Systems (21st Section 7)

Organization (cont'd)

11. Material (21st Section 8)
12. Drawings and Specifications (21st Section 9)
13. Welding (21st Section 10)
14. Fabrication (21st Section 11)
15. Installation (21st Section 12)
16. Inspection (21st Section 13)
17. Accidental Loading (21st Section 18)
18. Reuse (21st Section 15)
19. Minimum and Special Structures (21st Section 16)

Organization (cont'd)

- Annex A: 21st Edition Cross Reference to 22nd Edition Figures, Tables, and Equations
- Annex B – Commentary
- Bibliography

Organization (cont'd)

- Parts of 21st Edition Section 2 moved to 2MET
- Appropriate parts of 21st Edition Section 9 moved to 2GEO
- All portions of 21st Edition Sections 14 (Surveys) and 17 (Assessment of Existing Platforms) have been moved to 2SIM
- Parts of 21st Edition Section 18 (Fire, Blast, and Accidental Loading) are now in 2FB

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Special attention regarding the following non-API normative references:

- AISC *Specification for Structural Steel Buildings* , 1989 in 9th edition manual (Allowable Strength Design)
  - LRFD methods are based on calibration with building design practices and may not be applicable to offshore platforms
  - Work in progress to incorporate provisions of the new AISC specification into offshore design practices
- AWS D1.1/D.1.1M:2010 *Structural Welding Code – Steel*. Reference to a specific D1.1 edition (exceptions are already included in 2A) protects against possible future conflicting modifications.

Content (cont'd)

Table 4.1 — Exposure Category Matrix

Life Safety Category	Consequence Category		
	C-1, High Consequence	C-2, Medium Consequence	C-3, Low Consequence
S-1 manned-nonevacuated	L-1a	L-1a	L-1a
S-2 manned-evacuated	L-1	L-2	L-2
S-3 unmanned	L-1	L-2	L-3

a Manned-nonevacuated platforms are presently not applicable to the U.S. GoM waters where platforms are normally evacuated ahead of hurricane events. The metocean design criteria in Section 5 have not been verified as adequate for manned-nonevacuated in the U.S. GoM. However, the winter storm, sudden hurricane and earthquake criteria for the U.S. GoM have been verified as adequate for the manned-nonevacuated situation occurring during those events when platforms in the U.S. GoM waters are not normally evacuated.

Content (cont'd)

Table 5.5 — Design Level Criteria and Robustness Analysis

Exposure Category	Design Level Criteria	Robustness Level Ultimate Strength Analysis
L-1a	Use the 100 year full population and associated conditions from API 2MET or site-specific data developed in accordance with the requirements of API 2MET	Use the 1,000 year full population wave and associated conditions from API 2MET or site-specific data developed in accordance with the requirements of API 2MET
L-2	Use the 50 year full population and associated conditions from API 2MET or site-specific data developed in accordance with the requirements of API 2MET	Not required if L-2 exposure category platform has a robust configuration For non-robust configurations – Use the 500 year full population wave and associated conditions from API 2MET or site-specific data developed in accordance with the requirements of API 2MET
L-3	Use the 25 year full population and associated conditions from API 2MET or site-specific data developed in accordance with the requirements of API 2MET	Not required

a Manned-nonevacuated platforms are presently not applicable to the U.S. GoM waters where platforms are normally evacuated ahead of hurricane events. The metocean design criteria in Section 5 have not been verified as adequate for manned-nonevacuated in the U.S. GoM. However, the winter storm, sudden hurricane and earthquake criteria for the U.S. GoM have been verified as adequate for the manned-nonevacuated situation occurring during those events when platforms in the U.S. GoM waters are not normally evacuated

Table C.23 - Hurricane Winds, Waves, Currents and Surge in Deep Water, Western Gulf of Mexico (92° W to 98° W)

Return Period (years)	10	25	50	100	200	1,000	2,000
Wind Speed (10 m elevation)							
1 hour mean wind speed (m/s)	28.4	33.0	36.5	40.7	44.7	50.9	52.9
10 min mean wind speed (m/s)	31.2	36.5	40.6	45.6	50.5	58.1	60.5
1 min mean wind speed (m/s)	34.8	41.0	45.9	52.0	57.9	67.2	70.3
3 sec gust (m/s)	39.4	46.9	52.9	60.2	67.5	79.2	83.1
Waves (Depth ≥ 1,000 m)							
Significant Wave Height (m)	8.3	10.6	12.3	14.0	15.4	17.5	18.2
Maximum Wave Height (m)	14.7	18.7	21.7	24.7	27.2	30.9	32.1
Maximum Crest Elevation (m)	9.5	12.1	14.0	15.9	17.5	19.8	20.5
Peak Spectral Period (s)	12.6	13.7	14.4	15.2	15.7	17.0	17.3
Period of Maximum Wave (s)	11.3	12.3	13.0	13.7	14.1	15.3	15.6
Currents (Depth ≥ 100 m)							
Surface Speed (m/s)	1.42	1.65	1.80	2.00	2.15	2.49	2.59
Speed at Mid-Profile (m/s)	1.07	1.24	1.35	1.50	1.61	1.87	1.95
Bottom of Profile (m)	59.6	69.3	75.6	83.8	90.3	104.7	108.9
Currents (Depth 10-50 m)							
Uniform Speed (m/s)	1.42	1.65	1.80	2.00	2.15	2.49	2.59
Water Level (Depth ≥ 500 m)							
Associated Storm Surge (m)	0.22	0.34	0.43	0.53	0.62	0.74	0.80
Tidal Amplitude (m)	0.42	0.42	0.42	0.42	0.42	0.42	0.42

