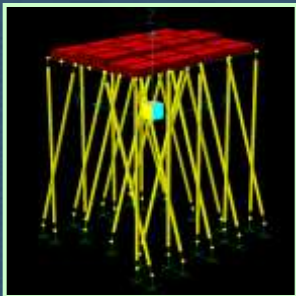




# Insights into the MOTEMS Audit Process

Presented by

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Principal Marine Engineer



*Halcrow*

September 9, 2008

# *Halcrow* MOTEMS EXPERIENCE

- Co-Author of MOTEMS as Han-Padron Associates (HPA)
- Conducted 2003 Northern California Trial Audit
- Participated in 5 of first 10 Initial MOTEMS Audits of “High” Risk Terminals Submitted in 2008



# MOTEMS AUDIT

- Periodic Review of the Complete Facility
  - Inspection / Condition Assessments
  - Engineering Evaluations / Verifications
  - Documentation
  - Determination of “Fitness-for-Purpose”



# FITNESS-FOR-PURPOSE

- Section 3102F.3.1 – Audit Objective
- Expressed by MOTEMS Condition Assessment Ratings (CARs)
  - Considers Current Operational Function
  - Understanding of Existing Condition
- Requires Engineering Analysis
- Demand  $\leq$  Capacity



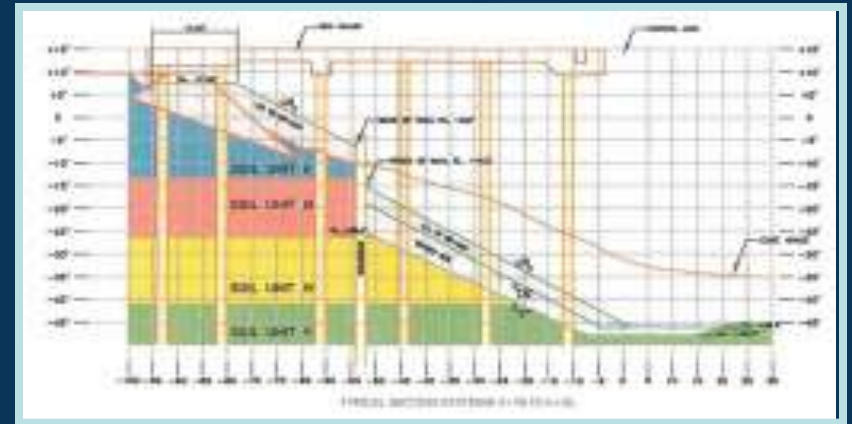
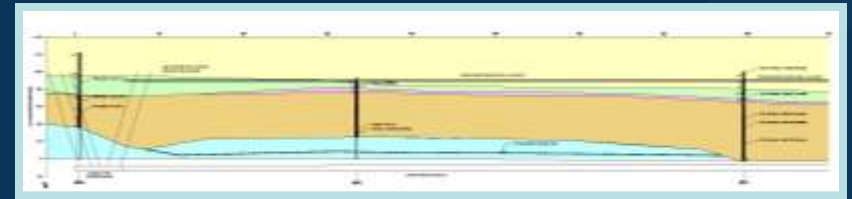
# STRUCTURAL INSPECTION

- Section 3102F.3.5
  - Document Existing Structural Condition
  - Establish Subsequent Inspection Intervals
  
- Issues:
  - Existing Condition Drives the Audit Process
  - Not Determination of Fitness-for-Purpose
  - Global vs. Local Condition
  - Above Water/Underwater CARS
    - Unclear – What is being rated?
    - Subject to misinterpretation
  - “Snap Shot” in Time



# GEOTECHNICAL HAZARDS

- Section 3106F.4
  - Flow Slides
  - Slope Movements
  - Lateral Spreading
  
- Issues:
  - Inertial & Kinematic Loads on Piles?
  - Backland Surcharges are Important (Tanks, Piping, Buildings, etc.)
  - Big Consequences
  - Poison Pill





