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Heavy Loads Search Summary

The following standards are in use:

DOE-STD-1090-99, "Hoisting and Rigging (Formerly Hoisting and Rigging Manual)," U.S. Department of Energy, March 1999.

MIL-HDBK-1038, "Weight Handling Equipment," Department of Defense Handbook, March 06, 1998.

NAVFAC P-307, U.S. Navy, June 1998.

Summary Finding from Studies on Load Handling Accidents

U.S. Department of the Interior
Minerals Management Service (MMS)
Gulf of Mexico OCS Region
Notice No. 125 - March 27, 1984

The Risk and Safety Analysis Unit of the MMS reviewed 50 crane related accidents for the period January 1 1971 to June 30, 1983. The major findings included:

a. The major contributing cause of crane accidents has been employee negligence and/or error.
b. About 44 percent of the crane accidents involved some type of equipment failure due to poor maintenance and/or overloading of the crane.

Findings and Recommendation of the Crane Accident Workgroup
B. Hauser, B. Lewis, W. Rhome, Engineering & Operations Division
October 16, 1998 (U.S. Department of the Interior, MMS)

Workgroup reviewed 34 incidents for period 1995 to 1998.

a. 17 listed as equipment failure (EF) and 12 listed as human error (HE).
b. Fatalities: 1 of 12 HE incidents; 5 of 17 EF incidents.
c. Major property damage: 1 of 12 HE incidents; 6 of 17 EF incidents.

"Independent Oversight Special Study of Hoisting and Rigging Incidents Within the Department of Energy," October 1996, Office of Oversite, Office of Environment, Safety and Health, U.S. Department of Energy

The DOE Occurrence Reporting and Processing System (ORPS) served as the principal information source for incidents relating to hoisting and rigging (H&R) operations. An initial set of 491 occurrence reports, corresponding to the October 1, 1993, to March 31, 1996, period, describing incidents related to H&R. There were 131 relevant hoisting and rigging incidents between October 1993 and March 1996.

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Summary Finding from Studies on Load Handling Accidents (continued)

Distribution of Hoisting and Rigging Incidents and Accidents

Equipment	Number of Incidents	Number of Accidents	Incidents as a Percent of Total*	Accidents as a Percent of Total*	Accidents as a Percent of Incidents*
Crane	66	49	50%	51%	74%
Forklift	40	36	31%	38%	90%
Other**	25	11	19%	11%	44%
Total	131	96	100%	100%	73%

- Rounded to the nearest whole number.
- *Includes manual and power-operated hoists, chainfalls, and block and tackle.

Root Cause of Hoisting and Rigging Incidents by Equipment Type*

Root Cause	Crane	Forklift	Other
Inattention to Detail	20%	23%	8%
Work Organization and Planning	18%	3%	27%
Procedure Not Used or Used Incorrectly	9%	15%	0%
Policy Not Adequately Defined, Disseminated, or Enforced	9%	10%	4%
Inadequate or Defective Design	5%	5%	19%
Defective or Inadequate Procedure	9%	5%	0%
Inadequate Administrative Control	9%	0%	4%
Defective or Failed Part	5%	5%	8%
Other Management Problem	3%	3%	12%
Other Human Error	3%	3%	0%
Inadequate Work Environment	0%	10%	0%
Lack of Procedure	2%	3%	4%
Insufficient Refresher Training	3%	3%	0%
Insufficient Practice or Hands-On Experience	5%	0%	0%
Communication Problem	2%	3%	4%
Inadequate Supervision	0%	3%	4%
Error in Equipment or Material Selection	0%	3%	4%
Weather	0%	3%	0%
No Training Provided	0%	0%	4%

*Rounded to the nearest whole number.

Summary Finding from Studies on Load Handling Accidents (continued)

Human error is the major cause of hoisting and rigging incidents.

> Human error, whether directly associated with supervisors or equipment operators, is the principal cause of H&R incidents. Factors not related to human performance, such as equipment failure and weather, are responsible for only 6 percent of H&R incidents—management (35 percent) and personnel errors (33 percent) collectively account for 68 percent of all H&R incidents, as reported into ORPS.

Management shortcomings and workers' inattention to detail account for a large proportion of incidents.

