Chevron Richmond Long Wharf - A MOTEMS Journey

October 2014

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Location Map

Google Earth Flyover:

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Richmond Long Wharf Background

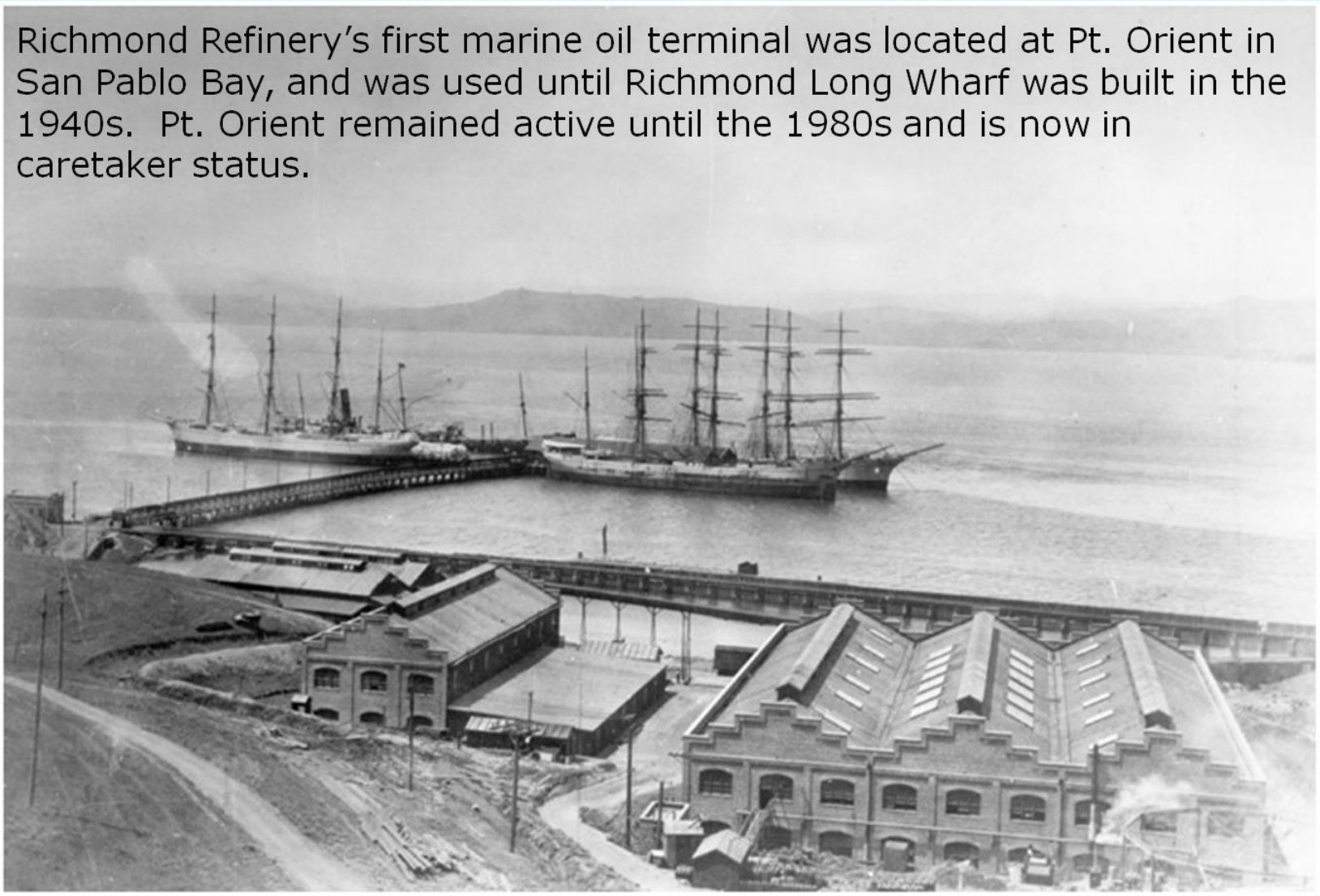
- Richmond Long Wharf (RLW) is located near the eastern terminus of the Richmond-San Rafael Bridge.
- RLW is the largest marine oil terminal in California, and its operations are regulated primarily by CSLC through State Lands lease, Article 5 of their regulations and MOTEMS (CBC Chapter 31F).
- 2008-2010 volume transfers – averaged 145 MMbbl/yr in 720 vessel calls.