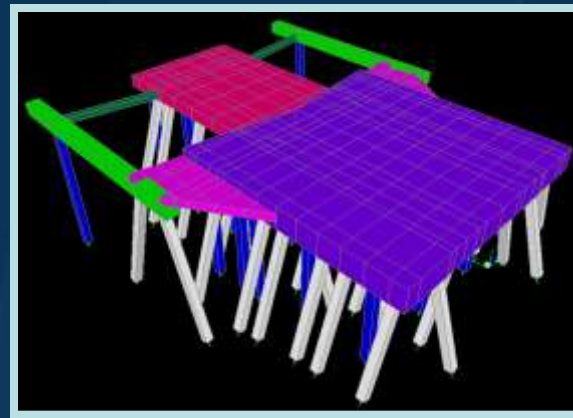
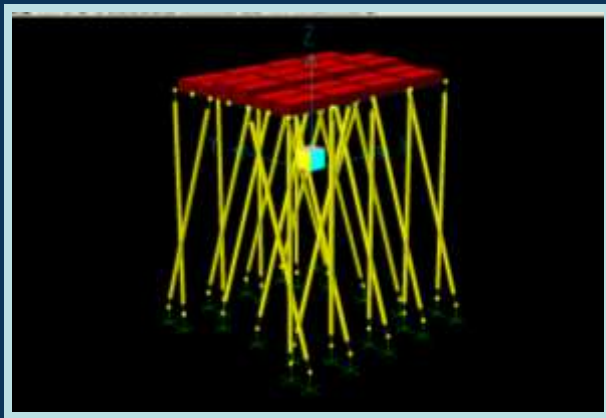
# MOORING & BERTHING ANALYSES

- Section 3105F
- Issues:
  - Terminal Operating Limits
  - What is the “Design Vessel”?
  - Not All Fixes are Structural
    - Berthing Controls
    - Wind Limits
  - Mooring Ownership



# SEISMIC ANALYSIS

- Section 3104F
- Issues:
  - Level 1 EQ May Govern Response
  - Strain Limits  $\neq$  Structural Failure
  - “Low” Risk Classification
  - Focus on Oil Spill Prevention





# FIRE MONITORS

- Section 3108F.6.5 - Fire Monitor System
  - Coverage of Vessel Manifold Required
  - “Unobstructed Path” Between Monitor & Target
  
- Issues:
  - Targeting
    - Direct Line-of-Sight vs. Ballistic Arc
    - Pre-Aiming vs. Remote Operating
    - Vessel Position Changes
  - First Responder Safety





*Note Fire Monitors in RED Circle*



# FIRE HAZARD ASSESSMENT

- Section 3108F.2.1
- Issues:
  - Talking to the Right People
  - Exploring the Right Scenarios
  - Event vs. Consequence
  - Risk Ranking



### Risk Assessment Matrix

							1	2	3	4	5
		Harm To People	Environment	Damage	Project Schedule	Facility Availability	Very Unlikely	Unlikely	Possible	Likely	Very Likely
A	Negligible	First aid injury	Within site boundary	Less than \$50,000	Impacted up to 1 hour	Production Revenue loss less than 12 hours	L A1	L A2	L A3	L A4	M A5
B	Moderate	Medical treatment/restricted work case	Within site boundary. Short term environmental impact.	\$50,000 to \$250,000	Impacted 1 to 12 hours	Production Revenue loss 12 hours to 1 day.	L B1	L B2	L B3	M B4	L B5
C	Significant	Day away from work case (temporary or permanent partial disability)	Outside site boundary. Localized pollution giving rise to significant environmental impact.	\$250,000 to \$1,000,000	Impacted 12 to 48 hours	Production revenue loss 1 day to 1 week	L C1	L C2	M C3	M C4	H C5
D	Severe	Single fatality, injury resulting in permanent and severe disability. May prevent operational safety case acceptance.	Extended exceedance	\$1,000,000 to \$2,000,000	Impacted 48 hours to 7 days	Production revenue loss 1 week to 1 month	L D1	M D2	M D3	H D4	H D5
E	Catastrophic	Multiple fatalities, multiple serious injuries. Likely to prevent operational safety case acceptance.	Massive & uncontrolled release	Over \$2,000,000	Impacted greater than 7 days	Production revenue loss more than 1 month	L E1	M E2	H E3	H E4	H E5





# Unusual Scenario?



# PIPELINE STRESS ANALYSIS

- Section 3109F.3 – Pipeline Stress Analysis
  - “Significant Seismic Displacements”
- Issues:
  - What is “Significant”?
  - Linkage between the seismic structural analysis & pipeline stress analysis
  - What is “Failure”?
  - Consequences of “Failure”





# MITIGATION ACTION PLAN

- Section 3102F.3.9
- Issues:
  - Mitigation is Continuous Process
  - How “Temporary” is Temporary?
  - Short/Medium/Long Term Repair Schemes
  - Repair vs. Rebuild
  - Continued Operations/Minimal Disruption
  - Early Discovery of Problems



# FINAL COMMENTS

- Every MOT is Unique