> Further analysis shows that deficient work planning (43 percent) and inadequate definition, dissemination, and enforcement of policy (24 percent) are responsible for two thirds of the incidents attributable to management deficiencies. Inattention to detail (56 percent) and not following procedures (28 percent) account for 84 percent of H&R incidents caused by personnel error. Furthermore, inattention to detail is the most prevalent cause of all 131 H&R incidents, accounting for about one in every five incidents. Additionally, there are no indications that certain root causes are becoming less frequent over time, are being remedied, or are being replaced with other causal factors.

Work planning is a significant factor in non-forklift incidents, while the work environment has more effect on forklift incidents.

> Work organization and planning require more attention in operations involving cranes and "Other" hoisting equipment than when forklifts are utilized. This is evident by the fact that inadequate work planning was the cause of 18 percent of all incidents involving cranes, 27 percent of the incidents involving "Other" hoisting (i.e., non-forklift) equipment, and only 3 percent of all forklift incidents. Similarly, the work environment (i.e., the characteristics of the area in which H&R equipment is operated) has a significantly greater influence on the frequency of forklift incidents than non-forklift incidents. As noted earlier, this is largely due to the mobility of forklifts and the increased likelihood of an incident when forklifts are used to transport loads over routes that are not protected from obstacles or other risks.

Training-related deficiencies were not identified as a major problem.

> Training-related deficiencies were not identified as a significant problem. Procedure-related problems, including applying procedures incorrectly, defective or inadequate procedures, or procedures not used, are responsible for 18 and 20 percent of crane and forklift incidents, respectively. They were not found as causal factors for incidents involving "Other" equipment. Communication, lack of procedures, and defective or failed parts cause incidents with approximately equal frequency for all equipment type categories, although it is the greatest for "Other" equipment (e.g., hoists, chainfalls, block and tackle).

Summary Finding from Studies on Load Handling Accidents (continued)

The use of mobile cranes by subcontractors is expected to increase, heightening the need for effective oversight of subcontractors' safety performance.

Discussions with H&R experts within the DOE (Federal workers, contractors, and subcontractors) indicate that as production-related operations are curtailed and superseded with activities directed at waste management, environmental restoration, and facility dismantlement, the need for stationary or overhead cranes will be reduced, and mobile units will be in more demand. Mobile cranes owned and operated by subcontractors are often used to perform material handling tasks of varying complexity, whereas overhead cranes are generally operated by contractors and are used to perform maneuvers that are relatively simple and often routine. Independent evaluations performed by the Office of Oversight, in addition to information reported into ORPS and the Department's Computerized Accident/Incident Reporting System (CAIRS), have highlighted deficiencies in oversight of subcontractor activities. Therefore, the additional risks posed as more H&R tasks involving cranes are performed by subcontractor personnel heightens the concern over H&R safety and the need for effective oversight of subcontractor performance. Information contained in ORPS does not explicitly and formally identify whether an H&R incident is associated with a contractor or subcontractor activity. While it was possible in this review to make this determination for some of the 131 incidents analyzed, it was not possible to resolve this issue for the entire sample.

Risk Assessment Summary

"Waste Isolation Pilot Plant TRUDOCK Crane System Analysis," October 1996, Westinghouse Pittsburgh, PA and WID Carisbad, NM.

Provides a risk assessment, fault trees and quantification, for the 5-ton rated TRUDOCK crane.
Per crane: Equipment failure (hook breaks) 74.4 percent, operator error 25.6 percent (improper connections).

"Savannah River Site Human Error Data Base Development for Nonreactor Nuclear Facilities," Westinghouse Savannah River Co., WSRC-TR-93-581, February 28. 1994.

Dropping of loads when using cranes or hoists was quantified using generic data.
Data base 200 drops in 2,000 crane years of operation and additional crane data from nuclear power plants — rate of 1.5E-4 per operating-hour, no error factor information available.
Given 1-hour for an operation (lift, move and setting down) and using a factor of 10 from nominal value (1.5E-4) and applying SRS specific data sources:

Type of load	Rate	EF	
Standard	3.0E-5/operation	10	(low mean value)
Typical	1.0E-4/operation	10	(nominal value)
Unusual	1.0E-3/operation	10	(high mean value)