		2008	2009	2010	Average
Total Wharf Volume	MM bbl	151.9	143.6	138.7	144.7
Total Transfers	#	1,930	1,738	1701	1,790
Total Vessel Calls	#	783	736	641	720

- Richmond Long Wharf has six berths for receiving raw materials and shipping final products. Two berths (9, 11) are limited to 5K DWT barges. Largest vessels accommodated are 193K DWT ships at Berth 4.
- Total vessel calls are split approximately 55% ships and 45% barges.

What did Chevron do before RLW?
Point Orient 1907

Richmond Refinery's first marine oil terminal was located at Pt. Orient in San Pablo Bay, and was used until Richmond Long Wharf was built in the 1940s. Pt. Orient remained active until the 1980s and is now in caretaker status.

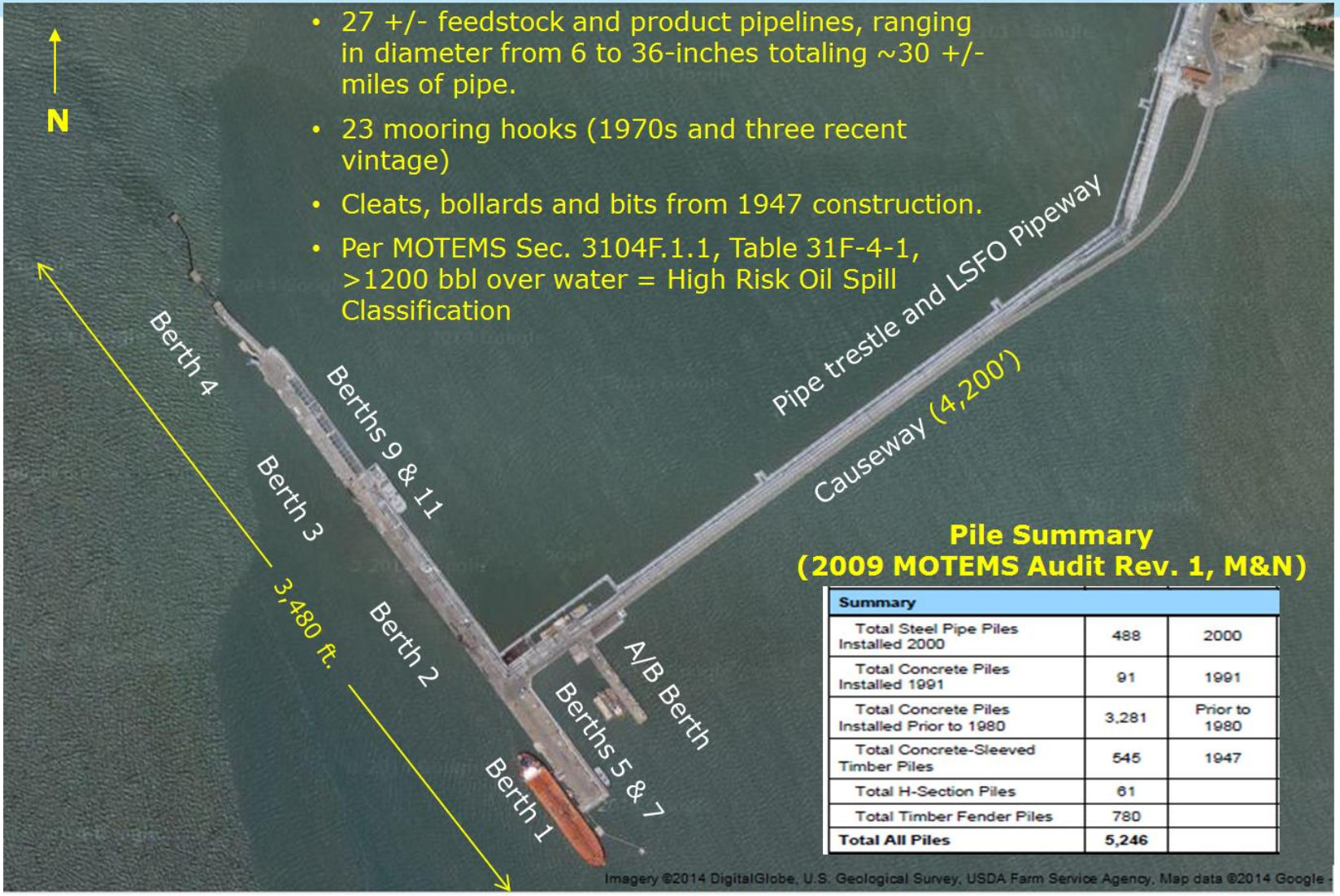


Richmond Long Wharf In Service 1948

The structure you see below, which comprises the majority of the modern RLW structure, was constructed in 1945-1947.

Long Wharf (1948)

Richmond Long Wharf Today



- 27 +/- feedstock and product pipelines, ranging in diameter from 6 to 36-inches totaling ~30 +/- miles of pipe.
- 23 mooring hooks (1970s and three recent vintage)
- Cleats, bollards and bits from 1947 construction.
- Per MOTEMS Sec. 3104F.1.1, Table 31F-4-1, >1200 bbl over water = High Risk Oil Spill Classification

Pile Summary
(2009 MOTEMS Audit Rev. 1, M&N)

Summary		
Total Steel Pipe Piles Installed 2000	488	2000
Total Concrete Piles Installed 1991	91	1991
Total Concrete Piles Installed Prior to 1980	3,281	Prior to 1980
Total Concrete-Sleeved Timber Piles	545	1947
Total H-Section Piles	61	
Total Timber Fender Piles	780	
Total All Piles	**5,246**	

RLW Pre-MOTEMS Construction

Year	Description	Facilities Modified
1945-47	Original construction	• Main Wharf and Causeway