NOTE:

Wind speeds for a given return period are applicable to all water depths throughout the region.

Crest elevation is referenced to MLLW and includes associated surge and tide.

Reference Figure C.15, Figure C.16 and Figure C.17 for wave and crest elevation values for water depths between 10 m and 1,000 m.

The peak spectral period and period of maximum wave apply to waves in all water depths. When assessing systems with dynamic sensitivity, a ±10% variation in wave period should be considered.

Currents in water depths between 50 m and 100 m should be estimated by interpolation.

Reference Figure C.18 for surge and tide in water depths less than 500 m.

Content (cont'd)

Minimum Deck Clearance

- New L-1 and L-2 platforms in the Gulf of Mexico:

"The elevation for the underside of the deck shall not be lower than the 1000-year return period maximum crest height elevation provided in API 2MET or site-specific data developed in accordance with the requirements of API 2MET."

Content (cont'd)

Minimum Deck Clearance cont.

- New L-3 platforms in the Gulf of Mexico:

"The deck may be located below the 1000-year return period crest elevation only if the entire topsides are located below the calculated crest elevation of the design wave designated for L-3 Structures. In this case, the full wave and current forces on the deck topsides shall be considered."

"However, if the deck is located above the crest elevation of the L-3 wave, then the deck shall be located above the calculated crest elevation of the wave designated for the L-1 structures."

