



Operating Experience
Session I
Cask Cranes
Wednesday May 8, 2013

Without the Cask Crane the Fuel
doesn't Leave the Pool

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Topics of Discussion

1. Codes and Standards
2. Two Types of Cask Cranes
3. Keeping the Old Ones Running
4. Modernizations
5. Operating Experience

NRC Branch Technical Position 9b

- First document issued by NRC dealing with SFP
- Believed based on TVA designs of their SFP Hoists
- Industry responds with Patented Designs
 - * Whiting first Patent # US 3,786,935
May 22, 1972
 - * Harnischfeger second Patent # 4,069,921
Jan. 30, 1976

Regulatory Guide 1.104

- Never adopted by NRC
- Withdrawn in August 1979
- Issued 2/76 as draft
- Required a hoist which could withstand two-blocking
- ASME forms Cranes for Nuclear Committee (CNF) to provide an industry alternative. Started work on the NOG-1

NUREG 0554

- Published May 1979
- Standard still requires hoist which can be two-blocked; an alternate is provided
- Upper Control and Power Limit Switches deemed acceptable alternate to two-blocking ability
- Premise, start with CMAA crane and add NUREG features
- Standard only 10 pages (Prescriptive not descriptive)
- Created numerous questions as how to comply

NUREG 0612

- Published July 1980
- Handling Heavy Loads Standard not Crane Design
- If load can not be dropped, must employ NUREG 0554
- Section 5 of standard contains this requirement
- Appendix C provides examples of methods used to upgrade existing cranes to NUREG 0554

ASME NOG-1 1982

- Original issue of standard
- Standard is Descriptive (Over 200 pages)
- TMI had ended new builds and standard not used in commercial nuclear after issue
- DOE starts specifying NOG type cranes
- Standard gains attention with Dry Cask Storage
- NRC states **NOG-1 2004** is acceptable in lieu of NUREG 0554
- NUREG 0554 easier to comply with than NOG-1

Bulletin 96-02: Movement of Heavy Loads ...

- Issued April 11, 1996
- Alerts to the importance of complying with existing regulatory guidelines:
 - Related to control of heavy loads,
 - Requests that utilities review their plans and capabilities for handling heavy loads,
 - Requires that operators report to the NRC their compliance with the requirements of this bulletin
 - It clarifies the regulatory intent regarding NUREG-0612 and related NRC documents.
 - Starts the interest in using NOG-1 as a compliment to NUREG 0554

NOG-1 vs NUREG 0554

NUREG-0554/ASME NOG-1 Conformance Matrix (Cont'd)

NUREG Section No.	Summary of NUREG Guidance	NOG-1 Paragraph No.	Method or Statement on NOG Conformance	Conforms (Yes/No)	Comments
4. Hoisting Machinery (Cont'd)					
4.4 Hoisting Speed	Maximum hoisting speed for the critical load should be limited to that given in the "slow" column of Figure 70-6 of CMAA 70.	5331.1(b) Table 5331.1-1	Maximum hoisting speed for the maximum critical load is limited to the "slow" column of Table 5331.1-1.	Yes	Although the slow speeds of NOG-1 are not identical to CMAA 70, they are considered equivalent, using the philosophy of slower speeds for higher loads.
	The rope line speed off the drum should be limited to ¼ m/s (50 ft/min).	...	Not addressed in NOG-1.	No but justified	Some speeds allowed by NOG-1 would result in higher than 50 ft/min line speed off the drum with typical reeving systems. However, likelihood of wire rope failure is significantly reduced by the NOG-1 requirements for withstanding two-blocking and for monitoring of mis-spooled wire rope.
4.5 Design Against Two-Blocking	The reeving system should be designed to prevent cutting or crushing of the wire rope if a two-blocking incident occurs.	5420(a)	The ropes shall not be cut or crushed in event of hook overtravel. Overtravel of the hoist encompasses two-blocking.	Yes	...
		5121(e)	Further, NOG-1 requires that the crane shall be able to withstand repeated two-blocking and load hang-up incidents with stresses limited to specified levels.		
	Mechanical and structural components of the complete hoisting system should have the required strength to resist failure if the hoisting system should "two-block" or if "load hang-up" should occur.	5121(e)	NOG-1 requires that the crane shall be able to withstand repeated two-blocking and load hang-up incidents with stresses limited to specified levels.	Yes	...

Modernized vs Original

- Single Failure Proof Upgrade Performed within last 10 years
- Upgraded with New VFD controls
- Original group of Single Failure Proof Crane built in the 1970's and 80's which are untouched
- Cranes primarily built by Whiting and P & H others supplied by Ederer and Kranco
- The original group needs to be modernized to assure reliable crane operation

Structural Concerns

- Normally not a problem
- Perform a through inspection
 - Look in high stress area
 - Inspect girder connections
 - Inspect tightness of connecting bolts
 - Inspect runway structure

Mechanical Concerns

- Component Obsolescence Issues
 - Holding Brakes
 - Small Gearboxes
 - Micro Drive Clutches
- If Hook Block has been placed in Borated Water
 - Consider Changing Sheave Bearings
 - Consider Changing Wire Rope
- Is the Mechanical Load Brake working
- Upgrading to VFD's potentially eliminates: Load Brakes, Clutches, Micro Drives and Oil Coolers

Electrical Concerns

- **The Question is not if the Crane will fail, but when & how long will it hold up Cask Loading**
- 1970's era Drive Failures potential can shut the crane and cask loading down for days or weeks
- Contactor Wound Rotor controls failure not as severe as components available
- Interface devices such as limits subject to failure
- Insulation failure of wiring also a concern
- Original Pendants and Radio Controls unreliable leading to use of cab controls (No Back-up)

Making the Case for Modernization

- How much does it Cost per Day to not Load Fuel
- Assume \$1,000,000 Vendor Budget Cost to Upgrade a SFP Crane with new Electrical Controls
- Options can include:
 - Radio Control
 - Zone Boundary Control
 - NOG and NUREG 0554 Protection Features
 - * Weigh Scale Systems
 - * Overload Protection
 - * Upper Power Limit Switch Protection

- Lack of Drum Gear Lubrication
- Poor Crane Preventative Maintenance
- Suggest Third Party Audit of Site PM's annually
- Wire Termination issues on Upgrade
- Interference issues on Upgrade
- Crane Speeds may change after upgrade
- Unconventional Installation Methods



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