1973	Long Wharf Modernization	• Construction of Berth 1, 3 and 4 Loading Platforms, dolphins and bump-outs, and two (of three total) fender units at Berth 3. • Installed 15 loading arms, and 23 mooring hooks.
1989	Berth 4 Mooring Dolphin Reconstruction	• A mooring hook and 60-ft of catwalk were rebuilt following vessel impact with the original dolphin.
1990	Long Wharf Emissions Reduction Project	• Vapor cranes installed at Berths 2, 3 and 4. The Berth 4 gangway tower was moved to accommodate new vapor recovery crane.
		• Between 1990 and 2000, the third fender and concrete bump-out were added in front of the Berth 3 Loading Platform
2000	Seismic Upgrade and Repairs	• 4-ft diameter steel piles and pilecaps inset into the Main Wharf. • Retrofit steel piles also added to the Causeway, A/B Berth and office building. • Replaced timber pipe trestle with steel structure.
2004	Long Wharf Electrical Upgrades	• Installed new cable tray, power distribution racks and cable for the 480V power system at Berths 1, 2, 3, 4, 9 and 11.

Richmond Long Wharf – MOTEMS Compliance Journey

- Chevron's Initial Audit was submitted in 2008.

- In June 2009, CSLC MFD requested Chevron to resubmit its initial audit based on numerous comments, including:
  - Difference of opinion regarding some Remedial Action Priorities (RAPs) assigned to deficiencies.
  - As-built documentation
  - Seismic analysis documentation
  - Repair implementation schedule for RAPs vs. date of inspection
  - Underwater inspection : % of piles inspected less than 33% of 5,246 total to be completed in 3 inspection intervals.
  - Site-specific current data, among other issues.

- Chevron and CSLC MFD agreed that a *revised* Initial Audit (Rev. 1) would be submitted by December 2009, and it was.

- The second MOTEMS Audit was submitted in 2012, on a 3-year cycle.