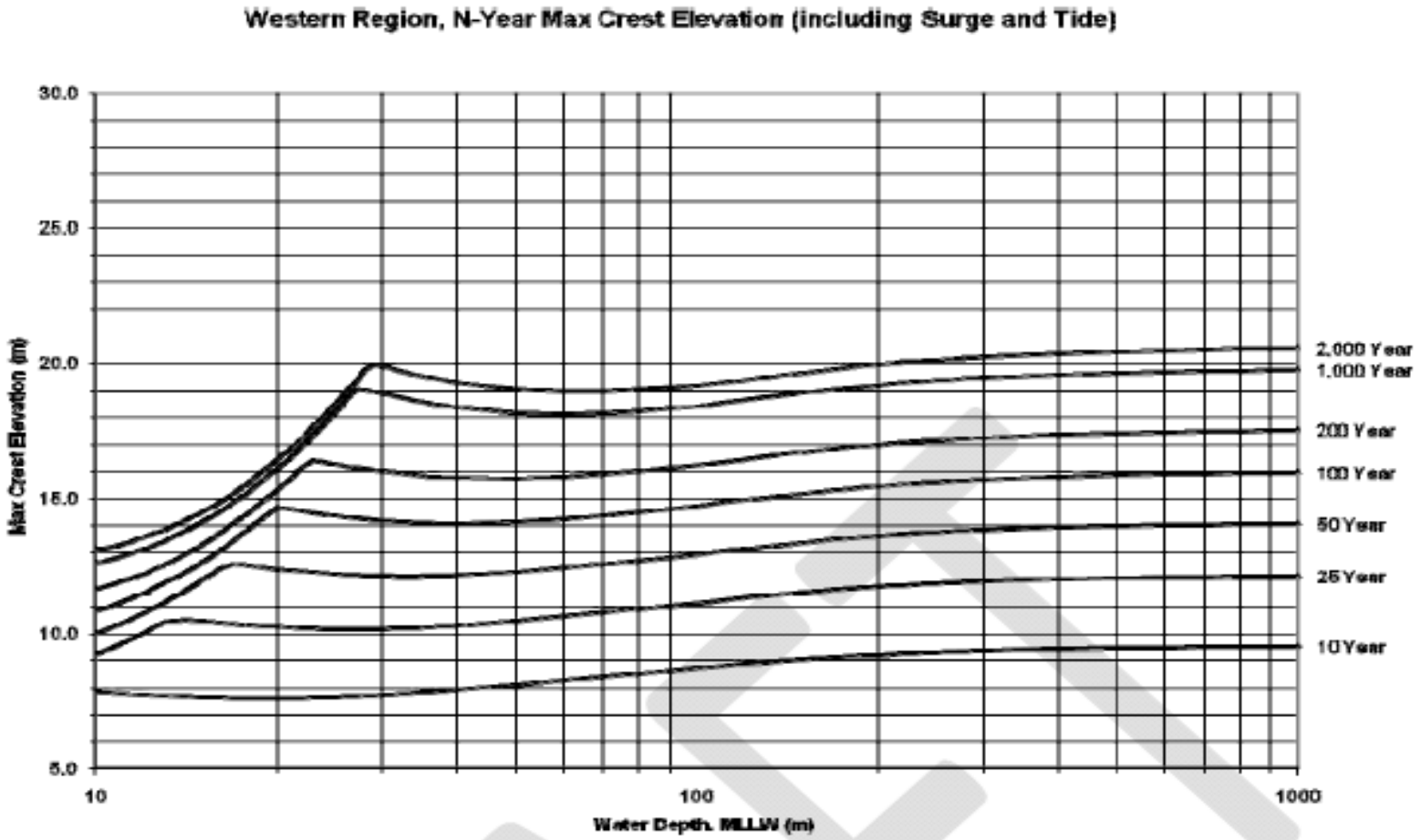

Figure C.17 - N-Year Max Crest Elevation, Western Gulf

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Joint Design rules requiring a minimum capacity to accommodate 50% of any effective member strength have been clarified and made more specific:

“Chords at the ends of tension and compression braces, in addition to developing the strength required by design loads, shall also have a minimum capacity of at least 50 % of the effective strength of each incoming brace for each design load condition (in-place, loadout, lifting, launch, accidental, etc.).”

Clarification (cont'd)

Joint failure prior to a brace failure is undesirable

50 % minimum chord capacity requirement is intended to:

- improve relative reliability of joints and members
- increase platform robustness
- provide a safety net for unanticipated loads such as support failure during loadout, unexpected weather conditions during launch or lifting, vessel collisions and dropped objects
- ensure minimum capacity for connections of secondary members that take on primary importance in reserve strength assessments

Clarification (cont'd)

For full advantage during reserve strength assessments, effective strength of brace should include effects of strengthening for:

- corrosion allowance
- section availability
- design events other than the one under consideration

Clarification (cont'd)

Non-critical joints may be excluded from minimum capacity requirement. A joint may be considered non-critical only if its failure:

- would not reduce reserve strength of structure for design event being considered
- would not reduce capacity of structure to withstand accidental loads
- would not have significant safety or environmental consequences

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- RP 2A has been significantly revised for the 22nd Edition in terms of both organization and content, but the content retained in the 22nd edition has not been significantly changed when used with API 2MET, 2GEO, 2EQ, 2SIM, 2FB and 2MOP.

- RP 2A 22nd Edition has passed through revision, balloting, revision, recirculation, revision, editorial review and revision, and page proof revision. Publication is expected in ?? quarter of 2014.

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- API RP 2A-WSD 22nd Edition -

  Based on OTC 23558, “Insights into Using the 22nd Edition of API 2A” by K. A. Digre and F. J. Zwerneman

- API RP 2A-LRFD 2nd Edition (tentative title)

  Modified adoption of ISO 19902, “Fixed Steel Offshore Structures”

API TG 19

High Level Summary

- Modified adoption involves
  - Detailed Review of ISO 19902 by TG
  - Prepare draft under API cover with proposed modifications
  - Review and ballot by SC2
- Deliver ready-to-ballot draft by Mar/31/2014
  - Achieve LRFD capability in API ASAP
  - Close alignment with ISO

Modifications

- Pile foundation section in LRFD 2nd edition
  - Capacity equations pointing to API 2GEO
  - Resistance factors to be the same as ISO 19902
- Shallow foundation section in LRFD 2nd edition
  - Capacity equations pointing to API 2GEO
  - Resistance factors from UT research will be reviewed by 2GEO TG and provided to LRFD TG

Modifications (cont'd)

- Other than foundation section
  - Load factors from API RP 2A-LRFD 1st Edition will be used
  - Retain API 50% minimum joint requirement
  - Difference in conical transition results to be investigated
  - Difference in hydrostatic effect to be investigated
  - Metocean criteria modified to match RP 2A-WSD 22nd edition
  - Overlap with 2SIM and 2MOP resolved

API 2TOP

- API 2TOP will be ready-for-ballot also by Mar/31/2014
  - Modified adoption of ISO 19901-3

ISO 19902 Status

- Next revision of 19902 on 2016/2017
- Albert Ku participating in ISO 19902 committee (partial factors & members/joints panels)
- Moises Abraham participating in API TG19
- TG19 action items shared with ISO 19902

Concluding Remarks

- TG19 currently working hard to have a ready-to-ballot draft by Mar/31/2014
- Work underway to compare ISO 19902 results to 2A-WSD results for several platforms