Audit-Identified Deficiencies

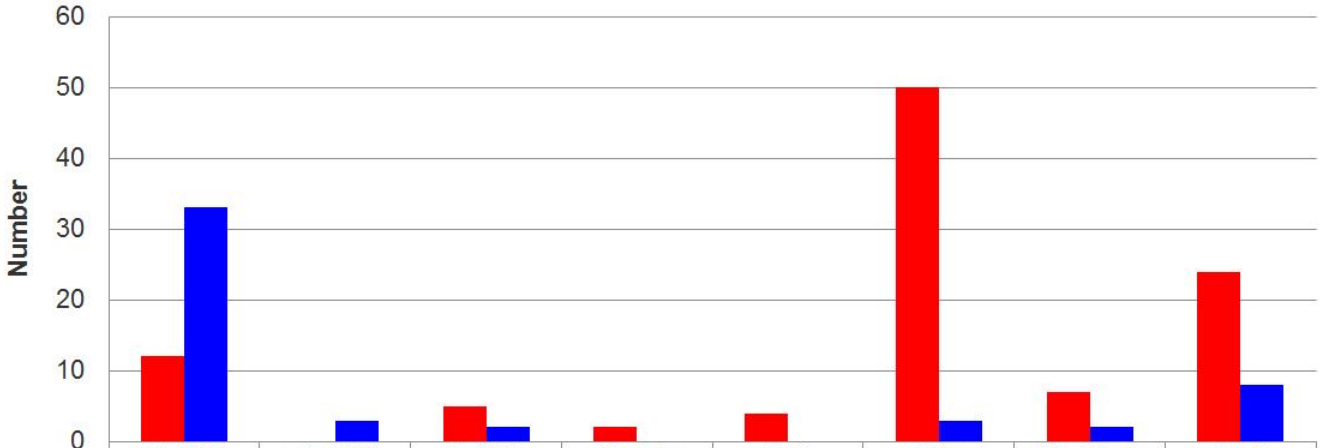
- **MOTEMS Initial Audit Deficiencies**
  - **104 Deficiencies and Recommendations**
    - **48% Piping-related**, primarily coating and pipe supports.
    - **23% Electrical** - issues were focused on sealing conduits, exposed cables, and some equipment labels.
    - **11% Above-water** - Significant concrete deck repair, in addition to mooring hardware rehabilitation and fender repair/replacement.
    - Balance (**19%**) split between **Mechanical, M&B, Seismic/Structural and Fire Protection.**

MOTEMS Audit 2012 Deficiencies

- **51 Deficiencies and Recommendations**
  - **65% Above-Water**– isolated concrete spalls, expansion joint repairs, guard rail corrosion. Concrete repairs was a factor of 10 reduced relative to 2009 audit.
  - **15% Electrical** – lighting levels, conduit.
  - Balance (**20%**) split nearly equally between **UW, Mechanical, Piping and M&B**

Audit Deficiencies and Recommendations

2009 vs. 2012 MOTEMS Audit Deficiencies and Recommendations



	2. AW	2. UW	5. MB	7. SS	8. F	9.P	10. Mech	11. E	Total
2009	12		5	2	4	50	7	24	104
2012	33	3	2			3	2	8	51

- No Priority 1 (P1) deficiencies were identified in the initial MOTEMS audit (2008/2009), nor the second audit (2012). All P2 deficiencies (4 total) were electrical related.
- Implementation of four major projects from 2009-2014 closed all P2-P4 deficiencies but one (P3), and all but 15 recommendations. The Berth 2 fender system replacement is undergoing CEQA review, and would complete the remaining P3 deficiency.

RLW MOTEMS Compliance
Construction Projects 2009-present

Year	Description	Facilities Modified	TIC ($MM)
2009-2012	MOTEMS 1	Berth 1 and Berth 4 Fender Replacements	$25
		Berth 1 & 4 steel platform replacements	
		Mooring hardware and foundation(s), rehabilitation and repairs	
		Recoated the pipe trestle along the causeway.	
		Concrete repair, bull rail replacement near MK-408	
		Main Wharf deck edge, curb and bull rail (800 ft.) along Berth 1 through Berth 4 were repaired.	
2010-2013	Rockfill Project / Pipe Reliability	Raised the active pipes off of the rocks and re-leveled the pipe runs by replacing deteriorated pipe supports in Rockfill area. Also raised seven pipelines that were in the "splash zone" to reduce the corrosion rate.	$22
2013-2014	MOTEMS 2	Concrete deck repairs, expansion joint replacement and light pole foundation repairs.	$3
2012-2013	Berth 9/11 Composite Piles	Replaced timber fender piles with composite piles at Berths 9 and 11 to make them MOTEMS compliant.	$2
		Completed MOTEMS Projects	**$52**

Berth 4 Breasting Dolphin
Fender Replacement (Oct 2011) – P3 Deficiency

Before

After

Drivers for replacement:

1. Seibu parts difficult to obtain.
2. Standardize fenders, larger panels.
3. Better performance with cone panels.

Berth 1 South Mooring Dolphin
Mooring Hook Replacement (2013) – P3/P4 Deficiencies

Before (2007)

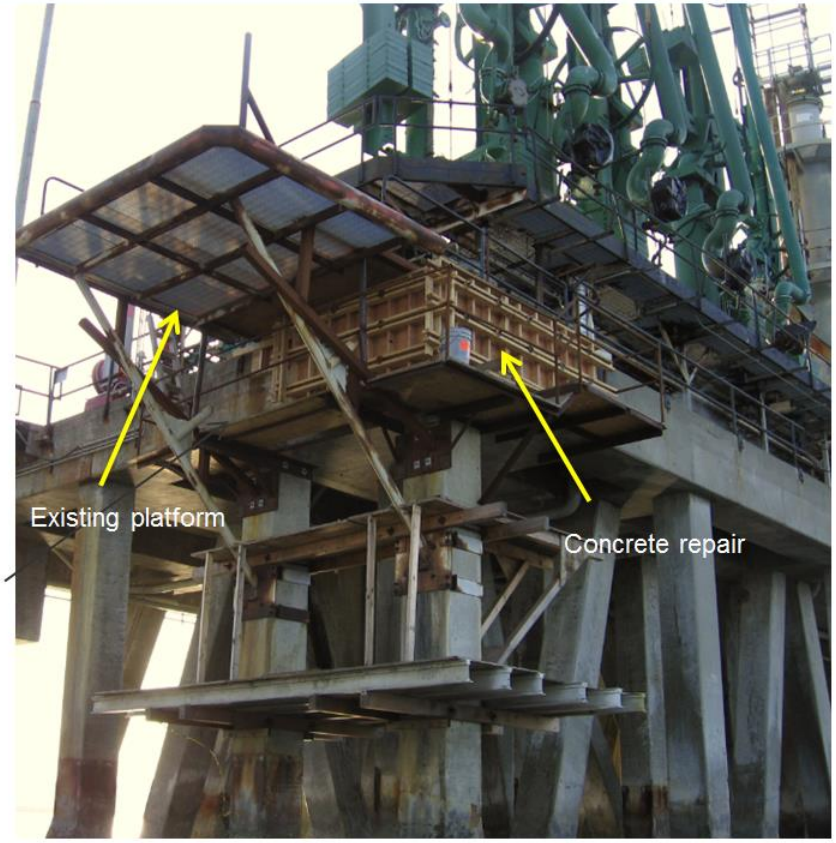
Photograph 49: MK101, Berth 1 Main Wharf

Reconditioned
(2010)

After Replacement (2013)

30-year CSLC lease renewal required tension monitoring at Berth 1 so Chevron installed a quintuple hook.

Berth 4 Loading Platform
Steel Platform Replacement (Oct 2011) – P3 Deficiency



Before

After

Replaced two 40 year old steel platforms at Berth 4 loading platform and a similar platform at Berth 1.

Berth 9 and 11 Timber Fender Piles
MOTEMS Compliant for M&B velocities – P3 Deficiency

Main Wharf, Berth 9 (before)
Approach velocity limitations, requiring AAS velocity monitoring.

Berth 9/11 - Composite piles with timber waler system, and new concrete curb.

Lessons learned: Composite piles (polyethylene sheath, concrete-filled) have >3-5x longer service life than untreated or exotic wood timber fender piles ; they are a more cost effective fendering solution.

Pipe Trestle Repairs / Coating
2009 Audit vs. Post-Project (2011) – P3 Deficiency

Before (2007/8):

Coating system nearing end of life resulting in surficial corrosion.

After (2011)

Photograph 2: Pipeway Trestle W-section Girders with Pipe Bracing

Berth 3 - Concrete, Deck Face, Bull Rail and Mooring Hardware Repairs – P4 Deficiencies

Safety is the #1 priority.

All MOTEMS-related construction from 2009-2014 was completed incident and injury free.

Construction BMPs:

- Chevron required the contractor to build two types of secondary containment (primary and alternate) while rebuilding the wharf face to ensure no materials were released to the bay.
- Chevron also had the contractor build temporary mooring line guides to protect integrity of the lines and moorings.

Lessons Learned

1. Open communication with CSLC enabled innovative solutions to complex problems.

- **Underwater Inspection** – CSLC and Chevron agreed to 3 audit cycle to complete inspecting the 5,246 piles at Richmond Long Wharf.
  - 2007 UW Inspection = 14% completed.
  - 2011 UW Inspection = 44% (58% total), completed.
  - 2016 UW Inspection = 42% (100% total), planned.
- **Alternatives Requests:**
  - **Non-Linear Seismic and Structural Analysis** – CSLC approved Chevron's Alternatives Request to apply the Chopra-Goel Method (1999) for the Berth 4 Loading Platform structure seismic and structural analysis.
  - **Current Study (2010-2012)** – site specific data obtained in 2009/2010, demonstrated that current velocities at RLW are less than 1.5 kts. Consistent with 1973 current survey; different from current-dominated Pt. Orient and other Bay Area terminals in Carquinez Straits.
  - **Wind vs. Current Mooring Line Forces** - RLW Mooring and Berthing forces in tidal marine environment are dominated by winds, not current.
    - AT RLW - Loads on mooring lines due to current are $1/6^{th}$ of the loads caused by wind. Therefore, a 3.5 kt current = the same mooring line force as a 40 kt wind at same heading (May 2013 M&N Analysis).
    - CSLC approved Chevron to reduce Berth 4 STOL wind speeds in lieu of a current meter.

Lessons Learned, continued

– **Equal or Better Protection Requests** (3101F.2)–

- CSLC approved to use PIANC/BS 6349 curves instead of MOTEMS step-function for berthing velocities, at Berth 3.
- Berths 9 and 11 - Alternative Berthing Method
  - CSLC approved Chevron to use two tugs to bring in loaded barges, as temporary measure to mitigate Allision Avoidance System (AAS) below-deck limitations.
  - Engineered solution - Composite piles vs. timber piles to eliminate berthing restrictions at B9/B11 – Chevron installed in 2012 (B9) and 2013 (B11).
  - Long term transition from timber to composite fender piles will improve performance of the fender system, reduce pile replacement frequency and drive down overall operational costs.

2. Integrate marine engineering contractor and construction contractor into project planning and development early.

- Ensure the correct people are actively engaged throughout planning, permitting and construction.
- Develop detailed work plans, identify critical construction inspection/oversight activities.
- ***Detailed construction execution planning is essential for injury-free work.***

Acknowledgements

On behalf of Chevron, I'd like to thank the following individuals for their roles in supporting Chevron RLW's past, present and upcoming MOTEMS compliance efforts:

CSLC:
Gary Gregory, Martin Eskijian, Kendra Oliver, Chris Beckwith, Laura Kovary, Avi Nafday, Alex Augustin, Hosny Hakim, Mike Edwards, Helen Galope, Don Hermanson, Donn Oetzel (LMD), Sarah Mongano (EPMD).

Chevron:
Bob Kendall, Tom Farr, Mickie Jensen (Connexsys), Jonathan Roman (Connexsys), Matt Bell, Jack Silva, Tim Potter, David Fowler, Dwight Damm, Walt Gill, Mauricio Mejicanos.

Moffatt and Nichol Engineers:
Jim Brady, Rod Iwashita, David Hebert, Ari Konyalian, Tyler Sparks, Rodney Hancock, Ron Heffron, Pooja Jain, Sid Srivastava, Erica Peterson and others.

Power Engineering and Construction:
David Mik, Hilary Tigue, Jeff VanMeter, Lars Olsen, Freddy Herrmann, Bennett Clegg

References:
MOTEMS Audits, prepared by Moffatt and Nichol on behalf of Chevron:

1. Richmond Long Wharf MOTEMS Initial Audit, Rev. 1 (2009), ES-2 Rev. 2
2. Richmond Long Wharf MOTEMS Audit (2012), ES-2, Rev. 8
3. Various correspondence with CSLC MFD, 2009-2014.

RLW Construction for Pile Supported Foundation